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& ichi Uino

Shun-Ichi UÉNO was born at Ibaraki near Osaka on December 8, 1930, to Masuzo and Yukiko UÉNO. He was rather a weak child and often had to stay away from kindergarten. His father, a zoologist and natural historian, was worried about this and endeavoured to take him along to the open air, mostly for looking for animals and plants on the nearby hills of Ôtsu City where he resided then. This must be one of the reasons why UÉNO junior grew up to be a naturalist.

In the second year of elementary school, his family moved from Ôtsu to Toyonaka near Osaka. It was already in the war time, and he had especially severe middle school days, being mobilized to an aircraft factory and suffering from violent bomb attacks. However, this trying experience made him strong, so did the starving days after the war. In later years, his younger associates and colleagues were frequently astonished at his toughness in the wilds and his endurance to hunger and thirst.

In these great hardships, he developed his interest in living things, above all in beetles. Entering Kyoto University in 1949, Uéno made up his mind to study systematics of ground beetles. His first target was the Bembidiinae, the Japanese species

of which were neatly revised in a modern way within three years. He was, however, intrigued with eyeless species living in caves, and began to explore caves by himself. With the success of his early collectings under the earth, he fell into a bottomless way. He was absorbed in researches of the cave fauna, which was almost unknown before his time, learned everything necessary for caving, and eventually became the only professional biospeologist in Japan. He discovered numerous eyeless animals, most of which were new to science, but his main interest was always in the carabid subfamily Trechinae.

In 1960, UÉNO graduated from Kyoto University with the degree of D. Sc., and two years later moved to Tokyo to become a curator at the National Science Museum. He has worked at the Museum ever since, as curator of reptiles and amphibians at first and as of insects later. During his tenure of office, he has always endeavoured to improve research system and to increase research activities of the Museum; as the director of the Department of Zoology, he has thrown all his energies to reorganizing collection rooms, enlarging the museum library, and establishing graduate school for natural history and biodiversity. Though looking mild, he is determined and daring. Once decided, he somehow attains his goal, not only for himself but for all who share his enthusiasm for natural history. This is partially why almost all the projects initiated by him were materialized.

In 1965, Shun-Ichi UÉNO got married to Yoshiko YAMAMOTO, then an assistant of English Department of Tokyo Woman's Christian College. Ever since, she has helped her husband in brushing up his papers, in reading proofs, and in revising papers by his students. For this reason, her name appears in some of the contributed papers to be given on later pages of this volume. Yoshiko is now Professor of English literature at Tokyo Metropolitan University and is well known in Japan as an eminent scholar of English Renaissance literature and Robin Hood legend.

UÉNO is a very good explorer. As a caver, he has explored thousands of caves and mines. As a mountaineer, he has climbed up many high mountains both at home and abroad. He organized many zoological expeditions to various parts of Asia and Australasia. He can patiently endure all the difficulties encountered during those expeditions. He is equally at ease in a camp of desolate wilderness and in a high-class restaurant in Tokyo, and does not care a bit for getting dirty or soaked, though he is dandy in big cities. As a leader, UÉNO is cautious in everything and seldom risks anything, so that his party has never met serious accident. This does not mean he is coward; he is just careful and always keeps an eye for potential danger.

It is for editing scientific journals and books that UÉNO has a special talent. Editing looks like almost his hobby, though he does not admit it. He edited among others the following important journals: *Memoirs of the College of Science, University of Kyoto, Series B* (1955–1962), *Bulletin of the National Science Museum, Tokyo* (1964– 1966) and its *Series A* (1975–1979), *Memoirs of the National Science Museum, Tokyo* (1969–1972), *Annotationes Zoologicae Japonenses* (Zoological Society of Japan; 1971– 1983), *Kontyû, Tokyo*, and *Japanese Journal of Entomology* (Entomological Society of

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Japan; 1974–1975, 1988–1989), Journal of the Speleological Society of Japan (1976– 1995), and Elytra, Tokyo (Japanese Society of Coleopterology; 1989–1995). UÉNO has read thousands of scientific papers as an editor or as a referee or as a supervisor. Working as an editor, he has seldom rejected contributed papers, unless they infringe upon other's priority; instead, he lends his hand to make the manuscripts acceptable, and sometimes wholly rewrites them, especially those by beginners and amateurs. In this way, he has encouraged inexperienced researchers with the hope that they would become excellent workers in the field of natural history. If he were to claim coauthorship for those articles, as is often practised by certain well-known biologists, his bibliography would double or even triple.

UÉNO is quick at reading manuscripts and proofs. He usually reads manuscripts once or twice and proofs at least once. He is punctual in issuing his journals, and always prints the exact dates of their publication. This is not an enviable task to do, but he fulfilled it admirably. He metamorphosed several journals to more attractive ones, and even now, he is editing two scientific serials despite the heavy pressure of other works.

Needless to say, UÉNO is a member of many scientific societies and other associations, and has repeatedly served on their committees. As the president, he served on the Japan Caving Association in 1982–1987 and again in 1994, the Speleological Society of Japan in 1986–1989, the Japanese Society of Coleopterology in 1989–1992, the Entomological Society of Japan in 1991–1992, and the Association of Japanese Cavers in 1994–1995. He has always endeavoured to reorganize minor societies for the development of respective fields of study, and has already succeeded in realizing coalition of the Coleopterists' Association of Japan with the Japanese Society of Coleopterology, and the merger of the three speleological societies, the Speleological Society of Japan, the Japan Caving Association and the Association of Japanese Cavers, will be realized in the coming summer. He has been the Japanese delegate of the Union Internationale de Spéléologie since 1973, and a commissioner of the International Commission on Zoological Nomenclature since 1982.

In the past two decades, nature was considerably devastated in Japan. The worst of all were wetlands, but broadleaved forests were also extensively cut down. UÉNO was much concerned at this unfortunate situation, especially so due to extinction of some trechine beetles of his own description. In 1976, he was appointed as a member of the wildlife conservation committee of the Environment Agency of the Japanese Government. After that, he has served as a chairperson of various committees, and since 1991 he has been a councilor of that Agency. He has also served on the committee of the World Wide Fund for Nature Japan (WWFJ) since 1987. His deep concern about this problem is clearly shown in his recent writings to be found in the checklist given later.

UÉNO has published more than 450 articles, about five-ninths of which are academic papers. He has described more than 300 new species of mainly ground beetles and more than 40 new higher taxa of the genus-group. His way of describing new taxa are discreet, being always based upon careful comparative study and reexamination of type material. Besides, he exerts every possible effort to find out habitat condition and life mode of the species concerned. To fulfill this requirement, UÉNO has made innumerable trips throughout Japan and her adjacent countries. No other Japanese biologists can compete with him in the scope of investigated areas, especially in view of the fact that his earlier field researches were largely made on foot. He has a very wide knowledge of biological books and periodicals, and is talented in finding out location of relevant literature within a very short time. He is deeply interested in ecology and zoogeography, and has often taught biogeography and other subjects at universities. His lecture is clearcut; his way of speaking is plain but impressive.

After retirement, UÉNO will take an honorary position at the National Science Museum, Tokyo, and will also become a fellow professor at Tokyo University of Agriculture. He will continue his studies on small beetles and other living things and, we hope, editorial works as well. He is planning to make new expeditions to northern Vietnam and southern China, where he will find his element. We all hope he will enjoy good health and continue to be our guiding light.

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Prologue

One day in the autumn of 1949, a freshman of Kyoto University was eagerly looking at a glass vial containing four specimens of a small insect. For him, this was the very first time to encounter a Japanese species of an eyeless beetle. This event turned his interest to the fauna of the bottomless underground world, the study of which became the life theme of his long career thereafter.

I was the boy with twinkling eyes, and the insect was an anophthalmic trechine beetle discovered by Riozo Yosii in 1939 and later described by myself under the name *Yosiitrechus ohshimai* (UÉNO, 1951, p. 84, pl. 4, fig. A; now called *Trechiama ohshimai*). This was one of the two species of Japanese blind beetles whose prewar specimens had been preserved to the 1950's, though later inquiries clarified that at least four species of cave-dwelling carabids had already been collected in the 1930's.

Since early childhood, I was always interested in living things, and grown up as a naturalist, more and more fond of insects, especially beetles. When in a high school, my interest was much aroused in ground beetles, mainly under the influence of Nobuyoshi TOSAWA, Masafumi OHKURA and Tsutomu MATSUDA, all of whom were amateur collectors and pioneer workers on carabid taxonomy. My liking for ground beetles continued to the university days, and a revisional study of the Japanese species of the Bembidiinae was taken up for the graduation thesis, which was never printed in its original form due to the unfavourable situation of publication in the 1950's.

All these times, I was attracted to Teiso ESAKI's accounts (1932 a, b) of eyeless beetles from Europe and North America. ESAKI was a leading entomologist of Japan then, and was one of the closest friends of my father's. He often visited our home, and always inspired in me love for insects and other living things. One of his favourites was cave insects, which he himself searched for in several caves of West Japan. He was sorry about unsuccessful results of his own researches, but still hoped that certain eyeless insects, especially trechine and bathysciine beetles, would turn up some day from Japanese caves. He loved insects from his heart, and his vivid presentation of eyeless beetles from European caves fascinated me. However, even ESAKI was skeptical over the prospect of Japanese biospeology, because it was the general belief at that time that highly modified cavernicoles, terrestrial species in particular, could not evolve in such an insular country as Japan, which is geologically recent, largely volcanic and only has rather limited calcareous areas.

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This is why I took up the Bembidiinae for my thesis instead of the Trechinae. My study on this subfamily progressed fairly well, as was outlined in a series of five papers in Japanese (UÉNO, 1953 a–b, 1954 a–c), but my interest was always drawn towards anophthalmic species of the Trechinae. I wanted to see their natural habitats by myself and to collect new material. Fortunately, I had two classmates coming from Kôchi and another from Tochigi, who were well acquainted with famous caves in their native places. Having known my ardent desire, they invited me to their homelands, and thus, my first cave explorations began.

Early Explorations of Limestone Caves

Early in the spring of 1950, I took a trip to Kôchi in the Island of Shikoku to see the famous limestone cave Ryûga-dô and some other less known caves. This trip was memorable not only as my first cave exploration, but also as my first collecting trip outside the Kyoto–Osaka area. Since only five years had passed after the Japanese defeat of the Second World War, it was not easy to make long travels at that time. Nowadays we can fly from Osaka to Kôchi in only 40 minutes, but in 1950, I had to take a night train at Kyoto, transfer to an Inland Sea ferry in the middle of the night, take another train at dawn, and at last arrived at Kôchi just before noon. It was still in the last days of winter at Kyoto when I started, but the Kôchi Plain was already in the blossoming spring. It looked like a paradise to me.

There I met Jûjirô ISHIKAWA, one of the pioneer biospeologists in Japan, who informed me that blind beetles had been collected in four different caves. He took me along to Ryûga-dô Cave, which was already protected as a natural monument, and showed me the habitats of *Ryugadous ishikawai* (a trechine) and *Jujiroa nipponica* (a platynine). He also introduced me to two young speleologists, Tetsuo KAWASAWA and Masazi UOZUMI, who guided me to three other caves that were known to harbour anophthalmic trechines. In those days, modern caving equipments were not yet known in Japan. Only the light we were albe to rely on was heavy acetylene lamp, which was difficult to manage in narrow squeezes or on steep descents. We had neither special coveralls nor good climbing shoes, only wearing, beside ordinary clothing for hiking, a pair of straw-sandals to avoid slipping on wet mud. It was a miracle that we managed to emerge safely from Saruta-dô Cave, an intricate, three-dimensionally developed cave, in which inexperienced explorers could be easily lost.

Anyway, my first cave explorations were successful in every respect. All my worries of entering caves were blown away, and I gained confidence in my ability for cave researches. One month after my return to Kyoto, I went to Shizushi-dô Cave, the type locality of *Trechiama ohshimai*, and obtained a good result. Then, I visited several caves on the Suzuka Mountains east of Lake Biwa-ko. Having examined the specimens thus obtained, I became aware of the fact that contrary to the general belief, Japanese limestone caves were rich in the fauna, which contained many new species. Besides, the trechine beetles I collected showed high endemicity, each species being

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Fig. 1. Trechiama ohshimai (S. UÉNO), one of the anophthalmic trechine beetles first found from Japanese limestone caves.

restricted to a single cave (this is, of course, not true in our present knowledge, though many Japanese trechines are very rare and extremely localized, above all in the Island of Shikoku).

The results gained by my explorations startled many zoologists including ESAKI and YOSII. Being a well known specialist of collembolans, YOSII was particularly interested in the Japanese cave fauna. We both believed in the promising future of the study of Japanese cave animals, and after carefully discussing the matter, decided to plan systematic cave investigations throughout the Japanese Islands. This plan was put into operation in 1951 and was carried on until 1955. To undertake this project,

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we had to clear up many difficulties. For instance, no one knew exactly where limestone caves were, with the obvious exception of some well known ones, so that we were compelled to locate them by ourselves. Since means of transport were still poor, we had to walk very often for a long distance to reach a destined cave. It was sometimes difficult even to find appropriate lodgings. And, of course, the hardest was to solve financial problems. However, most caves then known were explored and investigated in these five years, and a large number of specimens were collected and amassed at Kyoto University. They were sorted out and sent to specialists of respective groups for taxonomic examination, which resulted in publication of many papers dealing with animals entirely new to the fauna of Japan (cf. UÉNO, 1993). Many of them were named "*uenoi*" for commemorating my achievement, and this name is found in various groups of cave animals, including aquatic snails, pseudoscorpions, spiders, mites, crustaceans, millipedes and insects.

Needless to say, I myself took up the study of carabid beetles, particularly those belonging to the Trechinae. Only eleven species of this subfamily were known from Japan before 1950, one of them (*Trechiama angulicollis* JEANNEL) being endogean and anophthalmic. Though two more anophthalmic species were described by HABU in 1950, the total number of the species known at that time was still very small. By 1955, seventeen species were added to the above number, and moreover, I already became aware of the occurrence of many other species that awaited descriptions. They were diverse and highly differentiated, not only at the species rank but also at the generic or subgeneric level. Unfortunately, however, they were usually so rare that it was difficult to collect adequate number of specimens. To make the matter worse, males were generally fewer than females that were less important taxonomically. Therefore, I had to go to the same locality repeatedly for securing additional specimens.

On the contrary, collembolans were usually abundant and easily collected. This enabled Yosu (1956) to set up a monograph of the cave species much earlier than mine. His work was an important contribution to the Japanese biospeology, and was useful for those who were studying on the cave fauna of Japan.

On the way to caves, I always made collectings on the surface, which greatly enriched my field experience. In the summer of 1950, I was given an opportunity to participate in a biological survey of the Ozegahara Moor in Central Japan, and made investigations for the first time in the alpine zone. Similar opportunities were also given in 1952 and 1953, when surveys of the biota were made on Mt. Ontaké-san of the Northern Japanese Alps. I was fascinated by the unique vegetation and peculiar fauna of the alpine and subalpine zones, and since remarkable trechine beetles occurred there, my interest was divided into two objects, caves and high mountains. This was very fortunate, because a new aspect of the biospeology was opened in later years from the study of the high altitude fauna. I was also interested in the insular fauna after joining in a natural history investigation of the Tokara Group of the northern Ryukyu Islands made in the late spring of 1953.

After all, I was lucky in having unusual opportunities to see various aspects of

animal life in my undergraduate days. This was realized with generous support of many senior scholars and friends, to all of whom I have to thank heartily.

Network of Speleologists

Pursuing cave explorations, we often encountered insuperable obstacles. Most difficult was to descend vertical shafts and to surmount overhangs. Our early explorations were practised by two or three persons, or more frequently, only by myself. It was impossible for me to hang on an inflammable rope with a heavy acetylene lamp in one hand. For attaining further development of the Japanese biospeology, it seemed necessary to organize a speleological association and to explore caves as a teamwork.

On October 12, 1956, thirteen zoologists who were interested in cave animals assembled at Kanazawa and decided to establish the Spelaeological Society of Japan, with Masuzo UÉNO as the president. The new society took the next step immediately, calling for an assemblage of members on the 21st of the same month at Akiyoshi, the largest karstic area in Japan. The following five days were devoted to exploring caves in collaboration of scientists and cavers. Having learned from foreign literature, we introduced many new equipments into the exploration, which included a combination suit, canvas boots, a helmet with an electric lamp powered by dry-cell batteries, nylon ropes, and cable ladders with karabiners, all very popular now but unknown then. Since this collaborative exploration was very successful, we at last realized that caves should be explored and investigated by a team, not by an individual biologist.

In the summer of the next year, the Society invited Henri COIFFAIT from Toulouse, France, making a joint exploration of caves mainly in western Honshu and Shikoku (cf. COIFFAIT, 1959, pp. 457–465). We were surprised to see his lightweight ladders with



Fig. 2. New equipments including a combination suit and a helmet with an electric lamp were first introduced into our cave explorations in 1956. (Photo Tetsuo KAWASAWA.)



Fig. 3. *Phreatodytes relictus* S. UÉNO, a very strange phreatic beetle which cannot swim though completely aquatic and need not breathe air.

C-rings at each end, the type of which became widely used in later explorations. In several years after that, the Society made a series of cave surveys on the Kitakami Mountains in northeastern Honshu, including the well known exploration of Akkadô, the longest known limestone cave in Japan. All these projects naturally included investigations of the phreatic fauna, which had rapidly developed since 1950, mainly by the effort of Yoshifumi MIURA and Yoshinobu MORIMOTO. I also examined a large number of wells in various parts of Japan, and wrote an overview of the subterranean water fauna of Japan, with descriptions of a new family, two new genera and two new species of anophthalmic aquatic beetles (UÉNO, 1957).

I received a D. Sc. degree from Kyoto University in the spring of 1960 with the dissertation entitled "The trechids of Japan, with special reference to the problem of cave fauna". This thesis was not published in its original form, as it was too voluminous to be printed in one volume under the situation at that time. I therefore split it up into many shorter papers for publication, some of which had to be completely rewritten because of continuous discoveries of additional species. In 1962, I was appointed as a curator at the National Science Museum and moved from Kyoto to Tokyo. My position was the curator of herpetology and not of entomology, though



Fig. 4. UÉNO standing in front of the entrance to Ryûsen-dô Cave in Northeast Japan. Near the end of the 1950's.

I was permitted to continue my studies in entomology and biospeology.

My activities in biospeology was temporarily reduced by this move and by the preparation of a revisional book on the reptiles and amphibians of Japan. I took up this work, because I was always interested in salamanders as a control for analysing the distributional pattern of trechine beetles and in this connection, became aware of the fact that the Japanese herpetology was more than two decades out of date, at least taxonomically. After the publication of this book (NAKAMURA & UÉNO, 1963), I was able to spare more time for trechine beetles and to resume cave explorations. Unfortunately, however, the Japanese biospeology already passed its first peak, because most zoologists previously interested in cave animals either completed or almost finished their studies on my collection and were losing interest in subterranean inhabitants. Only a small number of speleologists including myself continued their pursuit of cave animals

Then, a break came in 1965, when five students of the exploration clubs of Tokyo University of Agriculture and Tokai University planned a speleological expedition to South Korea and invited Yoshinobu MORIMOTO and me as supervisors. We accepted this invitation, and the monumental expedition was carried into effect in the

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Fig. 5. Only through this tight crawl, can be reached the habitat of *Ryugadous kajimotoi* S. UÉNO, a rare anophthalmic trechine beetle. Kôtoko-dô Cave in the Island of Shikoku. (Photo Tetsuo KAWASAWA.)

spring of 1966 in collaboration with Korean scientists and cavers (cf. UÉNO, PAE & NA-GAO, 1966). Though there were many hindrances, this expedition achieved very good results. We explored 23 caves in total and examined groundwaters pumped up from 49 wells, collected various kinds of animals, and clarified an outline of the cave fauna, which was proved to bear a close relationship to that of the northern side of West Japan. Our collection was enthusiastically welcomed by Japanese zoologists, who restored energy to work on their specialties, which resulted in publication of more than two dozens of reports.

In the graduate days, I also climbed up many high mountains for collecting alpine and subalpine carabids. I made the first entomological survey of the northern Hidakas in Hokkaido in the summer of 1960. At that time, there were no climbing routes to reach the highest peak, Mt. Poroshiri-daké, so that six days' hard work was needed to climb up to the cirque just below the summit. There I was surprised to find many specimens of an anophthalmic trechine beetle from beneath heaps of stones accumulated at the edges of a snow-patch, which was indistinguishable from cave forms, at least morphologically (UÉNO, 1961). On the windy ridge above the cirque, I also collected a strange endogean species of microphthalmic trechine beetle from beneath large stones deeply embedded in the ground, which was named later *Masuzoa notabilis* (UÉNO, 1960 b). Occurrence of these trechines in the alpine zone was most unexpected, and it was suggestive of the way how future biospeological investigations would be.

Early in the next summer, Hiroyuki MORIOKA and I made the first postwar investigation of the high mountains of Taiwan. The fauna of this subtropical island was investigated by many zoologists in the prewar times, but only one or two of them climbed up high mountains, many of which approach a height of 4,000 m. For this



Fig. 6. *Gulaphaenops leptodiroides* S. UÉNO, one of the most strange leptodiroid trechine beetles from a limestone cave in South Korea.

reason, the alpine fauna was almost unknown then, with the exception of that of Mt. Yü-shan, the highest peak of the island. I went up to the summits of four important mountains, and collected various animals specially in the alpine and subalpine zones, which contained many ground-living species new to science. Unfortunately, my searches for subterranean forms were not very successful both on high mountains and in caves, only two specimens of depigmented microphthalmic beetles, a platynine (*Jujiroa*) and a staphylinine (*Quedius*), being obtained in the subalpine zone. However, occurrence of an interesting subterranean fauna in Taiwan was suggested by the discovery of these species. It was amply proved some thirty years later by our systematic investigations.

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Fig. 7. Upper part of a snow-patch on Mt. Poroshiri-daké in Hokkaido, at the edges of which were found many individuals of an anophthalmic trechine beetle, *Trechiama borealis* S. UÉNO.

Interlude

Nineteen sixty-seven was an unforgettable year in my long career. In that summer, I joined in a biological survey in Malaysia and Thailand made by Kyoto University. On August 9, I was involved in a car accident near Chantaburi in southeastern Thailand, broke my right arm, underwent an operation, and was confined in a hospital at Bangkok for about a month. After released from the hospital, I continued collectings in northern Thailand with my right arm in a sling, and though I entered some caves there, I was naturally unable to make detailed investigations.

Two months after returning from Thailand, I went to the United States as a visiting scientist at Harvard University. On the way to Cambridge, Massachusetts, I dropped in at Lexington, Kentucky, and met Thomas C. BARR, JR., who took me along to many caves including famous Mammoth Cave. Everything I saw there was considerably different from what I knew in Japan. Above all, I was struck with the abundance of trechine beetles, especially *Neaphaenops*, in contrast to the rareness of their Japanese relatives. It was a great pleasure for me to realize that there were many things which could be learned only by experience.

At Harvard, I concentrated on studying rich collection of trechine beetles from South America under the supervision of Philip J. DARLINGTON, JR. Before the next spring, I sorted out all the specimens and determined them to the species level. Though no new species were included in that collection, I was able to acquire a very good knowledge of the South American trechine fauna, which could not be obtained merely from JEANNEL's useful revision (1962). The Museum of Comparative Zoology collection also contained rich material of Australian species, which were studied at that time by Barry P. MOORE who published their revision later (1972). I was much interested in their striking radiation on one hand, which seemed to me almost comparable to that of marsupials, and in the close similarity between some of them and South American forms on the other.

Before leaving Harvard, I discussed the matter with DARLINGTON. He did not entirely agree with me in considering that the South American trechine fauna might have been derived from the Australian one via the Antarctic Continent. However, I learned from him many important ideas about zoogeography while I was staying at Cambridge, and therefore I owed much to him in developing my own ideas on the distribution of trechine beetles and other things. Thus, my visit to the United States opened a brave new world before me.

Turn of the Japanese Biospeology

Towards the end of the 1960's, our explorations of limestone caves and potholes were drawing to the completion, or most of us believed so. In fact there still remained some caves that had to be explored, and many other caves were in need of repeated investigations for obtaining male specimens from respective trechine populations. At that time, however, I thought that more than 80% of the cave trechines occurring in Japan were already brought to light and that I could concentrate on clarifying the high altitude fauna in the next decade. No one could foresee how unreasonable my expectation was.

In 1968, I was nominated for a member of a joint research project organized by the National Parks Association of Japan and the Japanese National Subcommittee for the Conservation of Terrestrial Animals in the International Biological Program. Since Mt. Fuji-san was selected as one of the research areas, the organizer needed someone capable of executing investigations of the fauna of lava caves, which was considered to be an important component of the nature of the mountain. I was the strong candidate, as there were no other biospeologists who were active in field works, and though not particularly enthusiastic for the research project, I had to accept the responsibility after all. I was reluctant because lava caves were generally considered too young to develop specialized cave animals. This belief was not groundless, as all but one of the lava caves theretofore explored did not harbour any troglobionts comparable to those found in limestone caves.

Once I accepted the task, I made field investigations systematically and energetically, soon finding out that our former supposition was completely erroneous. I already gave several accounts of the process and results of this project (cf. UÉNO, 1971, pp. 203–206, 1987, pp. 593–596; UÉNO & KASHIMA, 1978, pp. 112–119). However, some parts of these accounts will be reproduced below with some modification, since my investigation of the Fuji lava caves carried out from November 1968 to October 1971 is the most momentous event in the history of the biospeology.

Already in the late 1920's and 30's, there were a few biologists who showed in-

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Fig. 8. Descent on a thin cable ladder into Motosu-daiichi-fûketsu Cave on the northwestern slope of Mt. Fuji-san. Many lava caves are accessible only through vertical blow holes. (Photo Takanori Ogawa.)

terest in the fauna of the Fuji lava caves. They were interested in lava tubes because these were the only natural caves whose ages could be determined on geological evidences. As cave animals were believed to have become differentiated strictly in caves, and as lava caves in the Fuji area were various in their histories, it was surmised that age difference between old and young caves must be reflected on morphological specialization of cavernicoles. Investigations along this hypothesis were made above all by KUMANO (1943), who explored with his students ten lava caves in five lava flows of different ages. His attempt did not bring about good result, and his collection was lost by the war. However, I commenced my own investigation along the same line as KUMANO's, since his working hypothesis seemed to me to make a good starting point.

To my utmost surprise, my first trip to the western and southwestern sides of Mt. Fuji-san was very fruitful. Many cavernicoles including certain unexpected forms were collected in the caves visited. Encouraged by this success, I extended my cave explorations next to the northwestern side and then to the remaining sides of the volcano. Certain caves were proved either very poor in the fauna or entirely lacking in animal life, whereas some others were well populated, especially by spiders and millipedes. Such a difference seemed to have no direct bearing on the quality and derivation of lava

flows, since inhabited and uninhabited caves frequently lay side by side in the same lava flow.

On the other hand, decisive faunal difference was observed between the caves lying in old lava flows 8,000–13,000 years old and those in young ones about 1,100 years old. This appeared to indicate that highly modified troglobionts could be evolved in old lava caves but not in young ones. However, 10,000 years or so did not seem sufficiently long for differentiation of highly modified troglobionts, and besides, all the troglobionts found in Fuji lava caves belong to groups, whose members are widely distributed in the neighbouring areas. If we regard them as having been modified independent of their relatives, we cannot explain the close similarity between lava cave forms and limestone cave ones, unless very unusual parallel evolution could have taken place between them. Thus, I had to seek for other factors than mere age to account for the faunal difference between old and young caves.

Analysing the ecological data amassed during the course of cave explorations, I came to realize that there was a definite difference in environmental conditions between old and young caves. Young caves are mostly composed of bare lava and devoid of soil, and the climate is usually subject to diurnal and seasonal fluctuations because of the porous nature of the rock. On the contrary, old caves are more or less covered with layers of soil and frequently have muddy floors; the climate is usually stable throughout the year as in limestone caves. It is therefore evident that the former is not suited for the habitats of highly specialized cavernicoles, especially of such soil-dependent animals as chthoniid pseudoscorpions and trechine beetles.

When it is created, a lava cave is completely bare. As time goes by, its roof be-



Fig. 9. A tunnel-like passage in Mitsuiké-ana Cave at the western foot of Mt. Fuji-san. This lava cave harbours *Kurasawatrechus fujisanus* S. Uéno (an anophthalmic trechine beetle), *Nesticus uenoi* YAGINUMA (a nesticid spider), and many other interesting cavernicoles.

(Photo Takanori Ogawa.)

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comes gradually eroded, forested and finally covered with thick layers of humus and soil. This coating keeps the underground climate stable and protects the environment from substantial changes. On the other hand, the soil gradually percolates into the cave with rain water, accumulates on the floor, and fills up small voids in the rock. For this reason, old caves are always wet and often have shallow pools of groundwater. The presence of soil is also indispensable for the existence of many specialized cavernicoles, since autotrophic microorganisms living in the clay or silt deposits synthesize certain vitamins in the absence of light and serve as the nutrition of young cavernicoles (CAUMARTIN, 1959). After all, habitats suitable for specialized cavernicoles are yielded only in old caves.

It was necessary to see whether the existence of troglobionts in environmentally stabilized lava caves is peculiar to the Fuji area or universally observed. Accordingly, we extended our studies to all the areas where lava caves were known, that is, the Island of Daikon-jima on Lake Naka-umi in western Honshu, Aso Volcano in central Kyushu, the Satsuma Peninsula in southwestern Kyushu, and the Island of Fukué-jima of the Gotôs off the western coast of Kyushu. The results of the explorations accorded well with that obtained in the Fuji area, almost all the old caves examined being inhabited by highly specialized cavernicoles (UÉNO & MORIMOTO, 1970; etc.). It was confirmed beyond doubt that the controlling factor in the lava cave fauna was the environmental conditions, not simply the age of the caves concerned.

In the summer of 1973, my wife Yoshiko and I attended the 6th International Congress of Speleology held at Olomouc, Czechoslovakia, at which I delivered an address on the fauna of the lava caves in the Far East (UÉNO, 1977 a). On this occasion, we took an extended trip through eighteen European countries, visited museums



Fig. 10. Entrance to Kasaishi-no-ana Cave on the Aso Volcanoes in central Kyushu. This lava cave is inhabited by an anophthalmic trechine beetle, *Rakantrechus asonis* S. UÉNO. (Photo Teruo IRIE.)

and institutions, met many friends of mine, and examined types of the Trechinae from Asia, South America and many other parts of the world. This enlarged my knowledge of the global fauna of the subfamily. We also visited the Laboratoire Souterrain at Moulis in the Pyrénées, met active biospeologists of the time including Albert VANDEL and Christian & Lysiane JUBERTHIE, and observed the famous underground laboratory for rearing cavernicoles and undertaking other experiments. They took me to some caves nearby, where I saw for the first time living *Aphaenops*, one of the best known ultra-evolved trechines in the world.

Biospeological importance of lava caves was subsequently recognized by Ho-WARTH, who discovered many extraordinary troglobionts on the Island of Hawaii (HOWARTH, 1972, 1980), and later by MACHADO (1987, etc.) in the Canary Islands. All the troglobionts discovered by them belong to groups autochthonous to respective island groups and have become differentiated in isolated condition under the tropical or subtropical climates, so that they cannot be directly compared with temperate forms. Their studies are, however, very important in clarifying that a specialized cave fauna can exist wherever there is a suitable environment for colonization and adaptation.

Next problem to be cleared up was to determine whether or not the troglobionts extant in lava caves had evolved after the eruption of lava flows bearing the caves concerned. It was difficult to approach the subject directly from the data obtained by the studies of lava cave inhabitants. Fortunately, however, a new light was shed from a different direction and led us to a new field of biospeology.

Exploration of Mine Adits

In the autumn of 1970, when I was still in an inextricable maze of lava cave problems, an anophthalmic trechine beetle was discovered by Masahisa OHRUI in an abandoned adit of a gold mine on the Izu Peninsula on the Pacific side of Central Japan. After a careful examination, it became apparent that the beetle was a new species closely related to a lava cave inhabitant endemic to the southeastern foot of Mt. Fujisan (cf. UÉNO, 1972 b). Subsequent investigations made by myself revealed that the adit had an interesting fauna very similar to that of old caves in the Fuji area. Most important was the discovery of an eyeless spider called *Falcileptoneta caeca*, which was common between the two areas.

The location of the gold mine was not very far from the nearest lava flow in the Fuji area, but was still more than 20 km distant in a bee-line. Besides, the geological feature of the intervening area was very intricate and not comparable to relatively simple calcareous terrains or lava fields. If the troglobiontic spiders extant in the two areas became independently differentiated from a common ancestor, they could not be perfectly identical with each other, even though a striking parallelism could have taken place. Therefore, certain underground routes passable for the spider must exist between Fuji and Izu however implausible it seemed to be. This inference

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Fig. 11. Sketch map of Karasawabora-no-ana, an old gold mine in the Izu Peninsula, Central Japan. An epoch-making discovery in biospeology was made in this small underground world.

was also supported by the fact that the mine adit was only 100–150 years old, or much younger than the youngest known lava cave in the Fuji area. No troglobiont could have undergone an appreciable morphological modification within such a short time.

Five years prior to the discovery of the mine fauna on the Izu Peninsula, Kintaro BABA discovered an anophthalmic trechine beetle, which was in every respect troglobiontic, from narrow fissures of shale about 2 m below the surface (UÉNO, 1972 a). In our present concept, the habitat of this beetle is typically upper hypogean, but at that time I was unable to distinguish it from the endogean domain, although I was much surprised at its unusual depth. The realization that artificial cavities could harbour specialized fauna directed my eyes once again to the importance of BABA's discovery. Similar environment under the earth might well be the original habitat of terrestrial troglobionts found in the mine adit.

It was, however, not easy to dig deep holes into the ground for seeking minute animals of considerable rarity. An easier way to obtain the same result seemed to me to be the faunal investigation of artificial cavities already dug by someone else, and it was mine adits of various kinds that seemed most abundant. Besides, there were several previous records suggestive of a promising future of this project. In the autumn of 1954, Shigeru NOMURA explored an abandoned mercury mine in eastern Kyushu and found that its fauna was very similar to those of nearby limestone caves. Though lying in a calcareous area, the adit itself was dug into a small hill mainly composed of chert. In the following year, I myself paid a visit to that area and examined the adit in question and two other adits of another mine, all of which were found rich in specialized fauna. All the adits harboured anophthalmic trechine beetles, to which

the new names *Rakantrechus andoi* and *R. nomurai fodinarum* were given (UÉNO, 1959, 1960 a). However, biospeological importance of these discoveries was neglected at that time, mainly because those adits lay either in calcareous terrains or in their vicinities. Only when a rich troglobiontic fauna was found out in the gold mine on the Izu Peninsula widely distant from any calcareous areas, I woke to a realization that I had been stupid enough to overlook such an obvious clue for probing into the real nature of the so-called cavernicoles. Standing on a solid ground, I renewed my study of mine fauna with the hope of pursuing the origin of terrestrial cave animals.

As in the case of the faunal study of Fuji lava caves, our exploration of mine adits progressed systematically and rapidly, but at first the results were not so good as expected. I had to endure repeated disappointment and almost gave up the whole plan. However, a favourable light was shed at the beginning of 1975, when a dead body of an anophthalmic trechine beetle was found floating on the surface of a pool of groundwater in an abandoned adit of a manganese mine on the Minoo Hills to the north of Osaka. With the aid of Yoshiaki NISHIKAWA, I made repeated investigations of the adit, and by the end of that year, became thoroughly convinced that the beetle was a regular inhabitant of that seemingly deserted artificial cavity. It was described in the next year under the name of *Trechiama nagahinis* in the first volume of the new journal of the reorganized Speleological Society of Japan (UÉNO, 1976), the first convention of which was held at Akiyoshi on October 26, 1975.

The discovery of T. nagahinis inspired NISHIKAWA to further efforts towards clarification of mine fauna, and he soon located several abandoned adits rich in specialized cavernicoles in the vicinities of Kyoto and Osaka. Fertile adits were also found out in the Island of Shikoku, and by the end of the 1970's, we were fully aware of the fact that specialized hypogean faunas are found in various kinds of artificial cavities including mine adits, underground shelters, conduits, prospecting adits at dam sites, and so on. The age of the cavities is not significant with the faunas, since highly specialized troglobionts are found in old adits 100 or more years old as well as in very young ones that were dug only 2 or 3 years before. Moreover, their existence is not directly dependent on the nature of rocks into which the cavities in question are dug; igneous and metamorphic rocks are equally suitable to sedimentary ones. However, most favourable are such clastic rocks as mudstones, shales, schists and breccias. This means that manganese and antimony mines are usually favourable for the existence of specialized cavernicoles, which is not very fortunate for biospeologists, since old adits lying in these loose fissured rocks are apt to entail dangers of collapse. Tuff mines are also frequently, but not always, good for habitats of specialized cavernicoles. On the other hand, pure granite is always devoid of specialized fauna; this was one of the main reasons why our investigation of mine fauna was not successful at the beginning. It is apparent at present that the sterility of granitic cavities is mainly ascribed to ecological causes. When eroded, pure granite only produces pure sand, so that granitic cavities are usually devoid of clay or silt indispensable for the existence of many terrestrial cavernicoles. The situation is similar to that observed in young lava

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Fig. 12. Yamautidius compositus S. UÉNO, an anophthalmic trechine beetle so far known only from the abandoned adit of the gold mine called Uéki-kôzan in the Island of Shikoku. (Photo Toshiki MOHRI.)

caves which are almost always bare and very clean.

On the occasion of the 7th International Speleological Congress held at Sheffield, England, in Septembler 1977, I made an address on the biospeological importance of non-calcareous caves (UÉNO, 1977 b), emphasizing the importance of pursuing investigations of non-calcareous artificial cavities and pointing out the logical deduction that the so-called troglobionts are nothing but such animals as live deep in the earth or in fissures of rocks beneath the soil.

We, of course, tried more direct method of finding out terrestrial troglobionts from their supposed natural habitats alongside of the faunal investigation of mine adits. This was a laborious and time-consuming task; its progress was slow and expected results were not gained for some time. Here again, NISHIKAWA displayed tireless activities, and after 1976, our flair became more and more developed for locating extra-cave habitats of anophthalmic trechine beetles. Our investigations rapidly progressed above all in the northern part of the Kinki District, or in the vicinities of Kyoto and Osaka, and already in 1980, I was able to publish a monograph of the anophthalmic trechine beetles belonging to the group of *Trechiama ohshimai*, in which quite a new aspect of biospeology was first introduced into science.

In this monograph, I recognized twenty-two species, of which six were then known only from caves of some kind (two of the six were later found in extra-cave habitats), thirteen were obtained from the underground habitats we specially looked for, and the remaining three were taken from both inside and outside caves. Thus, it was proved beyond all reasonable doubt that the so-called troglobiontic trechines were not confined to caves but widely occurred in narrow spaces on or near the bedrock beneath thick layers of the soil. At that time, I regarded this habitat as the lowest zone of the endogean domain, though it was unusually deep and loose than ordinary endogean environment.

Digging into the Earth

Before 1970, only a small number of endogean species of anophthalmic trechine beetles were recorded in the Japanese Islands. This was rather strange, since one of those species (*Trechiama angulicollis* JEANNEL) had been discovered as early as in the 1920's. They were invariably known from isolated individuals accidentally found out from beneath large stones. Searching for natural habitats of hypogean species, however, I often came across endogean trechines, usually from beneath large stones deeply embedded in the soil and also from soil layers below. Many of them were short-legged and crawled about on the undersurfaces of stones, but there were others which were long-legged and usually ran about on the clayey soil under stones, not on the surfaces



Fig. 13. Suzuka masuzoi S. UÉNO, an endogean anophthalmic trechine beetle showing the highest modification of the articulation of fore and hind bodies.

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Fig. 14. Schematic cross section of a colluvium showing the habitat of anophthalmic trechine beetles and other troglobionts. UHZ – upper hypogean zone; S – soil layer.

of the stones themselves.

If soil layers were not compact because of inclusion of numerous stones of various sizes, these long-legged forms, including *T. angulicollis*, were also found in deeper places, sometimes 2 m or more below the surface, and were regularly found near the bedrock. It was inferred from this fact that they were originally the inhabitants of the deep zone near the bedrock and only temporarily emerged from there. This inference seemed reasonable, since long-legged anophthalmic trechines were sometimes met from under small stones, when the water level of gullies became higher than usual after heavy rains. Taking these matters into account, I concluded then that if we could locate such spots as the overlying soil mantle was relatively thin, we should be able to save the labour of excavation to a considerable extent.

After making futile attempts along this line, we finally came to realize that eyeless animals were most easily dug out from colluvia deposited under steep slopes at the sides of gullies or narrow streams. As they were particularly frequent along the courses of trickling waters, seepages made good starting points for excavation. Usually the thickness of the soil mantle was 50 cm or more, which means that we had to remove several tons of soil and rock debris before reaching the habitats of anophthalmic trechine beetles. In such places as the mantle was thin, however, they were found at a depth of only 10–20 cm, always in spaces between soil layer and bedrock, which form a pe-

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Fig. 15. Excavation of an upper hypogean habitat of *Trechiama murakamii* S. UÉNO, an anophthalmic trechine beetle, at the Gazatta-dani in the Island of Shikoku.

culiar environment named the upper hypogean zone. In other words, it was not the depth but the environment similar to the interior of caves that delimited their habitats.

With the discovery of the new method of locating extra-cave habitats of cavernicoles, our investigations made a marvelous progress. A large number of eyeless depigmented animals were brought to light by my own efforts with unfailing collaborations of many friends of mine. Anophthalmic trechines were found almost anywhere in the mainland of Japan excluding the northern and eastern parts of Hokkaido. They were usually nonexistent in pure granitic terrains and alluvial plains, but even on granitic hills, certain species like *Trechiama angulicollis* and *T. instabilis* were found in a kind of oasis suitable for their existence. It was indubitable that anophthalmic trechines and many other terrestrial cave animals distributed in temperate regions had originated in the upper hypogean zone.

The upper hypogean fauna existed also in such areas as had been immersed by Pleistocene transgressions. Anophthalmic trechines were widespread, for instance, in the Hokuriku District and the Mogami-gawa drainage area in northeastern Honshu, both of which had been immersed in the early Pleistocene. Moreover, a distinctive species, *Trechiama terraenovae*, was discovered on the Miura Peninsula, which had not been in existence in the Second Interglacial and had become a part of an alluvial plain through the Third Glacial (UÉNO, 1988). Since no long-legged anophthalmic trechines have ever been found in low plains less than 100 m high, colonization by ancestral *terraenovae* does not seem to have taken place either in the Third Glacial or in the Last Interglacial. In all probability, that colonization must have been effected

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Fig. 16. Schematic cross section of a micro-cavern harbouring *Masuzoa ussuriensis* LAFER, a microphthalmic trechine beetle of cursorial habit, on Mt. Oblachnaya of the Sikhote-Alin in the Russian Far East.

sometime in the Last Glacial after the upheaval of the apical part of the peninsula. All these evidences seem to indicate that colonization of the upper hypogean zone and subsequent speciation of so-called troglobionts usually took place after the Last Interglacial Age, or in other words, to suggest that their speciation must have progressed much more rapidly than it is generally considered.

In October 1985, the Zoological Society Prize of Japan was awarded me for the painstaking and time-consuming study on the derivation of terrestrial cave animals (UÉNO, 1985, 1987). My exploits were widely recognized in Japanese scientific societies, though there were still many problems that had to be clarified. Most important was to confirm if similar upper hypogean faunas were widespread in other Asian countries. This was not an easy task to carry out, because it appeared considerably difficult to locate appropriate places for excavation in such denuded dry areas as most parts of eastern China or in such granite-prevailing country as South Korea. I failed in finding out rich upper hypogean fauna in the Russian Far East, though a depigmented microphthalmic trechine, *Trechiama sichotanus*, was dug out from a typical upper hypogean layer (UÉNO & LAFER, 1992). Perhaps the Primorye Territory is too northern to develop a highly specialized terrestrial subterranean fauna. However, I was surprised to find a very peculiar habitat and habit of a depigmented microphthalmic trechine, *Masuzoa ussuriensis*, in the alpine zone of Mt. Oblachnaya

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on the Sichote-Alin. This unique species dwells in thick heaps of stones or rock debris, and spends a cursorial life on wet walls of a kind of micro-cavern formed by wide spaces among rock debris (cf. UÉNO, 1994). Its habitat cannot be said typically upper hypogean, but looks like a miniature of caves in an ordinary sense, and the mode of life of this species is similar to that of aphaenopsoid trechines in limestone caves. I have never seen any similar habitat of a trechine beetle in my long career of field investigations.

Before visiting the Russian Far East in 1991 and 1992, I organized zoological expeditions to the high mountains of Taiwan from 1989 to 1991. I climbed up many



Fig. 17. Two anophthalmic trechine beetles from high mountains of Taiwan. Left: Masuzonoblemus tristis S. UÉNO, an endogean species endemic to the subalpine zone (3,580 m in altitude) of Mt. Hsüeh Shan. Right: Trechiama hamatus S. UÉNO, an upper hypogean species known only from the subalpine zone (2,870 m in altitude) of Mt. Neng-kao-pei-feng. Shun-Ichi UÉNO



Fig. 18. Jujiroa parvicollis S. UÉNO et A. SAITO, a microphthalmic platynine carabid beetle known from the upper hypogean zone of Mt. Cho-she-ta Shan in central Taiwan.

high mountains, some of which had never been visited by entomologists before. Though many interesting arthropods were collected by our investigations, the most important discovery from the biospeological viewpoint was that a true upper hypogean fauna similar to that of Japan did exist in the subalpine zone of many high mountains. We dug out four anophthalmic species of *Trechiama* (UÉNO, 1990, 1991, etc.) and seven microphthalmic species of *Jujiroa* (UÉNO & SAITO, 1991), almost all from the typical upper hypogean zone. Besides, we discovered two endogean anophthalmic species of trechine beetles, also in the subalpine zone, which formed a new genus, *Masuzonoblemus*, with relatives known only from Northeast Japan (UÉNO, 1989, etc.). Lying at the northern periphery of the tropical zone, the Island of Taiwan is surmounted with high mountains, many of which exceed 3,000 m in height. This makes its fauna very rich and very much complicated. Limestone caves are known on low hills at the southern



Fig. 19. Map showing the distribution of anophthalmic trechine beetles in Japan. Map A is based solely on the species known from limestone caves. Map B is drawn from our present knowledge enlarged by the discoveries of mine and upper hypogean faunas.

part of the island, but do not harbour any terrestrial animals of deep biospeological interest. Specialized forms occur at higher elevations, usually more than 2,000 m in altitude and sometimes above 3,000 m in height. Most of them live in the upper

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hypogean zone along narrow streams on rather gentle slopes.

My pursuit of the upper hypogean fauna is still on the way even in Japan. About half a dozen new species of anophthalmic trechine beetles are being discovered every year, and the total number of the known species well exceeds 300 at present. As was noted before, only eleven species of the Trechinae were recorded from Japan when I started for my study of the subfamily. The number was brought up to about 130 when my explorations of natural caves attained to the end of the first phase. It multiplied with the progress of our faunal investigations of artificial cavities and the upper hypogean zone, and now amounts to more than thirty times the original figure. Thus, "digging into the earth" has become one of the most important things to do for biospeological studies. It has broadened the scope of biospeology to a considerable extent. By doing this, we can fill in wide blanks in our knowledge about the distribution of terrestrial cavernicoles, and can analyse their phylogeny on a much sounder basis than before. It is, however, a very laborious work to excavate a trench 1-2 m wide. 2-3 m long and 1-2 m deep for collecting several specimens of minute eveless animals. Very few scientists are willing to follow up this line of study. I myself cannot foresee how far and how long I shall be able to continue this hard work. Nevertheless, I cannot help hoping that someone will succeed me in pursuing the study of the upper hypogean fauna, as I am confident that this is a fruitful way to seek for the origin of terrestrial cave animals.

Epilogue

Looking back upon bygone days, I cannot help feeling that Fortune has been always smiling on me. I was born to Masuzo UÉNO, who was a leading zoologist and pioneer biospeologist in Japan. I learned from him all the elementary knowledge about biology and how to write scientific papers. Entering Kyoto University, I met Riozo YOSII, who first showed me Japanese specimens of an anophthalmic trechine beetle and always encouraged my study on cave animals. Through the undergraduate days, my investigations of the fauna of limestone caves were like stepping into an untrodden path. No one ever tried to perform such a quixotic act as to examine all the caves extant in Japan. Almost every organism I came across in those caves was new to science, and naturally, trechine beetles were no exceptions. It is seldom that a specialist in a group of animals is given the opportunity to work over an entirely new fauna in his or her home ground. I was very fortunate to have been given such an opportunity. Besides, cave explorers, not to speak of cave biologists, were extremely rare in the 1950's, so that I was much prized by local people who willingly offered lodgings and helped my cave explorations.

After moving to Tokyo at the beginning of the 1960's, I was often aided by serendipity. I was the first to have recognized several momentous facts in the field of biospeology. For the first time in the world, I realized clearly that the lava cave fauna is very important for pursuing the origin of terrestrial cavernicoles, that the

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vital factor to control the animal life is not the mere physical ages of lava caves but the environmental condition changing with passage of time, and that the so-called troglobionts have not evolved in lava caves themselves but secondarily colonized from adjacent areas. If I were not furnished, or rather forced to take, the opportunity to make biological explorations of the Fuji lava caves, my recognition of the real nature of cavernicoles might have been delayed considerably. Besides, I had the advantage of geographical position to make repeated explorations in the Fuji area, one of the best fields for the study of lava cave problems.

My investigation of artificial cavities that followed the biological exploration of lava caves was started off with OHRUI's timely discovery of an interesting specialized fauna in an abandoned adit of a gold mine. Existence of such a fauna was not expected till the end of the 1960's, even though some troglobiontic animals had been reported from a mercury mine in eastern Kyushu. With the success of this project, I became confident of my working hypothesis that terrestrial cavernicoles should occur anywhere under the earth so far as environmental condition allows their existence. To follow up this line of investigations, BABA's discovery of an anophthalmic trechine beetle (*Trechiama echigonis*) from the depth of about 2 m gave me a substantial clue to looking for their underground habitats. In carrying on this painstaking work, I was aided by many colleagues and friends, who did not avoid getting muddy and soaked with sweat. We still continue at this hard work and are obtaining new knowledge from time to time.

Beside biospeological studies mainly in Japan. I participated in many expeditions to foreign countries. I visited Southeast Asia and China many times, which included the Philippines and northern Vietnam. I visited Mexico once, with Robert W. MITCHELL. I organized expeditions twice to New Zealand, Australia and Tasmania, three times to the Himalayas including Nepal, West Bengal and Sikkim, three times to Taiwan, and twice to the Russian Far East. In all these expeditions, I endeavoured to collect trechine beetles, particularly on high mountains, and accumulated a large number of materials, which furnished a satisfactory basis for my study of the Far Eastern Trechinae. Though I described new species from foreign countries from time to time, it is not the purpose of my collecting trechine beetles in remote countries merely to describe new species or subspecies. My chief interest has always been in clarifying a general sketch of their distribution in connection with the origin and the routes of past dispersal of the Far Eastern species. I am convinced now that the extant trechine fauna of Australia and Tasmania is composed of a single phyletic group of the Trechini, which has a close relationship to South American forms, whereas that of New Zealand is composed of two phylogenetically different groups, one of which is remotely related to Australo-Tasmanian genera but the other has a close relationship to the Far Eastern ones. I am convinced now that the trechine fauna of the eastern Himalayas has a close relationship to that of East Asia including China, Taiwan and Japan, but that of the western Himalayas lacks some important elements and is different in this respect from the eastern fauna. All these conclusions have

been employed, either directly or indirectly, for analysing distributional patterns of the Far Eastern forms, and have furnished important auxiliary bases for my discussion. My only regret is that I have been unable to seize an opportunity to investigate the fauna of caves and mountains in North Korea, which must be essential for clarifying the trechine fauna of East Asia.

I am not certain in which subject I have had deeper interest, systematics of the Far Eastern Trechinae or biospeology. Perhaps the former has been my principal theme, since in the first place, I was lured into caves by trechine beetles, not by beautiful stalactites and stalagmites. In any case, investigations on these subjects come very expensive, and because of their rareness, trechine beetles may be the most expensive insects in Japan. Fortunately, my studies have been supported by grants-in-aid, mostly from the Ministry of Education, Science and Culture, Japan, but still I have had to defray considerable amount of money from my own pocket for undertaking field investigations. Needless to say, financial problems have been more difficult in making long-term expeditions to remote countries. Here again, expenses have usually been granted from the same ministry, but the money granted has not always been sufficient for covering our needs.

My principle of pursuing the systematics of trechine beetles is to make field investigations at any cost, to examine their natural habitats and mode of life, and to draw a conclusion from my own observations. Actually, I have seen almost all the known localities of flightless trechines in the Far East, and have visited many others in the world. I could never have accomplished this, were it not for the deep understanding and invaluable help of my beloved wife, Yoshiko, to whom I wish to express my warmest appreciation in closing this brief history.

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Checklist of Writings by Shun-Ichi UÉNO

The following checklist seems almost complete, though several ephemeral articles may be overlooked. Titles are arranged in chronological order. New English titles are given to all the articles entirely written in Japanese, and original Japanese titles are added to translated ones to avoid future confusion. Newspaper accounts and anonymous articles are omitted.

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1949

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On Threatened Plants in Japan

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Abstract General information on the threatened plants in Japan is discussed briefly. Information available at present is summarized to list up about 17 percent of vascular plants as threatened species. Non-vascular plants are studied less in detail, and examples of threatened species are listed up, as in the case of vertebrates and invertebrates. Monitoring of Red-Data plants in Japan is now carried on under a committee organized by the Japan Society of Plant Taxonomists supported by the Environment Agency. Two examples of comprehensive results of conservation biology, on *Primula sieboldii* and on *Farfugium* species, are introduced. Reintroduction is carried out especially by the staff members of the Botanical Gardens, University of Tokyo, for the plants of the Ogasawara Islands, an oceanic island group some 1,000 km south of Tokyo. Speciation of agamosporous fern species is also briefly commented.

Introduction

Biodiversity is a focus of discussion at the moment, not only in biological societies but also in general public in relation to natural genetic resources to be developed and to environmental elements to maintain our globe in coming centuries. Influenced by rapid increase of human population in global conspectus and diversification of human activities, nature on the earth has greatly been changed, and biodiversity is seriously endangered. We are facing the crisis of decrease of biodiversity caused by extinction of a number of species. This is to be overcome urgently in order to maintain harmonious coexistence of nature and mankind.

A Red Data Book on the vascular plants of Japan was edited in 1989. Eight hundred and ninety-five species among about 5500 existing species were listed up in Extinct, Endangered, Vulnerable, and Indeterminate in the IUCN categories of threatened species. Since then, a number of contributions have been made on the threatened species problem in Japan (IWATSUKI, 1994).

It is rather unusual to contribute this botanical paper to a commemorative volume of Dr. Shun-Ichi UÉNO, a great zoologist, but I expect that we have some common basis of interest in conservation biology. The present author wishes to dedicate this paper to Dr. UÉNO in commemoration of his retirement from the National Science Museum, Tokyo.

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1. Present Status of Red Data Book on Japanese Plants

In 1986, a working group was organized to survey the present status of endangered plants in Japan. This research group was formed under an umbrella of the World Wildlife Foundation, Japanese Committee (WWF-J) and the Nature Conservation Society, Japan (NACS-J), and supported by the Japan Society of Plant Taxonomists. The Environment Agency of the Japanese Government sent an observer to this survey group, and the process of survey was continuously informed to a special committee of studying threatened species organized in the Environment Agency. Thus, the survey of threatened plants in Japan was made in collaboration with plant taxonomists, and governmental and non-governmental organizations.

The survey group invited professional and amateur naturalists throughout Japan to contribute any information on dynamics of the flora of Japan. At least one naturalist contributed from each of 47 prefectures of Japan. There are a number of local naturalists in Japan who continuously observe the plants growing in their regions, and a large amount of valuable information has been supplied by them. Compiling such information, specialists of the fields concerned made a series of supplementary field observations. Through such a procedure, a Red Data Book was compiled and published by WWF-J and NACS-J.

Eight hundred and ninety-five species among about 5500 known plant species in Japan were seriously threatened, or listed up in Extinct, Endangered, Vulnerable and Indeterminate according to the IUCN categories (Table 1). Some seventeen percent, or one of every six species, is so large a figure as to give a shock to the botanists as well as to the general public in Japan. In addition to this tremendous figure, it was grievously noted that many wild species popular to Japanese people were threatened: for example, *Eupatorium fortunei* is one of the seven autumn flowers; *Lithospermum officinale* ssp. *erythrorhizon* is used to extract purple dye from the roots and is one of the important elements in 'Genji-Monogatari', one of the famous classics published in

	Extinct	Endangered	Vulnerable	Indeterminate	Total	
Pteridophyta	10	11	74	6	101	
Gymnospermae	0	0	4	0	4	
Angiospermae						
Dicotyledoneae						
Sympetalae	5	41	138	4	188	
Choriopetalae	10	41	190	3	244	
Monocotyledoneae						
Orchidaceae	6	40	94	4	144	
Other than orchids	4	14	177	19	214	
Total	35	147	677	36	895	

Table 1. Threatened vascular plant species in Japan.

Based on Endangered Plants Survey Group (1989).

		Extinct	Endangered	Vulnerable	Indeter- minate	Total
Development	Wetland development	8	19	110	5	142
	Deforestation	5	23	97	1	126
	Grassland development	1	7	28	2	38
	Construction of roads	0	1	17	1	19
	Construction of dams	1	2	8	0	11
	Other	1	11	39	0	51
Collection	Horticultural	3	71	178	2	254
	Medicinal	0	0	3	0	3
Other factors	Rare	0	22	252	2	276
	Eaten	0	3	8	0	11
	Trampling	0	0	9	0	9
	Volcanic ash	3	0	1	0	4
	Unknown	13	3	7	23	46

Table 2. Reasons for threats to plant species.

Modified from Endangered Plants Survey Group (1989).

some 10 centuries ago by famous Murasaki (purple)-shikibu; *Primula sieboldii* is a popular horticultural plant and hundreds of cultivars were bred already in the Edo dynasty, or in the 18th and early 19th centuries; *Adonis radiata* is another horticultural plant, especially evaluated as a pot flower in New Year days; *Habenaria radiata*, an orchid very common in marshy places; and so on.

A continuous campaign was made on the basis of this research. I myself have published a number of articles in a variety of journals in Japanese, and also several books in Japanese. Mass media in Japan, televisions and newspapers, have also been interested in this topic, and we could have a successful campaign about threatened plants in Japan. Our survey group intended further to evaluate the factors to give influences to the effect, and compiled a general scheme mostly based on speculation through experiences (Table 2).

This Red Data Book is on the vascular plants, or on pteridophytes and spermatophytes. A survey on bryophytes, algae, and fungi was carried out by a committee established in the Environment Agency, but it was difficult for this committee to invite naturalists to contribute information, since only a few naturalists know these organisms accurately. Therefore, a Red Data Book on these organisms was edited mostly depending on information available by the specialists of the groups concerned and more or less based on their knowledge extracted from their experiences. This tentative list was published in 1993, as in the case of vertebrate and invertebrate animals (1991).

Based on these fundamental surveys, dynamics on the flora and fauna of Japan were elucidated to some extent, and such a scientific basis urged the importance of protecting biodiversity in nature of Japan. An endangered species act was proposed in 1992 by the Environment Agency with collaboration of some other ministries, and was endorsed. Conservation of endangered species is now a national idea in Japan,

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and a few primary steps are taking actual effect to maintain species diversity in nature of Japan.

2. Monitoring of the Flora of Japan

Basic study on the flora of Japan is in progress, by applying a variety of modern biological techniques. Actually a number of excellent papers are contributed day by day, and we can see a great progress on the knowledge on the flora of Japan. An English edition of rather concise Flora of Japan is now under publication, with the first installment in 1993. Several volumes are expected to be completed before the end of this century, including modern knowledge in traditional floristic treatise.

Influenced by human activities, a great and rapid change of flora is seen even though conservation is promoted by various types of efforts. And, it is vitally important to observe dynamics of flora very carefully. From 1994 on, we have organized a network to trace daily changes of flora in details. This network is composed of some 100 naturalists throughout Japan, representing every prefecture at least by one naturalist. Many of the members are the same as those contributing to the edition of the Red Data Book. This network was originally planned by the Environment Agency, and the Japan Society of Plant Taxonomists agreed to accept its proposal. The JSPT has a special committee to contribute to monitoring of plant biodiversity in Japan. Thus, we now have a collaboration between governmental Agency and scientific Society, in organizing professional botanists and amateur naturalists to observe dynamics of flora very carefully.

This project has just started, and at first we have a three-year project to promote this activity. The data sheets are now at the hands of contributors, and detailed information will be accumulated in a data-base.

3. Conservation Biology

Basic survey of threatened species has been made as noted in the preceding sections. This type of survey is, however, made based only on observation in the fields. More analytical research on conservation biology is urgently needed for establishing actual conservation strategy, as we cannot see biological features of threat on the organisms from observing in the fields. In this respect, we have several examples quite interesting to understand actual structure of species.

Primula sieboldii in Tajima-ga-hara. This site is protected for more than half a century to conserve *Primula sieboldii* and thousands of stocks of this species bloom in the spring beautifully in 4 ha of protected area. This is often said as a good example of protection and is introduced in various ways. According to the observations, however, this species is not well protected there.

Primula has typical heterostyly in its flower, and is entomophilous. Although the protected area of 4 ha is well maintained, surrounding areas have completely been

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developed: resident areas, industries, schools, and a golf course. Primula is perennial, and lives for many years. Every year we can see full blossom of this perennial rooted on earth there. But, 4 ha is too narrow to accommodate insects to pollinate Primula there. For pollination purpose, insects have to be brought into this protected area, but there is no way available for insects to pass: even the golf course is not transferable for insects, as a large quantity of insect-killer chemicals are always sprayed on the golf course. The pollination cannot be performed, no fertile seeds are available for many years, and thus, no young plants are observed there. It is observed that all the plants within this protected area of 4 ha are genetically homogeneous; it is suggested that they had free exchange of genes many years ago, or pollination was performed at that time. And, Primula plants lost their completion of life cycle by recent development of the surrounding areas. It is clearly shown by this observation that only 4 ha are not enough to protect the site of the Primula species. In order to maintain lives of this particular species, it is necessary to provide satisfactory habitat for it, especially in this case, to keep harmonious coexistence with insects to pollinate it. It is a valuable suggestion to have complete conservation strategy and to maintain biodiversity in nature.

Farfigium in Yakushima. YAHARA et al. (1986) observed an endemic species of Farfigium in Yakushima. On this small island, F. japonicum is rather common in open areas in the coastal zone or in lower elevation. Contrary to this, an endemic species, F. hiberniflorum, is found only in dense mountain forests. The difference in their habitat selection maintains these two species on this small island. They can hybridize very easily without any particular process of artificial hybridization, if they are placed in neighboring places.

Actually, *F. hiberniflorum* seems to have evolved in dense forests and have been separated from the widespread species. And, we have at the moment a new problem on these two species. Roads were constructed in the mountainous area of this island, first to bring down woods from operated areas, and then for the sake of visitors for sightseeing. New roads occupied open zones on dense mountains, though the zones are very narrow. *Farfigium japonicum* was then coming up mountains along continuous narrow belt, and vigorously growing there.

Farfigium species are pollinated by insects, and it is observed that pollinators can fly only within a few metres. But anyway, the pollinators can meet F. hiberniflorum after having a visit to F. japonicum. Thus, natural hybridization can be performed naturally first just along a narrow belt of the open road side. It is therefore natural that gene flow is continuously introgressing deeply into forests, and it is awarded that F. hiberniflorum is rapidly losing its genetic distinctness, being supplied genes from population of F. japonicum through natural hybridization.

In this case, again, construction of roads is restricted to only narrow belts and most parts of huge primitive forest areas seem still protected. Actually, however, it is seriously threatened by genetic introgression through only a narrow belt artificially established. A careful consideration must be made on the events of this

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type of nature destruction, and conservation strategy must be established on careful observation of species in nature. In this respect, promotion in conservation biology is vitally important.

4. Reintroduction Project

As is elucidated by editing Red Data Book, it is apparent that many wild species of Japan are seriously endangered. In many cases, it is difficult to expect a recovery of their population even if their habitats are recovered for particularly endangered species. It is hardly possible to have natural evolution by themselves. For those plants, we have to offer some artificial reproduction in such institutions as botanic gardens and to reintroduce reproduced individuals to their native localities.

One of the most successful examples is a reintroduction on the Ogasawara Islands. SHIMOZONO and IWATSUKI (1986) started this project to recover natural population of seriously endangered Ogasawara species as *Melastoma tetramerum* and others. Though a full description of reintroduction process is left for another occasion, it will be summarized here on some particular points of this project.

Reintroduction is one of the symbolic activities of nature conservation, and arouses public interest. Mass media, televisions and newspapers, are interested in introducing this project, and now *Melastoma tetramerum* is one of the symbolic species of endangered plants in Japan, sometimes comparable with panda and the Japanese ibis *Nipponia nippon*.

The project is financially supported first by Tokyo Metropolitan local government and then the Environment Agency. The plantation of reproduced stocks in the Ogasawara Islands was conducted to invite local people including primary school pupils. Through such activities, interest of conservation by local people was very much promoted. At the moment, people of the Ogasawara Islands are careful to maintain species diversity there, and illegal collection for cultivation is hardly possible on these islands.

Most of the species of the Ogasawara Islands were neglected by systematic botanists, and *Melastoma* is an example of this case. Two distinct species are recognized isolated on Chichi-jima Island and Haha-jima Island, though both of them had been treated conspecific until this project was started. Further, these species are now considered to form a particular group within its enormous genus *Melastoma* and more analytical research including molecular techniques is now under operation. Promotion of reintroduction activities thus invites biosystematic analysis on the line of conservation biology.

Finally, one comment should be given here. As this project is successful and introduced through mass media, there are similar trials performed in various places on various species. Sometimes, materials taken from a locality are reproduced in institutes and introduced to a different locality where the species concerned is seriously threatened or even extinct. It is vitally important to keep genetic structure of local

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population, and we cannot be too careful not to transplant from one locality to another. Reintroduction project must be performed only in reintroducing the plants to their original locality. Even if we can say it the same species, we have analyzed their genetic structure only in a few examples, and in most cases we are not very sure if the species from two different localities is really homogeneous or not. If we misrecognize the species and bring it into a different locality, we may seriously destroy the natural equilibrium of the locality, which is the worst possible natural destruction. This is the only point to be commented in relation to reintroduction project.

5. Increase of Biodiversity under Human Activity

This is just a preliminary comment, as our suggestion has yet no sound scientific basis. There are a number of agamosporous or agamospermous species recognized especially in urban areas or at least in artificial or secondary forests. It is highly probable to consider that such an abnormal life style of land plants was introduced in relation to sudden destruction of their nature, or in other words, under artificial influence. This means that the evolution of mankind created a wide range of new habitats, and there are a number of species diversified in such habitats. We may refer this type of diversification to an increase of biodiversity, but this is only apparently.

In case of the ferns, some ten percent of all the known species are recognized as agamosporous; if we treat only the Japanese flora, more than fifteen species are known to be agamosporous. We are still not very sure how many species of them have actually be diversified in artificial habitats, but still, we can expect a fairly large number of species which have been introduced under artificial condition.

However, we have to note that such an agamosporous life style is not very welcome for them: agamosporous species seem to live rather vigorously at the moment, but this is just a tentative life style. They form this style as an urgent escape to live in a newly established habitat, but agamosporous species cannot be expected to have natural evolution unlike sexual species succeeding in its evolutionary history. Some modifications of life style were recorded (WATANO & IWATSUKI, 1988), though general tendency for agamosporous life style has not yet been elucidated. Such a type of increase in biodiversity is rather abnormal, and we cannot expect a prosperous future for such particular forms.

Conclusion

As briefly summarized on the five preceding subjects, conservation of biodiversity is a topic to be discussed in a broader sense to realize a harmonious coexistence of nature and mankind, and endangered species problem is one of the urgent topics to be overcome by human beings. I am rather reluctant to foretell the future in Japan, as we have already settled valuable treatise. But, in the global conspectus, we still have many problems to be solved. And, we need have many biologists who can contribute

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to this field.

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Two New Freshwater Cavernicolous Planarians (Turbellaria, Tricladida, Paludicola) from Sulawesi (Celebes), Indonesia

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Abstract Two new species of the genus *Dugesia* (Turbellaria, Tricladida, Paludicola) from caves of Sulawesi (Celebes), Indonesia, are described; they are the first and second records of freshwater triclads from this island. *Dugesia uenorum* KAWAKATSU et MITCHELL, sp. nov., from Lubang Pangni Cave, Maros-Karst, Camba, is a troglophile having 2 small eyes and some body pigmentation. This new species has an asymmetrical penis papilla with a weakly developed valve at its basal part. *Dugesia leclerci* KAWA-KATSU et MITCHELL, sp. nov., from Gua Tanette Cave, Kappang-Maros, is a white and eyeless troglobite. This new species has an asymmetrical penis papilla without a valve at its basal part. They can be separated easily from the other members of the genus in their external morphology and in the details of their genital anatomy and histology.

Introduction

In 1989, KAWAKATSU and MITCHELL reported the occurrence of *Dugesia* sp. from Gua (Cave) Tanette, located in southwestern Sulawesi (Celebes), Indonesia, based upon material collected by Dr. L. DEHARVENG (Toulouse Cedex), a member of the "Expédition Maros 1988" organized through the "Association Pyrénéenne de Spéléologie". Due to the absence of sexual specimens in the Gua Tanette collection, this white, eyeless, troglobitic, freshwater planarian from Sulawesi could not be identified with certainty.

After the above-mentioned paper was published, Dr. DEHARVENG and Dr. P. LECLERC (Bicêtre, Ivry sur Seine), who were members of the "Expédition Maros 1989" and "Expédition Maros 1990", graciously sent to KAWAKATSU preserved collections of planarians from 3 caves of Sulawesi: Lubang Pangni Cave, Gua Tanette Cave and Gua Londron Cave. Several sexually mature specimens were included in both the Lubang Pangni and Gua Tanette collections; the Gua Londron collection was a single, asexual specimen.

On examination of these preserved specimens and the series of their sections (pre-

pared in KAWAKATSU's laboratory), it has been found that each of the Lubang Pangni Cave and Gua Tanette Cave triclads belongs to an undescribed species of the genus *Dugesia* of the family Dugesiidae. The original descriptions of these two new species will be given in the present paper by KAWAKATSU and MITCHELL.

Localities, Materials and Methods

The animals used for the present study consists of 3 stocks. The Specimen Lot Numbers given to them are those registered in KAWAKATSU's fixing notebook according to his permanent recording system. The locations of the three caves where planarians were obtained are shown in Fig. 1 (for Gua Tanette Cave, see sketch-maps in KAWA-KATSU & MITCHELL, 1989 b, pp. 36–37, figs. 1 and 2).¹⁾ Topographical sketch-maps of Lubang Pangni Cave, Gua Tanette Cave and Gua Londron Cave are shown in Figs. 2 and 3.

1) Specimen Lot No. 1996. *Dugesia uenorum*, a new species which will be described in the present paper. Two sexual and 6 asexual specimens (8–10 mm long and 2–2.5 mm wide) collected from cave-waters in Lubang Pangni Cave (lat. 4°59′83″S. and long. 119°45′W.), Maros-Karst, near the Village of Bengo, District of Camba, Sulawesi (the altitude of the cave entrance, ca. 400 m); fixed in 70% ethanol. Coll. Messrs. D. RIGAL and P. SOLLIER; July 12, 1988. Received from Dr. P. LECLERC.

Note. This is a deep limestone cave (approximately 760 m in length). Planarians examined were collected in pools in the deepest region of the Cave (see Fig. 2, top and bottom).

Literature: "Maros 88-89" (issued in 1990), pp. 10-11, 34-35, fig. 3.12: "Indonésie 92" (issued in 1994), p. 41.

2) Specimen Lot No. 2009. Dugesia leclerci, a new species which will be described in the present paper. Five sexual and 5 asexual specimens (8–12 mm long and 1 mm wide) collected from cave-waters in Gua Tanette Cave (lat. 5°00'25''S. and long. 119°42'E.), Maros-Karst, Kappang-Maros, Sulawesi (the altitude of the cave entrance, ca. 100 m); fixed in 70% ethanol. Coll. Dr. P. LECLERC; August 14, 1990.

Note. This is a very large limestone cave discovered during the "Expédition Thai-Maros 86" (issued in 1987) (see KAWAKATSU & MITCHELL, 1989 b). Planarians examined were collected in a small pool in the deepest region of the Cave (approximately 6 km from the entrance of the Cave; see Fig. 3, top).

Literature: "Maros 88-89" (issued in 1990), pp. 10-12, 25-31, fig. 3.7, a folder; "Expédition Indonésie 90" (issed in 1992), pp. 9, 34, 39, fig. 5.1, p. 54; "Indonésie 92" (issued in 1994), pp. 5, 40.

3) Specimen Lot No. 2075. *Dugesia* sp. (this unidentified species is probably identical to the new species from Gua Tanette Cave). A single, asexual specimen (2 mm long and 0.4 mm wide; the posterior portion of the sample is broken) collected from cave-water in Gua Londron Cave (lat. 4°51′85″S. and long. 119°37′E.), Selantan, Pangkadjene (or Pangkajene), the north of Maros. Sulawesi (the altitude of the cave

¹⁾ The longitude shown in the sketch-map of the Maros-Karst (fig. 2 on p. 37): Change "12°50" to 119°38' and "12°55" to 119°43', respectively.



Fig. 1. The karst areas (brick) of Sulawesi Selantan and the location of Lubang Pangni Cave, Gua Tanette Cave and Gua Londron Cave (after the "Maros 88–89" and the "Expédition Indonésie 90"; modified). ①, Maros et Pangkadjene Karst; ②, Tacipi Karst; ③, Batu Putih Karst; ④, Cani Karst.



Fig. 2. Cave-map of Lubang Pangni Cave showing the collecting sites of *Dugesia uenorum* sp. nov. Top, a longitudinal section; bottom, a horizontal section. After the "Maros 88–89"; modified.

entrance, ca. 15 m); fixed in 70% ethanol. Coll. Dr. L. DEHARVENG; August 26, 1990. *Note.* This is a large limestone cave (approximately 5,893 m in length; see Fig. 2, bottom).

Literature: "Maros 88-89" (issued in 1990), pp. 10-12, 40-42, fig. 3.16, a folder; "Expédition Indonésie 90" (issued in 1992), pp. 9, 35, 70, a folder (fig. 5.21); "Indonésie



Fig. 3. Cave-maps of Gua Tanette Cave (top) and Gua Londron Cave (bottom) (horizontal sections). The locality of *Dugesia leclerci* sp. nov. in Gua Tanette is shown. After the "Maros 88-89", the "Expédition Indonésie 90" and the "Indonésie 92"; modified.

92" (issued in 1994), pp. 5, 16, 23, 40, a folder (fig. 6).

Serial sections (7-8 micrometers) were stained with Delafield's hematoxylin and erythrosin.

Species Descriptions

Order TRICLADIDA

Suborder PALUDICOLA or PROBURSALIA

Family Dugesiidae BALL, 1974

Genus Dugesia GIRARD, 1850

Dugesia uenorum KAWAKATSU et MITCHELL, sp. nov.²⁾

(Figs. 4-6)

External features. This is a rather small, low pigmented and probably troglophilic species. Examination of preserved specimens with high-power of the stereomicroscope proved that many, small, pale brownish pigment spots are scattered on the dorsal surface of the body except for the marginal area; no pigmentation is observable on the ventral side. The external appearance of 2 preserved specimens is shown in Fig. 4 (A–D).

The largest sexually mature specimen (No. 1996-a, holotype; both the head and tail are strongly curved to the ventral side) in the preserved condition from Lubang Pangni Cave measure 10 mm in length and 2.5 mm in width (triclad specimens fixed with 70% ethanol are usually strongly contracted along the longitudinal axis; cf. KAWAKATSU & MIYAZAKI, 1972); the other non-fully mature specimen (No. 1996-c, paratype; Fig. 4 A and B) is 8 mm in length and 2 mm in width.

The head of the animal in the preserved condition has an obtuse-angled triangular form (or slightly subtruncated form) with large, bluntly pointed auricles (Fig. 4 A–D). Auricular sensory organs could not be seen in the samples examined. There is a pair of small eyes in the usual position on the head; the distance between them is about one-third the width of the head at the level of eyes (Fig. 4 C). Behind the head, the body gradually widens, reaching its greatest width at the level of the pharynx and copulatory apparatus. The posterior end of the body is bluntly pointed (Fig. 4 A–D). There are no photographs or sketches showing the external appearance of living animals of the present new species.

The short pharynx is situated anterior to the middle of the body; it measures nearly one-seventh of the body length. The genital pore opens at the anterior one-third of the postpharyngeal length (Fig. 4 B).

Internal features. The anterior intestinal trunk has 20 or more lateral branches

²⁾ We have named this species in honor of Drs. Shun-Ichi and Yoshiko UéNo, on the occasion of Dr. S.-I. UÉNo's retirement from the National Science Museum, Tokyo, as well as of his father, the late Dr. Masuzo UÉNO (1900–1989), who was a Professor Emeritus of Kyoto University and a well-known limnobiologist (cf. UÉNO, S.-I., 1991, 1993). KAWAKATSU learned many academic things from the late Dr. M. UÉNO. Dr. S.-I. UÉNO is our respected friend during the past 40 years. Thus, the present paper is affectionately dedicated to them.

on each side; each posterior trunk has 15 to 18 or shorter lateral branches. In histological sections, the inner pharyngeal musculature is typical of the family Dugesiidae; it consists of a moderately thick layer of circular fibers adjacent to the epithelium of the pharyngeal lumen and a thin layer of longitudinal ones. The outer pharyngeal musculature consists of a thin layer of longitudinal fibers adjacent to the ciliated epithelium and a slightly thicker one of inner fibers (Fig. 4 E).

The histological structure of the eyes (*i.e.*, the pigment cell layer and the visual cells) in this white, hypogean species is normal (Fig. 5 A). The erythrophilic adhesive glands can be seen along the anterior and posterior margins of the body (Fig. 5 A and B).

A pair of rather small ovaries occur in the ventral position between the third and fourth branches of the anterior intestinal trunk (Fig. 5 B). Yolk glands (or vitellaria) are distributed throughout the body (Fig. 5 A).

The dorsal testes are very small in size, numerous, and are arranged on either side of the midline in 2 to 3 longitudinal rows extending from a level just behind the ovaries nearly to the posterior end of the body. The testes occupy about one-eighth to onetenth of the dorso-ventral space in sagittal sections (Fig. 5 C). Their total number is estimated to be 180 to 200.

Photomicrographs of parts of the copulatory apparatus are shown in Fig. 5 (D–H). The sagittal view of the copulatory apparatus of the holotype specimen (No. 1996-a) is shown in Fig. 6.

The penis consists of a moderately large, hemispherical bulb embedded in the parenchyma and a short papilla of a conical shape, projecting into the male genital antrum (Figs. 5 C–D, 6). The bulb is weakly muscular in nature; it contains a moderately wide and curved, club-shaped cavity (bulbar cavity or seminal vesicle; Figs. 5 D–E, H, 6). The cavity is lined with a rather thick glandular epithelium of a nucleate type. Below this epithelium there are two layers of muscle fibers, an inner, thin layer of circular ones and an outer, thin layer of longitudinal ones (Fig. 6). Each spermiducal vesicle forms a narrow sperm duct on the antero-lateral side of the bulb. Then, the two sperm ducts open separately into the anterior portion of the bulbar cavity from its ventro-lateral sides (Fig. 6).

The penis papilla of the holotype specimen may show a rather contracted state of the organ (Figs. 5 D–E, 6). It has an asymmetrical form (the dorsal lip of the papilla is larger than the ventral lip). As shown in Fig. 6, the basal part of the papilla is surrounded by a constriction or a weakly developed valve that is accompanied with many erythrophilic glands. The papilla is covered with a thin epithelium of nucleate type, bellow which is a thin layer of circular muscle fibers followed by a thin layer of longitudinal ones (Fig. 6). A moderately long ejaculatory duct, which is separated from the bulbar cavity by a diaphragm, opens on the ventral side of the papilla near its tip. Its covering epithelium has no nuclei; the subepithelial musculature is a slightly thickened layer of circular fibers (Fig. 6). Numerous erythrophilic glands open into the penis lumen at the region of the diaphragm.



Fig. 4. Dugesia uenorum sp. nov., 2 preserved specimens from Lubang Pangni Cave and a part of the pharynx (near mid-sagittal section). A and B: No. 1996-c (B is the ventral view of the specimen). Small arrow indicates the mouth; the large arrow, the genital pore. C and D: No. 1996-g (D is the ventral view of the specimen). E: No. 1996-a (holotype). phl, pharynx lumen. 1, Longitudinal fibers of outer muscle zone; 2, circular fibers of outer muscle zone; 4, longitudinal fibers of inner muscle zone; 5, circular fibers of inner muscle zone.

The male genital antrum is a cup-shaped cavity (Figs. 5 D–E, 6). Posteriorly, it opens to a short, tubular common genital antrum (which finally opens at the genital pore). The male antrum is lined with a thick, nucleate epithelium. The subepithelial



Fig. 5. Dugesia uenorum sp. nov., photomicrographs of near mid-sagittal sections. A and B: Head region of the body (No. 1969-a, holotype). C-G: Copulatory apparatus (No. 1969-a). H: Copulatory apparatus (No. 1996-c). br, brain; bs, bursal stalk; buc, bursal canal; cb, copulatory bursa; e, eye; gp, genital pore; mag, marginal adhesive gland; o, ovary; od, ovovitelline duct; pb, penis bulb; ph, pharynx; pp, penis papilla; sv, spermiducal vesicle; yg, yolk gland.

musculature consists of a layer of inner, thin, circular fibers and an outer, thin, longitudinal ones (Fig. 6).

The copulatory bursa is a moderately large, elongated ellipsoidal organ (the organ seems to be contracted in the holotype specimen; Figs. 5 F-G, 6). The bursal stalk is a short and rather wide, tubular duct that opens into the roof of the common genital antrum (Figs. 5 F-G, 6). The lumen of both the bursa and stalk are lined with a very tall, glandular epithelium. The subepithelial musculature of the anterior half section of the stalk is a thin layer of circular fibers. The posterior half of the stalk forms a vagina surrounded by three layers of subepithelial muscle fibers: an inner, thin layer of longitudinal fibers, a middle, slightly thick layer of circular ones, and an outer, slightly thick layer of longitudinal ones (Fig. 6).

The two ovovitelline ducts converge in the postero-ventral region of the vagina and open separately (or after forming a very short common ovovitelline duct) into the terminal portion of the vagina; this part receives numerous heavily erythrophilic glands



Fig. 6. Dugesia uenorum sp. nov., semi-diagrammatic sagittal view of the copulatory apparatus (No. 1996-a, holotype). bc, bulbar cavity; bs, bursal stalk; cb, copulatory bursa; cg, cement gland; ed, ejaculatory duct; gp, genital pore; ma, male genital antrum; od, ovovitelline duct; pb, penis bulb; ph, pharynx; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle; v, vagina.

(shell glands). The subepithelial musculature of the common antrum is well developed. Weakly erythrophilous cement glands open into the common antrum near the genital pore (Fig. 6).

The cocoon, or egg capsule, of the present new species is not known.

Type series. Holotype: One set of sagittal serial sections (Specimen Lot No. 1996-a: 7 slides). Paratype: One set of sagittal serial sections (No. 1996-c: 6 slides; non-fully matured specimen). The holotype and paratype will be deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

The other 5 sets of sagittal serial sections of non-sexual specimens (No. 1996-b, -d, -e, -f, and -g) and a broken specimen in 70% ethanol are retained in KAWAKATSU's laboratory, Fuji Women's College, Sapporo, Japan.

Locality. Lubang Pangni Cave, District of Camba, Sulawesi. For more detailed notes and collection data, see the section of "Localities, Materials and Methods" (see also Figs. 1 and 2).

Taxonomic remarks and differential diagnosis. According to the classification of Dugesia species from Asia by genital anatomy (cf. KAWAKATSU, OKI, TAMURA & SUGINO, 1976; see also KAWAKATSU, MITCHELL, OKI, TAMURA & YUSSOF, 1989, p. 11, fig. 9), the present new species, Dugesia uenorum, belongs to Group 3 (with an asymmetrical penis papilla, diaphragm in the penis lumen, a valve at the basal part of the penis papilla, and lack of adenodactyls). Seven species are now known in this group in addition to the eighth species D. uenorum. They are as follows:

Dugesia ryukyuensis KAWAKATSU, 1976, from the Southwest Islands of Japan (cf. KAWAKATSU, OKI, TAMURA & SUGINO, 1976; KAWAKATSU, OKI & TAMURA, 1993, 1994; TAMURA, OKI & KAWAKATSU, 1993, 1994); Dugesia batuensis BALL, 1970, from Malaysia (cf. KAWAKATSU, 1972 a, b; KAWAKATSU, MITCHELL, OKI, TAMURA & YUS-SOF, 1989); Dugesia hymanae ŠIVICKIS, 1928, from the Philippines (cf. KAWAKATSU, 1972 c); Dugesia indonesiana KAWAKATSU, 1973, from Indonesia (Sumatra and Java); Dugesia krishnaswamyi KAWAKATSU, 1975, from South India (cf. KAWAKATSU & BASIL, 1975); Dugesia lindbergi DE BEAUCHAMP, 1959, from Afghanistan, Pakistan and North India (cf. KAWAKATSU, 1973 b; KAWAKATSU & ÔGAWARA, 1974); Dugesia austroasiatica KAWAKATSU, 1985, from several artificial localities (tanks for tropical fish culture, etc.) in Japan (cf. KAWAKATSU, OKI, TAMURA & YAMAYOSHI, 1985; KAWAKATSU, TAKAI, OKI, TAMURA & AOYAGI, 1986). Sketch figures of the copulatory apparatus of D. ryukyuensis and a map showing the geographical distribution of several dugesiid species from Asia are shown in KAWAKATSU, OKI, TAMURA, TAKAI, TIMOSHKIN & PORFIRJEVA (1993, pp. 8–12, figs. 10–13).

Among these 7 species listed above, only *D. batuensis* seems to be troglophilic, having 2 small eyes and some body pigmentation (see color photographs of live specimens in pl. 1, in KAWAKATSU, MITCHELL, OKI, TAMURA & YUSSOF, 1989). An epigean, dark pigmented form of *D. batuensis* is also recorded from the vicinity of the type locality (the Batu Caves) (cf. KAWAKATSU, 1972 b). The penial anatomy of *D. batuensis* is characterized by having a large penis bulb with a wide bulbar cavity, asym-

metrical penis papilla moderate to large in size and with a well-developed valve at its basal part (the dorsal valve is usually much larger than the ventral one). In the female part of the copulatory apparatus in *D. batuensis*, a long and rather wide bursal stalk has a moderately thick muscle coat in its entire course. Moreover, the common genital antrum is not differentiated in this Malayan species. *D. batuensis* can be easily separated from the present new species *D. uenorum* by having a different anatomy and histology of the copulatory apparatus.

The present new species *D. uenorum* also bears a resemblance in the genital anatomy to 2 epigean species from Indonesia and the Philippines. In *D. indonesiana*, the dorsal testes are large in size, and there is a well-developed valve at the basal part of the papilla (the dorsal valve is much larger than the ventral one). The bursal stalk has a thin muscular coat, and the common genital antrum is lacking in this Indonesian species. In *D. hymanae*, the muscular penis (both the bulb and papilla) is very large in size, and there is a well-developed valve at the basal part of the papilla (the dorsal valve is smaller than the ventral one). The muscle coat of the slender bursal stalk is moderately developed; a tubu'ar common genital antrum is differentiated. Although there are certain similarities in morphology of Indonesian and Philippine species to the present new species, *D. uenorum* is different from them in details of the genital anatomy and histology.

Dugesia uenorum differs from the other members of the genus in the following characters: preserved animal rather small in size (ca. 10 mm in length and 2.5 mm in width) and low pigmented on the dorsal surface; head of obtuse-angled triangular form; two small eves; external musculature of the pharynx of outer thin longitudinal and inner circular fibers; very small dorsal testes in 2 to 3 longitudinal rows on either side extending nearly to the posterior end; penis bulb moderately large, hemispherical and weakly muscular with a moderately wide and curved, club-shaped bulbar cavity, into which sperm ducts enter separately at its anterior portion; asymmetrical penis papilla short, weakly muscular, and of conical shape, with a weakly developed valve at its basal part (the dorsal valve is slightly larger than the ventral one); moderately long ejaculatory duct opening on the underside of the papilla near its tip; with a diaphragm in the penis lumen; copulatory bursa moderately large in size, with a short and rather wide, tubular bursal stalk, the posterior half forming a vagina surrounded by a moderately developed muscle coat, and opening to the roof of the short, tubular, common genital antrum; ovovitelline ducts entering separately (though very close together) into the terminal portion of the vagina.

Fig. 7. Dugesia leclerci sp. nov., 3 preserved specimens from Gua Tanette Cave and a part of the pharynx (near mid-sagittal section). A and B: No. 2009-a (B is the side view of the specimen). C: No. 2009-f. Small arrow indicates the mouth; the large arrow, the genital pore. D: No. 2009-i. E: No. 2009-e (holotype). phl, pharynx lumen. l, Longitudinal fibers of outer muscle zone; 2, circular fibers of outer muscle zone; 4, longitudinal fibers of inner muscle zone; 5, circular fibers of inner muscle zone.



Dugesia leclerci KAWAKATSU et MITCHELL, sp. nov.31

(Figs. 7-10)

External features. This is a small, slender, unpigmented, eyeless troglobite. The external appearance of 3 preserved, sexual specimens (No. 2009-a, -f and -i, paratypes) is shown in Fig. 7 (A–D).

The sexually mature specimens in the preserved condition from Gua Tanette Cave measured 10 to 12 mm in length and 1 mm in width; the other asexual specimens were 7 to 8 mm in length and less than 1 mm in width. The head shape of the animal in life was not sketched by the collector. In the preserved condition, the head is rounded or bluntly pointed or a low triangular form (with a pair of bluntly pointed auricles) (Fig. 7 A–D; see also KAWAKATSU & MITCHELL, 1989, p. 38, fig. 3 A–E). Behind the head, the body has its greatest width at the level of the pharynx and copulatory apparatus; the posterior end of the body is bluntly pointed (Fig. 7 A–D). The short pharynx is situated at the middle of the body (Fig. 7 C).

Internal features. The anterior intestinal trunk has 18 to 20 lateral branches on each side; each posterior trunk has 15 to 18 or more short lateral branches. In histological sections, the inner pharyngeal musculature consists of a thick circular layer adjacent to the ciliated epithelium of the pharynx lumen and a thin layer of longitudinal fibers. The outer pharyngeal musculature consists of two layers, a thin layer of circular fibers beneath the longitudinal one (Fig. 7 E). The erythrophilic marginal adhesive glands could be seen (Fig. 8 A–B).

A pair of rather large ovaries occurs in the ventral position between the second and third branches of the anterior intestinal trunk (Fig. 8 A). Numerous yolk glands (or vitellaria) are distributed throughout the body (Figs. 8 B, 9 H).

The dorsal testes are rather large in size, numerous, and are arranged on either side of the midline in 2 to 3 or more longitudinal zones extending from the posterior level of ovaries almost to the posterior end of the body. The testes occupy about a half to one-third of the dorso-ventral space in sagittal sections of the prepharyngeal region (several large testes occupying the entire dorso-ventral space can be seen); in the pharyngeal and post-pharyngeal regions, they occupy about one-third to one-fifth of the dorso-ventral space (Fig. 8 A–B). The total number of testes is estimated to be 120 to 150. The spermiducal vesicles on either side of the copulatory apparatus are conspicuous in the present new species (Figs. 9 A, 10 A-B).

Photomicrographs of parts of the copulatory apparatus are shown in Figs. 8 (B) and 9 (A–H). The sagittal views of the copulatory apparatus of the holotype (No. 2009-e) and one of the paratype (No. 2009-g) specimens are shown in Fig. 10 (A–B). The following anatomical and histological descriptions of the copulatory appa-

³⁾ We have named this new species in honor of the discoverer, Dr. Philippe LECLERC, who is a French specialist of biological speleology and one of the members of the "Expédition Maros 1989, 1990".



Fig. 8. Dugesia leclerci sp. nov., photomicrographs of near mid-sagittal sections. A: Head and the prepharyngeal region of the body (No. 2009-e, holotype). B: Entire section (No. 2009-e). br, brain; mag, marginal adhesive gland; o, ovary; ph, pharynx; pp, penis papilla; t, testis; yg, yolk gland.

ratus are based chiefly upon the slides of these 2 specimens.

The penis consists of a rather small, hemispherical (or nearly globose) bulb embedded in the parenchyma and a rather large papilla of a stump-shape, or a conical



shape, projecting into the male genital antrum (Figs. 9 A, D–H, 8 A–B). The bulb is weakly muscular in nature and contains a rather wide, but short, club-shaped (or an urceolate) cavity. This bulbar cavity (or seminal vesicle) is lined with a rather thick glandular epithelium of a nucleate type. Its subepithelial musculature consists



Fig. 9 (on pp. 96–97). Dugesia leclerci sp. nov., photomicrographs of near mid-sagittal sections of the copulatory apparatus. A-C: No. 2009-e (holotype). D: No. 2009-a. E: No. 2009-f. F and G: No. 2009-g. H: No. 2009-i. bc, bulbar cavity; buc, bursal canal; cb, copulatory bursa; gp, genital pore; ma, male genital antrum; pb, penis bulb; pp, penis papilla; sv, spermiducal vesicle; yg, yolk gland.

of two layers, one of inner circular fibers and the other of outer longitudinal fibers (Fig. 10 A). The two sperm ducts open separately into the anterior portion of the bulbar cavity on its ventro-lateral sides (Fig. 10 A-B).

The penis papilla of the holotype specimen (Figs. 9 A, 10 A) may be in a rather contracted state; that of the other paratype specimen (Figs. 9 D–H, 10 B) shows a rather elongated state. Its asymmetrical shape is conspicuous (the dorsal lip of the papilla is much larger than the ventral one) and is moderately muscular in nature. The

papilla is covered with a thin, nucleate epithelium. The subepithelial musculature consists of a thin layer of circular fibers followed by a thin layer of longitudinal ones (Fig. 10 A). A moderately long, narrow and tubular ejaculatory duct opens on the ventral side of the penis papilla near its tip (Figs. 9 A, E–F, 10 A–B). It is lined by a thin, glandular epithelium; the subepithelial musculature is a slightly thickened layer of circular fibers (Fig. 10 A). A small diaphragm separates the ejaculatory duct from the bulbar cavity (Fig. 10 A–B). Numerous erythrophilic glands open into the penis lumen at the region of the diaphragm.

The male genital antrum is a cup-shaped cavity and opens to a rather long, tubular common genital antrum postero-ventrally (which finally opens at the genital pore) (Figs. 9 A, D–H, 10 A–B). The wall of the male antrum is covered with a rather thick, nucleate epithelium, below which there are two muscle layers, a thin, inner one of circular fibers and a thin, outer one of longitudinal fibers (Fig. 10 A).

The copulatory bursa is a moderately large, ellipsoidal organ. Its lumen is lined with a tall, glandular epithelium (Figs. 9 B, E, H, 10 A–B). The bursal stalk, a wide, tubular duct, opens at the roof of the common genital antrum. The bursal canal is lined with a very tall, highly glandular, nucleate epithelium (Figs. 9 B–C, 10 A–B). The muscular coat of the bursal stalk consists of three muscle layers, *i.e.*, an inner, thin layer of longitudinal fibers, a middle, thick layer of circular ones, and an outer, slightly thickened layer of longitudinal fibers. The posterior one-third of the stalk forms a moderately developed vagina and is accompanied by a thicker muscular coat than at the anterior portion (especially, the third outer layer of longitudinal muscle fibers becomes thicker than that of the other parts) (Fig. 10 A).

The two ovovitelline ducts converge in the region of the copulatory apparatus and open separately into the terminal portion of the vagina; this part receives numerous heavily erythrophilic glands (shell glands) (Fig. 10 A). The subepithelial muscle coat of the common antrum is well developed (Figs. 9 B, 10 A). Weakly erythrophilic cement glands open into the common antrum near the genital pore.

The cocoon of the present new species in not known.

Type series. Holotype: One set of sagittal serial sections (Specimen Lot No. 2009-e: 5 slides). Paratypes: Four sets of sagittal serial sections (No. 2009-a, -f, -g, -h, and -i). The holotype and one of the paratypes (No. 2009-g: 3 slides) will be deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

The other paratypes mentioned above and an additional 5 sets of sagittal serial sections of non-sexual specimens (No. 2009-b, -c, -d, -h, and -j) are retained in KAWA-KATSU's laboratory, Fuji Women's College, Sapporo, Japan.

Locality. Gua Tanette Cave, Kappang-Maros, Sulawesi. For more detailed

Fig. 10. Dugesia leclerci sp. nov., semi-diagrammatic sagittal views of the copulatory apparatus. A: No. 2009-e (holotype). B: No. 2009-g. bc, bulbar cavity; bs, bursal stalk; cb, copulatory bursa; cg, cement gland; ed, ejaculatory duct; gp, genital pore; ma, male genital antrum; od, ovovitelline duct; pb, penis bulb; ph, pharynx; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle; v, vagina.


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notes and collection data, see the section of "Localities, Materials and Methods" (see also Figs. 1, 2 B; KAWAKATSU & MITCHELL, 1989).

Taxonomic remarks and differential diagnosis. According to the genital-anatomyclassification of *Dugesia* species from Asia (cf. KAWAKATSU, OKI, TAMURA & SUGINO, 1976; see also KAWAKATSU, MITCHELL, OKI, TAMURA & YUSSOF, 1989, p. 11, fig. 9), the present new species, *Dugesia leclerci*, belongs to Group 2 (having an asymmetrical penis papilla, with a diaphragm in the penis lumen, without a valve at the basal part of the penis papilla, and without adenodactyls). The following 10 species are now known in this group.

Dugesia novaguineana KAWAKATSU, 1976, from Papua New Guinea; Dugesia borneana KAWAKATSU, 1972, from Sarawak in Indonesia and East Malaysia (cf. KAWA-KATSU & ÔGAWARA, 1974); Dugesia indica KAWAKATSU, 1969, from Central India; Dugesia tamilensis KAWAKATSU, 1980, from South India (cf. KAWAKATSU, TAMURA, YAMAYOSHI & OKI, 1980); Dugesia bengalensis KAWAKATSU, 1983, from Bengal in India (cf. KAWAKATSU, OKI, TAMURA & ADITYA, 1983); Dugesia nannophallus BALL, 1970, from Sri Lanka (Ceylon; cf. DE BEAUCHAMP, 1973; KAWAKATSU & ÔGAWARA, 1974); Dugesia andamanensis (KABURAKI, 1925) from the Andaman Islands, India; Dugesia burmaensis (KABURAKI, 1918) from Myanmar (Burma); Dugesia siamana KAWAKATSU, 1980, from Thailand (cf. KAWAKATSU, TAMURA, YAMAYOSHI & OKI, 1980); Dugesia deharvengi KAWAKATSU et MITCHELL, 1989, from Thailand.

Additionally, *Dugesia japonica* ICHIKAWA et KAWAKATSU, 1964, from the Far East, including the Japanese Islands, is classified in Group 4 in the previous genital-anatomy-classification proposed by KAWAKATSU's team (cf. KAWAKATSU, OKI, TAMURA & SUGINO, 1976; KAWAKATSU, MITCHELL, OKI, TAMURA & YUSSOF, 1989). However, its subspecies described from the Southwest Islands of Japan is given the rank of a separate species as *Dugesia ryukyuensis* KAWAKATSU, 1976 (this species belongs to Group 3; see foregoing section of the new species description of *Dugesia uenorum*), *D. japonica* should be reclassified as a member of Group 2 (distribution: Japan, Taiwan, the Korean Peninsula, China, and Primorskiy, southern Siberia, in Russia; cf. KAWAKATSU, OKI & TAMURA, 1993, 1994; TAMURA, OKI & KAWAKATSU, 1993, 1994; see also KAWAKATSU, OKI, TAMURA, TAKAI, TIMOSHKIN & PORFIRJEVA, 1993, pp. 8–12, figs. 10–13).

Of these 11 species listed above, *Dugesia deharvengi* from Thailand is the only one true troglobite without body pigmentation and eyes. The present new species *Dugesia leclerci* from Sulawesi is the second true troglobite among *Dugesia* species from Southeast Asia. It completely lacks both body pigmentation and eyes. Judging from the anatomical and histological details of the copulatory apparatus of the present new species, it is undoubtedly the twelfth member of Group 2. The Thai cave species, *D. deharvengi*, is characterized in having a large penis (especially, the asymmetrical papilla being very large and of turbinate form), sperm ducts entering separately into the anterior one-third portion of the bulbar cavity, a narrow, tubular bursal stalk having a thin muscular coat, and the posterior section of the stalk forming

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a thick-walled vagina, into which the common ovovitelline duct opens at its terminal portion. The present new species *D. leclerci* can be separated easily from *D. deharvengi* in the details of genital anatomy and histology.

Dugesia leclerci differs from the other members of the genus in the following characters: preserved animal small in size and slender (10-12 mm in length and 1 mm in width), white and eyeless; head rounded (head shape in life not known); external musculature of the pharynx consisting of a thin outer layer of longitudinal fibers and inner layer of circular fibers; numerous, moderately large, dorsal testes lying in 2 to 3 longitudinal rows on either side and extending almost to the posterior end (several large testes occupy the entire dorso-ventral space); penis bulb rather small, hemispherical (or nearly globose) and weakly muscular with a rather wide but short, club-shaped (or an urceolate) bulbar cavity, into which sperm ducts open separately at its anterior portion; asymmetrical penis papilla rather large, moderately muscular, and of a stump-shape or conical; moderately long, narrow and tubular ejaculatory duct opening on the ventral side of the papilla near its tip; with a diaphragm in the penis lumen; copulatory bursa moderately large in size, with a wide, tubular bursal stalk, of which the posterior one-third section forms a vagina that opens to the roof of the rather long. tubular common genital antrum; bursal stalk having a thick muscle coat consisting of three layers of fibers (it is thicker in the region of vagina than in other parts); ovovitelline ducts entering separately into the terminal portion of the vagina.

Dugesia sp. (species from Gua Londron Cave)

External features. A single, small, asexual specimen in preserved condition was examined under a high power stereomicroscope. The animal is unpigmented; the head is rounded and lacking eyes. Since the tail is bent double in the dorsal direction and broken, no histological sections were prepared.

Material. A broken specimen in 70% ethanol (No. 2075) is retained in KAWA-KATSU's laboratory, Fuji Women's College, Sapporo, Japan.

Locality. Gua Londron Cave, Pangkadjene, Sulawesi. For more detailed notes and collection data, see the section of "Localities, Materials and Methods" (see also Fig. 1).

Taxonomic remarks. Dugesia sp. from Gua Londron Cave seems to be identical with Dugesia leclerci, a new species from Gua Tanette Cave, described in the foregoing section of the present paper. The distance between these two caves is less than 20 km (see Fig. 1).

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Sungsotia uenoi gen. n., sp. n. (Arachnida, Opiliones, Phalangodidae), a Cavernicolous Harvestman from Northern Vietnam¹⁾

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Abstract Sungsotia uenoi gen. n., sp. n., is described from Hang Sung Sot Cave, Is. Sung Sot, northern Vietnam, as a member of the family Phalangodidae, subfamily Saracinicinae. The species may have a close relationship with some members of the Phalangodidae belonging to other subfamilies, such as Zepedanulus ROEWER (Epedaninae) and Tokunosia SUZUKI (Phalangodinae).

Introduction

Through the courtesy of Dr. Shun-Ichi UÉNO of the National Science Museum, Tokyo, I had an opportunity to examine an opilionid specimen recently collected by him from the Hang Sung Sot Cave, Is. Sung Sot, northern Vietnam.

The specimen was found to be an adult female of a phalangodid of the suborder Laniatores, new to science as described below.

Family Phalangodidae SIMON, 1879

Subfamily Saracinicinae ROEWER, 1912

Sungsotia gen. n.

Type species: Sungsotia uenoi sp. n.

Etymology. The name of the genus is feminine, and taken from the island name, from which the present material was collected.

Diagnosis. Distinguished from all other genera of the subfamily Saracinicinae by the presence of enlarged chelicerae dorsally with three stout spines each and by having unarmed eye mound.

Description. Medium-sized opilionid. Ocular mound very low without a spine. Scute with four areas, without prominent spines or tubercles. Chelicerae enlarged; proximal segment dorsolaterally with one and dorsally with 2 elongated spines. Palp

¹⁾ This paper constitutes a part of the results obtained of the "Investigation of the insect fauna of northern Vietnam — Particularly in relation to the Japanese fauna", which was organized by Dr. Shun-Ichi UéNo and supported by the Grant-in-aid No. 06041116 for Field Research of the Monbusho International Scientific Research Program, Japan.

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elongated; femur ventrally with 4 and ventromesally with 2 spine-tipped tubercles. Legs relatively long; distitarsus I, III, IV, each with 3 segments; distitarsus II, whose distinction from the remaining tarsal segments of leg II is inconspicuous, with 2(?) segments. Tarsal segmentation I to IV: 10–11, 29–31, 7, 8.

Notes. Subfamilial delimitation of the family Phalangodidae for Asian species in the manner of ROEWER (1923, 1938) needs to be revised to a large extent, though it has been generally accepted heretofore. For example, the number of segments of distitarsus I, which is used to delimit Epedaninae having 2 segments from Saracinicinae having 3, varies even within a single species (*e.g.*, it varies with a range from 2 to 4 in two Japanese species of Saracinicinae, *Pseudobiantes japonicus* HIRST, 1911 and *Epedanellus tuberculatus* ROEWER, 1911: SUZUKI, 1973). Furthermore, the number of the tergal areas of the scutum, which is an important diagnostic character to separate Phalangodinae with 5 areas from the Epedaninae–Saracinicinae lineage with 4 areas, is also found to be variable within a Japanese species of Phalangodinae, *Tokunosia tenuipes* SUZUKI; namely *Tokunosia t. tenuipes* from Is. Tokunoshima and Is. Amamiôshima, has 5 areas, whereas *T. t. tuberculata* SUZUKI from Is. Okinawa, has 4 areas instead of 5 (SUZUKI, 1971, 1973).

The present genus resembles Zepedanulus ishikawai SUZUKI, 1971 (Epedaninae) and a monotypic genus Tokunosia SUZUKI, 1964 (Phalangodinae) consisting of T. tenuipes SUZUKI, 1964 alone, both of which usually inhabit caves of several islands of the Ryukyu Islands of Japan and may actually constitute a single superspecies, in having 1) palpi with elongate spines in a similar disposition, and 2) an unarmed eye mound. Possible relationship among these three genera deserves to be considered in the future revisional work, though they are compelled to be affiliated to three different subfamilies in the present system.

On the other hand, presence of enlarged chelicerae with stout spines on their proximal segments might suggest the affinity of *Sungsotia* to some other genera of the Epedaninae, such as *Neoepedanus* ROEWER, 1912 from China. It seems, however, that such enlarged chelicerae have evolved independently in two or more different lineages, since *Sungsotia* sufficiently differs in the other characters from those genera of the Epedaninae with enlarged chelicerae.

Some eye regression, elongation of spines on the palp and lengthened appendages, found in the present genus, may indicate its close association with the subterranean habitat.

Sungsotia uenoi sp. n.

(Figs. 1-2)

Material. Holotype, female. Hang Sung Sot Cave, Is. Sung Sot, Vinh Ha Long, Quang Ninh Prov., northern Vietnam, 18 October 1994, Shun-Ichi Uéno leg. The type specimen [NSMT-Ad 142] is deposited in the National Science Museum (Nat. Hist.), Tokyo. *Etymology.* Specific name is dedicated to Dr. Shun-Ichi UÉNO, a distinguished coleopteran specialist, and the collector of the specimen, on the occassion of his retirement.

Measurements (in mm). Female holotype: Scutum 3.0 long, 2.6 wide. Total length of body 3.2.

Chelicera: proximal segment 1.5, distal segment 2.2 long.

Length of palp and legs: Palp (Tr/Fe/Pa/Ti/Ta; Total): 0.8/3.5/2.0/1.9/1.8; 10.0 Legs (Fe/Pa/Ti/Mt/Ta; Total): Leg I: 0.5/3.4/0.9/2.7/4.7/2.3; 14.5. Leg II: 0.6/5.9/ 6.1/8.6/5.9; 27.1. Leg III: 0.6/4.0/0.9/2.8/4.7/2.6; 15.6. Leg IV: 0.5/6.0/1.0/3.8/6.9/ 3.6; 21.8.

Description. Female: Body as shown in Fig. 1, roughly trapezoidal in shape. Surface of dorsum smooth, except for line of minute blunt tubercles along lateral margin. Ocular mound very low, twice wider than long, unarmed, only slightly raised at the middle portion (Figs. 1 B, 2 B). Eyes slightly reduced. Scutal groove distinct, posteriorly curved. Abdominal portion of scute with four tergal areas, weakly delineated. Genital operculum smooth (Fig. 2 A). Stigma visible. Coxa I with coarse hair-tipped granules; coxae I–IV with sparse hairs, anteriorly with minute granules (Figs. 1 B, 2 A).

Chelicerae (Fig. 2 C–E); proximal segment with 3 strongly extruded spines, of which 2 on dorsal surface are twice longer than the rest on dorsolateral surface (Fig. 2 C); remaining surface around these spines laterally and dorsally with 5–6 additional tubercles. Distal segment only hairy; edge of fingers toothed (Fig. 2 C).

Palpi (Fig. 2 F–G). Trochanter with one dorsal and one ventral spine. Femur dorsally smooth; ventrally with a row of 4 distinct spines and 4 additional small spines, medio-ventrally with 2 distinct spines. Patella ventroapically with 2 mesal and one ectal spinose tubercles. Tibia with 3 mesal and 4 ectal spinose tubercles. Tarsus ventrally with 3 spinose tubercles on each side. Additionally, tibia and tarsus armed with low hair-tipped tubercles on the ventral surface. Tarsal claw slightly shorter than tarsus, acutely curved.

Legs. Relatively long. Trochanters of all legs smooth, unarmed. Femora I– IV almost straight; all leg segments unarmed. Number of tarsal segments (I–IV): 10(L)-11(R), 29(L)-31(R), 7, 8. Distitarsus I, III, IV each with 3 segments. Distitarsus II may consist of 2 segments, though delimitation of distitarsus from other segments in tarsus II is indistinct. Double claws of tarsi III and IV simple, untoothed, not scopulate (Fig. 2 H–I).

Ovipositor (Fig. 2 J): each lobe with 2 ventral and 3 dorsal setae.

Coloration. Body and all appendages pale yellow. Distal portion of palpi obscurely reticulated with brown.

Male. Unknown.

Distribution. So far known from the type locality alone.



Fig. 1. Sungsotia uenoi sp. n., female holotype. A, Dorsal and B, lateral views of body. C, Dorsal view of body showing relative size of palpi to the body.

New Cavernicolous Harvestman from Vietnam



Fig. 2. Sungsotia uenoi sp. n., female holotype. A, Ventral view of body. B, Frontal view of eye mound. C-E, Left chelicera; frontal (C), mesal (D), and lateral (E) views. F-G, Left palp; mesal (F) and lateral (G) views. H-I, Lateral views of terminal segments of right legs III (H) and IV (I). J, Ventral view of ovipositor.

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A New Gamasholaspis (Acarina, Gamasida, Parholaspidae) Collected from a Natural Cave of Japan

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Abstract A new species of the genus Gamasholaspis belonging to the gamasid family Parholaspidae is described from Japan under the name of G. uenoi. It was collected from near a nest of the masked palm-civet in a natural cave.

The genus *Gamasholaspis* was proposed by BERLESE in 1904 for *Holostaspis* (*Gamasholaspis*) gamasoides collected from decaying vegetable material in Florence, Italy, and was later recorded by EVANS (1956) also from South America. Fifteen other species have been described from South America (EVANS, 1956), Japan (ISHIKAWA, 1966, 1980), East Russia (BREGETOVA et al., 1977), Malay Peninsula (ISHIKAWA, 1980) and China (GU, 1984). The mites of this genus are usually found in litter or humus layers of the soil, but sometimes occur in rodent nests or in caves; for example, three out of the eight species known from Russia were found not only in litter layers but also in rodent nests.

In Japan, six gamasholaspid mites have been recorded; two of them are endemic to Japan, while *G. browningi* (BREGETOVA et KOROLEVA) was found in a litter layers and an abandoned adit of a mine in the Island of Shikoku. In the present paper, a new species of *Gamasholaspis* collected from a natural cave in Shikoku will be described under the name *Gamasholaspis uenoi* sp. nov.

The holotype and one paratype of the new species are deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. The remaining paratypes are retained in the collection of the Laboratory of Biology, Matsuyama Shinonome College, Matsuyama.

Before going further, the author wishes to express his hearty thanks to Dr. Shun-Ichi UÉNO of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo, for his advice and criticism. Deep gratitude is also due to Dr. Kuniyasu MORIKAWA, President of Matsuyama Shinonome Junior College, for giving him valuable suggestions. Sincere thanks are also due to Mr. Tadashi YAMAUCHI, member of the Speleological Society of Japan, who kindly offered valuable material.

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Gamasholaspis uenoi sp. nov.

[Japanese name: Uéno-herage-hokodani]

(Fig. 1)

Female. Length of idiosoma ca. 748 μ m; width of idiosoma ca. 469 μ m; length of dorsal shield 690 μ m, 700 μ m, 710 μ m, 730 μ m; width of dorsal shield at the level of coxae IV 390 μ m, 445 μ m, 448 μ m, 450 μ m; light brown in colour.

Dorsum: Dorsal shield entire, sclerotized, without reticulation; anterior margin truncated. Dorsal shield provided with twenty-nine pair of simple setae, setae zl absent, and sixteen pair of pores.

Venter: Tritosternum well developed, a pair of pilose laciniae more than twice longer than tritosternal base. Presternal shields composed of a pair of large platelets. Sternal shield fused with endopodal shields, bearing three pair of simple setae and two pair of pores. Metasternal shields free, and provided with a pair of setae and pores. Epigynial shield convex posteriorly, with its base wider than the anterior margin, and with a pair of simple setae. Its postero-lateral corner coalesced in ventrianal shield. Ventri-anal shield large, subtriangular, reticulated, provided with four pair of preanal setae in addition to three perianal ones; anterior margin concave with antero-lateral corners rounded. Metapodal shields elongate, located anterolateral to preanal setae II. Interscutal membrane between dorsal and ventral shields bearing twenty-three pair of setae. Stigmata situated at a position antero-lateral to coxae IV. Peritremes extending to coxae I.

Gnathosoma: Epistome consisting of elongated median extension with denticulate anterior margin. Palpal apotele bearing three tines, two of which are spatulate distally. Fixed digit of chelicera provided with four teeth and a pilus dentilis; movable digit (62 μ m) bidentate and shorter than corniculus (97 μ m). Dorsal seta on fixed digit wedge-shaped. Salivary stylus (95 μ m) well developed. Length of anterior hypostomatic seta 70 μ m, external posterior hypostomatic seta 41 μ m, internal posterior hypostomatic seta 36 μ m and deutosternal seta 31 μ m.

Legs: Tarsus I with neither claws nor pulvilli; tarsus I (145 μ m) much longer than tibia I (103 μ m). Tarsi II to IV each with well developed claws and pulvilli. Length of legs: I (excl. sensory setae) 605 μ m, II 560 μ m, III 465 μ m and IV 720 μ m.

Male. Unknown.

Type series. Holotype \mathcal{Q} (NSMT-Ac 10521), Komi-no-tateana Pot, 580 m alt., Komi, Yanadani-mura, Kamiukena-gun, Ehime Pref., 4–XII–1988, T. YAMAUCHI leg. Paratypes: $3 \mathcal{Q} \mathcal{Q}$, same data as the holotype.

Remarks. The present species can be readily discriminated from Gamasholaspis akimotoi ISHIKAWA, 1966 (ex litter of a hemlock-spruce, Tsuga Sieboldii CARRIÉRE, Omogo Valley, Ehime Pref.) by the following characteristic features: epigynial shield convex posteriorly, with its base wider than anterior margin, instead of being nearly parallel-sided and somewhat rounded posteriorly; postero-lateral corner of epigynial shield coalesced in ventri-anal shield, instead of being free; ventri-anal shield large New Gamasholaspis Mite from Japan



Fig. 1. Gamasholaspis uenoi sp. nov., female. — A, Dorsum; B, venter; C, epistome; D, chelicera; E, venter of gnathosoma.

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with concave anterior margin, instead of being narrow with slightly concave anterior margin; sternal shield devoid of reticulated pattern, instead of having reticulations.

It is considered that though found near a nest of the masked palm-civet *Paguma larvata* (HAMILTON-SMITH), it is not a parasite of mammals but judging from the structure of its chelicerae, it is free-living and predatory on nematodes and micro-arthropods. It has not been found from outside caves, never in litter samples from more than 1,000 different localities of Japan.

The specific name was given after Dr. Shun-Ichi UÉNO, who has constantly given me advice since 1968, for commemorating his retirement from the head of the Department of Zoology, National Science Museum, Tokyo.

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Bakerdania uenoi, a New Species of Pygmephoridae (Acari, Heterostigmata) Associated with Cerambycid Beetles in Japan

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Abstract A new species of the genus *Bakerdania* SASA, 1961 (Acari, Pygmephoridae) is described and illustrated from Japan under the name of *B. uenoi*. It is known only from the adult female and found attached to the prosternum of lamiine cerambycid beetles, *Mesosa longipennis* BATES and *Ropica* sp. This species is readily distinguished from all the known congeners by the following combination of characters: 1) opisthosomal dorsal setae c_1 , c_2 , f and h_1 extremely long, 2) peritremes large and irregulary semicircular, 3) posterior margin of coxisternal plate IV tripartite.

Many papers have been published concerning mites phoretic or parasitic on cerambycid beetles, but none of pygmephorid mites are known to be such associates of the Cerambycidae as yet. I have examined many cerambycid beetles collected from various parts of Japan and found numerous specimens of associated mites belonging to the suborders Mesostigmata, Prostigmata (including Heterostigmata) and Astigmata. Among the heterostigmatid mites obtained in the survey are three unusual species of the Pygmephoridae. Closer examination has revealed that they are members of the genus *Bakerdania* SASA, 1961, all new to science.

The present paper deals with a description of one of these new species. The other two will be described on another occasion. The terminology of the structures and the setal notation used in this paper mainly follow those of LINDQUIST (1986), unless otherwise stated.

I wish to express my sincere gratitude to Dr. Nobuo OHBAYASHI, Entomological Laboratory, Ehime University (Matsuyama, Japan) for identification of the host beetles. Thanks are also due to Mr. Jun OKUMA (Sasebo, Japan) for his kindness in supplying the valuable materials.

Bakerdania uenoi KUROSA, sp. nov.

(Fig. 1-5)

Female. Body a little longer than 3/2 times as long as wide; cuticle moderately sclerotized. Length of idiosoma 177–249 μ m, width of idiosoma 109–154 μ m, distance between anterior coxo-trochanteral condyles III 63–76 μ m (mean 72.7 \pm S.D. 3.57 μ m, N=15). For the measurements of idiosomal setae and some leg structures, see Tables 1 and 2.



Figs. 1-2. Bakerdania uenoi KUROSA, sp. nov., female; habitus. — 1, Dorsum; 2, venter. Scale: 50 µm.

Gnathosoma (Fig. 2). Gnathosomal capsule subquadrate and nearly as long as wide (length 23–29 μ m, width 23–27 μ m) in forward oriented state, with ventrobasal margin deeply emarginated; dorsomedian apodeme distinct only in proximal 1/3–2/5; dorsum of capsule with 2 pairs of setae (ch_1 , ch_2) of subequal length; ch_1 inserted slightly before the mid-level, ch_2 usually at a level about 1/4 from the base; venter with a pair of moderately long setae on anterolateral margin. Palpus about 3/4 as long as capsule, terminating in a moderate-sized "claw"; genual seta a little longer than femoral seta; venter of palpal femurogenu with a rod-like striated solenidion and a much thicker, setigerous accessory structure with a large spheroidal head, both structures located

New Bakerdania from Japanese Cerambycids

nearly on the same level; medially near the base of palpal claw, a minute capsule containing a tiny rod (palpal tibiotarsal capsule, DASTYCH & RACK, 1993) is discernible. Pharyngeal muscular structure, sometimes faintly visible, subdivided into 3 parts; 1st part bow-shaped, 2nd part at a short interval from 1st and parallel-sided, 3rd part following close on 2nd and more or less rhombic; in one specimen, 1st, 2nd and 3rd parts about 4×9 , 16×11 and $11 \times 13 \mu m$, respectively.

Idiosomal dorsum (Fig. 1). Prodorsal shield rather small, irregularly trapezoidal, 42-47 µm long medially, nearly as long as or (usually) a little shorter than prosternal apodeme, covered posteriorly by anterior margin of opisthosomal plate C as far as bases of sensilla or nearly so, sometimes (probably in a deformed state caused by slidemounting) completely exposed as shown in Fig. 1: posterior margin thickened, straight or weakly curved, lateral margins in front of bothridia deeply emarginated; peritremes located on mid-level or a little before, fairly large, irregularly semicircular, well-marked except for lateral margins; stigmata guttate, moderate in size (7-9 μ m long, 3-5 μ m wide), placed more or less obliquely; transverse distance between centres of stigmata ca. 18-22 µm; trachea well visible, its main trunk leading to somewhat enlarged atrium being fairly long; sensilla (setae sc₁) inserted on posterior half of the shield, clavate; setae s_{C_0} 5–9 μ m anterior to, and less spaced from each other than, bases of sensilla, rather long and stout, much longer than their mutual distance, distinctly barbed, somewhat blunt-tipped; v_2 just anterior to sc_2 , only 4–6 μ m apart from the latter, moderately long (12–18 µm), relatively thick, somewhat blunt-tipped, with barbs. Opithosomal dorsum ovoid in dorsal view, with 7 pairs of weakly barbed setae; they are extremely fine at tips except for somewhat blunt-tipped d and e; c_1, c_2, f and h_1 very long; order in length of dorsal setae of idiosoma as follows: $f \ge c_1 \ge h_1 \ge c_2 > d \ge sc_2 \ge h_2 > sc_1 \ge e > sc_2 \ge h_2 > sc_1 \ge e > sc_2 \ge h_2 > sc_2 \ge sc_2 \ge sc_2 \ge h_2 > sc_2 \ge sc_2 \ge h_2 > s$ v_2 ; c_1 and c_2 transversely aligned; c_1 more than 1.5 times as long as their mutual distance; d a little shorter than (rarely as long as) their mutual distance; e nearly on the same level with, and only 8–12 μ m apart from, f; length ratio of h_2 to e 1.62–1.92; 2 pairs of cupules, ia and ih, present, both fairly large.

Idiosomal venter (Fig. 2). On either side of camerostome, a somewhat internal, longitudinal thickening present, which protrudes posteriorly into area of coxisternal plate I as a subtriangular process. Apodemes 1 and 2 moderately developed, the latter oblique, weakly curved or straight in medial 1/3, meeting prosternal apodeme at a point about 2/3 (0.62–0.70) from the posteriormost point of camerostome; secondary transverse apodeme absent; prosternal and sejugal apodemes well developed. Apodeme 3 well developed, evenly arcuate separately, weakened laterally, reaching anterior coxo-trochanteral condyles III; apodeme 4 somewhat reclinate, nearly straight (rarely weakly curved), running in the direction of centre of coxal foramen III, extending about 2/3–3/4 way to ventral margin of the foramen, sometimes indistinctly united with thickening along ventral margin of the foramen; apodeme 5 lacking; poststernal apodeme well developed though attenuated posteriorly. Posteromedial margin of coxisternal plate IV projecting as a rounded flap-like process (tegula), its lateral margins overlapped by medial margins of posterolateral lobes of coxisternal plate IV.

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Posterior genital sclerite rather narrowly triangular. Coxal setae short and thin, feebly barbed, with extremely fine apices; *Ia* and *2a* the longest; *Ia* inserted somewhat posterior to the posteriormost point of camerostome, moderately apart from prosternal apodeme; *2a* much more widely spaced from each other than are *Ia*; *2c* posterolaterad of, and 5–8 μ m apart from, *2b*; *3a* and *3b* adjoining apodemes 3 and 4, respectively (*3b* sometimes situated on apodemes 4); *3c* very closely mesad of (sometimes adjoining) anterior coxo-trochanteral condyles III; *4a* and *4b* frequently inserted on a very different level from that of each mate on the other side. Caudal (pseudanal) setae short and fine, with feeble barbs; alveoli of ps_1 and ps_2 adjoining; mutual distance ps_3-ps_3 usually about twice as large as ps_2-ps_2 .



Figs. 3–4. Bakerdania uenoi KUROSA, sp. nov., female; left legs, dorsal view. — 3, Leg I; 4, leg. II. Scale: 25 µm.

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Seta –	Length*			Mutual distance			
	Range	Mean±S.D.	(N)	Range	Mean±S.D.	(N)	
sc ₁	22- 30	27.6± 1.77	26	38- 57	45.4±4.28	14	
SC2	46-56	$50.8\pm$ 3.26	30	26-34	31.9 ± 2.18	15	
v_2	12-18	14.7 ± 1.24	24	25- 36	29.1±1.70	14	
c_1	91-118	107.4 ± 6.43	27	51- 67	60.1 ± 4.12	15	
C2	67-87	79.3± 5.19	20	91-116	108.5 ± 6.58	15	
d	50- 63	58.7 ± 3.05	27	53-71	65.4 ± 4.84	15	
е	18- 30	$24.5\pm$ 2.54	26	80-96	88.7±5.17	15	
f	91-145	127.4 ± 12.33	26	56-76	69.9±5.04	15	
h_1	66-110	89.2 ± 10.94	25	26-35	30.9 ± 3.05	15	
h_2	35- 53	44.2 ± 4.32	28	66- 92	77.3 ± 5.90	15	
ps_1	13- 20	16.9 ± 1.56	25	11-14	12.6 ± 0.75	15	
pS_2	9-12	11.0 ± 1.14	20	15-18	16.8 ± 0.89	15	
ps_3	10-14	$12.0\pm$ 1.07	13	29- 37	33.3 ± 1.84	15	
la	21- 32	27.5 ± 2.63	26	18-22	19.9±0.83	15	
1c	12-20	17.5 ± 2.34	11	41-49	45.7±1.88	14	
2a	21- 30	$25.0\pm$ 2.21	21	36-43	40.0 ± 2.29	15	
2c	13- 18	15.4 ± 1.44	20	44- 55	50.6 ± 3.32	15	
3a	15-22	18.2 ± 1.69	23	12-33	16.1 ± 5.20	14	
36	14-22	$17.6\pm$ 1.33	25	14-19	28.9 ± 2.94	15	
3c	15-19	17.4 ± 1.47	14	56- 68	64.9±3.55	14	
4a	13-17	15.1 ± 1.03	27	11-29	15.9 ± 3.84	15	
4b	14-23	$18.8\pm$ 2.56	26	21- 30	24.7 ± 2.16	15	
4c	14-20	17.3 ± 1.72	19	48- 59	56.0 ± 2.93	14	

Table 1.	Measurements (in µm)	of idiosomal	setae in	Bakerdania	uenoi
	sp. no	v., female.			

* It was impossible to determine the lengths of caudal (pseudanal) and coxal setae in accuracy because of the extreme fineness of the apices. Therefore, their approximate lengths are given instead.

Table 2.	Measurements (in μ m) of lengths of legs and, some leg segments
	and leg setae in Bakerdania uenoi sp. nov., female.

Part measured	Range	Mean±S.D.	(N)	Part measured	Range	Mean±S.D.	(N)
Leg I*	62- 82	75.7±4.82	27	Tibiotarsus I**	26-37	32.9±2.17	30
Leg II*	67-87	82.5±4.75	28	Tarsus IV***	27-38	$34.8 {\pm} 2.25$	30
Leg III*	66- 86	$81.0 {\pm} 4.69$	30	FeII-d	26-34	30.6 ± 2.12	25
Leg IV*	92-121	112.1 ± 6.70	28	FeIV-d	28-40	35.9 ± 2.27	29
				TiIV-d	49-67	57.8 ± 4.27	23

* Measured along longitudinal axis of legs from the basalmost point of femur (legs I-III) or trochanter (leg IV) to the base of claw(s).

** Excluding claw and its pedicell.

*** Including pretarsus but excluding claws and empodium.

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Legs. All legs well developed and moderately thick; legs I-III subequal in length, leg IV a little longer (see Table 2); number of setae and solenidia (in parentheses) on segments (trochanter, femur, genu, tibia and tarsus) of legs I-IV: I $1-3-4-6(2\varphi)+10$ (2ω) , II $1-3-3-4(1\varphi)-6(1\omega)$, III $1-2-2-4(1\varphi)-6$, IV $1-2-1-4(1\varphi)-6$; most of leg setae more or less barbed. Leg I (Fig. 3) 4-segmented; femoral seta *d* semi-membraneous, blade-like, reflexed in distal half, nude, pointed at tip; femoral seta *l'* somewhat modified, rather short ($6-9 \mu$ m), poorly taperd, weakly curved, appearing nude; genual seta *l'* fairly long and stout, blunt-tipped; tibiotarsus truncated distally, nearly rectangular in dorsoventral view, $26-37 \mu$ m long (pedicell of claw excluded), about twice as long as wide, nearly as wide as genu; internal tibiotarsal thickening lacking; claws pedicellate, moderate in size, dilated basally; pedicell with medial margin thickened; solenidia ω_1 and ω_2 located on the mid-level, φ_1 and φ_2 at a level about 1/3 from the base; ω_1 sub-



Fig. 5. Bakerdania uenoi KUROSA, sp. nov., female; left leg IV, ventral view. Scale: 25 μm.

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conical, ca. 9–11 μ m long; φ_1 , φ_2 and ω_2 subfusiform, not very different in length (ca. 4-9 μ m), but usually φ_1 is somewhat longer than φ_2 and ω_2 ; tibial seta k" setiform, barbed; 5 eupathidia (probably p', p'', tc', tc'' and ft'') present; order in lengths of eupathidia as follows: p'' > tc'' = tc' > p' > ft''. Leg II (Fig. 4) a little narrower than leg I; femoral seta d stout, 26–34 μ m long, blunt-tipped; tibial solenidion φ and tarsal solenidion ω both subbasal in position; φ subfusiform, ca. 3-5 μ m long; ω subconical, ca. 7-9 µm long; claws moderate in size, dilated ventrobasally; empodium very thin, with narrow stalk. Leg III a little narrower than leg II; femoral seta d not so stout as that on leg II, somewhat blunt-tipped; solenidion φ as in leg II, but slightly shorter (ca. 2.5–4.5 μm) on an average; claws and empodium as in leg II. Leg IV (Fig. 5); trochanter rectangular, with weak constriction; tarsus including pretarsus 0.41-0.47 times as long as 4 preceding segments combined; femoral seta d stout, poorly tapered. straight or only weakly curved, fairly long, blunt-tipped; tibial seta d usually longest of setae on leg IV; tibial seta v" short (8-14 µm), somewhat blunttipped; tibial solenidion φ , claws and empodium as in leg II, but the basal dilation of claws is almost lacking.

Host. All the female specimens examined, 38 in number, were found on the prosternum of an individual of *Mesosa longipennis* BATES with the exception of one specimen from the prosternum of an unnamed species of *Ropica*¹ (det. N. OHBAYASHI). Both the hosts are cerambycid beetles belonging to the subfamily Lamiinae. Nothing is known of the male and immature stages.

Type series. Holotype: \bigcirc , Matsuyama-chô, Sasebo City, Nagasaki Pref., 6–VII– 1984, ex *Mesosa longipennis*, J. OKUMA leg. Paratypes: 36 \bigcirc \bigcirc , same data as for the holotype; 1 \bigcirc , Yuwankama-rindô, Yamato-son, Amami-Ôshima Is., Kagoshima Pref., 6–V–1976, ex *Ropica* sp., J. OKUMA leg.

The holotype is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo. The paratypes are now retained in my private collection, but some of them will be distributed to certain foreign museums later.

Etymology. This new species is named in honour of Dr. Shun-Ichi UÉNO, an eminent entomologist and biospeologist in our country, who has rendered much help to my acarological study for a long period of time.

Remarks. The present species is easily distinguished from all the known congeners by the following combination of the characters: 1) opisthosomal dorsal setae c_1, c_2, f and h_1 extremely long, 2) peritremes large and irregularly semicircular, 3) posterior margin of coxisternal plate IV tripartite.

As stated before, two more species of *Bakerdania* are found associated with cerambycid beetles in Japan. Both of them resemble *B. uenoi* in having fairly long opisthosomal setae c_1 , c_2 and f, and coxisternal plate IV with tripartite posterior margin, but can readily be discriminated from the latter either in lacking coxal setae 4c, or in

¹⁾ According to OHBAYASHI (pers. comm., 1994), this cerambycid has been wrongly treated by most Japanese authors (*e.g.*, MAKIHARA, 1992) as *Ropica nobuoi nobuoi* BREUNING et OHBAYASHI. A work on this subject is to be published by Mr. H. MAKIHARA in a near future.

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possessing opisthosomal seta h_1 of moderate length (usually shorter than h_2).

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Oribatid Mites of High Altitude Forests of Taiwan II. Mt. Nan-hu-ta Shan¹⁾

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Abstract Twenty-seven species of oribatid mites are recorded from high altitude forests of Mt. Nan-hu-ta Shan in the northern part of Taiwan. Among them, two new species belonging to the families Otocepheidae and Achipteriidae are described. They are *Camachipteria uenoi* gen. et sp. n. and *Dolicheremaeus carinatus* sp. n.

AOKI (1991) reported on the oribatid mites of Mt. Pei-ta-wu Shan in the southern part of Taiwan. The present paper is the second part of the series of studies on the montane oribatids of Taiwan and deals with the oribatids collected from Mt. Nan-hu-ta Shan, a famous mountain in Tai-chung Hsien.

The study was carried out as a part of the national research project "Zoogeographic Study on the Derivation and Characteristics of the High Altitude Fauna of Taiwan". The project was conducted by Dr. Shun-Ichi UéNO of the National Science Museum, Tokyo, and one of the new species described here is named after him in commemoration of his retirement.

Collecting Data

(Nan-hu-ta Shan in Tai-chung)

TWN-3:	Above Szu-yuan, 2,280 m, Nov. 4, 1990, J. AOKI. Litter from secondary forest.
TWN-4:	Above Yu-sheng Ch'i, 2,380 m, Nov. 4, 1990, J. AOKI. Litter from secondary forest of pine tree and deciduous trees.
TWN-6:	Above Yun-leng Shan-chuang, 2,610 m, Nov. 2, 1990, J. Aoki. Litter from <i>Quercus</i> forest.
TWN-7:	On the ridge of mountain, 2,920 m, Nov. 2, 1990, J. Aoki. Litter from pine forest with thick bamboo undergrowth.
TWN-8:	On the ridge of mountain, 3,030 m, Nov. 2, 1990, J. AOKI. Litter from <i>Tsuga chinensis</i> var. <i>formosana</i> forest.

¹⁾ This study is supported by the Grant-in-aid No. 01041099 for Field Research of the Monbusho International Scientific Research Program, Japan.

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- TWN-9: Near Mt. To-chia-t'un Shan, 2,680 m, Nov. 4, 1990, J. AOKI. Litter from forest of *Picea morrisonicola* and *Tsuga chinensis* var. *formosana*.
- TWN-10: Mu-kan Ch'i, 2,300 m, Nov. 2, 1990, J. AOKI. From Coriolus fungus.
- TWN-12: Nan-hu Ch'i, 2,395 m, Nov. 3, 1990, J. AOKI. Litter from forest of *Picea* morrisonicola and *Tsuga chinensis* var. formosana.

List of Speceis Found

Family Phthiracaridae

- Phthiracarus clemens AOKI, 1963 2 exs. TWN-4, 2 exs. TWN-6.
- Plonaphacarus kugohi (AOKI, 1959) 1 ex. TWN-6, 5 exs. TWN-9.

Family Camisiidae

3. Platynothrus peltifer (С. L. Косн, 1839) 18 exs. TWN-7.

Family Damaeidae

- Belba verrucosa japonica AOKI, 1984 2 exs. TWN-6.
- Damaeus sp. TwA 2 exs. TWN-7, 1 ex. TWN-9.
- Damaeus sp. TwB 1 ex. TWN-7.
- 7. Damaeus sp. TwC 1 ex. TWN-7.

Family Ameridae

 Defectamerus crassisetiger australis AOKI, 1991 3 exs. TWN-4, 1 ex. TWN-6, 1 ex. TWN-8, 1 ex. TWN-9.

Family Eremobelbidae

9. Eremobelba japonica Aoкi, 1959 1 ex. TWN-12.

Family Heterobelbidae

10. Heterobelba stellifera Okayama, 1980 2 exs. TWN-12.

Family Gustaviidae

Gustavia longicornis BERLESE, 1904
1 ex. TWN-3.

 Metrioppia sp. 2 exs. TWN-12.

Family Tenuialidae

Tenuiala sp. 1 ex. TWN-10.

Family Carabodidae

14. Carabodes rimosus AOKI, 1959 1 exs. TWN-6.

Family Otocepheidae

- 15. Dolicheremaeus baloghi Аокі, 1967 5 exs. TWN-3.
- Dolicheremaeus carinatus sp. n. 1 ex. TWN-6.

Family Oppiidae

- 17. *Hammerella pectinata* (Аокі, 1983) 5 exs. TWN-3, 1 ex. TWN-6.
- 18. Lasiobelba remota AOKI, 1959 1 ex. TWN-12.
- Multioppia brevipectinata Suzuki, 1975 1 ex. TWN-6.
- 20. Oppiidae sp. 2 exs. TWN-12.

Family Haplozetidae

21. Haplozetes sp. 2 exs. TWN-3, 1 ex. TWN-12.

Family Parakalummidae

22. Neoribates sp. 1 ex. TWN-7.

Family Scheloribatidae

 Scheloribates sp. 2 exs. TWN-3, 1 ex. TWN-12, 1 ex. TWN-9.

Family Chamobatidae

24. Chamobates sp. 1 ex. TWN-8.

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Family Pelopidae

25. Eupelops sp. 1 ex. TWN-7, 1 ex. TWN-8.

Family Achipteriidae

 Campachipteria uenoi sp. n. 2 exs. TWN-6, 11 exs. TWN-9.

Family Galumnidae

 Pergalumna sp. 4 exs. TWN-3.

Description of New Genus and Species

Campachipteria gen. n.

Diagnostic characters. Lamellar cuspides separated anteriorly, a narrow slit between them not reaching the tip of triangular interlamellar region. Lamellar setae inserted on the ventral side of lamellar cuspides. Interlamellar setae thick and long. Areae porosae consisting of coarse granules of various sizes. Seta *ti* located posterior to area porosa *Aa*. Genu IV strongly bent (hence the name of the genus) and more than twice as long as genu III. All legs monodactyle.

Type species: Campachipteria uenoi sp. n.

Remarks. The new genus is related to the genus *Parachipteria* HAMMEN, 1952, which is distinguishable from the new genus by 1) lamellar cuspides completely separated from each other, 2) areae porosae consisting of fine and dense punctures, 3) genu IV weakly bent and about 1.6–1.7 as long as genu III, and 4) tridactyle legs.

Campachipteria uenoi sp. n.

(Figs. 1-7)

Measurement. Body length 420 (435) 445 μ m, width 300 (312) 320 μ m (measured on 9 specimens, the average in the parentheses).

Prodorsum. Lamella with thick marginal ridges on both sides; the anterior part strongly curved downward, so that the tip appears to be rounded, but actually it bears a sharp outer projection (Fig. 5). Lamellar seta inserted on ventral side of lamella, rather long and minutely barbed. Both lamellar cuspides separated in anterior half, leaving between them a very narrow slit, but in the posterior part they fuse together (Figs. 4 and 5). Interlamellar seta long and strong, almost reaching the tip of lamella. Rostral seta concealed under lamella, strongly curved inward and barbed unilaterally (Fig. 7). Sensillus elongate club-shaped, nearly smooth (Fig. 6).

Notogaster. Anterior projection of pteromorpha long and sharp, the tip strongly curved downward. Notogastral setae thin, sharply pointed at tip; setae ta and te

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Figs. 1-7. Campachipteria uenoi gen. n. et sp. n. 1: Ventral seta on tarsus II. 2: Area porosa A₁. 3: Leg IV (tibia, genu and a part of femur). 4: Dorsal view of body. 5: Lamellar cuspides with lamellar setae. 6: Sensillus. 7: Ventral side (the anterior half).

more than twice as long as the remaining setae. Four pairs of areae porosae circular or oval; in dorsal view the surface porous structure situated somewhat off the internal ring (Figs. 2 and 4). Seta *ti* and lyrifissure *im* located posterior to *Aa*.

Ventral side. Genital aperture with 5 pairs of setae; mutual distance of g_2 wider than that of g_1 , g_3 or g_4 ; setae g_5 and g_6 situated side by side. Mutual distance of aggenital setae about $1.5 \times as$ wide as genital opening. Anal aperture wider posteriorly; mutual distance an_1-an_1 nearly equal to an_2-an_2 . Adamal seta ad_2 situated much closer to ad_1 than to ad_3 .

Legs. A paraxial ventral seta on tarsus II conspicuously thick, bearing strong branches ventrally (Fig. 1). A dorsal seta on genu II thick and thorn-like. Genu IV strongly bent (Fig. 3) and more than twice as long as genu III. All legs monodac-tyle.

Type series. Holotype (NSMT-Ac 10544): Near To-chia-tun Shan, 2,680 m,

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Nan-hu-ta Shan, Nov. 4, 1990, J. AOKI. Litter from forest of *Picea morrisonicola* and *Tsuga chinensis* var. *formosana*. — 10 Paratypes (NSMT–Ac 10545, 10548): the same data as holotype. — 2 Paratypes (NSMT–Ac 10549 and 10550): Above Yun-leng shan-chuang, 2,610 m, Nov. 2, 1990, J. AOKI. Litter from *Quercus* forest.

Dolicheremaeus carinatus sp. n.

(Figs. 8-11)

Measurement. Body length 1,290 µm, width 760 µm.

Prodorsum. Rostrum surrounded by lamelliform expansion somewhat projecting anteriorly; lateral lamelliform expansions (*spa. 1.*) also well developed. Rostral and lamellar setae similar in shape, strongly curved inward, weakly barbed unilaterally. Lamellar ridge weakly bent, terminating in a triangular tip, a little behind it seta *le* inserted. A straight median ridge found between lamellar ridges, its pointed tip almost reaching rostral tip. Interlamellar setae very weakly roughened, a little longer than their mutual distance, inserted each on a tongue-shaped plate (Fig. 10). Sensillus rod-shaped, curved, only slightly thickened apically to form an inconspicuous spindleshaped head (Fig. 9). Lateral prodorsal condyle (*co. pl*) rounded lobe-shaped. Median prodorsal condyle (*co. pm*) low and inconspicuous. Most of prodorsal surface covered with dense granules.

Notogaster. Notogaster very stout, nearly as wide as long. Lateral notogastral condyle (*co. nl*) prominent, projecting as a rectangular plate on humeral region. Median notogastral condyle absent. Ten pairs of notogastral setae short, stiff, not so different in length; their RLN (relative length to notogaster): *ta* 14.7, *te* 16.0, *ti* 17.3, *ms* 16.0, r_1 16.7, r_2 10.0, r_3 16.7, p_1 11.3, p_2 10.7, p_3 10.0; Mutual distance of $ti - ti = 2.4 \times ti$; $ms - ms = 2.8 \times ms$. Notogastral surface covered with a dirty cerotegument with many irregular holes (Fig. 8); under the cerotegument are found large foveoles except on the anterior part covered with dense granules as on prodorsum.

Ventral side. Genital plates chestnut brown, without striae, with 4 pair of fine setae. Anal aperture with a dark-colored part along median margins. Anal setae an_1 a little more widely separeted from each other than an_2 are. Adamal setae ad_2 more closely situated to ad_1 than to ad_3 . Ventral plate covered with large foveolae. Epimeral region smooth, except on lateral part of *Ep. I* with a granular structure.

Type. Holotype (NSMT-Ac 10551): Near Yun-leng Shan-chuang, 2,610 m, Nan-hu-ta Shan, Nov. 2, 1990, J. AOKI. Litter from *Quercus* forest.

Remarks. In having stout body without median notogastral condyles, *Dolichere*maeus porcinolus AOKI, 1967, *D. nepalensis* AOKI, 1967, *D. inopinatus* AOKI, 1967, all from Nepal, and *D. tamurai* AOKI, 1990 from Taiwan resemble *D. carinatus* sp. n. The new species is, however, readily distinguishable from the congeners by the presence of long, strong median carina (hence the name *carinatus*) on the prodorsum. The notogastral setae of *D. porcinolus* and *D. nepalensis* are far longer than those of the new species. The setae of *D. inopinatus* are rather short, but sharply pointed at the tip. Oribatid Mites of Nan-hu-ta Shan



Figs. 8-11. Dolicheremaeus carinatus sp. n. 8: Dorsal view of body. 9: Apical part of sensillus. 10: Interlamellar seta and its vicinity. 11: Ventral side.

Dolicheremaeus tamurai is most similar to *D. carinatus* in its broad body shape, short and stiff notogastral setae and rectangular humeral projections, but it differs from the new species in the sensilli with an oval head and widely separated lamellae.

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A New Spitting Spider (Arachnida, Araneae, Scytodidae) from a Cave in Central Thailand¹⁾

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Abstract A new spitting spider of the family Scytodidae collected in a small cave at Thung Salaeng Luang, Phitsanulok Province, Thailand, is described under the name of *Stedocys uenorum* gen. et sp. nov. It represents a new genus, *Stedocys*, which stands isolated in the family Scytodidae by the peculiarity in the shape of male copulatory organ. The new genus comprises another species described from Fraser's Hill in Malaysia, *Stedocys leopoldi* (GILTAY, 1935), comb. nov., which is transferred from *Scytodes* of the original combination. The two species are closely related but distinguishable from each other in details of the structure of male palp. Judging from the morphology and the collection data, the new species is regarded as a scotophilous spider.

The world of subterranean spiders is rather poorly known in Southeast Asia, though there are numerous caves in that region. With the exception of some collections from the Philippines (SIMON, 1892, 1893), records of cave spiders in the region are made in this century. Most popular may be those from the Batu Caves situated in a limestone hill near Kuala Lumpur, Malaysia (ABRAHAM, 1923; FAGE, 1929; BRISTOWE, 1952; ROEWER, 1962); 15 species of spiders including a liphistiid, *Liphistius batuensis* ABRAHAM, 1923, were described or recorded from the caves. The second cave-dwelling spider of the suborder Mesothelae, *Liphistius tham*, was discovered in Suan Hin Cave in northern Thailand by SEDGWICK and SCHWENDINGER (1990). Other than these, two ochyroceratids, *Althepus noonadanae* BRIGNOLI, 1973, and *A. tibiatus* DEELEMAN-REINHOLD, 1985, were described from Latuan Cave in Mindanao of the Philippines, and from Chiang Dao Cave, Chiang Mai Province, Thailand, respectively. DEELEMAN-REINHOLD intensively studied cave spiders of tropical Asia, and reported about 40 species (mostly identified at generic level) collected from many caves in Thailand and Sumatra (1986) and 5 species from Niah Cave in Sarawak, East Malaysia (1989).

The Scytodidae *sensu stricto* is an interesting group including spiders which squirt mucus from their chelicerae not only in preying but also for defense against enemy. They inhabit dark places such as under stones and leaf litter, under tree barks, in caves as well as in buildings. *Scytodes thoracicus* (LATREILLE, 1802), a cosmopolitan species, is found in houses. Four species of the family have been known from caves in Southeast Asia, that is, *Scytodes fuscus* WALCKENAER, 1837, *S. magnus* BRISTOWE, 1952, and *S. cavernarum* ROEWER, 1962, from the Batu Caves, Malaysia, and *Scytodes* sp.

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from Niah Cave, Sarawak.

In the summer of 1987, I had an opportunity to participate in a zoological expedition to Malaysia and Thailand made by the National Science Museum, Tokyo. My main purpose in the field study was to collect specimens of liphistiid spiders (ONO, 1988 a, b; ONO & SCHWENDINGER, 1990), but many spiders of various families were also obtained. On 25 August, I entered into a cave situated in a forest at Thung Salaeng Luang of Phitsanulok Province in central Thailand, where a new liphistiid, *Liphistius owadai* ONO et SCHWENDINGER, 1990, was discovered, to assist my colleague, Dr. Mizuko YOSHIYUKI, and the staff of the Thailand Institute of Scientific and Technological Researches in collecting bats dwelling there. In a hall about 15 m under the entrance to the cave, I collected some specimens of a strange scytodid spider from under stones and rocks. The spider seems to have taxonomical significance, though it should not be a troglobiontic one. This interesting scytodid species will be described and illustrated in the present paper. A new genus will be established for the species and its relative, *Scytodes leopoldi* GILTAY, 1935, described from Fraser's Hill, Malaysia, and their systematic position within the family Scytodidae will be discussed.

The type specimens to be designated herewith are deposited in the collection of the Department of Zoology, National Science Museum, Tokyo (NSMT).

Family Scytodidae

Genus Stedocys nov.

Type species. Stedocys uenorum gen. et sp. nov.

Other congener. Stedocys leopoldi (GILTAY, 1935), comb. nov., described on the basis of the holotype male collected from Fraser's Hill, Malaysia.

Description and diagnosis. Prosoma expanded, highest at the middle, longer than wide; eyes in three groups, each group consisting of two eyes close to each other, eye area long; chelicerae, maxillae and labium compactly set, chelicera small, without teeth, its inner margin sclerotized and modified into a hard process, fang very short; maxillae distally convergent, labium as long as wide; margin of sternum sclerotized; legs very long, the first leg about ten times the length of carapace, leg formula I–II–IV–III. Male palp slender, femur, patella and tibia without apophyses and strong spines, tarsus very short, bulb long with curved embolic division. Female genitalia unknown.

General feature of the spiders of this new genus, especially the condition of prosoma and the arrangement of eyes, shows that the genus belongs to the family Scytodidae. After the former family (formerly a subfamily in the Sicariidae *sensu lato* (Sicariidae was synonymized with Loxoscelidae by PLATNICK *et al.*, 1991) was split up into three different families, Scytodidae, Loxoscelidae and Drymusidae (GERTSCH, 1979; GERTSCH & ENNIK, 1983; LEHTINEN, 1986), the Scytodidae *sensu stricto* has been constituted by only the genus *Scytodes* LATREILLE, 1804, including several dozens of species from the world. Judging from the stucture of the male palp, the species of the

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Fig. 1. Stedocys uenorum gen. et sp. nov., male holotype. (Body length: 11.7 mm.)

new genus have no characteristics common with the species of *Scytodes*. According to the morphology of male palp, the short tarsus and relatively long bulb with aciculate embolus are characteristic to the new genus. *Stedocys* should stand apart from the latter in the family, as LEHTINEN (1986) suggested. It appears that he had intention to propose a new subfamily for *Scytodes leopoldi* but actually gave no name. Its

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Figs. 2-4. Stedocys uenorum gen. et sp. nov., male holotype. — 2, Pro- and opisthosomata, dorsal view (scale: 1 mm); 3, palp, retrolateral view (scale: 0.2 mm); 4, palpal tarsus, retrolateral view (scale: 0.2 mm).

phylogenetic relationship within the family Scytodidae may be clarified in his worldwide revision in progress.

Distribution. Southeast Asia (Thailand, Malaysia).

Remarks. The generic name is formed by an arbitrary combination of letters; masculine.

Stedocys uenorum sp. nov.

(Figs. 1-5)

Type specimens. Holotype: 3, 1 immature 2 and 1 juvenile paratypes from a
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Fig. 5. Stedocys uenorum gen. et sp. nov., immature female paratype, pro- and opisthosomata, lateral view. (Scale: 1 mm.)

cave near (about 3 km apart from) Thung Salaeng Luang, 600 m alt., Phitsanulok Province, Thailand, 25-VIII-1987, H. ONO leg. (NSMT-Ar 3205-3206).

Description (mainly based on the male holotype). Measurement:— 3° , Body length 11.7 mm; prosoma length 6.0 mm, width 4.8 mm; opisthosoma length 5.8 mm, width 3.8 mm; lengths of legs and palp [total length (femur+patella+tibia+metatarsus +tarsus)]: I 57.1 mm (16.3+1.6+17.0+19.3+2.9), II 46.5 mm (13.3+1.6+13.4+15.9+2.3), III 30.6 mm (9.1+1.6+8.2+9.6+2.1), IV 41.1 mm (12.3+1.6+12.2+12.6+2.4), palp 6.8 mm (2.3+0.8+1.7+-+2.0).

Prosoma longer than wide (length/width 1.25), carapace very high, highest at the center, only metadiscus covered by hairs; six eyes arranged in three groups, almost the same in size but the posterior lateral one the largest, and the anterior lateral one the smallest, ratio of diameter 26: 23: 22, the two anterior median eyes, and the anterior and posterior lateral eyes close to each other, respectively, eye area relatively long (length/width 0.75), clypeus about twice the diameter of anterior eye. Chelicerae, maxillae and labium compactly set; chelicera small and without special projections or cheliceral teeth, but the distal part of inner margin is sclerotized and protrudes into a process like a large tooth, fang very short; maxillae long, distally convergent; labium as long as wide; sternum longer than wide (length/width 1.50). Legs very long, slender, in each leg metatarsus is the longest segment, leg formula I–II–IV–III; upper claws very long and with more than 10 teeth, lower claws small but also with some teeth. Female palp without trasal claw.

Male palp (Figs. 3–4). Femur, patella and tibia relatively long, without apophyses and spines, tibia with trichobothria in two rows; basal part of tarsus very short and crateriform, long bulb lying on the top of cymbium, embolic part long and aciform.

Opisthosoma longer than wide (length/width ♂ 1.53), covered with long hairs.

Coloration and markings (Figs. 2, 5). \mathcal{J} , Carapace light chestnut brown with two pairs of black lines on mesodiscus, a white stripe extending from mesodiscus to posterior declivity, three pairs of white patches and some small white markings on al-

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latum; chelicerae, maxillae and labium yellowish brown, maxillae distally white, sternum yellowish brown darker marginated; legs yellowish brown, palps dirty yellow. Opisthosoma faded, dorsally greyish white with black markings, ventrally purplish, spinnerets brown. Q, Darker, with annulated legs, and black opisthosoma with distinct white markings.

Biology. The specimens of this spider were collected from under stones lying on the ground near the entrance to the cave. The coloration of the body and other morphological characteristics of the new spider indicate that the spider should not be a subterranean species but a scotophilous one. Besides, the related species, *S. leopoldi*, seems to be an epigean spider.

Remarks. This new species is closely related to *Stedocys leopoldi* (GILTAY, 1935), but is distinguished from the latter by the shape of male palp. The embolic part of bulb of *S. uenorum* is strongly curved, extending ventrad and much longer than the basal part (Figs. 3–4), while that of *S. leopoldi* is slightly curved or straight, extending dorsad and as long as the basal part (GILTAY, 1935, fig. 3; LEHTINEN, 1986, fig. 7).

This species is dedicated to Drs. Shun-Ichi and Yoshiko Uéno for the reason to be explained in the next chapter.

Biographical Remarks

I first met Dr. Shun-Ichi UÉNO in October 1969, when the First Annual Meeting of the Arachnological Society of East Asia was held at the National Science Museum, Tokyo. Being a curator of the museum then, he was not only an excellent zoologist, above all specialized in Coleoptera (Insecta), Amphibia and Reptilia, but was a good caver and explorer. However, I did not know this being a high school boy. Besides, I was not accustomed to caving and cave researches. Once I tried to collect spiders in caves to help Dr. Takeo YAGINUMA, Emeritus Professor of Otemon Gakuin University, Osaka, who was studying cave spiders of the genus *Nesticus*. In a cave visited, I carelessly lost batteries for torch light and was confined in total darkness for two hours. Ever since, I have felt uneasy about entering caves, and realized that I was not made for speleology.

On the other hand, my interest went deeper and deeper in arachnology, especially in the study of the epigean family Thomisidae. Though I completed the law course at Gakushuin University, Tokyo, I became a student of Johannes Gutenberg University at Mainz, Germany, in October 1976, to properly study arachnology under the supervision of Professor Dr. Jochen MARTENS. While studying there, I took up the study of spiders collected by Professor MARTENS in the Nepal Himalaya and also endeavoured to re-examine types of Japanese species. Having been unable to find a good job in Japan, however, I had to extend my stay in Germany longer and spent seven years at Mainz.

On such a day in 1983, I received a letter from Dr. UÉNO inviting me to the National Science Museum, Tokyo. Thus, I was emplyed as a curator at the Department of

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Zoology of the Museum in October of that year with recommendation of Professor YAGINUMA, Professor MARTENS and above all Dr. UÉNO. For nearly a dozen years since then, Dr. UÉNO has shown me not only his leadership in the Japanese zoology, entomology and speleology, but also many other things, how to manage curatorial works, how to organize expeditions and scientific societies, and how to edit scientific journals and other publications. He is a born linguist and can read many foreign languages, but I suspect that his linguistic knowledge owes to some extent to his wife Dr. Yoshiko UÉNO, Professor of English literature at Tokyo Metropolitan University, who is a Shakespearean and a pioneer scholar in the study of Robin Hood legend.

I cordially thank Dr. Shun-Ichi UÉNO for his constant guidance not only in zoology but in everything related to nature, and wish to convey him my respectful congratulations on the occasion of his retirement from the head of the Department of Zoology, National Science Museum, Tokyo.

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A New Ground-living Spider of the Genus *Coelotes* (Araneae, Agelenidae) from Northern Vietnam¹⁾

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Abstract A new species of the agelenid genus *Coelotes* is described from Mt. Tam Dao in northern Vietnam. It is unique in conformation of its male palp and female epigynum, and is isolated within the genus in a strict sense. This is the first record of *Coelotes* from Vietnam.

In the autumn of 1994, an entomological expedition was made by the National Science Museum, Tokyo, to northern Vietnam under the leadership of Dr. Shun-Ichi UÉNO. The main purpose of this expedition was to collect small invertebrates on high mountains, and though good collecting sites were rather limited, we were able to find many interesting things, among which were found some specimens of agelenid spiders of the genus *Coelotes*.

Spiders of this genus have previously been unknown from Vietnam, as are those of many other groups (BRISTOWE, 1933), though numerous *Coelotes* in a broad sense have recently been described from China (YIN *et al.*, 1990). In the present paper, I am going to introduce into science an isolated new species of the genus in a strict sense from Mt. Tam Dao, an exceptionally well preserved mountain about 50 km northnorthwest of Hanoi. All the type specimens to be designated in this paper are deposited in the collection of the Department of Zoology, National Science Museum, Tokyo.

Before going further, I wish to express my hearty thanks to Dr. Shun-Ichi UÉNO, head of the Department of Zoology, the National Science Museum, Tokyo, for his constant guidance and for reading through the original manuscript of this paper. My deep indebtedness should be expressed to all the members of the 1994 expedition, Dr. Mamoru OwADA, Dr. Akiko SAITO and Dr. Masataka SATÔ, as well as to Professor HA Quang Hung and other staff of the Department of Entomology, Hanoi Agricultural University, and Mr. NGUYEN Thuyet for their kind support of my study in the field.

This paper is respectfully dedicated to Dr. Shun-Ichi UÉNO in commemoration of his retirement from the National Science Museum, Tokyo. Being a leading biologist and speleologist, Dr. UÉNO has always supervised my studies on spiders and other things, invited me to many expeditions both at home and abroad, and made me ac-

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quainted with various kind of animal life which is not known in nature to most biologists.

Coelotes yoshikoae NISHIKAWA, sp. nov.

(Figs. 1-8)

Female (holotype). Total length 13.2 mm; cephalothorax 6.0 mm long, 4.0 mm wide, abdomen 7.2 mm long. Ratio of the width to the length of cephalothorax 0.65; ratio of the width of head to that of thorax 0.63; ratio of the width of eye area to that of head 0.65.

Anterior eye row procurved, posterior eye row strongly procurved, posterior median eyes the smallest, the others almost equal in diameter to one another. Median ocular area slightly longer than wide (37: 34), anterior part as wide as the posterior. Clypeus about 1.4 times as wide as anterior median eye.

Cephalothorax covered with many hairs. Chelicera very strongly geniculate, with well developed lateral condyle. Retromargin of fang furrow with five teeth. Labium longer than wide (11:9). Sternum shield-shaped, longer than wide (5:4).

Leg formula 4, 1, 2, 3. First leg almost equal in length to the fourth one. Measurements of legs in mm as follows:

Leg	Femur	Pat. + Tib.	Metatarsus	Tarsus	Total
I	4.53	5.77	4.18	1.89	16.37
II	4.07	5.17	3.60	1.74	14.58
III	3.72	4.07	3.54	1.51	12.84
IV	4.65	5.70	5.81	1.74	17.90

Ventral spines of legs: 2-2-2 on each tibia. Dorsal spines on femur: I, 1-1-3 (pr. 1); II, 1-2-3 (pr. 1); III, 1-3-3; IV, 1-2-3.

Abdomen oval in shape. Posterior spinnerets long, with the apical segment slightly longer than the basal one.

Epigynum large, transverse, with the sides slightly emarginate in front and roundly produced laterad behind; each postero-lateral portion convex, with the internal margin obliquely straight, narrowly sclerotized, and covering curved aperture divergent internally; paired processes completely absent.

Colour brown in cephalothorax, which becomes darker towards head region; palp, chelicera, maxillae and labium dark reddish brown. Sternum brown, with infuscated median line widened at the middle. Legs brown on the dorsal side, infuscated on the ventral side, and devoid of ring flecks. Abdomen olivaceous brown with numerous small spots of black and white, and provided with five paired chevrons of whitish coloration on dorsum; venter yellowish brown sparsely mottled with irregular blackish spots.

Male (allotype). Similar to female in coloration and structure. Total length

140



Figs. 1–8. Coelotes yoshikoae NISHIKAWA, sp. nov., from Tam Dao, northern Vietnam. — 1, Dorsal view; 2, eye area, frontal view; 3, left chelicera; 4, sternum; 5, epigynum, ventral view; 6, female genitalia, dorsal view; 7, male palp, ventral view; 8, same, retrolateral view.

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11.7 mm; cephalothorax 5.7 mm long, 3.8 mm wide; abdomen 6.0 mm long.

Palp with a small embolic conductor, which is ridged at the basal part, gradually twisted and reflexed towards apex, and ending in a flattened terminus pointed at the extremity; integument at the lateral side forming a lamellar fold, which protrudes into an arcuate process at the side of the apical end of embolic conductor; radix not sharply separated from the base of embolus; tibial apophysis short and blunt, patellar one longer than the tibial though not long and simply blunt at the tip.

Type series. Holotype (\bigcirc) and allotype (\bigcirc), Mt. Tam Dao, 960–1,100 m alt., Vinh Phu Prov., northern Vietnam, 25–IX–1994, M. SATÔ & A. SAITO leg. Paratypes (3 \bigcirc \bigcirc 1 \bigcirc), same data as for the holotype.

Notes. This is a remarkable new species whose true affinity is not certain. It does not belong to any of the species-groups hitherto recognized in Japan and does not appear to have a direct relationship to any of the Chinese species hitherto described. The unique conformation of its male palpal tarsus and female epigynum is not comparable to those of any other species of *Coelotes* in a strict sense, and above all the presence of an arcuate process at the side of the apical end of the embolic conductor is a feature hitherto known only in the *corasides* complex, for which a new genus will be erected in a forthcoming paper (NISHIKAWA, in prep.). Further investigations are needed for determining its relationship, especially in Indo-chinese countries and southern China.

The type specimens of *Coelotes yoshikoae* were collected in an evergreen broadleaved forest near the top of Mt. Tam Dao, probably near the upper courses of narrow streams. However, detailed condition of its occurrence is not certain, as I myself was unable to take any specimen of this spider.

This interesting species is named in honour of Dr. Yoshiko UéNo, who has always helped her husband's works for promotion of Japanese entomology and biospeology.

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Two Cave-dwelling Isopod Crustaceans from Northern Vietnam^{1,2)}

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Abstract Two terrestrial isopod crustcaceans collected from caves of northern Vietnam are reported. One of them is proved to be a new species of the genus *Drya-dillo*, family Armadillidae, and the other belongs to the genus *Burmoniscus* of the family Philosciidae.

In October 1994, Dr. Shun-Ichi UÉNO and Dr. Yoshiaki NISHIKAWA examined the fauna of some caves of northern Vietnam as a part of the faunistic researches of the northern part of that country made by the National Science Museum, Tokyo, under the leadership of Dr. UÉNO. During the survey, two species of isopod crustaceans were collected and handed over to me for identification. As the results, it became clear that the collection included a new species of the genus *Dryadillo* of the family Armadillidae.

In the present paper, which is dedicated to Dr. Shun-Ichi UéNO in commemoration of his retirement from the head of the Department of Zoology, National Science Museum, Tokyo, the new species will be described under the name *Dryadillo uenoi*, and an undertermined species of the genus *Burmoniscus* will be recorded.

Order Isopoda

Family Armadillidae BRANDT et RATZENBURG, 1931 Genus *Dryadillo* HEROLD, 1931

Dryadillo uenoi sp. n.

(Fig. 1)

Material examined. $2 \stackrel{\circ}{\supset} \stackrel{\circ}{\bigcirc} (1 \stackrel{\circ}{\supset}, \text{holotype 6.4 mm in body length and } 1 \stackrel{\circ}{\bigcirc} \text{ paratype 6.6 mm in body length}) and <math>2 \stackrel{\circ}{\ominus} \stackrel{\circ}{\subsetneq} (1 \stackrel{\circ}{\ominus}, \text{ allotype 5.7 mm in body length and } 1 \stackrel{\circ}{\ominus}, \text{ paratype 4.1 mm in body length}), Hang Bo Nau Cave, Is. Bo Nau, Vinh Ha Long, Quang Ninh Prov., N. Vietnam, 18–X–1994, S.-I. UÉNO; 5 <math display="inline">\stackrel{\circ}{\supset} \stackrel{\circ}{\bigcirc} (\text{paratypes, 4.7-6.5 mm in body length}), Hang Bo$

¹⁾ This study is supported by the Grant-in-aid No. 06041116 for Field Research of the Monbusho International Scientific Research Program, Japan.

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Nau Cave, Is. Bo Nau, Vinh Ha Long, Quang Ninh Prov., 8-X-1994, coll. Yoshiaki NISHIKAWA; $3 \ Q \ Q$ (3.0–3.6 mm in length), Hang Sung Sot Cave, Is. Sung Sot, Vinh Ha Long, Quang Ninh, Prov., N. Vietnam, 18-X-1994, coll. Yoshiaki NISHIKAWA.

The type series is deposited as follows: Holotype (NSMT Cr-11444), allotype (NSMT Cr-11445), and 8 paratypes (NSMT Cr-11446–11453), at the National Science Museum, Tokyo; 7 paratypes (TOYA Cr-12439–12445) at the Toyama Science Museum.

Description. Male. Body 2.2 times as long as wide. Body color white in alcohol and also when alive (acc. to UÉNO, pers. comm.). Surface smooth. Frontal line of cephalon without any concavity in medial area. Eye wanting. Pereonite 1 (Fig. 1 B) with inner lobe of schisma rounded. Pereonites 2 and 3 each with a small rounded ventral inner teeth. Pereonites 4–7 without any schisma or tooth. Pleotelson hour-glass-shaped, with only a slightly concave lateral margin.

Antennula (Fig. 1 C):— First segment cylindrical; second segment half the length of the first; terminal segment slender and with 6–10 aesthetascs at the tip.

Antenna (Fig. 1 D) reaching the posterior border of the first pereonal somite. Flagellum 2-segmented; terminal segment 1.7 times as long as the basal one.

Right mandible (Fig. 1 E):— Pars incisiva 3-headed; lacinia mobilis 3-headed; 2 plumose setae behind lacinia mobilis; processus molaris represented by a single plumose seta.

Left mandible (Fig. 1 F):— Pars incisiva 3-headed; lacinia mobilis 3-4-headed; 2 plumose setae behind lacinia mobilis; processus molaris represented by a single plumose seta.

Maxillula (Fig. 1 G):— Inner lobe with 2 stout plumose setae at the tip; outer lobe with 10 teeth at the tip, inner four setae bifid.

Maxilla (Fig. 1 H) round and broad, dental area rather narrow.

Maxilliped (Fig. 1 I):— Endite rectangular with 3 stout spines on distal margin; palp relatively stout with 2 long setae on inner margin and a tuft of setae at the tip.

First percopod (Fig. 1 J):— Basis oblong with outer sternal margin bearing 12 setae; ischium rectangular, 45% as long as basis with 10–12 setae on both margins and a few setae at the outer distal corner; merus 2/3 as long as ischium, with sternal margin bearing 5 setae on inner margin and a seta on distal margin; carpus as long as merus, with 6 setae; propodus long with 7–8 setae.

Second percopod:— Basis oblong; ischium about 40% as long as basis; merus a little shorter than ischium; carpus almost as long as ischium, with 5–6 stout setae and many small setae on inner margin, and 3–4 setae on distal margin; propodus a little longer than carpus, with 6 stout and many minute setae.

Third percopod:— Basis oblong, 5 times as long as wide; ischium about half the length of basis; merus a little shorter than ischium with sternal outer distal margin bearing 2 longer setae; carpus rectangular; propodus long with setae on inner margin.

Fourth percopod:— Basis oblong; ischium about half the length of basis; merus a little shorter than ischium, bearing 2–3 setae; carpus twice as long as merus, bearing 7 longer setae on inner margin; propodus a little longer than merus, with 7 setae on

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Fig. 1. Dryadillo uenoi sp. n. — A, Dorsal view; B, venral view of pereonites 1–3; C, antennula; D, antenna; E, right mandible; F, left mandible; G, maxillula; H, maxilla; I, maxilliped; J, first pereopod; K, sixth pereopod; L, seventh pereopod; M, penes and male first pleopod; N, male second pleopod; O, third pleopod; P, fifth pleopod; Q, uropod and pleotelson. (All: male holotype.)

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inner margin.

Fifth percopod:— Basis oblong, 5 times as long as wide; ischium 60% as long as basis with sternal margin bearing a seta; merus rectangular; carpus rectangular with 5 setae on inner margin; propodus oblong with 10 stouter setae on inner margin.

Sixth percopod (Fig. 1 K):— Basis oblong with 10 setae on inner margin and 7–9 on outer margin; ischium half the length of basis, with 7 setae on inner margin and a seta on outer margin; merus half the length of ischium, with long 6–7 setae on inner margin and a seta on outer margin; carpus rectangular, with 5 longer and 6 shorter setae on inner margin and 10 setae on outer margin; propodus long, 1.2 times as long as carpus, with 9–10 setae on inner margin and more than 15 setae on outer margin.

Seventh percopod (Fig. 1 L):— Basis long with 7–9 long setae on inner margin; ischium with convex sternal margin and with 2–3 setae on outer margin and 2–3 setae on inner margin; merus rectangular with 3–4 setae on inner margin; carpus with 5 setae on inner margin; propodus long with 7–9 setae on inner margin.

Penes (Fig. 1 M) fusiform, its tip being rather truncated.

Pleopod 1 (Fig. 1 M):— Endopod with about 10 spinules at the apical part; exopod low triangular, pseudotracheae occupying about the distal half.

Pleopod 2 (Fig. 1 N):— Endopod long with filiform apical part, 1.3 times as long as exopod, and recurved; exopod long; pseudotracheae occupying the distal area.

Pleopod 3 (Fig. 1 O):— Endopod triangular with a seta on distal margin; exopod also triangular and smaller than endopod.

Pleopod 4:— Endopod triangular with setae on distal margin; exopod also triangular and smaller than endopod.

Pleopod 5 (Fig. 1 P):— Endopod triangular with 3 setae on distal margin: exopod also triangular and smaller than endopod.

Uropod (Fig. 1 Q) long; basis 2.2 times as long as wide with spines on outer margin; exopod 1.5 times as long as basis; endopod 1.6 times as long as wide, and slenderer than exopod.

Female. Differing from male only in primary sexual characters.

Remarks. Eleven species of the genus *Dryadillo* have hitherto been reported from Indonesia and the Indo-Chinese Region, mainly from Java, Bali, Lombok and Flores Islands (HEROLD, 1931; TAITI *et al.*, 1992). The present new species is allied to *Drya-dillo montanus* (HEROLD 1931, pp. 343–345), but is separated from the latter by the following features: 1) absence of eye, 2) white depigmented body, 3) longer exopod of uropod, 4) lack of scale on protopod of uropod.

According to Drs. UÉNO and NISHIKAWA, this new species was found in the dark zone of the insular caves and was mainly met around thin deposits of bats' excreta. It was not particularly agile, but did not usually enroll the body and crawled away when disturbed.

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Family Philosciidae VANDEL, 1952 Genus *Burmoniscus* BUDDE LUND, 1909

Burmoniscus sp.

(Fig. 2)

Material examined. $1 \Leftrightarrow (12.9 \text{ mm in body length) from Hang Sung Sot Cave, Is. Sung Sot, Vinh Ha Long, Quang Ninh Prov., N. Vietnam, 18–X–1994, S.-I. UÉNO. This specimen is deposited at the National Science Museum, Tokyo.$

Description. Female. Body slender, 3.0 times as long as wide. Body color pale brown with irregular patterns on dorsal surface in alcohol. Surface smooth. Eyes mediocre in size, each eye composed of about 15 ommatidia. Pleotelson triangular.

Antennula (Fig. 2 B):— First segment large; second segment square; terminal segment rectangular but tapered toward the tip, with 4 aesthetascs.

Antenna unfortunately broken.



Fig. 2. Burmoniscus sp. — A, Dorsal view; B, antennula; C, right mandible; D, left mandible; E, maxillula; F, maxilla; G, maxilliped; H, first pereopod; I, seventh pereopod. (All: female specimen.)

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Right mandible (Fig. 2 C):— Pars incisiva weakly 3-headed; lacinia mobilis single-headed; 2 plumose setae behind lacinia mobilis; processus molaris represented by a single plumose seta.

Left mandible (Fig. 2 D); pars incisiva 3-headed; lacinia mobilis single-headed; 2 plumose setae behind lacinia mobilis; processus molaris represented by a single plumose seta.

Maxillula (Fig. 2 E):— Inner lobe with 2 stout plumose setae at the tip; outer lobe with 10 teeth at the tip, four of the inner setae being bifid.

Maxilla (Fig. 2 F) broad, dental area relatively wide.

Maxilliped (Fig. 2 G):— Endite narrow with a stout spine on the distal margin; palp with 3 groups of tufts of setae.

First percopod (Fig. 2 H):— Basis oblong with more than 10 setae on inner margin; ischium rectangular with a seta on outer margin and 1–2 setae on inner margin; merus rectangular with 8 setae on inner margin and 3 setae on outer distal corner; carpus relatively stout, about half the length of basis; propodus a little longer than carpus.

Seventh percopod (Fig. 2 I):— Basis elongated and stout; ischium triangular, with 3 setae on outer margin and several setae on inner margin; merus rectangular and abruptly narrower than ischium, with 10–12 setae on inner margin; carpus oblong, 1.3 times as long as merus, with 5 groups of setae on inner margin and 9–10 seate on outer margin; propodus long, 1.2 times as long as carpus.

Uropod (Fig. 2 J) long; basis 2.2 times as long as wide with spines on outer margin; exopod 1.5 times as long as basis; endopod 1.6 times as long as wide, slenderer than exopod.

Remarks. The present specimen is similar to *Burmoniscus parvocellus* TAITI et MANICASTRI (1988, pp. 76–79), reported from Indonesia. The former is, however, separated from the latter by the following features: 1) stouter body shape, 2) more numerous ommatidia, 3) longer merus of seventh pereopod, and so on. Since only one imperfect specimen is available for this study, I refrained from establishing a new species.

According to Dr. UÉNO, two individuals of this isopod were met near the innermost of Hang Sung Sot Cave, from beneath stones lying on muddy floor. They ran so quickly that a second animal escaped into a narrow fissure of limestone and was not caught.

Acknowledgement

I would like to express my sincere gratitude to Dr. Shun-Ichi UÉNO of the National Science Museum, Tokyo, and Dr. Yoshiaki NISHIKAWA of Otemon Gakuin University, Osaka, for their kindness in submitting the interesting material to me for taxonomical study.

Two Cave-dwelling Isopods from Northern Vietnam

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A New Leucosiid Crab, Arcania uenoi, from the Ryukyu Islands

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Abstract Arcania uenoi, a new crab species of the family Leucosiidae, is described on a male obtained at a depth of 35 m in front of the entrance to a submarine cave of Ie-jima Islet in the central Ryukyu Islands. General formation of its carapace symmetrically armed with many stout tubercles indicates relation to *A. sagamiensis* SAKAI from central Japan, and *A. gracilipes* BELL from India and Australia, but the new species is readily distinguished from them by the features that the posteriormost branchial tubercle is the strongest of the dorsal and marginal ones, and the intestinal tubercle is also longer than the others.

Dr. T. KASE, a senior curator of the Department of Geology, the National Science Museum, Tokyo, is kind enough to place the crustacean specimens at the author's hand for study, which were collected together with his special interest, the cryptic molluscs living in submarine limestone caves of the Ryukyu Islands, the Philippines and the Palau Islands.

Among them is a leucosiid crab found in the interstices of coral rock at the shallow water in front of the entrance to one of the caves of Ie-jima Islet, the central Ryukyu Islands. This specimen, which was identified with a new species of the genus *Arcania* LEACH, was entirely whitish in life and different from the pinkish color of the other members of the genus. In fact, this is a good opportunity to name this distinctive species after Dr. Shun-Ichi UÉNO of the National Science Museum, Tokyo, to commemorate his retirement.

Before going into the description, the author has to extend his sincere thanks to Dr. T. KASE, who provided with the valuable specimen, the holotype, now preserved in the National Science Museum, Tokyo (NSMT).

Family Leucosiidae Genus Arcania LEACH, 1817

Arcania uenoi sp. nov.

(Figs. 1-2)

Material examined. One male, holotype (NSMT-Cr 11432), length of carapace excluding supraorbital tubercle and posterior median tubercle, 9.0 mm and breadth

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of carapace excluding lateral tubercles, 9.0 mm. — Ie-jima Islet, west of Okinawajima Island, the Ryukyu Islands, in front of Large Cave (26°42.9'N, 127°50.1'E), 35 m deep; Oct. 13, 1990; T. KASE leg.



Fig. 1. Arcania uenoi sp. nov., holotype male (breadth excluding lateral tubercles, 9.0 mm, and length in median line excluding posterior tubercle, 9.0 mm).

Description of holotype. Carapace nearly as long as wide, strongly convex dorsally for its most part behind front-orbital region, armed with 16 dorsal and 9 marginal tubercles; dorsal surface and margin of carapace seemingly smooth, though thickly spaced with microscopical granules; most of dorsal and marginal tubercles conical, but somewhat different in size and shape; protogastric main tubercle stout, too sharp to be regarded as a mound, but too blunt to be called a tubercle; protogastric subsidiary tubercle much smaller than, and situated obliquely in front of the main one; mesogastric region indicated only by a weak longitudinal ridge; cardiac tubercle as large as the main protogastric one, but distinctly tuberculated; of 6 branchial tubercles, anterior 2 of outer 3 tubercles and both of inner 2 tubercles conical, distinctly tuberculated, similar in size and shape to cardiac tubercle; anterior one of inner 2 tubercles just in a transverse line with main protogastric tubercle, and posterior one in a transverse line with intestinal tubercle; posteriormost of outer 3 tubercles markedly developed, strongest of all the dorsal tubercles, more than twice as long as other dorsal tubercles, obliquely directed posteriorly as a whole, curved dorsally near its tip; intestinal tubercle rather close to posterior border of carapace, similar to, but slightly shorter than main branchial tubercle, more or less depressed in dorsal view, directed posteriorly, with blunt apex.

Of 9 marginal tubercles of carapace, hepatic and branchial ones nearly the same in size, the former directed obliquely forwards just like anterior branchial one, but much

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Fig. 2. Arcania uenoi sp. nov., holotype male (cb $9.0 \times cl 9.0$ mm). a-b: Schematic figure of carapace in dorsal and lateral views, respectively, to show contour of carapace and arrangement of tubercles. c: Abdomen. d: Right cheliped. e: Right chela. f: Left first pleopod in abdominal view. g-h: Distal part of left first pleopod in abdominal and sternal views, respectively. Scales for d, e, and c and f=5 mm; scale for g and h=2 mm.

sharper; median one of 3 tubercles on posterior margin slightly smaller than lateral ones.

Supraorbital tubercle bluntly tuberculated, with convex dorsal surface; frontal region between supraorbital tubercles of both sides deeply excavated, somewhat eroded near its anterior margin, with a small median U-shaped incision.

Two long fused slits on supraorbital margin, and 1 on infraorbital margin; carapacial margin following external orbital angle rather thickened and directed towards anterior branchial tubercle. True carapacial margin directed towards antero-external

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angle of buccal cavern, which forms a part of roof and wall of distal end of spout and extends beyond front-orbital margin in dorsal view.

Third maxilliped long, roughened with tubercles mainly on merus and distal third of exopod, being studded with several pearly granules in a longitudinal line on median part of ischium and along outer margin of exopod; merus half as long as ischium, and exopod slightly narrower than ischium.

Chelipeds slender, mostly cylindrical, thickly covered with microscopical granules; merus only slightly longer than carpus and palm combined; palm slightly longer than fingers, distinctly tapering; both fingers weakly sinuate, leaving a narrow gape between them for their distal halves to two-thirds, with comb-like teeth armed with many perpendicular needle.

All of chelipeds and ambulatory legs detached. Ambulatory legs cylindrical and microscopically granulated, with thick setae on dactyli.

Proximal two abdominal segments linear; main fused segment long, convex ventrally at each side of basal third; distal two-thirds of main segment flattened for its most part, only with a small thin tubercle just near distal margin, with lateral margins of both sides subparallel or only weakly tapering distally; terminal segment more or less quadrate.

First pleopod curved outwards to be sickle-shaped at distal third, with a distal large flap of right-angled triangle frilled with spinules along hypotenuse.

Remarks. This new species is generally close to *Arcania gracilipes* BELL, 1855 from India and Australia, and *A. sagamiensis* SAKAI, 1969 from Japan, and differs from all the other species in the genus *Arcania* in having the symmetrically disposed, stout tubercles on margin and dorsal surface of the carapace, with thick pavement of microscopical granules. In the two known species, however, all the tubercles are almost the same in length and size. It is remarkable that in the new species the intestinal and last branchial tubercles are much longer than the others, and especially the last branchial one is the longest of all the dorsal and marginal tubercles.

The new species has relation also to *A. pulcherrima* (HASWELL, 1880) which has been recorded by HASWELL (1880, 1882), MIERS (1884), LAURIE (1906), TAKEDA (1979) and CHEN (1989). This species and *A. septemspinosa* BELL, 1855 were considered to be distinct from each other and transferred to the genus *Ixa* LEACH by CHEN (*op. cit.*). In these species the epibranchial tubercles of both sides are remarkably developed and protruded laterally beyond the general contour of the carapace. In the new species, however, the last branchial tubercle is stronger than the others, and the corresponding epibranchial, or the second branchial marginal tubercle is almost conical and subequal to the preceding tubercle. The systematic position of the present new species is in the genus *Arcania*, and not in the genus *Ixa*.

Etymology. The present new species is dedicated to Dr. Shun-Ichi UéNo, Director of the Department of Zoology, National Science Museum, Tokyo, who is to retire in this spring under the age limit. He is capable of supervising the studies on various animal groups not only insects but also amphibians and lower aquatic invertebrates,

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and was always kind enough to give useful comments on the author's manuscripts.

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The Group of *Epanerchodus bidens* (Diplopoda, Polydesmidae)

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Abstract Cave-dwelling millipeds belonging to the group of *Epanerchodus bidens* are enumerated. Seven species are recognized as the members of the species-group, and two of the seven are newly described under the names *E. yozawanus* and *E. ohruii*. The species-group is characterized by the gonopodal feature, and is endemic to the Kwantô Mountains and Fuji Volcano in eastern Honshu, Central Japan.

The genus *Epanerchodus* is the largest one of the polydesmid genera occurring in the Japanese Islands. Its members are widely known, more than seventy species having been recorded to the present. About eleven of them have hitherto been described from limestone caves in the Kwantô Mountains and lava caves in the Fuji and Izu areas. Studying Kwantô members, I have become aware of the fact that there is a group of species bearing certain similarity to one another in the gonopodal features. They are: *Epanerchodus angulatus*, *E. bidens*, *E. chichibensis*, *E. inferus* and *E. longus* (=*E. fujisanus*). Their gonopods are characterized by the presence of a long, abaxial and frangible accessory branch at the base of tibiotarsus as well as by the similarly shaped tibiotarsal shaft. So far as known to me, such a gonopodal peculiarity is found only in this group. Geographically, the members of this species-group are primarily allopatric, although their ranges are usually adjacent to one another. This group of species will be called the group of *Epanerchodus bidens*.

The purpose of the present paper is to elucidate the species-group and to give descriptions of two new species, which will be named *E. yozawanus* and *E. ohruii*. Total 238 mature specimens are examined. They have been collected from 25 different localities in about 30 years by Dr. Shun-Ichi UÉNO and many other scientists. Adding to these, the type specimens of two previously described species, *E. chichibensis* and *E. longus* deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo, were used for the present study. All the specimens examined including the type series of the new species will be deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

The abbreviation used in this paper are as follows: ab – accessory branch; as – acicular spine; cy – cyphopod; ef – epigynal flange; ep – external process; ip – inner process; lp – lateral process; pp – postfemoral process; NSMT – Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

Before going further, I wish to express my hearty thanks to Dr. Shun-Ichi Uéno of the National Science Museum (Nat. Hist.), Tokyo, for giving me the opportunity

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This paper is dedicated to Dr. Shun-Ichi Uéno for commemorating his retirement from the head of the Department of Zoology, National Science Museum, Tokyo.

Group of Epanerchodus bidens

Mainly characterized by the peculiar structure of male gonopod, which has a long accessory branch and several processes arranged regularly on the tibiotarsus. Its basic conformation can be seen in that of *Epanerchodus bidens* (Figs. 2–3). Accessory branch "ab" is laterally situated at the base of tibiotarsus; it is very long, slender, straightly projecting distad, and almost reaching the end of tibiotarsal shaft. Tibiotarsal shaft is basally broad and distally attenuated with three processes and one spine at the median portion; sharply triangular processes, an external "ep" and a lateral "lp", at the oral side, and a short tusked process "ip" and an acicular spine "as" at the aboral side. This basic form is modified according to the members of the group.

Range. Forty-nine known localities based on the specimens examined and literature records are indicated on the accompanying map (Fig. 1). So far as is known, the distributional range of the species-group is limited to the Kwantô Mountains, the

Fig. 1. Map showing the distribution of the group of Epanerchodus bidens. TAKAKUWA; $\bigstar \Box - E$. longus HAGA; $\blacktriangle - E$. angulatus MURAKAMI; $\bigcirc \bigcirc -E$. inferus VERHOEFF; $\Box \Box - E$. chichibensis HAGA; * - E. ohruii sp. nov.; $\odot - E$. yozawanus sp. nov. Solid symbols indicate localities from which specimens have been examined; open symbols are those based on literature records. Dotting and hatching show probable distributional range of E. bidens and E. longus. ---- 1, Saiko-kômori-ana Cave; 2, Nichi-dô Cave; 3, Getsu-dô Cave; 4, Shoiko-daiichi-fûketsu Cave; 5, Jinza-fûketsu Cave; 6, Mujinaana Cave; 7, Inusuzumi-daishi-fûketsu Cave; 8, Inusuzumi-daigo-fûketsu Cave; 9, Mitsuikéana Cave; 10, Uba-ana Cave; 11, Mamashita-ana Cave; 12, Hito-ana Cave; 13, Shin-ana Cave; 14, Uzura-ana Cave; 15, Banba-ana Pit; 16, Yashiki-ana Cave; 17, Mado-ana Cave; 18. Dainichi-ana Cave; 19. Kannon-ana Cave; 20. Koyama-tunnel; 21. Kuzure-ana Cave; 22, Funatsu-tainai Cave; 23, Narusawa-daiichi-kômori-ana Cave; 24, Narusawa-dainikômori-ana Cave; 25, Inno-tainai Cave; 26, Tôshimi-daiichi-fûketsu Cave; 27, Ohnofûketsu Cave; 28, Komakado-kaza-ana Cave; 29, Iwamuro; 30, Ananohara-dô Cave; 31, Karasawabora-no-ana Mine; 32, Nakaze-no-ana Mine; 33, Amagi-tôge; 34, Shiraishijizô-noana Mine; 35, Nutabata-dô Cave; 36, Mitsugô-dô Cave; 37, Ohtaké-dô Cave; 38, Yôzawadô Cave; 39, Kurasawa-dô Cave; 40, Nippara-dô Cave; 41, Mitsumata-dô Cave; 42, Aoiwa-dô Cave; 43, Oinu-ana Cave; 44, Hotoké-ana Cave (Ueno-mura); 45, Hotoké-ana Cave (Nakazato-mura); 46, Hashidate-dô Cave; 47, Mizukuguri-dô Cave; 48, Ogawamachi (Saitama Pref.); 49, Higashimatsuyama-shi (Saitama Pref.).

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Fuji-Hakoné and the Izu areas. Distributional pattern shown by the seven species can be recognized from this map.

Notes. Species of this group are usually found in caves, though three epigean habitats (Fig. 1, nos. 33, 48 and 49) are recorded. Only one species, *E. inferus* is troglobiontic, never having been found from outside limestone caves, and showing the highest morphological modification within the species-group. Other six species seem to be troglophilous, usually found in natural (limestone and lava) caves as well as in artificial cavities (mines, prospecting adits or tunnels).

The epigyne in females is not sufficiently differentiated to be useful for specific diagonoses, but it can be adopted as an auxiliary measure of specialization within the group.

Key to the Species

- 1 (10) Tibiotarsal shaft of gonopod pointed at the end (Figs. 2–7).
- 2 (5) Processes "ep" and "lp" on gonopodal tibiotarsus large and sharply triangular (Figs. 2, 7).
- 3 (4) Collum nearly subelliptical; process "ab" of gonopod very long and straightly projecting along tibiotarsal shaft (Figs. 2–3)E. bidens TAKAKUWA.
- 4 (3) Collum nearly semicircular; process "ab" of gonopod moderately long, projecting outwards (Fig. 7) E. chichibensis HAGA.
- 5 (2) Processes "ep" and "lp" on gonopodal tibiotarsus small or lacking (Figs. 4-6).
- 7 (6) Body colour pale reddish brown; lateral keels moderately thin; no irregular processes on the posterior side of tibiotarsus; process "ab" long and gently curved (Figs. 4–5).
- 8 (9) Gonopodal femur markedly protruding at the disto-ventral corner; processes "ep" and "lp" sharp, though small (Fig. 5) *E. angulatus* MURAKAMI.
- 10 (1) Tibiotarsal shaft of gonopod not pointed distally, with an obtuse incision at the end (Figs. 19, 26).
- 11 (12) Tibiotarsus moderately slender in distal half, its apex being truncated with a shallow notch (Fig. 19) *E. yozawanus* sp. nov.

Epanerchodus bidens TAKAKUWA

[Japanese name: Futaba Obiyasude]

(Figs. 2-3, 9)

Epanerchodus bidens Такакиwa, 1954, Diplopoden aus Japan, Tokyo, pp. 94, 109, fig. 127; type locality: Saiko-kômori-ana Cave, Aokigahara, Ashiwada-mura, Yamanashi Pref. — Таказніма & HaGa, 1956, Misc. Rept. Yamashina's Inst. Orn. Zool., Tokyo, 1, p. 333. figs. 10 a-b. — Міуозі, 1959, Über japanische Diplopoden, Osaka, pp. 97, 107, pl. 9, fig. 143. — ShiNoHaRa, 1973, Bull. natn. Sci. Mus., Tokyo, 16, p. 227, figs. 9–16.

Specimens examined. 1 Å, Saiko-kômori-ana Cave, Aokigahara, Ashiwada-mura, Yamanashi Pref., 12–V–1968, coll. by H. AKAMA; 1 Å, same cave, 14–VII–1972, by M. HIRAKE; 1 Å, same cave, 25–V–1986, by M. YOSHII; 1 Å, 1 \bigcirc , 1 larva, Nichi-dô Cave of the Shôji-o-ana caves, Aokigahara, Shôji, Kamikuisshiki-mura, Yamanashi Pref., 2–XI–1969, by S. UÉNO; 2 larvae, Shoiko-daiichi-fûketsu Cave, Karumizu, Narusawamura, Yamanashi Pref., 14–VII–1973, by M. HIRAKE; 3 ÅÅ, 4 \bigcirc \bigcirc , Inusuzumi-daigofûketsu Cave, Inusuzumi, Kamiidé, Fujinomiya-shi, Sizuoka Pref., 5–XII–1971, by S. UÉNO; 1 Å, Hito-ana Cave, Hitoana, Kamiidé, Fujinomiya-shi, Sizuoka Pref., 16–VIII– 1970, by S. UÉNO; 1 Å, 1 \bigcirc , 2 larvae, same cave, 21–VI–1980, by H. KIZAKI; 1 larva, same cave, 24–VII–1980, by H. KIZAKI; 2 ÅÅ, 1 \bigcirc , 2 larvae, Yashiki-ana Cave, Kamikawazawa, Kitayama, Fujinomiya-shi, Shizuoka Pref., 15–VII–1973, by M. HIRAKE; 1 Å, 1 \bigcirc , 6 larvae, Koyama-tunnel, Koyama, Honkawane-chô, Haibaragun, Shizuoka Pref., 24–X–1986, by M. YOSHII; 3 ÅÅ, 2 \bigcirc 2 larvae, same locality, 7–I–1987, by M. YOSHII (in baited traps set by M. YOSHII on 24–X–1986).

Diagnosis. Gonopod as characterized for the species-group and illustrated in Figs. 2 and 3.

Description. Colour pale reddish brown. Length of adult specimens 25–28 mm, greatest width 4.4 mm in segment 10. Lateral keels rather thin, wider than long (W: L=23: 17 in seg. 10 of a topotypical male), and slightly reflexed.

Range. Distributed to 17 lava caves at the western half of the Fuji area, and its range is stretched to the drainage of the Ôi-gawa River.

Notes. This species was described by TAKAKUWA in 1954 based on TORII's collection made in 1938 in Saiko-kômori-ana Cave (cf. UÉNO, 1971, pp. 206–210). Recently, 16 definite localities and a redescription of the species have been reported by SHINOHARA (1973) based on the collection made by Dr. S. UÉNO who carried out biospeological surveys of lava caves around Mt. Fuji-san in 1971. In the present paper, two new localities are added: the lava cave "Yashiki-ana" (Fig. 1, no. 16) and an abandoned tunnel called "Koyama-tunnel" (YOSHII, 1987), the latter of which is isolated from the main distributional range by about 45 km or more to the west-southwest. This locality (Fig. 1, no. 20) is situated on the right side of the Ôi-gawa River near "Kawane-koyama Railway Station" of the Ôi-gawa Line. The millipeds were found in a second small side tunnel about 200 m distant from the entrance (according to YOSHII, pres. comm.). This addition may shed a different light on our knowledge



Figs. 2–13. Left gonopodal telopodites (2–7) and epigynal flanges (8–13) of five known species belonging to the group of *E. bidens*, drawn from topotypical specimens. — 2, 3 and 9, *E. bidens*; 4 and 13, *E. longus*; 5, 8 and 12, *E. angulatus*; 6 and 11, *E. inferus*; 7 and 10, *E. chichibensis*.

of the distribution and ecology of E. bidens.

The gonopodal tibiotarsus shows some variation: a small process (Fig. 3, x) is present on the medial side in the topotypical specimens, while in the Koyama specimens, the spine is "as" bent in a L-shape and the process "ep" is rather distant from "lp".

Epanerchodus chichibensis HAGA

[Japanese name: Chichibu Obiyasude]

(Figs. 7, 10)

Epanerchodus chichibensis HAGA, 1956, in TAKASHIMA & HAGA, Misc. Rept. Yamashina's Inst. Orn.

Zool., Tokyo, 1, p. 333, pl. 1, fig. 11 a-b; type locality: Hashidaté-dô Cave, Kami-kagemori, Chichibu-shi, Saitama Pref. — Miyosi, 1959, Über japanische Diplopoden, Osaka, pp. 94, 97, pl. 6, figs. 104–104'.

Specimens examined. Type series deposited in NSMT: 1 \circ , Hashidaté-dô Cave, Kami-kagemori, Chichibu-shi, Saitama Pref., 1–X–1951, coll. by S. NOMURA; 1 \circ , same cave, 3–XI–1951, by K. SHINOHARA; 4 \circ \circ , 1 \circ , same cave, 1–X–1951, by S. NOMURA & A. YOSHIDA; 1 \circ , Mizukuguri-dô Cave, Chichibu-gun, Saitama Pref., 30– IX–1950, by NOMURA. Additional specimens: 1 \circ , 2 \circ \circ , 2 larvae, Oinu-ana Cave, Nakagoshizawa, Ueno-mura, Tano-gun, Gunma Pref., 22–VIII–1968, by S. SATO; 2 \circ \circ , 3 larvae, same cave, 28–IX–1968, by H. Akama; 1 \circ , 2 larvae, same cave, 5–V– 1979, by H. KIZAKI; 1 \circ , Hotoké-ana Cave, Otchizawa, Otchi, Ueno-mura, Tanogun Gunma Pref., 4–V–1979, by H. KIZAKI; 1 \circ , 1 \circ , Hotoké-ana Cave, Sanzugawa, Nakazato-mura, Tano-gun, Gunma Pref., 27–IX–1968, by H. Akama.

Diagnosis. The gonopod is closely similar to that of *E. bidens* in having sharply angulate processes "ep" and "lp", but differs from the latter in the shape of the accessory branch "ab" and of the distal portion of tibiotarsus.

Description. Colour pale reddish brown. Length 18-23 mm, greatest width 4.0 mm. Lateral keels rather thin, nearly horizontal with very weak sculpture, and as wide as long (W: L=18: 18 in segment 10 of a male paratype). Gonopod moderately large, of the form as illustrated in Fig. 7. Tibiotarsus not so slender, its distal portion briefly attenuated. Accessory branch "ab" moderately long, laterally situated at a level a little distant from the base of the tibiotarsal shaft, and projecting outwards and slightly bent backwards. Postfemoral process absent.

Range. So far known from five limestone caves (Fig. 1, nos. 43–47) in the Chichibu area and its vicinities at the central part of the Kwantô Mountains. Two epigean habitats were also recorded in the eastern part of the Chichibu area (Fig. 1, nos. 48–49; SHINOHARA 1978, p. 467, and pers. comm.).

Notes. In the original drawing of the gonopod of *E. chichibensis* (TAKASHIMA & HAGA, 1956, pl. 1, 11 b), a row of fine bristles are shown on the tibiotarsus along the aboral side of the distal portion. In the present study, however, such bristles cannot be observed not only in the type specimens but also in additional ones. Only one male specimen from Hotoké-ana Cave (Fig. 1, no. 45) possesses four weak bristles at the side of the spine "as". It is not certain if this is a normal variation or not.

Epanerchodus inferus VERHOEFF

[Japanese name: Horazumi Obiyasude]

(Figs. 6, 11)

Epanerchodus (Stygoerchodus) inferus VERHOEFF, 1940, Zool. Anz., 131, p. 136; 1941, Z. Karst-u.

Epanerchodus (Krenoerchodus) inferus VERHOEFF, 1940, Zool. Anz., 131, p. 130 [VERHOEFF removed the species to the subgenus *Stygoerchodus* on a later page (p. 136) of the same paper, and described the same species again in 1941 ("Mitt. Höhlen- u. Karstforsch., 1941, p. 42, figs. 12–14")]; type locality: Kurasawa-dô Cave, Okutama-machi, Nishitama-gun, west of Tokyo.

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Höhlenk., 1941, pp. 112, 115.

Epanerchodus inferus: Таказніма & Нада, 1956, Misc. Rept. Yamashina's Inst. Orn. Zool., Tokyo, 1, p. 334, pl. 1, fig. 16. — Міуозі, 1959, Über japanische Diplopoden, Osaka, p. 100, pl. 7, fig. 104.

Specimens examined. $2 \ Q \ Q$, 2 larvae, Kurasawa-dô Cave, Okutama-machi, Nishitama-gun, west of Tokyo, 16–X–1954, coll. by S. UÉNO; 2 larvae, same cave, 1–IV– 1977, by H. KIZAKI; 1 $\[d]$, 1 $\[Q]$, 4 larvae, same cave, 4–II–1979, by H. KIZAKI; 1 $\[d]$, 1 $\[Q]$, same cave, 10–VI–1979, by H. KIZAKI; 1 $\[d]$, same cave, 3–XI–1979, by H. KIZAKI; 4 larvae, same cave, 26–X–1986, by M. YOSHII; 1 $\[d]$, 1 $\[Q]$, 3 larvae, Nippara-dô Cave, Okutama-machi, Nishitama-gun, west of Tokyo, 28–III–1969, by Y. ISHIKAWA; 4 $\[d]$ $\[d]$, Mitsumata-dô Cave, Okutama-machi, Nishitama-gun, west of Tokyo, 15–X–1978, by H. KIZAKI; 1 $\[d]$, 1 $\[Q]$, Ohtaké-dô Cave, Yôzawa, Itsukaichi-machi, Nishitama-gun, west of Tokyo, 25–X–1986, by H. KIZAKI; 4 larvae, same cave, 25–X–1986, by Y. NISHIKAWA.

Diagnosis. Easily distinguished from the other members of the same speciesgroup by the modified tibiotarsus of gonopod, which bends to form an L-shaped accessory branch "ab", lacks lateral "lp" and external "ep" processes, and bears some irregular spines disto-aborally.

Description. Colour calcareous white. Length 23-29 mm, greatest width 5.4 mm. Lateral keels well developed, very thin and fragile, slightly reflexed, and wider than long (W: L=25 : 19 in segment 10 of a topotypical male). Pores open on the dorsal surface and distant from the lateral margin. Gonopod moderately large and specialized, of the form as illustrated in Fig. 6. Femoral clivus inconspicuous and ruggedly chitinous. Small postfemoral process present. Tibiotarsus without two regular processes of external "ep" and lateral "lp"; distal half moderately broad, bearing irregular spines on the aboral side. Accessory branch "ab" noticeably long and forming an L-shape, projecting outwards.

Range. Known from four limestone caves (Fig. 1, nos. 37, 39–41) in the Okutama area at the southeastern part of the Kwantô Mountains. Also recorded from a limestone cave called Aoiwa-dô (Fig. 1, no. 42; YOSHIDA & NOMURA, 1952, p. 1) lying in the western part of the same area.

Notes. Ohtaké-dô specimens were previously recorded under the name "*Epanerchodus* sp. [n. sp. B]" in an account of the cave fauna of the Itsukaichi area (UÉNO, NISHIKAWA & KIZAKI, 1988, p. 13). This may be due to my misidentification, and is corrected herewith. Only one available male from this cave shows an unusual gonopodal shape: tibiotarsal shaft is conspicuously slim, only bearing processes "as" and "ip"; accessory branch "ab" is slender and obtusely bent. This can be regarded as a local variation.

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Epanerchodus angulatus MURAKAMI

[Japanese name: Izu Obiyasude]

(Figs. 5, 8, 12)

Epanerchodus angulatus MURAKAMI, 1970, Annot. zool. japon., 43, 106, figs. 1–2; type locality: Ananohara-dô Cave, Ike, Itô-shi, Shizuoka Pref.

Additional specimens examined. $3 \stackrel{\circ}{\supset} \stackrel{\circ}{\rightarrow}, 3 \stackrel{\circ}{\subsetneq} \stackrel{\circ}{\heartsuit}$, Ananohara-dô Cave, 27–X–1968, by M. Ohrui; $3 \stackrel{\circ}{\supset} \stackrel{\circ}{\rightarrow}, 3 \stackrel{\circ}{\subsetneq} \stackrel{\circ}{\heartsuit}$, Iwamuro (an artificial tunnel), Itô-shi, Shizuoka Pref., 16–I–1970, by M. Ohrui; $3 \stackrel{\circ}{\supset} \stackrel{\circ}{\rightarrow}, 3 \stackrel{\circ}{\subsetneq} \stackrel{\circ}{\heartsuit}, 4$ larvae, same locality, 20–I–1970, by M. Ohrui; $3 \stackrel{\circ}{\supset} \stackrel{\circ}{\Huge}, 2 \stackrel{\circ}{\heartsuit}$, same locality, 26–I–1970, by M. Ohrui; $1 \stackrel{\circ}{\Huge}, 1 \stackrel{\circ}{\heartsuit}$, same locality, 12–III–1972, by M. Ohrui; 1 larva, same locality, 16–IX–1977, by M. Ohrui; $1 \stackrel{\circ}{\Huge}$, same locality, 29–VI–1978, by M. Ohrui.

Diagnosis. Different from all the other members of the species-group in having a remarkable protuberance at the disto-ventral corner of the gonopodal femur.

Description. Colour pale reddish brown. Length 21-24 mm, greatest width 3.5 mm. Lateral keels rather thin, nearly horizontal, and wider than long (W: L= 38:28 in segment 10 of the holotype). Gonopod as illustrated in Fig. 5. Distoventral corner of femur markedly protuberant, and distally chitinous. Accessory branch "ab" slender and shorter than tibiotarsal shaft, projecting slantly outwards. Two regular processes "ep" and "lp" on tibiotarsus rather acute though small.

Range. Endemic to the type locality (Fig. 1, no. 30) and Iwamuro (no. 29), which lie at the northwestern and northeastern parts of Mt. Ohmuro-yama in the Izu Peninsula.

Notes. Shinohara (1973) regarded the present species as a geographical race of E. bidens. He (p. 229) considered that the gonopodal differences between the two are not sufficiently large for specific separation. In my own view, however, these differences are large enough to be useful for specific diagnosis. Besides, the two species, E. angulatus and E. bidens, are allopatric in distribution, their ranges being widely distant from each other.

Habitat environment and some biological observation of *E. angulatus* were described in some detail by OHRUI (1986).

Epanerchodus longus HAGA

[Japanese name: Naga Obiyasude]

(Figs. 4, 13)

Epanerchodus longus HAGA, 1956, in TAKASHIMA & HAGA, Misc. Rept. Yamashina's Inst. Orn. Zool., Tokyo, 1, p. 335, pl. 1, figs. 20 a-b; type locality: Yôzawa-dô Cave, Kami-yôzawa, Itsukaichimachi, Nishitama-gun, west of Tokyo. — MIYOSI, 1959, Über japanische Diplopoden, Osaka, pp. 95, 100, pl. 7, figs. 115–115".

Epanerchodus lobatus Такакиwa, 1954, Diplopoden aus Japan, Tokyo, pp. 93, 108, figs. 125–126 (nec E. lobatus VERHOEFF, 1941). — Таказніма & Нада, 1956, Misc. Rept. Yamashina's Inst. Orn. Zool., Tokyo, 1, p. 335, pl. 1, figs. 19 a–b.

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Epanerchodus neolobatus Miyosi, 1959, Über japanische Diplopoden, Osaka, p. 99, pl. 8, fig. 108" [nom. nud.].

Epanerchodus fujisanus SHINOHARA, 1973, Bull. natn. Sci. Mus., Tokyo, 16, p. 231, figs. 24-30.

Specimens examined. Type series from Yôzawa-dô Cave deposited in NSMT: 1 ♂, 22-VI-1952, by A. YOSHIDA; 1 ♀, 22-VI-1952, by A. YOSHIDA; 1 ♂, 31-VIII-1951, by S. NOMURA; 2 99, 22-VI-1952, by A. YOSHIDA. Additional specimens: 3 ♂ ♂, 1 ♀, 13 larvae, Yôzawa-dô Cave, 25-XII-1966, by S. UÉNO; 4 larvae, same cave, 20-II-1979, by H. KIZAKI; 3 33, 1 larva, same cave, 21-VII-1985, by Y. MU-RAKAMI; 1 3, 5 9, same cave, 26–X–1986, by S. Uéno; 1 3, 1 9, same data, by Y. NISHIKAWA & M. YABUUCHI; 1 ♂, 1 ♀, 2 larvae, same data, by S. SONE; 1 ♀, 2 larvae, Ohtaké-dô Cave, Yôzawa, Itsukaichi-machi, Nishitama-gun, west of Tokyo, 16-II-1979, by H. Kızakı; 1 º, 1 larva, same cave, 20-II-1979, by H. Kızakı; 1 º, Mitsugôdô Cave, same area, 24-X-1986, by H. KIZAKI; 1 ♀, Nutabata-dô Cave, same area, 15-X-1972, R. TARU; 3 ♂♂, 2 9 9, same cave, 21-XII-1986, by H. KIZAKI; 6 ♂♂, 1 º, 13 larvae, tuff mine called Shiraishijizô-no-ana, Yumoto, Hakoné-machi, Kanagawa Pref., 13-V-1978, by S. UÉNO; 1 ♀, same data, by M. OHRUI; 1 ♂, 2 ♀♀, 1 larva, same locality, 15-VII-1978, by M. OHRUI; 5 ♂♂, 12 ♀♀, 3 larvae, same locality, 14-X-1978, by M. OHRUI; 4 ♂♂, 1 ♀, same locality, 30-XI-1978, by M. OHRUI; 1 ♀, same locality, 13-VIII-1979, by M. OHRUI; 1 ♂, 1 ♀, Jinza-fûketsu Cave, Karumizu, Narusawa-mura, Yamanashi Pref., 6-IX-1969, by S. Uéno; 1 ∂, 4 ♀♀, 8 larvae, Getsu-dô Cave of the Shôji-o-ana caves, Aokigahara, Shôji, Kamikuisshiki-mura, Yamanashi Pref., 2-XI-1969, by S. UÉNO & K. KATO; 13 ♂♂, 6 ♀♀, 1 larva, Komakado-kaza-ana Cave, Komakado, Fujioka, Gotenba-shi, Shizuoka Pref., 10-IX-1955, by S. UÉNO; 3 ♂♂, 3 ♀♀, Iwamuro, Itô-shi, Sizuoka Pref., 25-VI-1970, by M. OHRUI.

Diagnosis. Close to *E. angulatus* in the shape of gonopodal tibiotarsus, but the accessory branch "ab" is much longer and slowly slanting outwards and lacks acicular spine "as".

Description. Colour pale reddish brown. Length 25-30 mm, greatest width 5.2 mm. Lateral keels well developed, rather thin, slightly reflexed, and wider than long (W: L=24: 20 in segment 10 of a topotypical male). Gonopod as illustrated in Fig. 4. Femoral cavity shallow and rugose; postfemoral process "pp" small and chitinous. Accessory branch "ab" long and slender, projecting and slanting outwards, and distally incurved. Two regular processes "ep" and "lp" of tibiotarsus small and blunt, acicular spine "as" absent.

Range. Known from four limestone caves in the Itsukaichi area at the southeastern part of the Kwantô Mountains, thirteen lava caves at the northern and southeasten sides of Mt. Fuji-san, an abandoned mine adit at the eastern foot of the Hakoné Volcanoes, and an artificial lava tunnel on the northeastern slope of Mt. Ohmuro-yama in the Izu Peninsula.

Notes. TAKASHIMA and HAGA (1946) illustrated the gonopod of this species as to lack the accessory branch "ab" on the tibiotarsus. This is an error caused by the defective condition of the type specimens, which do not contain any perfect males. A

Group of Epanerchodus bidens

newly prepared figure is given herewith on the basis of perfect topotypical specimens (Fig. 4).

Before the description by TAKASHIMA and HAGA, this species was described by TAKAKUWA (1954) under the name of "*E. lobatus*" from the lava cave called "Komakado-kaza-ana" (Fig. 1, no. 28). According to UÉNO's account (1971, pp. 212–213), specimens from this cave were misidentified by TAKAKUWA with VERHOEFF's species. TAKASHIMA and HAGA (1956, p. 355) followed TAKAKUWA, while MIYOSI (1959, p. 99) and SHINOHARA (1973, p. 231) gave new names for the Komakado-kaza-ana population, "*E. neolobatus*" (*nom. nud.*) and "*E. fujisanus*", respectively. The latter authors might not be aware of HAGA's error, and the gonopodal illustrations of Komakadokaza-ana specimens given by these authors essentially agree with that of "*E. longus*" given by myself (Fig. 4). Thus, "*E. fujisanus*" falls in a junior synonym of "*E. longus*".

Epanerchodus yozawanus sp. nov.

[Japanese name: Yôzawa Obiyasude]

(Figs. 14-21)

Diagnosis. A medium-sized species very similar to the following new species in external features, but distinguished from the latter by details of male gonopods, and partly by the shape of female epigyne.

Description. Length 18–20 mm, greatest width 2.7 mm. Colour pale reddish brown. Body medium-sized, with relatively brittle skeleton. The shape of head and some selected segments in the holotype (20 mm in length) is as shown in Figs. 14–15; the widths of them as follows:

Head =1.75 mm Collum=2.00 mm Seg. 2=2.14 mm Seg. 3=2.21 mmSeg. 4=2.35 mm Seg. 5=2.57 mm Seg. 6=2.71 mm Seg. 10=2.71 mmSeg. 16=2.71 mm Seg. 17=2.42 mm.

Typical form of body segments as shown in Fig. 15. Dorsum slightly arched, with very weak sculpture of usual pattern. Lateral keels a little longer than wide (L: W = 14: 12 in segment 10 of the male holotype), relatively thin, and slightly reflexed.

Gonopods moderately large (about 1.1 mm in longitudinal length of telopodite), of the form as shown in Figs. 16–19. Femoral clivus low and roundish; cavity rather wide and shallow; postfemoral process "pp" small and nodulated. Tibiotarsus not pointed at the end, with regular pattern of processes on the median portion; external "ep" situated near lateral "lp"; acicular spine "as" rather short and situated mesially; apex as illustrated in Fig. 19; accessory branch "ab" long and slender, projecting abaxially. Epigyne of segment 3 in female rather simple as shown in Fig. 21.

Type series. $4 \stackrel{\frown}{\supset} \stackrel{\frown}{\supset}$ (including the holotype), $2 \stackrel{\bigcirc}{\subsetneq} \stackrel{\bigcirc}{\subsetneq}$ (including the allotype), Yôzawa-dô Cave, Kami-yôzawa, Itsukaichi-machi, Nishitama-gun, west of Tokyo, 25– XII–1966, by S. UÉNO; $1 \stackrel{\frown}{\supset}$, $1 \stackrel{\bigcirc}{\subsetneq}$, same cave, 20–II–1979, by H. KIZAKI; $1 \stackrel{\frown}{\supset}$, 1 larva, same cave, 26–X–1986, by Y. NISHIKAWA.



Figs. 14-21. Epanerchodus yozawanus sp. nov., holotype and female paratype (20-21). — 14, Head and five succeeding segments; 15, segment 10th; 16-17, left gonopod, mesial and lateral aspects; 18, tibiotarsal portion, mesio-aboral aspect; 19, terminal portion of tibiotarsal shaft; 20, distal part of left cyphopod, disto-lateral aspect; 21, epigyne, aboral aspect.

Other records. $1 \Leftrightarrow$, Ohtaké-dô Cave, Yôzawa, Itsukaichi-machi, Nishitamagun, west of Tokyo, 16–II–1979, by H. KIZAKI; $1 \circlearrowleft$, 4 larvae, same cave, 25–X–1986, by Y. NISHIKAWA.

Etymology. The species epithet refers to the type locality.

Notes. This species accords to some extent with the description of E. simplex (TAKAKUWA, 1954, pp. 112, 234, figs. 130, 131), but the gonopodal characteristics do not agree with TAKAKUWA's illustration, which was rather schematically drawn. It is to be hoped that the problem will be cleared up by future collectings of perfect topotypical males from Mt. Mitake-san, since the type material of E. simplex was destroyed during the World War II.

This new species was previously recorded as "*Epanerchodus* sp. [n. sp. A]" from two limestone caves, Yôzawa-dô and Ohtaké-dô, in an account of the cave fauna of the Itsukaichi area (UÉNO, NISHIKAWA & KIZAKI, 1988, pp. 12–13).

Group of Epanerchodus bidens

Epanerchodus ohruii sp. nov. [Japanese name: Ohrui Obiyasude] (Figs. 22–29)

Diagnosis. Medium-sized species similar in appearance to *E. yozawanus*, but distinguished from the latter by a little broader tibiotarsal shaft with differently shaped apex, and by the differently shaped epigyne.

Description. Length 19–21 mm, greatest width 3.1 mm. Colour pale reddish or grayish brown in alcohol. Form of body essentially similar to that of the former new species. Width values of some selected segments of the holotype (21 mm in length) as follows.

Head =2.0 mm Collum=2.1 mm Seg. 2=2.4 mm Seg. 3=2.4 mm Seg. 4=2.6 mm Seg. 5=2.8 mm Seg. 9=3.1 mm Seg. 16=2.7 mm.



Figs. 22-29. Epanerchodus ohruii sp. nov., holotype and female paratype (27-28). 22, Gonopods, in situ, cephalic aspect; 23-24, left gonopod, mesial and lateral aspects; 25, tibiotarsal portion, mesio-caudal aspect; 26, terminal portion of tibiotarsal shaft; 27, distal part of left cyphopod, disto-lateral aspect; 28, epigyne, aboral aspect; 29, the same of a specimen from the Amagi-tôge.

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Lateral keels a little longer than wide (L: W = 14: 13 in segment 10 of the holotype), and relatively thin.

Gonopods very similar to those in the former new species, *in situ*, lying parallel to median body axis and adjoining each other at tibiotarsal shaft (Fig. 22). Femoral clivus very low, and cavity rather wide and shallow; postfemoral process very small (Fig. 23). Tibiotarsal shaft moderately depressed and broad in distal half, with incised apex (Fig. 26); accessory branch "ab" long and slender, projecting latero-abaxial-ly. Epigyne observed in female paratypes as illustrated in Fig. 28, lamellar, nearly trapezoidal, with its distal margin slightly emarginate at the middle.

Type series. 1 $\overset{\circ}{\circ}$, 4 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, Karasawabora-no-ana Mine, Okuno, Itô-shi, Izu Peninsula, Shizuoka Pref., 26–XI–1970, by S. UÉNO & K. KATO; 2 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 3 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 6 larvae, same locality, 16–XI–1972, by H. SAITO; 2 $\overset{\circ}{\circ} \overset{\circ}{\circ}$ (including holotype), 6 $\overset{\circ}{\circ} \overset{\circ}{\circ}$ (including allotype), same locality, 5–X–1972, by M. OHRUI; 2 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 2 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 2 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, same locality, 16– XI–1991, by M. OHRUI; 3 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 3 $\overset{\circ}{\circ} \overset{\circ}{\circ}$, 2 larvae, same locality, 30–XI–1991, by Y. NISHIKAWA.

Other records. $4 \stackrel{\circ}{\supset} \stackrel{\circ}{\odot}$, $1 \stackrel{\circ}{\subsetneq}$, Nakazé-no-ana Mine, Iké, Itô-shi, Shizuoka Pref., 1-XI-1974, by M. OHRUI; $1 \stackrel{\circ}{\supset}$, Iwamuro, Itô-shi, Shizuoka Pref., 29-X-1971, by M. OHRUI; $4 \stackrel{\circ}{\subsetneq} \stackrel{\circ}{\heartsuit}$, 2 larvae, same locality, 30-XI-1991, by Y. NISHIKAWA; $1 \stackrel{\circ}{\supset}$, Amagi-tôge, SW of Mt. Amagi-san, Shizuoka Pref., 28-IX-1984, by M. OHRUI; $3 \stackrel{\circ}{\supset} \stackrel{\circ}{\circlearrowleft}$, $3 \stackrel{\circ}{\backsim} \stackrel{\circ}{\curvearrowleft}$, same locality, 12-X-1986, by M. OHRUI; $2 \stackrel{\circ}{\supset} \stackrel{\circ}{\Huge}$, $1 \stackrel{\circ}{\curvearrowleft}$, Shiraishijizô-no-ana Mine, Yumo-to, Hakoné-machi, Kanagawa Pref., 12-I-1979, by M. OHRUI; $2 \stackrel{\circ}{\boxdot} \stackrel{\circ}{\Huge}$, same locality, 30-XI-1978, by M. OHRUI.

Etymology. The species name is given in honour of one of the collectors of the type series.

Notes. This new species is doubtless a close relative of *E. yozawanus* sp. nov. from the southeastern part of the Kwantô Mountains in the gonopodal features, especially in having the tibiotarsal apex not pointed. These two species seem to fall in the same phylogenetic line within the group.

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Four New Species of the Genus *Kenyentulus* (Protura) from Yunnan, Southwest China¹⁾

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Abstract Four new species of the genus *Kenyentulus* are described from Yunnan, Southwest China. They are *K. xiaojinshanensis*, *K. menglunensis*, *K. ailaoshanensis* and *K. daliensis*.

Key words: Protura; new species; Kenyentulus; Yunnan.

Many proturan specimens have been collected from various places in Yunnan through the soil faunistic surveys by our Sino-Japanese joint party for 1992 and 1993, in which Dr. Shun-Ichi UÉNO participated. The present article, descriptions of four new species of the genus *Kenyentulus* TUXEN, is a fourth part of the series dealing with the results of our investigations on the proturan fauna of Yunnan. We wish to contribute this work to the entomological papers presented to Dr. Shun-Ichi UÉNO on the occasion of his retirement for commemorating his tireless and valuable partaking through our surveys.

The type specimens to be designated in the present paper is deposited in the collection of the Shanghai Institute of Entomology, Academia Sinica, China.

We are deeply indebted to Mr. CHENG Yi-Cun, Professors LI Chao-da, XIAO Ning-nian, Dr. Shun-Ichi UÉNO and all who favoured us with every kind of help through our cooperative works.

Kenyentulus xiaojinshanensis sp. nov.

(Fig. 1)

Specimen examined. 1 Q, Mt. Xiaojin Shan, 2,140 m alt. (above sea level), Diancang Shan Mts., Dali, Yunnan, 3–IX–1993, collected by YIN Wen-ying and others.

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Fig. 1. Kenyentulus xiaojinshanensis sp. nov. — A, Filamento di sostegno; B, pseudoculus;
C, striate band on abdomen VIII; D, comb on abdomen VIII; E, female squama genitalis;
F, foretarsus, exterior view; G, the same, interior view.

Body length 860 µm.

Head oval, 102 μ m in dorsal view. Additional seta absent. Maxillary palpus with two slender sensillae on penultimate segment, dorsal sensilla a little shorter and thinner than the ventral one. Labial palpus rudimentary, with three setae and one slender sensilla. Pseudoculus circular, with two small lids posteriorly (Fig. 1 B), PR=13. Filamento di sostegno long, the proximal part with two additional dilatations (Fig. 1 A).

Foretarsus (Fig. 1 F–G) 74 μ m, claw slender, TR=3.1; empodium short; Sshaped seta a little longer than the claw. Dorsal sensilla *t I* baculiform, BS=0.51; *t 2* thin and relatively long; *t 3* normal. Exterior sensilla *a* slender and long, its apex reaching the base of *f*; *b* short, its apex not reaching the base of γ 3; *c* relatively long, its apex reaching the base of γ 4; *d* a little shorter than *c*; *e* and *f* very close to each other; the apex of *f* hardly surpassing the base of γ 5. Interior sensilla *a'* short, at about the same level as *t 1*; *b'* somewhat proximal to α 4; *c'* slightly surpassing the tarsus. Ventral seta β 1 8 μ m and interior seta δ 4 12 μ m in length.

Chaetotaxy as shown in Table 1. Abdominal tergites I–VI each with three pairs of anterior setae, A 1, 2 and 5, P 3a absent; terg. VII with seven anterior setae, one of A 1 and three pairs, A 2, 4 and 5, P 3a absent; terg. VIII with the central seta M c and without M 1; terg. IX with seven pairs of tergal setae, 1, 2, 3, 3a, 4, 4a, and 5; terg. X with six pairs, 1, 2, 3, 3a, 4 and 5; terg. XI with three pairs, 1, 2 and 3; sternite VIII without posterior seta. On thoraces II–III, dorsal P 1a and 2a very short, about 3 μ m, less than one-eighth of P 1 in length. On terg. II–VI, P 3 situated somewhat

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		Dorsal		Ventral
	Formula	Composition of setae	Formula	Composition of setae
Thorax I	4		$\frac{4-2}{6}$	A 1, 2, M P 1, 2, 3
II–III	$\frac{6}{16}$	A 2, 4, M P 1, 1a, 2, 2a, 3, 4, 5, 5a	$\frac{7-2}{4}$	A c, 2, 3, 4, M P 1, 2
Abdomen I	$\frac{6}{12}$	A 1, 2, 5 P 1, 1a, 2, 2a, 3, 4	$\frac{3}{4}$	A c, 2 P 1, 2
II–III	$\frac{6}{16}$	A 1, 2, 5 P 1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{5}$	A c, 2 P c, 2, 3
IV-VI	<u>6</u> 16	A 1, 2, 5 P 1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{8}$	A c, 2 P 1, 1a, 2, 3
VII	$\frac{7}{16}$	A (1), 2, 4, 5 P 1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{8}$	A c, 2 P 1, 1a, 2, 3
VIII	6-7	A 1, 3, 5, M c, 2, 3, 4 P 2, 3, 4, 5	$\frac{4}{0}$	1, 2
IX	14	1, 2, 3, 3a, 4, 4a, 5	4	
x	12	1, 2, 3, 3a, 4, 5	4	
XI	6	1, 2, 3	6	1, 2, 3
XII	9		6	

Table 1. Chaetotaxy of Kenyentulus xiaojinshanensis sp. nov.*

* Notation of body setae is referred to that in IMADATÉ (1988).

anterior to the other posterior setae, P Ia and 2a short, 5–6 μ m, less than one-fourth of P I in length.

Abdominal appendages II–III each with two setae, the medial apical seta short, less than a half the subapical in length. On abdomen VIII, striate band reduced, with minute striae along the proximal margin (Fig. 1 C); comb consisting of about ten irregular teeth (Fig. 1 D). Female squama genitalis with pointed acrostylus (Fig. 1 E).

Holotype. $1 \Leftrightarrow$, Mt. Xiaojin Shan, 2,140 m alt., Diancang Shan Mts., Dali, Yunnan, 3–IX–1993, collected by YIN Wen-ying and others.

Notes. The present new species is similar in many respects to Kenyentulus kangdingensis from Sichuan Province in China (TANG & YIN, 1987). It is, however, distinguishable from the latter by the relative lengths of foretarsal sensillae, a, c, d, e, fand a'.

It is possibly due to an individual abnormality that one of A 1 is asymmetrically present on the abdominal tergite VII in the type specimen, one and only specimen examined.

The specific name is derived from the name of the type locality, Mt. Xiaojin Shan.

Kenyentulus menglunensis sp. nov.

(Fig. 2)

Specimens examined. 1 ♂ and 1 ♀, Menglun, 600 m alt., Xishuangbanna,

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Fig. 2. Kenyentulus menglunensis sp. nov. — A, Filamento di sostegno; B, pseudoculus; C, labium; D, striate band on abdomen VIII; F, female squama genitalis; G, foretarsus, exterior view; H, the same, interior view.

Yunnan, 10-IX-1993, collected by XIE Rong-dong and others.

Body length 760-820 µm.

Head oval, 94–97 μ m in dorsal view. Additional setae present. Maxillary palpus with two slender sensillae on penultimate segment, dorsal sensilla subequal to the ventral in shape and length. Labial palpus with three setae and one slender sensilla (Fig. 2 C). Pseudoculus circular, with two small lids posteriorly (Fig. 2 B), PR=12. Filamento di sostegno long, the proximal part with two additional dilatations (Fig. 2 A).

Foretarsus (Fig. 2 G–H) 66 μ m, claw slender, TR=3.1; empodium very short; S-shaped setae a little longer than the claw. Dorsal sensilla *t* 1 baculiform, BS= 0.50–0.52; *t* 2 thin, of medium size; *t* 3 small. Exterior sensilla *a* somewhat broad, its apex reaching the base of γ 3; *b* short, its apex hardly surpassing the base of γ 2; *c* and *d* subequal in shape and in length, their apices reaching the level of the base of f; *e* and *f* hardly surpassing tarsus; *g* of medium size, its apex surpassing the base of γ 5. Interior sensilla *a'* of medium size, its apex not reaching the base of *b'*; *b'* at about the same level as *t* 2; *c'* surpassing tarsus. Ventral seta β 1 and interior seta δ 4 short, about 4 μ m in length.

Chaetotaxy as shown in Table 2. Abdominal tergites I–VI each with three pairs of anterior setae, A 1, 2 and 5, P 3a absent; terg. VII with A 2, 4 and 5, P 3a absent; terg. VIII with M c, without M 1; terg. IX with seven pairs of tergal setae, 1, 2, 3, 3a, 4, 4a and 5; terg. X with tergal 1, 2, 3, 3a, 4 and 5; terg. XI with two pairs of tergal setae, 2 and 3, and without 1; sternite VIII without posterior seta. On thoraces II–III, dorsal P 1a and 2a very short, about 2 μ m, less than one-sixth of P 1 in length. On terg. II–VI, P 3 situated somewhat anterior to the other posterior setae, P 1a and 2a short, about 5 μ m, less than a half of P 1 in length.

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			Dorsal		Ventral
		Formula	Composition of setae	Formula	Composition of setae
Thorax	I	4		4-2	A 1, 2, M P 1 2 3
	П	$\frac{6}{16}$	A 2, 4, M P 1 1a 2 2a 3 4 5 5a	$\frac{5-2}{4}$	A c, 2, 3, M P 1 2
1	п	6	A 2, 4, M P 1, 10, 2, 20, 3, 4, 5, 50	7-2	A c, 2, 3, 4, M
Abdomen	I	6	A 1, 2, 5 B 1, 1a, 2, 2a, 3, 4, 5, 5a	$\frac{4}{3}$	A c, 2
II–I	п	6	A 1, 2, 5 B 1, 1a, 2, 2a, 3, 4 A 5	4 3 5	A c, 2
IV-V	٧I	<u>6</u>	P 1, 1a, 2, 2a, 3, 4, 4a, 5 A 1, 2, 5 P 1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{8}$	P C, 2, 3 A c, 2 P 1 15 2 2
v	п	6	P 1, 1a, 2, 2a, 3, 4, 4a, 5 A 2, 4, 5	8	P 1, 1a, 2, 3 A c, 2
VI	п	$\frac{16}{6-7}$	P 1, 1a, 2, 2a, 3, 4, 4a, 5 A 1, 3, 5, M c, 2, 3, 4	8	P 1, 1a, 2, 3 1, 2
I	x	8 14	P 2, 3, 4, 5 1, 2, 3, 3a, 4, 4a, 5	0 4	
,	X (I	12	1, 2, 3, 3a, 4, 5 2, 3	4	1. 2. 3
x	П	9	2, 0	6	., ., .

Table 2. Chaetotaxy of Kenyentulus menglunensis sp. nov.

Abdominal appendages II–III each with two setae, the medial apical seta short, less than a half the subapical in length. On abdomen VIII, striate band reduced, without striae (Fig. 2 D); comb consisting of about seven irregular teeth (Fig. 2 E). Female squama genitalis with pointed acrostylus (Fig. 2 F).

Holotype. $1 \Leftrightarrow$, Menglun, 600 m alt., Xishuangbanna, Yunnan, 10–IX–1993, collected by XIE Rong-dong and others.

Notes. This species is closely similar in many respects to *Kenyentulus jinghongensis* from Yunnan (YIN, 1983) and Hainan Provinces (YIN, 1987), China, but is discriminated by the relative lengths of foretarsal sensillae, e, f, g and a', by the shape of a and by the absence of tergal setae 1 on abdominal tergite XI.

The specific name is derived from Menglun, the type locality.

Kenyentulus ailaoshanensis sp. nov.

(Fig. 3)

Specimens examined. $2 \Leftrightarrow$, Mt. Ailao Shan, 2,662.6 m alt., Jingdong, Yunnan, 28–III–1993, collected by XIAO Ning-nian and others; $2 \Leftrightarrow$, ditto, 2,450 m alt., 28–III–1993, collected by XIE Rong-dong and others.

Body length 630-700 µm.

Head oval, 65-66 µm in dorsal view. Additional seta absent. Maxillary palpus

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Fig. 3. Kenyentulus ailaoshanensis sp. nov. — A, Filamento di sostegno; B, pseudoculus; C, abdominal appendage III; D, female squama genitalis; E, foretarsus, exterior view; F, the same, interior view; G, striate band on abdomen VIII; H, comb on abdomen VIII.

with two sensillae on penultimate segment, dorsal sensilla subequal to the ventral one in length and shape. Labial palpus rudimentary, with three setae and one slender sensilla. Pseudoculus circular, with two small lids posteriorly (Fig. 3 A), PR=10. Filamento di sostegno long, the proximal part with an additional dilatation (Fig. 3 A).

Foretarsus (Fig. 3 E–F) 43–44 μ m, claw slender, TR=3.3; empodium very short; S-shaped seta subequal to the claw in length. Dorsal sensilla *t 1* baculiform, BS= 0.55; *t 2* thin; *t 3* small. Exterior sensilla *a* thin, its apex reaching the base of γ 3; *b* short, its apex hardly surpassing the base of γ 2; *c* relatively long, its apex surpassing the base of *f*; *d* a little shorter than *c*, its apex reaching the base of *e*; *e* and *f* relatively short, their apices not surpassing the base of γ 5; *g* of medium size, its apex surpassing the base of γ 5. Interior sensilla *a'* somewhat broad, proximal to *t 1*; *b'* slightly thick, at about the same level as *t 2*; *c'* slightly surpassing tarsus. Ventral seta β 1 and interior seta δ 4 short, about 5 μ m in length.

Chaetotaxy as shown in Table 3. Abdominal tergites I–VI each with three pairs of anterior setae, A 1, 2 and 5, P 3a absent; terg. VII with A 2, 4 and 5, P 3a absent; terg. VIII with M c and without M 1; terg. IX–X with six pairs of tergal setae, 1, 2, 3, 3a, 4 and 5; terg. XI with three pairs, 1, 2 and 3; sternite VIII without posterior seta. On thoraces II–III, P 1a and 2a short, about 3 μ m, less than one-third of P 1 in length. On terg. II–VI P 3 situated somewhat anterior to the other posterior setae, P 1a and 2a short, about 5 μ m, less than a half of P 1 in length.

Abdominal appendages II-III each with two setae, the medial apical seta short,

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		Dorsal		Ventral
	Formula	Composition of setae	Formula	Composition of setae
Thorax I	4		4-2	A 1, 2, M
			6	P 1, 2, 3
II-III	6	A 2, 4, M	7-2	A c, 2, 3, 4, M
n-m	16	P 1, 1a, 2, 2a, 3, 4, 5, 5a	4	P 1, 2
	6	A 1, 2, 5	3	A c, 2
Abdomen I	12	P 1, 1a, 2, 2a, 3, 4	4	P 1, 2
	6	A 1, 2, 5	3	A c, 2
11-111	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	5	P c, 2, 3
	6	A 1, 2, 5	3	A c, 2
1V-VI	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
	6	A 2, 4, 5	3	A c, 2
VII	16	P 1, 1a, 2, 2a, 3, 4, 4a, 5	8	P 1, 1a, 2, 3
	6-7	A 1, 3, 5, M c, 2, 3, 4	4	1, 2
VIII	8	P 2, 3, 4, 5	0	
IX-X	12	1, 2, 3, 3a, 4, 5	4	
XI	6	1, 2, 3	6	1, 2, 3
XII	9		6	

Table 3. Chaetotaxy of Kenyentulus ailaoshanensis sp. nov.

less than a half the subapical in length (Fig. 3 C). On abdomen VIII, striate band reduced, with weak striae (Fig. 3 G); comb consisting of about ten small teeth (Fig. 3 H). Female squama genitalis with sharply pointed acrostylus (Fig. 3 D).

Holotype. $1 \Leftrightarrow$, Mt. Ailao Shan, 2,662.6 m alt., Jingdong, Yunnan, 28–III–1993, collected by XIAO Ning-nian and others.

Notes. This new form is related to *Kenyentulus minys* from Yunnan (YIN, 1983) and Hainan (YIN, 1987), and to *K. datongensis* from Shanxi (IMADATÉ & YIN, 1983), China. They are closely similar to one another in the position of foretarsal sensillae and in body chaetotaxy, but the former is different from the latter two in the relative lengths of foretarsal sensillae, a, c, d, f and b' and in the ratios, TR and BS.

The specific name is derived from the name of the type locality, Mt. Ailao Shan.

Kenyentulus daliensis sp. nov.

(Figs. 4-5)

Specimens examined. $4 \, \bigcirc$, Jizhaoan, 2,310 m alt., Diancang Shan Mts., Dali, Yunnan, 26–III–1993, collected by XIAO Ning-nian and others; $1 \, \bigcirc$, Mt. Weibao Shan, 2,200 m alt., Weishan, Yunnan, 26–III–1993, collected by XIE Rong-dong.

Body length 670-740 µm.

Head oval, 66–71 μ m in dorsal view. Additional seta absent. Maxillary palpus with two slender sensillae, dorsal sensilla subequal to the ventral one in shape and length. Labial palpus rudimentary, with three setae and one slender sensilla. Pseudoculus circular, relatively large, with two small lids posteriorly (Fig. 4 A), PR=9.

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Fig. 4. Kenyentulus daliensis sp. nov. — A, Pseudoculus; B, filamento di sostegno; C, comb on abdomen VIII; D, female squama genitalis; E, foretarsus, exterior view; F, the same, interior view; G, striate band on abdomen VIII.

Filamento di sostegno long, the proximal part with two additional dilatations (Fig. 4 B).

Foretarsus (Fig. 4 E–F) 43–45 μ m, claw slender, TR=2.8; empodium very short; S-shaped seta subequal to the claw in length. Dorsal sensilla *t* 1 baculiform, BS= 0.59–0.62; *t* 2 thin; *t* 3 small. Exterior sensilla *a* broad and relatively long, its apex surpassing the level of β 4: *b* short, its apex hardly surpassing the base of γ 2; *d* somewhat broad, a little shorter than *c*; *e*, *f* and *g* slightly surpassing tarsus. Interior sensilla *a'* broad, relatively short and its apex not reaching the base of *b'*; *b'* and *c'* somewhat broad, subequal to each other in shape and length; *b'* at about the same level as *t* 2, its apex reaching the base of α 6; *c'* surpassing the tarsus. Ventral seta β 1 and interior seta δ 4 short, about 7 μ m in length.

Chaetotaxy as shown in Table 4. Abdominal tergites I–VI with three pairs of anterior setae, A 1, 2 and 5, P 3a absent; terg. VII with A 2, 4 and 5, P 3a absent; terg. VIII with three pairs of middle setae, and without M c and 1 (Fig. 5 A); terg. IX–X with six pairs of tergal setae, 1, 2, 3, 3a, 4 and 5; terg. XI with only two pairs of tergal setae, 2 and 3, and without 1 (Fig. 5 B–C); sternite VIII without posterior seta; stern. XI with only two pairs of sternal setae, 1 and 3, and without 2 (Fig. 5 C). On thoraces II–III, dorsal P 1a and 2a very short, about 2 μ m, less than one-fourth of P 1 in length. On terg. II–VI P 3 situated somewhat anterior to the other posterior setae, P 1a and 2a short, 3–4 μ m, less than one-third of P 1 in length.

Abdominal appendages II-III each with two setae, the medial apical seta short, less than a half the subapical in length. On abdomen VIII, striate band reduced, with scattered faint striae along the posterior margin (Figs. 4 G & 5 A), comb consisting of

				Dorsal		13	Ventral
		Formula		Composition of setae	Formula	С	omposition of setae
					4-2	А	1, 2, M
Thorax	1	4			6	Р	1, 2, 3
		6	Α	2, 4, M	5-2	Α	c, 2, 3, M
	п	16	Р	1, 1a, 2, 2a, 3, 4, 5, 5a	4	Р	1, 2
		6	A	2, 4, M	7-2	Α	c, 2, 3, 4, M
1	Ш	16	Р	1, 1a, 2, 2a, 3, 4, 5, 5a	4	Р	1, 2
	2	6	A	1, 2, 5	3	Α	c, 2
Abdomen	1	12	Р	1, 1a, 2, 2a, 3, 4	4	Р	1, 2
		6	A	1, 2, 5	3	Α	c, 2
11-1	Ш	16	Р	1, 1a, 2, 2a, 3, 4, 4a, 5	5	Р	c, 2, 3
		6	A	1, 2, 5	3	Α	c, 2
IV-V	VI	16	P	1, 1a, 2, 2a, 3, 4, 4a, 5	8	Р	1, 1a, 2, 3
		6	A	2, 4, 5	3	А	c, 2
v	Ш	16	Р	1, 1a, 2, 2a, 3, 4, 4a, 5	8	Р	1, 1a, 2, 3
		6-6	A	1, 3, 5, M 2, 3, 4	4	1,	2
VI	ш	8	Р	2, 3, 4, 5	0		
IX-	X	12	1,	2, 3, 3a, 4, 5	4		
,	XI	4	2,	3	4	1,	3
X	III	9(8)	(-	P c)	6		

Table 4. Chaetotaxy of Kenyentulus daliensis sp. nov.



Fig. 5. Kenyentulus daliensis sp. nov. — A, Abdomen VIII, dorsal view; B, abdomen XI, dorsal view; C, the same, ventral view. Numbers in bold face, tergal setae. Those in Roman, sternal setae.

about twelve irregular teeth (Figs. 4 C & 5 A). Female squama genitalis with sharply pointed acrostylus (Fig. 4 D).

Holotype. 1 Q, Jizhaoan, 2,310 m alt., Diancang Shan Mts., Dali, Yunnan, 26-III-1993, collected by XIAO Ning-nian and others.

Notes. The present new species is closely similar in many respects to the former species, *Kenyentulus ailaoshanensis* sp. nov. It is, however, distinguishable from *K. ailaoshanensis* by the relative lengths and shape of foretarsal sensillae, a, d, e, f, a' and c', as well as by the absence of M c on abdominal tergite VIII and of tergal 1 on terg. XI.

The specific name is derived from Dali, the name of the general area, in which was found this new proturan.

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Population Dynamics of the Springtail, *Gulgastrura reticulosa* (Insecta, Collembola), from a Korean Cave

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Abstract Monthly population change was investigated for *Gulgastrura reticulosa* to see if it operates any regular egg-laying behavior through the year in spite of its strong cave-adapted features in external morphology. Two year study revealed a consistent pattern of population change suggesting the presence of a periodic egg-laying cycle. Characterized by either epigeic or hypogeous traits the present species apparently demonstrates a case of mosaic evolution and also an extreme divergence from any existing collembolan group, possibly representing a new family of the Order Collembola.

Introduction

One of the collembolan species (Insecta) from a Korean cave, *Gulgastrura reticulosa*, was assigned to the Hypogastruridae on temporary basis by the original author (Yosii, 1966). The ambiguity of its familial affinity was primarily due to the exceptional development of the apical organ at the apex of antenna, in addition to its overall regressions to complete absence of eyes, postantennal organ, IIIrd antennal organ and so on (Table 1). In addition, an early study of its intermolting period revealed it to be about 110 days, twice as long as the longest on record in other Collembola (LEE & THIBAUD, 1987). This advances a strong suggestion that the present species is fairly divergent from any existing collembolan group. The present work is, therefore, designed to confirm any extraordinary feature with respect to reproductive behavior it may operate as a cave-adapted form.

Materials and Methods

The present species has not been available for study from the original locality, Kosi-gul Cave, because it has long been commercialized as touristic cave, which brought about drastic environmental change. It was by chance at all, however, that the specimens were collected from another cave, Sanho-dongul, about 40 km northeast of the type locality. Ever since the intermolting cycle was investigated (LEE & THIBAUD, 1987) and the present work could be one of the follow up studies of the species in question.

For quantitative analysis of the population change, monthly samplings were made for two years, from December 1988 until November 1989 and from November 1990

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Table 1.	Major characters differentiating Gulgastrura reticulosa from
	related families of Collembola (Insecta).

Character	Hypogastruridae	Gulgastrura reticulosa	Onychiuridae
Apical organ	-	+	-
3rd antennal organ (IIIAO)	+	-	+
Postantennal organ (PAO)	+(-)		+
Ocelli	+(-)		_
Pseudocelli	-		+(-)
Furca	+(-)	-	-(+)
Intermolting period	32 days	110 days	54 days

Mark +: present,

-: absent,

+(-): present but absent in a few species.

Average number of days of intermolting period of the longest record: in Hypogastruridae = Typhlogastrura mendizabali 32 days at 10.5°C; in Onychiuridae = average of 58 days in *Tetrodontophora bielanensis* at 10.5°C and 50 days in *Protaphorura vannieri* at 10°C (from LEE & THIBAUD, 1987).





d - d: temperature, $\blacksquare - \blacksquare$: precipitation, $\blacktriangle - - \blacktriangle$: temperature in litter layer at the cave entrance.

Population Dynamics of Gulgastrura reticulosa

through October 1991. Since the litter layer was developed only within an area of about 150 m² at the cave entrance, coverage of sampling could not be made over an wider area. Samplers of the size $10 \times 10 \times 5$ cm were used to collect soil and litter from five spots taken at random from the site. They were put in polyvinyl bag, transported to the laboratory, and the Collembola were extracted by using Tullgren funnels for 72 hours. Collembolans thus obtained were fixed in 90% ethyl alcohol. The specimens, then, were counted by different size groups as a means to determine population change along different age groups.

Monthly change of temperature and precipitation of the region was as revealed from data record of the meteorological station of the Rural Guidance Office of Jeongseon-gun County (Fig. 1).

Results and Discussion

Number of specimens collected each year were 1,059 and 1,016, respectively, during the two successive years. Population size marked peak in the spring (March, April, May) and in a lesser extent in the autumn (September, October, November) (Fig. 2). Body size of more than 2.5 mm, apparently adults, appeared in those two peak periods even though they occurred also in January, February and December in the second year. Juveniles of small body size of less than 1.5 mm also dominated the



Fig. 2. Monthly population change in the number of individuals of *Gulgastrura reticulosa* for 2 year period [Dec. 1988 – Nov. 1989 (A) and Nov. 1990 – Oct. 1991 (B)]. (N: Number of individuals.)

 \blacksquare — \blacksquare : total individuals, \triangle — \triangle : juveniles, \bigcirc — \bigcirc : adults.

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population in number in the same peak periods of adults (Fig. 2). However, almost no individuals were observed and available for study during July (Figs. 3–4). The apparently complete absence of the population in July was confirmed in the two successive years of investigation period and it was also the case when we checked them up to 10 cm deep in the soil.

Appearance of adult in April and May may be brought about by the growth and overwintering of the juvenile population of August of the preceding year. These adults must be responsible for the next generation by egg-laying, but eggs are put to latent period whereas adults die out in the next months, June and July, when almost no populations are recovered, adults or juneniles, from the soil.

It is quite noticeable and even interesting that the "vacuum" period of the month of July corresponds to peak period of precipitation and temperature of the year.

The repeated pattern of the same trend leads us to speculate that the situation with regard to the life cycle has been brought about by the selection pressure from heat which probably puts eggs into diapause (BLANCQUAERT et al., 1982) and destroy





(N: Number of individuals.)

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Fig. 4. Monthly population change of *Gulgastrura reticulosa* by different size classes for the period Nov. 1990 – Oct. 1991.

(N: Number of individuals.)

adult population after oviposition.

The present study is considered to have made clear that *Gulgastrura reticulosa* is epigeic in terms of reproductive cycle operation even though its morpho-functional characters are extremely modified toward troglobiontic life forms. This surely manifests dual aspect of mosaic evolution.

Conclusion

Our hypothesis that the exceptional traits in morphological characters shown by *Gulgastrura reticulosa* must be a good indication suggesting that other functional characters, reproductive cycle, for instance, may also reveal some extraordinary traits as well. To our surprise this assumption was found to be right in that the present species turned out to be epigeic by operating reproductive cycle. It is in contrast to troglobiontic forms wherein no regular periodic egg-laying behavior is revealed even though it was demonstrated only in laboratory condition (THIBAUD, 1970). Therefore,

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the present species represents a mosaic evolution with the mixture of troglobiontic and epigeic features together. As working hypothesis it may be speculated that this species, once extant deep in the cave, must have migrated for some unknown reason toward the cave entrance which changed its reproductive cycle with selection pressure from photoperiodicity in the cave entrance. Another possibility might be that soil form of Collembola manifesting many cave traits as preadaptation invaded cave entrance (UÉNO, 1987) which affected the reproductive behavior in a similar way. The latter, however, contradicts with polychaetosis of *Gulgastrura reticulosa*, which is rarely shown by any soil-adapted forms.

Only work of expanded scope of study might give further clues to reveal any true picture of evolution which the present enigmatic species must have treaded on in the past.

Acknowledgements

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Growth of *Laccotrephes maculatus* (Heteroptera, Nepidae) with Notes on its Biology

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Abstract Postembryonic development of a Japanese water scorpion, *Laccotrephes maculatus*, was observed under laboratory rearing condition. Morphological description of immature stages and an outline of its natural habitats are also given.

A water scorpion, *Laccotrephes maculatus* (FABRICIUS), widely distributed in tropical and subtropical Asia, was recently recorded from Yonaguni Island, the Ryukyus (HAYASHI & IWATSUKI, 1992) as a third member of the genus from Japan. Though several additional specimens were later collected from other places, it has not been found on any other islands of the Ryukyus, Japan.

So far as I know, very little has been recorded on immature stages of this species with the exception of the details of eggs (HINTON, 1961, 1962). Through the courtesy of Prof. Masataka SATÔ, I was able to obtain living adults of the water scorpion collected from the island. Laboratory rearing was successful in obtaining several off-springs as reported here.

Materials and Methods

Living adults $(1 \stackrel{\circ}{\circ} 2 \stackrel{\circ}{\ominus})$ of the species, collected by M. SATô on March 24th, 1994 at Sonai, Yonaguni Island, the Ryukyus, Japan, were placed in a plastic case (90 $\phi \times$ 30 mm), and for the ovipositing bed well moistened tissue papers and a small lump of mud scooped up at the native habitat were also put into the bottom of the case.

After hatching, each nymph of the succeeding generation was individually reared in water in a plastic icecream cup (90 $\phi \times 50$ mm) on sufficient diet of the larvae of midges, *Tokunagayusurika akamusi* (TOKUNAGA) and *Chironomus* sp. A crumpled tissue paper was also put into the water for a foothold and a shelter for the nymphs. Dead preys were replaced with fresh ones everyday, and the water and the tissue paper were changed when soiled.

All the rearings of adults and nymphs were conducted in a laboratory in Tokyo under normal temperature and normal photoperiod conditions. Representative specimens of eggs and each instar nymph were preserved in 75% ethyl alcohol for a detailed morphological observation.

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Fig. 1. A typical habitat of *Laccotrephes maculatus* on Yonaguni Island. It dwells in a grassy irrigation runnel between a road and paddy fields. (Photo M. HAYASHI.)

Description of Habitat

According to personal communications from Prof. SATÔ and Dr. HAYASHI who have collected this species at Sonai on Yonaguni Island, the water scorpion was found in shallow stagnant water in old irrigation runnels around paddy fields. They camouflaged themselves with mud or tangled debris of plants. These pools are usually surrounded by grassy vegetation as shown in Fig. 1, and maintain a rich fauna of such aquatic insects as *Dineutus mellyi*, *Laccotrephes grossus*, *Enithares sinica*, *Anisops* spp., *Microvelia douglasi*, *Mesovelia japonica*, *Hydrometra annamana*, and so on.

Outline of Rearings

The rearing case of three adults was set on March 27th, 1994. They seem to feed on such small invertebrates as young snails, tubifexes and dipterous larvae which were brought in with mud. Any mating behavior was not observed until the adults were killed for specimens at the end of April.

On April 28th, several eggs were found oviposited into the tissue papers and the mud, only exposing their respiratory horns to the air. Though the oviposition itself was not observed, it was considered to have been made in middle April. Thus, the egg period is estimated at one or two weeks. Finally, 9 nymphs emerged from 11

No. (sex) of			Instars			Total	Date of
individuals	1	2	3	4	5	days	maturity
1(우)	10-12	6	4-6	8-10	16	46-48	30. VI, '94
2(3)	11-13	6	3-5	9-11	17	48-50	2. VII, '94
3	12-14	$4 + ^{+}$					
4(3)	12-14	8-10	6-8	16	18	58-60	12. VII. '94
5	12-14	8-10	5-7	$7 + ^{+}$			
6(3)	14-16	9	6	9	15	53-55	7. VII, '94
7	14-16	13	7+*				
8(♀)	14-16	6-8	6-8	8	$10 + ^{\dagger}$		
9	5+1						

Table 1. Duration (days) of each instar in 9 nymphs of Laccotrephes maculatus.

[†] Killed for specimen in alcohol.

oviposited eggs from 13th to 15th of May.

Though the nymphs were generally inactive in the rearing cases, they preyed on midge larvae very well except for one or two days before every moult and for a few hours after moult. Young nymphs solely fed on 4–8 *Chironomus* larvae a day, and 4th and/or 5th instar nymphs sucked 3–5 larvae of *T. akamusi* which were much larger than those of the former. However, the rapidity of nymphal growth did not synchronize even in early instars. Duration of respective instars for each individual is as shown in Table 1. General color of each instar nymph was pale brown to brown, but the coloration became conspicuously darker about two days before each moult.

Morphological Description

Measurements of adults and nymphs taken at full maturity in each stage are summarized in Table 2. Relative growth of each instar nymph agrees in general with that of *Laccotrephes* sp. (HOFFMANN, 1933), a smaller species collected from Canton, China. Different instar nymphs of this species can be easily recognized on their body size and the shape of their wing pads (Fig. 2 b-f).

Egg (Fig. 2 a). White, very slightly tinged with yellow around the posterior end. Respiratory horns glassy. Body elongate ellipsoidal, somewhat flattened ventrally, with a small elliptical chorionic hydropyle well before the posterior end. Rosette of respiratory horns located close to flattened ventral side and divergent apicad; each horn inwardly curved at distal third. Number of horns varying from 9 to 11 per egg (9 for one, 10 for four and 11 for four eggs). Length of body 2.0, width at middle 1.0 and length of respiratory horns 0.9 mm.

First instar nymph (Fig. 2 b). Body brown, with eyes blackish brown. A wide median longitudinal stripe throughout body above dark except for respiratory syphon. A pale line along meson running from frons to base of 2nd abdominal tergite. A pair of longitudinal stripes on thoracic and abdominal terga also pale, those on the

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former much more widely separated from each other than those on the latter. A pair of small spots on metanotum, and on 1st and 5–7th abdominal tergites blackish; those on metanotum and on 6th abdominal tergite much more conspicuous. Tip of respiratory syphon darkened. Mid- and hindlegs paler than forelegs; a pale ring marking at the middle of each femur and near base of each tibia. Body beneath pale.

Body elliptically flattened, covered with inconspicuous minute hairs, with several short sensory setae on head and pronotum which are hardly visible. Head ovate. Eye large, strongly prominent, as wide as interocular space. Rostrum thick, short, three-segmented. Antenna cylindrical, apically visible from above, seemingly twosegmented as its first segmentation is hardly recognizable. Pronotum transverse, distinctly raised in central part, with anterior margin very deeply and roundly concave, sharing the space with head; lateral margin nearly straight; posterior margin convex. Meso- and metanota depressed, each with lateral margin somewhat convex; posterior margin of the latter widely indented in tectiform; wing pads completely undeveloped; scutellum represented by a triangular area at the middle of mesonotal disc. Abdomen above slightly raised along meson, with lateral margins evenly rounded laterad; respiratory syphon porrect behind, as thick as hindfemur seen from above. Ventral paratergite of 2nd to 6th abdominal segments developed, forming a respiratory channel, but its outer margin expands only well before the carinate suture between median sternites and parasternites. Foreleg very thick especially in femur; tarsus sharp with a minute claw. Mid- and hindlegs normal in shape, with rows of long setae on the undersurfaces of tarsi and of the apical half of each tibia; claws sharply elongated.

Second instar nymph (Fig. 2 c). Similar to 1st instar nymph with the exception of its size and the following characters: Body elongate, with a longitudinal dark line running from prosternum to subgenital plate. Meso- and metacoxae each with a dark dot antero-basally. Head with four pairs of groups of sensory setae, one of which lies on lateral lobes and others on frons, each group being composed of 2 to 5 setae. Eye large, but distinctly narrower than interocular space. Antenna clearly three-segmented as its first segmentation is recognizable. Pronotum a little elongated, with three pairs of sensory setae on disc; posterior margin nearly straight. Meso- and metanota tectiform, each with wing pads slightly expanded postero-laterally; lateral margin of scutellum apparently carinate. Abdomen more raised along meson, with distinct submarginal carinae on 2nd to 7th tergites.

Third instar nymph (Fig. 2 d). Very similar to 2nd instar nymph, differing from it in body size and in the following points: Body pale brown. Median dark stripe of body above much more apparent than those of preceding ones. Small blackish spots on metanotum and 1st abdominal tergite obliquely prolonged, each with an appendant pale spot intero-laterally. Each group of sensory setae on head composed of 3 to 6 setae. First two segments of antenna very slightly inflated. Pronotum weakly quadricarinate longitudinally, with three pairs of groups of sensory setae, each composed of 2 to 4 setae. Wing pads, particularly of mesothorax, remarkably prolonged posterolaterally. Ventral paratergite of abdomen with the outer margin expanded near

			ź	ymphs			ΡV	ults
	1	2	ю	4	53	5 ¢	10	0+
Body length ¹⁾	4.8-5.0	7.5-7.9	11.3-11.9	16.8-17.5	21.3-21.5	22.3-22.6	28.5-30.6	29.3-36.8
Head width ^{\$)}	0.8	1.0	1.2-1.3	1.4-1.5	1.9	1.9-2.0	1.9-2.0	2.0-2.2
Thorax length ³⁾	1-1-0-1	1 7-1 8	2 5-2.7	3 4-3 6	4.6-4.8	4.9-5.0	5 2-5 88)	6.0-6.68
width ⁴⁾	1.6-1.7	2.2-2.4	3.3-3.5	4.7-5.0	6.8-6.9	7.1-7.2	4.5-4.8	4.8-5.2
Abdomen								
length ⁵⁾	2.0-2.2	3.0-3.2	4.5-4.9	6.2-6.6	8.0-8.2	8.5-8.7		l
width®>	1.7-1.8	2.3-2.5	3.3-3.6	4.2-4.5	5.4-5.5	5.6-5.8	5.4-5.7	6.1-6.5
legs								
length of								
forefemur	1.7	2.1-2.2	3.0-3.2	3.9-4.2	4.9-5.0	5.3-5.4	5.4-5.7	5.7-6.3
midfemur	1.1-1.2	1.4	2.0-2.1	2.7-2.9	3.4	3.7	3.8-4.0	3.9-4.4
hindfemur	1.3 - 1.4	1.7 - 1.8	2.5-2.6	3.4-3.6	4.5-4.6	4.7-4.9	5.1-5.5	5.3-5.8
length of								
foretibia	1.2	1.6-1.7	2.2-2.3	2.9-3.1	3.8	4.0-4.1	4.1-4.4	4.3-4.8
midtibia	0.9	1.1-1.2	1.5-1.6	2.2-2.3	2.7-2.8	2.9-3.0	2.9-3.1	3.1-3.5
hindtibia	1.3-1.4	1.8-1.9	2.5-2.7	3.5-3.7	4.5-4.6	4.9-5.0	4.9-5.3	5.4-6.0
Respiratory syphon length ⁷⁾	1.7-1.8	2.6-2.8	4.1-4.8	6.2-6.7	9.1-9.7	8.7-9.5	10.6-13.1	12.1-16.2
Number of								
individuals	6	00	7	9	3	2	4	۴

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Fig. 2. Egg and nymph of *Laccotrephes maculatus*. — a, Egg; b, 1st instar nymph; c-f, wing pads of 2nd to 5th instar nymphs; g, measurements of nymph (see Table 2).

parasternal suture, carina on which is laminately expanded.

Fourth instar nymph (Fig. 2 e). Coloration almost the same as in 3rd instar nymph except for forelegs which are concolorous with other legs. Structure of body also similar except for the size, but differing from that in the others as follows: Second segment of antenna evidently projected antero-laterally. Lateral margin of pronotum weakly concave. Posterior margin of mesonotum narrowly projected behind at the middle. Wing pads much more prolonged; protruded part of those of mesonotum as long as the notal length along meson. Sexual dimorphism faintly recognizable in the

shape of subgenital plates.

Fifth instar nymph (Fig. 2 f). Very similar in coloration to 4th instar nymph. Projection of 2nd antennal segment very long, a little shorter than apical segment. Pronotum more strongly elevated than in the preceding one, with lateral margins strongly sinuate. Mesonotum triangularly protruded behind between wing pads. Wing pads very long, with each tip extending to near the middle of 3rd abdominal tergite. Subgenital plate of female distinctly longer and more acute distally than that of male.

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I am grateful to Prof. M. SATÔ of Nagoya Women's University for giving me valuable materials of the water scorpion and information of its biology, to Dr. M. HAYASHI of Saitama University for providing me with the photographs and accounts of the habitat of the species, and to Dr. M. YAMAMOTO of Kankyô Kagaku Co. who identified the larvae of *Tokunagayusurika akamusi*. My sincere thanks are also due to Dr. S.-I. UÉNO of the National Science Museum, Tokyo, who carefully read the manuscript of this paper. Moreover, I wish to express my warmest gratitude to him on the occasion of his retirement for his continuous advice on my study.

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A New Species and a New Record of Coelidiine Leafhoppers (Homoptera, Cicadellidae) from the Ryukyu Islands, Japan

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Abstract Two coelidiine leaf hoppers are described and recorded from the Ryukyu Islands, Japan; they are *Lodiana uenoi* sp. nov. from Amami-Oshima Is., Okinawa Is. and Iriomote Is., and *L. alata* NIELSON new to Japan, collected from Ishigaki Is. and Iriomote Is.

In his revision of the world Coelidiinae, NIELSON (1977, 1982) recognized six Japanese species, including one species *incertae sedis* described by S. MATSUMURA from the Ogasawara (Bonin) Islands. Thanks to Mr. M. YOSHIMI who resided in Iriomote Island, S. Ryukyus, I was recently able to find out a yellow-banded coelidiine from mangrove forests of the archipelago. As a result of my taxonomic study, I have learned that this leafhopper belonging to the genus *Lodiana* NIELSON (tribe Coelidiini DOHRN) is new to science.

In this paper, I am going to describe the new species, together with a record of another congener new to Japan. Before going into further details, I wish to express my hearty thanks to Mr. M. YOSHIMI of Yokohama City for giving me valuable information. I am also indebted to Prof. K. MORIMOTO and Mr. S. KAMITANI of Kyushu University, Fukuoka (KUF), for loan of material, and to Prof. S. AZUMA and Mr. M. KINJÔ of the University of the Ryukyus, Okinawa, for kind help toward my field researches.

I am deeply grateful to Dr. S.-I. UÉNO of the National Science Museum, Tokyo, for kindly reading the manuscript and constantly giving invaluable guidance. To commemorate his retirement from the National Science Museum, I would like to dedicate this paper to him, leaving his name for the beautiful new leafhopper.

Lodiana uenoi M. HAYASHI, sp. nov.

(Figs. 1-2, 4-17)

Head dull ochreous with a central transverse linear fascia along sulcation on vertex, and posterior margin of vertex infuscated or black; frons shagreened, mostly black in \eth , while dull ochreous with lateral margin of clypeus (frontoclypeus) and outer marginal area of gena fuscous in \heartsuit . Thoracic nota black and sparsely pollinose

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Figs. 1-3. — 1-2. Lodiana uenoi sp. nov. (\vec{c}) in dorsal (1) and obliquely lateral (2) aspects. — 3. L. alata NIELSON (\vec{c}) in dorsal aspect.

in fresh specimens; pronotum mottled with ochreous specks; forewing brown, somewhat glossy and leathery, clothed with 2 yellow transverse bands (anterior one often widened). Abdomen black in $\stackrel{\frown}{\circ}$ and brunneous in \bigcirc , with posterior margins of 3rd– 7th terga yellow or ivory; ventral side of \bigcirc pygofer (tergum IX) pale ochreous.

Ventral part of thorax entirely black in 3° , and ochreous with lateral part blackened in \mathfrak{Q} ; subgenital plate in 3° black with outer lateral area pale ochreous apicad; \mathfrak{Q} 7th abdominal sternum black with caudolateral corner widely ochreous.

Head large, distinctly narrower than pronotum, with anterior margin broadly rounded; width of vertex measured at median level of eye nearly equal to entire median length; lateral margins of vertex slightly convergent basad; eye large and globular, wider than vertex; clypeus long, ca. $2 \times$ as long as wide, without median longitudinal carina; clypellus parallel-sided, much widened distad, and about 1/2 the length of clypeus. Pronotum smoothly knobbed; scutellum (mesonotum) large and triangular, distinctly longer than pronotum. Forewing elongate, ca. $3 \times$ as long as wide, with apex broadly rounded. Female abdomen conical, much lengthened distally; φ 7th sternum ca. $2.5 \times$ as long as penultimate segment, with caudal margin convex medially; ovipositor (valvula 3) very long, well beyond pygofer.

Male genitalia (Figs. 9–16) Pygofer triangular in lateral aspect, with apex of lobe acutely produced and caudoventral margin equipped with a short, flat, finger-like lobe; subgenital plate long and rather linear in shape, with outer lateral margin densely pilose (except for apical 1/4) and with apex roundly expanded; aedeagus asymmetrical, much elongated and narrowed, with a subapical lateral process extending backward; sub-

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Figs. 4–9. Lodiana uenoi sp. nov.; 4–6, head and thorax in dorsal (4), lateral (5) and full ventral (6) views; 7, posterior part of ♀ abdomen in lateral view; 8, ♀ 7th abdominal sternum; 9, ventral part of ♂ abdomen. Scale; 0.5 mm, for figs. 7–9.

apical process of shaft weakly twisted and acutely produced apicad, bearing 3 spine-like setae at base and 4 similar ones at apex; gonopore opening subapical and dorsal; connective primarily Y-shaped, with stem very short and arms much widened and truncate



Figs. 10–16. Male genitalia of *Lodiana uenoi* sp. nov.; 10, lateral aspect of pygofer and subgenital plate; 11, apical part of right pygofer lobe in ventral view; 12, style, connective and aedeagus; 13, left style; 14, connective; 15–16, distal part of aedeagus in lateral (15) and dorsal (16) views. Scales; 0.3 mm (10), 0.2 mm (11–16).

apicad; style shorter than 1/2 the length of aedeagus, with apophysis obtusely produced.

Body length (mean) to tip of folded forewing: 36.7-7.4 mm (7.1 mm), 98.5-9.4 mm (9.0 mm).

Holotype 3° , Hoshidate, Iriomote Is., Ryukyus, Japan, 22–VI–1992, M. HAYASHI et al. Paratypes: [Amami-Oshima] $3 \ (KUF)$, Nishinakama, 25–VII–1954, S. MIYA-MOTO & Y. HIRASHIMA. — [Okinawa] $1 \ 3^{\circ}$, Kesaji, Higashi, 27–VI–1992, M. HA-YASHI. — [Iriomote] $1 \ 3^{\circ}$, $4 \ 2^{\circ}$, same locality as holotype, 23–VII–1991, M. YOSHIMI; 26 3° , 38 9° , same data as holotype; 10 9° , same data except 24–VI–1992; $1 \ 3^{\circ}$, $2 \ 9^{\circ}$, same data except 6–VII–1993; $15 \ 3^{\circ}$, $18 \ 9^{\circ}$, Funaura, 25–VI–1992, M. HAYASHI et al.

Type depository. National Institute of Agro-Environmental Sciences, Tsukuba. *Distribution.* Japan: Ryukyus (Amami-Oshima, Okinawa and Iriomote).

Remarks. This coelidiine leafhopper, characterized by two yellow bands on the forewing, is very similar in general habitus to *L. brevis* (WALKER) from China, Vietnam, Thailand, etc., *L. spina* ZHANG from China (Yunnan), *L. brevisina* ZHANG from China (Yunnan), etc., but differs in some characters of the d genitalia such as the setal pattern of the subapical aedeagal process, the configuration of connective and the apical

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Fig. 17. Lodiana uenoi sp. nov. (♀) resting on Excoecaria agallocha. (Iriomote Is.; June 24, 1992.)

part of pygofer lobe, etc. (cf. NIELSON, 1982; ZHANG, 1990). The morphological characters in the \mathcal{J} genitalia suggest that *L. uenoi* shows a probable alliance to *L. praetexta* (DISTANT) occurring in Burma (Myanmar).

Bionomics. This colorful coelidiine leafhoppers live in the mangrove vegetation of the Ryukyus, feeding on *Excoecaria agallocha* L. of the Euphorbiaceae growing on the swamp zone fringed with rhizophoracean mangrove forest. This euphorbiacean must be the main host plant of the leafhopper. It is also observed that adults occasionally suck the sap on *Rhizophora stylosa* GRIFF. (Rhizophoraceae); this tree seems merely one of the food plants. Adult leafhoppers occur from early May to late July with the peak period of mid- and late June, and perch on twigs of the host plant, sitting head foremost (Fig. 17). On sunny days, they are very active and so agile to fly about if disturbed.

Lodiana alata NIELSON, 1982

(Fig. 3)

Lodiana alata NIELSON, 1982, Pacif. Ins. Mon., 38: 115.

This species has hitherto been known from China (Fukien, Hupeh, Chekiang,

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Hainan and Kwantung) and Taiwan, and it is collected from Japan (the Yaeyama group of the Ryukyus) for the first time.

Specimens examined: 1 \checkmark , Mt. Omoto-dake, Ishigaki Is., Ryukyus, 4–IX–1985, M. Hayashi; 1 \checkmark , Aira, Iriomote Is., Ryukyus, 12–V–1993, M. Hayashi *et al.*; 2 \bigcirc , Mt. Sonai-dake, Iriomote Is., 28–IX–1993, M. Hayashi *et al.*

Head ochreous with a pair of longitudinal fasciae on lateral part of clypeus and entire clypellus rufous. Thorax and forewing deeply infuscated to piceous with numerous dull ochreous specks (those on \bigcirc forewing reduced, arrayed on veins). Ventral parts of thorax and abdomen more or less fuscous to black; legs almost entirely ochreous. Head rather triangularly produced anteriad; vertex measured at median level of eye distinctly narrower than entire median length. Other structures and \bigcirc genitalia are described by NIELSON (1982). Body length: \bigcirc 7.2–7.4 mm, \bigcirc 8.6–8.8 mm.

This species seems to be rare in the Ryukyus; only a few specimens have been collected in jungles of montane areas on Ishigaki and Iriomote of the Yaeyama group. The host plant is unknown.

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A New Species of the Genus *Psylla* (Homoptera, Psylloidea) from Hokkaido, Northern Japan

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Abstract A new species of the genus *Psylla* is described under the name of *P. uenoi*. It is found on *Ulmus davidiana* var. *japonica* at Maruyama Park and Mt. Moiwa-yama of Sapporo in central Hokkaido, northern Japan.

Examining the Japanese psyllids in my collection, I have found an interesting species obtained at Maruyama Park and Mt. Moiwa-yama of Sapporo in central Hokkaido, northern Japan. This species feeds on *Ulmus davidiana* var. *japonica*, and resembles the European species, *Psylla ulmi* FOERSTER (1848) feeding on *Ulmus* spp. (OSSIANNILSSON, 1992).

After a careful examination, it has become clear that this species is new to science and will be described below under the name of *P. uenoi*. It is named in honour of Dr. Shun-Ichi UéNO on the occasion of his retirement from the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. The holotype of the new species to be described is deposited in the collection of the Laboratory of Entomology, Tokyo University of Agriculture. The paratypes are preserved in the Osaka Museum of Natural History, and in the author's private collection.

Before going further, the author wishes to express his hearty thanks to Professor Yasuaki WATANABE of the Laboratory of Entomology, Tokyo University of Agriculture, for his constant guidance, to Mr. Yorio MIYATAKE of the Osaka Museum of Natural History for his critical reading of the original manuscript and kind advice, and to Mr. Itsurou KAWASHIMA of the Laboratory of Entomology, Tokyo University of Agriculture, for his preparing drawings inserted in this paper.

Psylla uenoi K. MATSUMOTO, sp. nov.

(Figs. 1-2)

Coloration: — General color yellowish green to light green; eyes light brown; ocelli orange. Antenna light green, with 2 apical segments, apical half of 8th, and apices of 5th to 7th black. Vertex and genal cones yellowish green. Thorax often yellowish green dorsally, dorsal surface with a pair of longitudinal stripes of light green; forewing transparent, basal third more or less flavous; hind wing transparent; legs pale yellowish green, apical spurs of tibia and proximal segment of tarsi black.



Fig. 1. Psylla uenoi sp. nov., S, in lateral aspect. Scale: 0.5 mm.

Abdomen light green; male and female genitalia yellowish green.

Structure:— Head narrower than thorax, nearly vertical on the front plane. Vertex a half as long as wide, with a pair of deep depressions near the anterior margin; anterior margin arched, elevated near lateral ocelli, with short disperse pubescence. Genal cones longer than vertex at median suture, divided into two lobes by a deep excision, each lobe subtriangular, distinctly longer than broad, with long pubescence on the surface. Eyes small, not hemispherical. Antenna long and slender, about 2.3 times as long as width of head, each segment with small setae, apical segment with 1 long and 1 short apical setae; relative length of each segment as 0.5: 0.5: 4.3: 2.3: 2.0: 1.9: 1.8: 0.8: 0.7.

Thorax arched in lateral aspect, with short thin pubescence; pronotum much narrower than head, strongly arched cephalad; praescutum strongly convex, anterior part produced cephalad. Forewing large and elliptical, about 2.8 times as long as wide, narrowed at the base and rounded in apical margin; veins without setae other than C; Rs long and sinuate, upturned at the apex; M+Cu short, about 2/5 as long as R+M+Cu; M arcuate, basal half more or less parallel to R; M_{1+2} as long as M_{3+4} , slightly arcuate; Cu_{1a} strongly arcuate, apical half more or less parallel to M_{3+4} ; medial cell elongate and triangular; cubital cell wider than height. Hind wing long, 4/5 as long as forewing, 2.8 times as long as wide, narrowly rounded at the apex, R and M entire and not branched, cubital cell flat, 2.5 times as wide as high. Legs long and shortly haired; hind tibia with an acute basal spine, 1 outer and 2 inner apical spurs, and 2 or 3 long setae in the apical area; proximal segment of tarsi with 2 apical spurs and long hairs; apical segment of tarsi with 2 long setae at the apex; meracanthus long and slender, pointed at apex.

Abdomen moderately long, about 2/3 as long as thorax (excl. genitalia), without pubescence. Male genitalia small, about 1/3 as long as the rest of abdomen; proctiger long and moderately stout, about 1.4 times as long as forceps, caudal margin of basal 2/3 produced caudad in lateral aspect, apex slender, truncate, rugose and sclerotized, with long sparse pubescence; forceps long and slender, nearly parallel-margined in lateral aspect, slightly bent basally, rounded apically, inner side of apex with a strong tooth as illustrated, and with long bristles around the outer surface; aedeagus long and

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Fig. 2. *Psylla uenoi* sp. nov. — A, Forewing; B, hind wing; C, head, frontal view; D, male genitalia; E, inner side of tip of forceps; F, female genitalia; G, hind leg.

slender, apex of the second segment sickle-like; subgenital plate somewhat quadrilateral, with sparse hairs on the ventral side and along dorsal margin. Female genitalia small, 1/3 as long as the rest of abdomen, nearly triangular in lateral aspect; dorsal valve slightly longer than ventral valve, apical half tapering toward the rounded apex, with short setae on the surface in apical half, and with 4 or 5 long setae in the median area; ventral valve subtriangular in lateral aspect, acutely pointed and slightly upturned apically, ventral margin slightly convex, with pubescence in apical half.

Length of body, $\stackrel{\circ}{\supset}$ 2.0–2.2 mm, $\stackrel{\circ}{\ominus}$ 2.3–2.5 mm (to tips of folded wings, $\stackrel{\circ}{\supset}$ 4.2–4.4 mm, $\stackrel{\circ}{\ominus}$ 4.2–4.5 mm); length of forewing, $\stackrel{\circ}{\supset}$ 3.5 mm, $\stackrel{\circ}{\ominus}$ 3.7–3.8 mm; length of

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antenna 1.9-2.0 mm.

Holotype: 3, Maruyama Park, Sapporo, Hokkaido, Japan, 30–V–1991, on Ulmus davidiana var. japonica, K. MATSUMOTO leg.

Paratopotypes: $13 \stackrel{?}{\supset} \stackrel{?}{\supset}$, $11 \stackrel{?}{\ominus} \stackrel{?}{\ominus}$ (1 $\stackrel{?}{\supset} 1 \stackrel{?}{\ominus}$ in alcohol), the same data as for the holotype. Paratypes: $9 \stackrel{?}{\supset} \stackrel{?}{\supset}$, $9 \stackrel{?}{\ominus} \stackrel{?}{\Box}$, Mt. Moiwa-yama, Sapporo, Hokkaido, Japan, 2–VI–1991, on *Ulmus davidiana* var. *japonica*, K. MATSUMOTO leg.

Distribution. Japan (Hokkaido).

Host plant. "Harunire" – Ulmus davidiana var. japonica (REHDER) NAKAI, Ulmaceae.

Differs from the other Japanese species of the *Psylla* in having male forceps of characteristic form, and long and slender genal cones. It is similar to *Psylla matsumurai* MIYATAKE (1964) from Hokkaido, but differs from the latter in light green body color (black with orange stripes in *P. matsumurai*), much more slender male forceps, of which the apex bends cephalad and the inner tooth is modified as figured. It also resembles *Psylla ulmi* FOERSTER (1848) from Europa feeding on *Ulmus* spp., but differs from the latter in the following characteristics: the genal cones longer and more slender, the male proctiger stout at the base, and the forceps much longer, each having a large tooth at the apex.

Remarks. The specimens of the present new species was caught on young leaves of the host plant, with last instar nymphs and teneral adults. It is therefore probable that the emergence of new imago takes place from late May to early June.

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Immature Galls of the Subtropical Aphid *Pseudoregma* bambucicola (Homoptera), with Notes on the Soldiers and First-instar Fundatrices

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Abstract Five young galls of *Pseudoregma bambucicola* were collected from *Styrax* suberifolia in central Taiwan in May to know how the gall is formed and whether soldiers are produced early in the season. It was found that the aphid transforms a bud to be a flower into the gall. The galls already contained many sterile 2nd-instar soldiers. A number of sexuparae of *P. bambucicola* were collected from bamboo in southern Japan to obtain 1st-instar fundatrices. The morphology of the 1st-instar fundatrices obtained was typical of a gall-former, showing that they could not grow on bamboos. Key words: *Pseudoregma bambucicola*, aphid, gall formation, *Styrax*.

Many species of the aphid tribe Cerataphidini (Aphididae, Hormaphidinae) migrate between the primary and secondary hosts in southeastern Asia. The secondary hosts are various groups of plants including Gramineae, Palmae, Zingiberaceae and Loranthaceae, while the primary hosts are trees of a single genus, Styrax, on which they form galls of various shape (BLACKMAN & EASTOP, 1994; FUKATSU et al., 1994). In a series of papers, we have clarified which part of the hostplant is transformed into a cerataphidine gall. Ceratovacuna nekoashi (SASAKI), C. japonica (TAKAHASHI) and Cerataphis fransseni (HILLE RIS LAMBERS) transform axillary buds into their galls (KUROSU & AOKI, 1990, 1994; STERN et al., 1994). Astegopteryx bambucifoliae (TAKA-HASHI), Ceratoglyphina styracicola (TAKAHASHI) and Hamiltonaphis styraci (MATSU-MURA), on the other hand, initially form galls on the stems of developing shoots (KUROSU & AOKI, 1991 a, b; AOKI & KUROSU, 1990). In one paper (AOKI & KUROSU, 1992), weer roneously stated that galls of Pseudoregma bambucicola (TAKAHASHI) are made of axillary buds. However, we have recently collected young galls of this species on flower shoots of Styrax suberifolia in Taiwan, and found that the galls are in reality made of flower buds. In this paper, we retract our former statement and report the

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structure of the young galls and their inhabitants. In addition we will report that sexuales of *P. bambucicola* can still produce fundatrices in southern Japan.

1. Young galls of Pseudoregma bambucicola

In July and September, 1990, we collected several mature galls of *Pseudoregma* bambucicola from a few trees of *Styrax suberifolia* at Kuangyinshan near Puli, Nantou Hsien, central Taiwan (AOKI & KUROSU, 1992). On May 24, 26 and 29, 1992,



Fig. 1. A, Young gall (no. 92067) of *Pseudoregma bambucicola* on a flower shoot; B, one of its subgalls; C, a young gall of *Astegopteryx bambucifoliae* formed on a flower shoot (at Kuangyinshan on May 30, 1991). Scale: 7 mm for A and C, and 5 mm for B.

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we found a total of five immature galls of *P. bambucicola* on the same trees. All galls were still soft and small (8.9–19.0 mm across), and were brown in color but tinged with green. They were submerged in 80% ethanol immediately after collection, and later were dissected to examine the structure and inhabitants.

All galls were formed on flower shoots, on which bases of a few fallen flowers remained (Fig. 1 A). An unusually swollen five-edged calyx remained at the base of every gall (Fig. 1 A), which indicates that the fundatrix of *P. bambucicola* transforms a bud to be a flower into the gall.

Each gall consisted of from nine to 12 subgalls (Table 1). The subgalls were compressed (Fig. 1 B), about 1–3 mm wide and had a suture, which was about 1.5–2.5 mm long, at the tip. All subgalls of galls 92067, 92078 and 92084 were closed. The suture of one subgall of gall 92065 and those of eight subgalls of gall 92066 were already open to form an exit. The interior of all subgalls was smooth without projections.

We found a few young galls of *Astegopteryx bambucifoliae* also on flower shoots of *Styrax suberifolia* (Fig. 1 C). Because the young galls lacked the calyx-like structure at the base, we consider that they were formed on the stem of the flower shoot (cf. KUROSU & AOKI, 1991 a).

2. Inhabitants of young galls

No galls contained the fundatrix or 1st-instar defenders called "outsiders" (see KUROSU & AOKI, 1988, 1994). It may have been too late to collect them. The most developed gall contained more than 300 aphids (Table 1), but no wing-padded nymphs. All galls had already produced 2nd-instar soldiers (see fig. 2 B in AOKI & KUROSU, 1992). Percentage of soldiers ranged from 6.7 to 27.7 (Table 1). All (94) soldiers from gall 92066 were heated in 10% KOH solution, stained with Evans' blue, mounted in balsam, and examined under a differential interference microscope to see whether they would have the next instar cuticle developing inside. Because none of them had the cuticle developing inside, they are thought to be sterile as are soldiers produced in mature galls (AOKI & KUROSU, 1992). Each of two closed, undamaged subgalls of gall 92066 contained a single apterous adult (of the 2nd generation), several (14 and 16) non-soldier nymphs and four small but distinct soldiers. Soldiers are therefore already produced in the 3rd generation.

Gall #	Size (across) in mm	No. of subgalls*	Length of the longest subgall in mm	Colony size	% Soldier
92065	14.0	12(5)	17.0	208	25.5
92066	19.0	11(2)	19.1	339	27.7
92067	8.9	9 (8)	11.6	15	26.7
92078	12.5	10(4)	14.4	121	9.9
92084	14.0	10(4)	8.5	60	6.7

Table 1. Structure and inhabitant composition of five young galls of *Pseudoregma bambucicola*.

* No. of subgalls damaged by Assara formosana in parentheses.

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All galls were more or less damaged by one or two small larvae of the predaceous pyralid moth *Assara formosana* YOSHIYASU. In particular, gall 92067 was heavily damaged by a larva: eight out of nine subgalls had holes made by the larva and six of the eight contained no aphids. An anthocorid nymph was found in a subgall of gall 92066.

3. Sexuparae and first-instar fundatrices

Pseudoregma bambucicola migrates between *Styrax suberifolia* and bamboos of the genus *Bambusa* (AOKI & KUROSU, 1992). Because the aphids have the ability to maintain themselves continuously by parthenogenesis on bamboos, the species is also distributed in such places as southern Japan where *S. suberifolia*, the primary host, does not grow (AOKI & KUROSU, 1992). The population of *P. bambucicola* in southern Japan still produces many alate sexuparae which should be functionless (SUNOSE *et al.*, 1991). To know whether sexuales laid by these sexuparae still retain the ability to produce fundatrices, the following observation was made.

On November 16 and 17, 1990, a number of alate sexuparae were collected from colonies of *P. bambucicola* on *Bambusa multiplex* at Ono-chô, Mishigeno and Naka-tsuno, Kagoshima Pref., southern Japan. They were confined in a plastic jar with a few sheets of tissue paper. A dried leaf of *S. suberifolia* was added to facilitate larviposition. The sexuparae soon laid 1st-instar sexuales (males and oviparous females). The sexuales matured without taking food and copulated, and the oviparae laid a number of eggs. From these eggs, a total of 16 1st-instar fundatrices hatched between



Fig. 2. A, First-instar fundatrix of *Pseudoregma bambucicola* in ventral focus; B, tergites of another individual. Scale: 0.2 mm for A and 0.1 mm for B.

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March 30 and April 8, 1991. Some of them were mounted on slides, and their morphology was examined. The 1st-instar fundatrices (Fig. 2 A) had well-sclerotized tergites with long, capitate setae (Fig. 2 B), the ultimate rostral segment long and slender and the antennae with three apical setae; the morphology was typical of a cerataphidine gall-former (cf. fig. 1 A in KUROSU & AOKI, 1991 a). It is therefore almost certain that the fundatrices cannot grow on bamboos.

Acknowledgments

We wish to express our hearty thanks to Dr. Shun-Ichi UÉNO, who has been encouraging our study on gall-forming cerataphidines. Prof. J. YUKAWA and Dr. Sk. YAMANE kindly helped U.K. collect sexuparae of *P. bambucicola* in Kagoshima. We also thank Mrs. C. CHUNG for her hospitality in Taiwan. This study was supported in part by a grant-in-aid from the Fujiwara Natural History Foundation.

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The Genus Strepterothrips HOOD (Thysanoptera, Phlaeothripidae) from East Asia

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Abstract Two *Strepterothrips* species are recorded from East Asia. They are: *S. orientalis* ANANTHAKRISHNAN from Thailand, West Malaysia, Indonesia, Taiwan and Japan, and *S. uenoi* sp. nov. from Thailand, West Malaysia and Singapore. Being found on dead branches, they seem to be fungus-feeders.

The genus *Strepterothrips* HOOD, 1933, is a group of small-sized fungus-feeding tubuliferous thrips belonging to the tribe Stictothripini of the subfamily Phlaeo-thripinae. The members of the genus have the strongly reticulated bodies, seven-segmented antennae, long and medially reaching maxillary stylets and short and strongly expanded body setae. The forewings, when present, are sharply curved subbasally with no duplicated cilia. They usually show a strong sexual dimorphism as well as allometric growth of males. Large males have elongate heads and enlarged prothoraces and forelegs. Moreover, their foretarsi each bears a remarkably enlarged ventral hamus which is not homologous with a tooth. However, these features are not found in small males.

Up to this time, eight species are recognized in this genus, only one of these species, *orientalis*, having been previously recorded from East Asia (MOUND *et al.*, 1971; CHEN, 1980; ZUR STRASSEN, 1992). In this paper, I will describe a new *Strepterothrips* species from Thailand, West Malaysia and Singapore, and will report additional records of *S. orientalis* from East Asia.

Type depository. The holotype and most of the paratypes designated in this paper are preserved in the Laboratory of Entomology, Tokyo University of Agriculture.

Abbreviations. The following abbreviations are used for the collectors: SO, S. OKAJIMA; TN, T. NONAKA.

Before going further, I wish to express my hearty thanks to Dr. Toshifumi NONAKA of Tokyo, for his kind assistance in collecting thrips. Thanks are also due to Miss Hiromi URUSHIHARA of the Omogo Mountain Museum, Ehime, for her assistance in drawing excellent text figures.

Strepterothrips orientalis ANANTHAKRISHNAN

Strepterothrips orientalis ANANTHAKRISHNAN, 1964, 118–119.

This species was originally described from Madras, southern India, and there are

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a long series of its specimens collected from the tropics and subtropics of East Asia in the collection of Tokyo University of Agriculture. The records of these specimens given below suggest its wide distribution in East Asia.

Material examined. India: 1 º (apt.), Madras, on coconut sheath, 30-XI-1965, T. N. ANANTHAKRISHNAN. Thailand: Bangkok, Bangkhen, Campus of Kasetsart University, NBCRC (National Biological Control Research Center), on dead branches (mac.), 11–I–1988, 46 ♀♀ 2 ♂♂ (apt.), 13–I–1988, 57 ♀♀ 2 ♂♂ (apt.) 1 ♀ (mac.), 14–I–1988, 47 ♀♀ 2 ♂♂ (apt.), 18–I–1988 (SO); 24 ♀♀ 10 ♂♂ (apt.) 3 ♀♀ (mac.), NBCRC, on dead branches, 26-IX-1987 (SO); 4 ♀♀ 2 ♂♂ (apt.), NBCRC, on dead branches of Bougainvillea ? glabra, 28-XII-1987 (SO); 4 ♀♀ 1 ♂ (apt.), NBCRC, on aerial roots of *Ficus retusa*, 14–I–1988 (SO); $2 \ 9 \ 9$ (apt.), Kamphaeng Saen Campus of Kasetsart University, on dead branches, 12–I–1988 (SO): $5 \Leftrightarrow \varphi = 1 \swarrow$ (apt.) $1 \Leftrightarrow$ (mac.), Saraburi, on dead leaves and branches, 10-IX-1991 (TN & SO); 3 99 (apt.), $8 \oplus \oplus$ (mac.), Nakornprathom, Puttamonton, on dead branches, 18–IX–1991 (P. JANGVITAYA); $1 \ \varphi$ (apt.) $2 \ \varphi \ \varphi$ (mac.), nr. Chiang Mai, Phrow, on dead leaves and branches, 22–VIII–1992 (TN & SO); Phuket Is., $1 \stackrel{\circ}{\hookrightarrow} 1 \stackrel{\circ}{\rightrightarrows}$ (apt.), on dead branches, 19-VIII-1976 (SO), $3 \ 9 \ 9$ (apt.) $2 \ 9 \ 9$ (mac.), on dead leaves and branches, 14-IX-1992 (SO). West Malaysia: 1 ♀ 1 ♂ (apt.), about 20 km N of Kuala Lumpur, Templer Park, on dead leaves and branches, 12-IX-1990 (TN & SO). Indonesia: $1 \ (mac.)$, South Sulawesi, Malino, alt. ca. 900 m, on dead leaves and branches, 31-VII-1984 (SO). Taiwan: 1 ♀ 1 ♂ (apt.), Pingtung Hsien, Kenting National Park, on dead branches, 19-III-1984 (SO). Japan: 4 ♀♀ (apt.), Ogasawara Isls., Hahajima Is., on dead branches, 7-III-1988 (SO).

Distribution. India; Thailand; West Malaysia; Indonesia (Krakatau Isls., and Sulawesi Is.); Taiwan; Japan (Ogasawara Isls.); Fiji; Hawaii. Previously unknown from West Malaysia and Japan.

Strepterothrips uenoi sp. nov.

(Figs. 1-11)

Female (macroptera) (Fig. 8). Colour brown to dark brown; head brown, with genal area dark borwn, a little paler from vertex to between eyes; thorax brown, anterior and lateral portions of pronotum and posterior portion of metanotum somewhat paler; abdomen brown, segment VIII with lateral yellowish markings around spiracles; tube dark brown, with base and apex a little paler. Antennal segments I and II pale brown, almost concolorous with vertex; segment III yellow; segments IV to VII dark brown, almost concolorous with tube. All femora brown, with bases somewhat paler, with extreme apices whitish; all tibiae brown, with bases and apices pale, yellowish to whitish; all tarsi yellowish. Wings shaded with brown.

Head (Fig. 1) elongate, basal margin protruded at middle, strongly sculptured with raised reticulation, but tuberculated with fine warts along median longitudinal

line; two pairs of prominent cephalic setae present, postoculars and vertexals (=middorsals) stout and strongly expanded; cheeks subparallel (sometimes distinctly widened towards base due to cover slip pressure), tuberculated, slightly constricted just before basal collar, not strongly overlapping lateral margins of eyes. Eyes about one-fifth the length of head. Antennae (Fig. 5) a little longer than head; segment III longer than wide, almost as long as segment IV; segments III to VI sculptured with distinct transverse striae; sense-cones long and stout, segments III and IV with 0+1 and 1+2sense-cones, respectively.

Pronotum relatively weak in the genus, sclerotized weakly at anterior and lateral portions, sculptured with polygonal reticulation at median and anterior portions, tuberculated with scattered fine warts at posterior portion, with 16–18 discal setae. Mesonotum transversely striated, the striae with fine warts, with three pairs of pointed setae, a pair of medians and two pairs of submedians, medians the longest, setae on sides vestigial, each only with two setal sockets (or campaniform sensillae). Metanotum with anteromedian semicircular reticulated area, the area somewhat raised and usually with 8 pointed setae, the reticles with several small tubercles, posteromedian portion with 4–6 pointed setae and with similar reticles and tubercles, but the reticles are weaker. Wings typical in the genus; forewing with three subbasal setae.

Pelta (Fig. 2) trilobed, lateral lobes usually separated from median lobe, or barely fused, median lobe reticulated with some small warts. Terga II to VII each with two pairs of wing retaining setae, posterior pairs on terga II to VI wide and flat; B1 setae on tergum IX more or less longer than one-third the length of tube. Tube about 0.6 times as long as head, about three times as long as basal width. Anal setae almost half as long as tube.

Measurements of holotype macropterous female in μ m. Total distended body length about 1500. Head length 245, width 145; eye length 60, width 42–44. Pronotum length 93, width 214; forewing length 530–540. Pelta length 58, width 127. Tube length 148, basal width 48, apical width 23. Antenna total length 260; segments I to VII length (width) as follows: 31 (28); 43 (29); 37 (23); 40 (26); 37 (26); 35 (23); 52 (19). Length of setae. Postoculars 33, vertexals 25. Prothoracic anteroangulars 30–33, anteromarginals 23–25, midlaterals 22–24, posteroangulars 25, epimerals 40– 43. Subbasals: B1 17, B2 22, B3 28. B1 (B2) on tergum IX 65–67 (91–95). Anals about 90.

Female (aptera) (Fig. 9). Very similar in colour to macropterous female. Cheeks (Fig. 3) very weakly widened posteriorly; eyes very small; mesonotum with two pairs of pointed setae, medians and submedians with two pairs of well developed expanded lateral setae; metanotum generally reticulated, the reticles very weak and with scattered tubercles, with about 40 pointed setae; pelta (Fig. 4) broad, elliptical as figured; terga without wing-retaining setae.

Measurements of paratype apterous female in μ m. Total distended body length 1450. Head length 235, width 147: eye length 40, width 27–30. Pronotum length 108, width 222. Pelta length 42, width 180. Tube length 142, basal width 50, apical

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Figs. 1-4. *Strepterothrips uenoi* sp. nov.; 1, head of macropterous female; 2, pelta of macropterous female; 3, head of apterous female; 4, pelta of apterous female.

width 23. Antenna total length 255; segments I to VII length (width) as follows: 30 (28); 42 (29); 35 (25); 36 (26); 27 (27); 33 (23); 49 (20). Length of setae:— Postoculars 34–36, vertexals 24–28. Prothoracic anteroangulars 34–36, anteromarginals 23–26, midlaterals ?, posteroangulars 27–30, epimerals 33–35. B1 (B2) on tergum IX 63–65 (88–90). Anals about 90.

Male (aptera) (Figs. 10–11). Colour a little paler than in female, abdominal segment IX a little darker than the remaining segments. Somewhat similar in structure to apterous female, but showing extreme allometry. Large male:— head (Fig. 6) and



Figs. 5-7. *Strepterothrips uenoi* sp. nov.; 5, right antenna of macropterous female; 6, head, prothorax and right foreleg of large apterous male; 7, right foretarsus of large apterous male.

antennal segments elongate; head more or less produced in front of eyes; prothorax (Fig. 6) greatly enlarged; pronotum with anterolateral irregularly produced projections, the projections sclerotized weakly, posteromedian portion with a weak swelling; forelegs (Fig. 6) greatly elongate, forefemora longer than head, foretarsus (Fig. 7) with small tooth and well developed hamus, but foretibial apical tubercles are not developed. Small male:— Very similar to apterous female, but much smaller. B1 setae on tergum IX almost a half as long as tube in both large and small individuals.

Measurements of smallest-largest paratype apterous males in μ m. Total distended body length 1030–1420. Head length 180–273, width across cheeks 110–125. Pronotum median length 87–160, width (without projection) 177–275; forefemur length 121–370. Pelta length 32–53, width 124–165. Tube length 80–102, basal width 42–46, apical width 21–23. Antenna total length 246–338; segments I to VII length (width) as follows: 36–45 (28–31); 39–50 (27–28); 34–53 (23–22); 36–55 (26–26); 34–47 (24–23); 32–39 (23–21); 48–59 (21–21). Length of setae:— Postoculars 26–about 40,

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Figs. 8-11. Strepterothrips uenoi sp. nov.; 8, macropterous female; 9, apterous female; 10, large apterous male; 11, small apterous male.

vertexals about 20–27. Prothoracic anteroangulars 23–38, anteromarginals 15–30, midlaterals 18–38, posteroangulars 15–20, epimerals 27–35. B1 of tergum IX 47–63. Anals 68–88.

Holotype $\[mac.$). Thailand: Phuket Is., nr. Tone Sai Waterfall, on dead leaves and branches, 12–IX–1992 (TN & SO). Paratypes. Thailand, Phuket Is.: same locality, habitat and collectors as for holotype, 9 $\[mac.$], 16 $\[mac.$], 26 $\[mac.$], 11–IX–1992, 6 $\[mac.$], 9 $\[mac.$], 9 $\[mac.$], 1 $\[mac.$], 12–IX–1992, 37 $\[mac.$], 26 $\[mac.$], 26 $\[mac.$], 27 (apt.), 14–IX–1992; 4 $\[mac.$], 1 $\[mac.$], ame locality as holotype, on bamboo, 23–VIII– 1991 (TN & SO); 2 $\[mac.$], 1 $\[mac.$], 3 $\[mac.$], 26 $\[mac.$], 26 $\[mac.$], 27–VIII– 1991 (TN & SO); 2 $\[mac.$], 3 $\[mac.$], 4 $\[mac.$], 6 $\[mac.$], 6 $\[mac.$], 7 (apt.), detailed locality unknown, on dead leaves and branches, 24–VIII–1991 (TN & SO); 1 $\[mac.$], Rang Hill, on dead leaves and branches, 14–IX–1992 (SO). West Malaysia: about 20 km N of Kuala Lumpur, Templer Park, 3 $\[mac.$], 11 $\[mac.$], 6 $\[mac.$], on dead leaves, 11–VIII–1990 (TN & SO), 1 $\[mac.$], on dead leaves, 13–VIII–1990 (TN & SO), 1 $\[mac.$], on dead leaves, 13–VIII–1990 (TN & SO), 1 $\[mac.$], on dead leaves, 13–VIII–1990 (TN & SO); 3 $\[mac.$], 1 $\[mac.$], 1 $\[mac.$], and dead leaves and branches, 12–IX– 1990 (TN & SO); 3 $\[mac.$], 1 $\[mac.$], 2 (apt.), 1 (apt.), 1 (apt.), 1 (apt.), 1 (apt.)], 3–VIII–1990 (TN & SO); 3 $\[mac.$], 1 $\[mac.$], 2 (apt.), 1 (apt.)], 1 (apt.)], 3–VIII–1990 (TN & SO). Singapore: Macritchie Reservoir, on dead branches, 1 (apt.)], 3–VIII–1990 (TN & SO). 3 $\[mac.$], 3 $\[mac.$], 8 $\[mac.$], 8 $\[mac.$], 7–VIII–1990 (TN & SO), 3 $\[mac.$], 4 (apt.)], 7–VIII–1990 (TN & SO), 3 $\[mac.$], 3 $\[mac.$], 3 $\[mac.$], 3 $\[mac.$], 4 (apt.)], 3–VIII–1990 (TN & SO). 3 $\[mac.$], 3 $\[mac.$], 4 (apt.)], 3–VIII–1990 (TN & SO). 3 $\[mac.$], 3 $\[mac.$], 4 (apt.)], 7–VIII–1990 (TN & SO), 3 $\[mac.$], 3 $\[mac.$], 3 $\[mac$

Non-paratypical material. West Malaysia: $1 \Leftrightarrow (apt.)$, foot of Cameron Highland, 22 km NE of Tapah, on dead leaves and branches, 16-IX-1990 (TN & SO).

Distribution. Thailand (Phuket Is.); West Malaysia; Singapore.

Remarks. This new species is somewhat similar to *S. conradi* HOOD, 1933, from the New World, which is the type species of the genus, in the long head and well developed vertexal setae. However, it can easily be distinguished from *conradi* by the absence of well developed anteocellar setae. Moreover, the sense-cone formula of the third and fourth antennal segments (one on III and three on IV) and comparatively long median setae (B1) on the ninth terga are peculiar to this species in the genus. These two features seem to be intermediate between the genera *Stegothrips* HOOD, 1934, and *Strepterothrips*.

The specific name is given after Dr. Shun-Ichi UéNo, who has given me continuous guidance and encouragement, in commemoration of his retirement from the National Science Museum (Natural History), Tokyo, in March 1995.

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A New Cuculliine Moth of the Genus Sugitania (Lepidoptera, Noctuidae) from Taiwan¹⁾

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Abstract A new species of the noctuid genus *Sugitania* is described and illustrated from Taiwan under the name of *S. uenoi*. The new species is very similar in general appearance to those of the other three species, *S. lepida*, *S. clara* and *S. akirai*, distributed in Japan, but the male genitalia are unique for this species.

The cuculliine genus Sugitania was established by MATSUMURA (1926) as a monotypic genus, with the type species Sugitania maculifera MATSUMURA, 1926, from Kyoto and Kobe, western Honshu. In the revisional work on some Japanese cuculliine noctuids, SUGI (1958) synonymized S. maculifera with Graphiphora lepida BUTLER, 1879. Although the moths of Sugitania had long been regarded as a single species endemic to the Japanese Islands (SUGI, 1982), they were split up by SUGI (1990) into three species, S. clara SUGI, 1990, from Hokkaido, Honshu, Shikoku and Kyushu, S. lepida from Honshu (central and southwestern areas), Shikoku, Kyushu, Tsushima, Yakushima Is., and northern Vietnam (Tam Dao), and S. akirai SUGI, 1990, from Honshu (Aichi, Osaka), Shikoku (Tokushima) and Kyushu (Ôita).

In the middle of January 1992, I made a collecting trip to mountains of Taiwan for surveying moths of warm temperate forests in the winter. This trip was the final survey of the "Zoogeographical Study on the Derivation and Characteristics of the High Altitude Fauna of Taiwan" conducted by the National Science Museum, Tokyo, in cooperation with the National Taiwan University, Taipei, in 1989–1992 under the leadership of Dr. Shun-Ichi UÉNO, and was successful in collecting many interesting winter flyers, some of which were reported in detail (KISHIDA, 1993; OWADA, 1993; OWADA, HORIE & KOBAYASHI, 1993; OWADA & KOBAYASHI, 1993; OWADA, 1994 a, b; NAKAJIMA, 1994). In this paper, I am going to describe a new species of the noctuid genus *Sugitania*.

Before going further, I wish to express my hearty thanks to Dr. Shun-Ichi UÉNO for his continuous kindness in reading my original manuscripts and in giving me invaluable advice. It is a great pleasure for me to dedicate this paper to him for commemorating his retirement from the head of the Department of Zoology, the National Science Museum, Tokyo. My thanks are also due to the following entomologists for

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Sugitania uenoi sp. nov.

(Figs. 1, 6)

Male (Fig. 1). Length of forewing: 15 mm; expanse: 30 mm.

Antenna slightly ciliate. Second segment of labial palpus tufted with dark brown and blackish long scales, third segment long, porrect, smoothly scaled. Head ochreous brown, patagia ochreous brown, with blackish edge; thorax dark brownish grey.

Forewing dark brown, slightly tinged with purplish red; costal area creamy ochre, partly dusted with dark brownish scales, small black dot present at basal 2/3 of costa; median black stigma well developed, terminal edge slightly concave; orbicular stigma with a black dot at the centre; reniform stigma indistinct; transverse lines somewhat indistinct; cilia dark brown, with a pale basal line. Hindwing darker than forewing; cilia as in the forewing.

Male genitalia (Fig. 6):— Uncus simple, curved, pointed at apex. Tegumen moderately slender, peniculus indistinct; vinculum long, rather broad. Valva asymmetrical; costa broadly sclerotized, extending to a flattened large ampulla, the margin of which is irregularly waved; harpe short, broad, with blunt apex; cucullus with beak-shaped apex, membranous portion rather broad; sacculus markedly bulged, with a large sclerotized projection in dorso-basal portion, without processus of sacculus. Aedeagus slightly curved; everted vesica cylindrical, markedly curved at the middle, with membranous small triangular projections; a weakly sclerotized short spine present at distal end of everted vesica.

Female. Unknown.

Type series. Holotype, ♂, Taiwan, Taoyuan, Fuhsing, Suleng, 1,000 m in alt., 23–I–1992, Mamoru OwaDa leg., genitalia slide no. NSMT 2209 ♂, preserved in the National Science Museum, Tokyo.

Remarks. The wing maculation of the members of *Sugitania* is very similar (Figs. 1–5). Although only a single male has been collected from Taiwan, *S. uenoi* is characterized first by the small size, forewing length: 15 mm, expanse: 30 mm, which are almost of the same as those of the smallest species, *S. akirai*, forewing length: 14 mm; expanse 30 mm (SUGI, 1990). In the forewing maculation, this species is distinguished from the other species of *Sugitania* by the following points: 1) the costal area is creamy ochre, while it is pale purplish grey in *S. akirai* (Fig. 5), and reddish ochre in the dark form of *lepida* (Fig. 4); 2) the transverse lines somewhat indistinct, while they are traceable in the others. As was described by SUGI (1990), the subterminal line of *S. clara* (Fig. 2) is almost straight, and is always clearly associated with



Figs. 1–5. Moths of Sugitania. — 1, S. uenoi OWADA, sp. nov., ♂, holotype; 2, S. clara SUGI, ♂, Sodeyama, Iwate, 14–X–1982; 3, S. lepida (BUTLER), ♀, pale form, Kobe, 12–XII– 1994; 4, ditto, ♂, dark form, Tsushima, 19–XII–1992; 5, S. akirai SUGI, ♂, Mt. Sanageyama, Toyota, 11~12–XI–1994. Scale: ca. 10 mm.

two blackish points between the veins M_1 and M_3 , while that of *S. lepida* is more or less indented inwards on the vein M_2 , and is mostly associated with three loose blackish points. Although the holotype of *S. uenoi* is a little worn, its general appearance is most closely similar to that of the pale form of *S. lepida* (Fig. 3), but the subterminal line and the associated points are hardly traceable.

In the male genitalia, *S. uenoi* can be more easily separated from the others. In *S. clara* (Fig. 9), the sacculus bears a short processus which is absent in the others. The ampulla of *S. uenoi* is markedly developed, and is somewhat similar to that of *S. lepida* (Fig. 7), but its margin is smooth in the latter species instead of being waved in the former. The genitalia of *S. akirai* (Fig. 8) are the smallest, and the left ampulla is very short. The vinculum of *S. uenoi* is long and broad, while it is slender in the other species.

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Figs. 6-7. Male genitalia of Sugitania. — 6, S. uenoi OwADA, sp. nov., holotype; 7, S. lepida (BUTLER), NSMT 2353.

New Sugitania Moth from Taiwan



Figs. 8–9. Male genitalia of Sugitania. — 8, S. akirai SUGI, NSMT 2352; 9, S. clara SUGI, NSMT 2229.

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Occurrence of a New Carabid Beetle (Coleoptera, Carabidae) from the Northeastern End of Sichuan Province, Central China

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Abstract A new species of the genus *Carabus* (s. lat.) belonging to the Multistriati is described from the Dabashan Mountains near the northeastern end of Sichuan Province in Central China. It is peculiar in having a combination of hypertrophic apical tooth of the right mandibular retinaculum and quadrisetose penultimate segment of the labial palpus, and a new subgenus is proposed to place it, though the male is unknown. The new name given is *Carabus* (*Shunichiocarabus*) uenoianus.

Although not a few species or subspecies of the genus Carabus (s. lat.), both described and undescribed, from the western half of Sichuan Province in Central China have been introduced to science in recent years, the carabid fauna of the northeastern part of the same province is least known as yet. Recently, two female specimens of a very strange carabid beetle were collected on the Sichuan side of the Dabashan Mountains, stretching along the borders between the northeastern end of Sichuan Province and the southernmost part of Shaanxi Province, and were brought to me for identification and taxonomic study. At first sight, it looked like a member of Pseudocranion, and was similar in facies to one of the most specialized species, Carabus (Pseudocranion) benjamini SEMENOW known from northern Sichuan and southern Gansu, but evidently differed from it in having extraordinarily enlarged apical tooth of the right mandibular retinaculum. It seems to have certain relationship to some other Chinese subgenera, e.g., Pseudocoptolabrus of Yunnan, Lasiocoptolabrus of Shaanxi, Eccoptolabrus of Sichuan, Gansu and Shaanxi, Megodontoides and Aristocarabus of Sichuan, and Acoptolabrus of the northeastern territory, but is distinguished from all of them by the feature of the right mandibular retinaculum, the number of setae on the penultimate segment of the labial palpus, the shape of the median tooth of the mentum, the sculptural condition of the elytra, and the basic structure of the inner plate of the ligular apophysis, etc., above all by the combination of the former two characters. The difference may allow the species under consideration to hold its new taxonomic status not only at the specific level but also subgeneric, and I am going to describe it under a new subgenus in view of its taxonomical and zoogeographical importance, though the two female specimens now at my hand are not sufficient for determining its true affinity.

To commemorate the retirement of Dr. Shun-Ichi Uéno from the directorship at

Yûki Imura

the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo, both the new names given to the subgenus and species are dedicated to him, who has always been very kind in reviewing the manuscript of my entomological papers including the present one, and has continuously encouraged my studies on carabid beetles since nearly seven years.

The abbreviations used in this article are the same as those explained in previous papers of mine.

Before going further, I wish to express my deep gratitude to Dr. O. L. KRYZHANOVSKIJ of the Zoological Institute in the Academy of Sciences, St. Petersburg, for kindly permitting me to examine many type specimens of carabid beetles from China and Central Asia preserved in that institute under his genial care. Special thanks are also due to Messrs. Wakô KITAWAKI, Osaka, Boleslav BŘEZINA, Praha, and Kiyo-yuki MIZUSAWA, Yokosuka, for their kind help in various ways.

Subgenus Shunichiocarabus IMURA, nov.

Type species: Carabus (Shunichiocarabus) uenoianus subgen. et sp. nov.

Medium-sized carabid beetle presumably belonging to the Multistriati, with large head, strongly cordate pronotum, roughly sculptured dorsal surface, and comparatively long and slender extremities.

Head large and thick. Mandible rather long and slender, gently arcuate and tapered towards apex which is not so acutely hooked inwards. Retinaculum of right mandible bidentate, with the apical tooth extraordinarily hypertrophic and subquadrate in shape in dorsal view, basal tooth much smaller and triangularly protruded inwards. Retinaculum of left mandible also bidentate though much smaller, with the apical tooth subequal in length to the basal, the apices of which are visible beyond the inner margin of left mandible in dorsal view. Apical segment of galea not so elongate and moderately concave inwards, with the dorsal margin not so sharply edged in basal half and only shallowly emarginate in apical half. Penultimate segment of labial palpus quadrisetose. Median tooth of mentum neither forming a vertical ridge nor protruding ventrad. Submentum asetose. Pronotum strongly cordate and wider than long, with a single median seta along the margin. Elytral sculpture triploid heterodyname; primaries the strongest, composed of rows of callosities; secondaries less strongly raised and much more frequently segmented than primaries; tertiaries only partly recognizable as irregularly set rows of granules which show a tendency to fuse with primary callosities; elytral surface between intervals coarsely granulate. Metacoxa bisetose, proximal setae absent. Sternal sulci also absent. Inner plate of ligular apophysis well sclerotized, round in shape, strongly concave and cup-like.

Male genitalia unknown.

Range. Known so far only from the northeastern end of Sichuan Province in Central China.

Notes. As shown in Figs. 2–9, the present new subgenus is distinguished from the

other related subgenera mainly by having the combination of hypertrophic apical tooth of the right mandibular retinaculum and quadrisetose penultimate segment of the labial palpus. Also it may have a remote affinity with the subgenus *Nigracoptolabrus*, consisting of only one peculiar Myanmar species, *burmanensis* BREUNING, but the latter has normally bidentate right mandibular retinaculum and has only two setae on the penultimate segment of the labial palpus.

Carabus (Shunichiocarabus) uenoianus IMURA, subgen. et sp. nov.

(Figs. 1-2)

Length: 23.5–23.6 mm (from apical margin of clypeus to apices of elytra), or 26.6–26.7 mm (including mandibles). Width: 9.4–9.5 mm. Reddish coppery or dark reddish coppery and not shiny, except for bottoms of primary foveoles which are yellow-greenish with metallic lustre; elevated parts of head, pronotum and elytral intervals black; venter, legs and appendages also black.

Head large and thick, with protrudent eyes which are comparatively small; apical margin of labrum deeply emarginate; clypeus rhomboidal in shape, with the sides narrowed towards apex, apical margin shallowly emarginate, basal margin subequal in length to labrum; frontal furrows distinct, their posterior margins reaching apical third of eyes, with the surface sparsely punctate and irregularly rugulose on the basal halves; frons slightly convex above, with the surface strongly and irregularly rugose; mandibles as described under the subgenus, and their surface irregularly scattered with small punctures and obliquely set shallow wrinkles especially in the left one; apical segment of galea also as described under the subgenus; apical segment of palpus weakly but obviously dilated, more strongly so in labial one; penultimate segment of labial palpus quadrisetose in the two type specimens; median tooth of mentum shorter than lateral lobes and triangularly pointed though the apex is not sharply pointed; submentum asetose, with the surface glabrous; antennae barely reaching the middle of elytra in female, and relative lengths of scape and segments 2–4 as follows:— 1: 0.7: 0.9: 0.7.

Pronotum strongly cordate, wider than long, widest at about apical three-elevenths, and much more strongly contracted towards base than towards apex; PW/HW 1.27–1.30, PW/PL 1.32–1.33, PW/PAW 1.32–1.42, PW/PBW 1.48–1.55, PAW/PBW 1.09–1.12; apical margin moderately emarginate; front angles obtusely rounded and hardly produced anteriad; sides gently rounded in front, strongly sinuate behind, and sub-parallel-sided before hind angles which are subtriangularly protrudent posteriad, with the apices not so sharply pointed; disc slightly convex above, with subtriangular apical impression, roundly shaped impressions near front angles, and irregularly shaped basal impression along mid-line; surface irregularly foveolate and partly scabrous, and sparsely covered with small granules; median longitudinal line narrow but evidently impressed throughout; basal foveae small, almost roundly shaped and very shallowly concave; only one marginal seta inserted near the middle of pronotal margin, and basal

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seta is absent.

Elytra elongate oval, strongly convex above, widest a little behind the middle, more gradually narrowed towards bases than towards apices, with the shoulders not so distinct; EW/PW 1.65–1.71, EL/EW 1.56–1.62; preapical emargination faintly recognized in female; sculpture triploid heterodyname; primaries the widest and most strongly convex above, frequently interrupted by large, but not so deep primary foveoles as to form rows of elliptical callosities with various lengths, on whose surface is visible distinct microsculpture; secondaries much narrower, less strongly raised, and much more frequently interrupted by secondary foveoles which are shallower and much smaller than primary ones; tertiaries as described in the subgenus; striae between intervals slightly recongnizable mainly at bottoms of primary foveoles; elytral surface between intervals densely covered with small granules.

Pro- and mesepisterna smooth, metepisterna and sides of sternites irregularly rugose; sternal sulci absent; metacoxa bisetose, proximal setae absent; legs long and slender.

Outer plate of ligular apophysis in female genitalia with the sclerotized part oblong



Fig. 1. Carabus (Shunichiocarabus) uenoianus IMURA, subgen. et sp. nov., ♀ (holotype), from Bashan on the Dabashan Mountains in the northeastern end of Sichuan Province near Shaanxi borders, Central China.

New Carabid Beetle from Northeastern Sichuan



Figs. 2–9. Right mandible (a, dorsal view, black-shaded parts indicate retinaculum) and right labial palpus (b, right subdorsal view) of Carabus (s. lat.) spp. (♀). — 2, Carabus (Shunichiocarabus) uenoianus IMURA, subgen. et sp. nov., from Sichuan; 3, C. (Pseudocranion) gansuensis SEMENOW, from Gansu; 4, C. (Pseudocoptolabrus) taliensis FAIRMAIRE, from Yunnan; 5, C. (Lasiocoptolabrus) sunwukong IMURA, from Shaanxi; 6, C. (Eccoptolabrus) exiguus fanianus IMURA, from Shaanxi; 7, C. (Megodontoides) promachus konkerianus BREUNING, from Sichuan; 8, C. (Aristocarabus) viridifossulatus FAIRMAIRE, from Sichuan; 9, C. (Acoptolabrus) schrencki MOTSCHULSKY, from Ussuri. Scale: 1 mm.

in shape, widest near the apex, with posterior margin re-entrant at the middle: inner plate well sclerotized, almost round-shaped, strongly concave, and cup-like.

Male unknown.

Type series. Holotype: \mathcal{Q} , 1,600–1,900 m alt., near Bashan on the Dabashan Mountains in Chengkou Xian (Wanxian Diqu), northeastern end of Sichuan Province near the Shaanxi borders, Central China, in coll. Department of Zoology, National

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Science Museum (Nat. Hist.), Tokyo. Paratype: $1 \, \bigcirc$, same locality as for the holotype, in coll. K. MIZUSAWA.

Notes. As has been mentioned in the introduction, this new species is similar in general appearance to Carabus (Pseudocranion) benjamini SEMENOW at first sight. However, the former is readily discriminated from the latter not only at specific level but at subgeneric, mainly by the characteristic shape of the apical tooth of the right mandibular retinaculum, which is constantly shorter than, or at most subequal in length to the basal tooth in all the members of *Pseudocranion*. Besides, the former has less effaced shoulders and much more roughly sculptured dorsal surface, with the tertiary intervals of elytra showing a tendency to fuse with the primaries. Also it bears a striking resemblance to two peculiar Shaanxi species, namely, *C. (Eccoptolabrus) exiguus fanianus* IMURA, and *C. (Lasiocoptolabrus) sunwukong* IMURA, in coloration and sculptural condition. It is worth noting that the new species and the latter two inhabit two adjoining mountain ranges, the Dabashans and Qinlings, respectively, though the two ranges are divided by the Riv. Han Shui, one of the largest branch of the Riv. Chang Jiang.

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A New Apterous Tachyine (Coleoptera, Carabidae, Bembidiinae) from Northern Vietnam¹⁾

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Abstract A new species of the tachyine genus *Elaphropus* is described from a high mountain of northern Vietnam. It seems related to *E. haliploides*, but is readily recognized on atrophy of hind wings and differently shaped male genitalia.

Participating in an entomological expedition to northern Vietnam made by the National Science Museum, Tokyo, under the leadership of Dr. Shun-Ichi UÉNO, I came across a very small tachyine carabid beetle on a high mountain near the north-western border of the country. It looked like *Elaphropus haliploides* (H. W. BATES) (1892, p. 289; ANDREWES, 1925, pp. 471, 478), but a close examination revealed that the beetle is flightless and different from the well known species also in configuration of its male genitalia. It is doubtless a new species and is described in the present paper.

It is a great pleasure for me to dedicate this paper to Dr. UÉNO for commemorating his retirement from the head of the Department of Zoology, National Science Museum, Tokyo. He has always supervised my studies on the Coleoptera, read manuscripts of my papers and refined them. Were it not for his wide knowledge of ground beetles and rich collection of literature and material at his department, I could never have completed this study. He also took me along to expeditions to various parts of East Asia, which greatly enriched my experience in field works.

I also wish to thank all the members of the expedition 1994 for their kind support of my study. Deep gratitude is expressed to Mr. Sumao KASAHARA, who prepared the fine habitus drawing inserted in the present paper.

The abbreviations used herein follow those of Uéno's repeatedly explained in his papers.

Elaphropus shunichii A. SAITO, sp. nov.

(Figs. 1-2)

Length: 1.73–1.99 mm (from apical margin of clypeus to apices of elytra). Probably related to *E. haliploides* (H. W. BATES), but readily recognized on atro-

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Fig. 1. *Elaphropus shunichii* A. SAITO, sp. nov., 3, from the Hoang Lien Son Mts. in northern Vietnam. [CBM-ZI 33901] (Scale 0.5 mm.)

phy of hind wings, atrophy of elytral dorsal pore, hardly arcuate and apically dilated aedeagus with small basal part, and elongate biramous copulatory piece with the left branch not recurved at the proximal part.

Male. Body short and broad, well convex on dorsum, and glabrous throughout; surface polished and devoid of microsculpture; inner wings absent. Colour dark brown, head, prothorax, and small humeral portions of elytra usually reddish, elytra sometimes infuscate towards apices; venter of hind body blackish, especially at the lateral parts; proximal segments of antennae and legs pale yellowish brown, palpi and segments 3–11 or 4–11 of antennae infuscate.

Head with large convex eyes and very short genae; frontal furrows single, deep and straight, gently diverging behind and not reaching the mid-eye level; frons moderately convex; neck constriction deep and sharply marked at the sides; antennae short,

subfiliform, usually extending a little beyond basal sixth of elytra, segment 2 about as long as segment 3, segments 5–8 each elongated subovoid and about 2.5 times as long as wide, terminal segment the longest.

Pronotum transverse, much wider than head, much wider than long, widest slightly before the middle, and much more strongly contracted towards apex than towards base; PW/HW 1.46–1.51 (M 1.48), PW/PL 1.53–1.63 (M 1.58), PW/PA 1.56–1.64 (M 1.60), PW/PB 1.13–1.16 (M 1.15); sides finely bordered throughout, well rounded for the most part, especially near the widest part, briefly sinuate just before hind angles, and then more or less convergent towards them, which are either rectangular or somewhat obtuse; two pairs of marginal setae well developed; apex anteriorly arcuate, much narrower than base, PB/PA 1.35–1.41 (M 1.39), with front angles obtuse and hardly produced; base bisinuate, with the median part arcuately produced backwards; dorsum strongly convex, with a very fine median line reaching neither apex nor base; basal transverse impression fairly deep, finely crenulate, with a foveole on each side of median line, and laterally extending to the bottoms of basal foveae, which are relatively large and deep; basal area smooth; no postangular carinae.

Elytra strongly convex, short ovate, widest at about four-ninths from bases, and more gradually narrowed towards bases than towards apices; EW/PW 1.35–1.38 (M 1.37), EL/EW 1.28–1.30 (M 1.29); shoulders effaced; basal border meeting with the prehumeral one at an obtuse angle opposite to pronotal hind angle; sides smooth, moderately explanate except for humeral part, feebly arcuate behind shoulders, more strongly so behind, and very slightly emarginate before apices, which are somewhat produced and rather pointed; only stria 1 distinct on the disc though abbreviated before reaching base, finely crenulate, stria 8 deeply impressed behind the middle set of marginal umbilicate pores, others obsolete; scutellar striole short but deep; apical striole also short but deep, inwardly curved at the anterior end, which is a little closer to side margin than to suture; dorsal pore usually present on the site of stria 3 slightly after the middle, but very minute, asetose and often vanished.

Prosternum not medially sulcate but obtusely ridged, though the prosternal process is finely lined in apical half; metasternal process with a deep arcuate groove, which makes the triangular metasternal process sharply defined; anal sternite rather narrowly rounded at apex and bisetose.

Legs thin; tarsi fairly slender; protarsal segments 1 and 2 hardly dilated, though slightly denticulate inwards at apices and provided beneath with a few adhesive appendages; claws with vestiges of denticulation in basal halves.

Male genitalia small and poorly sclerotized. Aedeagus about one-third as long as elytra, high and compressed, hardly arcuate, and gradually dilated towards apical orifice, with small basal part rather abruptly curved ventrad and short apical lobe slightly curved ventrad; basal part low, narrowly produced in profile and narrowly rounded at the proximal end; viewed laterally, apical lobe narrow, nearly parallelsided, and blunt at the tip. Inner sac armed with a narrow copulatory piece at the proximal part, which is proximally biramous; left ramus nearly straight at the middle Akiko Saito



Fig. 2, Male genitalia of *Elaphropus shunichii* A. SAITO, sp. nov., left lateral view, with separated left paramere. [Paratype, NSMT]

part and ventrally curved at the two ends, the proximal end being acute; right ramus bisinuate, with the proximal part strongly recurved; an oval, lightly sclerotized field present attaching to the apical end of copulatory piece. Styles rather short and narrow, each bearing two setae at the tip and two other setae along the ventral margin just before apex.

Female. Unknown.

Type series. Holotype: ♂, 9–X–1994 [NSMT]. Paratypes: 1 ♂, 8–X–1994 [NSMT], 1 ♂, 8–X–1994 [CBM–ZI 33901], 1 ♂, 9–X–1994 [NSMT], 1 ♂, 9–X–1994 [CBM–ZI 33902], all A. SAITO leg.

The holotype and two paratypes are deposited in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo [NSMT]. The remaining two paratypes are preserved in the collection of the Natural History Museum and Institute, Chiba [CBM].

Type locality. Hoang Lien Son Mts., near the pass to the north of Mt. Phang Si Pang, 1,880 m in altitude, in Lao Cai Province of northern Vietnam.

Notes. This new species is peculiar in having large hemispherical eyes in spite of atrophy of hind wings. In many respects, it resembles *E. nipponicus* (HABU et BABA) (1967, p. 63, figs. 1–2; MORITA, 1985, p. 91, pl. 17, fig. 20) from Japan, but the body is obviously darker in coloration, the elytral dorsal pore is degenerated, and the male genitalia are different in configuration. Perhaps the resemblance between the two species is a mere convergence due to reduction of hind wings.

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Unlike many other apterous ground beetles, *Elaphropus shunichii* occurs in rather an open place. All the specimens of the type series were found from beneath stones lying in a narrow grassy patch of ground along the road leading to the pass north of Mt. Phang Si Pang. The ground was not particularly humid, and was considerably different from usual habitats of many other tachyine carabids. This is probably why the species was not collected by other members of the expedition, who were looking for trechines and other things in wetter spots.

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Notes on Some Anillines (Coleoptera, Carabidae, Bembidiinae) from Southeastern United States, with Descriptions of a New Genus and Two New Species

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Abstract The anilline genus Anillinus is characterized and its type species is established as A. fortis (HORN), a senior synonym of A. carolinae CASEY and an abundant species in the northeastern Unaka mountains. Troglanillus JEANNEL is a synonym of Anillinus. Anillinus steevesi sp. nov., is described from northwest Georgia. Serranillus gen. nov., is described from the North Carolina and Georgia mountains, with type species Serranillus jeanneli sp. nov.

The eyeless, depigmented carabids of the tribe Anillini (subfamily Bembidiinae) were reviewed by JEANNEL (1963 a, b). A total of 21 species, arranged in six genera, were listed for North America; but the number and diversity of species and genera in more carefully explored areas — notably Europe, central Africa, and Madagascar — suggests that this is only a small fraction of the North American fauna. VIGNA TAGLIANTI (1973) treated some anilline genera from Guatemala and southern Mexico. Anillines inhabit damp, cool soil in forested areas which were not subject to Pleistocene glaciation. They can be taken by hand from under large, deeply embedded stones on mountain slopes or in ravines, but the use of Tullgren or Berlese funnels often produces large series. Their small size (1.3–3.2 mm) and sporadic occurrence have contributed to their having remained a poorly known group in North America, where very few specimens have found their way into museum collections. Their occurrence at the base of the A zone of the soil profile, where they are more readily discovered, is directly related to soil moisture content, which fluctuates considerably depending upon local rainfall.

The high annual rainfall in the Unaka mountain region (North Carolina, Tennessee, and adjacent states) causes anillines to appear much more abundant in that region. As I showed for other carabid groups (BARR, 1969, 1985), species diversity in the Unaka region is much higher west of the Asheville basin than it is east of the Asheville basin, and this is conspicuously reflected among anillines of the region. Anillines are true edaphobites (COIFFAIT, 1958; JEANNEL, 1965), restricted to the soil and incapable of existing in other habitats. At least one species, *Anillinus* [=*Troglanillus*] valentinei (JEANNEL), is regularly cavernicolous and may be a troglobite. The type locality for *Anillaspis explanatus* HORN is a California cave, and anillines are not uncommon in caves of southeast Tennessee and northern Alabama; but usually their

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occurrence in caves is sporadic and of no greater ecological import than the occurrence of earthworms and soil arthropods in the same habitat.

In continental United States, anillines have previously been reported from the Unaka mountain region, the Valley and Ridge province (=Appalachian valley), the Interior Low Plateaus, and the Piedmont, as well as from the Balcones fault zone area of central Texas and the Sierras and Coastal ranges of California. Material currently in my collection awaiting description includes specimens from peninsular Florida, Puerto Rico, Virgin Islands, Oaxaca, Arkansas, Arizona, and southern Idaho. In BALL's key to genera of Bembidiini of America north of Mexico, all of these anillines key out to "Anillinus" in the second couplet. Most eastern specimens do, in fact, belong to Anillinus (with the exception of the new genus described below), and most western specimens belong to Anillodes (TX, AZ, CA, ID) (with the exception of Anillaspis in central California). The Caribbean material, however, is not Anillinus, nor does it belong to the Anillinus series. Other anilline species likely to come to the attention of North American coleopterists are Stylulus nasutus SCHAUFUSS, from the Virgin Islands, and Typhlonesiotes swaluwenbergi JEANNEL, from Oahu, Hawaii (cf. JEANNEL, 1963 a, 136–146).

The small size of anillines and the striking diversity of their male genitalia require dissection, clearing, and mounting; most aedeagi, for example, are typically 0.2–0.4 mm in length. I have found that dissection of whole specimens in a drop of polyvinyl alcohol/lactophenol on a glass slide is quite satisfactory; the parts, after positioning, are sealed under a $\#000\ 12\ mm$ cover slip. It is desirable to remove the parameres and position them alongside the median lobe of the aedeagus; by not doing so, JEANNEL (1963 a), relying on poorly preserved material, failed to realize that all species of *Anillinus* have a right paramere, often of diagnostic significance. I usually sketch the outline of the apex of the median lobe in dorsal view before permanent mounting, then mount in left lateral view.

It is a great pleasure and distinct honor to dedicate this paper to my good friend and eminent colleague, Dr. Shun-Ichi UÉNO. Harrison STEEVES, JR., and Stewart B. PECK provided many anilline specimens for study, and I am grateful for loan of specimens from the National Museum of Natural History, Washington, DC., and the Academy of Natural Sciences, Philadelphia.

Anillinus CASEY

CASEY, 1918, 167 (subgenus). Type species, Anillus (Anillinus) carolinae CASEY, by original designation (= Anillus fortis HORN, 1868). — JEANNEL, 1937, 349 (genus); 1963 a, 71.

Troglanillus JEANNEL, 1963 b, 147. Type species, Troglanillus valentinei JEANNEL, 1963 b. Syn. nov.

Form:— Short and rather slender, flattened to subconvex, microsculpture predominantly isodiametric; generally pubescent; no trace of eyes.

Head:— Frontal impressions, but no deep grooves; lateral carinae moderately developed; maxillary palps with penultimate segment elongate and relatively slender;

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labium: mentum free, mentum tooth present.

Pronotum:- Posterior marginal setae present.

Elytra:— Usually ovoid, sutural angles sharp, \pm convex, microsculpture isodiametric, 3 discal punctures; umbilicate series of type A, the 8th and 9th close together, "geminate"; abdomen with last visible sternite having apical margin entire; epipleural margin usually (rarely feebly) not crossed; subhumeral margin crenelate.

Legs:— Males with first protarsomere enlarged, with adhesive setae beneath; protarsi pentamerous. Males normally with metafemora unmodified or with small tubercle on ventral face (exception: northwest Arkansas, undescribed species); females normally with metafemora unmodified.

Aedeagus:— Median lobe \pm tubular, apex generally transversely oblique; right paramere small but always present, not obviously styliform, usually with apical setae; left paramere large, \pm laminar, often complex, definitely conchoidal rather than styliform, with or without a few small apical setae; copulatory pieces variable, most often including an elongate filament originating from one to 3–4 basal bulb-like structures, but also sometimes including a wide, blade-like sclerite with an apical crochet, 2–3 digitiform apical sclerites, and 6 to 25–30 heavy spines.

Anillinus fortis (HORN)

(Fig. 1)

Anillus fortis HORN, 1868, 127; type from "mountainous regions of Eastern Tennessee," in Academy of Natural Sciences, Philadelphia.

Anillinus fortis: JEANNEL, 1937, 352; 1963 a, 75 (in part).

Anillus (Anillinus) carolinae CASEY, 1918, 168; type from Black Mountains, North Carolina, in National Museum of Natural History, Washington. — JEANNEL, 1963 a, 76. Syn. nov.

The single most widely prevalent species of the Unaka mountain region east of the Asheville basin is HORN's Anillus fortis, of which A. carolinae is a junior synonym. HORN (op. cit.) notes that the type specimen came from Ulke, "collected by Mr. FUCHS in the mountainous regions of Eastern Tennessee"; this could have been anywhere from Camp Creek Bald to Roan Mountain or even the Virginia border near Mt. Rogers (see BARR, 1969, 1985 for discussion of the major mountain regions of the Unaka region); I have taken A. fortis in all these places and several other localities in between. The specimen from the vicinity of Nashville, mentioned by JEANNEL 1963 a (p. 76), is certainly not conspecific with the Unaka area species 250–350 km to the east, and its identity and affinities must await discovery of fresh material. The low diversity of anillines east of Asheville (A. fortis) and much greater diversity west of Asheville (2 genera and several species) is paralleled by other carabid groups. The Mount Pisgah specimens cited by JEANNEL (op. cit.) belong to an undescribed species; Mount Pisgah is across the Asheville basin (southwest) from the Black Mountains and was incorrectly placed in the Blacks by JEANNEL.

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Fig. 1. Anillinus fortis (HORN), Great Craggy Mountains, Buncombe Co., North Carolina. 1 a, Aedeagus, 0.45 mm; 1 b, right paramere; 1 c, dorsal profile of apical shelf; 1 d, detailed view of transfer apparatus and apex of aedeagus.

Anillinus valentinei (JEANNEL), comb. nov.

Troglanillus valentinei JEANNEL, 1963 b, 148; type from Manitou Cave, Fort Payne, DeKalb Co., Alabama, in National Museum of Natural History, Washington.

Troglanillus was established because of a series of 20–30 large spines within the internal sac of the aedeagus; otherwise, the genus was said to possess "absolument les même caractères généraux et chétotaxiques..." (JEANNEL, 1963 b, 147). *Troglanillus*
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valentinei is apparently a true troglobite distributed throughout the caves of northeast Alabama, east of the Wills Creek anticline. However, a group of about 6 similar spines is found near the apex of the internal sac in *Anillinus dunavani*, and an undescribed sister species with numerous spines has recently been collected from eastern Kentucky and adjacent Tennessee. The sclerites of the internal sac are varied, according to groups of species, in *Anillinus*, but in this case I prefer to stress the similarity of *Troglanillus* to *Anillinus* and to demonstrate the possible derivation of its spiny armature by a feasible intermediate stage as found in *A. dunavani*.

Anillinus steevesi sp. nov.

(Fig. 2)

Length 1.7–1.8 mm. Subconvex, pubescence short and very sparse, crenelations at hind angles of pronotum and at elytral margins feeble, elytra with evident longitudinal striae. Head with frontal grooves and frontal carinae very short; antennae scarcely attaining humeri when laid back. Pronotum with sides rounded in apical half, oblique in basal half; hind angles obtuse. Elytra with humeri prominent but slightly rounded, prehumeral border perpendicular to midline; 9th umbilicate puncture posterolateral to 8th umbilicate. Aedeagus 0.38–0.40 mm long, arcuate, with slight



Fig. 2. Anillinus steevesi sp. nov., Cloudland Canyon State Park, Georgia. 2 a, Aedegus, 0.40 mm; 2 b, right paramere; 2 c, dorsal profile of apical shelf.

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constriction behind basal lobes, apical blade with finger-like projection on right corner; ventral surface of median lobe with 14–18 short, stiff setae; internal sac with a small dorsal patch of dense scales and a short, U-shaped sclerite, the filament unusually long and slender, originating from a rather small bulb-like structure; right paramere small, paddle-shaped, with a few apical setae; left paramere large and conchoidal, bearing 2–3 setae at apex.

Holotype: Male (Carnegie Museum of Natural History) and numerous paratypes, Cloudland Canyon State Park, Dade County, Georgia, April 14, 1963, H. R. STEEVES, JR.; additional paratypes from the same locality, June 17, 1963 (H. R. STEEVES, JR.).

This species is immediately distinguished from all other known species of anillines in the United States by the form of the aedeagus and its conspicuous ventrolateral setae on the aedeagus. It bears the name of its discoverer, Harrison R. STEEVES, JR., friend and colleague from Birmingham, Alabama.



Fig. 3. Anillinus dunavani JEANNEL, Pisgah Lodge, Transylvania Co., North Carolina, 2.5 mm.

Anillinus dunavani JEANNEL

(Figs. 3-4)

JEANNEL, 1963 a, 76; type from Rocky Bottom, Sassafras Mountain, Pickens Co., South Carolina, in National Museum of Natural History, Washington.

This species is one of the larger (2.0–2.5 mm) and most abundant species of anillines in the Great Balsams/Pisgah Ledge, the Nantahala Mountains, the southern Great Smoky Mountains, and points south, including Sassafras Mountain, South Carolina, the type locality. It is readily diagnosed by the prominent blade-like expansion of the apex of the aedeagus, which bears a conspicuous tooth. It is a rather convex species, with transverse-subquadrate pronotum and gradually tapering elytra. I have taken it in the mountains of Rabun and Towns counties, Georgia, and in Haywood, Macon, Swain, and Transylvania counties, North Carolina.



Fig. 4. Anillinus dunavani JEANNEL. 4 a, Aedeagus, 0.42 mm; 4 b, right paramere; 4 c, detail of aedeagal apex.

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Serranillus gen. nov.

Diagnosis:— Near *Anillinus* CASEY, differing in the toothed margin of the last abdominal segment in males and the elaborate, twin-pedestal left paramere and absent right paramere of the aedeagus.

Form:— Moderately robust, subconvex and a little depressed to convex, microsculpture of elytra predominantly isodiametric but with tendency to form transverse rows, because of disappearance of lateral boundaries between cuticular polygons; generally pubescent; no trace of eyes.

Head:— Frontal impressions a little deeper than in most species of *Anillinus*, lateral carinae moderately strong; maxillary palps with penultimate segment elongate and moderately slender; labium: mentum free, tooth present.

Pronotum:- Transverse-subquadrate; posterior setae present in hind angles.

Elytra:— Ovoid, subconvex, pubescent, with 3 discal punctures, sutural angle sharp; umbilicate series of Type A, 8th and 9th punctures geminate; abdomen with last visible sternite having an apical margin that bears 3 teeth in males only; epipleura



Fig. 5. Serranillus jeanneli sp. nov., Coweeta Hydrologic Laboratory, Macon Co., North Carolina, 3.2 mm.

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crossed near apex, subhumeral margin strongly crenelate.

Legs:— Males with first protarsomere enlarged, first and second segments bearing adhesive setae beneath; femora, especially pro- and metafemora slightly swollen in males; front tarsi pentamerous; males with metafemora not bearing tubercles or spines.

Aedeagus— Median lobe swollen; basal bulb small; right paramere absent; left paramere very large and complex, with basal disc bearing a second conchoidal lamina on a stout pedicel, entire paramere anterior in position, rotated forward a little more than 90° from normal position.

Type species: Serranillus jeanneli sp. nov.

Serranillus jeanneli sp. nov.

(Figs. 5-7)

Size very large, 2.5–3.2 mm long, form robust and rather depressed. Males readily distinguished from other large species of anillines (notably *Anillinus dunavani*) with which this species coexists by the distinctly toothed apical margin of the last ventral sternite. Aedeagus large, constricted behind basal lobes but very thick in middle portion of median lobe, then tapering apically to a blunt shelf; an elongate row of microtrichia from basal constriction to apical shelf; homologies of copulatory ap-





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paratus with *Anillinus* spp. uncertain, *e.g.*, in place of elongate filaments with small basal bulbs is a thick, slightly curved sclerite with huge basal swellings; at the apical end of the internal sac are two or three digit-like processes and a wider, triangular sclerite terminating in a crochet, in addition to a bluntly lobed basal lamina; no right paramere; left paramere very large, conchoidal, but with a second conchoidal structure arising from the first on a short pedestal, the entire left paramere carried in an upright position, rotated about 90° from the usual position in *Anillinus* spp. The trivial name of this species honors the late Dr. René JEANNEL, preeminent in advancing our knowledge of the Anillines, as with so many other groups of Carabidae.

Holotype. Male, along Ball Creek, elevation approximately 950 m, Coweeta Hydrologic Laboratory, U.S. Forest Service, Macon Co., North Carolina, August 13, 1969, T. C. BARR; type deposited in Carnegie Museum of Natural History, Pittsburgh. Four paratypes, same date, site, and collector.

There can be no mistaking males of this large, distinctive species because of the toothed margin of the ventral sternite and the remarkably complex left paramere. It is easily the largest species of anillines in the Unaka mountains. In practice, *S. jeanneli* is likely to be found with a) *Anillinus dunavani*, which is more slender and more convex, b) a smaller, undescribed species of *Anillinus*, and c) a smaller and more convex, undescribed species of *Serranillus*. The geographic range of *S. jeanneli* as presently known extends from the south slopes of the Great Balsam Mountains (including Pisgah Ledge) south to Rabun and Towns counties, Georgia. Other material of *Serranillus* from the Piedmont of North Carolina (farther east) and Cloudland Canyon State Park, Georgia (farther west), will be addressed in a future paper.

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A New *Ocydromus* (Coleoptera, Carabidae) from Eastern Honshu, Japan

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Abstract A new bembidiine carabid beetle is described from East Japan, under the name of *Ocydromus* (s. str.) *uenoianus*. It is related to *O. thermarum* (MOTSCHULSKY), but differs from it mainly in the size and coloration.

It was about twenty-five years ago that I first met Dr. Shun-Ichi UéNo of the National Science Museum (Nat. Hist.), Tokyo. By that time, he had already described various interesting carabid beetles besides his principal specialty: a beautiful nebriine, *Nebria shibanaii*, an anophthalmic bembidiine, *Caecidium trechomorphum*, a strange patrobine, *Minypatrobus darlingtoni*, several cave-dwelling platynines, *Jujiroa troglo-dytes*, *J. elongata* and *Ja ana*. It was he who showed me specimens and reprints, and who had led me to take a great interest in them, especially bembidiine, patrobine and trechine beetles. Since then, under his guidance, I was able to describe more than twenty new species as an amateur.

To commemorate his retirement, I would like to dedicate this paper to Dr. S.-I. UÉNO, who has given me invaluable advice and constant encouragement.

The abbreviations used herein are the same as those explained in my previous papers.

I am deeply indebted to Dr. Shun-Ichi UÉNO for reading the original manuscript of this paper and to Dr. George E. BALL for giving me a North American bembidiine, "*Bembidion scopulinum* KIRBY", for comparative study.

Ocydromus (s. str.) uenoianus MORITA, sp. nov.

[Japanese name: Yakeishi-mizugiwa-gomimushi]

(Figs. 1-2)

Bembidion sp.: MORITA, 1989, Elytra, Tokyo, 17: 32.

Length: 3.83-4.65 mm (from apical margin of clypeus to apices of elytra).

Body small and elongate. Colour black; head and pronotum usually metallic green; elytra usually with very slightly bluish lustre, rarely with brownish lustre, and with a small spot at subapical part on each side; when alive, the spots are yellow and prominent; mandibles, palpi, antennal segments 1–2 and basal half of segment 3 yellowish brown; labrum, clypeus and legs brown; ventral side blackish brown.

Head narrow and convex above; frontal furrows wide, deep, usually diverging

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posteriad, rarely almost parallel and with several coarse punctures; eyes rather flat; anterior supraorbital pore(s) situated at about mid-eye level; posterior supraorbital one(s) situated at the post-eye level or slightly before that level; mentum tooth variable according to individuals, usually simple and rounded, sometimes slightly truncated at the tip; neck wide; microsculpture mostly vanished, but consisting of isodiametric or wide meshes on neck; antennae filiform; relative lengths of antennal segments as follows:— I: II: III: IV: V: VI: XI = 1: 0.72: 1.02: 0.99: 0.98: 0.95: 1.16.

Pronotum transverse subcordate and strongly convex; apex almost straight and usually narrower than base; sides strongly arcuate in front, sometimes very obtusely angulate at the widest part, sinuate posteriad, and then slightly divergent again before hind angles or parallel for a short way towards hind angles; base slightly arcuate; basal area sparsely and coarsely punctate and irregularly rugose; hind angles nearly rectangular or obtuse, with carinae; median line weakly impressed, deep at about basal 1/3 and reaching neither apex nor base; anterior transverse impression with a few fine punctures, clearly impressed and becoming deeper at sides and then distinctly con-



Fig. 1. Ocydromus (s. str.) uenoianus MORITA, sp. nov., 3, from Mt. Yakeishi-dake in Iwate Prefecture.

New Ocydromus from Eastern Honshu



Fig. 2. Aedeagus of *Ocydromus* (s. str.) *uenoianus* MORITA, sp. nov., from Mt. Yakeishi-dake; left lateral view (C1-C2: copulatory pieces; B1-B2: bundle of fibres). (Scale: 0.3 mm.)

Table 1.	Standard ratios of	body parts in Oc	vdromus (s. str.) uenoianus N	AORITA, Sp. nov.
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	PW/HW	PW/PL	PW/PA	PW/PB	PA/PB	$\mathbf{E}\mathbf{W}/\mathbf{P}\mathbf{W}$	EL/EW
10 රී ්	1.20-1.27	1.18-1.28	1.33-1.43	1.30-1.41	0.93-1.05	1.47-1.56	1.46-1.51
Mt. Yakeishi-dake	(1.25)	(1.23)	(1.37)	(1.34)	(0.98)	(1.51)	(1.54)
10 우우	1.24-1.28	1.20-1.29	1.30-1.38	1.29-1.38	0.95-1.04	1.49-1.62	1.47-1.57
Mt. Yakeishi-dake	(1.21)	(1.26)	(1.37)	(1.30)	(0.95)	(1.52)	(1.55)
5 ීරි	1.15-1.26	1.22-1.26	1.34-1.39	1.28-1.35	0.92-0.97	1.45-1.52	1.53-1.58
Tenjindaira	(1.21)	(1.23)	(1.37)	(1.32)	(0.96)	(1.49)	(1.55)
5 රීට්	1.21-1.24	1.22-1.31	1.32-1.41	1.30-1.35	0.93-1.02	1.45-1.59	1.54-1.63
Tenjindaira	(1.22)	(1.27)	(1.35)	(1.33)	(0.98)	(1.52)	(1.57)
1♀ Mt. Katta-dake	1.21	1.26	1.37	1.30	0.95	1.52	1.55

tinuous to marginal gutter; marginal pair of setae situated at about 1/3 from apex, the posterior one situated a little before hind angles; basal foveae deep, and with coarse punctures; microsculpture almost vanished on disc, sometimes consisting of irregular or of wide meshes on lateral and basal parts.

Elytra oblong-ovate, widest at about middle; shoulders distinct and widely rounded; sides gently arcuate, with preapical sinuation very shallow; apices forming a small re-entrant angle at suture; stria 1 entire, becoming shallower towards apices, and strongly and coarsely punctate but becoming indistinct near apex; striae 2–5 strongly punctate but becoming shallower towards apex and usually disappearing at basal 7/10; stria 6 as in stria 5, but disappearing at about middle; stria 7 marked with a row of punctures; scutellar striole long and strongly punctate; apical striole short, deep, almost straight and directed to the site of stria 5 or 6 or 7; microsculpture almost vanished, partially perceptible as consisting of fine transverse meshes.

Metasternal process rather widely bordered at the median part.

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Aedeagus elongate; apical part slightly inclined to the right in dorsal view; viewed laterally, apical lobe short and slightly bent towards ventral side just before apex, which is narrowly rounded. Inner structure basically similar to that of *Ocydromus modestus* (FABRICIUS); inner sac covered with poorly sclerotized scales and armed with four components of sclerites (C1, C2, B1, B2); linear piece (C1) elongate, twisted at basal 1/3 but almost straight at apical half; basal part of linear piece (C1) hemispherical and transparent, though the margin is moderately sclerotized; the other linear piece (C2) almost straight, rather heavily sclerotized and situated at the ventral side of linear piece (C1); the other bundle of fibres (C2) small; ostium flag narrow and elongate. Left style usually provided with 1 or 2 long seta(e) and 2 or 3 short setae at apex; right one usually provided with a long seta and 2 short setae at apex and rarely with a short seta at subapical part.

Type series. Holotype: \Im , allotype: \Im , paratypes: $25 \Im \Im$, $40 \Im \Im$, Mt. Yakeishi-dake, $3 \sim 4$ -VIII-1985, S. MORITA leg.; $1 \Im$, Mt. Katta-dake, 24-VII-1976, S. MORITA leg.; $8 \Im \Im$, $15 \Im \Im$, Tenjindaira, 6-VI-1986, S. MORITA leg.; $1 \Im$, Tenjindaira, 5-VI-1988, S. MORITA leg.

The holo- and allotypes are deposited in the National Science Museum (Nat. Hist.), Tokyo. The paratypes are preserved in the private collection of the author.

Localities. Iwate Prefecture (Mt. Yakeishi-dake); Miyagi Prefecture (Mt. Kattadake); Gunma Prefecture (Tenjindaira, Mt. Tanigawa-dake).

Notes. Because of the same structure of inner sac (C1, C2, B1, B2), this new species is doubtless closely related to *O. thermarum* (MOTSCHULSKY). It is, however, easily distinguished from the latter by smaller body, coloration and vague elytral spots.

This beetle is found from under stones at the edges of snow patches at high elevations.

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A New Species of *Onycholabis* (Coleoptera, Carabidae) from Jejudo, South Korea¹⁾

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Abstract A peculiar *Agonum*-like platynine ground-beetle, *Onycholabis uenoi* sp. nov., is described from Korea. The genus *Onycholabis* is a new addition to the Korean fauna.

A new species of the genus *Onycholabis* BATES, 1873, was discovered among the ground-beetles collected by the authors in Jejudo (Cheju-do, Quelpart Island), Korea, and was named *O. uenoi* after one of the most remarkable Japanese coleopterists, Dr. Shun-Ichi UÉNO. The holotype of *O. uenoi* is preserved in Sunchon National University. This paper is the seventh report of the study on the ground-beetles of Korea by the senior author.

The abbreviations used herein are as follows: HL – length of head from apex of clypeus to hind edge of tempora; HW – widest width of head; PA – width of pronotal apex; PW – widest width of pronotum; PB – width of pronotal base; PL_t – full length of pronotum; PL – length of pronotum, measured along middle line; EL – length of elytron, from the level of basal border at shoulder to elytral apex; EW – widest width of elytra; L – full length of beetle from the tips of mandibles to elytral apex; L_s = $HL+PL_t+EL$.

Before going further, we wish to express our deep gratitute to Mr. S. H. JUNG, the Chejudo Folklore and Natural History Museum, for his kind help in the field.

Onycholabis uenoi PAIK et LAFER, sp. nov.

(Fig. 1)

Colour. Body black. Labrum, mandibles and antennal segments 5-11 light brown, palpi, antennal segments 1-4 and legs pale yellow, pro- and mesocoxae brown.

1) Carabidae of Korea (VII).

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Lustre. Dorsal side of body strongly shiny.

Microsculpture. Head with feeble isodiametric reticulation in posterior half, reticulation in anterior portion vanished. Pronotum with rather coarse reticulation of transverse meshes along lateral sides and at base and with only traces of meshes on disc. Elytra with very gentle reticulation of transverse meshes.

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Sizes	ot	boo	ly	(IN	mm).

	Sex	HL	HW	PA	PW	PB	PL_t	PL	EL	EW	L	Ls
Holotype	Ŷ	1.40	2.05	1.40	2.15	1.30	1.65	1.61	5.82	5.82	9.80	8.87
Paratype	9	1.25	1.88	1.35	1.95	1.15	1.55	1.45	5.50	5.50	9.30	8.55

Description. A fairy slim species with small pronotum and comparatively long elytra, antennae and legs elongate.

Head of medium size with very strongly convex eyes and nearly rectilinear tempora, sharply narrowed posteriad but rather wide at neck. Dorsal side weakly convex and smooth. Frontal furrows curved angulate and reaching anterior supraorbital seta. Frons between frontal furrows fairly convex. Two supraorbital setae present, the posterior one located at level of hind edge of eye. Clypeus transverse, trapezium-shaped with 1 seta on each side. Labrum transverse, with 6 setae along apex. Mandibles elongate, slender, weakly sickle-like near tip, with lateral scrobe shallow. Palpi rather long. Last segment of maxillary palpus almost cylindrical with blunt tip. Mentum with tooth obviously bifid, with 2 setae posteriorly, without additional pores. Submentum with 2 setae on each side. Eye nearly adjoining maxillary fissure in profile. Antennae elongate, slender, filiform, pubescent from segment 3, reaching the middle of elytra. Segment 2 shortest, with 2 additional setae. Segment 3 longest, proportional length to its width 7.67. Length of antennal segments (in mm) from 1 to 11 as follows: 0.60, 0.30, 1.15, 0.90, 0.65, 0.65, 0.55, 0.50, 0.48, 0.50. Width of scape 0.20, width of all other segments 0.15 mm, respectively.

Pronotum rather small with a shape very similar to that of *Craspedonotus tibialis*, transverse (PW/PL_t 1.24, 1.26, PW/PL 1.34 in both specimens), slightly wider than head (PW/HW 1.04, 1.05), moderately narrowed anteriad and strongly and sharply narrowed posteriad (PW/PA 1.44, 1.54, PW/PB 1.65, 1.70), hind margin narrower than apex (PB/PA 0.85, 0.93). Lateral sides in anterior half nearly straight and parallel, in posterior third sharply narrowed and before hind angles nearly parallel or slightly divergent. Apex feebly emarginate, front angles widely rounded and faintly prominent. Hind angles slightly acute with pointed tip. Hind margin feebly convex in middle. Disc moderately convex and smooth, with very fine middle line and weak wrinkles in areas of anterior and posterior transverse impressions. Lateral margins weakly reflexed, lateral gutter very wide, with wrinkles and punctures, uneven, obviously less shiny than disc, near base confluent with basal fovea. Base with 1 basal fovea on each side, the latter rather deep, linear, curved outside in front. Base between basal foveae strongly convex and with irregular wrinkles, between basal foveae and thin lateral beads weakly

New Onycholabis from South Korea



Fig. 1. Onycholabis uenoi PAIK et LAFER, sp. nov., ♀, from Donnaeko on Is. Jejudo.

impressed. Two lateral setae on each side, the anterior one situated at 0.3 from anterior angle, posterior one situated on hind angle. Base constricted so strong that the pro-epipleura are visible in dorsal view.

Elytra comparatively large and elongate (EL/EW 1.44, 1.57, EL/PL_t 3.53, 3.55, EW/PW 1.72, 1.80), with weakly convex lateral margins, widely rounded at shoulders (apparently, false shoulders), with narrow rounded apex, moderately convex in profile. Basal border short, nearly transverse and adjoining lateral bead at about base of stria

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4 under faintly visible, very obtuse angle. Striae regular, in front and on disc superficial with fine, deep and dense punctures, in posterior quarter striae deeper and without punctures. Stria 1 adjoining its outer branch in front and at basal border appoaching stria 2. In bases of striae 1 and 2a basal umbilicate setiferous pore present. Inner branch of subsutural stria forming a long scutellar striole on interval 1. Intervals flat; interval 3 with 2 or 3 discal setiferous pores, anterior one adjoining stria 3 and situated at 0.22 from base in the holotype and at 0.25 in the paratype, median and hind discal pores adjoining stria 2. Median one situated at 0.42 from base in the holotype and apparently absent in the paratype, hind pore situated at 0.60 from base in the holotype and paratype. In the holotype median discal pore absent on the right elytron and in the paratype absent on both the elytra; other discal pores on the left and right elytra located more or less symmetrically. Near apex of elytron there are 2 setiferous pores adjoining stria 7 and 1 setiferous pore at sutural angle. Pores of lateral umbilicate series very fine, and divided into 2 parts, humeral and posterior but there is 1 pore present between the two parts; humeral group consisting of 7 pores, posterior one of 9-10 pores. Elytral plica not reaching lateral margin.

Ventral side of body glabrous and smooth but pro-episterna with a few punctures. Metepisterna long and narrow. Intercoxal process of prosternum slightly pointed at tip and indistinctly margined. Last sternite in the paratype with 8 setae along apex; in the holotype, there are 3 setae on the right side and no setae on the left (apparently broken).

Legs elongate (proportional length of hind tibia to PW 1.47), slender. Metacoxae without inner seta. Metatrochanter with 1 seta. Meso- and metafemora with 2 setae along hind margin. Protibia with very fine longitudinal striae. Femora and tibia with a few fine setae. Tarsi glabrous on dorsal side, segments 1–4 with setae underneath, segment 5 glabrous underneath. Segment 4 of all tarsi slightly bilobed. Claws simple.

Male unknown. Female genitalia not investigated.

Diagnosis. Onycholabis uenoi agrees well with the genus *Onycholabis* BATES in main characteristics (tooth of mentum bifid, antennae pubesent from segment 3, mandibles elongate and weakly curved, frontal furrows strongly curved, angulate, basal border of elytron very short, etc.). It is readily distinguished from its nearest relatives, *O. sinensis sinensis* BATES from China and Taiwan, and *O. sinensis nakanei* KASAHARA, 1986, from Japan, by strongly constricted base of its pronotum, by the presence of the posterior pair of lateral setae on pronotum, and other characteristics.

Type series. Holotype, \mathcal{Q} , labelled as follows: "Jejudo Is., Donnaeko, 300 m alt., 17–VII–1994, G. Lafer leg." Paratype, 1 \mathcal{Q} , labeled as holotype.

Type locality. Donnaeko, Jejudo Is., South Korea.

Notes. Both the specimens of the type series were collected on the bank of a large mountain stream, about 300 m upstream from a bridge on the road from Sŏng-pănak Rest Area to Chŏngbang Town. This mountain stream was very shallow at the time of the collection due to the unusually prolonged hot weather. Most of the bed of the stream was rocky with large boulders and was dried out. Both the specimens were

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found under pebbles on damp soil in a hollow under a large towered rock off the main stream. This large rock was located 70 cm away from the water edge and was near a deep pit with water at the bottom. They were very active in the evening (about 5 o'clock p.m.), and threw out protective liquid. Four specimens of *Agonum* (*Nipponanchus*) *leucopus* (BATES) were also collected at the same place.

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Two New Trichotichnus (Coleoptera, Carabidae) from Shikoku, Southwest Japan

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Abstract Two new montane harpaline carabid beetles, Trichotichnus (Trichotichnus) uenorum sp. nov. and T. (T.) shikokuensis sp. nov., are described from the Island of Shikoku, Japan. They belong to the *leptopus* group, and seem endemic to the island.

The montane species of the harpaline carabid genus *Trichotichnus* belonging to the *leptopus* group (*sensu* HABU, 1961, pp. 139–143) have hitherto been known from the Island of Shikoku, Southwest Japan, from only *T. tsurugiyamanus* HABU, 1959. However, we have examined many specimens of two unnamed species of the same group obtained by ourselves on various mountains in Shikoku. They are often found together, though clearly discriminated from each other and from their relatives by their characteristic facies and configuration of genitalia in the male. They must be new to science. In this article, we are going to describe them under the names *Trichotichnus* (*Trichotichnus*) *uenorum* sp. nov. and *T.* (*T.*) *shikokuensis* sp. nov. The former new species is dedicated to Dr. and Mrs. Shun-Ichi UÉNO for commemorating their contributions to the rearing of young coleopterologists. The abbreviations used herein are the same as those explained in other papers of the first author.

We are grateful to Dr. Shun-Ichi UÉNO, the head of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo, for his guidance during the course of this study. The present paper is dedicated to him for commemorating his retirement from his long leadership in the Japanese entomology and zoology.

Trichotichnus (Trichotichnus) uenorum sp. nov.

[Japanese name: Ishizuchi-tsuya-gomokumushi]

(Figs. 1, 3)

Description. Length (measured from apex of labrum to apices of elytra) 11.4-12.4 mm; width 4.4-4.7 mm. Black, shiny and iridescent, sometimes dark reddish brown in fore body; labrum, mandibles and venter dark reddish brown; appendages

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yellowish brown, though sometimes rather fuscous in femora and tibiae.

Head convex; eyes convex; post-genae short, strongly contracted behind; mandibles stout; labrum subtrapezoidal, emarginate at apex; clypeus shallowly furrowed between the marginal setae; clypeal suture fine; frontal oblique grooves distinct, often roundly depressed around the grooves; supraorbital setae inserted a little before the post-eye level; surface smooth, though often irregularly punctate on frons; microsculpture almost invisible, though clearly visible on labrum, formed by isodiametric meshes; antennae moderately long, reaching basal fourth of elytra.

Pronotum transverse, convex, widest at apical third, ca. 1.4 times as wide as head (PW/HW 1.40–1.48, mean 1.42), as wide as long in almost the same proportion (PW/ PL 1.37–1.44, mean 1.41), ca. 1.3 times as wide as base (PW/PBW 1.24–1.32, mean 1.29); lateral margins evenly arcuate and gently convergent posteriad, slightly sinuate just before basal angles, which are produced laterad and acute at the tips; apical margin gently emarginate, finely bordered, though generally obsolete at middle, apical angles hardly produced, rounded at the tips; basal margin wider than the apical, weakly emarginate and finely but distinctly bordered throughout; median line fine but distinct; basal foveae wide and shallow, strongly and densely punctate; outer sides of the foveae depressed and punctate, the depressions extending to apical angles along lateral margins, and strongly punctate throughout; both apical and basal transverse impressions usually weak or obsolete, but the former is sometimes distinct; surface distinctly punctate except in median areas; microsculpture partially and barely visible, formed by very fine transverse meshes.

Wings atrophied. Elytra oblong, elliptical, moderately convex, widest at middle, ca. 1.25 times as wide as pronotum (EW/PW 1.21–1.29, mean 1.25), ca. 2.7 times as long as pronotum (EL/PL 2.65–2.88, mean 2.74), ca. 1.44 times as wide as base (EW/ EBW 1.38–1.48, mean 1.44), ca. 1.55 times as long as wide (EL/EW 1.53–1.58, mean 1.55); basal border almost level, though slightly oblique on each side, very minutely dentate at shoulder; shoulders narrowly rounded; lateral margins evenly and gently arcuate from behind shoulders to apical fifth, then roundly convergent to preapical emarginations, which are shallow; apex of each elytron rather pointed though rounded at the tips; scutellar striole moderately long, arising from basal pore and lying on interval 2; striae fine but distinctly impressed throughout; intervals flat on disc, well convex in apical parts; interval 3 with a dorsal pore adjoining stria 2 at about middle; marginal series of pores 23–25 in number, some small pores lying on interval 9; microsculpture barely visible, formed by very fine transverse meshes.

Protibiae sulcate on each inner side. Venter shiny; pro- and metasterna and abdominal sternite 4 between metacoxae punctate and minutely pubescent; lateral parts of metasternum and abdominal sternite 3, and pro-, meso- and metepisterna punctate; lateral sides of sternites 4–7 irregularly rugose; prosternal process pubescent and plurisetose at the apex.

Aedeagus thick in basal part, gently arcuate and tapered towards apex in lateral view; apical part slightly curved to the right in dorsal view; apical lobe longer than

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Fig. 1. Trichotichnus (Trichotichnus) uenorum sp. nov., S, from Tsuchigoya on Mt. Ishizuchisan, Ehime Pref. Scale 4 mm.

wide, rounded at apex, which is raised and bordered dorsad; inner sac provided with a long and heavily sclerotized nail-like piece near apical orifice.

Type series. Holotype: \eth , Tsuchigoya, Mt. Ishizuchi-san, Ehime Pref., 2–IX– 1978, S. KASAHARA leg. Paratypes: $2 \Leftrightarrow \diamondsuit$, same data as for the holotype; $4 \circlearrowleft \circlearrowright$, $2 \Leftrightarrow \diamondsuit$, Mt. Takanosu-yama, Hongawa-mura, Kôchi Pref., 1–VI–1986, Y. Irô leg.; $2 \circlearrowright \circlearrowright$, 1 \diamondsuit , same locality, 25–VIII–1986, Y. Irô leg.; $1 \circlearrowright$, $2 \Leftrightarrow \heartsuit$, same locality, 7~8–IX–

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1986, S. KASAHARA leg.; 1 J, Mt. Nagasawa-yama, Hongawa-mura, Kôchi Pref., 7– VI–1986, Y. Irô leg.; 1 J, Yosakoi-tôge, Hongawa-mura, Kôchi Pref., 27–IX–1992, Y. Irô leg.

The holotype is preserved in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. The paratypes are separately deposited in the authors' collections.

Notes. The present new species somewhat resembles T. (T.) leptopus (BATES, 1883) in general appearance, but is clearly distinguished from the latter by more elongate body with wider pronotum, whose lateral margins are less convergent posteriad and less sinuate before the base than in the latter. The copulatory piece of male genitalia is conspicuously longer than that of T. (T.) leptopus (BATES). HABU (1973, p. 285) examined two specimens of Trichotichnus from Shikoku, and briefly observed that it was somewhat different from BATES' species though he was not confident of their identity. HABU's specimens in question may be conspecific with the present beetle.

Trichotichnus (Trichotichnus) shikokuensis sp. nov.

[Japanese name: Shikoku-tsuya-gomokumushi]

(Figs. 2, 4)

Description. Length (measured as in the preceding species) 9.9–11.2 mm, width 3.8–4.3 mm. Black, shiny and iridescent; clypeus, labrum and mandibles dark reddish brown; appendages yellowish brown; venter black, though the abdominal sternites are often dark reddish brown.

Head convex with convex eyes; post-genae short, strongly contracted behind; labrum subtrapezoidal, almost straight at the apex, though convex at the middle; clypeus shallowly furrowed between marginal setae; clypeal suture very fine, often obsolete at middle; frontal oblique grooves deep; supraorbital setae inserted at the post-eye level; surface smooth; microsculpture hardly visible, though clearly visible on labrum; antennae moderately long, reaching basal fifth of elytra.

Pronotum transverse, convex, widest at apical third, ca. 1.35 times as wide as head (PW/HW 1.30–1.42, mean 1.35), ca. 1.3 times as wide as base (PW/PBW 1.27–1.38, mean 1.30), ca. 1.4 times as wide as long (PW/PL 1.37–1.41, mean 1.39); lateral margins evenly well arcuate, then strongly convergent posteriad and sinuate before base, basal angles acutely produced laterad; apical margin gently emarginate, finely bordered, though the border is often obsolete at middle, apical angles somewhat produced, rounded at the tips; basal margin a little wider than the apical, slightly emarginate at the median part, finely but distinctly bordered throughout; median line deeply impressed; basal foveae wide and shallow, divergent anteriad in apical parts, strongly and densely punctate; outer sides of the foveae depressed, the depressions narrowly extending to apical angles along lateral margins, and punctate throughout; apical transverse impression rather distinct and punctate; basal transverse impression

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Fig. 2. Trichotichnus (Trichotichnus) shikokuensis sp. nov., S, from Meoto-ike on Mt. Tsurugisan, Tokushima Pref. Scale 4 mm.

weak or obsolete; surface punctate in apical, basal and lateral areas; microsculpture

almost invisible.
Wings reduced, half as long as and a third as wide as each elytron. Elytra oblong subovate, convex, widest at or a little behind the middle, ca. 1.3 times as wide as pronotum (EW/PW 1.26-1.34, mean 1.30), ca. 2.8 times as long as pronotum (EL/PL 2.72-2.89, mean 2.79), ca. 1.5 times as wide as base (EW/EBW 1.45-1.56, mean 1.52),

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Figs. 3–4. Male genitalia of *Trichotichnus* (*Trichotichnus*) spp. — 3, *T*. (*T*.) uenorum sp. nov., from Mt. Takanosu-yama, Kôchi Pref.; 4, *T*. (*T*.) shikokuensis sp. nov., from Meoto-ike on Mt. Tsurugi-san, Tokushima Pref.; a–c, aedeagus; a, left lateral view; b, dorsal view, basal part omitted; c, ventral and apical view; d, left paramere; e, right paramere; cp, copulatory piece. Scale 1 mm.

ca. 1.55 times as long as wide (EL/EW 1.51–1.59, mean 1.55); basal border slightly curved; shoulders narrowly rounded, sometimes obtusely and indistinctly angulate; lateral margins more strongly arcuate than in the preceding species; each elytron rather pointed at apex, though blunt at the tip; scutellar striole moderately long, arising from basal pore and lying on interval 2; striae finely but deeply impressed

throughout, almost smooth; intervals gently convex, though well convex in apical parts; interval 3 with a dorsal pore adjoining stria 2 at about middle; marginal series of pores 24–26 in number, some small pores lying on interval 9; microsculpture invisible on the disc.

Venter shiny; pro- and metasterna and abdominal sternite 4 between metacoxae punctate and minutely pubescent; lateral parts of metasternum, and meso- and metepisterna, and sternite 3 punctate; prosternal process punctate and pubescent, plurisetose at the apex. Protibiae sulcate on each inner side.

Aedeagus thick in basal part, arcuate and tapered towards apex in lateral view, gently curved to the right in apical part in dorsal view; apical lobe wider than long, apex rounded, though often more or less truncate at middle, raised and bordered dorsad, ventral margin with a minute but distinct notch, each side of the notch minute-ly but acutely dentate; ventral side longitudinally and shallowly depressed in apical part; inner sac with a heavily sclerotized peg-like piece near apical orifice; parameres wide, rounded at apices.

Type series. Holotype: $\vec{\sigma}$, Meoto-ike, Mt. Tsurugi-san, Tokushima Pref., 28– VIII–1978, S. KASAHARA leg. Paratypes: $2 \ \varphi \ \varphi$, same locality as for the holotype, 30–VIII–1987, S. KASAHARA leg.; $1 \ \vec{\sigma}$, $1 \ \varphi$, Mt. Kumosô-yama, Kamiyama-chô, Tokushima Pref., $17 \sim 18$ –VII–1988, Y. Itô leg.; $1 \ \vec{\sigma}$, Mt. Shinkurô-yama, Kitô-son, Tokushima Pref., 27–V–1989, Y. Itô leg.; $1 \ \vec{\sigma}$, Mt. Ohtaki-san, Shionoe-chô, Kagawa Pref., 11–IX–1993, Y. Itô leg.; $1 \ \vec{\sigma}$, $1 \ \varphi$, Tsuchigoya, Mt. Ishizuchi-san, Ehime Pref., 1–IX–1978, S. KASAHARA leg.; $2 \ \vec{\sigma} \ \vec{\sigma}$, Mt. Masakinomori, Yanadani-mura, Ehime Pref., 27–X–1985, Y. Itô leg.; $1 \ \vec{\sigma}$, $1 \ \varphi$, Okuôdô, Tôwa-mura, Kôchi Pref., $15 \sim 18$ – IX–1993, Y. Itô leg.; $1 \ \vec{\sigma}$, Kuroson, Nishitosa-mura, Kôchi Pref., 6–IX–1986, S. KASAHARA leg.

The holo- and paratypes are separately preserved in the same collections as for the preceding species.

Notes. The present new species is easily distinguished from the preceding species by having narrower pronotum, whose lateral margins are more strongly convergent posteriad, and more rounded elytra. The aedeagi with copulatory pieces of the two species are clearly different in configuration from each other. Judging from the conformation of male genitalia, it may have some relationship with T. (T.) pacificatorius HABU, 1954, described from Mt. Hiko-san in northern Kyushu, but is discriminated from that species by smaller and robuster body.

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Two New Species of Harpaline Beetles (Coleoptera) from Southeast Asia

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Abstract Two new species of the harpaline genera *Calathomimus* and *Trichotichnus* are described from Java and Vietnam under the names *C. uenoi* and *T. lindskogi*, respectively. The former is peculiar in having reduced hind wings.

In this paper, I am going to describe two new species of the halpaline genera, *Calathomimus uenoi* from Java and *Trichotichnus lindskogi* from Annam (Vietnam). The former species, named *C. uenoi*, is peculiar in having reduced hind wings, and is dedicated to Dr. Shun-Ichi UÉNO, an authority of the carabid taxonomy and biospeology, who has greatly contributed to the development of the entomology in Japan. His deed is pronounced above all in clarification of the trechine fauna of Japan and other Asian regions, which was scarcely known before his time.

The latter species is named after Dr. Per LINDSKOG of the Naturhistoriska Riksmuseet, Stockholm, who kindly loaned me many important holotypes under his care. My cordial thanks also go to Dr. Bert GUSTAFSSON of the same museum for his kind support. Furthermore, I must express my hearting thanks to Dr. Fritz HIEKE of the Museum für Naturkunde der Humboldt-Universtät zu Berlin for his kind loan of valuable materials to my study.

Calathomimus uenoi sp. nov.

(Figs. 1, 3)

Body rather widely oblong, flattened, slightly brownish black, shiny, very slightly iridescent on elytra; palpi and tarsi light brown, antennae, tibiae and femora brown, mandibles reddish brown.

Head more or less convex evenly, entirely impunctate, comparatively narrow, twofourths narrower than the pronotal width, with interocular space relatively wide, seventenths the width of head including eyes; labrum subtrapezoidal, angularly rounded at apical corners, with shallowly emarginate apex; clypeus narrowly, but clearly depressed along apex, weakly, transversely swollen in posterior half, obscurely and longitudinally rugose between the depression and swelling; clypeal suture fine and shallow, not clear even near junctions of frontal impressions, which are shallow, not clear, reduced distantly before eyes and extend obliquely behind; eyes large, but not very prominent;

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temples somewhat convex and obtusely meeting with neck constriction; genuine ventral margin of eye narrowly separated from buccal fissure; mandibles robust and sharpened distad, gently curved inwards; antennae slender, 3rd segment pubescent in apical half, equal in length to the 4th and about twice as long as the 2nd; palpi long and slender, 3rd segment of labial palpus as long as the 2nd and sparsely pubescent; ligula more or less widened forwards, weakly arcuate at apex; paraglossae prolonged forwards beyond ligular apex, adnate to ligula lengthwise, wide, oblique at outer sides and arcuate at apices; mentum moderately large and entirely sutured with submentum, median tooth transversely triangular, rounded at tip, epilobes well expanded forwards, steeply oblique at inner margins; microsculpture obscurely visible, consisting of mixtures of transverse lines and subsquare meshes.

Pronotum quadrate, widest at apical two-fifths, a little wider than one and onethird the length, gently declivous apico-laterad and flat in central area, smooth except for basal area which is very sparsely punctulate; sides gently arcuate in front, almost straightly and weakly oblique behind from the widest point, not reflexed near base; apex rather deeply emarginate, straight in middle, and entirely bordered; base onethird wider than apex and brokenly bordered; apical angles narrowly rounded; basal angles subrectangular and blunt at tips; lateral furrows narrow in apical third, gradually widened backwards, separated from sides by slight convexities in basal half and linked with basal foveae, which are shallow, ill-defined and bear small swellings medially; front transverse impression shallow and somewhat clear, hind transverse one obscurer than the front one: median line fine, sharply impressed though rudimentary near both apex and base; surface finely, transversely meshed for the most part and isodiametrically microsculptured medially in basal foveae.

Hind wings reduced to half ordinary size, Elytra oblong, subparallel-sided, about half longer than wide, relatively flat, gently sloping apicad and rapidly slanting basad on 8th intervals; humeral angles sharp and well protrudent forwards; apices narrow and fully produced behind, apical sinus shallow; striae narrow and not deep, finely crenulate, scutellar striole moderate in length; intervals mostly flat, a little raised near apices, 3rd interval with a row of 5–6 small setiferous pores along 2nd stria; marginal series moderately interrupted in middle, consisting of 8+12 umbilicate pores; microsculpture fine and more or less clear, largely composed of transverse lines and partly of transverse meshes.

Ventral surface impunctate, almost glabrous, with very short and sparse pubescence along the middle of 2nd to 6th abdominal segments; metepisterna short and not well contracted, each only one-fifth longer than wide; 6th abdominal segment unisetose on each side and obtusely notched at apex, apical border interrupted in the notched portion.

Fore femur plurisetose along front margin, mid femur seriately spinous at front margin; mid coxa bearing only two or three setae; fore tibia slender, clearly sulcate on dorsal side, apico-externally with two short spines, apex weakly arcuate, with minute protuberance at middle, terminal spur simple and slender; 1st segment of mid tarsus



Figs. 1-3. Habitus of Calathomimus and Trichotichnus (s. str.) spp. — 1, C. uenoi sp. nov.; 2, T. (T.) lindskogi sp. nov.; 3, T. (T.) lautus (ANDREWES).

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Fig. 4. Male genitalia of Calathomimus uenoi sp. nov.; d, dorsal side; v, ventral side.

biseriately squamous only near apex, hind tarsi long, two-fifths longer than the width of head, 1st segment as long as the 2nd and 3rd together and four-fifths longer than the 2nd, 3rd about one and three-fourths the 4th, claw segment bisetose ventrally along each side.

Aedeagus (Fig. 4) thin and long, gently sinuate before apex, with small basal bulb; apical orifice very large, occupying most of the apical part; inner sac bearing several short peg-shaped pieces; apical lobe subparallel-sided and arcuate at tip; ventral side longitudinally convex, rather widely bordered along apical margin.

♀. Unknown.

Length: 9.0 mm. Width: 3.2 mm.

Holotype: ♂, West Java, G. FRUHSTORFER leg. (preserved in the Museum of Humboldt University).

This new species is easily distinguished from *Calathomimus masumotoi* N. ITO (1991) by the pronotum clearly rounded at basal angles, the elytra much more weakly iridescent and never convex on intervals, and the hind wings not entire. Also the present species is different from *C. limatus* ANDREWES (1937) from Java in having the elytra shorter and bearing the striae not deep and crenulate and the intervals not convex.

In the genus Calathomimus, the reduction of hind wings are quite exceptional.

Trichotichnus (s. str.) lindskogi sp. nov.

(Figs. 2, 4)

Body oblong-oval, relatively convex, black, shiny, with feebly greenish reflection and weakly iridescent lustre on elytra; antennae light brown, palpi and legs yellowish

brown.

Head narrow, a little less than three-fifths the pronotal width, more or less convex evenly, very finely and sparsely punctate; labrum subquadrate, gently oblique at sides, with more or less emarginate apex; clypeus weakly, transversely convex in posterior half, obscurely rugose in longitudinal direction, and shallowly emarginate at apex; clypeal suture fine and shallow, almost obliterated in middle; frontal impressions divergent behind, moderately deep only near junctions of the suture, rapidly shallowed behind and reduced at middle between apices and eyes; eyes large and not so prominent as those of Trichotichnus szekessyi (JEDLIČKA); temples short, in continuation of the convexity of eyes; space between genuine ventral margin of eye and buccal fissure very narrow; mandibles short and robust, abruptly curved before apices, which are well narrowed distad and sharp at tips; antennae weakly tumid at each segment, reaching basal fifth of elytra, 3rd segment rather thickened apicad, one-tenth shorter than the 4th and one and one-third the length of the 2nd; 3rd segment of labial palpus more or less tumid in middle and one-fifth longer than the 2nd; ligula subparallel-sided, weakly constricted behind apex; paraglossae gently oblique at outer sides, produced forwards a little beyond ligula and fused with the latter up to the ligular constriction; mentum not transverse, median tooth rather prominent in a regular triangle and rounded at tip, epilobes weakly expanded in front; microsculpture weaker than in T. szekessyi, mostly invisible, observable as vague transverse meshes only near supraorbital setae.

Pronotum transversely quadrate, widest at basal two-fifths, less transverse than in *T. szekessyi*, a half wider than long, flattened on disc and steeply declivous apicolaterad, mostly smooth, rather sparsely and moderately punctate only in basal area, the punctures interrupted in middle; sides gently curved, weaker in curvature backwards than forwards; apex shallowly emarginate and truncate at the bottom, clearly bordered throughout; base a half wider than apex, almost straight, with entire border; basal angles obtuse and angulate, bluntly toothed at tips; each lateral furrow wholly running in a line along lateral margin due to discal convexity occupying most area of pronotum; basal foveae small, isolated from lateral margins by wide bulges; both front and hind transverse impressions vague; median line fine, only reaching apex; surface obscurely microsculptured and invisible in part, partly detected as transverse lines in the front impression and basal foveae.

Hind wings fully developed. Elytra ovate, about two-fifths longer than wide, uniformly and moderately convex, very fine and sparse punctures partly observable under $40 \times$ magnificantion; sides gently arcuate in humeral areas, subparallel in middle, thence gradually strongly convergent behind and shallowly sinuate before apices; apices widely rounded, not produced, narrowly separated from each other, blunt at sutural angles; bases mostly truncate, weakly oblique just before sides; humeral angles a little wider than rectangle and angulate, with small protuberances at tips; striae moderate in width and depth, finely crenulate, scutellar striole fairly long; intervals almost flat or weakly convex on disc, relatively convex laterad and basad, a setiferous pore on 3rd interval situated a little behind middle; marginal series interrupted medially, Noboru Ito



Figs. 5-6. Male genitalia of *Trichotichnus* (s. str.) spp.; d, dorsal side; v, ventral side. — 5, T. (T.) lindskogi sp. nov.; 6, T. (T.) lautus (ANDREWES).

composed of (7-10)+(9-11) umbilicate pores; microsculpture almost evanescent, partly visible as very obscure transverse lines.

Ventral surface impunctate for the most areas, sparsely and vaguely punctate on metepisterna and laterally on metasternum, with very short and sparse pubescence medially on metasternum and on 2nd and 3rd abdominal segments; metepisterna well contracted behind, one-third longer than wide; 6th abdominal segment in $\stackrel{?}{\circ}$ bisetose on each side, completely bordered, and subtruncate at apex.

Mid coxa bearing several setae in apical half; fore femur tri- or quadrisetose along front ventral margin, mid femur sparsely bearing short spines along front margin and on ventral side; fore tibia moderately expanded in front, not sulcate dorsally, truncate, triangularly and minutely protuberant at middle of apex and bispinous apico-externally, terminal spur long and lanceolate; 1st mid tarsal segment with small adhesive squamae only at apex, 2nd to 4th entirely covered with biseriate squamae; hind tarsi as long as the width of head, 1st segment equal in length to the 2nd and 3rd combined and two-

thirds longer than the 2nd, 3rd one and two-fifths the length of 4th, claw segment bisetose along each ventral margin.

Aedeagus (Fig. 5) moderately arcuate, thinned and weakly curved ventrad at apex; apical lobe elongate, twice as long as wide, clearly bordered and rounded at tip; apical orifice wide, inner sac furnished with many peg-shaped pieces.

Length: 6.5 mm. Width: 3.2 mm.

♀. Unknown.

Holotype: 3, Montes Manson, 2–3,000 feet. Tonkin, IV–V, H. FRUHSTORFER leg. (preserved in the Museum of Humboldt University). Paratypes: 333, same data as the holotype.

This new species belongs to the *orientalis* group. It resembles *T. szekessyi* (JEDLIČKA, 1954), but is distinguished from the latter, in addition to the characters mentioned in the description, by the pronotum bearing the lateral furrows never widened posteriad, the elytra with weaker iridescent lustre and feebly greenish reflection instead of pure black, and the metepisterna less elongate. The species is also closely allied to *T. lautus* (ANDREWES, 1947) (Figs. 3, 6), but differs from the latter in having the head larger and with larger eyes, and the pronotum widely bulging laterally in the basal area instead of being explanate, and never widened behind in the lateral furrows.

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Sugimotoa parallela HABU (Coleoptera, Carabidae, Lebiini): Redescription, Geographical Distribution, and Relationships Based on Cladistic Analysis of Adult Structural Features

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Abstract For *Sugimotoa parallela* HABU, 1975, known only from the Oriental Ryukyu, and Southwest Pacific Solomon and Vanuatu archipelagos, descriptive details and illustrations of external structural features and of male and female genitalia provide the basis for a cladistic analysis of this taxonomically enigmatic genus and species. Included in the analysis, based on the distribution of the states of 40 characters, are representative Harpalini, Platynini, and Lebiini. The results indicate that the monobasic *Sugimotoa* is a basal lebiine, but is sufficiently isolated from the other taxa of that tribe to be included in its own subtribe, Sugimotoina HABU. Additionally, evidence used in the cladistic analysis indicates that *Actenonyx bembidioides* WHITE, 1846, is related to *Sugimotoa*, but is sufficiently distinct to require its own subtribe of which it is sole member, the Actenonycina BATES. An appendix provides stereo-electron micrographs of mouthparts exemplary of the lebiine subtribes Actenonycina, Physoderina and Lebiina, and of the odacanthine *Pentagonica*. Also illustrated are the ovipositors of Actenonycina and Pentagonicina.

Introduction

Distinctive faunal assemblages have been used to recognize and define biogeographical regions (SCLATER, 1858). The stamp of a region is seen in commonness of particular taxa as well as in their presence. Two of us (DHK and GEB) became familiar with the carabid fauna of the Southwest Pacific during an expedition to Papua New Guinea and in its aftermath, at the Bernice Pahuai Bishop Museum, Honolulu. While studying the Solomon Islands carabid assemblage in the Bishop Museum, we George E. BALL, David H. KAVANAUGH and Barry P. MOORE



Fig. 1. Photograph, illustrating habitus, dorsal aspect, of *Sugimotoa parallela* HABU.

noted a discordant element, represented by three *Bradycellus*-like beetles. Closer examination revealed that these beetles were indeed discordant, for they could not be identified with any genus known from the region in question. It seemed possible that the specimens had been mislablelled, for it occurred to us that they may have been normal elements of a carabid assemblage from some other part of the world.

In an effort to learn more about the distribution of the taxon represented by these specimens, we sent habitus photographs (Fig. 1) and descriptive notes to various individuals and institutions. Barry P. MOORE (*in litt.*) advised us that he had seen a single specimen collected by the Percy Sladen Expedition, in the New Hebrides (Vanuatu) archipelago, located southeast of the Solomons (Fig. 6 B). This specimen had been returned to the South Australian Museum, with a label he had attached: "*tribus novus*". Dr. MOORE agreed to join the first two authors in the project.

This information satisfied us that the specimens were residents of the area indicated by their locality labels. In effect, they represented not only a discordant element in the carabid fauua of the Southwest Pacific area, but in the Carabidae as a whole. Their combination of external structural features was enigmatic.

Through our colleague, Yves BOUSQUET (Biological Resources Division, Agricul-

Sugimotoa parallela HABU

ture Canada, Ottawa), we learned some years after our initial enquiry, that these specimens were likely members of the monobasic genus *Sugimotoa*, described by the eminent carabid specialist, Akinobu HABU (1975) from material collected in the Ryukyu Archipelago, Japan. Subsequently, study of a paratype of *S. parallela* HABU confirmed the probable conspecificity of the Solomon Islands – Vanuatu specimens with that species.

HABU (1975, 77), with considerable reservation, assigned *Sugimotoa* to the Harpalini, as the sole member of a new subtribe, Sugimotoina. Sharing his reservation, and with the opportunity offered by the material available to us, we have undertaken a detailed study of structural features of *Sugimotoa* to seek its relationships within the Family Carabidae. This paper represents our collective thoughts and doubts.

We take considerable pleasure in dedicating this modest contribution to carabid classification to our distinguished colleague, Shun-Ichi Uéno on the occasion of his retirement from his position as Head of the Department of Zoology, National Science Museum of Japan. We trust that the leaving behind of formal responsibilities associated with that position will enable Dr. Uéno to devote more of his considerable energy and skill to continued elucidation of the Carabidae of eastern Asia. We wish him a long, happy and intellectually rewarding retirement.

Material and Methods

Material.

In addition to five adults of *Sugimotoa parallela* (including one paratype), we examined in some detail 50 adults representing the tribes and subtribes recorded in Table 1, and housed in the entomological collections of the California Academy of Sciences (CASC) and Strickland Museum, University of Alberta (UASM). Material was borrowed also from the following institutions each of which is designated by a four-letter coden. Names of curators who made the loans are enclosed in parentheses.

- BPBM J. Linsley Gressitt Center for Research in Entomology, Department of Entomology, Bernice P. Bishop Museum, P.O. Box 19000A, 1525 Bernice Street, Honolulu, Hawaii, 96819. U.S.A. (G. Allan SAMUELSON);
- ITLJ Laboratory of Insect Systematics, Division of Entomology, National Institute of Agro-Environmental Sciences, Kannondai, Tsukuba, Ibaraki Prefecture, 305 Japan (T. MATSUMURA);
- SAMA South Australian Museum, North Terrace, Adelaide, South Australia (E. G. MATTHEWS).

Methods.

Specimens were prepared for study and illustration using standard techniques outlined by SHPELEY and BALL (1994, 10–11). The principal measurement recorded in this paper, standardized body length (SBL) is the sum of three measurements: length of head along mid line, from base of the left mandible to a point opposite the posterior margin of the left eye; length of pronotum along mid-line, from anterior to posterior

George E. BALL, David H. KAVANAUGH and Barry P. MOORE

Table 1. List of taxa used as exemplars for analysis of phylogenetic relationships of Sugimotoa HABU. Character state information acquired by dissection and direct examination of adults representing the taxa listed below was used to supplement and test data extracted from ACORN and BALL (1991), BALL (1975, 1982), BALL and HILCHIE (1983), BALL and SHPELEY (1983), HABU (1967, 1973, 1975, 1978), LIEBHERR (1986, 1988), SHPELEY (1986), SHPELEY and BALL (1993), and SHPELEY *et al.* (1985).
Harpalini Pelmatellina

Lecanomerus sp. Stenolophina Bradycellus nitidus (DEJEAN) Bradycellus sp. Lebiini Actenonycina Actenonyx bembidioides WHITE Apenina Apenes spp. Calleidina Calleida platynoides G. HORN Celaenephina Celaenephes linearis (WALKER) Cymindina Cymindis arizonensis SCHAEFFER Dromiina Dromius piceus DEJEAN Galerucidiina Galerucidia erotyloides BATES Lebiina Lebia atriventris SAY Metallicina Euproctinus quadriplagiatus (REICHE) Pericalina Catascopus spp. Physoderina Physodera dejeani ESCHSCHOLTZ Platynini Platynus decentis (SAY) Platynus mannerheimii (DEJEAN) Tanystoma maculicolle (DEJEAN)

margin; and length of elytra, along the suture from the basal ridge to the apex of an elytron.

Line drawings were made with the aid of a *camera lucida* attached to a Wild M-5 stereoscopic dissecting microscope. Scanning electron micrographs were obtained using a Cambridge S-150 "Stereoscan" Scanning Electron Microscope (SEM).

Species recognition was based on overall similarity - that is the Solomon Islands -
Vanuatu Islands specimens were inferred to be conspecific with the type material of *Sugimotoa parallela* because differences observed seemed taxonomically insignificant in comparison with the numerous similarities of the two groups. Inference of conspecificity has a more general meaning: we assume that the two geographical groups, though widely separated, would interbreed freely, given the opportunity to do so.

Supraspecific relationships were inferred by computer-based methods of cladistic analysis (see below for details). Ranking was based on precedent widely accepted in the community of carabid workers.

Taxonomic Treatment

Following are the principal diagnostic details recorded by HABU (1975, 77–81), and observations about features of sugimotoines that he did not report. We place this group in the tribe Lebiini, and support this decision in the section dealing with cladistic analysis.

Subtribe Sugimotoina

Sugimotoina HABU, 1975, 77. Type genus (by monotypy and original designation): Sugimotoa HABU, 1975.

Sugimotoini: KASAHARA, 1985, 150, and plate 27, fig. 31. — BOUSQUET and LAROCHELLE, 1993, 37.

Ranking. — KASAHARA (1985, 150) treated this group as a tribe within the subfamily Harpalinae. Although BOUSQUET and LAROCHELLE (1993, 37) treated this group as a tribe, also, they did so because they believed it did not have harpaline affinities, and with its systematic position "unclear", they elected not to assign it to any previously established tribe.

Recognition. — Within the Lebiini, sugimotoine adults are recognized by the following combination of easily observed features. Size rather small (overall length about 5.5 mm), habitus (Fig. 1) *Bradycellus*-like; color generally rufo-piceous; setal pattern markedly distinctive — head ventrally with pair of suborbital setae, pronotum (Fig. 4 A) with pair of paramedial setae, each elytron (4 B) with row of setae in intervals 1, 3, 5 and 7, and umbilical setae in continuous row, penultimate setigerous puncture not displaced laterad or mediad; labrum transverse; labium with pair of paramedian pits (Fig. 3 D, **mp**, and 3 F).

Other details are recorded below, in the description of Sugimotoa parallela HABU.

Genus Sugimotoa HABU

References are the same as those for the subtribe, above.

Type species (by monotypy and original designation). — Sugimotoa parallela HABU, 1975.

Generic name. — Not specified, but evidently based on the surname of Mr. A. SUGIMOTO, who collected the type series.

Sugimotoa parallela HABU

References are the same as those for the subtribe, above.

Type material and type locality. — Holotype and two paratypes, males, all collected between June 29 and July 5, 1973, on Ishigaki-jima, an island in the Ryukyu Archipelago, Japan (ITLJ).

Although more specific information about the type locality was not provided in the original description, UÉNO (*in litt.*) informed us as follows. The U–V light where the specimens were collected was at Maésato, in the southeastern part of Ishigaki-jima. Accordingly, the type locality is restricted to Maésato.

Specific epithet.— A Latin adjective (feminine gender to agree with the feminine form of the generic name), derivation not specified, but evidently referring to the nearly straight and hence parallel sides of the elytra.

Description.— Habitus as in Fig. 1. *Bradycellus*-like. Standardized body length 3.96–4.70 mm. Color of body piceous, appendages flavous. General features of basal Lebiini.

Microsculpture. Mesh pattern transverse on labrum and clypeus; isodiametric on frons, including frontal impressions, and on occiput; vertex smooth, without microlines. Pronotum with most of surface smooth, with microlines in form of isodiametric mesh in various areas. Elytral interneurs with isodiametric mesh pattern, intervals partly smooth, partly with isodiametric to slightly transverse mesh pattern.

Fixed setae. Average for Lebiini, and: head with pair of suborbital setae; pronotum (Fig. 4 A) with two pairs of lateral setae, antero-lateral pair near anterior angles; disc with pair of paramedial setae; odd-numbered elytral intervals, including sutural intervals, with row of setae.

Head. Eyes prominent. (See HABU, 1975, 79–80 for additional details.)

Antennae. Filiform, antennomeres 4-11 with deep groove (Fig. 5 K, ag) in anterior and posterior faces.

Mouthparts. Labrum transverse, average for lebiines. Mandibles (Figs. 2 A-I): in general form, average for less derived carabids, though narrow for lebiines, falcate, with prominent incisors (Figs. 2 B and C, I); in lateral aspect (Figs. 2 A and D), right broader at base than left; occlusal margin (Figs. 2 F and G) with retinaculum (**R**) larger than average, and especially posterior retinacular tooth (Fig. 2 B, **prt**); right mandible with retinaculum very prominent, anterior retinacular tooth (Fig. 2 C, **art**) blunt but clearly indicated; ventral groove (Figs. 2 E and H, **vg**) very long, extended from base nearly to apex; ventral microtrichia (in ventral groove) dense and long; sensory groove (Figs. 2 E and H, **sg**) moderately long. Maxillae (Figs. 3 A–C): average for Lebiini, except lacinial tooth (Fig. 3 C, **It**) blunt at apex, and dorsal surface apically with thick brush of setae (Fig. 3 B; as in cyclosomine Masoreini). Labium (Figs. 3 D–F): average for Lebiini in these aspects— glossal sclerite (Fig. 3 D) with two apical setae and labial palpomere 2 bisetose; mentum with medial sinus very shallow, tooth broad (Fig. 3 D, **mt**) and epilobes broad (Fig. 3 D, **el**); pair of paramedial pits



Fig. 2. SEM photographs of mandibles of Sugimotoa parallela HABU. A, B, Left mandible, lateral and dorsal aspects, respectively; C, D, right mandible, dorsal and lateral aspects, respectively; E, F, left mandible, ventral and occlusal aspects, respectively; G, H, right mandible, occlusal and ventral aspects, respectively; I, right mandible, ventral aspect, sensory groove. Legend: art, anterior retinacular tooth; I, incisor tooth; M, molar region; mt, molar tooth; prt, posterior retinacular tooth; R, retinaculum; sg, sensory grooves; T, terebra; tr, terebral ridge; tt, terebral tooth; and vg, ventral groove. Scale bars: A–H (bar with Fig. 1 A)=100 μm; I=10 μm.

(Fig. 3 D, mp) present.

Thorax. Pronotum with form and grooving as in Fig. 4 A (for details, see HABU, 1975, 80). Fore coxal cavities uniperforate.

Elytra (Fig. 4 B). Narrow, humerus rounded, lateral margin nearly straight, only slightly sinuate; preapically, slightly sinuate, apical margin slightly rounded. Parascutellar (=scutellar) interneur (ss) and apical part of interneur 1 (ila) continuous, basal part of 1 (diagonal, so called "scutellar stria") absent; most interneurs not extended to apex, terminated freely, not joined to one another. For additional details, see HABU (1975, 80).

Metathoracic wings (Fig. 4 C). Fully developed, with oblongum cell (o) narrow, sinuate, and wedge cell (w) short and narrow.

Legs. Average for Lebiini. Fore tarsomeres of males and females similar in form, those of males (Figs. 5 A-E) not expanded; ventral surface setose, setae climbing



Fig. 3. SEM photographs of maxilla and labium of Sugimotoa parallela HABU. A-C, Left maxilla: A, ventral aspect; B, dorsal aspect; C, apical portion of lacinia and galea, ventral aspect. D-F, Labium: D, ventral aspect; E, dorsal aspect; F, mental pit, ventral aspect. Legend: el, epilobe; g-2, galeomere 2; gs, glossal sclerite; lp, labial palpus; mp, maxillary palpus; lt, lacinial tooth; mp, mental pit; and pg, paraglossa. Scale bars: A-E=100 μm; F=5 μm.

type (scansorial-type ii [STORK, 1980, 300]), bent apically (Fig. 5 B), most setae apically subspatulate, some spatulate (Figs. 5 C and D), most such setae on tarsomere 4. Tarsomeres of mid-legs similar to those of fore, but with fewer spatulate setae. Males without normal secondary sexual vestiture. Claws (Fig. 5 E) smooth.

Abdomen: pre-genital region. Sterna 3–6 with several setae in addition to ambulatory series; sternum 7 with numerous short setae on surface, posteriorly males with two pairs of ambulatory setae, females with three or four pairs.



Fig. 4. Line drawings of external and genital features of Sugimotoa parallela HABU. A, Pronotum, dorsal aspect; B, left elytron, dorsal aspect; C, left hind wing, dorsal aspect; D-G, male genitalia— D, median lobe, left lateral aspect; E, same, apical portion, dorsal aspect; F, left paramere, lateral aspect; G, right paramere, lateral aspect; H, ring sclerite, dorsal aspect; I-K, female, abdominal sclerites of genitalia region— I, tergum 8, dorsal aspect; J, sternum 8, ventral aspect; K, tergum 10, dorsal aspect; L-M, female reproductive tract— L, dorsal aspect; M, ventral aspect. Legend: bc, bursa copulatrix; ila, interneur 1, apical portion; lo, lateral oviduct; o, oblongum cell; sp, spermatheca; spg, spermathecal gland; ss, scutellar striole; and w, wedge cell.

Male genitalia (Figs. 4 D–H). Median lobe in left lateral aspect (Fig. 4 D) with apical portion bent rather sharply; latter moderately long, and tapered (Fig. 4 E); dorsal surface with membranous portion extensive. Parameres, especially left, rather long for Lebiini; left paramere (Fig. 4 F) ca. 3/4 length median lobe, apex tapered; right paramere (Fig. 4 G) ca. half length of median lobe, narrower than left paramere, apex rounded. Ring sclerite as in Fig. 4 H.

Female abdominal sclerites of genital region. Tergum 8 (Fig. 4 I) with hemitergites sclerotized completely; sternum 8 (Fig. 4 J) with hemisternites narrowly membranous medially, broadly membranous laterally, anterior projections rather short. Tergum 10 (Fig. 4 K) generally sclerotized, posterior margin asetose.

Ovipositor (Figs. 5 F–K). Average for basal Lebiini: valvifer broad, with row of setae apically; stylomere 1 (S1) longer than wide, with few setae apically; stylomere 2 (Figs. 5 F and G, S2) laterally with two ensiform setae, one on medial margin (Fig. 5 I, es); sensory pit (Fig. 5 J, sp) distinctly preapical, with pair of nematiform setae (ns) and several (four or so) pit pegs (pp).

Internal genitalia of females (Figs. 4 L–M). Bursa copulatrix (**bc**) campaniform anteriorly; spermatheca (**sp**) apically large, sac-like; spermathecal gland (**sg**) with duct inserted on narrow basal part of spermatheca.

Geographical variation.— Specimens from the Solomon Islands and Vanuatu are larger than the male paratype from the Ryukyus that we examined : SBL, male, Vanuatu – 4.54 mm; females, Solomons – 4.22–4.70 mm; male, Ryukyus – 3.96 mm.

In pronotal features, the lateral margins are markedly sinuate in the Ryukyu material (HABU, 1975, 78, fig. 11), whereas in the Solomon Islands – Vanuatu series the lateral margins are only slightly sinuate (Fig. 4 A).

In details of the median lobe of the male genitalia, the male from Vanuatu (Fig. 4 D) has the apical portion longer; in dorsal aspect, the apex is more broadly rounded. In contrast, the male from the Ryukyus has a shorter apical portion and in dorsal aspect the apex is pointed (cf. HABU, 1975, 81, fig. 14).

Habitat.— Little is known about this subject. UÉNO (*in litt.*) advised us that the U–V light at the type locality was "... situated in a cultivated field not far from the sea-shore." Further, considering the characteristic tarsal adhesive vestiture of adult *S. parallela*, a type of vestiture that is associated more with arboreal habitats, he suggested that, considering the absence of trees in the area, and the abundance there instead of tall grasses, such as sugar cane, the beetles may be residents on such plants.

^{Fig. 5. SEM photographs of tarsomeres, ovipositor, and antennomeres of Sugimotoa parallela HABU. A-E, Left fore tarsus of male: A, spatulate setae, lateral aspect; B, tarsomeres 2–5, ventral aspect; C, same, spatulate setae, apical portions; D, same, lateral aspect; E, same, tarsal claws, apical aspect. F–J, Ovipositor, left sclerites: F, valvifer, and stylomeres, lateral aspect; G, stylomere 2, lateral aspect; H, stylomere 2, ventral aspect; I, stylomere 2, medial aspect; J, same, sensory pit, ventral aspect. K, Antennomere 9, anterior aspect. Legend: ag, antennal groove; es, ensiform seta; ns, nematiform seta; pp, pit peg; S–1, stylomere 1; S–2, stylomere 2; tc, tarsal claw; and Vf, valvifer. Scale bars: A, B, E, F, and K=100 µm; C, D, G, and H–J=10 µm.}





Fig. 6 A. Map of Eastern Eurasia, Australia and adjactent islands, showing positions of collecting localities for *Sugimotoa parallela* HABU.

Large eyes (Fig. 1) and rufous to rufo-piceous color of the beetles are consistent with other characteristic grass stem-inhabiting lebiines. Grasses of sugar cane type are seldom examined by carabid collectors, and further, it is difficult to work one's way within densely planted cane fields. Thus, beetles in such habitats are encountered infrequently.

An additional possibility is that population samples of *Sugimotoa parallela* may have been imported into the Ryukyu Archipelago with a shipment of sugar cane from farther south, and that the species "...may have a wide range in the tropics of the Southwest Pacific."

Geographical distribution (Figs. 6 A-B).— This species is known from the following Oriental – Southwest Pacific island archipelagos, only: Ryukyus, Solomons, and Vanuatu.

Material examined.- Five specimens. Male, two females, labelled: SOLOMON



Fig. 6 B. Map of the Southwest Pacific area, showing islands on which specimens of Sugimotoa parallela HABU were collected. Legend: A, Santa Isabel Island, Solomons Archipelago; B, Espiritu Santo Island, Vanuatu Archipelago.

IS./Santa Ysabel/Buala, 27. VI. '60; Light Trap; C.W. O'Brien/Collector (BPBM). Female labelled: Malao Village in Big Bay Area./Espiritu Santo, New Hebrides./28 Aug. 1971. G.F. Gross./Roy. Soc. Percy Sladen Exp.; Carabidae/tribus nov./det. B.P. Moore '75: S.A. Museum/Specimen [red label] (SAMA). Male, labelled: VI. 29. 1973/Ishigaki Is./Ryukyu/A. Sugimoto; Paratype/Sugimotoa/parallela/HABU (ITLJ).

Phylogenetic Relationships of Sugimotoa

HABU (1975) "hesitatingly" assigned *Sugimotoa* to the tribe Harpalini and erected for it the subtribe Sugimotoina. He suggested "slight" affinity between *Sugimotoa* and the subtribe Stenolophina, based on similarities in form of the ligula (=glossal sclerite), legs, and the marginal umbilicate series of elytral setae. However, he noted also that, as far as he was aware, members of no other harpaline species have two

pairs of supraorbital setae. Another unusual trait of *Sugimotoa* adults is their suborbital setae, a feature that, to the best of our knowledge, is found elsewhere only in certain Lebiini and in the genus *Actenonyx*, which has been assigned previously to the Pentagonicini (CSIKI, 1932, 1506), Lebiini (BRITTON, 1941, 135) and most recently to the Odacanthini (LIEBHERR, 1988, 18). These traits, otherwise unknown among Harpalini, led us to question HABU's tribal assignment of *Sugimotoa* and to conduct a preliminary analysis of phylogenetic relationships among this genus and several possibly related tribes and subtribes. Our goal was to better assess the phylogenetic affinities of *Sugimotoa*.

Methods.

Rather than including an extensive array of representative species for each of these other taxa, thereby complicating the analysis at the taxonomic level desired, we chose one or a few exemplar species to represent each tribe or subtribe. We supplemented character state information acquired directly from dissection and examination of these exemplars with data extracted from ACORN and BALL (1991), BALL (1975, 1982), BALL and HILCHIE (1983), BALL and SHPELEY (1983, and 1986), HABU (1967, 1973, 1975, 1978), LIEBHERR (1986, 1988), SHPELEY and BALL (1994), and SHPELEY *et al.* (1985). A list of taxa used as exemplars is provided in Table 1. An Appendix provides comments about and descriptions and illustrations of structural features for representatives of four lebiomorph taxa not treated in detail in the publications noted above.

We examined the state distributions of 52 characters in 16 taxa, including Sugimotoa, Platynini, two subtribes of Harpalini, 11 subtribes of Lebiini, including Actenonycina, and a hypothetical outgroup (included to fix the root of trees; see below). The characters, states of each, and a matrix of states for taxa studied are presented in Table 2. Characters examined included both those traditionally used to distinguish and/or group "higher grade" carabid tribes and several others introduced here to characterize Sugimotoa or one or more other taxa and which we thought might be useful in elucidating relationships among the taxa compared. In fact, 12 of the 52 characters were found to be autapomorphic or invariant among the taxa examined and therefore phylogenetically uninformative. These included characters 4, 8, 9, 10, 20, 27, 28, 31, 32, 41, 45, and 49 (see Table 2). Only the remaining 40 informative characters were used in the phylogenetic analysis.

We applied equal weighting, subjective differential weighting, and successive weighting of characters in different analyses performed. Because not all characters are represented by the same number of states (the range among characters we used is from 2 to 4 states), and characters with more states are naturally accorded more weight (*i.e.* a greater minimum number of steps is required for their transformation) even the equal weighting of characters is somewhat arbitrary.

Where subjective differential weighting was applied intentionally, seven characters (1, 2, 6, 17, 33, 39, and 40) were assigned a high weight [=3], two (characters 25)

	Tabla 2 Character State Matrix f	hvlvh	anan	Tic AT	alveis	Ta	KON 3	hhrev	ation	5. AC	1=40	(nong)	A AI	A=90	nenin	a. Cal	11	
	Calleidina, Cel=Celaenephini, A Calleidina, Cel=Celaenephini, A Metallicina, Pel=Pelatellii Sugimotoa. Other symbol with states 0 throug	Sym=C a, Per= s: "0, 1" h 2; "?'	Perio	dina, alina on dii aracte	Dro= Phy= norph	Drom =Phys ic, wi iunkı	th bo	hyp= na, Pl th stat	hypot a=Pla es 0 a =chai	hetica utynin nd 1; acter	l outg i, Ste "0-2" state	sroup =Ster =tax not a	Leb= tolopl on po pplica	=Lebi nina, lymor ble.	ina, N Sug= phic,	flet=		
	character		Pla	Cel	Sug	Per	Ape	Cym	Met	Cal	Phy	Gal	Leb	Dro	Act	Pel	Ste	hyp
Adul	t external characters																	
01	supraorbital setae		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
	0 = 2 pairs; $1 = 1$ pair																	
8	suborbital setae		0	0	1	-	0	0	0,1	0	0	-	0	0	1	0	0	0
	0 = absent; 1 = present																	
03	antennomere 1, vestiture		0	6	1	0	0	6	0	0	1,2	0	0	0	1	0	0	0
	0 = glabrous; 1 = sparsely																	
	setose; 2 = moderately setose																	
8	antennomere 2, macrosculpture		0	0	0	0	0	0	0,1	0	0	0	0	0	0	0	0	0
	0 = without carina or depression;																	
	1 = carina or depression present																	
05	antennomere 2, vestiture		0	5	1	0	5	5	0	0	1,2	0	0	0	1	0	0	0
	0 = glabrous; 1 = sparsely																	
	setose; 2 = moderately setose																	
90	antennomere 3, vestiture		0,2	6	5	0	5	5	0	0	-	0	1	-	1	5	5	0
	0 = glabrous; 1 = very sparsely																	
	setose; 2 = moderately setose																	
20	antennomeres 4 to 11, sensory grooves		0	0	-	0	0	0	0	0	-	0	0	0	0	0	0	0
	0 = absent; 1 = present																3	ł
08	antennomeres 5 to 11, sensory pits		0	1	0	0	0	0	0	0	0	•	0	0	0	0	0	0
	0 = absent; 1 = present ventrally																	
8	mandible, right, terebral tooth		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	0 = present; 1 = absent																	
10	mandible, left, anterior retinacular tooth		0	•	0	0	0	0	0	0	0	0	•	0	0	0	0	0
	0 = absent; 1 = present																	
11	mandible, right, anterior retinacular tooth		0	0	0	0	1	0	-	1	-	2	-	0	0	0	0	0
	0 = present; 1 = absent																	
12	mandibles, posterior retinacular tooth		0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
	0 = moderate; 1 = enlarged																	

-	uracter	Pla	Cel	able	Per Co	Ane	ed Cvm	Met	Cal	Phv	Gal	Leb	Dro	Act	Pel	Ste	hvn	29
		!	5	2	!		1		5	2	}	ł	2	1	:		10-	0
mandible	, right, retinacular ridge	0	1	5	0	0	3	2,3	1	3	0	0	1	1	0	3	0	
9 m e	= slightly projected; 1 = moderately ojected; 2 = markedly projected; = reduced																	
nandible	e, left, premolar tooth	0	0	1	0	0	1	0	0	0	2	0	0	0	0	0	0	C
0	= present; 1 = absent																	ieo
nandible	es, ventral setal groove	1	-	6	0,1	6	0,1	0,1	0	-	1	1	0	1	1	1	1	rge
0	= short; 1 = long; 2 = very long																	: E.
nandibl	es, ventral secretory groove	0	7	6	5	0,2	1	5	3	0	6	0	1	0	0	0	0	. B
0	= absent; 1 = present, short;																	ALI
6	= present, long																	., I
Daraglos	ssae, sclerotization	0	0	0	0	1	1	1	1	1	1	1	-	0	0	0	0	Jav
) = membraneous; 1 = sclerotized																	/Id
glossal :	sclerite, apical setae	0	0	0	1	0	0	1	0,1	1	0	0	1	1	0	0	0	H.
0	= two setae; 1 = four or more setae																	K
ronotu	m, midlateral setae	0,1	0	0	0	0	0	0	0	1	1	0	0	-	0	0	0	AV/
0	= present; 1 = absent																	ANA
nonotu	m, paramedial setae	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	UC
0	= absent; 1 = present																	H a
pronotu	m, basolateral setae	0,1	0	0	0	0	0	0	0	0	0	0	0	1	1	-	0	anc
0	= present; 1 = absent																	1 B
ront co	xal cavities	0,1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	arr
0	= unbridged (uniperforate);																	y ł
-	= bridged (biperforate)																	'. N
lytron,	shape apex	1	3	0	1	з	3	3	3	3	1	3	3	5	1	0	1	40
0	= rounded; 1 = tapered preapically;																	ORI
2	= subtruncate; 3 = truncate																	E
lytron,	subapical sinuation	0	6	1	0,1	0,1	8	5	0	1	5	1	1	5	1	3	0	
0	= present, distinct; $1 =$ present,																	
>	ery shallow; 2 = absent																	
lytron,	basal margination	0	1	5	1,2	0	0-2	1	0	1	0	0-2	0-2	0	0	0	0	
0	= complete; 1 = extended medially																	
õ	nly to interneur 3 ; $2 = extended$																	
5	adially only to interneur 5																	

			-	able	2. CC	ntinu	ed										
	character	Pla	Cel	Sug	Per	Ape	Cym	Met	Cal	Phy	Gal	Leb	Dro	Act	Pel	Ste	hyp
26	elytron, interneur 1	0	0	1	0	0	0	0	0	0		0	0	0	1	1	0
	0 = entire, extended from base;																
	1 = absent basally, fused with																
	apex of scutellar striole																
27	elytron, intervals 1, 5, & 7	0	0	1	0	0	0,2	0	0	0	0	0	0	0	0	0	0
	0 = without setiferous pores; 1 =																
	setiferous pores present, adjacent																
	to interneurs; 2 = densely setose																
28	elytron, interval 8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 = without setiferous pores; $1 =$																
	setiferous pores present																
29	elytron, penultimate umbilicate seta	0	0	0	0,2	5	0	0	0	0	1	-	0	0	0	0	0
	0 = in line with other setae; 1 =																
	displaced medially; 2 = displaced																
	laterally																
30	elytron, apical microsetae	0-2	1	1	0	0	0,1	0	5	0	5	6	0	0	0	0	0
	0 = absent or present only on																
	interval 3; 1 =present on interval																
	1; 2 = present on interval 2																
31	front tibia, upper spur	0	0	0	0	0	0	0,1	0,1	0	0	0,1	0	0	0	0	0
	0 = present; 1 = absent																
32	front tarsus, adhesive vestiture, male	0	0	٦	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 = present on one or more																
	tarsomeres; $1 = absent$																
33	middle tarsus, adhesive vestiture, male	0	0	0	1	0	0	0,1	1	1	1	0	0	0	0,1	1	0
	0 = absent; 1 = present on one																
	or more tarsomeres																
34	front & middle tarsi, climbing vestiture	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0	0
	0 = absent; 1 = present apically																
	on one or more tarsomeres																
35	hind tarsomere 4, apical margin	0,1	0	0	0	0	0	1	0,1	1	1	0	0	0	0	0	0
	0 = slightly emarginate;																
	1 = bilobed																

	į		able.		nuuu	Da						¢			č		
character	Pla	Cel	Sug	Per	Ape	Cym	Met	Cal	Phy	Gal	Leb	Dro	Act	Pel	Ste	hyp	
 genitalia																	
parameres, relative size 0 = right subequal to left; $1 = $ right slightly to moderately smaller than	0	0	-	6	6	6	2	5	6	7	7	2	1	0	0	0	
left; 2 = right much smaller than left median lobe, dorsal sclerotization	0	0	0	1	1	-	-	-	0	1	1	1	г	0	0	0	
0 = almost enturely mebraneous, I = sclerotized except for apical onfice copulatory piece 0 = absent; 1 = present	0	0	0	0	0	-	0,1	0,1	-	0	0	0	0	0	0	0	
le genitalia	3	. 9	3	3								,		¢	C	c	
tergum 8, form 0 - antire: 1 - divided medially	0	0	1	I	1	-	-	-	1	1	1	-		0	0	0	
o = cinue, 1 = urviced incutany into hemitergites																	
tergum 8, lateral margin	0	1	0	1	1	1	1	-	1	1	1	-	1	0	0	0	
0 = rounded, not toped; 1 = distanced lobed, associated with pygidial ducts															ŝ)	
sternum 10, form, female	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0 = memoraneous; 1 = scierouzed, spiculate basally															8		
stylomere 2, form	0	0	0	0	0	-	0,1	-	-	-	-	-	0	0	0	0	
0 = falcate; 1 = straight, non-falcate stylomere 2, dorsobasal lobe	0	5	0	0,2	1	6	5	5	2	2	5	2	5	0	0	0	
0 = moderately long; 1 = markedly																	
long; $2 =$ short or absent															28	5	
stylomere 2, lateral ensiform setae	0	0	0	0	1	1,2	0-2	5	2	6	6	1	0	-	-	0	
0 = two or three setae; 1 =																	
one seta; $2 = none$																3	
stylomere 2, medial ensiform setae	0	0	0	0	0	0	0,2	0	0	0	0	0	0	0	0	0	
0 = one seta; $1 = $ none; $2 =$																	
two or more setae															1	2	
stylomere 2, preapical sensory furrow	0	0	0	0	1	0	1	1	-	-	1	1	0	0	0	0	
0 = present, narrow; 1 = absent																	

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Sugimotoa pa	irallela HABU
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				Table	2. C	ontinu	per										
	character	Pla	Cel	Sug	Per	Ape	Cym	Met	Cal	Phy	Gal	Leb	Dro	Act	Pel	Ste	łył
47	<pre>stylomere 2, length nematoid setae 0 = 0.1 to 0.5 times length stylomere 2; 1 = or > length stylomere 2; 2 = about 0.05 times length stylomere 2.3 = about</pre>	0	1	0	0	•	5	e	ŝ	ŝ	9	e	3	6	0	0	0
48	bursa copulatrix, shape, dorsal aspect 0 = skirt-like; 1 = sac-like	0,1	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0
49	bursa copulatrix, sclerites 0 = absent; 1 = present	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	<pre>spermatheca, shape 0 = short to medium length, sac-like, without narrowed basal duct; 1 = long, tubular, duct-like, 2 = large sac-like; 3 = short, sac-like, with narrow basal</pre>	0,1	6	0	-	0	0	0,1	0	0	0	6	0	6	0	0,1	0
51	auct spermatheca, chamber 0 = simple. linear: 1 = bifurcate	0	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0
52	spermathecal gland, insertion 0 = basal or sub-basal on duct or sac; 1 = midlength or subapical on sac; 2 = apical on sac	0,1	0	0	0	1	0	0	0	1	0	0	1	5	0	0	0

and 30) were assigned a low weight [=1], and the remaining 31 characters were assigned medium weight [=2]. High weight was accorded characters for which character state transformations are either consistently informative in phylogenetic analyses across diverse groups of Carabidae at comparable taxonomic rank (characters 1, 6, 17, and 33) or unique to the group of taxa analyzed in this study (characters 2, 39, and 40). Low weight was accorded characters with transformations found repeatedly among diverse groups of Carabidae.

The plesiomorphic state of each character transformation was assessed provisionally using the outgroup comparsion method (see BALL, 1975; CRISCI & STUESSY, 1980; KAVANAUGH, 1986; MADDISON, 1993). For this purpose, our outgroup included the "basal" and "intermediate" grade carabid tribes (*e.g.* Nebriini, Carabini, Elaphrini, Bembidiini, Patrobini, Psydrini, etc.). The state judged to be most plesiomorphic for each character was assigned to state "0", with relatively apomorphic states assigned to state "1", "2", or "3". Character states for the "hypothetical outgroup", as recorded in Table 2 and used in our phylogenetic analyses, represent the proposed plesiomorphic states for all characters. All trees were rooted at this hypothetical outgroup. In the absence of any specific background assumption about character evolution (*sensu* MADDISON, 1993), our analysis was based on parsimony methods. We searched for most parsimonious trees using the computer program, PAUP version 3.1 (SWOFFORD & BEGLE, 1991). Trees discovered were then analyzed using the computer program, MacClade version 3.0 (MADDISON & MADDISON, 1992). Tree lengths and consistency and retention indices provided are those calculated by MacClade.

One search was conducted using PAUP's branch and bound option to guarantee discovery of the shortest trees. All characters were equally weighted and unordered, with MAXTREES set to 700, addition sequence set to "furthest", and zero-length branches collapsed. Three additional searches were conducted using PAUP's heuristic search option with different character weighting schemes, but all with characters unordered. Each of these searches involved 30 different random addition sequences and subsequent tree- bisection-reconnection (TBR) branch rearrangement, with MAXTREES set to 700, MULTIPARS turned on and STEEPEST DESCENT off, and zero-length branches collapsed. In the first search, all characters were assigned equal weight. In the second, characters were assigned our subjective differential weighting. In the third search, characters were subjected to successive weighting, with reweighting proportional to the maximum rescaled consistency indices over trees discovered in the previous search (base decimal weight set to 10.00). The starting trees for this search were the shortest trees found in the branch and bound search (*i.e.* with equally weighted characters).

Results.

Our search using PAUP's branch and bound option, with characters equally weighted, found seven shortest trees, each with a length of 165 steps, consistency index (CI) equal to 0.62, and retention index (RI) equal to 0.58. The heuristic search with

characters equally weighted found the same seven shortest trees; and this set of trees was found in all 30 replicates using different random addition sequences. A strict consensus tree of these seven trees differs with the tree in Figure 7 only in having 1) branch I collapsed, resulting in a trichotomy involving the Cymindina, Dromiina, and branch J, and 2) branches K and L collapsed, resulting in a polytomy involving Physoderina, Metallicina, Calleidina, and Galerucidiina. Because our purpose was to establish the relationships of *Sugimotoa* to the other taxa examined and not to resolve further the relationships of subtribes within the Lebiini, unresolved polytomies within the Lebiini did not concern us.

The heuristic search with characters assigned our subjective differential weighting found a single shortest tree (length=330 steps, CI=0.62, and RI=0.61). Again, this same tree was found in all 30 replicates using different random addition sequences, and it was also one of the seven trees found by both searches using equally weighted characters (Fig. 7). The heuristic search using successive weighting found a single shortest tree (length=405.43 steps, CI=0.73, and RI=0.82). Shortest tree length and character weights were identical in the second and third (as well as in two subsequent) search runs, and, once again, the same tree was found in all 30 random addition sequence replicates in each run. Most importantly, the shortest tree found in this search (Fig. 7) also was found shortest, or at least among the shortest, in all of the other searches.

According to the hypothesis of relationship suggested by this cladogram, Sugimotoa is the adelphotaxon (sister group) of Actenonyx. Monophyly of a clade including these two taxa is supported by three synapomorphies (unambiguous changes): antennomere 1 sparsely setose (character 3), posterior retinacular tooth of mandibles enlarged (markedly so in Sugimotoa, less so in Actenonyx— character 12), and male right paramere slightly to moderately smaller than left (character 36). The inferred adelphotaxon of this clade is the Pericalina. Monophyly of the Pericalina+Sugimotoa + Actenonyx is supported by one synapomorphy: suborbital setae present (character 2). The occurrence of suborbital setae also in galerucidiines and some metallicines probably represents convergence.

All taxa distal to branch G (*i.e.*, the Apenina, Cymindina, Dromiina, Lebiina, Physoderina, Metallicina, Calleidina, and Galerucidiina) appear to form a clade, the monophyly of which is supported by three synapomorphies: paraglossae sclerotized (character 17) and female stylomere 2 with only one lateral ensiform seta (character 44) and nematiform (=nematoid) setae absent (character 47). The inferred reappearance of nematiform setae in the Cyminidina is somewhat problematic. Although requiring one additional inferred step, convergent loss of nematiform setae from the apenines and taxa distal to branch I may be a more plausible explanation of observed character state distribution. Absence of nematiform setae would then be a synapomorphy for taxa distal to branch I rather than those distal to branch G.

The monophyly of a clade including all taxa distal to branch E is supported by four synapomorphies: front coxal cavities bridged ("biperforate"; character 22), male

right paramere much smaller than left (character 36), male median lobe sclerotized dorsally except for apical orifice (character 37), and female tergum 8 divided medially into hemitergites (character 39). If the inclusion of *Sugimotoa* within this clade correctly reflects its evolutionary history, then two, or perhaps three, of its traits represent reversals. The unbridged ("uniperforate") front coxal cavities and male median lobe unsclerotized dorsally are plesiomorphic features; and the male right paramere only slightly to moderately smaller than the left, a trait shared with its suggested adelphotaxon, *Actenonyx*, is also plesiomorphic.

Evidence for the monophyly of a clade comprising all taxa distal to branch D (*i.e.* Celaenephina, all other lebiines, and *Sugimotoa*) includes three synapomorphies: ventral secretory groove of mandibles present and long (character 16), lateral margin of tergum 8 distinctly lobed (forming a projection that bears the opening of the duct from the pygidial gland, on each side (character 40), and dorsobasal lobe of female stylomere 2 short or absent (character 43). Again, inclusion of *Sugimotoa* in this clade infers that reversals occurred in the history of this genus in the evolution of two of these characters. We found no trace of a lobe or projection laterally on tergum 8 in either sex, and the dorsobasal lobe on stylomere 2 in females is moderately long. Both of these features are shared only, among the taxa studied, with platynines and harpalines and are considered plesiomorphic.

Character 16 (ventral secretory grooves on the mandibles) is postulated to exhibit a very complex history, involving both reduction (independently in cymindines and dromiines) and several independent losses (from the mandibles of *Actenonyx*, some apenines, lebiines and physoderines). Nevertheless, this evolutionary pattern is contained in the best-supported cladogram that we were able to find.

Are we confident that phylogenetic relationships of *Sugimotoa* inferred from this most parsimonious cladogram accurately reflect the phyletic history of the genus ? Yes, but only to a limited degree. The data matrix (Table 2) exhibits discordance among characters, hence many instances of homoplasy. Although we have not addressed any of the questions raised by the abundance of polymorphisms found in several characters among terminal taxa, these also limit our confidence in the appropriateness of some of our choices of exemplars and the inclusiveness of our data. Ideally, we should have included two or more exemplars for each taxon, carefully selected to embrace both early- and late-diverging lineages within each group. This, of course, would have required pre-existing phylogenetic hypotheses for each of the groups in-

Fig. 7. Most parsimonious cladogram determined using PAUP, version 3.1 algorithm, under both branch and bound and heuristic search options, and with characters equally, subjectively differentially, and successively weighted in different searches (length=165 steps, CI=0.62, and RI=0.58). Branch segments discussed in text are identified by capital letters (A-L). Only characters that change states unambiguously are noted on the cladogram (by character number; see Table 2). For character state changes that occur more than once on the cladogram, the character number is underlined. State changes that represent advances are shown beside dashes, and those that represent reversals, beside x's.



cluded in the analysis, and even general hypotheses are not currently available for more than one or two of these groups (see LIEBHERR, 1986; BALL & SHPELEY, 1986). Also, it would have been desirable to expand the scope of the analysis to include several additional tribes, particularly the Pterostichini, Zabrini, Lachnophorini, Masoreini, Ctenodactylini, and Odacanthini (including the Pentagonicini; LIEBHERR, 1988).

Our choice of this most parsimonious cladogram (Fig. 7) as the best current hypothesis of phylogenetic relationships of *Sugimotoa* is based mainly on its discovery as the shortest tree under all character weighting schemes applied. Clearly, there is a consistent pattern that emerges. But are there any trees just slightly longer than the shortest that suggest other relationships ?

With characters weighted equally, trees of length 166 steps, one step longer than the shortest tree, identify either the harpalines (Pelmatellina+Stenolophina) or all lebiines (including Celaenephina and Actenonycina) as the adelphotaxon of *Sugimotoa*. If characters are assigned subjective differential weights, the next shortest trees that involve a change in placement of *Sugimotoa* have the same topologies as the two just described, but they require three more steps (length 333 steps) than the preferred tree (length 330 steps). With successive weighting applied, the next shortest tree that shifts the placement of *Sugimotoa* has a length of 425.90 steps (20.47 steps longer than the preferred tree. Trees with the clade *Sugimotoa*+harpalines or with *Sugimotoa* as the adelphotaxon of lebiines (including *Actenonyx*) have minimum lengths of 426.52 steps (21.09 steps longer than the preferred tree).

The monophyly of a clade including only *Sugimotoa*+harpalines is supported by one synapomorphy: elytral interneur 1 absent basally, fused with apex of scutellar striole (character 26). This feature occurs among a disparate array of higher grade carabid genera and tribes. Similarity in this feature is most likely due to convergence. Other traits shared by *Sugimotoa* and our harpaline exemplars (see Table 2) are probably symplesiomorphies. The only consistent synapomorphy for Harpalini of which we are aware, the presence of a single pair of supraorbital setae (character 1), is not shared with *Sugimotoa*. Nonetheless, it is easy to understand HABU's placement of the genus in the Harpalini, based on habitus as well as several discrete (but symplesiomorphic) features.

One of the most distinctive features of *Sugimotoa* adults is the presence of paramedial pronotal setae. We were unaware of the occurrence of such setae in any other carabid taxon; but David MADDISON (personal communication) recalled having seen such setae in adults of *Acupalpus alternans* (LECONTE) from Ontario, Canada. We have since confirmed his recollection with an examination of specimens. Although this similarity is quite remarkable, we have no other evidence indicative of close relationship between *A. alternans*, or any other species of *Acupalpus*, and *Sugimotoa*. Although we find little support for a *Sugimotoa*+Harpalini clade, such placement cannot be ruled out at present.

The only synapomorphy supporting the monophyly of a clade in which *Sugimotoa* is the adelphotaxon of all lebiines including *Actenonyx*, is the presence of a long ventral

secretory groove on the mandibles (character 16). This feature also supports the clade above branch E (which includes *Sugimotoa* among the lebiine subtribes) in the preferred cladogram, and, hence, it does not persuade us to reject the shorter tree.

Finally, then, we recognize the tribal affinities of *Sugimotoa* as inferred from the preferred cladogram. This is a lebiine genus, perhaps most closely related to the Pericalina or some part of that clade. For the present, we propose recognition of *Sugimotoa* as representing a distinct lebiine subtribe, Sugimotoina, the name already proposed by HABU (1975).

Concluding Remarks

In Sugimotoa, we have identified another putative basal lineage of Lebiini — one more relict group from the Oriental – Southwest Pacific area, to join with Celaenephes and Actenonyx, each of which forms a monobasic, probably relict, subtribe. We began with the thought that Sugimotoa represented a discordant element in the fauna inhabiting the volcanic and coral islands that dot the warm, shallow Pacific seas and fringe the northeastern part of the Australian continent. But that discordance may apply only to the present, and is probably the sign of an ancient faunal element that has dwindled, yet persisted, even as its place in the tropical sun is being taken by the later-evolving and seemingly more progressive and more highly derived lineages of the great lebiine adaptive radiation. Sugimotoa and the other basal lebiine groups provide us with a glimpse of a biota that flourished at an earlier time.

The initial discovery of this astounding, putatively ancient genus, by Akinobu HABU, was an important though unheralded event in the chronicle of efforts of systematists not only to make known diversity, but also to understand the significance of its elements. What did it cost? — to obtain the specimens, only the seemingly casual efforts of an interested resident entomologist to erect and service a light trap; and then, to prepare, interpret and describe the taxon represented by the specimens, the standard effort of a skilled, effective and perceptive systematic entomologist.

Obtaining the additional Solomon Islands – Vanuatu material came about as the result of routine collecting efforts of entomologists who were in those places by virtue of participation in expeditions of scientific discovery. To prepare and house the specimens adequately, three museums had to make modest investments. Overall, the cost of the several discoveries of the known specimens of *Sugimotoa parallela* and their subsequent maintenance could not have been very great— probably measured in terms of a few thousand dollars and yen.

In a sense, groups like *Sugimotoa* represent pots of gold at the end of the rainbow of biodiversity— not just some more new genera or new species, but rather bearers of unexpected information that give insights into the quest for knowledge about evolution. How many more such "pots of gold" are there to be discovered?

Enormous amounts of public funds are being invested in pursuit of distant and dimly perceived rainbows of the mind, such as the quest in outer space for electronically

transmitted signs of intelligent life that inhabits other planets, or the location of black holes postulated by astrophysicists to balance their abstruse equations.

It is a pity that public investment is not rather more generous in support of discovery of knowledge about life on planet Earth. Increased funding of biodiversity studies would hasten the process of discovery of taxa like *Sugimotoa*. Considering the present rate of habitat destruction with its concomitant loss of biodiversity, hastening of discovery is to be desired greatly.

We must not end this study with dark thoughts of biotic loss. Rather, consideration of what to do next to learn more about *Sugimotoa parallela* should be foremost in our minds.

To the present, only systematic entomologists have considered this species, and their work has been based on adults, only. Thanks to the perceptive observations of Dr. UÉNO— the man who we honor— we have been able to suggest that the adult beetles live on large grasses. Perhaps an entomologist with ecological leanings might be induced to visit the Maésato cane fields on Ishigaki-jima, to seek out the beetles and undertake a detailed study of their way of life. Such a study could test our postulates, but more important, it would bring us to another plateau of understanding of this remarkable carabid species.

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Y. BOUSQUET helped us substantially with his discovery that the puzzling specimens from the Southwest Pacific area that led to the present investigation, were at least congeneric with *S. parallela*. M. J. D. BRENDELL (Department of Entomology, The Natural History Museum, London) searched through the Sladen expedition material, housed in his institution, for additional specimens of *S. parallela*.

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6 B, also.

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Appendix

Presented below is evidence for some of our statements about structural features, especially of the mandibles. The notes and illustrations will be useful, as well, in future studies of structural details of the lebine subtribes. We have taken the opportunity also to comment about relationships and classification of the genus *Actenonyx* WHITE (monobasic, including only the New Zealand species *A. bembidioides* WHITE), and to compare its mouthparts and ovipositor with those of one of its putative non-lebine relatives, *Pentagonica* SCHMIDT-GÖBEL (represented by the New World species *P. felix* BELL).

Actenonyx bembidioides WHITE

(Figs. 8 A-F, and 9 A-I)

BATES (1871, 80) placed Actenonyx in its own suprageneric group (Actenonycinae), which he compared with the Odacanthinae. CSIKI (1932, 1506) included the former group with the tribe Pentagonicini in a single tribe. BRITTON (1941, 185) included Actenonyx in the Lebiini, but expressed the opinion that probably it is a member of the Odacanthini.

LIEBHERR (1988, 18) combined the Pentagonicini with the Odacanthini, primarily on the basis of shared features of the internal female genitalia. He did not refer to any structural details of *Actenonyx*, nor did he present any illustrations of members of this taxon. Because *Actenonyx* females do not exhibit the bifurcate spermatheca characteristic of the Odacanthini, we leave it in the Lebiini and place it in another monobasic subtribe, the Actenonycina.

Description.— Mouthparts. Labrum (Fig. 9 A) transverse, with anterior margin subtruncate. Ventral surface with epipharynx with pedium (**ped**) short, not extended to labral base, parapedial setae (**ps**) rather dense; complex of microtrichia basad parapedial projection.

Mandibles (Figs. 8 A-F) elongate in form, with terebra (Fig. 8 A, t) in dorsal aspect

relatively narrow; incisor (i) rather short, sharply bent (especially on the left mandible) relative to long axis of terebra; occlusal margin (Figs. 8 A and B) with complete array of teeth (left mandible with tt, rt, pm, m; right mandible with two retinacular teeth, rather than one — art and prt) and ridges (Fig. 8 A, str, tr; Fig. 8 E, rr); in occlusal aspect, surfaces moderately narrow, curved ventrally somewhat, from basal area to incisor; ventral surface (Figs. 8 E–F) with long ventral groove (vg) and moderately long micro-trichia (vm).

Maxillae (Figs. 9 B-C). Lacinia with dense brush of curved microtrichia along occlusal margin, dorso-apical margin with dense brush (lb); tooth sharp, long; galeomeres 1 and 2 (g-2) subequal in length; palpomeres 3 and 4 (mp-4) subequal in length.

Labium (Figs. 9 D-E) with submentum (sm) and mentum (m) separated by distinct suture, each of these sclerites with one pair of setae; mentum toothed medially (mt), tooth deeply cleft; epilobes (ep) prominent apically; prementum with glossal sclerite (gs) dentiform, quadrisetose; paraglossae (pg) distinctly narrowed apically, shorter than glossal sclerite, in dorsal aspect (Fig. 9 E) generally setose, setae short; palpomere 3 (lp-3) shorter than 2.

Ovipositor (Figs. 9 F–I) with valvifer (9 G, Vf) and stylomere 1 (S–1) setose apically; stylomere 2 (9 G, S–2) in lateral aspect falcate, lateral margin with two ensiform setae (9 H, es), ventrally with rather broad sensory pit, with two short nematiform setae (9 I, ns — one nematiform seta broken away at its base), and two pit pegs (vpp).

Material examined.— Female, New Zealand, South Island, Mistletoe Creek, at Lake Te Anau, 26-XI-1993, Stop # 19A (CASC).

Comparisons. - Although Actenonyx and Pentagonica were included by several authors in the same tribe, adults differ markedly in numerous details of mouthparts and ovipositor (Figs. 8 and 9; cf. Figs. 12 and 13). In most features, Actenonyx exhibits the more plesiomorphic states: for example, the labrum, with the more numerous parapedial setae (ps, Fig. 9 A; cf. Fig. 13 A), and the shorter pedium (ped); mandibles, with a complete set of teeth occlusally, scrobes laterally, and ventral groove and microtrichia ventrally (Figs. 8 A-F; cf. Figs. 12 A-F); maxillae (Figs. 9 B-C; cf. Figs. 13 B-C), with the occlusal margin of the lacinia densely setose, and apex of palpomere 4 subtruncate (mp-4); labium (Figs. 9 D-E; cf. Figs. 13 D-E) with submentum and mentum separated by a distinct suture, glossal sclerite (gs) comparatively narrow, paraglossae (pg) comparatively large, without large setae dorsally, and labial palpomere 3 (lp-3) with apex subtruncate; ovipositor stylomere 2 (S-2, Figs. 9 F-I; cf. Figs. 13 F-G) long, slender falcate, with only two lateral ensiform setae near about mid-length. Also, in the internal female genitalia, the spermatheca of Actenonyx is a simple sac, whereas that of Pentagonica is bifurcate, which is postulated as the apomorphic condition. In contrast, Pentagonica exhibits some features that are plesiomorphic, but only in the mouthparts: maxillary lacinia (Fig. 13 B; cf. Fig. 9 C) without apical brush (lb); glossal sclerite of labium (gs, Fig. 13 D; cf. Fig. 9 D) with apex broad not dentiform.

These extensive differences between the two genera are bridged partly by the features of the pentagonicine genus *Scopodes*, whose adults exhibit mandibular scrobes, and whose females have stylomere 2 more like those of *Actenonyx* (Figs. 9 G-H) than those of *Pentagonica*. Nonetheless, and at least for the present, we accept the inclusion of *Scopodes* and *Pentagonica* in the Odacanthini, with *Actenonyx* in the Lebiini.



Fig. 8. SEM photographs of the mandibles of Actenonyx bembidioides WHITE. A, C, E, Left mandible, dorsal, occlusal and ventral aspects, respectively; B, D, F, right mandible, dorsal, occlusal and ventral aspects, respectively. Legend: art, anterior retinacular tooth; bb, basal brush; i, incisor tooth; m, molar tooth; pm, premolar tooth; prt, posterior retinacular tooth; rr, retinacular ridge; s, scrobe; str, superior terebral ridge; t, terebra; tr, terebral ridge; vg, ventral groove; vm, ventral microtrichia.

Physodera amplicollis POLL

(Figs. 10 A-F)

Mouthparts, mandibles. Relatively short and broad, scrobes (10 A, s) broad, shallow, sparsely setose; terebra in dorsal aspect (10 A, t) broad, lateral margin curved



Fig. 9. SEM photographs of mouthparts and ovipositor sclerites of Actenonyx bembidioides WHITE. A, Labrum-epipharynx, ventral aspect. B-C, left maxilla, ventral and dorsal aspects, respectively. D-E, Labium, ventral and dorsal aspects, respectively. F-I, Ovipositor sclerites, left stylus and part of valvifer: F, ventral aspect; G, lateral aspect, principally of stylomere 2; H, stylomere 2, dorsal aspect; I, stylomere 2, ventral aspect, showing sensory groove and associated sense organs. Legend: cr, crepis; ep, epilobe; es, ensiform seta; gs, glossal sclerite; lc, lacinial brush; lp-3, labial palpomere 3; lt, lacinial tooth; m, mentum; mp-4, maxillary palpomere 4; mt, mental tooth (only one part indicated, note deep cleft in middle); ns, nematiform seta; ped, pedium; pg, paraglossa; pp, parapedial projection; ps, parapedial seta; S-1, stylomere 1; S-2, stylomere 2; sm, submentum; vf, valvifer; vpp, ventral pit peg. Scale bars: Figs. A-H=100 μm; Fig. I=10 μm.



Fig. 10. SEM photographs of mandibles of *Physodera amplicollis* POLL. A, C, E, Left mandible, dorsal, occlusal and ventral aspects, respectively; B, D, F, right mandible, dorsal, occlusal and ventral aspects, respectively. Legend: bb, basal brush; i, incisor tooth; m, molar tooth; prt, posterior retinacular tooth; rr, retinacular ridge; s, scrobe; t, terebra; tr, terebral ridge; tt, terebral tooth; vg, ventral groove; vm, ventral microtrichia.

markedly, incisor tooth slightly bent in relation to curvature of terebra; occlusal margin (10 A, B) curved, with curved terebral ridge (tr); left mandible with only terebral tooth (tt) and molar tooth (m); right mandible with terebral tooth (tt), posterior retinacular tooth (prt) and molar tooth (m); both mandibles with distinct basal brush (bb) in dorsal aspect; occlusal surfaces (Figs. 10 C–D) narrow, essentially straight from basal area to incisor; ventrally (Figs. 10 E–F) with short retinacular ridge (rr); ventral groove mod-

Sugimotoa parallela HABU



Fig. 11. SEM photographs of mandibles of Lebia (Chelonodema) balli REICHARDT. A, C, E, Left mandible, dorsal, occlusal and ventral aspects, respectively; B, D, F, right mandible, dorsal, occlusal and ventral aspects, respectively. Legend: bb, basal brush; i, incisor tooth; m, molar tooth; prt, posterior retinacular tooth; rr, retinacular ridge; s, scrobe; t, terebra; tr, terebral ridge; tt, terebral tooth; vg, ventral groove; vm, ventral microtrichia.

erately long, with moderately dense row of short microtrichia. Material examined. -- Female, THAILAND, Chiang Mai, Doi Inthanon Nat. Park, 11-V-1990 (UASM).

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Fig. 12. SEM photographs of mandibles of Pentagonica felix BELL. A, C, E, Left mandible, dorsal, occlusal and ventral aspects, respectively; B, D, F, right mandible, dorsal, occlusal and ventral aspects, respectively. Legend: bb, basal brush; m, molar tooth; mr, molar ridge; prt, posterior retinacular tooth; rr, retinacular ridge; t, terebra; tr, terebral ridge; tt, terebral

Lebia (Chelonodema) balli REICHARDT

Mouthparts, mandibles. Only moderately broad, moderately long, scrobes (11 A, s) rather shallow, terebra (t) in dorsal aspect with lateral margin moderately curved; incisor



Fig. 13. SEM photographs of mouthparts and ovipositor sclerites of *Pentagonica felix* BELL. A, Labrum-epipharynx, ventral aspect. B–D, Left maxilla, dorsal and ventral aspects, respectively. C–E, Labium, ventral and dorsal aspects, respectively. F–G, Ovipositor sclerites, left stylus and part of valvifer: F, stylus and valvifer, medial aspect; G, stylomeres 1 and 2, lateral aspect, principally of stylomere 2. Legend: cr, crepis; es, ensiform seta; g–2, galeomere 2; gs, glossal sclerite; lp–3, labial palpomere 3; lt, lacinial tooth; m, mentum; mp–4, maxillary palpomere 4; ns, nematiform seta; ped, pedium; pg, paraglossa; pp, parapedial projection; ps, parapedial seta; S–1, stylomere 1; S–2, stylomere 2; vf, valvifer; vpp, ventral pit peg. Scale bars: Figs. A–D=100 µm; Figs. E–G=200 µm.

tooth (i) rather sharply bent in relation to lateral and occlusal margins; left mandible with terebral ridge (tr) rather slightly curved, right terebral ridge (11 B, tr) more markedly so; occlusal margin of left mandible with small terebral tooth (tt) and small molar tooth (m); right mandible with indistinct terebral tooth, posterior retinacular tooth (prt) and molar tooth (m); both mandibles with basal brush evident dorsally; in occlusal aspect (Figs. 11 C–D) surfaces broad, curved ventrad from basal area to incisor; in ventral aspect (Figs. 11 E–F) with moderately prominent retinacular ridge (rr); ventral groove long and microtrichia dense and moderately long.

Material examined.— Female, MEXICO, Sonora, 32.3 km. E. Rio Yaqui, 26~27-VII-1987 (UASM).

Pentagonica felix BELL

(Figs. 12 A-F and 13 A-G)

See Actenonyx, above, for a comparison of structural features.

Mouthparts. Labrum (Fig. 13 A) with anterior margin distinctly curved. Ventral surface with epipharynx with pedium (**ped**) broad apically, and long (extended to base); parapedial setae (**ps**) few, in single row each side, widely spaced; without basal complex of microtrichia, only few, short sensory setae; parapedial projection (**pp**) moderately prominent.

Mandibles (Fig. 12 A–F). Form broad, short, scrobes laterally absent, terebra (Fig. 10 A, t) in dorsal aspect broad, outer margin markedly curved, incisor tooth of left mandible (Fig. 10 A) slightly bent relative to long axis of terebra, right mandible with incisor tooth (Fig. 12 B) even less so; occlusal margin (Figs. 12 A, B) with curved terebral ridge (tr), left mandible with only terebral tooth (tt) and molar tooth, right mandible with prominent terebral tooth, posterior retinacular tooth (prt) and molar tooth (m); basal brush not evident dorsally; in occlusal aspect (Figs. 12 C–D) with surfaces narrow, markedly curved ventrally from basal area to incisor; ventrally (Figs. 12 E–F) each mandible with short retinacular ridge (rr), molar ridge (mr), and small, indistinct basal brush (bb); without ventral groove or ventral microtrichia.

Maxillae (Figs. 13 B-D). Lacinia with sparse group of rather widely spaced microtrichia along occlusal margin, apically without brush dorsally; tooth (Fig. 13 D, lt) slender, pointed sharply; galeomere 2 (Fig. 13 D, g-2) shorter than galeomere 1; palpomere 4 much longer than 3.

Labium (Fig. 13 C–E). Submentum and mentum fused, suture absent. Submentum bisetose. Mentum (Fig. 13 C, m) bisetose (one seta broken off, at base), with apical margin edentate; prementum with glossal sclerite (Figs. 13 C–E, gs) broadly rounded apically (not dentiform), paraglossae (pg) very small, not extended to apex of glossal sclerite; in dorsal aspect, each paraglossa with row of long setae, in addition to dense cover of short microtrichia; palpomere 3 (Fig. 13 E, lp-3) distinctly longer than 2.

Ovipositor (Figs. 13 F–G). Apical margin of valvifer (Fig. 13 F, Vf) and stylomere 1 (S–1) setose. Stylomere 2 (Figs. 13 F–G, S–2) short, awl-like; dorsal margin sloped evenly from base to apex, not falcate; ensiform setae (Fig. 13 G, es) numerous, in cluster preapically on dorsal, lateral and medial surfaces; ventral sensory pit with one pair of long nematiform setae (Fig. 13 F, ns) and group of four pit pegs (vpp).

Material examined.- Female, MEXICO, Sinaloa, 174.4 km. W. El Vergel, Chihuahua,

15-VII-1983 (UASM).

Comments.— The most interesting structures are the mandibles, which lack scrobes, ventral grooves and associated microtrichia, and have markedly reduced occlusal dentition. Also striking is the labium, with its fusion of the submentum and mentum. The ovipositor, with its short awl-like stylomere 2 that has many ensiform setae, seems to be highly derived.



A New Species of the Genus *Microdytes* (Coleoptera, Dytiscidae) from Northern Vietnam¹⁾

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Abstract A new species of the dytiscid genus Microdytes is described from northern Vietnam under the name of M. *shunichii*. It is readily recognized on the characteristic marking of the elytra and the peculiar configuration of the male genitalia.

The genus *Microdytes* contains 8 described species, all distributed in the zone of evergreen broadleaved forests in Southeast Asia, from northern India to the Ryukyu Islands. In the course of the entomological survey in northern Vietnam made in the autumn of 1994, I was able to find a small dytiscid species belonging to this genus in small torrents on Mt. Tam Dao in Vinh Phu Province. After a careful study of the specimens, I have come to the conclusion that the dytiscid beetle belongs to a new species to be described in the present paper.

This faunal survey was carried out by the National Science Museum, Tokyo, under the leadership of Dr. Shun-Ichi UÉNO, to whom I am very grateful, and this small paper is dedicated to him in commemoration of his retirement from the head of the Department of Zoology of that museum.

Microdytes shunichii M. SATÔ, sp. nov.

(Figs. 1-2)

Body hemispherical, well convex, polished. Colour dark reddish brown, with pronotum, buccal appendages and legs brown, elytral markings yellowish brown.

Head about 2.2 times as broad as long, surface obsoletely microreticulate in front with minute scattered punctures all over, and provided with a series of minute punctures along the inner and antero-lateral sides of each eye.

Pronotum about 2.5 times as broad as long, broadest at the base which is about 1.3 times as broad as the anterior breadth; surface smooth, mostly with fine scattered punctures which are a little more distinct than those on head and separated from one another by 2 to 4 times their diameter, and also provided with a series of punctures along the anterior margin and with a group of punctures along the posterior margin, the latter of which are close, distinct, somewhat longitudinally rugose and separated

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Figs. 1-2. Microdytes shunichii M. SATÔ, sp. nov.; 1, right half of body; 2, male genitalia.

from one another by their diameter.

Elytra about 1.2 times as broad as pronotum, a little longer than broad, broadest at the basal third, thence gently narrowed anteriad, more distinctly narrowed posteriad, and decorated with four markings as illustrated; surface smooth, with minute scattered punctures which are almost of the same size as those on the main part of pronotum, provided with two longitudinal series of obsolete punctures, of which the outer one is recognized in basal third.

Ventral surface polished. Prosternal process swollen apically with rounded apex; surface more or less rugose. Metacoxal wings obsoletely punctate and provided with a series of fine punctures along the anterior margin. Metacoxae scattered with obsolete punctures. Abdominal sternites obsoletely punctulate; posterior margin of 1st to 3rd visible sternites finely crenulate, 2nd bearing long hairs at the centre and 2nd to 3rd each with a transverse line. Claws of hind leg unequal, the longer one being a little shorter than the 5th segment of tarsus. Male genitalia of typical type; lateral lobes well sclerotized, inwardly bent with rounded apex and furnished with setiferous punctures; median lobe membraneous and notched at the apex.

Length: 1.6-1.7 mm; breadth: 1.1-1.2 mm.

Holotype and 45 paratypes: Mt. Tam Dao, alt. 960–980 m, N. Vietnam, 22–IX– 1994, M. Satô leg.

The holotype and some paratypes are preserved in the collection of the National Science Museum (Nat. Hist.), Tokyo. The remaining paratypes are deposited now in the collection of the Biological Laboratory, Nagoya Women's University.

Notes. The present new species can easily be distinguished from the previously
New Microdytes from Northern Vietnam

known species of the genus by the remarkable markings of elytra, and by the distinctive structure of male genitalia as shown in text-figures.

This species is dedicated to Dr. Shun-Ichi UÉNO for commemorating his great contribution to both the fields of coleopterology and speleology on the occasion of his retirement.

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A New Species of the Genus *Helochares* (Coleoptera, Hydrophilidae) from Japan, with a Key to the Japanese Species of the Subgenus *Hydrovaticus*

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Abstract *Helochares uenoi* sp. nov. belonging to the subgenus *Hydrovaticus* MACLEAY, 1871, is described from Yonaguni-jima Island of the Ryukyu Islands, Japan. It is clearly distinguished from all the other species hitherto described in the subgenus by the peculiarities of male genitalia. A key to the Japanese species of the subgenus *Hydrovaticus* is provided.

Introduction

The subgenus *Hydrovaticus* MACLEAY includes only two known species, *H. ancho*ralis SHARP, 1873, and *H. striatus* SHARP, 1873, both from Japan. In the present paper, a new species of the subgenus is described from Yongauni Is., the Ryukyu Islands, Japan. It can be determined with confidence only by the peculiarities of the male genital organ.

I have the pleasure to dedicate this short paper to Dr. Shun-Ichi UéNo who has made many contributions to the entomology. My deep gratitude is also expressed to Dr. T. NAKANE, who has encouraged my study in various ways.

Subgenus Hydrovaticus MACLEAY, 1873

Hydrovaticus MACLEAY, 1873, 31.

Elytra with ten well-marked striae; last segment of maxillary palpus as long as the penultimate segment at the most and as a rule shorter than the latter.

Helochares (Hydrovaticus) uenoi sp. nov.

(Figs. 1-5)

Male. Body oval, moderately convex, shining above. Maxillary palpi, antennae (except for brown club), tarsi, propleura and a pair of anteocular spots testaceous; clypeus reddish; labrum blackish; pronotum and tibia reddish brown; elytra dark brown; undersurface blackish brown.

Head coarsely and rather closely punctured, with Y-shaped line on vertex, interval not reticulate; apical margin of clypeus deeply emarginate: eyes rather small, the



Figs. 1–5. *Helochares (Hydrovaticus) uenoi* MATSUI, sp. nov.; 1, antenna; 2, maxillary palpus; 3, male genitalia (scale: 0.5 mm); 4, last ventral segment; 5, outline of body (scale: 1 mm).

distance between them about 5 times as broad as the breadth of an eye; labrum strongly transverse (1: 4), moderately emarginate in middle, very finely and densely punctate, intervals of the punctures not micro-reticulate. Antennae nine-segmented, with last three segments forming a loosely articulated club, densely pubescent, terminal segment longer than usual; 1st segment elongate and thickened to apex, 2nd stout but shorter than the 1st, 3rd segment much shorter and smaller than the 2nd, very thin and cylindrical, 4th and 5th very short and small, 6th elongate and covering the base of the club at the apex (Fig. 1). Maxillary palpi slender, relative lengths of three apical segments as 3.7: 3.4: 3.0 (Fig. 2).

Pronotum rather strongly transverse, about twice as broad as long, broadest near the base, and distinctly narrowed anteriad; anterior angles obtuse, posterior angles rounded; punctation dense, same as on clypeus, intervals of the punctures entirely shining. Scutellum oblong-triangular, punctate as on pronotum, without microsculpture.

Elytra widest at about middle, a little broader than pronotum, about 1.25 times as long as wide, with ten well marked striae: surface finely and densely punctate like that

of pronotum, intervals of the punctures not reticulate.

Ventral surface finely and densely pubescent; prosternum not carinate medially; mesosternal laminae not developed. Legs very slender, all femora finely and densely pubescent except for apical portions. Last ventral segment deeply semicircularly emarginate at apex (Fig. 4).

Male genitalia as shown in Fig. 3.

Female. Similar to male, with egg cases attached to the abdomen until the larvae hatch.

Length of body: 4.5 mm. Width of body: 2.5 mm.

Holotype (\mathcal{J}), allotype (\mathcal{Q}) and 9 paratypes: Tindabana, Yonaguni Is., Okinawa Pref., 8–VIII–1989, E. MATSUI leg. The holotype and allotype are preserved in the Entomological Labaratory, Kyushu University, Fukuoka. The paratypes are in the author's collection.

Distribution. Ryukyu Islands (Yonaguni Is.).

Remarks. This species is closely allied to *H. striatus*, but differs from it in the peculiarities of male genitalia.

Biology. This species was found with *Laccobius yonaguniensis* MATSUI in a small stream.

Helochares (Hydrovaticus) striatus SHARP, 1873

(Figs. 6-10)

Helochares striatus SHARP, 1873, 60.

Male genitalia as shown in Fig. 8.

Length of body: 4.0-4.5 mm. Width of body: 2.3-2.5 mm.

Specimens examined. [Ehime]: 2 exs., Obara, Uwa-chô, 2-V-1991; 48 exs., 3-V-1991, & 44 exs., 3-VIII-1991, Nakagumi, Matsuno-chô; 2 exs., Nakanotani, Yoshidachô, 2-V-1991. [Kagawa]: 5 exs., Ohkawa-chô, 5-VIII-1991; 2 exs., Minamino, Hikita-chô, 5-VIII-1991; 1 ex., Ido, Miki-chô, 5-VIII-1991. [Kôchi]: 1 ex., Motomura, Nakamura-shi, 4-V-1991; 25 exs., 4-V-1991, 17 exs., 4-VIII-1991, Unoe, Nakamura-shi; 3 exs., Motomura, Ohkata-chô, 4-VIII-1991; 4 exs., Kawanohori, Nakamura-shi, 4-VIII-1991; 1 ex., Misato, Nakamura-shi, 4-VIII-1991. [Tokushima]: 1 ex., 12-VIII-1991, 2 exs., 4-VIII-1992, Kurozo Moor; 3 exs., Isshogamori, Anan-shi, 6-VIII-1991; 1 ex., 6-VIII-1991, 8 exs., 5-VIII-1992, Aratano, Anan-shi; 15 exs., Yamaguchihô, Anan-shi, 6-VIII-1991. [Kumamoto]: 14 exs., Yado, Araoshi, 3-V-1993; 1 ex., Ichibu, Arao-shi, 4-V-1993; 1 ex., Imuta-ike, Seiwa-mura, 24-VI-1990; 1 ex., Tatsuno, Toyono-mura, 5-V-1992; 3 exs., Funatsu, Kôsa-chô, 5-V-1992; 5 exs., Noda, Jônan-chô, 5-V-1992; 2 exs., Tatsuno, Ue-mura, 8-VII-1991; 8 exs., 24-VIII-1991, 5 exs., 7-IV-1991, Miyafumoto, Okaharu-mura; 7 exs., 8-VIII-1991, & 8 exs., 12-VIII-1992, Tontokoro, Sue-mura; 3 exs., Yamamoto, Sagara-mura, 6-VII-1986; 19 exs., Kyoumine, Nishiki-chô, 1-VI-1986; 1 ex., Kurokawa, Minamioguni-chô, 20-V-1989; 1 ex., Atogase, Aso-chô, 8-VI-1989; 15 exs., 7-VI-1986,



Figs. 6–10. *Helochares (Hydrovaticus) striatus* SHARP; 6, antenna; 7, maxillary palpus; 8, male genitalia (scale: 0.5 mm); 9, last ventral segment; 10, outline of body (scale: 1 mm).

7 exs., 28–VIII–1986, Jigoku, Chôyo-mura; 8 exs., Kamishijuku-ike, Tamana-shi, 7– VIII–1986; 10 exs., 14–V–1989, 1 ex., 17–III–1991, 1 ex., 6–IV–1992, 3 exs., 10–X– 1991, Hondo-machi, Hondo-shi; 1 ex., Hirakouchi, Itsuwa-chô, 10–VI–1990; 1 ex., Ichinotani, Itsuwa-chô, 13–VI–1991; 2 exs., Goryou, Itsuwa-chô, 6–VII–1991; 2 exs., Ide, Itsuwa-chô, 31–VII–1991; 3 exs., Gonosako, Itsuwa-chô, 17–V–1992. [Kagoshima]: 10 exs., Kamisato, Chiran-chô, 9–VIII–1988; 1 ex., Yotsue, Yoshimatsu-chô, 1–VI–1986; 24 exs., Jusso-ike, Ohkuchi-shi, 10–X–1985; 4 exs., Sakiyama, Ohkuchishi, 2–VIII–1988; 6 exs., Suzukidan, Akune-shi, 4–VIII–1988; 1 ex., Mikazuki-ike, Kurino-chô, 1–VI–1986; 10 exs., Shimosato, Chiran-chô, 9–VIII–1988. All the specimens recorded were collected by the author.

Distribution. Honshu, Shikoku, Kyushu; Korea.

This species was originally described from Nagasaki (Kyushu).

Helochares (Hydrovaticus) anchoralis SHARP, 1880

(Figs. 11-15)

Helochares anchoralis SHARP, 1880, 352.

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Figs. 11–15. *Helochares (Hydrovaticus) anchoralis* SHARP; 11, antenna; 12, maxillary palpus; 13, male genitalia (scale: 0.5 mm); 14, last ventral segment; 15, outline of body (scale: 1 mm).

Male genitalia as shown in Fig. 13.

Length of body: 5.0-5.8 mm. Width of body: 2.6-2.9 mm.

Specimens examined. [Kumamoto]: 1 ex., 4-VIII-1984, S. IMASAKA leg. (IMA-SAKA, S., et al., 1985).

All the following specimens were collected by the author. [Ryukyu Islands]: 1 ex., Yairi, Amami-Ohshima Is., 20–VIII–1987; 3 exs., Nehara, Amami-Ohshima Is., 25–III–1988; 4 exs., Ura, Amami-Ohshima Is., 25–III–1988; 3 exs., Kawauchi R., Amami-Ohshima Is., 21–VIII–1987; 1 ex., Kamize Dam, Tokunoshima Is., 18–VIII–1987; 13 exs., Debana, Okinoerabu Is., 16–VIII–1987; 1 ex., Amata R., Okinoerabu Is., 16– VIII–1987; 6 exs., Nakijin-mura, Okinawa Is., 18–VIII–1989; 5 exs., Kin-chô, Okinawa Is., 19–VIII–1989; 26 exs., Motobu-chô, Okinawa Is., 17–VIII–1990; 25 exs., Izena Is., 23–VIII–1989; 1 ex., Sakita R., Miyako Is., 5–VIII–1989; 3 exs., Takada, Ishigaki Is., 6–VIII–1989; 2 exs., Kohama Is., 9–VIII–1989; 1 ex., Ohmiya, Iriomote Is., 7–VIII–1990; 5 exs., Komi, Iriomote Is., 9–VIII–1990; 19 exs., Komi, Iriomote Is., 1 ~4–I–1994; 1 ex., Minamidaitô Is., 26–VIII–1989; 18 exs., Minamidaitô Is.,

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 $25 \sim 27$ -XII-1993; 7 exs., Sonai, Yonaguni Is., 7-VIII-1989. [Taiwan]: 23 exs., Tayuan, Taoyuan Hsien, 26-XII-1992; 6 exs., Pate, Taoyuan Hsien, $25 \sim 27$ -XII-1992; 70 exs., Chungli, Taoyuan Hsien, 26-XII-1992.

Distribution. Kyushu (Kumamoto), Ryukyu Islands; Taiwan, China, Southeast Asia.

This species was originally described from Ceylon, and is very widely distributed. Kumamoto Prefecture seems to be the northern limit of its distribution in Japan.

Key to the Japanese Species of the Subgenus Hydrovaticus

1.	Body more than 5 mm in length; body oblong-oval; last ventral segment deeply emarginate at apex in a V-shape; male genitalia as shown in Fig. 13. Kyushu
	(Kumamoto), Ryukyu Islands; Taiwan, China, Southeast Asia
	H. anchoralis Sharp
-	Body less than 5 mm in length; body oval; last ventral segment deeply or semi- circularly emarginate at apex
2.	Last ventral segment shallowly semicircularly emarginate at apex; clypeus red- dish; male genitaia as shown in Fig. 8. Honshu, Shikoku, Kyushu; Korea
	Last ventral segment deeply semicircularly emarginate at apex; clypeus blackish;
	male genitalia as shown in Fig. 3. Ryukyu Islands (Yonaguni Is.).
	<i>H. uenoi</i> sp. nov.

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Cholevid Beetles Found in a Limestone Cave of Kumamoto Prefecture, Central Kyushu, Southwest Japan

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Abstract Cholevid beetles from Ohsé-no-ko-ana Cave in Kumamoto Prefecture, central Kyushu, is recorded. Four species are included in the collection. One of them is described as a new species, *Nemadus uenoi* sp. nov.

Dr. Shun-Ichi UÉNO of the National Science Museum (Nat. Hist.), Tokyo, who made a faunal investigation of Ohsé-no-ko-ana Cave in Kumamoto Prefecture, central Kyushu, in 1978, kindly lent me for taxonomic study a series of cholevid beetles collected at that time. They are classified into four species of three genera, including one new species. According to Dr. UÉNO (1978, pp. 6–7, and pers. comm.), Ohsé-no-ko-ana Cave is a small semi-vertical pit lying above Ohsé-dô and Kyûsen-dô Caves at the right side of the Kuma-gawa River. All the specimens were caught in baited traps set by Messrs. Toshiki MOHRI and Hiroshi MIYAMA on April 30, 1978, near the bottom of the narrow pit.

In the present paper, I am going to report on the cholevid collection from Ohséno-ko-ana Cave, with description of the new species. This new cholevid beetle is dedicated with deep gratitude to Dr. Shun-Ichi UÉNO for commemorating his retirement from the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. My thanks are also due to Mr. Hiroshi MIYAMA of Odawara City for his kind help, and to Dr. Shûsei ARAI of Kitakyushu City who helped Dr. UÉNO in the field works. The abbreviations used herein were already explained in my previous papers. All the specimens from Ohsé-no-ko-ana Cave including the holotype of the new species are preserved in the collection of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

Ptomaphagus (Ptomaphagus) sp.

Specimens examined. $2 \bigcirc \bigcirc$, Ohsé-no-ko-ana Cave, Ohsé, Kuma-mura, Kumamoto Pref., SW Japan, 26–V–1978, S. UÉNO & S. ARAI leg.

Notes. The present species is similar to *Ptomaphagus (Ptomaphagus) chendai* J. MÜLLER and *P. (P.) sibiricus* JEANNEL in the shape of antennal segments. However, it can be distinguished from the latter two by the following points: antenna with segments II and III equal in width, IV and V small, wider than long, and equal in size (cf. JEANNEL,

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1934, 1936). The spermathecal configuration of the species is somewhat similar to that of P. (P.) hastatellus SZYMCZAKOWSKI (1976, pp. 45–48, figs. 1–10), originally described from northwestern Turkey, but it does not agree with the latter in other respects. I prefer to withhold its final determination until male specimens are available for study.

Nemadus uenoi M. NISHIKAWA, sp. nov.

[Japanese name: Ohsé-hime-chibishidemushi]

(Figs. 1-4)

Male. Length 1.93 mm (in normal condition), width 1.00 mm. Body elliptical, with silky adpressed pubescence. Mouth parts clear yellowish brown; head and labrum reddish brown, though the occiput is blackish brown, with margins darker; basal five antennal segments clear yellowish brown, segments VI to XI darker, though apical portion of the last segment is paler; pronotum light brown, with hind angles paler; scutellum, elytra and epipleura slightly paler than pronotum, with blackish epipleural margins; ventral surface almost reddish brown, with basal margin of each sternite blackish; legs with femora reddish brown, tibiae yellowish, tarsi paler.

Head gently convex, strongly punctured, slightly lineolate in basal half, wider than long (ca. 8: 5), widest at the level of occipital carina; maxillary palpus with last segment about 4/7 as long as the preceding one; labrum transverse trapezoidal, front margin almost straight; eyes normal, gently convex. Antennae rather slender, hardly reaching hind angles of pronotum; segment I oval, II slightly shorter and narrower than I, III as wide as IV, IV and V equal in length, V 3/4 as wide as long, V and VI equal in width, VI $2 \times$ as long as wide, VII slightly wider than long and slightly narrower than VIII, VIII transverse, VIII to X equal in width, IX slightly shorter than X, XI $2 \times$ as long as IX, slightly narrower than the preceding three segments. Segmental measurements (length followed by width) in the holotype as follows: I, 0.1, 0.0625; II, 0.0875, 0.05; III, 0.07, 0.0375; IV, 0.0375, 0.0375; V, 0.0375, VI, 0.025, 0.05; VII, 0.0625, 0.07; VIII, 0.02, 0.075; IX, 0.05, 0.075; X, 0.055, 0.075; XI, 0.1, 0.07.

Pronotum transverse, trapezoidal, gently convex, widest just before hind angles, WP/WH 1.64, WP/LP 1.80; front margin shallowly emarginate; front angles rounded; sides arcuate, converging anteriorly; hind angles subrectangular; basal margin slightly sinuate near hind angles; surface distinctly punctato-strigate. Scutellum triangular, distinctly punctured, the punctures equal in size to those on pronotum.

Elytra gently convex, widest at the middle, EW/PW 1.11, EL/PL 2.75, EL/EW 1.38; sides gently arcuate; apices separately rounded; suture complete; sutural striae fine, slightly arcuate outwards, joining suture at apical 1/3; surface finely punctatostrigate, the strigae slightly oblique to sutural stria; epipleura punctate as on elytra, ending at apical 1/6. Pygidium finely and shallowly punctate. Hind wings full.

Ventral surface moderately punctured, sometimes linearly impressed. Mesosternum with a simple carina on mid-line.

Cholevid Beetles Found in a Cave of Central Kyushu



Figs. 1–4. *Nemadus uenoi* M. NISHIKAWA, sp. nov., from Ohsé-no-ko-ana Cave in Kumamoto Prefecture, central Kyushu. — 1, Outline of body, *∂*; 2, antenna, *∂*; 3, same, *♀*; 4, left paramere of male genitalia (freehand drawing).

Legs with protibia dilated towards apex along inner margin, widest in preapical portion, though the outer margin is almost straight; first segment of protarsus wider than apex of protibia; first segment of mesotarsus distinctly thicker than segments II–V.

Aedeagus 2/3 as long as parameres, pointed apically, widest at base. Parameres conchoidal, with dorsal margin sinuate, ventral margin also sinuate and strongly notched at the middle; apical half gradually narrowed towards apex, which is hooked. Basal piece elongate, $1.75 \times$ as long as aedeagus.

Female. Length 1.78–1.80 mm (in normal condition), width 0.90–0.95 mm. Similar to male in general appearance. Segmental measurements of antenna (length followed by width) in the allotype as follows: I, 0.0875, 0.05; II, 0.075, 0.0375; III, 0.05, 0.0375; IV, 0.025, 0.0375; V, 0.03, 0.045; VI, 0.02, 0.05; VII, 0.0625, 0.0625; VIII, 0.0125, 0.05; IX, 0.05, 0.075; X, 0.05, 0.075; XI, 0.0875, 0.07. Proportions of body parts as follows: WP/WE 1.48–1.56 (M 1.52), WP/LP 1.79–1.86 (M 1.83), WE/WP 1.07–1.12 (M 1.10), LE/WE 1.34–1.39 (M 1.37). Inner margin of protibia, basal segments of protarsus and first segment of mesotarsus simple.

Type series. Holotype: \vec{o} , Ohsé-no-ko-ana Cave, Ohsé, Kuma-mura, Kumamoto Pref., SW Japan, 26–V–1978, S. UÉNO & S. ARAI leg. Allotype and paratypes: $3 \neq \varphi$, same data as for the holotype.

Notes. The present new species is closely similar to Nemadus asagi M. NISHIKAWA (1983, pp. 107-109, figs. 1-2), originally described from the Tanzawa Mountains in

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central Honshu, Japan, in having the ordinary colored antennae and the conchoidal parameres. They belong to the *parasitus* group (*sensu* JEANNEL, 1936, pp. 165–168), but the new species can be distinguished from the latter and the other related species by the characteristic shape of parameres in the male genital organ and the configuration of antennal segments (cf. JEANNEL, 1936; COIFFAIT & UÉNO, 1955; SZYMCZAKOWSKI, 1961, 1964).

Nemadus ishiharai MIYAMA, 1985

Nemadus ishiharai MIYAMA, 1985, Trans. Shikoku ent. Soc., 17, pp. 18–20, figs. 16–20; type locality: Omogokei, Ehime Pref., Shikoku. — HISAMATSU & HAYASHI, 1985, Coleopt. Japan Col., Osaka, 2, p. 242, pl. 43, fig. 19. — HISAMATSU, 1989, Check List Jpn. Ins., 1, p. 253.

Specimens examined. $2 \stackrel{\circ}{\supset} \stackrel{\circ}{\supset}, 4 \stackrel{\circ}{\subsetneq} \stackrel{\circ}{\downarrow}$, same data as for the preceding new species. *Distribution*. Japan (Honshu, Shikoku, Kyushu!).

Notes. The present species is new to the fauna of Kyushu. The specimens from Ohsé-no-ko-ana have blackish apical edge of the antennal segment VII, while in the epigean specimens examined the segment is wholly black. This species also appears in epigean habitats, as recorded below.

Epigean specimens examined. $1 \stackrel{\circ}{\supset}, 1 \stackrel{\circ}{\subsetneq}, 0$ mogo-kei, Ehime Pref., Shikoku, 8– XI–1973, Y. FURUKI & S. KINOSHITA leg.; $1 \stackrel{\circ}{\subsetneq}$, Fudakake, Tanzawa Mts., Kanagawa Pref., central Honshu, 11-V-1981, M. NISHIKAWA leg. (carrion-baited trap).

Catops nipponensis JEANNEL, 1936

Catops nipponensis JEANNEL, 1936, Mém. Mus. Hist. nat., Paris, (n. s.), 1, pp. 373–374, 406, figs. 956, 971–972; type locality: Nagasaki, Kyushu. — NAKANE, 1955, Shin-Konchû, Tokyo, 8 (7), p. 56, fig. 7. — NISHIKAWA, 1983, Check-list Coleopt. Japan, (23), p. 5. — HISAMATSU & HAYASHI, 1985, Coleopt. Japan Col., Osaka, 2, p. 244, pl. 43, fig. 35. — HAYASHI, 1986, Trans. Shikoku ent. Soc., 17, pp. 185–186, figs. 1–7. — HISAMATSU, 1989, Check List Jpn. Ins., 1, p. 254.

Specimen examined. $1 \Leftrightarrow$, same data as for the preceding species. *Distribution.* Japan (Kyushu).

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A New Species of the Genus *Liophilydrodes* (Coleoptera, Staphylinidae) from Sichuan Sheng, Southwest China

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Abstract A new species of the genus *Liophilydrodes* is described and illustrated under the name of *L. uenoi*. It was obtained on the border of Chang Hai (3,100 m alt.) at Jiuzhai Gou in Sichuan Sheng, Southwest China.

The genus *Liophilydrodes* belonging to the subfamily Omaliinae can be distinguished from the related genera by the presence of a narrow U-shaped sulcus on the vertexal area and the absence of front depression at the middle of pronotum just behind the anterior margin. Six species of the genus have hitherto been known only from Japan proper. One of them was reported by SHARP (1889, p. 47), three by NAKANE and SAWADA (1956, pp. 53–54), and the other three by WATANABE (1990, pp. 301–302, 303–306), all having been found from under small stones along mountain streams.

Recently, through the courtesy of Dr. Shun-Ichi UÉNO, I have had an opportunity to examine an interesting staphylinid species obtained by himself in Sichuan Sheng, Southwest China. After a careful examination, it becomes clear that the species can be included in the genus *Liophilydrodes* and seems to be new to science on account of strong punctures on the head and pronotum, and characteristic configuration of the male genital organ. It will be described in the present paper to commemorate the retirement of Dr. Shun-Ichi UÉNO from the directorship at the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. The type series of the new species to be described is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Before going further, I wish to express my cordial thanks to Dr. Shun-Ichi UÉNO, National Science Museum (Nat. Hist.), Tokyo, for his kindness in giving me the opportunity of studying on the interesting species and much valuable advice on the present study.

Liophilydrodes uenoi Y. WATANABE, sp. nov.

(Figs. 1-3)

Body length: 4.7–5.4 mm (from front margin of head to anal end); 3.1–3.7 mm (from front margin of head to elytral apices).

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Body elliptical and depressed above. Black and moderately shining, with mouth parts, antennae and tarsi a little rufescent.

Male. Head subtrapezoidal, narrowed anteriad and depressed above, apparently broader across compound eyes than long (width/length=1.50), with postocular part short, less than a half as long as the longitudinal diameter of each compound eye, which is prominent laterally; surface moderately densely covered with somewhat coarse



Fig. 1. Liophilydrodes uenoi Y. WATANABE, sp. nov., 3, from Chang Hai of Jiuzhai Gou in Sichuan Sheng, Southwest China. Scale: 1.0 mm.

setiferous punctures and with extremely fine coriaceous ground sculpture; clypeo-frontal area subtriangularly depressed, surface of the depression smooth and impunctate; vertexal area somewhat depressed and bearing a narrow but deep oblique sulcus on each side of the middle; ocelli distinct, the distance between them being evidently larger than that from the outside of ocellus to the inner margin of each eye. Antennae filiform and elongate, extending to the middle of elytra and not thickened towards the apical segment, all the segments opaque, 1st robust, about twice as long as broad, 2nd to the apicalmost equal in width to one another, 2nd twice as long as broad though shorter (2nd/1st=0.75) and narrower (2nd/1st=0.75) than 1st, 3rd more than twice as long as broad (length/width=2.33) and a little longer than 2nd (3rd/2nd=1.16), 4th twice as long as broad though somewhat shorter than 3rd (4th/3rd=0.86), 5th to 9th equal in length to one another, each more than twice as long as broad and slightly longer than 4th (each of 5th to 9th/4th=1.08), 10th twice as long as broad though slightly shorter than 9th (10th/9th=0.92), apicalmost the longest, more than three times as long as broad and more than 1.5 times as long as 10th, narrowly rounded at the apex.

Pronotum feebly convex and transverse (width/length=1.24), a little broader than head (pronotum/head=1.22), widest near the anterior third and more strongly narrowed posteriad than anteriad; lateral margins bordered, the border continuing onto posterior margin, which is feebly bisinuate, anterior margin slightly emarginate at the middle, anterior angles rounded and perceptible from above, posterior ones blunt at the corner; surface covered with coarser coriaceous ground sculpture than those on head, bearing a shallow small fovea at the middle in front of posterior margin, moderately densely and setiferously punctate, the punctures becoming somewhat sparser in the median area than in lateral areas. Elytra flat and trapezoidal, distinctly dilated posteriad, slightly longer than broad (length/width=1.04) and considerably longer (elytra/ pronotum=2.24) and apparently broader (elytra/pronotum=1.74) than pronotum; lateral margins almost straight, posterior angles broadly rounded; surface covered with setiferous punctures, which are denser and shallower than those on pronotum. Legs moderately long; protarsus slightly widened; last segment of metatarsus elongate, equal to the four preceding segments together.

Abdomen broad and flat, gradually narrowed towards third visible segment, thence strongly so towards apical end; surface of each tergite covered with extremely fine coriaceous ground sculpture and somewhat sparingly, setiferously punctured, preapical sternite broadly and semicircularly emarginate at the middle of posterior margin.

Genital organ trilobed and almost symmetrical. Median lobe elongate, with basal part globular and somewhat curved ventrad in profile; viewed ventrally, median lobe somewhat dilated near the middle and more strongly narrowed apicad than basad, apical part abruptly tapered towards the tip which is bluntly pointed. Parameres slender, each slightly thickened near the apex, almost as long as median lobe, and provided with three fine setae at the apex. Yasuaki WATANABE



Figs. 2–3. Male genital organ of *Liophilydrodes uenoi* Y. WATANABE, sp. nov.; ventral view (2), and lateral view (3). Scale: 0.5 mm.

Female. Similar in general appearance to male, though the last two abdominal sternites are simple and the protarsi are less widened.

Type series. Holotype, \Im , allotype, \Im , Jiuzhai Gou, Chang Hai (3,100 m alt.), Nanping Xian, Sichuan Sheng, Southwest China, 27–VII–1993, S. UÉNO leg. Paratypes, 4 $\Im \Im$, 6 $\Im \Im$, same data as for the holotype.

Distribution. Sichuan Sheng (Southwest China).

Notes. This new species is similar in colour and coriaceous pronotum to *L. pullus* (NAKANE et K. SAWADA) from Japan, but clearly differs from it in the following points: head less densely and more deeply punctate, bearing a shallow depression on the vertexal part between ocelli; pronotum more convex, with surface much more strongly punctate and provided with a shallow small fovea at the middle before the posterior margin; elytra more coarsely punctate; male genital organ with median lobe more elongate and dilated near the middle, parameres almost as long as median lobe.

According to Dr. UÉNO, the type specimens of this staphylinid beetle were found from among fist-sized stones half-immersed at the water edge of Chang Hai, the highest subalpine lake at Jiuzhai Gou. The lake is surronded by coniferous trees under bald rocky peaks.

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A Second Report on the *Nazeris* Species (Coleoptera, Staphylinidae) from Taiwan

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Abstract Two new species of the genus *Nazeris* are added to the staphylinid fauna of Taiwan. Both the species belong to the *femoralis* group, and are named *N. persimilis* sp. nov. and *N. uenoi* sp. nov.

In my previous paper (ITO, 1985), four species and one subspecies of the staphylinid genus *Nazeris* were described from Taiwan. Of these, two species, *N. femoralis* and *N. matsudai*, were recognized on the peculiarity of hind trochanters, each of which is armed with a distinct hook at the external side. Recently, I had an opportunity to examine more than 400 Taiwanese specimens of *Nazeris* through the courtesy of Dr. A. SMETANA, Ottawa, and Mr. Y. SHIBATA, Tokyo. In the present paper I am going to describe two additional new species of the *femoralis* group, which is characterized by the hooked hind trochanters. A sketch map of Taiwan showing the localities of the four known species of this species-group will be given to illustrate their distribution in Taiwan (Fig. 8).

Nazeris femoralis Ito

(Fig. 1)

Nazeris femoralis ITO, 1985, Ent. Rev. Japan, 40: 55.

In the female, the abdominal sternites are not modified, the hind femora lack distinct long hairs on the inner sides, and the hind trochanters are inerm on the external sides and only bear a feeble depression.

Specimens examined. 2 ♂♂ (holotype and paratype), Fenchihu, Chiai Hsien, Taiwan, 4–V–1983, T. ITO leg.; 3 ♂♂, 5 ♀♀, Fenchihu (1,400 m), Chiai Hsien, Taiwan, 9–VIII–1974, 6–VIII–1977 and 13–VIII–1983, Y. SHIBATA leg.

Nazeris persimilis sp. nov.

(Figs. 2-4)

Body a little shiny, reddish to blackish brown, elytra dark brown, abdomen blackish, labrum brown, partially darkened along middle, each side of frons margined with black, antennal segments except for basal two or three ones and legs brownish yellow, trochanters somewhat darker; pubescence brownish to blackish with the exception of black erect submarginal setae.

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Fig. 1. Holotype of Nazeris femoralis Ito.

Length: 5.0-5.3 mm.

Head nearly quadrate, a little longer than wide or about as long as wide, coarsely, closely and deeply punctate and without any microsculpture, the punctures being a little irregular in size and shape; frons slightly depressed, vertex evenly convex; eyes relatively large and prominent, each longer in longitudinal diameter than a half the length of postgena; postgenae subparallel-sided slightly convergent behind and widely angulate to neck; labrum with inner teeth moderately slender and clearly longer than the outer two; antennae slender, extending slightly beyond the middle of pronotum, all the segments distinctly longer than wide, 1st the thickest and about as long as the following two segments together, 2nd small, 3rd 1.5 times as long as the 2nd, 3rd to 10th gradually decreasing in length, 11th longer and wider than the 10th. Ventral surface of head with punctures similar to those on dorsum but more regular in size; mentum smooth and shining, submentum slightly uneven.

Pronotum short oval, a little longer than wide (1.04: 1), shorter (0.90: 1) and narrower (0.90: 1) than head; lateral sides bearing two or three long erect setae near the widest part at apical third, thence arcuately convergent toward apex and sublinearly convergent toward base; discal punctures very coarse and deep, becoming more or less finer laterad, and slightly disrupted in arrangement along the middle by median line, which is hardly visible and weakly depressed on each side. Scutellum small and seemingly lacking distinct punctures. Prosternum usually carinate medially, the carina weakened near apex.

Elytra subtriangular, somewhat constricted at shoulders, dilated apicad and widest near apices, which are as wide as pronotum; surface undulate and coarsely, closely





and rugosely punctate, the punctures on pleural parts somewhat irregularly shaped.

Abdomen slightly expanded laterad, without visible microsculpture; punctures less coarse on basal segments than on pronotum, becoming smaller in size distally, those on each tergite coarser at base than at apex, and on each sternite deeper and rather regular in size than on the corresponding tergite. In male, 7th sternite not depressed along middle and very weakly sinuate at apical margin in the middle, 8th sternite widely and shallowly excised in the middle of apical margin; legs with hind femora bearing no conspicuous long black hairs as in *N. femoralis*, hind trochanters distinctly armed with a hook on each external side.

Male genitalia rather slender; median lobe clearly curved ventrad, slightly constricted at middle, and rapidly narrowed apicad, with the tip extremely thin and sharp; apophyses slender, but slightly inflated toward apex, not extending beyond median lobe.

Holotype: \eth , Fenchihu (1,400 m), Chiai Hsien, Taiwan, 9–VIII–1974, Y. SHI-BATA leg. (coll. Tokyo University of Agriculture). Paratypes: $6 \eth \eth$, $2 \heartsuit \heartsuit$, same locality as for the holotype, 9–VIII–1974, 6–VIII–1976, 6~7–VIII–1977 and 13–VIII– 1983, Y. SHIBATA leg.

Notes. The present species belongs to the *femoralis* group in having a distinct hook on each hind trochanter of the male. It is easily separable from the two known species of the species-group by the following points: from N. *femoralis*, by the aedeagus quite differently shaped, the male hind femora only bearing much shorter and less prominent hairs, the male abdomen with the 6th and 7th sternites not depressed along middle, the head shorter in proportion, the eye larger and distinctly longer than a half the length of postgena, and the body generally lighter in color; from N. *matsudai*, by the median lobe of male genitalia much slenderer with the apex more clearly extending beyond the tip of apophysis, the head wider, not longer than wide, the pronotum relatively short, and the male 8th sternite a little more narrowly excised.

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Nazeris uenoi sp. nov.

(Figs. 5-7)

Body somewhat shiny, reddish to blackish brown; mouth parts, antennae and legs sordid yellow to brown, with brownish to blackish pubescence.

Length: 4.7-5.3 mm.

Head subquadrate, slightly shorter than wide or nearly as long as wide; punctures coarse, close, deep and rather regular in size and arrangement but those on subdepressed frons are slightly irregular in arrangement; eyes moderately sized, each as long as a half the length of postgena in longitudinal diameter; postgenae subparallel-sided and angulate behind; antennae extending beyond the middle of pronotum, 1st segment as long as the following two segments together, 2nd short and wide, 3rd to 10th gradually decreasing in length, 10th shorter than the 11th and subequal to the 2nd in length. Ventral surface of head similarly but a little more regularly punctate than dorsum.

Pronotum ovate, longer than wide (1.12:1), narrower (0.88:1) and a little longer (1.03:1) than head, widest at apical third, from where the lateral sides are more roundly convergent toward apex than toward base, a few erect setae near the widest part barely visible; disc more rugosely, more coarsely and more deeply punctate than on head, median line and depressions very feeble and obscure but perceptible on basal third.

Elytra with distinctly effaced shoulders, rather straightly widened toward apices, wider than long (1.10: 1), shorter (0.81: 1) and slightly wider than pronotum, coarsely, rugosely and rather regularly punctate.

Abdomen a little enlarged at sides, with punctures showing a usual tendency of decreasing in size and density toward distal segment, no visible microsculpture. In



Figs. 5–7. Nazeris uenoi sp. nov.; 5, male genitalia in lateral view; 6, same in ventral view; 7, outline of the 8th sternite in \mathcal{J} .

Nazeris Species from Taiwan



Fig. 8. Map showing the distribution of the group of Nazeris femoralis in Taiwan; 1, Nazeris matsudai; 2, Nazeris femoralis; 3, Nazeris persimilis; 4, Nazeris uenoi.

male, 6th sternite widely but feebly depressed along middle, 7th sternite lightly depressed at base and slightly sinuate at apical margin in the middle, 8th sternite rather narrowly and triangularly excised in the middle of apical margin; legs with hind femora and trochanters similar to those of the preceding species.

Male genitalia rather small and wide in ventral view; median lobe with apical part well sclerotized, consisting of a wide basal blade and a narrow apical triangle, the triangular apex being very sharply pointed; apophyses thin, slightly thickened apicad, and not extending beyond the apex of median lobe.

Holotype: ♂, Lushan (1,200 m), Nantou Hsien, Taiwan, 29–VII–1978, Y. SHI-BATA leg. (coll. Tokyo University of Agriculture). Paratypes: 5 ♂♂, 3 ♀♀, same locality as for the holotype, 26–VII–1976, 27 ~28–VII–1977, 30–VII–1978, 28–VII–1983 and 5–VIII–1985, Y. SHIBATA leg.

Notes. Though the present species is closely similar in general appearance to the preceding species and *N. matsudai*, it is distinguished from them by the following points: from *N. persimilis*, by the median lobe of male genitalia wider, the excision of

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the male 8th sternite narrower, the depression of the male 7th sternite visible, and the pronotum proportionally longer; from N. matsudai, by the median lobe of male genitalia also wider and the apophyses not extending beyond the tip of median lobe, the male abdominal segments with the 7th sternite visibly depressed and the 8th sternite relatively narrowly excised, and the elytra more strongly narrowed at shoulders. The present species is similar to N. femoralis in the depressions of the male abdominal sternites, but is easily distinguished from the latter by having apparently different median lobe of male genitalia and no conspicuous long hairs on the male hind femora.

The specific name is dedicated to Dr. Shun-Ichi UÉNO, who is not only the most famous and most active coleopterologist in Japan but also an expert caver, and to whom I am indebted for his pertinent critical suggestions for my study on the Staphy-linidae.

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Two New Species of *Pseudorientis* WATANABE (Coleoptera, Staphylinidae, Staphylinini, Quediina) from China

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Abstract Two new species of the genus *Pseudorientis* WATANABE, 1970, *P. uenoi* (China, northwestern Yunnan) and *P. gongga* (China, Sichuan) are described and illustrated. A key to the three species of *Pseudorientis* known at present is given.

Introduction

The genus *Pseudorientis* was established by WATANABE (1970, 70) to accommodate the new species *P. shinobuae*, collected in Gumma Pref., Honshu, Japan. The species was subsequently collected at other locations on Honshu, but no additional species of the genus were discovered until now.

Recently, two additional, undescribed species of this distinctive genus were discovered in the provinces of Yunnan and Sichuan of the People's Republic of China.

The purpose of this paper is to describe the two new species and to provide a key to the three species of *Pseudorientis* known at present.

Pseudorientis uenoi sp. nov.

(Figs. 1-5)

Piceous, with pronotum, elytra along suture and apical margin, and apical margins of abdominal tergites somewhat paler, apex of abdomen yellowish brown; mouthparts, antennae and legs testaceous, antennae each inconspicuously darker toward apex, middle and hind tibiae with medial faces vaguely darker.

Head in general of rounded quadrangular shape, about as long as wide, moderately narrowed posteriad behind eyes, posterior angles rounded and indistinct; eyes moderately convex and prominent, tempora longer than eyes seen from above (ratio 1.25); no additional punctures between anterior frontal punctures; surface of head with very fine and dense microsculpture of transverse waves, with scattered micropunctures. Antenna moderately long, segments 2 and 3 subequal in length, segment 4 slightly, segment 5 vaguely, longer than wide, segments 6–10 each about as long as wide, last segment about as long as two preceding segments combined. Pronotum as long as wide, broadly rounded basally, distinctly narrowed anteriad, disc markedly transverse-ly convex; dorsal rows each with four fine punctures, sublateral rows with four or five

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punctures, posterior puncture situated distinctly behind level of large lateral puncture; microsculpture on pronotum similar to that on head. Scutellum moderately large, impunctate, with fine submeshed microsculpture. Elytra rather long, at base slightly narrower than pronotum at widest point, at suture slightly longer (ratio 1.15), at sides distinctly longer (ratio 1.30) than pronotum at midline; punctation and pubescence moderately dense, punctures fine, slightly asperate, transverse distance between punctures mostly twice to three times diameter of punctures; surface between punctures without microsculpture. Wings fully developed. Abdomen with tergite 7 (fifth visible) bearing whitish apical seam of palisade fringe; punctation and pubescence of abdominal tergites slightly finer and denser than that of elytra, gradually becoming slightly sparser toward apex of abdomen; surface between punctures with exceedingly fine and dense microsculpture of transverse striae.

Male. First four segments of front tarsus slightly dilated, sub-bilobed, each with modified pale setae ventrally; segment two about one-third narrower than apex of tibia; segment four narrower than preceding segments, vaguely sub-bilobed. Sternite 8 with two long, strong setae on each side; with moderately wide, rather shallow, sub-arcuate medio-apical emargination (Fig. 1). Genital segment with tergite 10 narrow, markedly narrowed toward subacute apex, with five unequally long setae at and near apex (Fig. 2); sternite 9 subarcuate apically, with several variably long setae on apical portion (Fig. 3). Aedoeagus (Figs. 4–5) rather small and short; median lobe parallel-sided in middle portion, then narrowed toward minute, narrowly obtuse apex, without tooth on face adjacent to paramere. Paramere relatively long, wide, covering most of median lobe, slightly dilated anteriad and then narrowed into short, narrowly obtuse apex about reaching apex of median lobe; four setae at apex and two similar setae at each lateral margin below apex; underside with numerous sensory peg setae situated at random on apical portion; internal sac simple, with two small, elongate sclerites.

Female. Unknown.

Length 4.1 mm.

Type material. Holotype (male): "China Yunnan 1–19–VII. HEISHUI. 35 km N Lijiang 27°13'N 100°19'E J. Jendek leg. 1992". In the collection of the Naturhistorisches Museum, Vienna, Austria.

Geographical distribution. Pseudorientis uenoi is at present known only from the type locality in northwesternmost Yunnan.

Bionomics. Nothing is known about the habitat requirements of this species.

Discussion. Pseudorientis uenoi is similar to the Japanese species P. shinobuae WATANABE, 1970, but it differs, in addition to the sexual characters (see Figs. 1–5, 11–

Figs. 1–12. Pseudorientis uenoi: 1, apical portion of male sternite 8; 2, male tergite 10; 3, male sternite 9; 4, aedoeagus (ventral view); 5, apical portion of underside of paramere, with sensory peg setae. — Pseudorientis gongga: 6, apical portion of male sternite 8; 7, male tergite 10; 8, male sternite 9; 9, aedoeagus (ventral view); 10, apical portion of underside of paramere, with sensory peg setae. — Pseudorientis shinobuae: 11, aedoeagus (ventral view); 12, apical portion of underside of paramere, with sensory peg setae.

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12), by the less dilated first four segments of the front tarsus, by the shorter head which is somewhat less narrowed toward the neck, by the smaller eyes, by the narrower pronotum and by the finer punctation of both the elytra and the abdomen.

Etymology. Patronymic. The species has been named in honour of my distinguished friend, Dr. Shun-Ichi UÉNO, National Science Museum, Tokyo, in recognition of his enormous contribution to our knowledge of the beetle fauna of Asia, and that of Japan in particular.

Pseudorientis gongga sp. nov.

(Figs. 6-10)

Piceous, with pronotum and apical margins of abdominal tergites somewhat paler, apex of abdomen pale brown; mouthparts, antennae and legs brunneo-testaceous, antennae each inconspicuously darkened toward apex, middle and hind tibiae with medial faces vaguely darker.

Head in general of rounded quadrangular shape, about as long as wide, almost parallel-sided behind eyes, with posterior angles entirely rounded and indistinct; eyes small, only slightly convex, not prominent, tempora distinctly longer than eves seen from above (ratio 1.50); two additional punctures between anterior frontal punctures; surface of head with very fine and dense microsculpture of transverse waves, becoming submeshed on frons, with scattered micropunctures. Antenna rather short, segments 2 and 3 subequal in length, segment 4 slightly longer than wide, segments 5 and 6 as long as wide, segments 7-10 transverse, last segment about as long as two preceding segments combined. Pronotum about as long as wide, broadly rounded basally, moderately narrowed anteriad, disc markedly transversely convex; dorsal rows irregular, each with seven fine punctures, sublateral rows each with four punctures, posterior puncture situated much behind level of large lateral puncture; microsculpture on pronotum similar to that on head. Scutellum moderately large, impunctate, with fine, dense, submeshed microsculpture. Elytra rather short, at base slightly narrower than pronotum at widest point, at suture slightly shorter than (ratio 1.17), at sides as long as pronotum at midline; punctation and pubescence moderately dense, punctures fine, slightly asperate, transverse distance between punctures mostly twice diameter of punctures; surface between punctures without microsculpture, but with some microscopical irregularities. Wings fully developed. Abdomen with tergite 7 (fifth visible) bearing very fine, whitish apical seam of palisade fringe; punctation and pubescence of abdominal tergites somewhat finer than that of elytra, gradually becoming slightly sparser toward apex of abdomen; surface between punctures with exceedingly fine and dense microsculpture of transverse striae.

Male. First four segments of front tarsus distinctly dilated, sub-bilobed, each with modified pale setae ventrally; segment two almost as wide as apex of tibia; segment four narrower than preceding segments, vaguely sub-bilobed. Sternite 8 with three long setae on each side; with wide, rather deep, triangular medio-apical emargi-

nation (Fig. 6). Genital segment with tergite 10 shorter and wider than that of P. *uenoi*, with numerous unequally long setae on apical portion (Fig. 7); sternite 9 similar to that of P. *uenoi*, but shorter and wider, more setose (Fig. 8). Aedoeagus (Figs. 9–10) larger and longer than that of P. *uenoi*; median lobe almost conically narrowed into a subacute apex, without tooth on face adjacent to paramere. Paramere similar to that of P. *uenoi*, but apical portion longer, narrowed into subacute apex not quite reaching apex of median lobe; four setae at apex and two similar setae at each lateral margin below apex; underside with numerous sensory peg setae situated at random on apical portion; internal sac with two elongate, solid sclerites, and with two long structures composed of dense, long spines.

Female. Unknown.

Length 3.9 mm.

Type material. Holotype (male): "CHINA, Sichuan, Gongga Shan, above Camp 3 3050 m, 22. VII. 94 A. SMETANA [C 18]". In the Collection A. SMETANA, Ottawa, Canada. (To be eventually deposited in the Musée d'Histoire Naturelle, Genève, Switzerland).

Geographical distribution. Pseudorientis gongga is at present known only from the Gongga Shan range in Sichuan.

Bionomics. The holotype was found in a large, moist pile of coniferous sawdust on the ground of an opening in the forest.

Discussion. Pseudorientis gongga differs from the two other species of the genus, in addition to the sexual characters, by many external characters, most conspicuous of which are the presence of the additional punctures between the anterior frontal punctures on the head, the rather short antenna with outer segments transverse, the dorsal rows on the pronotum each with seven punctures, and the rather short elytra.

Etymology. The specific name is the name of the Gongga mountain range, in apposition.

Key to Species of Pseudorientis

- Head without additional punctures between anterior frontal punctures. Antenna with outer segments as long as wide. Dorsal rows on pronotum each with four punctures. Elytra rather long, at suture at least as long as pronotum at midline. Aedoeagi different (Figs. 4–5, 11–12).
- Aedoeagus relatively large and elongate; paramere elongate, with apex narrowly arcuate, not reaching apex of median lobe (Figs. 11–12). Head behind eyes markedly narrowed toward neck; eyes moderately large, tempora about as long as eyes seen from above. Larger, length 4.3–4.5 mm.

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P. shinobuae WATANABE, 1970
Aedoeagus relatively small and short; paramere moderately long, with short, narrowly obtuse apex about reaching apex of median lobe (Figs. 4–5). Head behind eyes moderately narrowed toward neck; eyes moderately large, tempora longer than eyes seen from above (ratio 1.25). Smaller, length 4.1 mm. P. uenoi sp. nov.

Reference

WATANABE, Y., 1970. Descriptions of a new genus and a new species of Quediini from Japan (Coleoptera: Staphylinidae). Kontyú, Tokyo, 38: 70-74.

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Description of a New Species of the Genus Trichophya (Coleoptera, Staphylinidae) from Japan

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Abstract A new species, *Trichophya uenoi* NAOMI, of the staphylinid subfamily Trichophyinae is described from Hokkaido, Japan, and the aedeagus and sternites 8 and 9 of the male are illustrated for comparison. In addition, *Trichophya japonica* WATANABE et SHIBATA, 1962, is first reported from Hokkaido, Japan.

The genus *Trichophya* MANNERHEIM belongs to the monogeneric subfamily Trichophyinae, which is characterized by such derived states in the adult as the form of nuchal constriction and the spindle-shaped segment 4 and extra-segment 5 of maxillary palpus, and also by several derived states in the larva (ASHE & NEWTON, 1993). Up to the present, twelve species of *Trichophya* have been known from the Holarctic and Oriental Regions (*e.g.*, WATANABE & SHIBATA, 1962; ZHENG, 1987; ASHE & NEWTON, 1993). From Japan, however, only *Trichophya japonica* was described from Honshu by WATANABE and SHIBATA (1962). In this paper I am going to describe a second species, *Trichophya uenoi* NAOMI from Hokkaido, and to illustrate its aedeagus and sternites 8 and 9 of male for comparison.

Trichophya uenoi NAOMI, sp. nov.

(Fig. 1)

Male and female. Body 1.7–2.0 mm in length, elliptical, a little broad, moderately shining, covered with dense, short and regular, yellowish brown to reddish brown pubescence.

Coloration: Head black to dark brown, clypeal area reddish brown; pronotum, elytra and abdomen dark brown to dark reddish brown; 8th and 9th abdominal segments yellowish brown; labrum black; antennae and legs reddish brown to yellowish brown.

Relative measurements: HL: 24; HW: 31; PL: 28; PW: 44; EL: 40; EW: 51.

Head weakly convex, almost triangular in outline, narrowed anteriorly, clypeal area transverse, indistinctly coriaceous, its anterior margin very weakly rounded, frontoclypeal suture distinct, genal areas relatively long, nuchal constriction very distinct; surface on vertex finely coriaceous, neck smooth, with fingerprint-like microsculpture which runs transversely. Eyes each situated at posterolateral corner of head, relatively small, prominent laterally and minutely facetted. Labrum narrow Shun-Ichiro NAOMI



Fig. 1. Trichophya uenoi sp. nov. A, Sternite 8 of male; B, sternite 9 of male; C, aedeagus and evaginate internal sac.

and setous, anterior margin much rounded. Antennae reaching anterior 1/3 of elytra, covered sparsely with setae of various length; 1st segment robust and broad, 2nd segment globose, 3rd and 4th segments each much narrower than 2nd, almost baculiform, 5th to 10th segments each constricted near apical 1/3, so that each segment consists of basal broad area and apical narrow area, the basal broad area baculiform in 3rd segment, spindle-shaped in each of 5th to 10th segments, 11th elongate-elliptical, but somewhat asymmetrical, ALP: 10: 9: 11: 10: 10: 9: 9: 8: 8: 8: 12.

Pronotum transverse and very narrowly marginate, moderately convex above, broadest near the middle, anterior margin broadly and arcuately emarginate, lateral margin much rounded, hind margin very weakly tri-sinuate; surface finely coriaceous;

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punctures very small, regular, sparse and somewhat indistinct, interstices a little or much longer than diameter of punctures. Mesoscutellum with visible part almost triangular, posterior corner narrowly rounded; surface with dense punctures, and sparse pubescence.

Elytra moderately convex above, broadened posteriorly, side margin weakly rounded, hind margins together forming a wide and shallow emargination; surface a little rough, punctures dense, regular, shallow and sometimes indistinct, interstices narrower than diameter of punctures, indistinctly sculptured.

Legs moderate in length; tibiae elongate.

Abdomen broad, broadest at 5th segment, side margin rounded; paratergites developed and erect; surface of abdomen with reticulate sculptures and very fine, sparse and indistinct punctures.

Male. Fore tarsi with 1st to 4th segments moderately dilated; middle tarsi with 1st to 4th segments weakly dilated; 8th sternite (Fig. 1 A) with 3 pairs of long setae, posterior margin widely and shallowly emarginate; 9th sternite (Fig. 1 B) asymmetrical at base, pubescent at apical part, with a pair of black and erect setae and a pair of very long subtransparent setae, posterior margin very minutely and indistinctly pointed at the middle. Aedeagus (Fig. 1 C) with median lobe moderately sclerotized except for basal part, gourd-shaped in basal 3/5, then moderately constricted and narrowed toward acutely pointed apex, relatively compressed dorso-ventrally in apical 2/5; parameres slender, each provided with 4 short setae at apex which is weakly swollen; internal sac of evaginate condition (Fig. 1 C) well-developed and very long, with a moderately sclerotized depression near base, and additional long sac at the apical part, external surface of internal sac of evaginate condition bearing numerous fine spines.

Female. Eighth sternite produced and rounded at the middle of posterior margin. Holotype, male (Type No., CBM-ZI 33618), Himenuma, Rishiri Is., Hokkaido, 26-VI-1986, S. NOMURA coll. Paratypes, 1 female, Kamishihoro, Hokkaido, 5~12-VII-1989, K. HAGA coll.; 1 female, Misaki-machi, Shiretoko, Hokkaido, 9-VII-1986, S. NOMURA coll.; 1 male, Jôzankei, Hokkaido, 20-VII-1988, M. ÔHARA coll.

Distribution. Japan (Hokkaido).

Remarks. Trichophya uenoi sp. nov. is similar to T. japonica WATANABE et SHIBATA, but is easily separable from the latter by the characters used in the key given below. Information of the morphology of T. japonica given in the key is based not only on the account of WATANABE and SHIBATA (1962), but on one female specimen examined in the course of this study (Kamishihoro, Hokkaido, $12 \sim 14$ -VI-1990, K. HAGA coll.). As T. japonica has previously been known only from Honshu, this is the first record from Hokkaido.

Specimen measured is the paratype from Jôzankei, Hokkaido.

Etymology. This species is named in honor of Dr. Shun-Ichi Uéno of the National Science Museum (Natural History), Tokyo.

Shun-Ichiro NAOMI

Key to the Species of Trichophya from Japan

Acknowledgements

This paper is dedicated to Dr. Shun-Ichi UÉNO of the National Science Museum (Natural History). Tokyo. I thank Dr. Shûhei NOMURA (Kyushu University), Mr. Kaoru HAGA (Niigata), and Dr. Masahiro ÔHARA (Otaru Museum) for their kindness in offering me the valuable specimens used in this paper.

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Coleopterous Fauna of the Nests of *Reticulitermes speratus* (KOLBE) (Isoptera, Rhinotermitidae) of Kanagawa Prefecture, Japan¹⁾

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Abstract From nests of the termite, *Reticulitermes speratus* (Isoptera, Rhinotermitidae), collected at Kanagawa Prefecture, Japan, six coleopterous species were found, namely *Ptinella* sp. (Ptiliidae), *Trichopsenius japonicus* SEEVERS (Staphylinidae), Aleocharinae sp. (Staphylinidae), *Thyroderus porcatus* SHARP (Cerylonidae), *Macrorhyncolus crassiusculus* WOLLASTON (Curculionidae) and *Dryophthorus sculpturatus* WOLLASTON (Rhynchophoridae). The two staphylinids showed their behaviors with direct contacts with termites, and were regarded as true termitophiles, though the manners of contact differed. The curculionid and the rhynchophorid showed no direct contact with termites, which suggests that they are the so-called "termitariophiles", while little biological and ethological characteristics were detected in the other two beetle species.

Introduction

Up to the present, coleopterous fauna of termites' nest has been very little studied in Japan although some species have been known to inhabit termites' nests (HASEGAWA & KUBOTA, 1944; MORIMOTO, 1983; IWATA, 1989; IWATA *et al.*, 1992). This is the first report of our investigation on the beetles collected from the nests of a termite species, *Reticulitermes speratus* (Rhinotermitidae), to observe their behaviors with special attention to their physical contacts with their host termites.

Materials and Method

Reticulitermes speratus nests in fallen trees and rotten timbers were collected at three localities, namely 1) Fujisawa Campus of Nihon University, Ishikawa, Fujisawa, 2) the Komatsu River, Kawajiri, Shiroyama, and 3) Mutsukawa, Minami-ku, Yoko-hama, all being within Kanagawa Prefecture, Central Japan. They were introduced to the laboratory, kept in large containers under laboratory-rearing condition and occasionally disintegrated carefully with saws, choppers and knives to expose all the insects inhabiting them. While collecting beetles, their relative location in the nest were noted in order to determine their natural status within termites' colony. Several dozens of termite workers and the beetle were then accommodated in a petri-dish, with

¹⁾ Notes on the termitophilous Coleoptera. II.

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a wet filter paper placed on its bottom, to observe their interactions or physical contacts. Unless their positive interactions were observed, the "termite-soil" of which the nest was made was added to them in a small quantity to observe beetles' reaction to it.

Results and Discussion

The following six coleopterous species were collected from *Reticulitermes*' nests, some of them showing peculiar biological and ethological aspects:

1. Ptinella sp. (Ptiliidae) (Fig. 1)

2 exs., locality (2), from nest in a fallen *Quercus* tree collected on 31–VIII–1992, exposed at laboratory on 1–IX–1992, found in a small space (1 cm \times 5 mm) under the bark together with termites.

Little interaction or contact with termites was observed until their death.

Taxonomical and distributional notes. According to Dr. H. SASAJI, this is an allied species of *Ptinella mekura* KUBOTA, an eyeless species originally described from Odawara, Kanagawa Prefecture. In the present unidentified specimens, however, eyes are prominently present, each ommatidium being observed.



Fig. 1. Ptinella sp. adult (Ptiliidae) (slide prepared by Dr. H. SASAJI).

Beetles from Reticulitermes speratus Nests



Fig. 2. Trichopsenius japonicus SEEVERS adult (Staphylinidae, Aleocharinae) (right), and the 1st instar larva of its host termite, *Reticulitermes speratus* (KOLBE) (Rhinotermitidae) (left), in lateral view.

2. Trichopsenius japonicus SEEVERS (Staphylinidae, Aleocharinae)

I ex., locality (3), from nest in a *Pinus* rotten sawn timber collected on 27-IX-1992, exposed at laboratory on 28-X-1992, found among termites (Fig. 2).

Distributional notes. This is the only termitophilous staphylinid hitherto known from Japan proper. The known localities are Mooka, Tochigi Pref., Zushi and Kamakura, Kanagawa Pref., Mt. Amagi, Shizuoka Pref., Uji and Kyoto, Kyoto Pref. (NAOMI & TERAYAMA, 1986; IWATA, 1989; HAYASHI, 1991), to which many more localities in the southern lowlands of West Japan are expected to be added: a record of an unidentified staphylinid found with the present termite species at Ôiso and Odawara, Kanagawa Pref. (HASEGAWA & KUBOTA, 1944) is presumably ascribed to this species. In addition, the senior author examined the same from Lake Sayama, Tokorozawa, Saitama Pref. (exposed at lab. on 6-XII-1993, A. MONDEN leg.).

Ethological and biological notes. The only one specimen dropped out of wood together with many termites. Its behavior considerably differed from the following species: it approached and ran against termites very actively, and climbed around termites' heads. Its abdomen was never observed bent upward. Like its host, it showed negative phototaxis. Morphologically, it somewhat resembles the 1st instar larva of host termite in lateral view, with its abdomen being rather robust (Fig. 2).

Its life history is quite unknown, but the present record, as well as those from the literature (NAOMI & TERAYAMA, 1986; IWATA, 1989), suggests that adults appear in all seasons.

3. Aleocharinae sp. (Staphylinidae) (Figs. 3-8)

1 ex., locality (1), from nest in a fallen *Pinus* tree collected on 14–IV–1991, exposed at laboratory on 29–V–1991, found among termites.

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3 exs., locality (1), from the same nest as above, exposed at laboratory on 30-V-1991, found among termites.

2 exs., locality (1), from the same nest as above, exposed at laboratory on 31-V-1991, found among termites.

8 exs., locality (1), from the same nest as above, exposed at laboratory on 29-VI-



Figs. 3-8. Aleocharinae sp. adult (Staphylinidae). — 3, Behavior of getting away quickly from the termites' approach; 4, behavior of keeping distance from the hosts; 5, behavior of bending the abdomen upward; 6, termite workers' behavior of licking beetles' anal portion; 7, behavior of bending the abdomen laterally; 8, behavior of feeding on termites' semi-liquid excretion.

1991, found among termites.

1 ex., locality (1), from nest in a fallen *Pinus* tree collected on 29–III–1992, exposed at laboratory on 17–VI–1992, found among termites.

2 exs., locality (1), from the same nest as above, exposed at laboratory on 22-VII-1992, found in termites' path among termites.

Taxonomical and distributional notes. According to Dr. S. NAOMI (pers. comm.), this is an undescribed species, belonging to a genus hitherto unknown from Japan. Also, he examined specimens of the same species from Kyushu University Campus, Hakozaki, Fukuoka City, Kyushu (Y. TAKEMATSU leg.),²⁾ and the senior author examined the same from Inogashira Park, Mitaka, Tokyo Pref. (exposed at lab. on 10–IX–1993, Y. KANEMAKI leg.). It resembles the genus *Hypocyptus* in its appearance, but is phylogenetically quite different from it in having 11-segmented antennal structure and different tarsal formula. Its description will appear elsewhere. This species is easily distinguished from another *Reticulitermes*-associated minute staphylinid from Japan, *Trichopsenius japonicus*, by having limuloid and darker-colored body.

Ethological and biological notes. Adults (ca. 1.1 mm in length) have been found from May to September, and never in winter. Adult beetles were always found together with the host termites from the nest. The sites where they were found ranged from sapwood portion to the pith, but all were situated within the termites' pathways and chambers, where the wood surface was relatively smooth and clean with less "termitesoil" contamination. These facts strongly suggest that the present staphylinid is a true symphile of Reticulitermes speratus with whom they are always living. The host termites often try to approach and contact the beetle: during a 5-minute observation, where 20 termite workers and a beetle were released together into a glass petri-dish, more than 20 approaches toward the beetle were observed, while the beetle has a tendency to get away quickly from the termites' approaches (Fig. 3), always trying to keep distance from the host (Fig. 4). If the beetle was surrounded by termites, it kept motionless, then suddenly slipped out of siege. The beetle also showed a peculiar behavior: its abdomen was frequently observed bent upward (Fig. 5), and termite workers occasionally licked beetles' anal portion (Fig. 6), suggesting interspecific proctodeal trophallaxis. Not only upward, but also lateral bending of the abdomen was possible, which seemed to be utilized in turning quickly while walking (Fig. 7), as often seen in limuloid beetles.

Beetles were observed to feed themselves on termites' semi-liquid excretion on the wet filter paper with duration of more than several seconds (Fig. 8).

By chance, BECKER (1966) found out *Reticulitermes flavipes* workers follow ball-point pen drawing as a mimic of the social trail, and HAVERTY (1980) verified following behaviors of termitophiles, including *Trichopsenius depressus*, of the trail of their own host, *R. virginicus*. We, accordingly, tested the reaction of our new termitophile against ball-point pen drawings on the filter papers. The result was that no

²⁾ According to Dr. S. NAOMI (pers. comm.), the statement by CHÛJÔ and NAOMI (1991) on the occurrence of a species of "Hypocyptus" in Reticulitermes speratus nest is referred to this record.

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Fig. 9. Thyroderus porcatus SHARP, adult (Cerylonidae).

followings were observed along the black drawings with Zebra's and Bic's products, which R. speratus follows as trail, and, on the contrary, the drawings repelled the beetles when touched by them, enabling us to confine the beetles within a circle drawn with these pens.

4. Thyroderus porcatus SHARP (Cerylonidae) (Fig. 9)

1 ex., locality (1), from nest in a fallen *Pinus* tree collected on 29-III-1992, exposed at laboratory on 17-VI-1992, found among a small number of termites.

2 exs., locality (1), from the same nest as above, exposed at laboratory on 22-VII-1992, found among a small number of termites.

Ethological and biological notes. When termites and the beetle were released together into a glass petri-dish, it kept calm at a certain distance from termite group, with little interaction or contact with termites observed until its death. According to Dr. H. SASAJI (pers. comm.), the genus *Thyroderus* usually feeds on mold fungi, which suggests that our beetle was dependent upon "termitophilous mold fungi" in the nest. 5. *Macrorhyncolus crassiusculus* WOLLASTON (Curculionidae)

2 exs., locality (1), from nest in a fallen *Pinus* tree collected on 29-III-1992, exposed at laboratory on 22-VII-1992, found among a small number of termites together with the below rhynchophorid.

Ethological and biological notes. When released into a petri-dish together with termites, it kept calm at a certain distance from the termite crowd. After the "termite-soil" aggregates, of which the nest was made, were added to the petri-dish, they bored and sneaked into them. Thus, there was very little interaction or contact between the beetles and termites, and it might be hypothesized that this curculionid is dependent, not upon the termites, but upon the substance of termites' nests as its habitat and food.

6. Dryophthorus sculpturatus WOLLASTON (Rhynchophoridae)

1 ex., locality (1), from nest in a fallen *Pinus* tree collected on 14–IV–1991, exposed at laboratory on 31–V–1991, found among termites.

5 exs., locality (1), from nest in a fallen *Pinus* tree collected on 29-III-1992, exposed at laboratory on 10-VII-1992, found among a small number of termites.

3 exs., locality (1), from the same nest as above, exposed at laboratory on 22-VII-1992, found among a small number of termites.

12 exs., locality (1), from the same nest as above, exposed at laboratory on 23-VII-1992, found among a small number of termites.

Ethological and biological notes. It has already been known that this species is often found with termites (MORIMOTO, 1983). The sites of collection within the woods were the portions that abounded with "termite-soil", with rather low density of termites. Like the above curculionid, they kept calm at a certain distance from the termite crowd and bored and sneaked into termite-soil aggregates in the petri-dish. The senior author once collected this species from termiticide field test apparatus at Fukiage-Hama, Fukiage, Kagoshima Pref. (10 exs., 21–III–1987), where killed Coptotermes formosanus workers and soldiers were found scattered and from abandoned part of C. formosanus nest at Yamazaki-chô, Miyazaki, Miyazaki Pref. (2 exs., 22–III–1987). Therefore, we may conclude that this rhynchophorid species is dependent, not upon the termites, but upon the nest substance of Coptotermes and Reticulitermes.

General Discussion

The above observations indicate obligatory termitophily of the two staphylinids, *Trichopsenius japonicus* and the undescribed Aleocharini sp., with the host being, at least, *R. speratus*, a unique termite species native to the most part of Japan proper. As *Trichopsenius* adults have been found almost throughout the year, and Aleocharini sp. adults only in the spring to the late summer, the life histories of the two seem to be quite different. Information on the appearance season of *Trichopsenius* adults, if this represents the true life cycle, also suggests that this is more integrated into the host termite society than the other, because termites' nests are said to be constantly climatized throughout the year.

On the other hand, *Madrasostes kazumai* is a ceratocanthid beetle, hitherto found only in abandoned part of *Coptotermes formosanus* nest, and was designated "termitariophile" by IWATA *et al.* (1992). Like this, the curculionid, *M. crassiusculus*, and the rhynchophorid, *D. sculpturatus*, are also termitariophiles, having relations, not to the living termites, but to the nest or the soil the termites handle, where substances derived from termites' wood digestion and activity must play an important role. This view is also supported by the above-stated fact that *D. sculpturatus* is associated also with *Coptotermes*: species-specificity seems less developed in termitariophiles. As ARAYA (1994) pointed out, termites' nest is a rather integrated, independent, and nutrition-rich ecosystem, and thus, it is a safe and utilizable resource for the organisms

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that can afford to cope with its biotic and abiotic conditions.

In the other two beetle species, *Ptinella* sp. and *Thyroderus porcatus*, observations were not enough to detect any ethological and biological characteristics of them.

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The present paper is dedicated to Dr. Shun-Ichi UÉNO, a distinguished zoologist, for commemoration of his retirement from the National Science Museum, Tokyo.

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Description of a New Species of the Genus Awas (Coleoptera, Pselaphidae) from Taiwan^{1,2)}

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Abstract A new species, *Awas shunichii*, is described from Taiwan. This is a second species of the recently established genus belonging to the tribe Arnylliini.

The genus *Awas* was recently described by LÖBL (1994) based on the type species *A. giraffa* collected from Malaysia. This genus is classified to the tribe Arnylliini as a result of the phylogenetic analysis by LÖBL. In this study, the genus *Awas* is redefined and a new species *A. shunichii* is described from Taiwan.

Genus Awas LÖBL

Awas Löbl, 1994, Rev. suisse Zool., 101: 686. Type species: Awas giraffa Löbl, by original designation.

Body large-sized, elongate, narrowed on head, constricted at base of abdomen, densely covered with long and bold pubescence. Head very elongate behind eyes, narrowed basally (generally transverse in Harmophorus), eyes well developed, U-shaped to reniform. Antennae reaching basal margin of pronotum, elongate, without distinct club; maxillary palpi short, 3rd segment short, broadened distally, with a long seta at apico-lateral angle, 4th largest and ovoid. Pronotum subcylindrical, weakly narrowed anteriorly, with a transverse T-shaped sulcus at antebasal part. Elytra very large, nearly hexagonal, widest at middle. Metasternum swollen at median part. Legs slender, fore femora each with minute subapical denticle (large in Harmophorus as shown in Fig. 2 C), mid trochanters very large as in Harmophorus. Abdomen strongly constricted at base, with dense hairs around the constriction, 3rd segment large, separated from 4th by deep constriction, with a longitudinal dorso-median sulcus and semicircular metacoxal process between hind coxae, 4th segment predominantly large. Male genitalia symmetrical, parameres paired, attached to apical part of median lobe, median lobe reniform, with a pair of hook-like sclerites at apex, endophallus located at middle of median lobe, elongate.

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Remarks. The genus Awas is most closely allied to the genus Harmophorus MOTSCHULSKY (=Arnyllium REITTER) in the triangular and unisetose third segment of the maxillary palpus, the unidenticulate fore femur, large mid trochanter and the reniform and symmetrical aedeagus with articulate parameres and a pair of sclerites at the apical part. The genus Awas is very distinct in the tribe Arnylliini in having the elongate head and the very large fourth abdominal segment.

Awas shunichii sp. nov.

Male (Fig. 1). Length 4.2 mm. Width 1.2 mm.

Body reddish brown, maxillary palpi and tarsi light brown, elongate and subcylindrical, strongly narrowed anteriorly, constricted at base of head and base of abdomen.

Head very long and elongate behind eyes, weakly broadened and thickened anteriorly, clypeus arcuately projected anteriorly, frons elevated on both lateral sides and weakly concave at median part, with a short median longitudinal sulcus, vertex flattened, postgenae very large, covered with bold pubescence. Eyes situated before the middle, reniform and roundly convex, each composed of about 100 facets. Maxillary palpi (Fig. 2 A) short, nearly reaching eyes, 1st segment short and tubular, 2nd elongate, weakly thickened distally, 3rd short, broadened distally, nearly triangular, with a long seta at apico-lateral angle, 4th largest and ovoid, about 2.2 times as long as wide, palpal spine 1/3 times as long as 4th segment. Antennae short, thick, reaching posterior margin of pronotum, 1st segment short and thick, 2nd to 4th subequal in width, each subcylindrical, weakly thickened distally, 5th to 8th subequal, each subglobose, 9th larger than 8th, subglobose, 10th slightly wider than 9th, globular, 11th largest, ovoid, 1.5 times as long as wide; relative lengths (widths) of each segment from base to apex: 1.2 (1.0): 1.0 (0.8): 1.1 (0.8): 1.0 (0.8): 0.9 (0.8): 0.8 (0.8): 0.8 (0.8):0.8 (0.8): 1.1 (1.0): 1.1 (1.2): 1.8 (1.2).

Pronotum shorter than head, subcylindrical, 1.3 times as long as wide, widest at middle, weakly narrowed anteriorly, covered with bold and curved pubescence, with 2 pairs of fringed constrictions on basilateral sides and a T-shaped transverse sulcus connecting with anterior pair of basilateral constriction, prosternum weakly concave and densely haired. Elytra 1.1 times as long as wide, nearly hexagonal, convex on dorso-lateral surface, but weakly depressed at basimedian part, mostly covered with long pubescence, with long and bold setae at postero-lateral margins, each elytron with a deep basimedian fovea and subsutural sulcus. Metasternum roundly swollen at median part, densely with long hairs on both sides of the swollen part. Legs slender, fore femora slightly swollen distally, each with an indistinct denticle at inner side of the apex (Fig. 2 B), mid and hind femora slender, each weakly bent, slightly swollen at middle and suddenly dilated at apex, tibiae very slender, densely with bold setae at apical part, tarsi long and slender.

Abdomen short, strongly constricted and sulcate at base, densely covered with

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Fig. 1. Dorsal aspect of the male of Awas shunichii sp. nov.

long hairs around the basal constriction, 3rd segment large, covered with elytra, separated from 4th by deep constriction, with a narrow longitudinal sulcus at dorsomedian part, and a small, semilunar metacoxal process at ventro-median part, 4th predominantly large, broadened posteriorly, 5th to 6th very short, 7th 1.5 times as long as 6th, 8th tergite nearly triangular (Fig. 2 E), 8th sternite very short and crescent (Fig. 2 F). Male genitalia (Fig. 2 G–I) symmetrical and weakly sclerotized; parameres fused to each other at base, composed of X-shaped basal sclerite and a pair of lamellar apical

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Fig. 2. A, C-I, Awas shunichii sp. nov., male; B, Harmophorus sp. in Taiwan. A, Left maxilla; B-C, fore femur in ventral view; D, meso-metasterna; E, 8th abdominal tergite; F, 8th sternite; G, male genitalia in ventral view; H, ditto, in lateral view; I, ditto, in dorsal view.

sclerites, each apical sclerite articulated with apical arm of the basal sclerite by membrane, broadened distally and suddenly curved ventrally at apical part, median lobe reniform, broadly membranous and concave on dorso-apical part, with a pair of hooklike sclerites at ventro-apical part, endophallus located at middle of median lobe, large and elongate, covered with long and dense bristles.

Female. Unknown.

Distribution. Taiwan.

Holotype, male, Mt. T'engchih (1,550 m alt.), Paoshan-ts'un, T'aoyüan-hsiang, Kaohsiung-hsien, Taiwan, 1-XI-1989, Hirotsugu ONO leg., in National Science Museum, Tokyo.

Remarks. This new species is very similar to *A. giraffa* LÖBL in general aspect, but is distinguished by the following characters: the body is larger, the head is scarcely constricted behind eyes (distinctly constricted in *giraffa*), the eyes are roundly convex (angulate in *giraffa*), the fifth to tenth antennal segments are each subglobose (elongate in *giraffa*), the prothorax bears a pair of vertical sulci behind the T-shaped transverse sulcus on both basilateral sides, each elytron bears a basimedian fovea and a subsutural sulcus and the aedeagus possesses a pair of ventrally curved hook-like sclerites at the

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apical part of the median lobe (dorsally curved sclerites in giraffa).

This species name is dedicated to Dr. Shun-Ichi UÉNO for his great contribution to the Japanese coleopterology and his assistance to the present study in various ways.

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A Redescription of *Aesalus himalayicus* (Coleoptera, Lucanidae) from Nepal

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Abstract Aesalus himalayicus is redescribed on the basis of all available specimens, and its genital organs are illustrated for the first time. This Himalayan Aesalus seems closer to Southeast Asian members than to Palearctic ones.

Aesalus himalayicus is a rare and poorly known lucanid species described by Y. KUROSAWA (1985) on the basis of several females from the high mountain region of Nepal. Being unable to see any male specimen, we have been unable to make satisfactory discussion on its systematic position. For example, BARTOLOZZI (1991) revised the Palearctic and Taiwanese *Aesalus*, but did not mention to this Himalayan *Aesalus* at all.

Recently, through the courtesy of Dr. S.-I. UÉNO, I had an opportunity to examine the specimens of A. himalavicus including its type series deposited in the National Science Museum (Nat. Hist.), Tokyo, and found that one of the damaged specimens which had been reported as a female in the original description was a male (ARAYA et al., 1993). Although the specimen was seriously damaged, I was fortunately able to examine several important characters such as male genital organ, which are necessary for determining the true affinity of this species within the genus Aesalus. In the following lines, I am going to redescribe A. himalayicus mainly based upon this male specimen with the illustrations of its genital organs, and make a brief comment on its systematic position. Abbreviations used herein are: PEL-pronotum-elytra length; BT-body thickness; HL-head length; HW-head width; PL-pronotum length; PWpronotum width; EL-elytra length; EW-elytra width; FTL-front tibia length; FTWfront tibia width (see ARAYA et al. (1993) for measuring methods). The male genital organ was observed in 70% ethanol after treating it with weak solution of potassium hydroxide, whereas female ones were observed in dry condition. The terminology for description of genitalia used herein is the same as that in other papers of mine (ARAYA et al., 1993; ARAYA, 1993).

Before going further, I wish to express my deep appreciation first of all to Dr. S.-I. UÉNO, a leading biologist in Japan, who will retire from the National Science Museum (Nat. Hist.), Tokyo, for giving me the opportunity to examine the specimens of A. *himalayicus*. Further, he was the leader of the field research team when the type series of A. *himalayicus* was obtained. I also thank Dr. M. MATSUI and Dr. M. KON, Kyoto

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University, for critically reading the manuscript of this paper.

Aesalus himalayicus Y. KUROSAWA, 1985

(Figs. 1-17)

Aesalus himalayicus Y. KUROSAWA, 1985, Bull. natn. Sci. Mus., Tokyo, (A), 11, p. 49, fig. 1; type locality: Nepal. — ARAYA et al., 1993, Elytra, Tokyo, 21, p. 94.

Large-sized *Aesalus*, length from anterior margin of head to apices of elytra 5.9–7.0 mm (n=5). Body elongate, outline elliptical in dorsal view (EW/PEL 0.56–0.58, n=3) (Fig. 1), relatively thick and semicircular in lateral view (BT/PEL=0.42–0.44, n=4) (Fig. 3). Body integuments reddish to chocolate brown in color; dorsal surface largely covered with scale-like black bristles partly forming small clumps but without whitish-golden tomentum (Fig. 4).

Head (Fig. 5) punctuated weakly, its anterior margin obtusely projected. Eye with distinct canthus covering about one-third of outer margin. Mandible (Fig. 6) with a sharp apical tooth and a smaller subapical tooth on dorsal side; without mola and brushy setae. Mentum with well-defined punctures each bearing a short yellowish grey hair; some of the punctures connected and forming irregular sulcus. Antenna (Fig. 5) consisting of ten segments, geniculate between scape and second segment; scape moderately curved, with a few long setae; second segment strongly subconical, about 1.5 times as long as wide; third slender, about three times as long as wide; fourth as long as wide; fifth transverse; sixth and seventh very short and somewhat acutely projected laterally; eighth to tenth forming wholly pubescent club, weakly lamellate, eighth and ninth transverse, tenth about as long as wide.



Figs. 1-3. Aesalus himalayicus Y. KUROSAWA, ♀, holotype; 1, dorsal view; 2, ventral view; 3, lateral view.

Pronotum (Fig. 7) about three-fifths as long as wide (PL/PW=0.60-0.67, n=5), widest near the middle; dorsal surface densely but shallowly punctuated, with sparsely arranged short scale-like bristles not forming clumps. Scutellum forming an elongate triangle. Elytra about 1.4 times as long as combined width (EL/EW=1.40-1.51, n= 3) densely but shallowly punctuated, without striae but with regularly arranged small black clumps of short scale-like bristles; each shoulder with a protuberance. Hind wings fully developed (Fig. 11).

Intercoxal process of prosternum (Fig. 9) relatively flat, expanding anteriorly, with isodiametric and well-defined punctures each bearing a short yellowish grey hair; anterior margin straight, not rounded; posterior margin rounded, reaching metasternum. Metasternum with fine punctures each bearing a yellowish grey hair. Metepisternum with shallow sulcus for receiving middle leg. Mesocoxae separated. Intercoxal pro-



Figs. 4–11. Aesalus himalayicus Y. KUROSAWA — 4. Body of ♀, paratype, dorsal view. —
5. Head of ♂, (right), and of ♀, paratype (left). — 6. Right mandible of ♀. — 7. Pronotum of ♀, paratype. — 8. Right front tibia of ♀, paratype. — 9. Intercoxal process of prosternum of ♀, paratype. — 10. Abdominal segments of ♀, paratype. — 11. Hind wing of ♀, paratype. Scales: 2.0 mm for Fig. 4; 1.0 mm for Figs. 5, 7, 10; 0.5 mm for Figs. 6, 8, 9; 3.0 mm for Fig. 11.

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Figs. 12–17. Aesalus himalayicus Y. KUROSAWA — 12–16. Male genital organ; 12, aedeagus, dorsal view; 13, ditto, right lateral view; 14, ditto, ventral view; 15, ditto, left lateral view; 16, ninth abdominal segment. — 17. Female genitalia of paratype. Scales: 0.5 mm for Figs. 12–17.

cess of hind legs forming a sharp regular triangle produced anteriorly. Abdomen (Fig. 10) about five-sixths as long as wide; five abdominal sternites visible; each sternite with isodiametric to elongate foveae bearing minute setae.

Front tibia (Fig. 8) relatively slender, not so widened in distal portion (FTW/ FTL=0.21-0.23, n=3), with fine punctures bearing minute setae; outer margin with two denticles and a large curved hook-like apical spine at distal end. Front femora with punctures bearing minute setae. Middle and hind legs with fine punctures bearing suberect pilosity; middle and hind tibiae with small denticles on outer margins, each with a large denticle at outer distal end and with a sharp spine at inner distal end.

Male genital organ. Male genitalia (Figs. 12–15) well sclerotized, with very short basal piece fused to both parameres and penis; penis thick, asymmetrical, banana-shaped, somewhat narrowed distally; internal sac with a large globe, with dense minute hairs on dorsal side; paired struts absent; paramere slender, about three-eighths as long as penis, closely appressed to penis. Ninth abdominal segment (Fig. 16) partly sclerotized in the middle, with setae on ventral side.

Female genital organ. Female genitalia (Fig. 17) with visible styli; hemisternite

Redescription of Aesalus himalayicus

well sclerotized, with long setae on posterior end.

Sexual dimorphism in external morphology. In the male, the canthus and the projection of anterior margin of head are a little more developed than in female (Fig. 6). No sexual dimorphism is distinct in the shape of mandibles.

Distribution. Himalayas.

Type depository. The holotype and two paratypes are preserved in the collection of the National Science Museum (Nat. Hist.), Tokyo (abbreviated as NSMT), and a paratype in the British Museum (Natural History).

Specimens examined. $3 \oplus \oplus$ (holotype and two paratypes), Kalapokhri, 3,000 m in alt., Singalila Dara, E. Nepal, 2–X–1983, Y. NISHIKAWA leg. (NSMT); 1 \bigcirc , Deorali, 3,200 m–2,800 m in alt., nr. basecamp of Mt. Machhapuchhale, Central Nepal, 21–X–1981, M. SAKAI leg. (NSMT); 1 \oplus , Thakham, 3,350 m in alt., Singalila Ridge, West Bengal, India, 4–X–1983, M. SAKAI leg. (NSMT).

Notes. Aesalus himalayicus is one of the most important and interesting species in the genus Aesalus both taxonomically and zoogeographically, since its type locality (Nepal, on the southern slope of the Himalayas) is the center of the known distributional range of Aesalus in the Old World. Generally, from the zoogeographical point of view, Nepal, the type locality of A. himalayicus, belongs to the Oriental Region which contains most part of Southeast Asia. However, in the original description of A. himalayicus, KUROSAWA (1985) considered that the discovery of this species bridges the two isolated distributional ranges of the genus Aesalus (Esat Asia and Europe) in the Palearctic Region. Further, he suggested that this Himalayan species should be assigned to the true Aesalus group, which consists of Palearctic and Taiwanese members, whereas A. timidus from Sumatra may represent a genus different from Aesalus. This KUROSAWA's suggestion on A. timidus was accepted by ZELENKA, and a new genus Echinoaesalus, which contains all the members of Southeast Asian Aesalus including A. timidus, was erected by the same author (ZELENKA, 1993, 1994). Aesalus himalayicus superficially resembles the Palearctic Aesalus because of its elongate body outline but differs from Southeast Asian members having circular outline. However, the present detailed re-examination of A. himalayicus has revealed that this Himalayan species shares the following important characteristics, which are not shared by Palearctic ones, with the Southeast Asian members: mandible showing no sexual dimorphism; third antennal segment long and slender, not transverse; antennal club wholly pubescent; eye with distinctly developing canthus; pronotum widest near the middle part; intercoxal process of prosternum flat, not convex; penis not cylindrical or symmetrical. Of these, the characteristics in the mandible and the antennal club are also found in Taiwanese A. imanishii. These findings suggest that A. himalayicus is phylogenetically closer to Southeast Asian members than to Palearctic ones, as is consistent with the current zoogeographical knowledge. It is well known that the spherical or limuloid postures of adults, which are considered to be related to their defence against attacks by predators, particularly ants or termites, are found in many beetle taxa especially in tropical regions (CROWSON, 1986). Therefore, it is suggested that circular body shape,

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which forms limuloid posture, shared by all the Southeast Asian members may be synapomorphy, and that *A. himalayicus*, perhaps *A. imanishii* also, may retain the ancestral character states (*i.e.* elongate body shape) in the Oriental taxa. Further field works may possibly yield additional undescribed species of this genus closely related to *A. himalayicus* from other regions such as northern Thailand or southern part of Mainland China.

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The Male Genitalia of the Genus *Ceracupes* (Coleoptera, Passalidae), with New Records of *Ceracupes chingkini* from Thailand and Vietnam

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Abstract Male genitalia are described and illustrated for four species of the passalid genus *Ceracupes*: *C. arrowi* HELLER, *C. chingkini* OKANO, *C. fronticornis* (WEST-WOOD) and *C. yui* OKANO. *Ceracupes chingkini* OKANO is recorded for the first time from Thailand and Vietnam.

The genus *Ceracupes* KAUP (Coleoptera, Passalidae) is characterized by having three horns projecting strongly forward and a little upward, and consists of four known species: *C. arrowi* HELLER, 1911 from Taiwan, *C. chingkini* OKANO, 1988 from Taiwan, *C. fronticornis* (WESTWOOD, 1842) from the eastern Himalayas, Myanmar, Thailand and Vietnam and *C. yui* OKANO, 1988 from Taiwan. Up to the present, male genitalia have not been described for any species of the genus. In this paper, we are going to describe and illustrate the male genitalia of the four *Ceracupes* species and to record *C. chingkini* from Thailand and Vietnam for the first time.

The male genitalia of *Ceracupes* species were observed and described in 70% ethanol after treated with weak solution of potassium hydroxide. We adopted the terminology of LINDROTH (1957) in the description of male genitalia and referred to HINCKS and DIBB (1935, 1958) and OKANO (1988) for the distribution of each species. The acronyms for the entomological collection of the Department of Zoology, National Science Museum (Natural History), Tokyo, that of the Department of Zoology, Kyoto University, and the personal collection of Y. JOHKI are NSMT, KUZ and YJ, respectively.

Before going further, we wish to express our hearty thanks to Dr. S.-I. UÉNO and Mr. M. TÔYAMA for giving us the opportunities to examine some *Ceracupes* specimens.

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Ceracupes arrowi HELLER

(Figs. 1-3)

Ceracupes arrowi HELLER, 1911, Annls. Soc. ent. Belg., 55, p. 256.

Males from Taiwan. Penis rounded, with latero-frontal margin slightly concave, as long as wide in ventral view, sclerotized and with sparse fine granules on ventral side, less sclerotized on dorsal side, with orifice at the center of dorsal side. Tegmen consisting of one piece, with lateral margin concave in ventral view. Parameres sclerotized and united together on ventral side, not sclerotized on dorsal side. Basal piece completely united with parameres, sclerotized on ventral side, not notched at the middle of posterior margin of ventral side, less sclerotized on dorsal side.

Specimens examined. 1 Å, Taiwan (YJ); 1 Å, $2 \Leftrightarrow \Diamond$, Parin, Taiwan, 13–VI–? (YJ); 5 ÅÅ, 6 $\Leftrightarrow \Diamond$, Nanshanshi, Taiwan, 23–VIII–1986, M. Kon & Y. JOHKI leg. (KUZ).

Distribution. Taiwan.

Notes. In his key to the genera of the subfamily Aulacocyclinae, GRAVELY (1918) regarded the male genitalia consisting of three pieces (penis, parameres and basal piece) as one of the diagnostic characters separating the genera *Ceracupes* and *Cylindrocaulus* from the genera *Aulacocyclus, Taeniocerus* and *Comacupes* which have the male genitalia consisting of two pieces (penis and tegmen). In *Ceracupes arrowi*, however, the basal piece is united with the parameres, which results in that the male genitalia of *C. arrowi* appear to consist of two pieces as in *Aulacocyclus, Taeniocerus* and *Comacupes*.

Ceracupes chingkini OKANO

(Figs. 4-6)

Ceracupes chingkini OKANO, 1988, Entomo Shirogane, 1, p. 2.

Males from Thailand. Penis rounded, slightly longer than wide in ventral view, sclerotized and with a few fine sparse granules on ventral side, less sclerotized on dorsal side, with orifice at the center of dorsal side. Tegmen consisting of two pieces, with lateral margin almost straight in ventral view. Parameres sclerotized and united together on ventral side, less sclerotized on dorsal side. Basal piece sclerotized on ventral side, separated from parameres by V-shaped membranous part on ventral side and by distinct joint on lateral side, very slightly notched at the middle of posterior margin of ventral side, shorter than parameres in ventral view, less sclerotized on dorsal side.

Specimens examined. 1 \Diamond , Wiangpapao, Chiang Rai, Thailand, 6–XIII–1987, N. KOYAMA leg. (YJ); 1 \Diamond , 1 \heartsuit , Doi Saket, Chiang Mai, Thailand, 23–IX–1992 (KUZ); 1 \Diamond , ditto, 13–XI–1992 (KUZ); 1 \heartsuit , Chiang Mai, Thailand, 28–V–1992 (KUZ); 1 \heartsuit , Doi Suthep, Thailand, 23–V–1978, K. AKIYAMA leg. (NSMT); 1 \heartsuit , Phuping, Doi Pui, Thailand, 18–IV–1985, M. TAO leg. (YJ); 1 \heartsuit , Mt. Tamdao, Vietnam, 7–V–1992

Male Genitalia of Ceracupes



Figs. 1–15. Male genitalia of *Ceracupes* spp. (scale, 2 mm). — 1–3, *C. arrowi* HELLER from Nanshanshi, Taiwan; ventral view (1), dorsal view (2), left lateral view (3). — 4–6, *C. chingkini* OKANO from Chiang Rai, Thailand; ventral view (4), dorsal view (5), left lateral view (6). — 7–9, *C. fronticornis* (WESTWOOD) from Chiang Mai, Thailand; ventral view (7), dorsal view (8), left lateral view (9). — 10–12, *C. fronticornis* (WESTWOOD) from Mt. Tam Dao, Vietnam; ventral view (10), dorsal view (11), left lateral view (12). — 13–15, *C. yui* OKANO from Wushe, Taiwan; ventral view (13), dorsal view (14), left lateral view (15).

(KUZ); 1 \bigcirc , Taiwan, 21–VI–1941 (YJ); 1 \bigcirc , Taiwan, late 1930's to early 1940's (YJ); 1 \bigcirc , Horisha, Taiwan, 18–V–VIII, H. KAWAMURA leg. (NSMT).

Distribution. Thailand (new record), Vietnam (new record), Taiwan.

Notes. When we examined a series of *Ceracupes* specimens from Thailand and Vietnam, we found some specimens of a form specifically distinct from *C. fronticornis* in several external characters. On careful comparison with the specimens of *C. chingkini* from Taiwan, we identified the Thai and Vietnamese form with *C. chingkini*, because there is no notable differentiation in the external morphology.

In the present study, we were unable to examine the male genitalia of *Ceracupes* chingkini from Taiwan and Vietnam, since no male specimen was available. It is to be hoped that a comparative study of male genitalia can be made between speci-

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mens of C. chingkini from Taiwan, Vietnam and Thailand.

Ceracupes fronticornis (WESTWOOD)

(Figs. 7-12)

Passalus fronticornis WESTWOOD, 1842, Ann. Mag. nat. Hist., 8, p. 124.

Males from Thailand. Penis rounded, almost as long as wide in ventral view, sclerotized and with sparse fine granules on ventral side, less sclerotized on dorsal side, with orifice at the center of dorsal side. Tegmen consisting of two pieces, with lateral margin almost straight in ventral view. Parameres sclerotized and united together on ventral side, less sclerotized on dorsal side. Basal piece sclerotized on ventral side, separated from parameres by V-shaped membranous part on ventral side and by distinct joint on lateral side, slightly notched at the middle of posterior margin of ventral side, longer than parameres in ventral view, less sclerotized on dorsal side.

Males from Vietnam. Basal piece united with parameters on ventral side. The other points are just as described for males from Thailand.

Specimens examined. 1 \circlearrowleft , Chiang Mai, Thailand, V–1986, N. KOYAMA leg. (YJ); 3 \circlearrowright \circlearrowright , 1 \heartsuit , ditto, 31–XII–1992 (KUZ); 1 \heartsuit , Fang, Thailand (KUZ); 1 \heartsuit , Meo Village, Thailand, 31–V–1978, K. AKIYAMA leg. (NSMT); 1 \circlearrowright , Mt. Tam Dao (800– 1,000 m), Vietnam, 2–IX–1990, K. KUME leg. (YJ); 2 \circlearrowright \circlearrowright , 5 \circlearrowright \circlearrowright , ditto, VII–1992, S. NAGAI leg. (KUZ).

Distribution. Eastern Himalayas, Myanmar, Thailand, Vietnam.

Notes. Some geographic variation was observed in the male genitalia between Thai and Vietnamese specimens. In males from Thailand, the basal piece is distinctly separated from the parameres, whereas in males from Vietnam the former is united with the latter on the ventral side.

Ceracupes yui OKANO

(Figs. 13-15)

Ceracupes yui OKANO, 1988, Entomo Shirogane, 1, p. 1.

Males from Wushe, Taiwan. Penis rounded, as long as wide in ventral view, sclerotized and with fine sparse granules on ventral side, less sclerotized on dorsal side, with orifice at the center of dorsal side. Tegmen consisting of two pieces, with lateral margin almost straight in ventral view. Parameres sclerotized and united together on ventral side, not sclerotized on dorsal side. Basal piece sclerotized on ventral side, separated from parameres by fine V-shaped membranous line on ventral side and by distinct joint on lateral side, slightly longer than parameres in ventral view, not sclerotized on dorsal side.

Male from Lalashan, Taiwan. Basal piece united with parameters in the middle of ventral side. Other points as described for males from Wushe, Taiwan.

Specimens examined. 2 ♂♂, 3 ♀♀, Wushe, Taiwan, IV-1964 (YJ); 1 ♂, ditto,

28-VII-1968 (YJ); 1 ♂, Lalashan, Taiwan, 21-VIII-1987 (YJ); 2 ♀♀, Taiping, Taiwan, 15-VII-1969 (YJ).

Distribution. Taiwan.

Notes. In a male from Lalashan, the boundary between the basal piece and the parameres is indistinct in the middle of ventral side, whereas it is more distinct in males from Wushe. However, further studies are needed for revealing geographic variation in the male genitalia of *Ceracupes yui*, because only one specimen from Lalashan was examined in the present study.

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A New Leptaulax Species (Coleoptera, Passalidae) from Luzon, the Philippines

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Abstract A new passalid beetle, *Leptaulax uenoi* sp. nov., is described from Luzon, the Philippines. This new species is characterized by brachypterous condition and according modification of body aspect, narrow elytral bases, and absence of middle tubercle of anterior border of head.

Leptaulax uenoi sp. nov.

(Figs. 1-3)

Entirely black, shining; rather convex for a member of the genus.

Antenna with three short lamellae. Labrum hairy; anterior border straight, angles rounded, left angle a little more prominent than right one. External angle of mandible very obtuse, with apex rounded; upper tooth biconvex, anterior tip of left upper tooth very obtuse, posterior tip higher than anterior one, rounded; left anterior lower tooth simple, larger than right one, and larger than left lowest terminal one. Middle part of mentum smooth, anterior border distinctly convex anteriad; scar J-shaped; lateral piece rather sparsely covered with large hair-bearing punctures.

Anterior angle of head not prominent; outer tubercle triangular, acute, smaller than inner one; inner tubercle triangular, rather acute, with apex rounded; the distance between the two inner tubercles twice as large as that between inner and outer tubercles; middle tubercle of anterior border of head absent; anterior angle of eye canthus rounded; central tubercle as low swelling, joining frontal ridge by a longitudinal ridge; frontal ridge sharp, rather strongly and roundly curved at the middle, and extending to inner tubercle; parietal ridge weakly arcuate, extending to supraorbital ridge; supraoccipital ridge ending just behind supraorbital ridge; frontal and depressed areas rather sparsely covered with hair-bearing punctures. Hypostomal process longitudinally depressed, with the bottom shagreened and less shining.

Pronotum almost smooth, transverse, widest behind the middle; lateral border arcuate, anterior angle not projecting, posterior angle widely rounded; median groove distinct; marginal groove each with a series of punctures, extending to about third along anterior border, lateral scar occasionally with a few hairs and a few punctures.

Elytra fused (2 exs.) or not fused (1 ex.), rather convex, a little narrower than pronotum on base, widest behind the middle, shoulders not prominent; anterior vertical portion hairy, hairs becoming longer in front of shoulders; ribs slightly convex, grooves distinctly punctate, lateral grooves more strongly punctate than dorsal ones, all punc-

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tures in grooves rounded; first groove combined with fourth one, seventh groove combined with tenth one in all the examined specimens; hindwings considerably reduced.

Median keel of prosternum not flattened, posterior plate of prosternum almost smooth, shining and weakly raised along the whole borders. Mesosternum rather smooth medially, though clothed with some large hair-bearing punctures between the two lateral scars; scar widened posteriorly, finely rugose or finely punctate, gradually becoming shallower posteriorly, posterior end of scar indistinct. Mesepisternum coarsely punctate dorsally, shagreened and opaque ventrally. Central area of metasternum almost smooth, anterior depression small and shallow; anterior intermediate area rather densely covered with shallow hair-bearing punctures; posterior intermediate area rather densely covered with umbilicate punctures internally, smooth externally; lateral area narrow, finely rugose, shining, with a few hairs anteriorly. Abdominal sternites rather smooth; scars rather small, with scattered punctures; sixth (ultimate) sternite with indistinct grooves at both sides of the middle along posterior border. Middle tibia with a minute tooth behind the middle.

Male genitalia as shown in Fig. 3.



Fig. 1. Leptaulax uenoi sp. nov., dorsal aspect.

New Leptaulax from Luzon



Figs. 2-3. Leptaulax uenoi sp. nov.; 2, head; 3, male genitalia, dorsal view (a), lateral view (b), ventral view (c).

Total length: 23.0–24.0 mm; pronotal length: 5.8–6.2 mm; elytral length: 14.0– 14.5 mm. Pronotal width: 7.3–7.8 mm; elytral width: 8.5–8.6 mm.

Holotype: 3, V-1988. Banaue, Ifugao, Luzon. Paratypes: 233, same data as for the holotype.

The holotype will be preserved in the National Science Museum (Nat. Hist.), Tokyo.

This new species is distinguished from the other Philippine species of the genus *Leptaulax* KAUP by the following points: body length, flightless aspect (convex body and narrow elytral base), lack of middle tubercle on anterior border of head and broad frontal area of head. On the other hand, this new species resembles the members of the genus *Trichostigmus* KAUP, but can be easily distinguished by the lack of hairs at the elytral sides.

This new species is dedicated to Dr. Shun-Ichi Uéno of the National Science Museum (Nat. Hist.), Tokyo, for commemorating his retirement.

Kazuo Iwase

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New or Little-known Geotrupine Species (Coleoptera, Geotrupidae) from Central and Western China

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Abstract Three new geotrupine species from central and western China are described under the names *Geotrupes* (*Odontotrupes*) *uenoi* sp. nov., *G.* (*O.*) *imurai* sp. nov., and *G.* (*O.*) *koiwayai* sp. nov. *Geotrupes* (*Phelotrupes*) *compressidens* FAIRMAIRE, 1891, originally described from Chang-Yang in Central China, is recorded from Mt. Xitianmu Shan, Lin'an Xian, Zhejiang Sheng.

Several years ago, Dr. Shun-Ichi Uéno showed me an interesting geotrupine specimen taken by himself in Zhejiang Sheng, eastern China, and permitted me to study it. It looked like Geotrupes insularis HOWDEN, 1965, originally described from Taiwan, but appeared to be specifically different from the latter. Later in 1993, Dr. Yûki IMURA, one of my best friends in entomology, brought many geotrupine specimens for me from Shaanxi Sheng, which I have never had seen before. In the autumn of the same year, Dr. Yoshihiko KUROSAWA, ex-director of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo, handed me another geotrupine specimen from Qinghai Sheng through Mr. Hiroshi SAWADA in Aomori Prefecture. I then started a study of these Chinese geotrupine species, and visiting the Muséum National d'Histoire Naturelle, Paris, and the Natural History Museum, London, in March 1994, I had opportunities of comparing these specimens with types and other materials preserved in the museums. Finally, I have come to the conclusion that there are three new and a previously described species. I will describe the former as new species and record the latter from these collections. In the present paper, I am going to deal with these geotrupines.

The holotypes of the new species to be described are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Before going into description, I wish to express my heartfelt thanks to Dr. Yûki IMURA, Yokohama, Dr. Yoshihiko KUROSAWA, Tokyo, and Messrs. Hiroshi SAWADA, Aomori, and Satoshi KOIWAYA, Tokyo, who submitted important materials to me for taxonomic study. Thanks are also due to Dr. Yves CAMBEFORT, Muséum National d'Histoire Naturelle, Paris, and Mr. Malcolm KERLEY, the Natural History Museum, London, who permitted me to examine types and other materials under their care. I also thank Dr. Makoto KIUCHI, National Institute of Sericultural and Entomological Science, for his kind help in various ways, Dr. Ottó MERKL, Természettudományi Múzeum, Budapest and Mr. Teruo OCHI, Osaka, for giving me invaluable advice, and

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Mr. Kaoru Sakai, Tokyo, for taking photographs inserted in this paper.

This paper is dedicated to Dr. Shun-Ichi UÉNO for commemorating his retirement from official duties. He has always given expert advice to younger entomologists, both professionals and amateurs, and highly contributed to the development of Japanese entomology.

Geotrupes (Odontotrupes) uenoi sp. nov.

(Figs. 1, 4-6)

Male. Body bluish black and alutaceously shining. Segment 2 of antennal club with ventral edge of uniform thickness, not partially enclosed by segments 1 and 3. Mandibles with outer edges slightly sinuate near apices. Head coarsely rugoso-punctate; clypeus feebly raised postero-medially, with apical margin triangularly produced apicad, fronto-clypeal border impressed in a V-shape, the impression feebly sinuous on each side; frons longitudinally impressed at the middle, apex of the impression connected with fronto-clypeal impressions, antero-internal side of each eye with a distinct conical tubercle; genae roundly produced laterad before eyes; eyes oblique with outer edges narrowly rounded in dorsal view. Pronotum trapezoidal; anterior margin rimmed, the rim gently thickened in middle; front angles subrectangular; disc strongly convex and irregularly scattered with large punctures, which become denser laterally, impressed at the middle in lateral portions. Scutellum subcordate, scattered with large and small punctures. Elytra medium-sized for a member of this genus; 1st striae almost complete though finely undulate, other striae incomplete, scabrous, irregularly fused with one another. Metasternum coriaceous and finely haired, with midline impunctate and glabrous. Fore coxa and femur not modified. Fore tibia with apical spur not expanded, ventral inner surface ridged, the ridge with 4-5 obtuse teeth in basal half. Hind femur without tubercle on posterior edge; hind trochanter without tubercle.

Female. Similar to male in shape.

Body length: 17.5-20 mm.

Type series. Holotype, \mathcal{J} , Maijieshi, 2,410 m alt., SW. of Chang'an Xian, Shaanxi, China, 29–V–1993, native collector. Paratypes, 3 exs., same data as for the holotype; 3 exs., near the headwaters of Riv. Laoyu-He, 2,000 m alt., SW. of Hu Xian, Shaanxi, 11–V–1993, native collector.

Type depository. Holotype: NSMT. Paratypes: 1 ex., SAWADA coll.; 1 ex., KIUCHI coll.; 4 exs., MASUMOTO coll.

Notes. This new species resembles *G. biconiferus* FAIRMAIRE, 1887, originally described from Tibet, but can be discriminated from the latter by the clypeus more strongly produced forwards, the pronotum with a gently inclined apex (steeply inclined in *G. biconiferus*), the elytra more strongly wrinkled and the striae incomplete and scabrous (in *G. biconiferus*, shallow striae are visible). As far as I see NIKOLAEV's figure (p. 380, fig. 30), the new one also somewhat resembles "*G. (Odontotrupes) semi-*

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Figs. 1–3. Habitus of *Geotrupes* spp. — 1. *Geotrupes (Odontotrupes) uenoi* sp. nov., holotype, ♂. — 2. G. (O.) imurai sp. nov., holotype, ♂. — 3. G. (O.) koiwayai sp. nov., holotype, ♂.

cribrosus (FAIRMAIRE, 1891)" in the shape of apical portion of male genitalia.

Geotrupes (Phelotrupes sensu JEKEL) compressidens FAIRMAIRE, 1891

(Figs. 7-9)

Geotrypes [sic] compressidens FAIRMAIRE, 1891, C.-R. Soc. ent. Belg., 1891: VI (Central China).

Specimen examined. 1 3, Laodian, 1,120 m alt., Mt. Xi-tianmu Shan, Lin'an Xian, Zhejiang Sheng, 4-IX-1989, S.-I. UÉNO leg.

Notes. The lateral lobes of this species are very simple in shape for a member of this species-group. See Figs. 7 & 8.

Geotrupes (Odontotrupes) imurai sp. nov.

(Figs. 2, 10-12)

Male. Bluish black and dully shining, with dorsal surface dark bluish black and polished. Segment 2 of antennal club with ventral edge of uniform thickness, not partially enclosed by segments 1 and 3. Mandibles with outer edges gently sinuate near apex. Head rather closely punctate, the punctures often fused with one another in apical portion; clypeus longitudinally raised in postero-medial portion, with apical margin roundly produced, fronto-clypeal border impressed in a V-shape, the impression weakly sinuous on each side; frons impressed just behind the V-shaped impression, antero-internal side of each eye obliquely, gently ridged; genae weakly produced obliquely forwards before eyes; eyes with outer edges narrowly rounded in dorsal view.

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Pronotum distinctly large; anterior margin rimmed; front angles obtuse; disc strongly convex and impunctate, though scattered with large punctures near lateral margins, impressed at the middle in lateral portions. Scutellum widely triangular with rounded sides, almost impunctate, longitudinally concave medially. Elytra finely punctatostriate, even-numbered striae sometimes disappearing; intervals feebly raised, sparsely, transversely wrinkled. Metasternum coriaceous and sparsely haired, with midline weakly impressed. Fore coxa and femur not modified. Fore tibia rather distinctly slender with apical spur not expanded, ventral inner surface ridged, the ridge with a sharply pointed tooth and 2–3 obtuse teeth in basal 1/3. Hind femur with a distinct tubercle on posterior edge at basal 1/3; hind trochanter with a small tubercle at apex.

Female. As compared with male, clypeus more distinctly rugoso-punctate, pronotum smaller and narrowed forwards, elytral punctato-striae clearer, legs shorter and thicker, and fore tibia with 4–5 obtuse teeth on ventral surface.

Body length: 13-15 mm.

Type series. Holotype, \mathcal{J} , near the headwaters of Riv. Feng-He, 1,900 m alt., SW. of Chang-an Xian, Shaanxi, China, 9–V–1993, native collector. Paratypes, 1 ex., same data as for the holotype; 9 exs., Pass between Banfangzi and Xindianr, 2,000 m alt., Zhouzhi Xian, Shaanxi, 21 ~ 23–V–1993, native collector.

Type depository. Holotype: NSMT. Paratypes: 1 ex., IMURA coll.; 1 ex., KIUCHI coll.; 1 ex., SAWADA coll.; 7 exs., MASUMOTO coll.

Notes. This new species somewhat resembles *G. armicrus* FAIRMAIRE, 1888, originally described from Yunnan, but can be distinguished from the latter by the clypeus more strongly, roundly produced forwards, the pronotum with sides more strongly punctate and front angles more roundly produced forwards, the elytral intervals smoother and more convex (feebly, transversely wrinkled in *G. armicrus*).

Geotrupes (Odontotrupes) koiwayai sp. nov.

(Figs. 3, 13-15)

Male. Piceous and cyaneously shining, with dorsal surface dark purple and gently shining. Segment 2 of antennal club with ventral edge of uniform thickness, not partially enclosed by segments 1 and 3. Mandibles with outer edges distinctly sinuate near apices. Head rugoso-punctate; clypeus with apical margin rather strongly produced forwards and gently reflexed above, fronto-clypeal border obliquely impressed; frons longitudinally impressed medially, apex of the impression connected with fronto-clypeal impressions, antero-internal side of each eye with a distinct conical tubercle; genae gently produced laterad before eyes; eyes with outer edges narrowly rounded in dorsal view. Pronotum with anterior 1/4 steeply inclined forwards, slightly concave along anterior margin on each side; anterior margin raised with medial portion obtusely ridged; front angles subrectangular with rounded corners; disc rather closely and shallowly punctate, sparsely scattered with large and coarse punctures, the punctures becoming denser and rugose in lateral portions. Scutellum subcordate, feebly

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Figs. 4-15. Male genitalia. — 4-6. G. (O.) uenoi sp. nov., dorsal view (4), lateral view (5), sternite and pleurosternite (6). — 7-9. G. (Phelotrupes) compressidens FAIRMAIRE, dorsal view (7), lateral view (8), sternite and pleurosternite (9). — 10-12. G. (O.) imurai sp. nov., dorsal view (10), lateral view (11), sternite and pleurosternite (12). — 13-15. G. (O.) koiwayai sp. nov., dorsal view (13), lateral view (14), sternite and pleurosternite (15). (M. KIUCHI del.)

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rugose. Elytra irregularly punctato-striate; intervals irregularly and somewhat transversely rugose. Metasternum closely and finely punctate and haired except for the medial portion, with midline gently carinate and impunctate. Fore coxa and femur not modified. Fore tibia with apical spur not expanded, ventral inner surface ridged, the ridge with a row of 5–6 small conical teeth. Hind femur without small tubercle on posterior edge near trochanter.

Female. As compared with male, head more produced forwards and more coarsely rugoso-punctate, pronotum more densely punctate, legs shorter, lower apical spur of hind tibia slenderer.

Body length: 14.5-19.5 mm.

Type series. Holotype, \bigcirc , west slope of Riyue-Nanshan, 3,750–3,900 m alt., Qinghai, China, 26–VI–1993, S. KOIWAYA leg. Paratypes, 77 exs., same data as for the holotype; 19 exs., 27–VI \sim 1–VII–1993, 12 exs., 30–VI–1993, 10 exs., 27–VI–1993, 2 exs., 26–VII–1993, same locality and collector as for the holotype.

Type depository. Holotype and 1 paratype: NSMT. Paratypes: 2 exs., Muséum National d'Histoire Naturelle, Paris; 2 exs., the Natural History Museum, London; 2 exs., Aomori Prefectural Museum; 4 exs., KUROSAWA coll; 4 exs., ISHIDA coll.; 2 exs., TSUKAMOTO coll.; 2 exs., NAKANE coll.; 2 exs., KIUCHI coll.; 2 exs., OCHI coll., 71 exs., SAWADA coll.; the others, MASUMOTO coll.

Notes This new species resembles *G. orichalceus* FAIRMAIRE, 1895, originally described from "Sikkim", but can be distinguished from the latter by the clypeus more strongly produced forwards, the pronotum more distinctly punctate in postero-lateral portions, with the anterior margin evenly arcuate, the elytra obviously, feebly wrinkled and the dorsal surface without dark greenish lustre.

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A New Onthophagus (Coleoptera, Scarabaeidae) from the Malay Peninsula

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Abstract Onthophagus uenoi sp. nov. is described from the Malay Peninsula. It is related to O. diabolicus HAROLD, but can be readily recognized on the remarkably costate interval of the elytra.

Onthophagus diabolicus is a distinctive large species of coprophagous scarabaeid beetle originally described by HAROLD (1877) on a single male specimen from Sarawak, North Borneo. It was later recorded from many localities in Southeast Asia, from Borneo in the east to India in the west and from Java in the south to South China in the north.

Recently, the author had an opportunity to examine a long series of specimens of the so-called *diabolicus*, which included the type specimens, preserved in the Museo Civico di Storia Naturale "Giacomo Doria", through the courtesy of Dr. Roberto POGGI. Studying on this collection, the author realized that they included two different species, one of which, from the Malay Peninsula, was new to science.

In the present paper, this new species will be described under the name of *On-thophagus uenoi* for commemorating the retirement of Dr. Shun-Ichi UÉNO from the head of the Department of Zoology, National Science Museum, Tokyo.

Onthophagus uenoi sp. nov.

(Figs. 1-8)

Length: 11.7–20.1 mm; width: 6.5–10.8 mm (n=87).

Body very large, oblong-oval, strongly convex; dorsal side glabrous, relatively mat; ventral side shiny, partly clothed with blackish brown hairs. Colour black; mouth parts, palpi, and all legs more or less reddish; antennal foot-stalks reddish brown; club segments of antenna each blackish brown in the proximal half and yellowish brown in the remaining part on the dorsal side; on the ventral side, only the basal segment of antennal club is similarly coloured to the dorsal, the remaining segments being wholly yellowish brown.

Male. Head 1.08–1.33 times as wide as long (n=20); clypeus strongly produced forwards as a reflexed rounded lobe at the middle, with sides almost straight except for a little expanded portions near the carinate clypeo-genal sutures; clypeo-frontal suture carinate and raised, the carina only slightly but evenly procurved; genae well produced

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Figs. 1-6. — 1, 3-6, Onthophagus uenoi OCHI, sp. nov.; 1, head and pronotum, dorsal view, ♂;
3, antenna, dorsal view, ♂; 4, protibia, dorsal view, ♂; 5, metatarsi, dorsal view, ♂; 6, ditto,
Q. — 2, O. diabolicus HAROLD; head, dorsal view, ♂. Scale: 1 mm for figs. 1-3, 5-6;
2 mm for fig. 4.

laterally, with genal angles rounded; vertex produced backwards as a broad prolonged lamina, which is sigmoidally inclined in lateral view, obtusely convex in the middle, and parallel-sided and angulate on each distal side, with the median distal part bearing an elongate cylindrical process; surface densely and transversely rugose on clypeus, granulate on genae, and sparsely and finely punctate on vertex; antennae with scape roughly serrate on the anterior side; in minor males, clypeus less produced forwards and less reflexed, lamina reduced to a short flat subtriangular projection which is narrowly emarginate at the apex, and the surface more strongly punctate on vertex.

Pronotum strongly convex, about 1.45-1.52 times as wide as long (n=20), with an obtuse longitudinal impression along median line in posterior half; anterior margin emarginate and bordered, but the marginal line becomes much widened in the middle; lateral margins gently rounded in front, sinuate behind, with distinct marginal line; basal margin strongly angulate at the middle, with the tip a little raised, and with marginal line well pronounced; anterior angles bluntly subangulate; posterior angles obtuse; disc circularly and deeply excavated just behind anterior margin for receiving cephalic lamina, with a pair of very obtuse small elevations medially on each side of the upper edge of the excavation; surface micro-granulose, sparsely and finely punctate ex-

New Onthophagus from the Malay Peninsula



Figs. 7–8. Aedeagus, lateral and dorsal views. — 7, Onthophagus uenoi OCHI, sp. nov.; 8, O. diabolicus HAROLD. Scale: 1 mm.

cept for the excavation, in which the surface is smooth marginally and asperately punctate or granulate medially; in minor males, pronotum less convex, with the excavation becoming narrower and shallower.

Elytra about 1.51-1.66 times as wide as long (n=20); striae rather deeply and finely impressed, with strial punctures indefinite; 7th striae clearly curved; intervals weakly but distinctly convex, micro-granulose, sparsely and finely punctate; sutural intervals each longitudinally and very strongly costate along sutural margin, arising from a little behind base and extending to apex.

Pygidium gently convex, carinate at base, micro-granulose, shallowly and rather rugosely punctate. Metasternum declivous in front, with a marked longitudinal carina in the middle of the declivity; median part shiny, sparsely and finely punctate behind, roughly punctate in front; lateral parts densely and coasely punctate. Protibiae stout and broad, feebly incurved, with four strong lateral teeth; the 1st tooth sharp and curved, the 2nd the largest, the 3rd a little smaller than the 2nd, the 4th small; inner

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distal end of protibiae slightly and sharply produced; terminal spur spatulate. Mesoand metatibiae short and stout, weakly digitate at each outer distal end; metatarsi with basal segment about 2.1–2.6 times as long as wide, toothed at the outer edge.

Aedeagus robust. Parameres broad, subquadrate in lateral aspect, weakly constricted at the middle and distinctly angulate near apices in dorsal aspect; apical tooth widely separated in dorsal view.

Female. Head with clypeal margin parabolical, less reflexed and broadly bordered; clypeo-frontal suture carinate and very strongly elevated, the carina well arched; vertex deeply and transversely excavated between eyes, with a short and narrow vertical lamina which is deeply emarginate at the apex; surface more strongly rugose on clypeus. Pronotum less convex; disc slightly and shallowly excavated just behind anterior margin, with a pair of obtuse elevations medially on the upper edge of the excavation. Protibiae broader with stronger lateral teeth, terminal spur similarly spatulate and a little longer. Metatarsi with basal segment broader, about 1.7–2.0 times as long as wide.

Type series. Holotype: male, 19 miles from Tapah, Perak State, Malaysia, 11– IV–1976, MANICAM lgt. Paratypes: 1 $\overrightarrow{\sigma}$, same data as the holotype; 1 \bigcirc , same locality as the holotype, 31–III–1976, MANICAM lgt.; ditto, 2 $\overrightarrow{\sigma}$, 3 \bigcirc \bigcirc , 2–IV–1976, MANICAM lgt.; ditto, 1 $\overrightarrow{\sigma}$, 3–IV–1976, MANICAM lgt.; ditto, 1 $\overrightarrow{\sigma}$, 4–IV–1976, MANICAM lgt.; ditto, 2 $\overrightarrow{\sigma}$, 2 \bigcirc \bigcirc , 7–IV–1976, MANICAM lgt.; ditto, 2 $\overrightarrow{\sigma}$, 3 \bigcirc \bigcirc , 8–IV–1976, MANICAM lgt.; ditto, 1 $\overrightarrow{\sigma}$, 11–IV–1976, MANICAM lgt.; ditto, 1 $\overrightarrow{\sigma}$, 1 \bigcirc , 20–V–1976, MANICAM lgt.; 4 $\overrightarrow{\sigma}$, 4 \bigcirc \bigcirc , nr. Cameron Highland, Perak State, Malaysia, 1986, T. OCHI coll.; ditto, 32 $\overrightarrow{\sigma}$, 8 \bigcirc \bigcirc , IV–1988, T. OCHI coll.; ditto, 9 $\overrightarrow{\sigma}$, 9 \bigcirc \bigcirc , 1994, T. OCHI coll. The holotype will be deposited in the National Science Museum (Nat. Hist.), Tokyo.

Notes. The present new species is closely related to Onthophagus diabolicus HAROLD (1877, p. 78), but can be distinguished from it by the following characteristics: 1) body larger; 2) each elytron with sutural interval strongly and distinctly costate along sutural margin from near base to apex, while in O. diabolicus, it is neither strongly nor distinctly costate; 3) elytra with intervals distinctly convex, instead of being flat; 4) antennae with clubs bicolorous, instead of being entirely yellowish brown; 5) in major males, clypeo-frontal suture slightly and evenly procurved and cephalic lamina long and well developed, while in O. diabolicus, the former is strongly curved on each side and the latter is relatively short; 6) in major males, pronotum with a deep excavation behind anterior margin and a pair of elevations obsolete, while in O. diabolicus, the former is less excavated and the latter is well pronounced; 7) in male, parameres differently shaped.

This new species seems to form a particular species-group together with *O. diabolicus* HAROLD, *O. manipurensis* ARROW and *O. rubricollis* HOPE. These species were formerly placed in the subgenus *Digitonthophagus* BALTHASAR, but were excluded from it by ZUNINO (1981, p. 413), who regarded BALTHASAR's subgenus as a full genus. They may be classified in their own subgenus, though the author prefers to refrain from proposing a new taxon at this place.

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A Review and Two New Species of the Genus *Pseudeucinetus* HELLER from Southeast Asia and a World Checklist of the Thaumastodinae (Coleoptera, Limnichidae)

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Abstract Two new species — *Pseudeucinetus uenoi* from Sabah, Borneo, Malaysia and *P. spilmani* from the Moluccas, Bacan Island, Indonesia — are described. The new species are compared to the two previously described species assigned to the genus — *P. zygops* HELLER (1921) from the Philippines and *P. novabritannica* DELÈVE (1973) from the Bismarck Archipelago. The habitus and external morphological characteristics of the new species are illustrated by scanning electron micrographs. The male terminalia of the four species and ovipositors of the two new species in the genus are illustrated by line drawings. A key to separate males of the four species of the genus is included. A list of taxa and distribution data for the Thaumastodinae are given.

Members of the genus *Pseudeucinetus*, as well as those of the other four genera assigned to the Thaumastodinae, are riparian taxa. The genus was described by HELLER in 1921 for *P. zygops* from the Philippines and, as part of a study of the Thaumastodinae, SPILMAN (1959) published a redescription of the genus and compared it with the other three genera assigned to the subfamily at that time. The synonymic taxa *Thaumastodus* and type species *T. fusiformis* were described by CHAMPION (1924 a) who a few months later placed them as a synonym of *Pseudeucinetus* and *P. zygops*.

A second species, *P. novabritannica* DELÈVE (1973), was described from the Bismarck Archipelago and two new species are described below to further define the genus.

Pseudeucinetus HELLER

Pseudeucinetus HELLER, 1921, 155; type species: Pseudeucinetus zygops HELLER, by original designation. — CHAMPION, 1924 b, 160. — SPILMAN, 1959, 117. — SATÔ, 1994, 176.

Thaumastodus CHAMPION, 1924 a, 25; type species: Thaumastodus fusiformis CHAMPION, by original designation.

Diagnosis. Members of *Pseudeucinetus* may be recognized by the following combination of characters: distinctive fusiform shape (Figs. 1–3); pubescent cuticle, subcircular eyes that are nearly contiguous apically; hypognathous head; 11-segmented antennae; 4-segmented maxillary palpi, last segment of maxillary palpi swollen and ending in a nipple-like process (Fig. 10); 4–4–4 tarsal formula; elytral border

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entire; and long, large, metacoxal plates. In addition, the genus has the metacoxal processes laterally recessed for reception of the femora when retracted and numerous, long, stout spines on the metatibiae and metatarsi.

Pseudeucinetus uenoi sp. n.

(Figs. 1-17)

Diagnosis. Length, 1.92 mm. Pronotal microreticulation fine, distinctly impressed. Male genitalia with parameres, in dorsal or ventral view, acuminate apically; both parameres without an angular preapical or subbasal projection; median lobe moderately swollen at midlength and acuminate apically (Fig. 13). In lateral view, parameres broad and tapered from base to obtuse apices (Fig. 14).

Holotype ♂. — Form and Size:— Elongate, fusiform, moderately convex transversely (Figs. 1–3). Length, 1.92 mm; width, 0.95 mm.

Color:- Dorsum black except eyes dark reddish brown.

Head:— Hypognathus (Fig. 3–6); densely pubescent; with short, appressed, silky, hair-like setae (Figs. 3, 4, 6). Frons densely, moderately coarsely punctate; punctures separated by $\frac{1}{4}$ to $\frac{1}{2}$ puncture diameter; cuticle between punctures smooth (Fig. 5); area behind eyes densely and finely microreticulate. Eyes large, subcircular; very narrowly separated, when viewed from above (Fig. 4). Antenna 11-segmented.

Thorax:— Pronotum with dense, silk-like pubescence; densely and coarsely microreticulate and punctate; microreticulation more coarse than that behind eyes; punctures coarse, separated by $\frac{1}{2}$ to 4 times puncture diameter; as densely pubescent as elytron; with silvery patches of pubescence, thus appearing maculate in certain lights. Elytron punctate and pubescent as pronotum (Fig. 11). Prosternal process, mesosternum, and metasternum on same plane and covered with dense, silvery, appressed setae (Figs. 2, 5). Basal protarsal segment very broad, flattened, and densely pubescent ventrally (Figs. 7). Protibiae, mesotibiae, and metatibiae pubescent. Metacoxal plates very large, longer than distance between metacoxa and mesocoxa; strongly oblique, deeply recessed laterally for reception of metafemur (Fig. 2). Metafemur with small, narrow, basal cluster of golden yellow setae (Fig. 12, arrow) (seen only in certain light). Metatibia and metatarsi pubescent; with numerous, long, stout spines along entire length (Figs. 8, 9). Metatarsal claws grooved ventrally.

Abdomen:— Last visible abdominal sternum with a tooth-like extension on each side of an apicomedial emargination (Fig. 2); with several long, stout, lateral, golden setae; setae directed medially.

Genitalia:— As illustrated (Figs. 13–15). Each of the two apical struts on sternum 9 is drawn in dorsal and dorsolateral views (Fig. 15).

Female. Externally identical to male except size averages slightly larger and basal protarsal segment not broadly expanded nor densely pubescent ventrally. Ovipositor typically limnichid type; coxites slender, inner margin sinuous (Fig. 16). Urosternite

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Figs. 1–9. Pseudeucinetus uenoi sp. n.: 1, habitus, dv, ×40; 2, habitus, vv, ×40; 3, habitus, lv, ×50; 4, head, dv, ×170; 5, head, vv, ×150; 6, head, lv, ×170; 7, protarsus, male, vv, ×400; 8, hindleg, ×120; 9, metatibial spines, ×600. dv=dorsal view; lv=lateral view; vv=ventral view.

with long, slender base; apex with slender, lateral projections and rounded apicomedially (Fig. 17).

Type data. Holotype ♂: [Malaysia]: Sabah, Telupid (20 km E), 14 Aug. 1983, G. F. HEVEL & W. E. STEINER; deposited in the National Museum of Natural History,

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Figs. 10-12. Pseudeucinetus uenoi sp. n.: 10, maxillary palpus, apical segment, ×1000; 11, elytral cuticle, beside scutellum, ×1500; 12, metacoxal plates and metafemoral base, setal cluster at arrow, ×220.

Smithsonian Institution.

Allotype: Same data as holotype. Paratypes: Same data as holotype, $2 \stackrel{\circ}{\supset} \stackrel{\circ}{O}$, $2 \stackrel{\circ}{\bigcirc} \stackrel{\circ}{\bigcirc}$.

Habitat. The specimens of *Pseudeucinetus uenoi* were collected at a blacklight operated in a clearing in a logging area 20 kilometers east of Telupid. The clearing was on a semi-forested hilltop bordered by large, tall trees. The limnichids were collected along with some other small aquatic beetles at the light.

Etymology. In respect for his long and distinguished career as a systematic en-



Figs. 13-17. *Pseudeucinetus uenoi* sp. n.: 13, genitalia, male, ventral view; 14, genitalia, male, lateral view; 15, sternum 9; 16, genitalia, female, ovipositor; 17, genitalia, female, urosternite.

tomologist and his excellent contributions to Coleopterology, I am pleased to dedicate this species to Dr. Shun-Ichi UÉNO. I wish him a long and happy retirement and will remember, with pleasure, Dr. UÉNO's kind hospitality during my visit to Tokyo some years ago.

Pseudeucinetus spilmani sp. n.

(Figs. 18-31)

Diagnosis. Length, 1.50 mm. Pronotal microreticulation extremely fine and shallowly impressed. In dorsal or ventral view, male genitalia with parameres broad and rounded apically and each with an acute angular projection subbasally; median lobe swollen medially, with elongated nipple-like apex (Fig. 27).

Holotype J. — Form and Size:— Elongate, fusiform, moderately convex transversely (Fig. 19). Length, 1.50 mm; width 0.76 mm.

Color:- Dorsum black except eyes dark reddish brown.

Head:— Hypognathus (Figs. 19, 20); densely pubescent; with short, appressed, silky, hair-like setae (Figs. 18, 20). Frons densely, moderately coarsely punctate; punctures separated by half puncture diameter; cuticle between punctures smooth (Fig. 20); area behind eyes densely and finely microreticulate. Eyes large, subcircular; very narrowly separated when viewed from above (Fig. 18).

Thorax:- Pronotum with dense, silk-like pubescence; densely and coarsely microreticulate and punctate; microreticulation more deeply impressed than that behind eyes; punctures separated by 2 times puncture diameter. Elytron with toothlike apicolateral extension followed by a shallow preapical emargination (Fig. 25); border not denticulate; surface microreticulate, finely punctate, and as densely pubescent as pronotum; punctures separated by half puncture diameter to $1\frac{1}{2}$ times puncture diameter; with silvery patches of pubescence thus appearing maculate in certain lights. Prosternal process, mesosternum, and metasternum on same plane and covered with dense, silvery, appressed setae (Fig. 19). Protibia, mesotibia, and metatibiae pubescent. Basal protarsal segment very broad, flattened; ventrally, with enlarged adhesive setae and densely pubescent (Figs. 21, 22). Metacoxal plates very large, longer than distance between metacoxa and mesocoxa; strongly oblique, deeply recessed laterally for reception of metafemur (Fig. 19). Metafemur with small, narrow, basal cluster of yellow setae. Metatibia and metatarsi pubescent; with numerous, long, stout spines along entire length (Figs. 19, 21). Metatarsal claws grooved ventrally (Figs. 23, 24).

Abdomen:— Last visible abdominal sternum with tooth-like extension on each side of an apicomedial emargination (Fig. 25) and several long, lateral, golden setae; setae directed medially (Figs. 25, 26).

Genitalia:— As illustrated (Figs. 27–29). The two apical rod-like struts on sternum 9 are drawn in dorsal view (Fig. 29).

Female. Externally identical to male except size averages slightly larger and

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Figs. 18–26. Pseudeucinetus spilmani sp. n.: 18, head, thorax, scutellum, ×130; 19, habitus, vv, ×50; 20, head, vv, ×170; 21, protarsus, ov, ×400; 22, protarsal adhesive setae, ×1000; 23, mesotarsal claws, vv, ×1000; 24, metatarsal claws, vv, ×1300; 25, last visible abdominal sternum, notch, ×300; 26, last abdominal sternum, setation beside notch, ×600. ov= oblique view, vv=ventral view.

basal protarsal segment not broadly expanded nor densely pubescent ventrally. Ovipositor typically limnichid type; coxites broad, inner margin with short basal emargination (Fig. 30). Urosternite with long, slender base; apex with slender, lateral projections and rounded apicomedially (Fig. 31).

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Figs. 27–31. Pseudeucinetus spilmani sp. n.: 27, genitalia, male, ventral view; 28, genitalia, male, lateral view; 29, sternum 9, dorsal view; 30, genitalia, female, ovipositor; 31, genitalia, female, urosternite.

Type data. Holotype, \mathcal{J} : [Indonesia]: Moluccas, Bacan Island, Kampung Wayamiga, 27–31 July 1981, A. C. MESSER; deposited in the National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype. Paratypes: Same data as holotype, $3 \stackrel{?}{\supset} \stackrel{?}{\supset}, 4 \stackrel{?}{\subsetneq} \stackrel{?}{\subsetneq}$.

Habitat. Unknown.

Etymology. The specific epithet is a patronym for my colleague Theodore J. SPILMAN who contributed extensively to our knowledge of the limnichid subfamily Thaumastodinae and described the only thaumastodine genera known from the Western Hemisphere — *Martinius* SPILMAN (1959) and *Mexico* SPILMAN (1972).

Pseudeucinetus zygops HELLER

(Figs. 32-34)

Pseudeucinetus zygops Heller, 1921, 156. — Champion, 1924 b, 116. — Maulik, 1931, 505. — Spilman, 1959, 117. — Delève, 1973, 18. — Satô, 1994, 173.

Thaumastodus fusiformis Champion, 1924 a, 27; 1924 b, 116. — MAULIK, 1931, 505. — SPILMAN, 1959, 117.

Diagnosis. Because of the external similarities, the few specimens available, and the small size (1.65–2.3 mm) of the known species of *Pseudeucinetus*, the differences in the male genitalia are the most notable distinguishing characters. *Pseudeucinetus zygops* (Figs. 32–34) has the slender median lobe and parametes tapering without

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widening at the midlength and lacking angular preapical or subbasal projections when viewed dorsally (Fig. 32); in lateral view, the parameres taper from base to acute apex and are moderately sinuous from midlength to apex (Fig. 33). The two apical struts on sternum 9 are drawn in dorsal and dorsolateral views (Fig. 34).

Distribution. Pseudeucinetus zygops is known from: Kumon, India; Kuala Lumpur, Malay Peninsula, Malaysia; New Ireland, Bismarck Archipelago; Balabac, Palawan, Mindanao, and Negros Islands, Philippines; and Santa Anna and Santa Catalina, Solomon Islands.

Pseudeucinetus novabritannica DELÈVE

(Fig. 35)

Pseudeucinetus novabritannica DELÈVE, 1973, 18.

Diagnosis. As in *P. zygops*, the male genitalia are diagnostic and distinguish *P. novabritannica* (Fig. 35). In dorsal view, *P. novabritannica* has a broad median lobe with a short, moderately broad, nipple-like apex; the parameres have a distinctive, preapical, angular projection on the inner surface and a more acutely angular projection near the base; the apices of the parameres are evenly broad from the base to the apex (Fig. 35). The illustration of the dorsal view of the genitalia is redrawn from DELÈVE (1973).

Distribution. Known only from New Britain, Bismarck Archipelago.

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Figs. 35. Pseudeucinetus novabritannica DELÈVE, male genitalia (redrawn from DELÈVE).

Discussion

The four recognized species of *Pseudeucinetus* are presently known from a total of 46 specimens. Of those 46 specimens, 30 specimens have been identified as *P. zygops*; 1 specimen (the unique type) is *P. novabritannica*; 9 specimens are *P. spilmani*; and 6 specimens are *P. uenoi*. The diagnostic male terminalia seem to be the only reliable characters for identifying species of *Pseudeucinetus* and the following key is based on the male terminalia.

Key to the Species of Pseudeucinetus

Males

1.	Apex of median lobe of aedeagus acuminate in dorsal or ventral view (Figs. 13,
	32) 2
	Apex of median lobe of aedeagus nipple-like in dorsal or ventral view (Figs. 27, 35).
2.	Paramere, in lateral view, sinuous and narrowed from midlength to apex (Fig. 33)
-	Paramere, in lateral view, not sinuous and relatively broad until decurved sub- apically (Fig. 14)
3.	Parameres, in dorsal or ventral view, each with obtuse angular projection sub- apically on inner margin and acute angular projection subbasally on inner margin (Fig. 35). Median lobe of aedeagus with short, blunt nipple-like apex

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I thank the following Smithsonian Institution personnel: Gary F. HEVEL and Warren E. STEINER for collecting aquatic and semiaquatic beetles for me during their fieldwork in Borneo among which the new species *Pseudeucinetus uenoi* was found. I also thank them for supplying the habitat data for *P. uenoi*. For the specimens of *P. spilmani*, I am grateful to Adam C. MESSER who collected many insects for the Smithsonian Institution while assisting Paul M. TAYLOR, Smithsonian Anthropologist, with his research in the Moluccas. I thank my colleague Silvia SANTIAGO-FRAGOSO for constructively reviewing the manuscript and Phyllis M. SPANGLER for editorial assistance.

Checklist of Members of the Limnichid Subfamily Thaumastodinae

Acontosceles hydroporoides CHAMPION, 1924, 29: India; Philippines Acontosceles tagalog SPILMAN, 1959, 116: Philippines, Luzon Island Acontosceles yorioi M. SATÔ, 1966, 60: Ryukyu Islands, Japan

Babalimnichus masamii M. SATÔ, 1994, 175: Ryukyu Islands, Japan

Babalimnichus taiwanensis M. SATÔ, 1994, 174: Taiwan

Martinius ripisaltator SPILMAN, 1966, 124: Cuba

Martinius tellipontis SPILMAN, 1959, 119: Panama, Canal Zone

Martinius temporalis WOOLDRIDGE, 1988, 314: Ecuador

Mexico litoralis SPILMAN, 1972, 114: Mexico

Pseudeucinetus zygops HELLER, 1921, 156: India, Kumaon; Malaysia, Kuala Lumpur; Philippines — Balabac, Palawan, Mindanao, and Negros Islands; Bismarck Archipelago, New Ireland; and Solomon Islands, Santa Anna and Santa Catalina. Thaumastodus fusiformis CHAMPION, 1924 a, 27 (synonym).

Pseudeucinetus novabritannica DELÈVE, 1973, 18: Bismarck Archipelago, New Britain Pseudeucinetus uenoi SPANGLER, 1995, 396: Malaysia, Sabah

Pseudeucinetus spilmani SPANGLER, 1995, 399: Indonesia, Moluccas, Bacan Island

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Spec. Bull. Jpn. Soc. Coleopterol., Tokyo, (4): 407-418, March 28, 1995

46. Beitrag zur Kenntnis der indo-malaiischen Cantharidae (Coleoptera)

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Abstract To the knowledge of the Indo-malayan Cantharidae (Coleoptera). — The following species new to science are described: *Kandyosilis uenoi* (Taiwan), *K. bruneiensis* (Brunei), *K. lijiangensis* (China), *K. shimomurai* (Nepal), *K. tigerhillensis* (N India), *K. diversecarinata* (N Thailand), *Prothemus nigripennis* (N Vietnam), *P. reductus* (N Thailand), *P. longiphysus* (N Vietnam). *Cantharis grouvellei* PIC and *C. meillieri* PIC are both transferred to the genus *Prothemus*, *Rhagonycha bipartita* WITTMER is transferred to *Kandyosilis*.

Kandyosilis uenoi n. sp.

(Abb. 1)

♂. Kopf und Halsschild orange; Fühler schwarz, Glieder 1 bis 3 gelb, bei 3 teils leicht angedunkelt; Schildchen und Flügeldecken schwarz; Schenkel orange, Schienen und Tarsen mehr oder weniger angedunkelt.

Kopf mit den Augen ein wenig schmäler als der Halsschild, glatt. Fühler (Abb. 1) ca. 10% kürzer als die Flügeldecken, Glied 2 ungefähr so lang wie 3, an der Spitze so breit wie 1, 3 zum Apex verbreitert, an der Basis ein wenig ausgehöhlt, darüber, etwas seitlich ein feiner Kiel, basal etwas stärker erhöht und kurz nach hinten verlängert, gegen den Apex allmählich erlöschend, 4 bis 6 am Apex nach innen verbreitert, 7 weniger stark verbreitert. B bis 11 normal, 4 bis 7 mit einem feinen Längskiel, kaum wahrnehmbar krenuliert. Halsschild breiter als lang (26×22.5), Seiten nach vorne schwach verengt, wenig ausgerandet, glatt, undeutlich punktiert. Flügeldecken ca. 5 mal länger als der Halsschild, parallel, runzlig gewirkt, an der Basis Punkte vorhanden.

Länge: 4.5 mm.

Holotype (NHMB): Taiwan: Hohuanchi, 1,950 m, Nantou Hsien, 17–VI–1982, T. SHIMOMURA.

Diese neue Art ist neben *mucronata* WITTMER zu stellen, mit der sie nahe verwandt ist und von der sie sich durch die Form der Fühler unterscheidet. Bei *mucronata* sind die Glieder 4 bis 6 am Apex nicht verbreitert.

Es freut mich sehr diese schöne Art meinem lieben Kollegen, Dr. Shun-Ichi UÉNO, widmen zu dürfen, mit dem ich jahrzehntelang in brieflicher Verbindung stand und den ich anlässlich des Internationalen Entomologischen Kongresses in Kyoto kennenlernte und auch als Menschen sehr schätze.

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Kandyosilis bruneiensis n. sp.

(Abb. 2-4)

♂. Kopf schwarzbraun, vom Hinterrand der Fühlerwurzeln nach vorne gelb; Fühler schwarz; Halsschild dunkelbraun, am Vorderrand etwas dunkler; Schildchen dunkelbraun bis schwarz; Flügeldecken schwarz; Beine dunkelbraun.

Kopf mit den Augen so breit wie der Halsschild an der Basis, glatt, mit zerstreuten feinen Haarpunkten. Fühler (Abb. 2 und 3) so lang wie die Flügeldecken, dicht, kurz behaart, Glied 3 zur Spitze am stärksten verbreitert, bis 6 abnehmend verbreitert, ab 7 fast parallel, 3 und 4 am Apex ein wenig nach innen verbreitert und hier mit einem länglichen Eindruck versehen, 5 Verbreiterung nur angedeutet. Halsschild ein wenig breiter als lang (24×23), vor den Basalecken am breitesten, Seiten nach vorne in fast gerader Linie schwach verengt, Scheibe mit 2 schwachen Längsbeulen, glatt. Flügeldecken fast 5 mal länger als der Halsschild, parallel, leicht runzlig gewirkt mit Spuren von 2 Längsrippen.

Kopulationsapparat ventral Abb. 4. Parameren des ventralen Basalstücks lang, am Apex nach innen gebogen und hier schwach verbreitert.

Länge: 5.2 mm.

Holotypus (BM), Paratypus (NHMB): Brunei: Kuala Belalong FSC, 115°17′E, 04°34′N, 17–VI. und 8–VII–1991, ground malaise 4, Dipterocarp forest, N. MAWDSLEY.

Diese neue Art ist neben *basicrassicornis* (WITTMER) zu stellen. Sie unterscheidet sich durch die Form der Fühlerglieder 3 bis 7, die verschieden eingedrückt sind und die bei *basicrassicornis* bei 3 bis 5 am Apex nicht nach innen verbreitert sind.

Kandyosilis lijiangensis n. sp.

(Abb. 5-6)

♂. Schwarz, nur der Vorderkopf, beginnend knapp hinter den Fühlerwurzeln, gelb.

Kopf mit den Augen breiter als der Halsschild, Stirne leicht gewölbt, fein chagriniert bis glatt, zerstreut, etwas erloschen punktiert. Fühler (Abb. 6) fast so lang wie die Flügeldecken (Glied 11 fehlt), 2 ein wenig kürzer als 3, 4 fast doppelt so lang wie 2, an der Spitze ein wenig breiter als 3, 5 bis 9 mit einem länglichen, glatten Eindruck von variabler Länge. Halsschild ein wenig länger als breit (28×27), Seiten fast gerade, nach vorne schwach verengt, fein chagriniert bis glatt, Punktierung etwas deutlicher als auf dem Kopfe. Flügeldecken ca. 4 1/2 mal so lang wie der Halsschild, körnig gewirkt, Längsrippen angedeutet oder fehlend.

Kopulationsapparat ventral Abb. 5. Die Fortsätze die hinter jeder Paramere des ventralen Basalstücks sichtbar sind, sind keine Laterophysen, es sind die Anhänge des ausstülpbaren Sackes des Mittelstücks.

 \bigcirc . Vorderkopf weniger stark aufgehellt und Fühler kürzer als beim \eth . Länge: 6 mm.

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Abb. 1–6. 1, Fühlerglieder 1–5 von Kandyosilis uenoi n. sp. ♂. — 2–3, Fühlerglieder 1–6 und 3–5 in verschiedenen Stellungen von K. bruneiensis n. sp. ♂. — 4, Kopulationsapparat ventral von idem. — 5, Kopulationsapparat ventral von K. lijiangensis n. sp. ♂. — 6, Fühlerglieder 5–9 von idem. Massstab von 1 auch für 5, von 2 auch für 3.

W. WITTMER

Holotypus und 2 Paratypen (NHMB): China, N Yunnan: Lijiang, 2,600 m, 30-VI. – 2-VII-1990.

Diese neue Art ist neben *yunnana* WITTMER zu stellen, sie ist nur wenig kleiner, hat kleinere Augen, deutlich eingedrückte Fühlerglieder, bei *yunnana* sind die Eindrücke nur angedeutet, und dunklere Beine. Der Kopulationsapparat ist sehr verschieden gebaut.

Kandyosilis shimomurai n. sp.

(Abb. 7)

Ganzer Körper mit den Fühlern und Beinen schwarz, ausgenommen der orangerote Halsschild, der am Vorderrand und manchmal auch am Basalrand schmal schwarz ist, seltener sind auch die Seiten sehr schmal schwarz, besonders auf der vorderen Hälfte.

♂. Kopf mit den Augen breiter als der Halsschild an der Basis, fein gewirkt. Fühler (Abb. 7) lang und schlank, ein wenig länger als die Flügeldecken, Glied 3 mit einer kurzen, kleinen Narbe (nicht immer gut sichtbar), 4 bis 10 mit einer leicht gebogenen Längsrippe von der Basis bis fast zur Spitze und hier ausserdem ein Längseindruck, 11 kaum merklich länger als 10. Halsschild so lang wie breit, Seiten nach vorne fast geradlinig verengt, ähnlich wie der Kopf gewirkt. Flügeldecken fast 5 mal länger als der Halsschild, körnig gewirkt, mit Spuren von 2 Längsrippen.

♀. Fühler viel kürzer, einfach.

Länge: 6.3-7 mm.

Holotypus und 2 Paratypen (NHMB): C Nepal: Godawari, Kathmandu Valley, 1,600 m, 15–V–1983, T. SHIMOMURA; Mt. Pulchoki, Kathmandu Valley, 1,800–2,000 m, 2–V–1983, T. SHIMOMURA, 4 Paratypen (NHMB).

Es freut mich diese Art ihrem Entdecker, Herrn T. SHIMOMURA, zu widmen.

Diese neue Art ist mit *carinata* WITTMER verwandt. Sie unterscheidet sich durch die längeren Längsleisten auf den Fühlergliedern 4 bis 10, die am Apex ausserdem noch mit einer Längsfurche versehen sind. Auch sind die Fühler von *carinata* kürzer und die Längsleisten sind auf die Glieder 3 bis 7 beschränkt, die Längsfurchen daneben, am Apex, fehlen.

Kandyosilis tigerhillensis n. sp.

(Abb. 8)

♂. Schwarz, Fühlerglieder 1 und 2 gebräunt; Beine mehr oder weniger bräunlich.

Kopf mit den Augen ein wenig breiter als der Halsschild an der Basis, glatt. Fühler (Abb. 8) kurz, um ca. 1/4 kürzer als die Flügeldecken, Glied 3 kaum merklich länger als 1, gegen den Apex verengt, mit einem ovalen Eindruck, der fast den Apex, nicht aber die Basis erreicht; 4 kürzer und ein wenig breiter als 3, ziemlich breit eingedrückt; 5 bis 7 ein wenig länger als 4, länger als 8 bis 10, 11 länger als 3, etwas nach

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Abb. 7–9. Fühler von *Kandyosilis* ♂: 7, Glieder 1–11 von *K. shimomurai* n. sp.; 8, Glieder 1–5 von *K. tigerhillensis* n. sp.; 9, Glieder 1–11 von *K. diversecarinata* n. sp. Massstab von 7 auch für 9.

der Mitte am breitesten. Halsschild nur wenig breiter als lang (20.5×19) , Seiten nach vorne schwach, gerade verengt, glatt. Flügeldecken ein wenig mehr als 4 mal so lang wie der Halsschild, fast parallel, fein körnig gewirkt, teils glatt.

Länge: 3.7 mm.

W. WITTMER

Holotypus (NHMB): Indien, Darjeeling Distr.: Tiger Hill, 2,340–2,500 m, 12. – 13–VIII–1981, W. SUZUKI.

Diese neue Art gehört zu den kleineren Vertretern der Gattung. Sie ist leicht zu erkennen an ihrem schwarzen Körper und den stark vergrösserten, ziemlich breit längseingedrückten Fühlergliedern 3 und 4.

Kandyosilis diversecarinata n. sp.

(Abb. 9)

3. Einfarbig schwarz, nur der Halsschild ist rotorange.

Kopf mit den Augen kaum merklich breiter als der Halsschild, Basis chagriniert, dazwischen punktiert, nach vorne verschwindet die Chagrinierung zusehends, die Oberfläche wird glatter, die Punkte bleiben. Fühler (Abb. 9) ca. 10% länger als die Flügeldecken, Glieder länglich, 3 bis 9 mit einer Längsleiste in der Mitte. Halsschild ein wenig breiter als lang (34×33), Seiten gerade, fast parallel, ähnlich wie der Kopf punktiert, weniger deutlich chagriniert. Flügeldecken ca. 3 1/2 mal so lang wie der Halsschild, parallel, fein körnig gewirkt.

Länge: 5.5 mm.

Holotypus (NHMB): N Thailand: Doi Suthep, Chiang Mai, 1,100 m, 16-VI-1983, T. SHIMOMURA.

Diese neue Art ist mit *carinata* WITTMER verwandt, die jedoch einen roten Kopf besitzt und bei der die Fühlerglieder 3 bis 6 mit einer Längsleiste versehen sind. Bei *diversecarinata* ist der Kopf schwarz und die Fühlerglieder 3 bis 9 besitzen eine Längsleiste, die ausserdem länger ist als bei *carinata*.

Kandyosilis bipartita (WITTMER), n. comb.

Rhagonycha bipartita WITTMER, 1941, Philipp. J. Sci., 74: 205.

Diese Art ist in die Gattung Kandyosilis zu transferieren.

Kandyosilis semifumata (FAIRMAIRE)

Podabrus semifumatus FAIRMAIRE, 1889, Annls. Soc. ent. Fr., (6), 9: 39.

In Entomologica Basiliensia, **13**, 1989, 219, Zeile 20 schrieb ich versehentlich *Rhagonycha semifumatus* anstatt *Podabrus semifumatus*.

Prothemus nigripennis n. sp.

(Abb. 10-11)

Kopf, Fühler, Schildchen, Flügeldecken und Abdomen einfarbig schwarz: Halsschild orange, Basis und Vorderrand mit einem schlecht begrenzten, schwarzen Flecken; Beine schwarz, oder Schenkelbasis bis zur Hälfte orange.

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Abb. 10–11. Kopulations apparat von *Prothemus nigripennis* n. sp. \mathcal{F} : 10, dorsal 60×; 11, ventral 60×.

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♂. Kopf mit den Augen schmäler als der Halsschild, chagriniert, dazwischen ziemlich grob punktiert. Fühler lang, Glieder 3 bis 10 von oben gesehen fast parallel, von der Seite gesehen zur Spitze schwach verbreitert, 3 bis 9 mit einem deutlichen Längseindruck, bei 10 schwer sichtbar, 3 nur wenig mehr als doppelt so lang wie 2, 4 um ca. 1/6 länger als 3. Halsschild ein wenig breiter als lang, Seiten ziemlich stark gerundet, kaum merklich chagriniert, feiner und weniger dicht als der Kopf punktiert. Flügeldecken langgestreckt, parallel, leicht körnig skulptiert bis glatt, matt, bei 1 Exemplar ist eine Längsrippe angedeutet.

Kopulationsapparat dorsal $60 \times Abb. 10$, ventral $60 \times Abb. 11$. Parameren des dorsalen Basalstücks breit, der Ausschnitt am Innenrand ist fast herzförmig, Apex spitz, die beiden Spitzen berühren sich. Laterophysen sowohl dorsal wie auch ventral gesehen, kurz, gerade spitz. Parameren des ventralen Basalstücks verhältnismässig kurz, leicht gebogen.

 Q. Wie das ♂ gefärbt. Augen kaum kleiner. Fühler etwas kürzer, ohne Eindrücke. Halsschild ein wenig breiter.

Länge: 11-13 mm.

Holotypus und 3 Paratypen (NHMB): N Vietnam, Vinh Phu Prov.: Tam Dao, 900 m, 6. — 21–V–1990, L. DEMBICKÝ, J. HORAK; idem, 13. — 24–V–1989, A. OLEXA, PACHOLATKO, 2 Paratypen (NHMB); Tam Dao, 80 km N Hanoi, 900 m, 15. — 17–IV–1986, Paratypus (SMNS); Manegao, 14–IV–1986, L. MEDVEDEV, 4 Paratypen (NHMB).

Diese neue Art ist neben *svihlai* WITTMER zu stellen. Abgesehen von der grösseren Gestalt, ist die Färbung des Halsschildes verschieden, bei *nigripennis* grösstenteils orange, nur am Vorder- und Basalrand kurz schwarz, bei *svihlai* sind die beiden Ränder schmal orange und in der Mitte liegt ein schwarzer Längsflecken, der in der Mitte meistens mehr oder weniger eingeschnürt ist. Am Kopulationsapparat sind die Seitenteile des dorsalen Basalstücks bei *svihlai* viel schmäler, vor der Spitze ein wenig nach innen verbreitert, bei *nigripennis* nicht nach innen verbritert.

Prothemus reductus n. sp.

(Abb. 12-13)

 \vec{o} . Orange bis braun, nur die Fühler, ausgenommen Glied 1 und die Basis von 2, Schienen mehr oder weniger und Tarsen angedunkelt.

Kopf mit den halbkugelförmigen, herausstehenden Augen ein wenig schmäler als der Halsschild, fein gewirkt, fast körnig, dazwischen einzelne, undeutliche Punkte. Fühler lang, Glieder 3 bis 10 zur Spitze nur ganz wenig verbreitert, fast parallel, 3 um 2 1/3 mal länger als 2, 4 fast um die Hälfte länger als 3, 4 bis 9 mit kurzen Längseindrücken, bei 10 und 11 sind sie stark verkürzt, kaum sichtbar. Halsschild ein wenig breiter als lang, Seiten nach vorne etwas stärker gerundet verengt als nach hinten, Vorderecken fast vollständig mit dem Vorderrand verrundet, chagriniert, einzelne Punkte noch erkennbar. Flügeldecken langgestreckt, fast parallel, mit Spuren von 2 Längsrippen, Oberfläche leicht uneben, einzelne Punkte erkennbar.

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Abb. 12-13. Kopulationsapparat von *Prothemus reductus* n. sp. ♂: 12, ventral 37×; 13, dor-soapikal 55×.

Kopulationsapparat ventral $37 \times$ Abb. 12, dorsoapikal $55 \times$ Abb. 13. Die Seitenteile des dorsalen Basalstücks sind auf der Innenseite ausgehöhlt, sie verschmälern sich gegen den Apex allmählich, die Spitzen überlappen sich ein wenig, am Innenrand gegen die Basis jederseits ein kräftiger an der Basis breiter Zahn. Laterophysen nicht sichtbar, vielleicht vorhanden, aber verdeckt.

Länge: 11 mm.

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Holotypus (NHMB): N Thailand: Doi Suthep, 1,100 m, Chiang Mai, 8–IV–1983, T. SHIMOMURA.

Diese neue Art ist neben *vitalisi* (PIC) zu stellen. Das dorsale Basalstück des Kopulationsapparates ist ähnlich gebaut, doch ist die Färbung des Körpers braunorange, bei *vitalisi* sind die Flügeldecken schwarz.

Prothemus longiphysus n. sp.

(Abb. 14)

♂. Kopf oben schwärzlich, Schläfen, Wangen und Unterseite bräunlich; Fühler und Beine schwarz; Halsschild braun bis schwärzlich, Seiten in variabler Breite und Basis schmal aufgehellt; Flügeldecken rotbraun, Behaarung rötlich.

Kopf mit den Augen so breit wie der Halsschild, fein chargriniert und ziemlich dicht punktiert. Fühler lang, Glieder 3 bis 10 gegen die Spitze nur ganz wenig breiter, fast parallel, 3 drei mal länger als 2, 4 um ca. 1/3 länger als 3, 4 bis 10 mit einem schmalen kurzen Längseindruck, bei 10 wenig deutlich. Halsschild ungefähr so lang wie breit, Seiten gerundet, nach vorne leicht verengt, chagriniert, Punkte weniger deutlich als auf dem Kopf. Flügeldecken langgestreckt mit Spuren von 2 Längsrippen, leicht matt.

Kopulationsapparat dorsal 80× Abb. 14. Parameren des ventralen Basalstücks lang und schmal, zugespitzt. Parameren des dorsalen Basalstücks in lange, schmale,



Abb. 14. Kopulationsapparat dorsal von Prothemus longiphysus n. sp. 3, 80×.

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zugespitzte Fortsätze ausgezogen, ventralwärts gebogen, die beiden Spitzen überlappen sich und liegen hinter den Spitzen der ventralen Parameren; der Innenrand des dorsalen Basalstücks ist kurz vor der gespaltenen Basis stark gerundet, sodass sie eine fast runde Öffnung bilden, darüber jederseits mit einem spitzen Zahn und einem gerundeten Vorsprung. Laterophysen sehr lang und schmal (von der Dorsalseite gesehen), leicht schräg, lange Lamellen, die nach oben schwach verbreitert sind, Spitze gerundet.

Länge: 9-10 mm.

Holotypus (NHMB): N Vietnam, Vinh Phu Prov.: Tam Dao, 900 m, 17. — 21-V-1990, J. HORAK; Tam Dao, 12. — 24-V-1989, PACHOLATKO, Paratypus (NHMB).

Diese neue Art gehört in die Verwandtschaft von *sanguinosus* (FAIRMAIRE), neben die sie zu stellen ist. Der Kopulationsapparat ist ähnlich gebaut und doch sehr verschieden (siehe WITTMER, 1987, Mitt. ent. Ges. Basel, (N.F.), **37**: 78, Abb. 11).

Prothemus grouvellei (PIC), n. comb.

Cantharis grouvellei PIC, 1906, Échange, (22): 83.

Es wurde folgendes Material untersucht: Lectotypus und 6 Paralectotypen (MP), 1 Paralectotypus (NHMB): China, Yunnan. Weiteres Material: Yunnan Sen, 2 Ex. (MP), 2 Ex. (NHMB), diese 4 Exemplare hatten keine Typenetiketten.

Diese Art hat den für die Gattung *Prothemus* typischen Bau des Kopulationsapparates und die Bildung der Klauen, die Form des Halsschildes ist jedoch abweichend. Derselbe ist mehr quadratisch, mit gerundeten Vorder- und Basalecken, bei den übrigen Arten der Gattung ist der Halsschild länger, die Seiten sind stärker gerundet, der Vorderrand ist mehr gerundet und fast vollständig mit den Seiten verrundet. Durch die abweichende Form des Halsschildes gleicht grouvellei äusserlich mehr einem Vertreter der Gattung *Cantharis*.

Prothemus meillieri (PIC), n. comb.

Cantharis meillieri PIC, 1926, Échange, hors-texte (42): 35.

Von dieser aus Laos nach $1 \, \varphi$ beschriebenen Art, besitzt das MP den Holotypus. Die Art gleicht dem *subobscurus* (PIC) sehr und ist möglicherweise mit ihr identisch. Erst durch das Auffinden eines \Im kann dies entschieden werden.

Verwendete Abkürzungen

MP = Muséum de Paris NHMB=Naturhistorisches Museum Basel SMNS = Staatliches Museum für Naturkunde Stuttgart

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Stagetus uenoi (Coleoptera, Anobiidae), a New Dorcatomine Species from Japan¹⁾

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Abstract A new anobiid species, *Stagetus uenoi*, is described from Japan. Synonymic notes on a Japanese species, *Theca hilleri* SCHILSKY, are summarized in relation to the genus *Stagetus*. Representative of the genus is recorded for the first time from Japan.

In 1901, SCHILSKY described a new species, *Theca Hilleri*, from Japan and established a new subgenus *Sculptotheca* for this species. According to some authors' indications, *viz*. MÉQUIGNON (1941), ESPAÑOL (1964, 1969 a) and WHITE (1974), it became clear that the anobiid genus *Theca* MULSANT et REY, 1861, was a synonym of *Stagetus* WOLLASTON, 1861, and a junior homonym of *Theca* MORRIS, 1845, while the subgenus *Sculptotheca* (sensu SCHILSKY) was defined as a good genus by ESPAÑOL (1973). Representative of the genus *Stagetus* eventually became disappeared from the Japanese fauna. *Sculptotheca hilleri* SCHILSKY identified correctly was shown by SAKAI (1985).

In the course of studying the Japanese Dorcatominae, I found some specimens apparently belonging to the genus *Stagetus*. After a detailed examination, they were proved to be a new species having a close relation to European species, *Stagetus elongatus* (MULSANT et REY). NAKANE (1963) illustrated a beetle under the name of *Theca hilleri* SCHILSKY in "Iconographia Insectorum Japonicorum, II", but the beetle seems to be a species of true *Stagetus*, so far as judged from the figure and the brief description.

Stagetus uenoi sp. nov.

[Japanese name: Sujibane-kinoko-shibanmushi]

(Figs. 1-5)

Length, 2.40-2.71 mm; width, 1.25-1.34 mm.

Male. Body elongate elliptical, 1.9 to twice as long as wide, subparallel-sided in the middle. Color dark brown to dark reddish brown; elytra except for side margins and pronotum except for apical margin usually more infuscate; antennae, palpi and tarsi diluted with light red. Pubescence dual; shorter hairs fine, dense and recumbent,

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Fig. 1. Stagetus uenoi sp. nov.

backward in general direction on elytra and undersurface, forward or sideward on pronotum; long hairs erect to suberect, sparsely bearing among short ones on head and dorsum, wanting on venter.

Head gently convex, circular in dorsal outline, bi-foveolate in front, profoundly sulcate along supra-antennal ridges and mesal margins of eyes; punctures on dorsal surface dual, smaller punctures fine, densely and uniformly arranged, larger punctures shallow, variable in density, separated by a distance equal to one to two times their diameter in front, separated on an average by 4 times or more on vertex and nearly evanescent on occiput; punctures on ventral surface rather large, dense in front and becoming sparser posteriad; fronto-clypeal suture indistinct. Eyes large, but never protruding, separated by about their own vertical diameter, faintly emarginate beside the antennal insertions. Under surface of head not modified for the reception of antennae in retraction. Antennae 11-segmented, apical three segments enlarged, forming a loose club; 1st segment robust, 2nd elongate-rotundate, a little longer than 3rd, 3rd elongate-cylindrical, scarcely dilated apically, about 1.4 times as long as 4th, 4th through 8th more or less produced inwards, 4th as well as 6th the shortest and with the weakest inner projection, 5th also short, but appreciably larger than 4th or 6th, 7th provided with long inner projection, 8th similar in shape to 7th but decidedly larger, 9th enlarged, dilated apically, about equal in length to 6th through 8th segments combined, 10th similar to 9th in shape and size, 11th oblong-oval, about 2.5 times as long as wide, and about 1.4 times as long as 10th. Last segment of maxillary palpus subtriangular, rather elongate, nearly twice as long as wide, with apical margin obliquely subtruncate; last segment of labial palpus strongly dilated, a little wider than long.

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Pronotum convex, entirely concealing head in repose, about 1.5 times as long as wide, widest at base, then uniformly narrowing toward apex; sides ridged from base to apex, but the ridge is weakened or obsolete at extreme apex; hind corner rounded; basal margin gently produced posteriad at the middle; punctures dual, minute punctures dense, almost uniform in arrangement on whole surface, larger punctures variable in arrangement, separated by a distance equal to 1 to 1.5 times their diameter at the center, diminishing the size and density at apex and base, and quite confused at extreme sides. Scutellum small, subcircular, widening slightly from the base, then round-ly narrowed toward apex, minutely shagreened and pubescent on disc.

Elytra well convex above, conjointly 1.5 to 1.6 times as long as wide, subparallelsided in basal 3/5; each elytron with 10 distinct striae which include longitudinal punctures having the same width to a stria, lateral two or three striae more deeply and widely sulcate than sutural one; scutellary striole definite, relatively long, arranged in the same manner as discal striae; a small pit more or less indicated between scutellary striole and scutellum; interstices flattened, minutely punctate and transversely rugulose;



Figs. 2-5. *Stagetus uenoi* sp. nov. — 2, Antenna of male; 3, maxillary palpus; 4, labial palpus; 5, male genitalia, dorsal view.

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humeral callus appreciably protruding.

Prosternum rather long, deeply concave on disc, forming a part of structural organ to receive the head in retraction; prosternal process short, triangularly produced between front coxae, sharply pointed at apex, and reaching basal 3/8 of front coxa behind prosternum. Mesosternum short and narrow, invisible when the body is retracted. Metasternum with anterior 1/3 declivous, marginate by carina, deeply excavated for the reception of middle legs, and interrupted at the middle by an elongate rhomboidal process which is exposed even in repose; posterior 2/3 of metasternum unevenly convex, minutely punctate at center and at the middle of apex, but the punctation intergrades to large, shallow and cribrate punctures toward base and sides; medio-longitudinal groove deep and broad, the anterior end forming a profound mycangium-like pit; intermetacoxal process blunt, deeply incised.

Abdominal sternites gently and evenly convex, punctate in a manner similar to that on pronotum; minute punctures densely distributed over the surface; larger punctures shallow, cribrate, denser medianly, separated on an average by 1 to 2 times their diameter on 2nd sternite, by 0.5 to 1 times their diameter on 3rd, nearly contiguous with one another on 4th and at least confusedly arranged on 5th; 2nd and 5th the longest, 1.25 times as long as the shortest 3rd or 4th, 5th grooved along apical margin, with the apex gently rounded; abdominal sutures almost straight, fine but entire.

Legs:— Front coxae large, divided by a ridge into exposed transverse plate and concealed portion forming a part of structural organ to receive head in retraction together with prosternum and anterior folded portion of pronotum.

Male genitalia symmetrical except for endophallic organ, similar in conformation to those of *Stagetus elongatus* (MULSANT et REY), but the endophallic flagella are recurved, inner process of lateral lobe bisected by a cleft, and apex of inner projection and palpi-like process of lateral lobe heavily provided with long hairs, respectively.

The male genitalia of this species show a variation of reversion as often recognized in some genera of the Anobiidae, namely, the endophallic flagella of the holotype are curved leftwards in dorsal view, but those of a paratype are curved rightwards.

Female. The external sexual dimorphism is quite uncertain, but the 7th and 8th segments of antennae are comparatively short, and less produced inwards.

Distribution. Japan (Honshu, Shikoku, Kyushu).

Type series. Holotype: ♂, Mt. Yasumandake, Hirado City, Nagasaki Pref., 5– VIII–1981, T. MATSUO leg. Allotype: ♀, Mt. Zôzu, Kagawa Pref., 16–VII–1978, M. KOTANI leg. Paratypes: 1♀, Second Dam of Hatanagi, Tashiro, Shizuoka Pref., 12– VI–1983, Y. TAHIRA leg.; 1♂, Mt. Iwawaki, Osaka Pref., 25–VI–1966, KIMURA *et al.* leg. (attracted to light trap); 1♂, do., 13–VIII–1966, Y. HAYASHI leg. (attracted to light trap).

Type depository. Most of the type series including the holotype are preserved in the Entomological Laboratory, College of Agriculture, Ehime University, Matsuyama. One paratype is in the author's collection.

Notes. Stagetus uenoi bears a close superficial resemblance to a European species,
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S. elongatus (MULSANT et REY), but may be distinguished from the latter by the antennal conformation, flattened interstices of elytra, punctation of pronotum and the different structure of the male genitalia (cf. ESPAÑOL, 1969 a).

A specimen of the genus from Tsushima Island has decidedly sparser punctuation on pronotum, and a female specimen from Mt. Ohtaki, Tokushima Prefecture has a compact proportion of body and slightly elevated interstices of elytra, but their taxonomic status is not conclusively determined in the present paper due to inadequacy of material.

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On the Adaptive Characteristics of the Genus Lederia (Coleoptera, Melandryidae), with Description of a New Species from Japan

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Abstract The apterous and jumping characteristics of *Lederia* REITTER (Coleoptera, Melandryidae) are discussed from the morphological viewpoint. *Lederia* (*Lederina*) kidoi sp. nov. is described from Japan.

The beetles belonging to the genus *Orchesia* (Melandryidae) are commonly collected from decayed wood and fungi, and are characterized by jumping habits like mordellids or scraptids. The subfamily Orchesiinae (or tribe Orchesiini) is composed of the genera *Orchesia*, *Lederia*, *Microscapha* and *Eucinetomorpha*, and easily distinguishable from the other Melandryidae by the following features: 1) front coxae separated by a narrow front coxal process; 2) tibial spurs of hind legs very strongly developed and distinctly serrate; 3) hind coxae very large, usually with an oblique suture. Among the species of the Orchesiinae, *Lederia* and its allies have the most adaptive features for the litter-living and jumping behaviour, and I would like to show them from the viewpoint of comparative morphology, by comparing with the related taxonomic groups. On this occasion, a new species is described from Japan.

Before going further, I wish to dedicate this paper to Dr. Shun-Ichi UéNo, of the National Science Museum (Nat. Hist.), Tokyo, for commemorating his retirement. My special thanks are due to Mr. K. KIDO, Fukuoka, for his kind gift of materials.

Adaptive Characters of the Genus Lederia REITTER

The genus *Lederia* REITTER, 1879 (Melandryidae: Orchesiinae) consists of 16 known species as far as the named ones are concerned, and has extremely large triangular hind coxae (Fig. 12), which are undoubtedly correlated with the strong jumping ability of these beetles. According to Mr. K. KIDO, *Lederia pion* jumped up about 50 cm high (body length of *L. pion* ca. 3 mm), and its species name "*pion*" had been given for its nature.

The following morphological tendencies are probably related to the strong jumping abilities by the hind legs (A) and the complete reduction of hind wings (B).

- A. Characters correlated with jumping abilities.
 - 1) Hind coxa extremely large, especially in the length of outer side (Fig. 12-

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Cx3).

2) Complicated internal and posterior structures and the presence of an oblique line (Fig. 12-Ob) are probably related to attachment of heavy muscles.

3) Thickness of middle and hind femora (Fig. 12).

4) Short and thick hind tibiae, with strongly serrate and large spurs (Fig. 12–TS).

5) Unusually strong development of large metendosternite (Fig. 15).

The reduction of hind wings are often observed in the fungivorous, the decayed wood or the litter living beetles. Some of them have reduced hind wings, in various degree. *Orchesia* has distinct wings with well developed veins (Fig. 17), although I have not observed actual flying of them. *Lederia* entirely lacks functional hind wings without distinct veins. Compared with *Orchesia* (Fig. 17), *Lederia* has the following reductive (apomorphic) features from viewpoint of comparative morphology.

B. Characters correlated with reduction of wings.

1) Scutellum of mesothorax entirely invisible externally, and basal side of pronotum gently arcuate and not bisinuate as in *Orchesia* or *Microscapha* (Fig. 1).

2) Scutellum and scutum of mesothorax extremely reduced (Fig. 10, cf. Fig. 19).

3) Mesepisternum and mesepimeron scarcely definite (Fig. 12, cf. Fig. 19).

4) Tergal region of metathorax extremely simplified, probable metascutum and metascutellum fused, with vestigial processes of hind wings (Fig. 11, cf. Fig. 19).

5) Metasternum narrow (Fig. 12), except in some species belonging to other subgenera.

In this genus, curious structural features are observed on the median line of metasternum in both sexes and on the median areas of abdomen in the male. These are species-specific and very useful for taxonomic characteristics, although reproductive or physiological functions of these complicated structures are unknown to us.

Description of a New Species, with Phylogenetic Importance

Lederia (Lederina) kidoi sp. nov.

[Japanese name: Kido-nomi-nagakuchiki]

(Figs. 1-15)

Holotype (♂): Is. Ooshima, Ooshima-mura, Fukuoka Pref., Japan, 1-V-1994,

^{Figs. 1–9. Lederia (Lederina) kidoi sp. nov. — 1, Dorsal habitus; 2, head, showing tentorium (solid line); 3, left maxilla, ventral view; 4, left antenna, ventral view; 5, labium, ventral view; 6, left mandible, ventral view; 6, prothorax, ventral view; 8, abdomen, ventral view; 9, male genitalia, ventral view; BP, basal piece; Cx, coxa of front leg; LL, lateral lobe; MD, median depression of abdominal sternites; ML, median lobe; PC, postcoxal process of prosternum; R, retinaculum; TA, anterior tentorial arm; TP, posterior tentorial arm. 1.0 mm to Fig. 1; shorter 0.5 mm to Figs. 7–8; longer 0.5 mm to Figs. 2,-4, 9; and 0.1 mm to Figs. 5–6.}



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Figs. 10–15. Lederia (Lederina) kidoi sp. nov. — 10, Dorsal parts of mesothorax, dorsal view, elytral parts shaded; 11, dorsal parts of metathorax, with vestigial wing, dorsal view; 12, meso- and metathoraces, ventral view, male; 13, front leg, ventral view, male; 14, median area of metathorax of female; 15, metendosternite; A, lateral arms; Cx2, Cx3, coxae of middle and hind legs; Es2+Em2, mesepisternum and mesepimeron combined; E, elytra; MD, median depression of metasternum; Ob, oblique suture of hind coxa; S, stalk; S2, S3, meso- and metasterna; Scl2, mesoscutellum; Sct2, mesoscutum; Sct3+Scl3, metascutum and metascutellum combined; TS, tarsal spur. 0.5 mm scale to all figs.

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Figs. 16–19. Orchesia (Clinocera) imitans LEWIS. — 16, Meso- and metathoraces, male, ventral view; 17, hind wing; 18, metendosternite; 19, meso- and metathoraces, dorsal view; Cu, cubitus; Cx2, Cx3, coxae of middle and hind legs; Em2, Em3, mes- and metepimera; Es2, Es3, mes- and metepisterna; Ob, oblique suture of hind coxa; S2, mesosternum; Scl2, Scl3, meso- and metascutella; Sct2, Sct3, meso- and metascuta; TS, tibial spur; W, anal cell (wedge cell). 1.0 mm scale to Figs. 16, 18, 19; and 0.1 mm scale to Fig. 17.

K. KIDO leg., preserved in the collection of the Entomological Laboratory, Kyushu University, Fukuoka, Japan.

Allotopotype (\bigcirc): The same data as the holotype. Paratopotypes: $5 \triangleleft \Diamond \uparrow$, $1 \heartsuit$, the same data as the holotype; a paratopotype (\triangleleft) is dissected and mounted on two microscopic slides.

Male (holotype). Body elongate oval, 2.07 times as long as wide, widest at anterior 2/5, strongly narrowing anteriorly and very strongly narrowing apically, with a pointed apical tip. Dorsum brown in general; frons pale brown, with dark vertical area. Pronotum dark brown with rather wide anterior and basal areas pale brown. Lateral areas of pronotum becoming gradually reddish brown. Antennae and legs pale yellowish brown. Underside of body reddish brown to yellowish brown. Dorsal pubescence pale yellow, minute and fallen backward.

Head small, 0.44 as wide as pronotal width. Eye small, strongly transverse and widely emarginate antero-internally; interocular distance 0.56 as much as head width. Clypeus subtrapezoidal, sides weakly narrowing apically, anterior margin of clypeus almost straight and very weakly narrowing apically, surface of clypeus and frons uniformly, rather densely punctate and distinctly shagreened. Tentorium (Fig. 2) composed of 2 pairs of longitudinal arms, both of which are fused with each other at the

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basal ends. Antenna (Fig. 4) fairly long and slender, ca. 0.74 as long as pronotal width; relative length of each segment as 14: 16: 6: 5: 4: 4: 5: 6: 9: 9: 15; each of 3 apical segments distinctly longer than thickness; the terminal segment 1.5 times as long as thick with a pointed apex. Mandible (Fig. 6) very stout with an obtusely pointed apex. Terminal segment of maxillary palpus (Fig. 3) elongate securiform with an obliquely truncate apical side, 1.5 times as long as wide.

Pronotum large, pronotal base 0.84 as wide as body width, and about 0.84 as wide as long in dorsal aspect; antero-lateral sides of pronotum rather weakly arcuately narrowing apically. Lateral margin of pronotum finely and distinctly marginate, and very weakly bisinuate with rounded anterior corners. Surface of pronotal disc almost impunctate, and extremely finely and transversely rugose. Basal margin of pronotum very sharply edged and overhanging on humeral parts of elytra. Anterior coxal cavities (Fig. 7) open posteriorly, and very narrowly separated by very thin prosternal process; the cavity internally narrowly open by extending postcoxal process (PC).

Scutellum entirely invisible externally (Fig. 1); vestigial sclerites of mesothoracic scutellum and scutum shortly observed by dissection (Fig. 10). Elytra (Fig. 1) narrow, 1.54 times as long as wide in dorsal view, posterior half strongly narrowing and caudal apex fairly pointed; apex of each elytron (Fig. 8) fairly narrowly rounded; elytral epipleuron narrow and ending near apical margin of 1st abdominal sternite (Fig. 8). Mesosternal process (Fig. 12) long and sharply pointed; median line of anterior half of mesosternum sharply edged; suture between mesepimeron and mesepisternum scarcely defined.

Both anterior and posterior margin of metasternum strongly obliquely situated in ca. 40° for vertical axis. Longitudinal median depression (Fig. 14–MD) elongate lanceolate, widest a little before the middle; somewhat longer than 1/2 of the sternum; outer margin of depression well carinate and clearly defined; posterior part of depression distinctly carinate. Metepisternum fairly narrow and nearly parallel-sided (Fig. 12). Tergal region of metanotum (Fig. 11) extremely reduced and vestigial. Metendosternite (Fig. 15) as figured and stout.

Front leg (Fig. 13) relatively slender; tibia about 2/3 as long as femur, weakly sinuate, tibial spur entirely wanting; tarsus much narrower than in the other known species of Japan; basal segment 1.4 times as long as wide; 2nd segment wider than long; 3rd nearly as wide as and shorter than 2nd. Middle leg (Fig. 12) also wanting tibial spur, as in other species of the genus; tibia 4/5 of femur in length; 1st tarsal segment relatively narrow, 1.7 times as long as wide; 2nd distinctly longer than wide; 3rd nearly as long as wide. Hind coxa (Fig. 12–Cx3) very large, trapezoidal, and oblique line (Fig. 12–Ob) represented on ventral surface which is convergent laterally to anterior side of coxa. Complicated structures are observed at inner portion of hind coxa; interior edges of hind coxa are illustrated by broken line. Trochanter with a basal projection. Femur simple but fairly thick. Hind tibia very stout, strongly constricted at base; basal segment of tarsus 1.5 times as long as tibia, weakly curved, longer tibial spur 2/3 as long as basal segment, and shorter one 7/8 as long as longer one; 2nd and

Adaptive Characteristics of Lederia

terminal tarsal segment cylindrical.

Abdominal median depression (Fig. 8) very distinct and deep on 3rd, 4th and 5th visible apical sternites and 2 basal sternites distinctly elevated at median portions but not clearly defined by carinae. Outer areas of 3rd, 4th and 5th depressions nearly parallel-sided by distinct carinae, those of 3rd and 4th nearly the same in their shape, of 5th slightly longer than wide. Outer areas of depressions, especially of basal and 2nd, bearing very thick and long hairs. Male genitalia as illustrated (Fig. 9).

Variation in paratypes (male). Dorsal coloration often paler and in the palest specimen entirely yellowish brown.

Female. Tarsal segments of front and middle legs much slenderer and weakly dilated laterally. Body shape somewhat broader than in male, L/W: 1.90–1.93. Meta-sternal depression (Fig. 14) parallel-sided at anterior part, and rather weakly carinate. Abdominal depressions indistinctly recognized.

Body length. 2.40-2.38 (2.62) mm; width: 1.72-2.16 (1.92) mm; L/W: 1.97-2.20 (2.07) in male, 1.90-1.93 in female; depth: ca. 1.50 mm. Those of the holotype are in parentheses.

Distribution. Japan (Kyushu).

Remarks. The present new species is closely related to *Lederia* (*Lederina*) pion in large and narrow body shape but obviously separable from the latter by the longer tibial spurs, slenderer tarsi in the male and slender maxillary palpus. From *L. angusticarinatus*, it is distinguishable by the deep abdominal depression, the slender front tarsus, etc.

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A New Species of the Genus Yakuhananomia (Coleoptera, Mordellidae) from Taiwan

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Abstract A new mordellid beetle, *Yakuhananomia uenoi* sp. nov., is described from Taiwan. It is closely allied to the species of Far East Asia in general appearance, but differs from them in the characteristic vertex, maxillary palpi, pygidium and so on.

At present, the mordellid genus *Yakuhananomia* KôNo comprises 6 species from Far East Asia, central Africa and North and Central America and an undeterminable species from Sumatra (by ERMISCH, 1950). Most of them are characterized by having quadrate scutellum with projected hind angles and short triangular pygidium, and are more or less similar to each other in the elytral maculate pattern.

Recently, I had an opportunity to examine two female specimens of this genus from Taiwan. They are very closely allied to Y. yakui (KôNO) from Japan and Russia, the type species of the genus, and Y. tsuyukii TAKAKUWA from Japan mainly in elytral maculate pattern, but are evidently different from them in some important structures. It is doubtless that the Taiwanese specimens belong to neither of the above species. Therefore, I will describe them herewith as a new species.

Before going further, I wish to express my sincere gratitude to Dr. Shun-Ichi UÉNO of the National Science Museum (Nat. Hist.), Tokyo, for his continuous guidance of my study and critical reading of many papers of mine. Deep thanks are also due to Messrs. Takaharu HATTORI and Kôyô AKIYAMA for their kindness in offering valuable materials, and to Miss Sachiyo NIRASAWA for her kind advice and help on the genus *Yakuhananomia* and in collecting literature.

This paper is dedicated to Dr. Shun-Ichi UéNO for commemorating his retirement from the chief of the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

Yakuhananomia uenoi sp. nov.

(Figs. 1, 4-5)

Female. Body black; spurs and apical parts of each sternite reddish brown; claws brownish; apical three or four segments of front and middle tarsi, base and apex of front tibia, apex of middle femur, base of middle tibia, apex of terminal segment of hind tarsus and almost all parts of antennae largely dark brown.

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Figs. 1-3. Females of Yakuhananomia spp. — 1, Y. uenoi sp. nov., holotype; 2, Y. yakui (Kôno) from Honshu; 3, Y. tsuyukii TAKAKUWA.

Head densely clothed with pale golden yellow pubescence. Pronotum densely clothed with golden yellow pubescence, except for three large spots consisting of dark fuscous one, the central one of which is elongate quadrate and reaches anterior medial lobe. Scutellum clothed with silvery pubescence. Elytra clothed with golden yellow pubescence or scales and bearing maculations of dark fuscous pubescence as follows: a pair of circular spots near base, pre-median zigzag pattern, a post-median fascia and an apical fascia, the first two maculations being connected by a pair of thready lines, and the second and third ones by six stripes (though the stripes are occasionally vague). Pygidium clothed with white to pale yellow pubescence, which is gradually darkened apicad, and bearing a few blackish hairs in medio-posterior area. Abdomen largely clothed with silvery pubescence, except for anal sternite and middle parts of 1–4 segments which are clothed with pale yellow to golden yellow one.

Head densely but minutely punctate, weakly convex, hardly excavated and without distinct concavity at pre-vertex; eyes oval, not bearing hairs; tempora fairly broad. Last segment of maxillary palpus semisecuriform; outer margin gently curving, about a half longer than inner one which is shorter than the apical. Antennae short, faintly longer than the shortest distance between eyes; relative lengths of segments in the holotype as follows: 1.2: 1: 1.0: 1.0: 1.0: 1.0: 0.95: 0.95: 0.9: 0.8: 1.35; 1st and 4th shaped as a thick log; 5th to 10th serrate; last segment semioval with obliquely truncate apex, about 1.35 times as long as wide. Pronotum about 1.43–1.45 times as wide as the length excluding anterior medial lobe; surface more or less intricately rugose; an-

New Species of Yakuhananomia from Taiwan





terior medial lobe fully protruded, but somewhat shorter than in Y. yakui and Y. tsuvukii; hind angle rather angulate, though the tip is narrowly rounded; lateral margin arched in dorsal view, nearly straight in lateral view. Scutellum almost square, with hind angle roundly projected latero-posteriad. Elytra narrower than pronotum and the maximum width of metacoxae in dorsal view, about 2.25 times as long as wide; sides widest behind humeri, rather sinuately convergent apicad; surface punctured as follows: areas near base intricate, humeri and the areas behind them evidently, intricately rugose, the other parts densely covered with deep punctuations, each of which is more or less longitudinal; apex separately rounded. Pygidium very short, 1.21 times as long as wide, moderately flattened as compared with those of Y. vakui and Y. tsuyukii; sides gradually, very slightly roundedly convergent in less than basal halves, apparently and straightly so in more than apical halves, without dorsal median carina; apex broadly truncate in dorsal view, the vertical section being circular, subsiding, with a distinct long projection at an upper central portion. Anal sternite short, about 1.3 times as wide as long, about 0.64 times as long as pygidium, faintly roundedly narrowed towards apex which is narrowly truncate. Front tibia straight in dorsal view, curved downwards in lateral view. Hind tibia with only one comb just before apex; inner spur about 2.5 times as long as outer one.

Body length (incl. head and excl. pygidium): 7.2, 8.0 mm. Elytral length: 5.0, 5.3 mm.

Type series. Holotype: \mathcal{Q} , Tapang, 1,500 m in alt., Taichung Hsien, central Taiwan, 24–VII–1994, T. HATTORI leg., in Kanagawa Prefectural Museum of Natural History, Odawara. Paratype: 1 \mathcal{Q} , Kukan, Taichung Hsien, central Taiwan, 4–IX–1989, K. RA leg., in my collection.

Distribution. Central Taiwan.

Notes. The present new species is closely similar to *Y. yakui* (KÔNO) from Russia, Hokkaido and Honshu and *Y. tsuyukii* TAKAKUWA from Honshu in the elytral maculate pattern, but evidently differs from them in the following respects: head hardly excavated at pre-vertex (broadly, shallowly excavated and with a distinct concavity in the

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latter two); last segment of maxillary palpus with outer margin gently rounded (almost straight in basal part and distinctly curving in apical 3/4-4/5 in *yakui*); medial longitudinal blackish mark of pronotum rather elongated quadrate (elongate elliptical in the latter two); each elytral yellowish maculation behind scutellum longer than in the latter two, not connected with premedian yellowish fascia (connected with that along suture in the latter two); pygidium straightly narrowed apicad in more than apical half (roundedly so before apex which is rather parallel-sided in the latter two), without dorsal median carina (usually with longitudinal carina at about apical half in the latter two), lacking clear maculation (with large blackish mark in the latter two), and more broadly truncate at apex in dorsal view; apical vertical section of pygidium circular (oval in the latter two); anal sternite narrower, about 1.3 times as wide as long (usually a half wider than long in the latter two).

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A New Species of the Genus *Formosotoxotus* (Coleoptera, Cerambycidae) from Kalimantan

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Abstract A fourth species of the lepturine genus *Formosotoxotus* is described from Kalimantan, Indonesia, under the name *F. uenoi* N. OHBAYASHI, sp. nov.

Up to the present time, three lepturine species have been known as the members of the genus *Formosotoxotus*. Recently, I had an opportunity to examine some specimens of this genus from various areas of Southeast Asia through the courtesy of my friends. After a careful examination, I have concluded that the collection contains a species new to science. In this paper, I am going to describe it together with drawings of its male genitalia. The types to be designated are preserved in the collection of the Entomological Laboratory, Ehime University.

I wish to express my sincere gratitude to Dr. Shun-Ichi Uéno of the National Science Museum (Nat. Hist.), Tokyo, for his continuous guidance on my study. My thanks are also due to Prof. Masataka SATÔ of Nagoya Women's University, and Dr. Masahiro SAKAI of Ehime University for their kind support in various ways, and also to Messrs. M. TÔYAMA and S. NAGAI for their kindness in supplying valuable materials used in preparing this paper.

Formosotoxotus uenoi N. OHBAYASHI, sp. nov.

(Figs. 1-6)

Male. Body robust and stocky; colour dark chestnut brown except for basal three-fifths of each femur which is yellowish brown; dorsal surface densely clothed with glossy pale yellowish pubescence which is irregularly arranged in various directions and showing marmoraceous reflection on elytra.

Head longer than pronotum, slightly narrowed posteriad behind eyes; mandibles large and stout; labrum depressed medially; clypeus narrowly transverse; frons separated from antennal tubercles by a deep Y-shaped groove which runs backwards to occiput through vertex; antennal tubercles strongly elevated and extending forward like ridges. Eyes very coarsely faceted, large, almost oval and slightly emarginate behind antennal insertions. Antenna slender, almost filiform though each segment is slightly thickened apically, not reaching the apex of elytra; scape distinctly curved, inserted laterally to antennal insertion; relative length of each segment as follows:— 45: 13: 40: 40: 50:

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Figs. 1-2. Formosotoxotus uenoi N. OHBAYASHI, sp. nov.; 1, holotype (male); 2, allotype (female).

50: 50: 45: 43: 40: 46. Maxillary palpus with last segment spindle-shaped, broadest at basal two-thirds, roundly pointed at apex.

Pronotum trapezoidal with lateral conical tubercles, widest across the tubercles, 1.18 times wider than long, narrowly margined at apex and base; base 1.33 times as wide as apex; disc provided with two pairs of tubercles, of which the anterior ones are large and conical, and the posterior ones are low and transverse ridge-like. Scutellum nearly tongue-shaped.

Elytra less than twice as long as wide, broadest at humeri, nearly parallel-sided from humeri to apical one-fifth, then gently curved to rounded sutural apex; disc slightly convex at both sides behind scutellum and provided with a pair of indistinct carina extending from just behind humeri to middle of apical one-third, sparsely provided with large distinct punctures like dents; the pubescence around these dents radially arranged.

Legs rather short and stout; femur clavate; all the tibiae distinctly depressed and about twice as wide as thickness: each tarsus with first to third segments dilated apically, third segment deeply emarginate, the first segment as long as the second and third combined.

Male genitalia slender; tegmen with lateral lobes one-fourth as long as its total length; median lobe gradually narrowed toward roundly pointed apex with dorsal



Figs. 3-6. Male of *Formosotoxotus uenoi* N. OHBAYASHI, sp. nov.; 3, dorsal view of eighth abdominal tergite; 4, dorsal view of tegmen; 5, dorsal view of median lobe; 6, lateral view of median lobe (part). Scale: 1.0 mm.

plate not reaching the apex. Eighth abdominal tergite deeply emarginate at the apex. Length (from the tip of mandible to elytral apex): 9.4 mm; width (across humeri): 3.4 mm.

Female. Almost the same as male, but different from it in the following points: Antenna short and the relative length of each segment as 35: 12: 30: 30: 38: 35: 33:30: 30: -: - (lacking the last two segments); pronotum with discal tubercles more or less weaker than in male; legs with each tibia normal, thickened apically and not depressed.

Length (from the tip of mandible to elytral apex): 7.5 mm; width (across humeri): 2.5 mm.

Type series. Holotype: male, Mt. Berangin, W. Kalimantan, Indonesia, VIII-1992, collected by a native. Allotype: female, Mt. Saran, W. Kalimantan, Indonesia, IX-1992, collected by a native.

Notes. This new species is the fourth species of the genus *Formosotoxotus* and easily distinguished from the other three known species by the following features: body dark chestnut brown and basal three-fifths of each femur yellowish brown; elytral pubescence irregularly arranged in various directions, especially radially arranged

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around the dents and showing marmoraceous reflection; each tibia strongly depressed in male.

This interesting species is dedicated to Dr. Shun-Ichi UÉNO for commemorating his retirement from the head of the Department of Zoology, National Science Museum, Tokyo.

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Two New *Glaphyra* (Coleoptera, Cerambycinae) from Taiwan

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Abstract Two new species of the molorchine genus *Glaphyra* are described from Taiwan under the names *G. uenoi* and *G. concolor*. The former is somewhat allied to *G. lishanensis* and *G. jiuyuehtana*, and the latter to *G. subgrabra* and *G. rufosternalis*. Six Taiwanese species currently placed in the genus *Molorchus* are transferred to *Glaphyra*.

Six species have been added to the molorchine fauna of Taiwan since the revisional study of the genus *Molorchus* by HAYASHI and MATSUDA (1976); they were mostly described by HAYASHI (1984) except for only one species by NIISATO (1986). The molorchine fauna of Taiwan seems to be very rich, since fifteen species of the genus *Glaphyra* including six species currently placed in *Molorchus* have previously been recorded. And also, I have examined still more unrecorded species of the genus from that island.

In the present paper, I am going to describe two new species of *Glaphyra* from Taiwan, one of which will be named after Dr. Shun-Ichi Uéno in commemoration of his retirement from the National Science Museum (Nat. Hist.), Tokyo. The abbreviations used herein are the same as those explained in the previous papers of mine.

Before going into details, I wish to express my hearty thanks to Dr. Shun-Ichi UÉNO for his constant guidance and reading through the manuscript of this paper. Thanks are also due to Dr. Keishi KINUGASA, and Messrs. Wenron CHEN, Jun ITO, Takeshi ITO, Sumao KASAHARA, Tôru SHIMOMURA and Masatoshi TAKAKUWA, for their offer of material and/or help for the present study.

Glaphyra (s. str.) uenoi sp. nov.

(Figs. 1, 3-4, 7-9)

Small species of slender body form, with thin appendages. Colour blackish brown to dark reddish brown, more reddish on appendages, shiny; elytra dark brown, decorated with subquadrate pale yellow maculation on centre of basal 5/9; peduncular parts of femora pale yellow, though the fore one is usually yellowish brown; abdomen reddish brown (\mathcal{J}) or dark yellowish brown (\mathcal{Q}). Hairs sparse though long and strongly erect.

Head rather small and not so transverse, moderately convex posteriad, though weakly concave near vertex, HW/PA 1.08–1.20 (M 1.14), coarsely punctured; frons gently convex, FL/FB 0.65–0.81 (M 0.73), with arcuate grooves along the lateral sides

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deep and rather broad, and a median longitudinal groove weak and narrow, usually reaching vertex, sparsely scattered with punctures and thinly haired; clypeus moderate, nearly 1/3 as long as base, which is weakly emarginate; genae moderate, 2/5-1/2 the depth of lower eye-lobes; eyes moderately prominent, separated from each other by a little more than 1/2 the maximum width of head; antennae eleven-segmented in $\vec{\sigma}$, slender and relatively long, 1.34 ($\vec{\sigma}$) or 0.68–0.75 times as long as body, barely reaching the apical margin of 5th abdominal tergite in \mathcal{Q} , clothed with dense minute pubescence on segments 5–11, scape weakly clavate, provided with a few punctures, nearly equal in length to ($\vec{\sigma}$) or slightly longer than (\mathcal{Q}) segment 3, segment 3 a little shorter than segment 4 and 7/10 the length of segment 5, segments 5–7 nearly equal in length ($\vec{\sigma}$) or slightly decreasing in length (\mathcal{Q}), terminal segment slightly longer than the preceding segments, narrowly hooked at the extremity.

Pronotum small and moderate in length, nearly parallel-sided though feebly contracted to apex and moderately so near base; PL/PA 1.53 in 3° , 1.51–1.59 (M 1.54) in \mathfrak{P} , PB/PA 0.90 in 3° , 0.78–0.88 (M 0.82) in \mathfrak{P} , PW/EW 0.83 in 3° , 0.81–0.83 (M 0.82) in \mathfrak{P} , PL/EL 0.81 in 3° , 0.88–0.92 (M 0.90) in \mathfrak{P} ; sides narrowed for a short distance from apex, weakly divergent (3°) or weakly sinuate (\mathfrak{P}) to basal 2/5, then moderately (3°) or weakly rounded (\mathfrak{P}), though the most prominent part in male is provided with a vague small tubercle on each side, and then constricted and gently dilated to basal angles; apex weakly arcuate; base arcuate though slightly emarginate near middle; disc weakly convex, slightly impressed just behind apex, strongly so in basal 1/5, scattered with large punctures, provided with a pair of irregular small impunctured area on apical 1/5 and oblong or rounded large one on centre naer the middle, though the former pair are usually difficult to observe in female, clothed with sparse erect long brownish hairs, and with dense recumbent silvery white pubescence on sides of apical 1/5 and basal 1/5. Scutellum quadrate, small, densely clothed with pale yellow pubescence.

Elytra moderate in length, EL/EW 1.30–1.39 (1.34), reaching the basal 1/3 of 3rd abdominal tergite, not exposing the sides of metathorax, narrowly dehiscent in apical 5/11; sides moderately prominent at humeri, arcuately and rather distinctly narrowed to apex, where they are narrowly rounded; disc gently convex, slightly impressed near suture just behind scutellum and obliquely so just behind middle, rather sparsely punctured and rather sparsely clothed with short to medium-sized erect pale hairs. Hind wing a little less than 1+3/10 the length of hind body, moderately emarginate in base of hind margin, with two anal veins rather lightly sclerotized.

Prosternum rugosely punctured and rather densely clothed with irregular-sized pale hairs; prosternal process narrow and moderately vertical, almost reaching the level of the posterior margins of fore coxae; furcasternum well developed and slightly extending to the level of the hind margins of epipleura, with a short median anterior process. Meso- and metathoraces sparsely punctured, haired as in prosternum, though densely clothed with pale pubescence at the sides of mesothorax (especially on mesepimera) and near hind coxae. Abdomen long and elongate in δ , very sparsely

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Fig. 1. *Glaphyra* (s. str.) *uenoi* sp. nov., 3 (holotype), from Paichi, northern Taiwan. Scale: 2 mm.

punctured, rather sparsely clothed with long pale hairs and also with dense pale pubescence at the sides of sternites 4-6 (3-6 in two female paratypes).

Legs thin and relatively long; hind legs a little more than 9/11 the length of body in 3° , with femur gradually clavate in apical 1/2, and the first tarsal segment a little longer than the following two segments combined.

Male genital organ small and rather broad, weakly sclerotized. Median lobe fairly broad; apical lobe moderately convex in profile, with rather long median struts,

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7/10 the whole length of median lobe; dorsal plate broad and nearly parallel-sided, roundly truncate at apex; ventral plate moderately bent downwards near apex, with sides arcuately emarginate, the apical margin subtruncate with weak emargination near the middle. Tegmen nearly 1/2 the length of median lobe; paramere triangularly narrowed to apex, the apex pointed and provided with five short setae.

Body length: 5.8-6.3 mm.

Type series. Holotype \mathcal{J} , Paichi, ca. 300 m in alt., Tachi Shi, Taoyuan Hsien, northern Taiwan, 30–III–1979, T. Iro leg. Allotype \mathcal{Q} , same locality as the holotype, 5–IV–1978, J. Iro leg. Paratypes: 1 \mathcal{Q} , Lienhwachih, about 800 m in alt., Yuchih Hsiang, Nantou Hsien, central Taiwan, 11–III–1979, T. Iro leg.; 1 \mathcal{Q} , same locality as the preceding, 14~16–III–1980, T. SHIMOMURA leg. The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, and the paratypes are separately deposited in the private collection of the above collectors.

Notes. Glaphyra uenoi is one of the smallest of the Taiwanese species of the genus, and is characterized by the delicate body with thin antennae and legs, the small and subparallel-sided pronotum which has three impunctured areas in the male, and the weakly clavate hind femur. This species is somewhat similar to *G. lishanensis* (HAYASHI, 1974, p. 22) described from the central mountains of Taiwan, but is decisively distinguished from it by the different pattern of the impunctured area of male pronotum (those of *G. lishanensis* are composed of five developed ones), the subquadrate pale maculation on each elytron which is hardly projected externally, and the thinner antennae and legs. This new species is also similar to *G. jiuyuehtana* HAYASHI (1984, pp. 89–90), but differs from the latter in the basal pale maculation on the elytra and the clavation of the hind femora.

This species shows considerable individual variation in the arrangement of pubescence on the abdominal sternites. In most members of *Glaphyra*, the pubescent pattern is one of the important characters for determination of the species. In the specimens from Paichi of northern Taiwan $(1 \triangleleft^{\circ} \text{ and } 1 \triangleleft)$, the sides of the 3rd sternite have no pubescent maculation, while in those from Lienhwachih of central Taiwan $(2 \triangleleft^{\circ} \triangleleft)$ they are densely and largely pubescent.

Glaphyra (s. str.) concolor sp. nov.

(Figs. 2, 5-6, 10-12)

Relatively small species of robust body form. Colour black to blackish chestnut brown, dark reddish brown on abdomen, antennae and legs, without pale parts on elytra and the peduncles of femora.

Head relatively small, not so voluminous, HW/PA 1.11–1.24 (M 1.17), moderately convex though depressed in front, slightly and broadly concave near vertex, sparsely covered with rather large punctures, though slightly rugose posteriorly; frons with arcuate grooves along the lateral sides entire though relatively weak, and a median longitudinal groove usually deep and extending to the anterior part of occiput, sparsely

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Fig. 2. *Glaphyra* (s. str.) *concolor* sp. nov., of (holotype), from Nanshanchi, central Taiwan. Scale: 2 mm.

provided with coarse punctures, and thinly clothed with pale hairs, FB/FL 0.70–0.84 (M 0.75); clypeus rather long, nearly 2/5 the basal width, with base weakly and arcuately emarginate; genae narrow, 1/3 the depth of lower eye-lobes; eyes rather weakly prominent, separated from each other by about 1/2 the maximum width of head; antennae slender and relatively long, 1.41 ($\stackrel{\circ}{\circ}$) or 0.65–0.68 times as long as body, clothed with dense minute pubescence on segments 5–11, 11-segmented and almost filiform (though weakly thickened apically on segments 3 and 4) in $\stackrel{\circ}{\circ}$, reaching the posterior

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margin of 4th abdominal tergite and weakly serrate at segments 5–8 in \mathcal{Q} , scape hardly clavate apicad, nearly impunctured, slightly longer than segments 3, segment 4 a little longer than segment 3 and distinctly (a) or slightly (a) shorter than segment 5, terminal segment narrowly appendiculate (a) or simply acute (a) at the extremity.

Pronotum moderate, not so wide, weakly contracted to apex and moderately so to base; PL/PA 1.59 in ♂, 1.44-1.58 (M 1.50) in ♀, PB/PA 0.92 in ♂, 0.89-0.95 (M 0.93) in ♀, PW/EW 0.79 in ♂, 0.77-0.83 (M 0.81) in ♀, PL/EL 1.00 in ♂, 1.08-1.16 (M 1.10) in Q; sides weakly constricted just before apex, moderately arcuate to apical 1/5, then weakly arcuate and divergent to near middle (\mathcal{J}) or gradually divergent to near middle (\mathcal{Q}) and then weakly rounded with small lateral tubercles (\mathcal{J}) or moderately rounded (Q), and with the constricted parts of basal 1/5 subparallel and slightly sinuate; apex slightly rounded and weakly emarginate near the middle; base weakly bisinuate; disc moderately convex except for basal 1/5, weakly concave just behind apex, coarsely scattered with large punctures except for apical 1/5 and on the five smooth parts, a pair of large oblique oblong ones of the latter being situated in apical 3/10 to the middle, a pair of small rounded ones on basal 3/10 (though both the pairs are joining in 3), and also a median small oblong one near the middle, sparsely clothed with long erect pale hairs, and partially with dense silvery white pubescence at the sides of apical 1/5 and basal 1/6. Scutellum subquadrate, moderate in size, densely clothed with silvery white pubescence.

Elytra broad and moderate in length, reaching the postertior part of 3rd abdominal tergite, EL/EW 1.09–1.11 (M 1.10), slightly exposing the sides of metathorax, with sutural margins moderately arcuate and dehiscent in apical 7/12; sides with humeri rather strongly projecting forwards, then gradually though weakly arcuately narrowed towards apices which are rather narrowly rounded; disc gently raised, distinctly and longitudinally concave near suture behind scutellum, and moderately so on each arcuate longitudinal part between the middle of basal 1/6 and the suture of apical 1/3; punctuation sparse though distinct, somewhat rugulose near apices; hairs short and rather sparse. Hind wings a little less than 1+2/5 the length of hind body, slightly emarginate in bases of hind margins, with two anal veins heavily sclerotized.

Prosternum moderately raised near the middle, rugosely punctured and clothed with long pale hairs; prosternal process moderate, strongly narrowed towards apex and moderately vertical, slightly exceeding the level of the middle of fore coxae; furcasternum well developed and extending to the level of the hind margins of epipleura, with a moderate median anterior process. Meso- and metathoraces moderately provided with small punctures though roughened on mesosternum, haired as in prosternum though most hairs are strongly erect, and also with dense pale pubescence on mesepimera and near hind coxae. Abdomen elongate and rather long in 3, sparsely provided with small punctures, moderately clothed with long erect pale hairs and also with dense pale pubescence at the sides near apical margins of sternites 3–5 and those of most part of sternites 6–7.

Legs stout and relatively long; hind legs nearly 4/5 the length of body in 3, with



Figs. 3–6. Habitus of *Glaphyra* spp. — 3–4, *G*. (s. str.) *uenoi* sp. nov., $\sigma(3)$, $\varphi(4)$; 5–6, *G*. (s. str.) *concolor* sp. nov, $\varphi(5)$, $\sigma(6)$.

femur gradually clavate in apical 7/12 and provided with coarse punctures, the first tarsal segment a little longer than the following two segments combined.

Male genital organ slender and moderately sclerotized. Median lobe long and slender, hardly arcuate in profile, with long median struts which is 3/10 the whole length of median lobe; dorsal plate with sides arcuately emarginate near base and weakly narrowed to subtruncate apex; ventral plate strongly bent downwards near apex, with sides moderately divergent to middle, then arcuate and narrowed to apex, whose tip is bluntly tuberculate. Tegmen slender, nearly 1/2 the length of median lobe; paramere long and narrow, gradually narrowed to apex, which is provided with short setae.

Body length: 6.1-7.2 mm.

Type series. Holotype \mathcal{J} , Nanshanchi, ca. 1,000 m in alt., Jenai Hsiang, Nantou Hsien, central Taiwan, 7–IV–1980, T. SHIMOMURA leg. Allotype \mathcal{Q} , near Liukuei, Kaohsiung Hsien, central Taiwan, 7–IV–1985, W. CHEN leg. Paratypes: $4 \mathcal{Q} \mathcal{Q}$, near Shengping, ca. 1,000 m in alt., near Liukuei, 8–III–1983, W. CHEN leg. The holotype and allotype are deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, and the paratypes are separately deposited in the private collection of the above collectors.

Notes. Though differing in facies, especially in the small body, this new species has some relationship with G. subgrabra (GRESSITT, 1938, p. 150), comb. nov. and G.

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Figs. 7–12. Male genital organ of *Glaphyra* spp. — 7–9, *G*. (s. str.) *uenoi* sp. nov.; 10–12, *G*. s. str.) *concolor* sp. nov; 7, 10, median lobe in dorsal view; 8, 11, apical part of median lobe in ventral view; 9, 12, tegmen in dorsal view. Scale: 0.25 mm.

rufosternalis (HAYASHI, 1984, pp. 87–88), comb. nov. They are recognized at first sight by the black body with globular prothorax and the long filiform antennae in the male. Besides, the sexual differentiation in the shape of prothorax and the length of antennae is common in the three species, and the latter dimorphism is similar to that of the species of *Epania*. It is also related in several respects to *G. kiyoyamai* (HAYASHI, 1974, p. 21) widespread in the mountain areas of Taiwan, but the wide gap is recognized between the two species in such basical morphology as the arrangement of the pubescence on antennal segments (segment 4 is clothed with dense minute pubescence in *G. kiyoyamai*). It may be related to *G. liukueiensis* HAYASHI (1984, p. 90) in the unicoloured body; however, this new species differs from the latter in the conspicuous white pubescent maculations on the pronotum and fairly broad elytra with distinct punctuation.

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Taxonomical Status of Some Taiwanese Molorchine Species

According to my provisional review of the Japanese Molorchini (NIISATO, 1986, pp. 7–12), species of the genus *Glaphyra* are clearly discriminated from those of *Molorchus* by the posteriorly extended furcasternum of the prothorax (the fore coxal cavities are closed in external view), the large eyes which are approximate to the mandibles, and the isolated two anal veins. It is doubtless that all the Taiwanese species which are currently placed under the genus *Molorchus* should be transferred to *Glaphyra* by the above morphological differences.

Glaphyra (s. str.) subglabra (GRESSITT, 1938), comb. nov.

Epania subglabra GRESSITT, 1938, Philip. J. Sci., 65, p. 150, pl. 1, fig. 7; type locality: Hassenzan, Formosa (designated in 1951, Longicornia, 2, p. 168).

Molorchus (Molorchus) subglabrus: HAYASHI & MATSUDA, 1974, Bull. Osaka Jonan Women's Jr. Coll., (6), p. 34, pl. 1, fig. 5, pl. 3, fig. 42, pl. 4, fig. 63, pl. 5, fig. B.

Molorchus subglabrus: NAKAMURA et al., 1992, Check-list Longic.-beetl. Taiwan, p. 36.

Glaphyra (s. str.) rufosternalis (HAYASHI, 1984), comb. nov.

Molorchus rufosternalis HAYASHI, 1984, Ent. Rev. Japan, **39**, pp. 87–88, pl. 3, fig. 4; type locality: Dokuritsuzan, Chiayi Hsien (holotype), and Liukuei, Kaohsiung Hsien. — NAKAMURA *et al.*, 1992, Check-list Longic.-beetl. Taiwan, p. 36.

Glaphyra (s. str.) yui (HAYASHI, 1984), comb. nov.

Molorchus yui HAYASHI, 1984, Ent. Rev. Japan, **39**, p. 88; type locality: Rarashan, Taipei Hsien. — NAKAMURA et al., 1992, Check-list Longic-beetl. Taiwan, p. 36.

Glaphyra (s. str.) cupreoviridis (HAYASHI, 1966), comb. nov.

Molorchus (Linomius) cupreoviridis Науаяні, 1966, Bull. Osaka Jonan Women's Jr. Coll., (1), p. 5; type locality: Tattaka, northern Taiwan. — Науаяні & Матѕида, 1974, Bull. Osaka Jonan Women's Jr. Coll., (6), p. 29, pl. 1, figs. 21–22, pl. 2, fig. 23, pl. 3, fig. 51, pl. 4, fig. 70.
 Molorchus cupreoviridis: NAKAMURA et al., 1992, Check-list Longic.-beetl. Taiwan, p. 36.

Glaphyra (s. str.) taiwana (HAYASHI et MATSUDA, 1974), comb. nov.

Molorchus (Molorchus) taiwanus HAYASHI et MATSUDA, 1974, Bull. Osaka Jonan Women's Jr. Coll., (6), pp. 32–33, pl. 5, figs. A; type locality: Meifeng, Nantou Hsien (holotype), and Lishan, Taichung Hsien, Taiwan.

Molorchus taiwanus: NAKAMURA et al., 1992, Check-list Longic.-beetl. Taiwan, p. 36.

Glaphyra (s. str.) semitaiwana (HAYASHI, 1984), comb. nov.

Molorchus semitaiwanus HAYASHI, 1984, Ent. Rev. Japan, 39, pp. 88-89, pl. 3, fig. 6; type locality:

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Liukuei (holotype) and Fengshan, Kaohsiung Hsien, Taiwan. — NAKAMURA et al., 1992, Check-list Longic.-beetl. Taiwan, p. 36.

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Taxonomic Changes in the Japanese Cerambycidae (Coleoptera)

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Abstract Taxnomic changes are proposed for five Japanese species of the subfamilies Lepturinae and Lamiinae of the Cerambycidae. Two new taxa are recognized: *Pachyta uenoi* sp. nov. and *Ropica japonica amamiana* subsp. nov. *Ropica nobuoi* BREU-NING et OHBAYASHI is regarded as a junior synonym of *Pterolophia (Pseudale) oshimana* BREUNING. Two new combinations are proposed: *R. japonica japonica* HAYASHI, stat. nov., and *R. japonica tokarana* TAKAKUWA, stat. nov.

Subfamily Lepturinae

Tribe Rhagiini

Pachyta uenoi sp. nov.

[Japanese name: Kyushu-kiberikatabiro-hana-kamikiri]

(Figs. 1 C, 2 C, 3 C, 4 C, 5 C, 6 C, 7 C, C', 8)

Pachyta erebia: KUSAMA & TAKAKUWA, 1984, Longic.-Beetles Japan Col., pp. 162–163, pl. 8, fig. 42 e.

Male. Form robust, tapering posteriorly. Color black, apical segments of maxillary palpi dark chocolate brown; head, pronotum and elytral humeri covered with white hairs; first to fifth segments of antennae with silvery pubescence, the last sixth segments with fine brown pubescence; elytra brown except for margins, suture and large Y-shaped marking; ventral surface clothed with silvery pubescence, apical 1/3 of fore tarsi with golden yellow pubescence on ventral sides.

Head small, narrower than pronotum, temples and neck continuous, frons moderately long, genae as long as eyes; vertex concave, coarsely punctate; pubescence somewhat long, fine, suberect; antennae slender, inserted below anterior margin of eyes, about as long as body, relative lengths of segments (%):— 8.4: 2.0: 11.7: 9.7: 12.0: 10.4: 10.4: 8.4: 8.4: 8.0: 10.7, first to fifth somewhat coarsely pubescent, sixth to eleventh densely minutely pubescent, antennal tubercles contiguous; eyes finely faceted, shallowly notched.

Pronotum longer than broad, sides broadly tuberculate, deeply impressed at base and apex; disc strongly convex, medially grooved; pubescence somewhat dense, long, erect and suberect; surface dull shining, confluently and separately punctate; prosternum confluently and rugosely punctate, densely clothed with long erect hairs; meso-

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Fig. 1. Pachyta spp., 3; A, P. lamed lamed (LINNAEUS) from Hokkaido; B, P. erebia BATES from Nagano Pref.; C, P. uenoi sp. nov. from Kumamoto Pref., holotype.

sternum deeply and confluently punctate, clothed with long, erect and suberect hairs; metasternum shallowly and minutely punctate, densely clothed with fine, long, sub-depressed pubescence.

Scutellum triangular, longer than broad, apex rounded; disc concave, finely and minutely punctate, densely covered with fine and suberect pubescence.

Elytra 1.8 times as long as broad, tapering apically; basal margin strongly elevated above scutellum; base moderately coarsely, confluently punctate; surface dull shining, minutely pubescent at the most; apices slightly obliquely, deeply emarginate-truncate, both angles well developed.

Legs slender, densely pubescent; posterior femora attaining apex of elytra; tibiae entire, spurs terminal; first segment of posterior tarsi longer than the following two together, third segment cleft to middle.

Abdomen densely clothed with long, subdepressed, S-shapedly curved pubescence; apex of seventh sternite somewhat sinuately rounded; apex of eighth tergite sinuately truncate.

Median lobe of male genitalia with median struts strongly curved (Fig. 8 b), apex of ventral plate strongly projected (Fig. 8 b); tegmen with basal-piece (Fig. 8 a), lateral lobes clothed with long, dense setae at apex (Fig. 8 a').

Body length: 18.1 mm.



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Female. Unknown.

Distribution. Central Kyushu.

Type material. Holotype male, (Type No. 3001, Kyushu University), Shiiya Pass, Kumamoto Pref., Kyushu, 26–VII–1974, on the flower of *Hydrangea paniculata* SIEB. (Saxifragaceae), K. YAMASAKI leg.

Type depository. The holotype is preserved in the collection of the Entomological Laboratory, Faculty of Agriculture, Kyushu University.

This species is named in honour of Dr. Shun-Ichi UÉNO of the National Science Museum, Tokyo, in commemoration of his retirement and for his contribution to the entomology.

This new species is related to *P. erebia* BATES from central Honshu, and similar to *P. lamed lamed* (LINNAEUS) from Hokkaido, northern and middle Europe, Siberia etc., but distinguishable from it by the following key.

Key to the Pachyta spp. from Japan in Male

 Vertex shallowly, finely punctate (Fig. 2 A); first to fifth segments of antennae shining, with short black pubescence; pronotum broader than long (Fig. 4 A), finely punctate; scutellum flat, broader than long; fore tarsi with black pubescence; elytra shining, shallowly punctate (Fig. 5 A), apices shallowly emarginate-truncate (Fig. 6 A); seventh abdominal sternite with a small projection at apex (Fig. 7 A); eighth abdominal tergite rounded (Fig. 7 A)

..... P. lamed lamed (Fig. 1 A).

- Vertex deeply, confluently and rugosely punctate (Fig. 2 B-C); first to fifth segments of antennae dull shining, with long white pubescence; pronotum as long as broad (Fig. 4 B) or longer than broad (Fig. 4 C), confluently and rugosely punctate; scutellum concave, longer than broad; fore tarsi with golden yellow pubescence; elytra dull shining, deeply punctate (Fig. 5 B-C), apices deeply truncate (Fig. 6 B-C); seventh abdominal sternite rounded at apex (Fig. 7 B-C); eighth abdominal tergite sinuate truncate (Fig. 7 B-C) 2.
- Genae as long as eyes (Fig. 3 C); apical segments of maxillary palpi dark chocolate brown; pronotum longer than broad (Fig. 4 C); dorsal tubercles of pronotum well developed, without depressions; outer apical angles of elytra well developed



Fig. 7. Eighth abdominal tergite (A–C) and seventh abdominal sternite (A'–C') of *Pachyta* spp., ventral view, ♂; A–C same as Fig. 1, A'–C' same as A–C.

Taxonomic Changes in the Japanese Cerambycidae



Fig. 8. Male genitalia of *Pachyta uenoi* sp. nov.; a, a', tegmen; b, b', median lobe; a, b, lateral view; a', b', ventral view.

Subfamily Lamiinae

Tribe Pteroplini

Pterolophia (Pseudale) oshimana BREUNING

Pterolophia (Pterolophia) oshimana BREUNING, 1955, Bull. Soc. ent. Fr., 60, p. 64.

Pterolophia (Pseudale) oshimana: KUSAMA & TAKAKUWA, 1984, Longic.-Beetles Japan Col., p. 412, pl. 60, figs. 450, 450 a.

Ropica nobuoi BREUNING et OHBAYASHI, 1964, Bull. Jpn. ent. Acad., 1 (4), p. 7 [syn. nov.].

Specimens examined. [Amami-Oshima Is.] Hatsuno: $1 \ 0, 13$ -VI-1962, M. SATÔ leg. (paratype of *Ropica nobuoi*); $1 \ 0, 7$ -VII-1962, N. OHBAYASHI leg. (holotype of *R. nobuoi*); $1 \ 0, 15$ -IV-1962, N. OHBAYASHI leg. (paratype of *R. nobuoi*); $10 \ 0, 0, 3 \ 0, 9$, 19-IV-1974, H. MAKIHARA leg. Nishinakama: $25 \ 0, 50 \ 0, 9 \ 0, 1 \ -7$ -VI-1970, H. MAKIHARA leg.; $1 \ 0, 28$ -VI-1975, H. MAKIHARA leg.; $3 \ 0, 50 \ 0, 9 \ 0, 3 \ -5$ -VII-1976. Naze: $2 \ 0, 26$ -V-1970, H. MAKIHARA leg. Ashikebu: $1 \ 0, 9$ -VI-1970, H. MAKI-HARA leg. Yuwan: $2 \ 0, 3 \ 0, 1 \ 0, 29$ -VI-1975, H. MAKIHARA leg.

Distribution. Amami-Oshima Is., the Ryukyu Islands.

Note. Pterolophia (Pseudale) oshimana is a species endemic to Amami-Oshima Is.

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of the Ryukyus. It was described by the late Dr. S. BREUNING in 1955 on the basis of a specimen from Amami-Oshima Is. in the collection of R. OBERTHÜR, and was described again by S. BREUNING and K. OHBAYASHI in 1964 as a new species of another genus, *Ropica*.

Tribe Apomecynini

Ropica japonica japonica HAYASHI, stat. nov.

(Fig. 9)

Ropica formosana: HAYASHI, 1956, Ent. Rev. Japan, 7: 15 [nec BATES]. Ropica formosana japonica HAYASHI, 1972, Ent. Rev. Japan, 24: 37. Ropica nobuoi japonica: MAKIHARA, 1985, Coleopterists' News, Tokyo, (67/68): 2.

Specimens examined. [Yakushima Is.] Anbo: $1 \stackrel{<}{\circ}, 9 \stackrel{<}{\circ} \stackrel{<}{\circ}, 30-V \sim 1-VI-1969$, H. Makihara leg.; $10 \stackrel{<}{\circ} \stackrel{<}{\circ}, 20 \stackrel{<}{\circ} \stackrel{<}{\circ}, 6 \sim 8-VI-1969$, H. Makihara leg.; $4 \stackrel{<}{\circ} \stackrel{<}{\circ}, 2 \stackrel{<}{\circ} \stackrel{<}{\circ}, 24-VII-1976$, S.-I. Naomi leg. Onoaida: $1 \stackrel{<}{\circ}, 24-VII-1976$, S.-I. Naomi leg. Kurio: $2 \stackrel{<}{\circ} \stackrel{<}{\circ}, 1 \stackrel{<}{\circ}, 27-VII-1975$, H. Makihara leg.

Distribution. Yakushima Is. off southern Kyushu.

Ropica japonica tokarana TAKAKUWA, stat. nov.

(Fig. 10)

Ropica formosana: HAYASHI, 1956, Bull. Osaka Mus. nat. Hist., (9): 16, pl. 5, fig. 7 [nec BATES]. Ropica formosana tokarana TAKAKUWA, 1984, Longic.-Beetles Japan Col., p. 12, pl. 57, figs. 414 b-d. Ropica nobuoi tokarana: MAKIHARA, 1985, Coleopterists' News, Tokyo, (67/68): 3.

Specimens examined. [Tokara Isls.] Kuchinoshima Is.: $27 & 37, 28 \neq 9, 26$ –VI~ 3–VII–1969, H. Makihara leg. Nakanoshima Is.: $233, 8 \neq 9, 23$ –VI–1973, H. Makihara leg.; $433, 4 \neq 9, 19, 20$ –VI–1975, H. Makihara leg. Akusekijima Is.: 333, 19, 30–VI–1969, M. Sakai leg.

Distribution. Tokara Isls. (Kuchinoshima Is., Nakanoshima Is., Akusekijima Is.) of the Ryukyu Islands.

Ropica japonica amamiana subsp. nov.

(Fig. 11)

Ropica formosana: HAYASHI, 1962, Ent. Rev. Japan, 14: 14. Ropica nobuoi BREUNING et OHBAYASHI, 1964, Bull. Jpn. ent. Acad., 1 (4), p. 7. Ropica nobuoi nobuoi: MAKIHARA, 1985, Coleopterists' News, Tokyo, (67/68): 2.

This new subspecies is similar to R. *japonica japonica* HAYASHI and R. *japonica tokarana* TAKAKUWA, but can be distinguished by the following key:

Taxonomic Changes in the Japanese Cerambycidae



Figs. 9–11. Ropica japonica subspp.; 9, R. japonica japonica Начаяні from Yakushima Is.; 10, R. japonica tokarana Такакима from Nakanoshima Is. of the Tokara Isls.; 11, R. japonica amamiana subsp. nov. from Amami-Oshima Is., paratype.

Body length 5.9-10.0 mm (in male) or 6.5-10.5 mm (in female).

Host plants. Morus australis POIRET, Ficus Wightiana WALL., F. retusa L. (Moraceae) and Mallotus japonicus MUELL. ARG. (Euphorbiaceae).

Distribution. Amami Isls. (Amami-Oshima Is., Kikaijima Is. and Tokunoshima Is.) of the Ryukyu Islands.

Type material. Holotype 3 (Туре No. 3002 Kyushu University), Nishinakama, Amami-Oshima Is., 5–VII–1975, H. Макінака leg. Paratypes: [Amami-Oshima Is.] Nishinakama: 53 33, 58 99, 1~7–VI–1970, H. Макінака leg.; 2 33, 3 99, 23– V–1973, H. Макінака leg.; 1 9, 24–V–1973, H. Макінака leg.; 2 33, 2 99, 1– VII–1975, H. Макінака leg.; 7 33, 5 99, 26–V–1976, H. Макінака leg.; 4 33, 1 9, 24~26–V–1978, H. Макінака leg.; 1 3, 8–VI–1978, Y. Shono leg. Naze: 1 3, 1 9, 26–V–1970, H. Макінака leg.; 8 33, 3 99, 28–VI–1973, H. Макінака leg.; 6 33, 1 9, 29–VI–1973, H. Макінака leg.; 1 33, 20–IV–1974, H. Макінака leg.; 1 3, 1 9, 28–VI–1975, H. Макінака leg.; 2 33, 1 9, 8–VI–1975, H. Макінака leg.; 6 33, 5 99, 23–V–1978, H. Макінака leg.; 17 33, 6 99, 27–V–1978, H. Макінака leg. Ashikebu: 13 33, 9 99, 23–V–1978, H. Макінака leg. Yuwan: 1 33, 1 9,

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11–V–1972, Y. YOSHIYASU leg. Yuwandake-rindô, 1 \bigcirc , 7–V–1976, J. OKUMA leg. Maru-batake: 1 \bigcirc , 10–V–1976, H. MAKIHARA leg. Yanma: 1 \bigcirc , 5–VII–1976, H. MAKIHARA leg. Kamio-rindô: 1 \bigcirc , 10–VI–1978, J. OKUMA leg. [Kikai-jima Is.] 2 \bigcirc , 20–V–1973, H. MAKIHARA leg. [Tokunoshima Is.] Inokawa: 11 \bigcirc \bigcirc , 10 \bigcirc \bigcirc , 28~31– V–1970, H. MAKIHARA leg.

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Two New Species of the Genus *Mecotropis* (Coleoptera, Anthribidae) from Thailand and the Philippines¹¹

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Abstract Two new species of the anthribid genus *Mecotropis* are described from Thailand and the Philippines under the names *M. uenoi* (from Thailand) and *M. watarui* (from the Philippines).

The genus *Mecotropis* LACORDAIRE (1866, p. 495) comprises forty-five species of anthribid beetles mainly distributed in Southeast Asia. These anthribids are variable in dorsal maculation and colour, proportions of body, structure of head and prothorax, and so on.

JORDAN (1913, pp. 265–268) classified the fourteen species of this genus in the VAN DE POLL collection into three species-groups based on difference in cephalic structure. The first group is characterized by the median groove of rostrum continuing onto the frons, and the anterior margins of eyes straight. The second group is recognized on the groove of rostrum continuing onto the frons, and the sinuate anterior margins of eyes. The last group possesses carinate frons and non-sinuate margins of eyes. *Mecotropis uenoi* SENOH, sp. nov. to be described in this paper belongs to the first group, and *M. watarui* SENOH, sp. nov. to the second group.

This paper is dedicated to Dr. Shun-Ichi UÉNO in commemoration of his retirement from the head of the Department of Zoology, National Science Museum, Tokyo.

Before going further, I wish to express my sincere gratitude to Professor Yasuaki WATANABE of the Laboratory of Entomology, Tokyo University of Agriculture, and Professor Katsura MORIMOTO of the Entomological Laboratory, Kyushu University, for their constant guidance and encouragement. I am much indebted to Dr. Shun-Ichi UéNO of the National Science Museum (Nat. Hist.), Tokyo, for his constant guidance and for reading the original manuscript of this paper, and to Dr. Wataru SUZUKI and Mr. Masatoshi NISHIMURA for their kindness in providing me with the valuable specimens used in this study.

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Mecotropis uenoi SENOH, sp. nov.

(Fig. 1)

Length: 12-21 mm (from apical margin of rostrum to apices of elytra). Relatively slender species.

Male. Colour entirely black. Pubescence dense, black, pale yellow and white; head with two pale yellow stripes from occiput to the basal part of rostrum; antennae with white rings in apical parts of 3rd and 4th segments; black and pale yellow hairs of pronotum and elytra forming leopard-brindled patches; pygidium with a linear black patch at the middle and a pair of longitudinal ones at the sides in basal half; underside mainly covered with pale yellow hairs; legs with white broad rings in middle of first segments of median and posterior tarsi and in basal two-thirds of fifth segments of all the tarsi.

Head slender, extending forwards, with a deep longitudinal sulcus from between eyes to between antennal scrobes, and a distinct one along upper margin of each eye; eyes moderately large, almost hemispherical, moderately convex above, and moderately approximate to each other, anterior margin straight; rostrum slender, thick, rugged, gradually narrowed apicad in basal half, gradually widened in apical half, widest at the bases of mandibles, strongly emarginate at the middle of anterior margin, and with a deep longitudinal sulcus extending from lower margin of each eye to each side of mentum and a pair of deep fossae at the middle of underside; maximum width of rostrum about 1.95 times as wide as the shortest distance between eyes. Antennae long, about 2.5 times as long as the length of body, scape and pedicel relatively thick, proportions in length from 1st to 11th about 18:8:60:75:80:89:87:95:74:12:25, apical segment somewhat curved and pointed.

Pronotum relatively slender, about 1.1 times as long as wide, widest at basal twofifths; anterior margin somewhat emarginate; dorsal transverse carina slightly arcuate, depressed at the middle, and roundly connected with each lateral carina, the latter declivous, extending to the subapical part of side margin; carinula obscure, not reaching dorsal transverse carina. Scutellum small and rounded. Elytra slender, about 1.95 times as long as wide, parallel-sided in basal three-fourths, then narrowed posteriorly; strial punctures small, smaller and shallower in subbasal and apical fourth, distance between them being narrower than the widths of intervals; intervals slightly swollen, and sparsely with rather fine strial punctures; subbasal swellings weak. Pygidium subtrapezoidal, somewhat inclined backwards, about 1.2 times as wide as long, lateral margins reflexed, gradually convergent towards truncated apex; disc slightly swollen except for apical part which is depressed.

Prosternum with a distinct transverse sulcus in front of each coxal cavity; mesosternal process subtriangular, gradually narrowed towards rounded apex; metasternum with a trisinuate sulcus behind median coxal cavities, and with a transverse one in front of posterior coxal cavities; 1st to 4th visible sternites conjointly almost horizontal in lateral view, 5th somewhat slanting. Legs long and thin; anterior, median and

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Fig. 1. Mecotropis uenoi SENOH, sp. nov., d, from Northwest Thailand.

posterior femora subequal in length to one another; anterior tibia distinctly longer than the median which is longer than the posterior; anterior tarsus distinctly longer than the median which is longer than the posterior.

Female. Antennae short, extending basely beyond the basal margins of elytra, 8th and apical four-fifths of 7th segment covered with white hairs, proportions in length from 1st to 11th about 23:11:23:24:24:22:24:16:23:18:28; pygidium linguiform, relatively long, about 1.1 times as long as wide, lateral margins reflexed, gradually convergent towards broadly rounded apex; last visible abdominal segment consisting of pygidium and 5th sternite, and extending backwards.

Type series. Holotype: 3, Doi Suthep, Chiang Mai Prov., NW Thailand, 23– VI–1993, Toshio SENOH leg. Paratypes: $2 \ \varphi \ \varphi$, same data as for the holotype; $1 \ 3$, $2 \ \varphi \ \varphi$, Doi Pui, Chiang Mai Prov., NW Thailand, 7–VI–1980, Toshio SENOH leg.; $1 \ 3$, Doi Pui, Chiang Mai Prov., NW Thailand, 2–VI–1984, Adam Kotton leg. The type

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series is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo. *Distribution*. Northwest Thailand.

Notes. In general appearance, this species is very similar to *Mecotropis duplicatus* JORDAN, 1911, described from Sarawak, Borneo, but can be distinguished from the latter by the following characteristics: pedicel of antennae stumpy; pronotum widest at basal two-fifths; dorsal transverse carina not rounded; 1st tarsal segment of median and posterior legs with white broad rings in middle; 2nd tarsal segment of posterior legs evidently longer than the 5th; prosternum with a distinct transverse sulcus in front of each coxal cavity; and so on.

Mecotropis watarui SENOH, sp. nov.

(Fig. 2)

Length: 18 mm (from apical margin of rostrum to apex of pigidium). Relatively slender species.

Male. Colour entirely black. Pubescence dense, mud yellow and black; head including rostrum and prothorax mainly with mud yellow hairs, except for a round black patch behind each eye and a pair of longitudinal ones on pronotum; antennae with no ring, 1st to basal half of 3rd segments with mud yellow hairs inside; elytra variegated with mud yellow and black hairs; pygidium with a black round patch on anterior half; each abdominal sternite with three black transverse patches along the basal margin except for the 1st which bears a linear one along whole basal margin; legs mottled, with a black band behind middle of posterior femur, with a black ring in apical third to half of each tibia, with one in apical half to two-thirds of each 1st tarsal segment, and with one from apical third of 2nd tarsal segment to claw in each.

Head slender, extending forwards, and with a deep longitudinal sulcus from between eyes to between antennal scrobes; eyes relatively large, well convex above, approximate to each other, anterior margin sinuate in upper half; rostrum slender, thick, gradually narrowed apicad in basal third, gradually widened in apical two-thirds, widest at the bases of mandibles, strongly emarginate at the middle of anterior margin expanded anteriorly, and with a deep longitudinal sulcus extending from the lower margin of each eye to each side of mentum, a deep transverse one behind mentum and a pair of very deep oblong fossae closely behind the deep transverse one; maximum width of rostrum about 3.6 times as wide as the shortest distance between eyes. Antennae long, nearly three times as long as the length of body, scape thick, proportions in length from 1st to 11th about 12: 8: 56: 78: 77: 93: 93: 90: 69: 13: 29.

Pronotum slender, about 1.2 times as long as wide, widest at basal two-fifths; anterior margin somewhat emarginate; disc with a depression in front of dorsal transverse carina, the carina slightly sinuate and roundly connected with each lateral carina, the latter declivous in basal half and horizontally extending to the subapical part of side margin; carinula indistinct. Scutellum small and round. Elytra relatively slender, about 1.78 times as long as wide, parallel-sided in basal three-fourths, then narrowed



Fig. 2. *Mecotropis watarui* SENOH, sp. nov., δ , from Luzon Is., the Philippines.

posteriorly, somewhat depressed before the middle; strial punctures small, distance between them being narrower than the widths of intervals; intervals slightly swollen, and with fine strial punctures; subbasal swellings weak. Pygidium linguiform, somewhat inclined backwards, about 1.15 times as wide as long, lateral margins reflexed, gradually convergent towards broadly rounded apex; disc slightly swollen, somewhat depressed at apical part.

Prosternum without sulcus; mesosternal process relatively slender, gradually narrowed towards apex, somewhat depressed longitudinally; metasternum with a deep transverse sulcus in front of each coxal cavity; 1st to 4th visible sternites conjointly almost horizontal in lateral view, and with a sulcus along anterior margin of the 1st,

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5th somewhat slanting. Legs long and thin; anterior femur a little shorter than the median which is distinctly shorter than the posterior; anterior tibia distinctly longer than the median which is distinctly longer than the posterior; anterior tarsus distinctly longer than the median which is a little longer than the posterior.

Female. Unknown.

Holotype 3, Quezon National Forest Park, near Lucena, Luzon Is., the Philippines, 22–VIII–1979, Wataru Suzuki leg. The holotype is deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Distribution. Luzon Is., the Philippines.

Notes. This species resembles *Mecotropis whiteheadi retipennis* JORDAN, 1928, described from the Island of Musbate, the Philippines, but can be distinguished from the latter by the differently formed markings on both dorsal and ventral sides, particularly immaculate prosternum, and the posterior femur distinctly longer than the median, and so on. The specific name is given in honour of Dr. Wataru SUZUKI who collected this new species on the Island of Luzon, the Philippines.

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A New Genus and Two New Species of the Edaphic Weevils (Coleoptera, Curculionidae) from Japan

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Abstract A new genus of the edaphic weevil, *Edaphotrypetes* gen. nov. and its two new species, *ovipennis* and *parallelipennis* spp. nov are described from the Ryukyus, Japan. It is close to *Cylindrotrypetes* ZIMMERMAN known from Guam and may belong to the "Group Phoenicobatina CHAMPION, 1914" described from the Seychelles, which is tentatively treated as the subfamily rank in this paper.

It is with great pleasure that I dedicate this paper to my longtime and cherished friend on entomology, Dr. Shun-Ichi UÉNO. My earliest contact with him was in 1950 when he visited Kochi for the survey of cave fauna. My interest in insects was so rising by his warm leading and continuous spurring during my student days of senior high school that I resolved to major in entomology at the university in 1952. He has been my superior friend ever since and has guided me in various fields of entomology including the collecting method of the edaphic weevil which constitutes a fundamental technique for the present study.

The edaphic weevils are interesting from the viewpoints of speciation and zoogeography because of the limited ability in moving by the atrophy of the hind wings. This atrophy accompanies the reduction of humeri of the elytra, shortening of the metathorax, broadening of the intercoxal process of the venter, and reduction of the eyes in most species. The speciation of these weevils are apt to occur through geographic isolation due to the formation of the mountains or mountain ranges and islands in Japan during the Quaternary as briefly reviewed (MORIMOTO, 1993). This is the second paper on the edaphic weevils from East Asia followed after the revision of *Myosides* (MORIMOTO & LEE, 1993).

I express my gratitude to Dr. Shûhei NOMURA, Dr. Kazuo OGATA and Mr. Hiroaki KOJIMA for their kind offer of materials, and to Dr. Sumiaki MIYAKAWA for his kind help in various ways.

Edaphotrypetes gen. nov.

Type species: Edaphotrypetes ovipennis sp. nov.

Head subglobular, not constricted behind eyes; eyes lateral, oblong oval, coarsely

* Contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (Ser. 4, No. 74).

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faceted; forehead between eyes a little narrower than the base of rostrum. Rostrum robust, curved, with a shiny median carina on the underside; mandibles tridentate, with two setae, of which the basal one is longer; maxillary palpi with three segments; postmentum shortly pedunculate; prementum almost as long as broad, with a pair of setae at laterointerior margin behind apex; labial palpi inserted at anterior edge of prementum, with three segments; scrobes distinct, oblique, close to each other and only separated by carina at the base on the underside, upper margin not touching eye. Antennae inserted before the middle of rostrum in both sexes, scape reaching the hind margin of eye or a little beyond it, funicle 5-segmented, first segment larger, second segment sharply necked at the base, club oval to oblong-oval, shorter than funicle, with setae denser on apical third and sparser on basal two-thirds, sutures obsolete.

Prothorax almost as long as broad, rounded at sides, anterior margin almost as broad as posterior margin, subapical constriction weak or obsolete on dorsum, distinct on the underside, without ocular lobe. Scutellum minute to absent. Elytra broader than pronotum, punctate striate, seventh interval abbreviated at basal area, ultimate stria abbreviated behind hind coxa and appears again near apical margin as weak stria. Pygidium concealed by elytra. Hind wings atrophied.

Prosternum with fore coxae inserted at about the middle, coxal cavities broadly separated internally and externally, flat before coxal cavities. Mesosternal process on the same plane with pro- and metasterna; mesocoxal cavities separated internally and externally; mesepimera small, triangular; metepisterna narrow, metepimera minute; metacoxa almost touching side margin of elytron at a point; intercoxal process between hind coxae much broader than pro- and mesosternal processes. Venter with first two ventrites fused, with faint suture at sides, third and fourth ventrites short, fifth ventrite longer than third and fourth combined; second to sixth tergites pale brownish, with spicule patches present on fourth to sixth tergites in both sexes, without stridulating organ. Metendosternite with short and broad stalk, lateral arms small, producing internally, anterior tendons as widely separated as the width of stalk.

Legs with femora clavate, unarmed, neither sulcate nor carinate; tibiae shorter than femora, not carinate, mucronate at apex; tarsi with second segment strongly transverse, much wider than first and as broad as third, the latter bilobed; claws simple, free.

Male aedeagus with parameres absent, struts about as long as penis, internal sac with a pair of sclerites, which connate at base.

This new genus is close to *Cylindrotrypetes* ZIMMERMAN, 1942 from Guam in having the following common characters: Prosternum flat, fore coxae widely separated and inserted at about the middle; mesosternal process flat, on the same plane with pro- and metasterna; antennae with five segments in funicle; femora unarmed; tibiae not uncinate; tarsi with second segment much wider than first and as broad as third; claws simple; elytra with seventh interval abbreviated at base; pygidium concealed.

These two genera are different from the weevils of the Trypetidini or Trypetidinae by the absence of the unci on the tibiae and median position of the procoxae on the

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prosternum, and may belong to "Group Phoenicobatina CHAMPION, 1914", which was originally described from the Seychelles and has not been cited in any literature including Coleopterorum Catalogus. CHAMPION's "Group" is equivalent to subfamily in modern sense and is treated tentatively as the subfamily Phenicobatinae in this paper. Similar tarsi and five-segmented funicle are also present in *Arecocryptus* HUTTON, 1904 and *Novitas* BROUN, 1880 from New Zealand, but they belong to the Cossoninae having the unci from the outer angle of the tibiae. Weevils of the Phoenicobatinae from the Seychelles and *Cylindrotrypetes* have been captured on palms and *Pandanus*, but our weevils were all captured by sifting litter and from rotten wood.

Similar weevils with broad second segments in the tarsi and distant fore coxae can be separated in the following key.

- 1 (2) Tibiae uncinate. Cossoninae
- 2(1) Tibiae not uncinate, fore coxae inserted at about the middle of prosternum.
- 4 (3) Antennae with five segments in funicle, claws normal.

Edaphotrypetes ovipennis sp. nov.

Derm dark brown to brown, scapes, funicles and tarsi yellowish brown, with minute sparse setae; rostrum, legs, lateral and dorsal surfaces of prothorax and elytra coriaceous, mat, sterna and venter smooth, shiny.

Head with dense small punctures, forehead between eyes a little narrower than the base of rostrum, without median fovea, without constriction or depression. Rostrum about three-fourths as long as pronotum, curved, similarly punctate as on head, slightly shiny at apex, with a short shiny weak carina in the middle on dorsal surface, with a shiny carina on the underside in entire length, with three pairs of long setae along anterior margin on dorsum and a long seta on each side behind mandible in both sexes, with about ten long setae in male or a pair of long setae in female on postmentum; antennae inserted before the middle of rostrum, scrobes lateral, invisible dorsally, oblique, upper margin directing posteriorly below eye and close to each other

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Fig. 1. Mouth parts of *Edaphotrypetes ovipennis* sp. nov. — A: ventral aspect. B: apicolateral aspect.

at the base. Antennae with scape sinuate, about as long as funicle, with a few short setae, funicle with first segment 1.5 times as long as broad, second segment with a sharp neck at the base, club subfusiformed, twice as long as broad, with sparser setae on basal two-thirds than the apical third.

Prothorax as broad as long, broadest at or a little before the middle, evenly rounded at sides, subapical constriction obsolete on disk, anterior margin about as broad as posterior margin, disc densely punctate, punctures obsolete along anterior margin, each puncture with a minute greyish seta, with a weak median carina before the middle. Scutellum absent.

Elytra ovate, evenly rounded at sides, broadest at basal third, conjointly rounded at apices; striae well developed, coarsely punctate; broader than intervals, intervals convex, third and eighth intervals conjoined and often subcostate at apex, seventh interval abbreviated on basal third, each interval with a row of greyish minute setae. Hind wings completely atrophied.

Legs with femora indefinitely and shallowly punctate, minutely setose; tibiae with yellowish terminal setae, mucrones of male a little greater than those in female, especially of hind pair.

Prosternum as densely punctate as lateral sides of prothorax, prosternal process and sternellum between coxae shiny, impunctate. Mesosternum shiny, with a transverse row of punctures connecting anterior margin of coxae. Metasternum shiny, with distant punctures, metepisterna coriaceous, narrow. Venter shiny, broadly and shallowly depressed in male, almost flat or slightly convex in female, two basal ven-

Fig. 2. Edaphotrypetes ovipennis sp. nov. — A: habitus, male. B: male, lateral aspect. C: female head, lateral aspect. D: male, ventral aspect. E: antenna. F: fore leg. G: hind leg. H, I: male aedeagus, dorsal and lateral aspects. J: 8th and 9th segments of male abdomen, ventral aspect. K: spiculum ventrale of female 8th sternite. L: spermatheca.

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trites similarly punctate as on metasternum, third and fourth ventrites almost impunctate or with a row of minute punctures, fifth ventrite with scattered small punctures, which become sparser basally.

Male aedeagus with penis parallel-sided and tapered apically from the point of ostium, narrowly rounded and setose at apex; tegmen with manubrium Y-shaped, small; internal sac with a pair of sclerites, which are thick at base, curved dorsally at anterior part and prolonged apically as weak streaks. Spiculum ventrale of female eighth sternite V-shaped, spermatheca strongly bent hook-shapedly, without lateral lobe, spermathecal duct and gland close at bases.

Length: 1.6–1.7 mm (excl. rostrum).

Holotype ♂ (Туре по. 2944, Kyushu Univ.), Mt. Kuburadake, Yonaguni I., 3-VII-1993, K. Могімото and H. Коліма leg.

Paratypes: Same data as holotype 56 exs. Mt. Inbidake, Yonaguni I., 1 ex, 14-III-1993, S. NOMURA leg. Mt. Urabudake, Yonaguni I., 6 exs, 14-III-1993, S. NOMURA leg. Kampire, Iriomote I., 5 exs., 27-III-1984, S. NOMURA leg.; 5 exs., 16-X-1988, S. NOMURA leg. Mt. Bannadake, Ishigaki I., 14 exs., 18~22-VI-1991, K. MORIMOTO leg.; 11 exs., 5-VII-1993, K. MORIMOTO & H. KOJIMA leg. Mt. Omoto, Ishigaki I., 6 exs., 11-IV-1986, S. NOMURA leg. Ie-rindo, Okinawa I., 60 exs., 14 & 16-III-1985, S. No-MURA leg.; 3 exs., 23-IV-1986, S. NOMURA leg.; 8 exs., 11-X-1988, S. NOMURA leg. Mt. Terukubi, Okinawa I., 80 exs., 15-III-1985, S. NOMURA leg. Mt. Nishimedake, Okinawa I., 8 exs., 12-II-1991, K. OGATA leg.; 33 exs., 14-III-1991, S. NOMURA leg. Oku, Okinawa I., 3 exs., 14-III-1991, S. NOMURA leg. Mt. Hedonoutaki, Okinawa I., 4 exs., 14-III-1991, S. NOMURA leg. Yona, Okinawa I., 4 exs., 15-III-1985, S. NOMURA leg.; 6 exs., 24-III-1988, S. NOMURA leg. Mt. Inokawadake, Tokunoshima I., 6 exs., 5-V-1988, S. NOMURA leg. Hatsuno, Amami-Oshima I., 6 exs., 10-VIII-1984, S. No-MURA leg. Mt. Yuwandake, Amami-Oshima I., 2 exs., 14-V-1983, S. NOMURA leg.; 12 exs., 8-V-1987, S. NOMURA leg. Nakanoshima I., Tokara Isls., 79 exs., 2-V-1987, S. NOMURA leg.

Distribution. Japan: Ryukyus (Nakanoshima, Amami-Oshima, Tokunoshima, Okinawa, Ishigaki, Iriomote and Yonaguni Is.).

Weevils were collected by sifting litter in forests then and there or by use of Berlese's funnel in the laboratory.

Edaphotrypetes parallelipennis sp. nov.

Derm brownish black to black, scapes, funicles and tarsi brownish, bare; coriarious, dorsal and lateral surfaces mat, median part of metasternum and venter shiny.

Head with indefinite small punctures, forehead between eyes a little narrower than the base of rostrum, with or without median fovea, without constriction. Rostrum about four-fifths as long as pronotum, curved, similarly punctate as on head, slightly more shiny at apex in female, without median carina, with a shiny carina on the un-

New Edaphic Weevils from Japan



Fig. 3. Edaphotrypetes parallelipennis sp. nov. — A: habitus, male. B: male head, lateral aspect. C: female head, lateral aspect. D: elytron, lateral aspect. E: hind wing. F: antenna. G: fore leg. H: middle leg. I: hind leg. J, K: male aedeagus, dorsal and lateral aspects. L: apex of penis, dorsal aspect. M: 8th and 9th segments of male abdomen, ventral aspect.

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derside in entire length, with three pairs of setae along anterior margin on dorsum and a pair of long setae at sides in both sexes, with about ten long setae in male or a pair of long setae in female on postmentum, antennae inserted before the middle of rostrum, scrobes lateral, invisible dorsally, oblique, upper margin directing posteriorly below eye and close to each other at the base. Antennae as in *ovipennis*, but scape reaching hind margin of eye and club oval, two-thirds as broad as long.

Prothorax about as long as broad, broadest before the middle, weakly rounded at sides, subapical constriction obsolete on disc, anterior margin slightly narrower than posterior margin, disc densely punctate, punctures obsolete along anterior margin, with an obtuce median carina on anterior half. Scutellum minute, punctiformed, shiny.

Elytra with rounded humeri, then almost parallel-sided to the middle and evenly rounded and narrowed thereafter; striae well developed, coarsely punctate, broader than intervals, becoming shallower and narrower posteriorly on apical third, third and eighth intervals conjoined at apex, sixth and seventh intervals abbreviated on basal half, consequently with five striae on dorsum in basal half. Hind wings reduced in size, narrow, simply folded at rest, with a seta at pivot.

Legs as in *ovipennis*, mucrones of the same size in all legs, small and rounded at apex, those of hind pair in male a little longer and curved.

Sterna and two basal ventrites as densely punctate as lateral sides of prothorax, those a little weaker and sparser at sides of metasternum; metepisterna linear, without punctures. Venter with interstices between punctures a little more shiny, third and fourth ventrites coriarious along anterior and posterior margins, with a row of minute punctures, fifth ventrite evenly with small punctures.

Male aedeagus with penis parallel-sided, subtruncate with broadly rounded corners at apex, ventral surface not pigmented, brownish lateral surface continuous to each other as a narrow brownish band behind apical margin; tegmen membranous, delicate, without parameres; internal sac with a pair of sclerites, which are thick and continuous at base.

Length: 1.9-2.0 mm (excl. rostrum).

Holotype 🖒 (Type no. 2945, Kyushu Univ.), Mt. Inbidake, Yonaguni I., 23–IV– 1993, Н. Колма leg.

Paratypes: Same data as holotype, 78 exs. Mt. Urabudake, Yonaguni I., 3 exs., 14–III–1993, S. NOMURA leg. Mt. Inutabudake, Tokunoshima I., 1 ex., 5–V–1988, S. NOMURA leg. Nakanoshima I., Tokara Isls., 2 exs., 2–V–1987, S. NOMURA leg. Cape Sata, Kagoshima Pref., 1 ex., 20–III–1994, S. NOMURA leg.

Distribution. Japan: Kyushu (Cape Sata), Ryukyus (Nakanoshima, Tokunoshima and Yonaguni Is.).

Weevils were collected by KOJIMA in a rotten wood lying on floor of forest in a mass, and the others were taken by sifting litter by NOMURA.

New Edaphic Weevils from Japan

Key to Species

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Lepidimerodes gen. nov. (Coleoptera, Curculionidae) with Descriptions of Three New Species^{1,2}

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Abstract A new genus, *Lepidimerodes*, and three new species *L. taiwanensis* from Taiwan, *L. johkii* from E. Malaysia and *L. yasunagai* from Thailand are described in the tribe Ochyromerini of the curculionid subfamily Tychiinae.

Lepidimerodes gen. nov.

Type species: Lepidimerodes taiwanensis sp. nov.

Body slender. Derm clothed with hairy scales. Head more or less constricted behind eyes; forehead between eyes nearly as wide as the base of rostrum, without median fovea. Eyes flat, slightly convex from temples, large in lateral view. Rostrum slender, with five rows of carinae behind the antennal insertions; antennal scrobes running to the lower part of eyes. Antennal scape reaching eye; funicle with six segments. Prothorax subparallel-sided at basal half, thence narrowing toward the apex; subapical constriction very weak. Elytra subparallel-sided at basal half, separately rounded at the apex; striae faintly, shallowly punctured. Pygidium usually exposed in the male. Legs with front femora as great as the posteriors, femora unarmed; fore and middle tibiae with definite unci from inner angle, but those of hind tibiae usually indefinite. Prosternum with coxae located behind the middle. Venter with the posterior margins of second to fourth ventrites curved posteriorly at sides in the same degree, first to fourth subequal in length, fifth a little shorter than third and fourth combined. Seventh tergite with a pair of scrapers for stridulatory organ at the anterior margin. Aedeagus with median lobe asymmetrical and long, freely articulated with very short struts; inner sac with weakly sclerotized flagellum; tegmen T-shaped.

Discussion. This genus is somewhat similar at first sight to *Apionodes* MARSHALL of the subfamily Eugnominae, but is classified in the tribe Ochyromerini of the subfamily Tychiinae by the following points: posterior margins of second to fourth ventrites curved posteriorly at sides; metendosternite with anterior tendon arisen from the base of anterior arm and penis with median lobe freely articulated with struts. This is closely related to *Gryporrhynchus* ROELOFS and *Imerodes* MARSHALL in having six segments in the funicle, widely separated eyes and similar front femora to the pos-

¹⁾ Study on the tribe Ochyromerini (Coleoptera, Curculionidae) from East Asia III.

²⁾ Contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (Ser. 4, No. 89).

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teriors, but characteristic in the slender body, scaled derm, asymmetrical median lobe of penis and T-shaped tegmen.

Key to Species

- Derm reddish brown. Rostrum with carinae only behind the antennal insertions. Elytra clothed with subrecumbent or suberect hairy scales.
 L. taiwanensis sp. nov.
- 2(1) Derm blackish, often legs reddish brown. Rostrum with carinae extending toward the apex.
- 4 (3) Derm black except for reddish brown legs. Prothorax and elytra densely clothed with recumbent and suberect hairy scales. L. yasunagai sp. nov.

Lepidimerodes taiwanensis sp. nov.

(Figs. 1, 3-5, 8-11)

Male and female. Derm light reddish brown, rostrum a little darker, antennal funicle, club, meso- and metathoraces, and often first ventrite dark brown to blackish.

Head clothed with recumbent whitish hairy scales, faintly constricted behind eyes. Forehead between eyes with suberect whitish hairy scales along eyes and recumbent



Figs. 1–3. Habitus and legs of Lepidimerodes spp. — 1, 3, L. taiwanensis sp. nov.; 2, L. johkii sp. nov.

whitish hairy scales. Rostrum slightly curved, longer than pronotum (4: 3 in male, 7: 5 in female), with five rows of carinae behind the antennal insertion, with three rows of recumbent setae as on forehead on each side of basal half. Antennae inserted at the middle (female) or just a little before the middle (male) of rostrum; scape longer than funicle (4: 3); funicle with first segment twice as long as broad, second 3/5 times as long as first, third to sixth subequal in length, about half as long as second; club as long as basal three segments of funicle combined.

Prothorax 1.1 times as wide as long, indefinitely punctured, clothed with recumbent or subrecumbent whitish hairy scales. Scutellum densely clothed with fine recumbent greyish setae. Elytra 1.5–1.6 times as long as wide, each interval with a row of subrecumbent, often suberect hairy scales as on pronotum except that the basal parts of first, third and seventh intervals bear a few rows of scales. Pygidium exposed at the apex, clothed with fine recumbent whitish hairy scales in the male or concealed in the female. Legs clothed with scales as on pronotum; front femora faintly with a trace of tooth; tibiae slender, front tibiae slightly dilated internally a little behind the middle; tarsal claws widely divergent, each with a broad, flat basal process.

Prosternum with the distance between the coxae and submarginal sulcus a little greater than that between this sulcus and anterior margin.

Length: 1.9-2.0 mm.

Holotype: male (Type No. 2997, Kyushu Univ.), Hohuanchi – Sunchuankang, Nantou Hsien, Taiwan, 24–VI–1976, H. MAKIHARA leg.

Paratypes, 3 males and 2 females, same data as holotype; 1 male, same locality as holotype, 23–VI–1976, H. MAKIHARA leg.

Distribution. Taiwan.

Remarks. This is characteristic in the coloration and separable from the others by the characters noted in the key.

Lepidimerodes johkii sp. nov.

(Figs. 2, 6, 12)

Male. Derm black, antennae and legs dark brown to blackish.

Head clothed with recumbent white hairy scales, weakly constricted behind eyes. Forehead between eyes with suberect white hairy scales along eyes and a pair rows of recumbent white scales. Rostrum slightly curved, longer than pronotum (3: 2), with five rows of carinae behind the antennal insertion, median three carinae extending to the apex, with three rows of recumbent white hairy scales on each side of basal half. Antennae inserted at the middle of rostrum; scape longer than funicle (4: 3); funicle and club as those of *L. taiwanensis*.

Prothorax as wide as long, indefinitely punctured, clothed with recumbent white hairy scales. Scutellum densely clothed with fine whitish scales. Elytra 1.47 times as long as wide; each interval with a row of recumbent white hairy scales. Pygidium with greyish setae. Legs clothed with recumbent hairy scales as on pronotum; front

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femora with an indefinite trace of tooth; tibiae shorter and stouter than those in *L*. *taiwanensis*, front tibiae slightly dilated internally a little before the middle.

Prosternum with the distance between the coxae and submarginal sulcus nearly as great as that between this sulcus and anterior margin.

Female. Unknown.

Length: 1.9 mm.

Holotype: male (Type No. 2998, Kyushu Univ.), Sepilok, Sandakan, Sabah, East Malaysia, 23-VII~4-VIII-1981, Y. JOHKI leg.

Distribution. E. Malaysia (Sabah).

Remarks. This is easily separable from the others by the black derm, weakly constricted head and shorter and stouter tibiae.

Lepidimerodes yasunagai sp. nov.

(Figs. 7, 13, 14)

Female. Derm black, antennae dark brown, legs reddish brown.

Head clothed with recumbent yellowish grey hairy scales, faintly constricted behind eyes. Forehead between eyes with suberect scales as on head along eyes and with recumbent hairy scales. Rostrum weakly curved, longer than pronotum (4:3), with five rows of carinae behind the antennal insertion, median three carinae extending to near the apex, with three rows of recumbent hairy scales on each side of basal half. Antennae inserted a little behind the middle of rostrum; scape longer than funicle (4:3); funicle and club as those of *L. taiwanensis*.

Prothorax nearly as wide as long, indefinitely punctured, densely clothed with recumbent and suberect yellowish grey hairy scales. Scutellum covered with short recumbent hairy scales. Elytra 1.47 times as long as wide; each interval with dense recumbent yellowish grey hairy scales and medially a row of suberect longer hairy scales. Pygidium covered with hairy scales as on elytra. Legs clothed with recumbent hairy scales as on elytra; each femur without any trace of tooth; front tibiae slender, slightly dilated internally in the middle.

Prosternum with the distance between the coxae and submarginal sulcus a little greater than that between this sulcus and anterior margin.

Male. Unknown.

Length: 1.5 mm.

Holotype: female (Type No. 2999, Kyushu Univ.), Mt. Doi Pui, Chiang Mai, Thailand, 18-XI-1989, T. YASUNAGA leg.

Distribution. Thailand.

Remarks. This is characteristic in having the derm densely covered with two kinds of scales.

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Figs. 4–10. Heads and prothoraces, antenna and aedeagus of *Lepidimerodes* spp. — 4, 5, 8– 10, *L. taiwanensis* sp. nov.; 4–5; head and prothorax; 4, female; 5, male; 8, antenna; 9–10, aedeagus; 9, penis; 10, tegmen; 6, *L. johkii* sp. nov., male; 7, *L. yasunagai* sp. nov., female.



Figs. 11-14. Photos of *Lepidimerodes* spp. — 11, *L. taiwanensis* sp. nov., lateral view; 12, *L. johkii* sp. nov., lateral view; 13-14, *L. yasunagai* sp. nov.; 13, lateral view; 14, dorsal view.

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We dedicate this paper with gratitude to Dr. Shun-Ichi UÉNO on the occasion of his retirement. Our hearty thanks are also due to the following entomologists: Mr. H. MAKIHARA, Dr. Y. JOHKI and Dr. T. YASUNAGA for their offering of materials.

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Tenthredo uenoi sp. nov. (Hymenoptera, Tenthredinidae) from High Mountains of Taiwan¹⁾

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Abstract *Tenthredo uenoi* sp. nov. is described and illustrated on the basis of two females obtained from the high altitude of central and southern Taiwan. It represents a northern element showing close affinity to *T. dentina* ENSLIN and *T. ferruginea* SCHRANK, both of which occur in cold temperate zones of the Palearctic Region.

The Island of Taiwan lies in the subtropics, but its high mountains, attaining almost to 4,000 meters in altitude, are inhabited by predominantly Palearctic and highly endemic fauna. Our knowledge on the high altitude insects of the island is, however, still quite limited. To obtain more information in this regard, the National Science Museum, Tokyo, in collaboration with National Taiwan University, Taipei, sent a series of expeditions to the high mountains of Taiwan in a period of three years from 1989 under the sponsorship of the Ministry of Education, Science and Culture, Japan. The first field survey team in this project, headed by Dr. Shun-Ichi UÉNO, visited Mt. Neng-kao Shan and Mt. Kuan Shan, the former in central and the latter in southern parts of the island, in June, 1989. In a small but very interesting collection of sawflies made by the members of this team were two specimens of a new species belonging to the genus *Tenthredo*, which will be described in the following lines.

Tenthredo LINNAEUS, 1758, is a huge genus of sawflies comprising about 700 species distributed mainly in temperate regions of the Northern Hemisphere. In a checklist of Taiwanese sawflies, CHOU and NAITO (1991) enumerated 14 species, of which 12 had been described from Taiwan and 10 were known only from the island. The new species has little in common with any of them but closely resembles the Palearctic species *T. ferruginea* SCHRANK, 1776, and *T. dentina* ENSLIN, 1912.

The present paper as well as the specific name of the new species described herein are dedicated to Dr. Shun-Ichi UÉNO, an eminent zoologist and speleologist of the National Science Museum, Tokyo, who has continuously encouraged and supported my studies on sawflies.

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Tenthredo uenoi sp. nov.

(Figs. 1-5)

Female (holotype). Length about 10 mm. Head black, with the following parts pale yellow: face below line connecting middle of antennal sockets, including supraclypeal area, lower inner orbit and clypeus; line along inner eye margin extending up to dorsal eye margin; top of supraantennal tubercle; lower 2/3 of gena and line extending dorsally along crassa to postocellar area; entire mouth parts, except for blackish marking on labrum, apex of mandible, and marking on palpi. Antenna black, with apical part of 3rd segment ventrally, ventral side of 4th segment, 5th to 7th segments, except for blackish line along outer (posterior) surface of each segment, yellowish white; ventral side of 7th segment and 8th to 9th segments, except blackish outer (posterior) surface, dark brown, becoming whitish beneath. Thorax black, with the following parts pale yellow: ventral half of cervical sclerite; broad posterolateral corner and most of lateral surface of pronotum; tegula, except for blackish posterior spot; narrow posterior margins of mesoscutal lateral lobes (line lateral to mesoscutellum); posterior margin of metascutum (line lateral to metascutellum); broad band at anterior margin of metapostnotum just posterior to metascutellum; lateral and ventral parts of mesothorax and metathorax, except for blackish lines along anterior and dorsal margins of mesepisternum. Lateral side of thorax more or less brownish or amber. Wings hyaline, slightly stained with gray; veins blackish brown, with vein C, anterior half of R, basal half of anal veins, and entire stigma pale yellowish or brownish. Legs pale yellow to pale brown, with the following parts black: very narrow coxal bases; narrow, short longitudinal line near apex of hind coxa; marks on dorsal surfaces of trochanter, femur and tibia of each leg, together forming a line, becoming narrower, once interrupted and fading toward apex on tibia. Abdomen pale brown above and pale yellow beneath, except as follows: pronotum black, with lateral part and posterior margin pale yellow; 2nd tergum black above and pale yellow laterally; each of 3rd and 4th terga with narrow longitudinal black marking.

Dorsal side of head very densely covered with small to medium-sized, distinct, well-separated punctures, with very narrow interspaces smooth; punctures densest on postocellar and adjacent regions. Gena, malar space, ventral part of frons, clypeus and inner orbit rather smooth, partly coriaceous, with minute, inconspicuous punctures. Head covered with short, silvery pubescence. Clypeus with anterior margin circularly incised (Fig. 3); supraantennal tubercle conspicuous at the edge of antennal socket, gently sloping backward and not continuous to very low, inconspicuous frontal ridge; postocellar area long (about 1.3 times as wide as long), uniformly, very weakly convex; antenna with 3rd segment about 1.4 times as long as 4th. Mesoscutum uniformly covered with rather dense, small to medium-sized, distinct punctures, with somewhat coriaceous interspaces, weakly shining; mesoscutellum weakly, roundly convex, densely covered with medium-sized, distinct punctures, with rather spaces; posttergite medially, longitudinally carinate, rugose, with several large irregular punc-

Tenthredo uenoi sp. nov. from Taiwan



Figs. 1-2. Tenthredo uenoi sp. nov., ♀, holotype.

tures; mesepisternum coriaceous all over, covered with small, inconspicuous punctures; lateral swelling not very high but ridged, with shallow crater-like depression dorsally; mesopreepisternum without conspicuous projection. Abdominal segments smooth, shining, with very feeble, fine, transverse striation. Sawsheath as in Fig. 4. Teeth of lancet as in Fig. 5.

Male. Unknown.

Distribution. Taiwan.

Holotype: ♀, Yün-hai (2,360 m) ~ T'ien-ch'ih (2,860 m), Mt. Neng-kao Shan, Nantou Hsien, 22–VI–1989, M. SATÔ. Deposited in National Science Museum, Tokyo.

Paratype: $1 \Leftrightarrow$, Kuan Shan Ya-k'ou (2,600 m), T'ai-tung Hsien, $11 \sim 12$ -VI-1989, M. OwaDa. Deposited with the holotype.

Variation. The paratype is almost identical with the holotype in size, coloration and structure, differing but slightly as follows: Pale yellow stripe along crassa not reaching postocellar area; supraantennal tubercle entirely black; black stripe along dorsal margin of each tibia reduced, only basal part remaining; black marking on 3rd tergum very small and 4th tergum without black marking.

Host-plant. Unknown.

Remarks. Southeast Asian species of *Tenthredo* were revised by MALAISE (1945), who treated all those currently recorded from Taiwan, except *T. horishana* TAKEUCHI, 1927, and *T. xueshanensis* TOGASHI, 1980. The new species would run to couplet 38 in MALAISE's (1945) key, possessing most of the characters given in the first section,

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Figs. 3–5. *Tenthredo uenoi* sp. nov., \mathcal{Q} . — 3, Clypeus and labrum, frontal view, holotype; 4, sawsheath, lateral view, holotype; 5, 12th and 13th teeth from apex of lancet, paratype.

but in *T. uenoi* the stigma and part of the veins are pale brown, not black. A number of new species were described thereafter from Asia, most of them from the Himalayas (*e.g.*, SINGH & SAINI, 1988), but none of them show close resemblance to *T. uenoi*.

The new species has much in common with *T. dentina* ENSLIN and *T. ferruginea* SCHRANK, both inhabiting cold temperate zones of the Palearctic Region. In ENSLIN's (1920) key to the Palearctic species, the two species are included in the same couplet (103), to which the new species safely runs. *Tenthredo uenoi* is a smaller species, however, distinguished from the two species by the following combination of characters: ventral sides of head, thorax and abdomen pale orange to yellow, except for narrow inconspicuous black lines along margins of thoracic sclerites; pale yellow line present extending dorsally from gena along crassa (nearly or actually) to postocellar area; abdomen with dorsal surfaces of propodeum and 2nd tergum (both segments laterally pale yellow) and narrow median longitudinal marking on 3rd (and sometimes also 4th) tergum black, without black marking on apical segments. From *T. dentina*, the new species is also separated by the long postocellar area (about 1.3 times as wide as long) and more or less dark-colored two apical antennal segments, and from *T. ferruginea* by the black-striped anterior femur and almost entirely pale yellow lateral part of pronotum.

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Tenthredo uenoi sp. nov. from Taiwan

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A New Luciliine Blow Fly (Diptera, Calliphoridae) from Taiwan

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Abstract *Lucilia taiwanica* sp. nov. from Taiwan is described and illustrated. The new species has a general appearance similar to those of common green bottle flies, *Lucilia porphyrina* (WALKER) and *L. papuensis* MACQUART, but the male genitalia are very characteristic as shown in figure.

The new luciliine fly looks like a large-sized Lucilia porphyrina (WALKER) at a glance, but a close observation shows that the 3rd and 4th abdominal tergites are banded as in L. papuensis MACQAURT. Males are quite easily separated by the shapes of aedeagus and parameres, but the females are very difficult to distinguish from those of L. papuensis with certainty. The number of postsutural ac is mostly three, if two, then the anterior pair of postsutural ac is more advanced than the 2nd pair of postsutural dc. This is one of the criteria to separate the new species. The type material is mainly based upon the collection of calliphorid flies made by the author (RK) and Dr. M. Iwasa, Obihiro University of Agriculture and Veterinary Medicine, Obihiro, during the expedition to Taiwan (Tokyo Medical and Dental University Overseas Scientific Research). We were very happy to find a specimen on loan from the Carnegie Museum of Natural History, Pittsburgh and from Dr. T. OKADOME's collection in Meijo University. Seven species of Lucilia were previously recorded from Taiwan (KURAHASHI, 1987).

We wish to express our sincere thanks to Dr. M. IWASA, Obihiro University of Agriculture and Veterinary Medicine, Obihiro; Dr. T. OKADOME, Meijo University, Nagoya; and Dr. Chen W. YOUNG, the Carnegie Museum of Natural History, Pittsburgh, who gave us the opportunity to examine this interesting material.

We are privileged to have the opportunity to present this paper to the commemorative volume in honour of Shun-Ichi Uéno upon his retirement in March, 1995 from the National Science Museum, Tokyo. Our old friend, Dr. Uéno is one of the lead-

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ing entomologists in studying the Japanese fauna.

Lucilia taiwanica sp. nov.

 3° . Head: Eyes bare, holoptic, frons index=0.02-0.03; frontal stripe narrow, triangular anteriorly and posteriorly, reduced to a fine line throughout the narrowest part of frons, blackish, slightly reddish anteriorly; parafrontalia narrow, reduced to fine vitta posteriorly, covered with silver tomentum, but darkened towards vertex in certain light, with black hairs; parafacialia narrower than the width of 3rd antennal segment, bare; face and facialia fuscous, grey-dusted, the latter with black setulae on lower 1/2; face with minute black setulae on 1/3 medially; vibrissae strongly developed; epistoma with narrow brown anterior margin; vibrissaria and medianae narrow, reddish brown, vibrissaria with black setulae; genae black, grey-dusted, clothed with black hairs; post-genae concolorous with genae, largely blackish haired, yellowish haired posteriorly; occiput black, grey-dusted, clothed with yellow hairs on central portion and below; antennae dark brown, ventral side and base of 3rd segment reddish, 3rd segment more than $3 \times$ as long as 2nd; arista brown on basal 1/2, blackish on apical 1/2, long-plumose; palpi orange, with black setulae.

Thorax: Metallic purple or blue, thinly covered with silver dusting; humeri and scutellum concolorous with dorsum, humeri entirely with black hairs; prosternum and propleura with hairs; supraspiracular convexity black, pubescent; pleurotergite black haired; post-alar declivity with a tuft of black hairs in central circle, and also setulose above on posterior wall; posterior parasquamal and tympanic tufts developed; thoracic spiracles blackish. Chaetotaxy; ac 2+2-3, if postsutural ac 2, then first pair of postsutural ac more advanced than the level of 2nd pair of postsutural dc, dc 3+3, ia 1+2, h 4-5, ph 3, prs 1, sa 3-4, pa 2-3, n 2, st 2+1, sc 4-5+2, propleural and prostigmatal bristles developed.

Wings: Hyaline, infuscated at base; veins fuscous; epaulet and basicosta black; stem-vein bare; subcostal sclerite fuscous brown, fuscous brown pubescent, with several blackish setulae on apical half; 3rd longitudinal vein with a row of setulae above and below more than 1/2 of way from node to anterior cross-vein; 4th vein bent at right angle; squamae fuscous brown except for basal portion of upper one somewhat paler, thoracic one bare on dorsal surface. Halteres fuscous, brown at base.

Legs: Black, with black hairs; fore tibia with 1 p and a row of short 8–9 ad; mid tibia with 1 ad, 1 pd, 1 p and 1 v; hind tibia with 2 av, 2 pd, a row of short ad, 1 rather long ad locates near middle of length.

Abdomen: Metallic blue, with purple tinge, without remarkable pruinosity on dorsal surface; tergite 1+2 submetallic, black, more or less with blue tinge, greydusted on ventral sides; tergites 3–4 with marginal band; tergite 3 with decumbent marginal bristles on lateral sides of abdomen; tergites 4–5 with erect marginal bristles, the latter also with many fine erect bristles on disc; sternites and edges of tergites black haired. Male genitalia as shown in Fig. 1.



Fig. 1. Lucilia taiwanica sp. nov., male; a, epandrium, cercus and paralobus, lateral view; b, cerci and paralobi, caudal view; c, aedeagus, lateral view; d, aedeagus, posterior view; e, anterior and posterior parameres, lateral view.

 \bigcirc . Head: Eyes bare, separated at vertex by 0.22–0.25 of the head width; frons slightly narrowed posteriorly; frontal stripe black, slightly reddish anteriorly and on lateral sides, parallel-sided, and slightly narrowed at vertex, twice the width of one of

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parafrontalia just in front of anterior ocellus; parafrontalia and parafacialia black, densely silvery-grey dusted; parafrontalia with black setulae and 11 pairs of *ori*; *ors* 2-3+1; *oc* developed; *iv* and *ov* strongly developed; *poc* almost parallel or convergent; 1-2 *occ* present behind *iv*; *acoc* indistinct; epistoma brownish; pleural hairs black.

Abdomen: Marginal bristles on tergites 3-4 decumbent, but fine erect bristly hairs are present on disc and margin of tergite 5.

Otherwise as described for male except for ovipositor.

Holotype ♂, Taiwan: Tsuifeng, 29–V–1972, R. KANO. Paratypes: Taiwan: 1 ♀, same data as holotype; 1 ♂, Pingtung Hsien, Kentin Park, 16–III–1968, T. OKADOME; 1 ♂, Nantou, Meifeng, 2,130 m, T 147-yellow pan traps, VII–1993, A. SMETANA; 3 ♀, Tsupun, Taiton, 21–V–1981, M. IWASA.

Type depository. Holotype and paratype $(1 \ \circle)$ are deposited in Reference Museum, Department of Medical Entomology, the National Institute of Health, Tokyo. Paratypes are also preserved in the National Science Museum, Tokyo $(1 \circle 1 \circle)$; the Carnegy Museum of Natural History, Pittsburgh $(1 \circle)$; Obihiro University of Agriculture and Veterinary Medicine, Obihiro $(2 \circle)$.

Bionomics. Unknown.

Distribution. Taiwan.

Relationships. The present new species belongs to the *fumicosta*-group and closely resembles both *Lucilia porphyrina* (WALKER), *L. salazarae* KURAHASHI and *L. papuensis* MACQUART in general appearance. *Lucilia taiwanica* sp. nov. can be readily distinguished from the previously known species of *Lucilia* by the male genitalia.

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Spec. Bull. Jpn. Soc. Coleopterol., Tokyo, (4): 491-496, March 28, 1995

Rana ijimae (STEJNEGER, 1901), a Junior Synonym of Rana narina STEJNEGER, 1901 (Amphibia, Anura, Ranidae)

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Abstract Examination of the holotype of *Rana ijimae* from Okinawajima has revealed that it differs from *R. utsunomiyaorum* and *R. supranarina* from Ishigakijima and Iriomotejima Islands by having a longer hindlimb; it differs from *R. amamiensis* from Amamioshima and Tokunoshima Islands of the Amami Group by having a smaller body and relatively large tympanum. *Rana ijimae* also differs from *R. swinhoana* from Taiwan by having a narrower disc on the third finger. On the other hand, it does not differ from *R. narina* from Okinawajima in any morphological character, and is thus confirmed to be synonymous with the latter.

STEJNEGER (1901) described *Buergeria ijimae* from "Okinawa shima" (=Okinawajima), based on a single specimen (No. 19 (914)) in the collection of the Science College Museum of Tokyo, dedicating it to Prof. Isao IJIMA of Tokyo Imperial University. He, however, moved it to the genus *Rana* later (STEJNEGER, 1907). INGER (1947) considered that this species is a junior synonym of *R. narina*, a species also described by STEJNEGER (1901) from "Okinawa shima". Since then, this idea has been tentatively accepted by many Japanese authors and the name *R. ijimae* has rarely been used (NAKAMURA & UÉNO, 1963; KURAMOTO, 1979; MAEDA & MATSUI, 1989).

However, the idea has not been popular outside of Japan, partly because of the limited range of the *R. narina* complex (confined to the Ryukyus and Taiwan). Thus, in spite of its repetitive reference as synonymous with *R. narina* by Japanese authors (see above), *R. ijimae* is still treated as a species distinct from *R. narina* in some recent works (*e.g.*, DUELLMAN, 1993). The other reason for the present taxonomic confusion lies in the absence of convincing conclusion on this problem based on actual examination of the holotype of *R. ijimae* since STEJNEGER (1907).

Recently, we had an opportunity to examine the type of R. *ijimae* deposited in the University Museum, the University of Tokyo. In this short article, we will introduce the present state of the type specimen of R. *ijimae* and formally synonymize it with R. *narina*.

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It is a pleasure to dedicate this article to Dr. Shun-Ichi UÉNO who, in addition to his reputation as an entomologist, has greatly contributed to the field of Japanese herpetology by the publication of a comprehensive book, "Japanese Reptiles and Amphibians in Colour" (NAKAMURA & UÉNO, 1963).

Before going further, we thank Dr. Masahiro AIZAWA and the late Yoshiaki TOMINAGA for allowing us to examine specimens under their care. The research was partly supported by a grant from the U.S. National Geographic Society to the senior author (No. 4505–91).

Rana ijimae (STEJNEGER, 1901)

(Fig. 1)

Buergeria ijimae STEJNEGER, 1901, Proc. biol. Soc. Wash., 14: 190. Type, University Museum, the University of Tokyo, No. 19 (914), from Tanebimura, Okinawa Prefecture.

Redescription. An adult female; body moderately slender; head triangular, longer than wide; snout blunt, projecting beyond lower jaw; eye large, as long as snout; canthi distinct; lores deeply concave, vertical; nostril nearer to tip of snout than to eye; internarial distance wider than interorbital; latter slightly narrower than upper eyelid; tympanum conspicuous, one-half of eye diameter and separated from eye by four-fifths of tympanic diameter; vomerine teeth in oblique groups, beginning from a line connecting centres of choanae and extending posteromedially, groups equidistantly separated from each other and from choanae; tongue deeply notched, without papilla.

Forelimb slender; fingers unwebbed; first finger longer than second; fourth subequal to first; tips dilated into small discs having circummarginal grooves, two outer ones wider than phalanges but less than half diameter of tympanum; fingers without narrow fringes of skin.

Hindlimb rather long, about 2.7 times the length of forelimb; heels overlapping when limbs are held at right angles to body; tibiotarsal articulation of adpressed limb reaching far beyond tip of snout; discs of toes slightly narrower than those of two outer fingers; third toe shorter than fifth; toes well webbed, the following phalanges free of broad web: first toe, (0.5) - 2nd toe, inner web (1.5), outer web (0) - 3rd toe, inner web (2), outer web (0.5) - 4th toe, inner web (2), outer web (2) - 5th toe (1), fourth toe narrowly webbed to base of disc on inner and outer edges; excision of membrane between two outer toes reaching between middle and proximal subarticular tubercles of fourth when toes are in contact; webs thick, not crenulate; subarticular tubercles very prominent, oval; inner metatarsal tubercle distinct, oval, two-fifths length of first toe; outer metatarsal tubercle distinct; no tarsal fold.

Dorsum very obscurely shagreened; feeble dorsolateral line formed by short ridges only on shoulder region; supratympanic folds weak; side of trunk coarsely granular; chest and abdomen smooth.

Colour in alcohol. After long years in preservative, the coloration has nearly completely faded. Dorsum brownish without spots or dots; lore without markings below

Rana ijimae, a Junior Synonym of Rana narina



Fig. 1. Dorsal (A), ventral (B), and lateral (C) views of the holotype of *Rana ijimae* (SCT 19, SVL=61.2 mm).

canthus; upper lip without dark markings; limbs unmarked dorsally; ventral surface without heavy pigmentation of melanophores.

Measurements (in mm). In preservative, SVL 61.2; head length 24.8; snouttympanum length 20.0; snout length 9.7; eye length 10.0; tympanum-eye length 3.8; tympanum diameter 4.5×5.2 ; head width 21.7; head depth 10.9; internarial distance 6.0; interorbital distance 5.8; forelimb length 44; third finger disc width 2; hindlimb length 116.7; tibia length 36.6.

These values slightly differ from corresponding measurements given by STEINEGER (1907: SVL 68; eye length 9; tympanum diameter 4.5; head width 23; internarial distance 7; interorbital distance 5; hindlimb length 118; tibia length 38). Whether these differences resulted from the difference in the method of measurements or from shrinkage and slacking of the specimen after long years preservation is unknown.

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Taxonomic conclusion. The relative sizes of morphometric characters in the type of R. *ijimae* were simply expressed as ratios to SVL and shown in Table 1 together with those in female specimens of the species formerly assigned to R. *narina* until recently (MATSUI, 1994). Identification of the type of R. *ijimae* was made using the key for the R. *narina* complex provided by MATSUI (1994). First, the hindlimb is long, and the tibio-tarsal articulation of adpressed limb exceeds tip of snout. Thus, it is not R. *utsunomiyaorum* or R. *supranarina*. The finger disc is small, and the width relative to SVL is less than 0.038. This trait excludes the specimen from R. *swinhoana*. The small body of the type of R. *ijimae*, SVL being less than 75 mm, fits R. *narina* and not R. *amamiensis*.

Notes on taxonomic history. STEJNEGER (1907) wrote that the type specimen of R. *ijimae* had been obtained from "Tanebimura", Okinawa shima. However, this locality name is not of a current use and the exact type locality of R. *ijimae* is not detectable by any source of geographical references. The assignment of the type specimen to the genus *Buergeria* (STEJNEGER, 1901) was made because of the outward conformation of its terminal digital joint, but six years later, he (STEJNEGER, 1907) moved it to

Table 1. Morphological variation in females of the *R*. *narina* complex. SVL (in mm) expressed by means \pm SD and ratios to SVL by medians (ranges in parenthesis). For abbreviations, see text.

	$_{(N=1)}^{ijimae}$	a mamiensis (N=14)	(N=10)	supranarina (N=20)	utsunomiyaorum (N=21)	swinhoana (N=10)
SVL	61.2	87.5±7.1	70.0±2.4	92.6±5.2	53.9±2.9	76.8 ± 3.8
		(75.5-101.0)	(65.8-74.5)	(81.4-103.0)	(45.5-58.7)	(70.9-82.5)
HL/SVT	40.5	37.7	38.2	38.4	38.2	36.7
		(36.7-39.4)	(36.5-40.7)	(36.4-39.9)	(36.1-39.6)	(35.1-37.9)
S-TL/SVL	32.7	29.5	30.8	30.4	30.3	29.5
		(28.1-31.2)	(29.2-31.6)	(28.6-31.5)	(28.1-31.9)	(29.1-30.8)
SL/SVL	15.8	15.3	15.4	15.2	14.7	15.0
		(14.1 - 16.2)	(14.2 - 16.6)	(13.8 - 16.3)	(13.5 - 16.5)	(14.1 - 16.3)
EL/SVL	16.3	13.0	14.0	12.8	14.6	12.7
		(11.8 - 14.1)	(13.5 - 14.8)	(11.9 - 13.6)	(13.1 - 16.0)	(12.6 - 14.5)
T-EL/SVL	6.2	3.9	3.3	4.1	3.6	3.5
		(3.0 - 4.5)	(2.6 - 4.1)	(3.0 - 4.6)	(2.2 - 4.1)	(2.6 - 3.9)
TD/SVL	8.5	6.9	7.9	6.9	7.7	6.2
		(6.1 - 7.4)	(7.1 - 9.2)	(6.4 - 7.6)	(6.4 - 8.9)	(5.7 - 7.3)
HW/SVL	35.5	34.0	33.4	34.0	35.1	34.4
		(32.5-35.2)	(32.2-34.9)	(31.3-36.1)	(32.2-37.3)	(32.4-35.4)
IND/SVL	9.8	10.2	9.9	9.7	9.7	10.6
		(9.6 - 11.1)	(9.0-10.3)	(8.9-10.3)	(8.8 - 11.1)	(9.6 - 11.0)
IOD/SVL	9.5	8.5	8.1	8.3	8.0	8.4
		(7.4 - 9.3)	(6.8 - 9.0)	(7.1 - 9.5)	(7.4 - 8.8)	(7.8 - 9.1)
HLL/SVL	190.7	189.3	187.8	166.8	163.7	187.2
		(183.6-213.3)	(178.6-200.0)	(156.8-177.4)	(154.7 - 180.7)	(173.8-193.2)
TL/SVL	59.8	61.6	61.5	52.7	51.6	59.0
		(59.6-69.8)	(57.7-65.1)	(49.3-56.5)	(48.6-56.3)	(54.1-62.1)
Rana, because he confirmed the absence of interpolated bone in the type specimen. What seems strange is that STEJNEGER (1901, 1907) never associated *R. ijimae* with *R. narina*, although he (STEJNEGER, 1901) described both the species in the same publication. Later, VAN DENBURGH (1912, p. 193) referred specimens from the southern Ryukyus, obviously belonging to the *R. narina* complex (MATSUI, 1994), as *R. ijimae* but without providing any concrete reason for this identification.

It was INGER (1947) who first synonymized R. *ijimae* with R. *narina*. He (INGER, 1947, p. 331) considered that the descriptions of *narina* and *ijimae* in STEINEGER (1907) and OKADA (1931) indicated these forms to be very similar in important characteristics such as the position of the vomerine teeth, the tubercles surrounding the tympanum, the swollen tips of the digits, the blunt snout, and the general form and size. INGER (1947) considered that STEINEGER's designation of the two distinct species was the result of misinterpretation of poorly preserved types; too much dried *narina* vs. too soft state of *ijimae*.

NAKAMURA and UÉNO (1963) briefly noted that *R. ijimae* should be relegated in the synonymy of *R. narina*. Since then, few Japanese herpetologists admitted the validity of *R. ijimae*. For example, KURAMOTO (1979) negated the name of *R. ijimae* and stated that two distinct species are not present in *R. narina* sensu lato from any single island of the Ryukyus. On the other hand, OKADA (1966, p. 121) continued to use the names of *R. narina* and *R. ijimae*, the contents of which are identical with OKADA (1930, p. 133; 1931, p. 151). Because OKADA's monograph (OKADA, 1966) is written in English, it has generally been more frequently referred abroad as compared with NAKAMURA and UÉNO (1963) and KURAMOTO (1979) that are written in Japanese.

Probably following OKADA (1966), FROST (1985) recognized R. *ijimae* as valid, and cited both R. *ijimae* and R. *narina* in his checklist of the world amphibians, although he commented that the former is regarded as a synonym of the latter by some authors. Opposing this account, MAEDA and MATSUI (1989) stressed the synonymous state of R. *ijimae* with R. *narina*, but this was still insufficiently accepted by subsequent authors. For example, DUBOIS (1992) included both R. *narina* and R. *ijimae* in his new subgenus *Eburana* without mentioning the reason for recognizing the two forms as distinct. DUELLMAN (1993) followed DUBOIS (1992) in admitting R. *ijimae* and assigning it to *Eburana*, but he did not mention the relation of this species to R. *narina*, either.

MATSUI (1994) revised the *R. narina* complex and recognized five, including three new, species. Thus, frogs identified by VAN DENBURGH (1912) as *R. ijimae* are currently identified as *R. utsunomiyaorum* and *R. supranarina*. Similarly, OKADA's *R. ijimae* (OKADA, 1930, p. 133; 1931, p. 151) includes *R. amamiensis* besides *R. utsunomiyaorum* and *R. supranarina*. In this revision, MATSUI (1994) again called attention to the synonymy of *R. ijimae* with *R. narina*.

The present report clearly confirmed the synonymous state of *R. ijimae* with *R. narina*, and we hope this is sufficient to terminate long-lasting taxonomic confusion related to these forms. By recognizing invalid status of *R. ijimae*, it would be easier to analyze phylogenetic relationships of the subgenus *Eburana* as proposed by DUBOIS

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(1992), because it decreases the number of terminal taxa to be examined.

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Taxonomic Status of *Rhinolophus formosae* SANBORN, 1939 (Mammalia, Chiroptera, Rhinolophidae) from Taiwan¹⁾

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Abstract The rhinolophid bat *Rhinolophus formosae* SANBORN, 1939 from Taiwan has been synonymized by some authors with *Rhinoplohus luctus*. However, comparison of external, cranial, dental and karyotypic characters between some species of the *luctus* group and *R. formosae* proves that they are specifically distinct.

In May and June, 1991, a field research of small mammals was made in Taiwan by the senior author, who participated in a zoological expedition to the high mountains of Taiwan made by the National Science Museum, Tokyo. On this trip was collected a specimen of *R. formosae* belonging to the *Rhinolophus trifoliatus* group (formerly the *philippinensis* group, CORBET & HILL, 1992) at Meifeng, central Taiwan. Though currently synonymized with *R. luctus*, a comparative study based upon the new material proved that *R. formosae* was a good species. The purpose of the present paper is to introduce the result of this study into science.

The senior author is deeply indebted to Dr. Shun-Ichi UéNo, leader of the zoological expedition to the high mountains of Taiwan, for reading the original manuscript of this paper, and to Dr. Lawrence R. HEANEY, curator of mammal section of the Field Museum, USA, for giving information about the type specimen of *R. formosae*. She also wishes to express her hearty thanks to Dr. Chung-wei YEN, assistant curator, collection manager of ornithology, division of collection and research, National Museum of Natural Science, Taichung, central Taiwan, and some of his assistants and Mr. Jiahn-chang JEHNG, student of Tunghai University, Taichung, for their help in collecting bat specimens at Meifeng, central Taiwan.

We have a pleasure to dedicate this short paper to Dr. Shun-Ichi UÉNO on the occasion of his retirement from the Department of Zoology, National Science Museum, Tokyo.

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Rhinolophus formosae SANBORN, 1939

[Japanese name: Taiwan Mukuge Kikugashirakoumori]

(Figs. 1-4, 5 below)

Rhinolophus formosae SANBORN, 1939, Zool. Ser., Field Mus. nat. Hist., 24: 41.

Rhinolophus luctus: JONES, 1975, Quart. J. Taiwan Mus., 28: 187.

Rhinolophus luctus: CORBET & HILL, 1992, Mammals of the Indomalayan Region, 92. -- WILSON & REEDER, 1973, Mammal Species of the World, a Taxonomic and Geographic Reference, (ed. 2), 167.

Type locality. Only given as Formosa.

Type specimen. No. 46001 Field Museum of Natural History, Chicago. Adult male in alcohol. Collected by M. MAKI. Not located in the collection of the museum (pers. comm., Lawrence R. HEANEY, curator of mammal section in the museum). Specimens examined (see Table 1).

Table 1. Examined materials of Rhinolophus formosae and Rhinolophus luctus.

No.	Collecting site	Collector
R. formosae		
NSMT-M29856 Ad. male	Mixed forest at Meifeng, 2,000 m alt., Taiwan	М. Үознічикі
Harada 202 Ad. male	Irrigation conduit at Kunonsing, Nan Tou, Taiwan	M. HARADA
R. luctus		
Harada 379 Ad. male	Paktongchai, Nakhonrajasima, Thailand	M. HARADA
Harada 1247 Ad. male	Doi Chang Kieng, Chiang Mai, Thailand	M. Harada

Description. External characters (Fig. 1):- Ear translucent, blackish, acutely pointed at the apex: antitragal lobe high, straight at the anterior and posterior borders, and deeply separated from ear at the external side. Noseleaf also jet black in colour, consisting of anterior, intermediate and posterior parts, the last one of which is tapered into a lancet-shaped lobe; intermediate part remarkable, bearing a pair of circular lateral lappets at the basal portion of sella, and with low connecting process; anterior part horseshoe-shaped with a deep notch at the middle of lower margin, protruding on either side beyond upper lip.

Wing membrane translucent, blackish, attached to the base of metatarsal. Hind foot very long; of metacarpals, the fifth the longest, and the third the shortest. Plagiopatagium, also translucent, blackish, attached to a lower portion of lower leg, without keel and terminal lobe; terminal tail vertebra generally free from margin of uropatagium. Fur silky and glossy, particularly glossy on neck and shoulder back, forming a mantle posteriorly; approximate hair length 15 mm at the back of neck and shoulder, forming mantle posteriorly, 10 mm on back and rump, and 10 mm at the underpart of mantle.

Taxonomic Status of Rhinolophus formosae



Fig. 1. Face of *Rhinolophus formosae*, NSMT-M29856; adult male from Meifeng, central Taiwan.

Skull (Figs. 2–4) strong, similar in general aspect to that of *R. luctus* though smaller. Dorsal view:— Nasal swelling large, with deep postnasal depression, whose sides form strong ridges continuing to and converging towards remarkabke sagittal crest; anterior naris deep, its posterior margin lying at the level of the anterior border of anterior upper molar (M 1); lachrymal foramen small and subcircular; anteorbital foramen also small, lying near to and opening on the same plane as the lachrymal, its posterior border lying at the central level of M 2. Lateral view:— Dorsal margin of skull the highest at nasal swelling, deeply concave at the interorbital portion, then rather abruptly becoming higher at the anterior portion of braincase, and gradually slanting down posteriad; zygomatic arch distinctly convex at the middle. Ventral view:— Premaxillaries small, anchor-shaped, with the palatal branches narrowly protruding postero-laterad; anterior palatal emargination deep, U-shaped, its posterior margin lying almost on a line connecting the anterior margins of first upper molars (M 1); auditory bullae small, covering one-third of the surface of large cochleae, anterior

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		-						BWt	IIF
	FA	TL	T	нв	HFcu	1 1D	Е	(g)	М
R. formosae									
Type 46001 Male	60.2		39.0			32.8	32.0		
NSMT-M29856 Male	56.4	123.0	33.0	90.0	16.0	28.0	33.0	21.9	40.0
Harada 202 Male	57.5				17.0	29.0		21.5	40.0
R. luctus									
Harada 379 Male	70.0		46.5		19.0	35.5	45.0		53.0
Harada 1247 Male	69.8		46.0	Sugar.	19.0	35.5	41.0		50.0
		IIIF			IVF			VF	
	М	1PHA	2PHA	М	1PHA	2PHA	М	1PHA	2PHA
R. formosae									
Type 46001 Male	40.4	23.5	30.5	47.4	12.5	21.8	48.4	14.4	21.8
NSMT-M29856 Male	36.5	19.5	29.0	43.0	11.5	19.0	44.0	13.5	21.0
	36.0	21.0	29.0	42.5	10.5	18.5	45.5	12.5	21.0
Harada 202 Male	50.0								
Harada 202 Male R. luctus	50.0								
Harada 202 Male <i>R. luctus</i> Harada 379 Male	45.0	25.0	40.0	52.0	14.5	23.0	53.0	16.5	24.0

Table 2. External measurements of Rhinolophus formosae and R. luctus

Abbreviation: FA, forearm; TL, total length; HB, head and body; T, tail; HFcu, hind foot cum unguis; Tib. tibia; E, ear; BWt, body weight; IIF, second finger; IIIF, third finger; IVF, fourth finger; VF, fifth finger; M, metacarpal; PHA, phalanx.

portion of basicochleal fissure broad. Palate wide, so deeply emarginate both in front and behind that its median length is smaller than the shortest distance of a tooth row. Mandible low, mental protuberance vertical or protruding slightly posteriad, lower margin of mandible horizontal, angular process thick, condyloid process rather slender, its upper margin being much higher than the upper border of alveolar level, masseteric fossa comparatively shallow.

Teeth:— Upper incisor very small, bicuspid, upper canine strong and massive, bent downwards; upper anterior premolar P 2 minute, in tooth-row, the crown area larger than that of upper incisor; large posterior premolar P 4 not touching upper canine, its crown area almost identical with that of canine; anterior molars M 1 and M 2 almost of the same size, crown area of M 3 less than two-thirds of that of M 1. Lower incisors i 1 and i 2 (Fig. 5) slightly imbricate, the tips deeply and equally trifid, their crown areas almost the same in size; lower canine three-faced, internal, external and posterior; lower anterior premolar p 2 less than a half as high as posterior premolar p 4, middle lower premolar p 3 similar to anterior upper premolar, external to tooth-row. Lower molars m 1, m 2 and m 3 similar to one another, but the crown area is smaller in m 3 than in m 1 and m 2.

Ecological notes. We collected one specimen of this species in a primeval

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Figs. 2–4. Cranium of *Rhinolophus formosae*, NSMT–M29856; adult male from Meifeng, central Taiwan. — 2, Dorsal view; 3, ventral view; 4, lateral view.

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	and	R. meins	(in min).			
	GLS	CCL	RW	INT	ZYG	WBC
R. formosae						
Type 46001	27.4		6.5		12.4	10.0
NSMT-M29856	25.2	22.2	6.4	2.5	11.9	10.8
Harada 202			6.5	2.9		9.9
R. luctus						
Harada 379	30.4	26.9	8.3	3.0	15.1	12.0
Harada 1247	30.4	27.1	8.4	3.2	15.0	11.8
	MAST	C-C	M3-M3	C-M3	MAND	c-m3
R. formosae						
Type 46001	11.7					
NSMT-M29856	11.3	6.3	8.7	9.4	16.6	9.7
Harada 202		6.5	9.2	9.8	16.5	
R. luctus						
Harada 379	13.2	7.4	10.3	10.3	20.8	11.8
Harada 1247	12.9	8.1	10.6	11.7	21.4	12.4

Table 3.	Cranial	and	dental	measurements	of	Rhinolophus	formosae
			and R.	luctus (in mm).		

Abbreviations; GLS, greatest length of skull from canine; CCL, condylo-canine length; RW, width rostral swelling; INT, interorbital constriction; ZYG, zygomatic width; WBC, width of braincase; MAST, mastoid width, C-C, width across C-C (crown); M3-M3, width across M3-M3; C-M3, upper tooth row (canine to last molar); MAND, mandible; c-m3, lower tooth row (canine to last molar).



Fig. 5. Mandibles of *Rhinolphus formosae*, NSMT-M29856 (below) and *R. luctus*, Harada 1247, adult male from Doi Chang Kieng, Chiang Mai, Thailand (above).

forest of central Taiwan by Japanese mist nets and another in an irrigation conduit by an insect net. SANBORN (1939) recorded that the bats of this group were solitary

Spacios	2	CNI		Auto	osome	s Sex cl	nrome	somes Referen	nces
species	Zh	PIN ⁺	M·SM	ST	Α	х	Y		
R. formosae	52	60	6	4	40	ST	А	ANDO et al.,	1980
R. luctus	32	60	30	0	0	M · MS	A	HARADA et a NAIDU & GU HOOD et al.,	l., 1985 ruraj, 1984 1988

Table 4. Karyotypes of Rhinolophus formosae and R. luctus.

* The number of autosomal arms was defined as the fundamental number.

and of retiring habits. He may be right, as we were unable to observe crowd of flying bats and as the specimens caught were both solitary. It may live alone or in a pair.

Discussion

As the results of examination of external, cranial and dental characters made by the senior author and the karyotypic analysis made by the junior author, R. formosae is considered specifically different from R. luctus for the following reasons:

1) Though similar to *R. luctus* TEMMINCK, 1834 (type locality: Tapos, Java), *R. formosae* is much smaller in size than *R. luctus*, especially in the measurements of forearm and tail length which are not contained in the range of those in *R. luctus* (Table 2; ANDERSEN (1905), LEKAGUL & MCNEELY (1977).

2) The senior author clarified that in the group of *Rhinolophus cornutus* clinal variation is apparent, that is, the body size is evidently larger in the populations of the northern region or mountain areas than in those of the southern region or lowland areas (YOSHIYUKI, 1989; YOSHIYUKI *et al.*, 1989). If *R. formosae* is a subspecies of *R. luctus*, it must be larger than the latter. Since it is decisively smaller than *R. luctus*, it cannot be regarded as belonging to the *luctus* group, but to another group of species.

3) Geographically, the nearest relative of *R. formosae* is *R. lanosus* ANDERSEN, 1905 (type locality: Kuatun, NW Fujian, China), which was recently synonymized with *R. luctus*. According to ANDERSEN, the forearm length of the type specimen of *R. lanosus* is 71.5 mm, much longer than that of *R. formosae*.

4) The karyotype is markedly different between R. formosae and R. luctus as was already pointed out by the junoir author and others (Table 4).

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Speleominerals from Two Karst Regions in Malaysia

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Abstract Two new localities of speleominerals are reported on specimens from four caves in two karst regions of Malaysia, lying in West Peninsular Malaysia and East Malaysia — Sarawak.

Mineral identification was made by X-ray powder diffraction method and 6 minerals of 4 classes were revealed as follows: carbonate (dolomite), sulfate (gypsum), phosphates (hydroxyapatite, lipscombite, and whitlockite), and oxide (quartz). Lipscombite is reported as a new finding from the calcareous cave environment. It is formed in response to the tropical climatic condition.

Introduction

The members of the Scientific Exploration Club of Ehime University carried out an expedition to the caves in Malaysia from July 27th to August 23rd, 1989 (Fig. 1). During the course of this expedition, they were able to take 13 specimens of speleominerals.

The purpose of this preliminary report are 1) to report the results of some mineralogical data of speleominerals from Malaysia and 2) to bring out the differences in phosphate minerals produced in caves under different climatic environments.

Outline of the Caves Studied

I. West Peninsular Malaysia

The geology of the studied area is published by the Geological Survey Malaysia (1973) as a part of the Geological Map of Peninsular Malaysia at a scale 1: 2,000,000.

Perak Tong Cave and Gua Kek Look Tong Cave are developed in weakly metamorphosed marine calcareous rocks of the Devonian System.

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Fig. 1. Index map of Malaysia, showing the location of studied caves.

1) Perak Tong Cave This cave is situated about 6 km north of Ipoh City, approximately 120 km north of Kuala Lumpur, the capital of Malaysia.

Perak Tong Cave lies on an isolated karst tower and is well known for the existence of Buddhist temple. It has two entrances and the tourist passage runs through the karst tower. It attains the total length of about 200 m.

2) Gua Kek Look Tong Cave (Chinese name is Paradise Cave) Gua Kek Look Tong Cave, one of the Buddhist temple caves, is located about 6 km east of Ipoh City. The entrance opens on an isolated karst tower, and the passage pierces through the limestone hill. The cave contains the tourist passage of nearly 200 m in length, and the walls are mineralized by phosphate minerals. The origin of this cave is ascribed to the erosion of a subterranean river.

II. East Malaysia - Sarawak

The stratigraphy of Sarawak area was described by the Geological Survey of Malaysia (1986). In the studied region, northern Sarawak, Neogene strata (including some upper Paleogene rocks) mainly consist of arenaceous and argillaceous rocks with some chaotic deposits, coal and calcareous beds.

1) Deer Cave Deer Cave (local name is Gua Payau) is situated approximately 110 km southeast of Miri City, in the Gunung Mulu National Park, northern Sarawak, near the Brunei border.

This is one of the well known caves in the region, lying near Good Luck Cave which is well known for the largest cave hall named "The Room of Sarawak".

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Deer Cave has the largest cave passages in the world which attain to about 100 m in its average width and roof span. The Deer Cave mountain lies at the southern part of the Mulu band of limestone, which belongs to the Melinau Limestone Formation placed in the Tertiary (Eocene-Miocene). The tourist passage continues for about 1,400 m with strikingly large guano deposits.

2) Niah Great Cave The Niah Caves (Mouse Cave, Great Cave and Painted Cave) are located in the Niah National Park, about 70 km southwest of Miri City, northern Sarawak. Niah Great Cave is developed in a limestone of the Tertiary (Oligocene-Miocene) age. Bats and martens are roosting high on the roof of an entrance and the main passage. The cave passages are mineralized by guano phosphate minerals.

Analytical Results

Table 1 gives a list of the studied specimens, brief descriptions of their occurrence, and the results. The mineralogy of samples was determined by X-ray powder diffraction analysis using a Shimazu Seisakusho Ltd. X–D 3A–unit equipped with a copper tube and nickel filter.

Table 1.	Occurrence	of	speleominerals	in	analysed	specimens.
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Caves	No.	Occurrence	Minerals
Perak Tong Cave	1	greyish white to white unconsolidated powder on floor	lipscombite
Gua Kek Look Tong Cave	2	yellowish to dark brown earthy deposit in solution pocket	quartz
	3	yellowish and dark brown stratified al- ternated clay beds in solution pocket	quartz
	4	greyish to yellowish white earthy deposit in solution pocket	hydroxyapatite
	5	white and yellow consolidated earthy deposit on floor	hydroxyapatite
	6	brown or dark brown granular deposit on floor	gypsum
Deer Cave	7	yellowish white fine powder on guano deposit	gypsum
	8	dark brown and white crust	hydroxyapatite dolomite
	9	greyish white powder	gypsum, quartz
Niah Great Cave	10	yellowish brown to reddish yellow powder on floor	whitlockite
	11	dark brown to dark grey powder on floor	gypsum
	12	dark grey powder on floor	gypsum
	13	grey to yellowish grey powder on floor	gypsum

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Conclusive Remarks

The phosphate speleominerals of Malaysia were listed by HILL and FORTI (1986) as follows: dahlite, hannayite, monetite, newberyite, niahite, purpurite, strengite, taranakite, variscite, vivianite, whitlockite and woodhouseite.

The most remarkable phosphate minerals found in the studied caves are lipscombite and whitlockite. Whitlockite has deposited from leached bat guano after hydroxyapatite, apparently due to decrease of calcium in the solution (HILL & FORTI, 1986). On the other hand, lipscombite was first reported from calcareous caves as an iron analog of konincite and strengite. It results from reaction of bat guano with iron hydroxides and between guano and terra rossa deposits in a strong reducing environment.

In the studied region, combination of high temperature with high humidity, and of dry and wet seasons of monsoon climate, cause rapid weathering of chemical characters. At the same time, torrential rains cause leaching and surface erosion.

It is suggested from the feature described above that an active process of phosphate mineralization is apparent in the cave environment of Malaysia, much more effectively progressing than in more temperate climatic regions, such as South Korea, China and the Japanese Islands (Table 2).

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3110	gin	Name	Formula	Korea	Japanese Isls.	South China	Malaysia
		Niahite	Mn(NH4)PO4.H ₈ O				•
		Hannayite	$(NH_4)_2Mn_3H_4(PO_4)_4 \cdot 8H_2O_4$				•
		Newberyite	MgHPO ₄ ·3H ₂ O				•
	Aluminous cave clay	Sasaite	(AI, Fe) ₁₄ (PO ₄) ₁₁ SO ₄ (OH) ₇ ·83H ₂ O		•		
	(AI, Mg, K,	Taranakite	$(K, NH_4)Al_3(PO_4)_3(OH)\cdot 9H_2O$	•	•	•	•
	re, Mn, Na)	Vashegyite	$Al_4(PO_4)_3(OH)_3 \cdot 3H_2O$		•		
		Variscite	AIPO4.2H ₉ O		•	•	•
		Purpurite	MnPO ₄				•
		Crandallite	CaAl ₃ (PO ₄) ₂ (OH) · H ₂ O		•	•	
uano, Urea,		Woodhouseite	CaAl ₃ (PO ₄)(SO ₄)(OH) ₆			•	•
O., K. NH4 Na)	Ore	Vivianite	$Fe_{3}(PO_{4})_{2} \cdot 8H_{2}O$				•
	(Zn, Fe, Cu)	Lipscombite	$Fe_{3}(PO_{4})_{3}(OH)_{2}$				•
		Konincite	FePO4.3H2O		•		
		Strengite	FePO ₄ ·2H ₂ O			•	•
		Brushite	CaHPO4.2H ₂ O	•	•	•	
		Monetite	CaHPO ₄				•
	wall rock	Whitlockite	$Ca_{a}(Mg, Fe)H(PO_{4})_{7}$				•
	(CO ₃ , Ca,	Hydroxyapatite	$Ca_{s}(PO_{4})_{3}(OH)$	•	•	•	•
	50 ⁴)	Ardealite	$Ca_2(SO_4)(HPO_4) \cdot H_2O$	•	•	•	
		Dahlite	Ca ₅ (PO ₄ , CO ₃) ₃ (OH)				•

Table 2. Phosphate speleominerals from South Korea, the Japanese Islands, South China and Malaysia.

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