

## Endophallic Structure of the Genus *Zaitzeviaria* NOMURA (Coleoptera, Elmidae, Elminae), with Review of Japanese Species

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**Abstract** The endophallus of the genus *Zaitzeviaria* is characterized by membranous sac with several bladders covered by spines. The endophallic structures of most members are observed in detail and their homologies are examined. Five Japanese members of the genus including a new species are reviewed: *Z. sotai* sp. nov., *Z. ovata* (NOMURA), *Z. brevis* (NOMURA), *Z. gotoi* (NOMURA) and *Z. kuriharai* KAMITE, OGATA et M. SATÔ. *Zaitzeviaria sotai* sp. nov. is collected from Shimane and Tottori Prefectures including Oki Islands.

**Key words:** comparative morphology, internal sac of aedeagus, Macronychini, riffle beetle.

### Introduction

In recent years, the methodology of observation for fully everted membranous endophallus in small-sized beetles has been developed. SUGAYA and YAMASAKO (2014) described a new species of the subterranean trechine beetles (Carabidae) and figured its fully everted endophallus using hypodermic syringe with a fine needle. The total length of the trechine new species is about 5–6 mm and the length of endophallus is about 1.5 mm (see SUGAYA & YAMASAKO, 2014, fig. 11). DAM (2014) reported that the methodology of “a simple, rapid technique” for the eversion of the endophallus in the minimum-sized weevils, *Schizomicrus caecus* (CASEY) using a 36-gauge syringe. The size of the endophallus is about 0.4 mm (see DAM, 2014, fig. 6F). These approaches are expected to apply to other small beetles.

The genus *Zaitzeviaria* is described as a subgenus of the genus *Zaitzevia* CHAMPION based on carina on elytral intervals by NOMURA (1959). The type species is *Zaitzevia brevis* NOMURA, 1958. NOMURA (1961) treated it as a genus that comprising three Japanese species, *Z. brevis*, *Z. ovata* (NOMURA, 1959) and *Z. gotoi* (NOMURA, 1959). KAMITE *et al.* (2006) described an additional member, *Zaitzeviaria kuriharai* KAMITE, OGATA et M. SATÔ from Tsushima Islands, Nagasaki Prefecture.

The Japanese members of the genus have been possible to easily identified by body shape and color (YOSHITOMI *et al.*, 1999; KAMITE *et al.*, 2006). However, HAYASHI *et al.* (2013) analyzed phylogenetic relationship of 23 taxa of Japanese Elmidae based on mitochondrial cytochrome oxidase subunit I and nuclear 28S rRNA gene sequences. The phylogenetic tree combined COI and 28S gene sequences shows that the genus *Zaitzeviaria* is monophyletic group but *Z. ovata* is paraphyletic within the trees. Their results suggest that “*Z. ovata*” specimens analyzed by HAYASHI *et al.* (2013) included an unknown species of the genus. We reexamined the “*Z. ovata*” with observation of the endophallus in detail and found out a new species of the genus.

In general, fully everted endophallus of the small beetles are a useful character for its identification (e.g. SUGAYA & YAMASAKO, 2014). The endophallus of the genus *Zaitzeviaria* is characterized by

the membranous sac with several bladders covered by spines. However, the morphology of endophallus in *Zaitzeviaria* has not been studied by its minimum size (about 0.4–0.3 mm in length).

In this paper, we described a new species and its larva from Shimane and Tottori Prefectures, West Japan. We also examined fully everted endophallus of aedeagus of the new species, *Z. brevis* and *Z. ovata*, and reviewed known Japanese species of the genus with revised the key to species.

### Materials and Methods

*Specimens.* All the specimens observed in this study are collected from Japan: almost adult specimens are dry condition with pinned label; larval specimens are also dry in part, other specimens fixed 70% or 99% ethyl alcohol. Abbreviation of depositories are as follows:

EUMJ: Ehime University Museum, Matsuyama (H. YOSHITOMI)

HOWP: Hoshizaki Institute for Wildlife Protection, Izumo (M. HAYASHI)

NMW: Naturhistorische Museum, Wien (M. A. JÄCH)

NSMT: National Science Museum, Tsukuba (S. NOMURA)

*Fully everted membranous endophallus.* Endophallus (internal sac of aedeagus) of this genus is membranous and lacks remarkable sclerites. In this study, living adults were soaked in a water solution of sodium percarbonate (Oxygen-based bleaching agent available) in 24 hours keep the room temperature. The endophallus was inverted by the pressure of the bubbles in the body. The specimens were preserved in 60% ethyl alcohol. Unfortunately, it must be noted that the success rate is low by this method.

*Morphological observation.* Living adults on small water tank were photographed by Canon digital camera, EOS 70D attached macro photo lens MP-E 65 mm and macro twin light MT-24EX in the laboratory.

The external morphology of larvae were examined under a stereoscopic microscope (Nikon SMZ) and photographed for the external structure under a zoom microscope, Nikon AZ-100 with a digital camera, Nikon Digital Sight (DS-L2). About five to ten digital photographs were made by focus stacking, using a digital image processing software, Adobe Photoshop CS4 for Macintosh. Habitus of adults were photographed by this system.

Endophallus and larval microstructures were photographed under a light microscope, Nikon Eclipse E600 with the digital camera (DS-L2). These photographs were also made by focus stacking, using the digital image processing software. General observation and dissection of the adults were made under a stereoscopic microscope (Leica MZ95). Microstructures were observed, under a microscope (Olympus BH-2), of the dissected part mounted on hollow slides with pure glycerine. After observation, the dissected parts were mounted on slides with Canada Balsam. Some structures were observed with a SEM (Hitachi S-225) after coating with gold.

Morphological abbreviations used in measurement are as follows (also see Fig. 1): BL—basal length of penis, from base to the point where MH and ML lines meet; C—degree of an angle at MH point, formed by LBP and LCP lines crossing; CL—caudal length of penis (= ML - BL); EL—length of elytra; EW—width of elytra; LB—length of phallobase; LBP—length of basal portion, the line connected with base to MH point; LCP—length of caudal portion, the line connected with MH point to apex; MH—maximum height of penis, vertical line from ML line to MH point; ML—maximum length of penis (= BL+CL); PL—length of pronotum; PW—width of pronotum; TL—PL + EL. The average is given in parentheses after the range.

Abbreviations for wing form are as follows: AF, apterous form; MF, macropterous form.

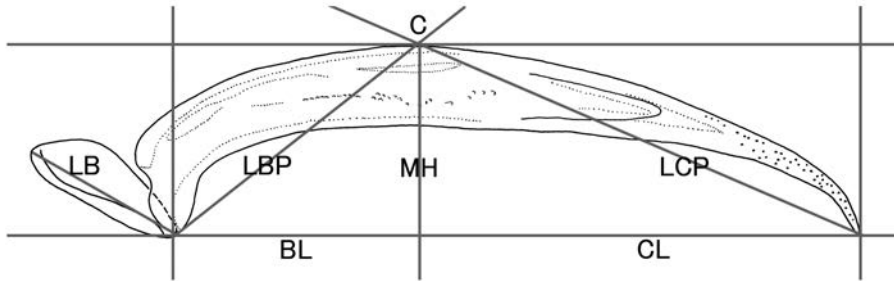


Fig. 1. Aedeagus in left aspect, showing the morphometric measurements. For abbreviations see in the text.

Terminology is followed after KODADA and JÄCH (2005) for morphological features of elmid larva and adult.

### Endophallic Structure of the Genus *Zaitzeviaria*

The membranous endophallus is developed in several genus of the subfamily Elminae, such as *Grouvellinus* (JÄCH, 1990), *Macronevia* (JÄCH & BOUKAL, 1995), *Haraldana* (JÄCH & BOUKAL, 1995), *Graphelmis* (ČIAMPOR, 2001, 2002, 2003, 2004, 2005 a, b, 2006; ČIAMPOR & J. KODADA, 2004), *Oka-lia* (KODADA & ČIAMPOR, 2003), *Ancyronyx* (KODADA & JÄCH, 2005), *Hedyselmis* (ČIAMPOR & ČIAMPOROVÁ-ZAT' OVIČOVA, 2008) and most genera of Macronychini (JÄCH & BOUKAL, 1995). However, the endophallic morphology has not been applied to taxonomy of Elmidae. In this study, we firstly observed the fully everted membranous endophallus of the genus *Zaitzeviaria*.

The fully everted endophallus examined in this study, the general shape is bilateral symmetry. We recognized several structures of the everted endophallus based on *Z. brevis* (Fig. 2), as follows (*Z. kuriharai* is not examined):

Ejaculatory duct (ej): a tubular in the endophallus visible by transmitted beam.

Gonopore (gp): opening of ejaculatory duct with corona and a pair of apical sclerites.

Apical sclerite (as): two sclerites present, entirely slender, apex acute, situated near the gonopore; elongate in *Z. gotoi*.

Apical bladder (ab): relatively small, lacking spines on surface, projecting forward from gonopore but projecting dorsally in *Z. gotoi*.

Dorsal sac-supporting sclerite (ds): two elongate sclerites on the base of endophallus; bent sclerites situated on the opening of penis when the endophallus not everted.

Dorso-apical bladder (dab): the bladder on behind of gonopore, with spines; developed in *Z. brevis* but indistinct in other species.

Dorso-basal bladders (abb): the bladder on dorso-basal area, near the apex of penis; two bladders developed laterally in *Z. sotai* and *Z. ovata*; covered by spines in *Z. brevis*, *Z. sotai* and *Z. ovata*, but lacking in *Z. gotoi*.

Ventro-apical bladder (vab): the bladder on ventro-apical area, below the apical bladder; apex divided two pieces in *Z. sotai* and *Z. ovata*.

Ventro-basal bladder (vbb): the bladder on ventro-basal area.

## Taxonomy

### Genus *Zaitzeviaria* NOMURA, 1959

[Japanese name: Himetsuya-doromushi Zoku]

*Zaitzevia* (*Zaitzeviaria*) NOMURA, 1959, 35. Type species: *Zaitzevia brevis* NOMURA, 1958.

*Zaitzeviaria*: NOMURA, 1961 [as genus], 3; 1963, 41.

**Diagnosis.** Adults. Body small, length about 1–2 mm, oblong to oval. Coloration of most species uniformly brown to black. Antennae relatively long, 8-segmented (Figs. 6G, 10B). Labrum (Figs. 6F, 10C) a little wider than long, convex dorsally. Mandibles (Fig. 10D) with two apical teeth. Maxillae (Fig. 10F) with 4-segmented maxillary palpi. Labium (Fig. 10E) with trapezoidal ligula; labial palpi 3-segmented. Pronotum (Fig. 7) wider than long; sublateral grooves present in basal half; median groove distinct, extending from base to near anterior margin. Elytra (Figs. 8, 9) oblong to oval, roof-like in cross section; elytral carinae consisting of granules on intervals VII and VIII (Fig. 6A, C, D). Hind wing with two dimorphism in apterous (AF) and macropterous (MF, Fig. 10A) forms. Legs moderately long. Intercostal process of sternite III (Fig. 6E) wide, pentagonal. Sternite VII (Fig. 6H) arcuate in caudal margin, irregularly granulate.

**Male genitalia.** Tergite VIII (Fig. 10G) semicircular, closely covered with minute setae. Sternite VIII (Fig. 10H) semicircular, with a long median strut, sparsely bearing short setae in caudal margin. Sternite IX (Fig. 10I) oblong, with a pair of lateral sclerites and median strut. Aedeagus (Fig. 11) long, curved dorsally; parameres completely confused to penis (Fig. 11B, F) or recognized only apical part (Fig. 11D, H, J); penis slender, pointed or expanded at apex, with/without apical teeth. Endophallic structures (Figs. 2–4) as above mentioned.

**Female genitalia.** Tergite VIII (Fig. 10J) semicircular, bearing short setae. Sternite IX (Fig. 10K) semicircular, with long median strut. Ovipositor (Fig. 12) relatively short; stylus curved laterally; apical part of coxite projecting laterally; bursa copulatrix with 4 small sclerites.

**Larvae** (Figs. 14–16, also see HAYASHI & SOTA, 2010, figs. 13). Body semi-cylindrical, convex dorsally and flattened ventrally, dorsum lacks projections, a cross section of body triangular. Thorax convex not flat; prothorax lacks ventral sclerite on post-medial part of procoxae. Tergite I as broad as thickness.

**Biological notes.** The member of this genus lives in a sandy small stream in Japan (Fig. 13E–H), and one to four species of this genus can be collected together in the same site. *Zaitzeviaria brevis*, *Z. gotoi* and *Z. ovata* were reported from some caves (ARITA & SATŌ, 1969; some specimens were examined in this paper), but ARITA and SATŌ (1969) suggested that these are not troglobite but troglophile.

Macropterous form individuals are sometimes attacked to light, and MIYATA and MIYATA (2014) reported that *Z. gotoi* and *Z. brevis* were collected from car net in the evening (about PM 6:00–7:30).

**Remarks.** The genus is characterized by carinate "6th" and "7th" elytral intervals by NOMURA (1959) but the sutural interval is excluded in his number. In this paper, sutural interval is treated as first interval therefore the carinate in intervals VII and VIII in the genus (see also YOSHITOMI & NAKAJIMA, 2007).

This genus is represented by the four Palearctic (all occurred in Japan) and 12 Oriental species (KODADA & JÄCH, 2005). The Palearctic members are revised and added a new species in this paper, but the remaining members of the Oriental Region are very diverse and must be reviewed in near future (JÄCH & BOUKAL, 1995).

This genus is distinguished from the related genera by the 8-segmented antenna and elytral carinae on intervals VII and VIII. Particularly some genera of Asian Macronychini are very similar to it in

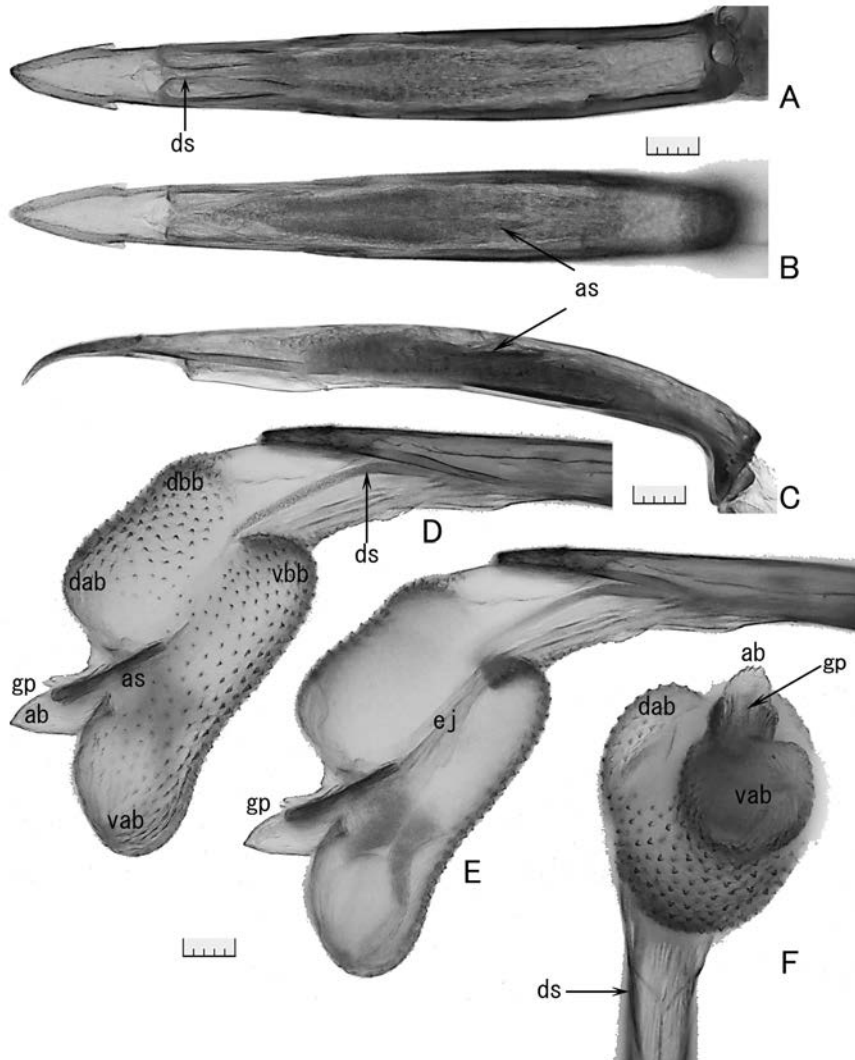


Fig. 2. Endophallic structure of *Zaitzeviaria brevis* (Hikawa, Izumo, Shimane Pref.). — A–C, Endopallus in penis (A, ventral view; B, dorsal view; C, lateral view); D–F, fully everted endopallus (D, F, surface structure; E, inner structure: D, E, lateral view; F, frontal view). Abbreviations; as, apical sclerite; ab, apical bladder; dab, dorso-apical bladder; dbb, dorso-basal bladders; ds, dorsal sac-supporting sclerite; ej, ejaculatory duct; gp, gonopore; vab, ventro-apical bladder; vbb, ventro-basal bladder. All scales are 0.05 mm. All photographs by light microscope.

having small body size and external feature, but they have different antennal segment number (7-segment in *Sinonychus*) and elytral carinae (on V, VI, VII in *Sinonychus* and *Indosolus*; on III, V, VII, VIII/III, V, VII/V, VII in *Jilanzhunychus* and *Aulacosolus*).

***Zaitzeviaria sotai* sp. nov.**

[Japanese name: San-in-himetsuya-doromushi]

(Figs. 3, 5A, B, 6, 7A, 8A, B, 11A, B, 12A, 13A, 14, 15, 16A–C)

*Zaitzeviaria ovata*: HAYASHI & SHIMADA, 2006, 138 [in part; misidentification]; HAYASHI & KADOWAKI, 2007, 166; 2010 183 [in part; misidentification]; HAYASHI *et al.*, 2011, 304 [in part; misidentification].

*Zaitzeviaria* sp.: FUJIWARA & NUMATA, 2009, 269.

*Type series.* Holotype (EUMJ), 1 male (apterous form: AF), Hobomi, Chichii, Ama-chô, 20.X.2014, MHa & H. KADOWAKI. Paratypes (EUMJ, HOWP, NMW, NSMT), 1 female (AF), same data as for the holotype; 1 ex. (AF), same locality, 3.VII.2012, MHa; 1 ex. (AF), same locality, 12.V.2013, MHa; 12 exs. (AF), Odaka-suiro, Okanari, Yonago-shi, 13.XII.2006, H. KADOWAKI; 7 exs. (AF), same locality, 28.XII.2008, H. KADOWAKI; 3 exs. (AF), Syojin-kawa, Daisen-bashi, Akamatsu, Daisen-chô, 28.XII.2008, H. KADOWAKI; 12 exs. (AF), same locality, 4.IV.2008, HK; 1 ex. (AF), Enjo-gawa, Nakaenjo, Daito-chô, Unnan-shi, 29.IV.2005, MHa; 7 exs. (AF), Hiratafunakawa, Mandao-hashi, Izumo-shi, 3.VIII.2008, MHa; 6 exs. (AF), Ibo-kawa, Hikawa-chô, Izumo-shi, 22.X.2013, MHa; 1 ex. (AF), Kimachi-gawa, Kamikimachi, Shinji-chô, Matsue-shi, 24.IV.2005, MHa; 9 exs. (AF), Shimizu-gawa, Shimane-chô, Matsue-shi, 19.II.2006, MHa; 9 exs. (AF), St. 1, same locality, 24.III.2006, MHa & H. NAKANO; 2 exs. (AF), St. 2, same locality, 24.III.2006, MHa & H. NAKANO; 1 ex. (AF), Araki-gawa, Araki, Saigo, Okinoshima-chô, 2.VI.2012, H. KADOWAKI; 1 ex. (AF), Igo, Saigo, Okinoshima-chô, 10.X.2008, J. FUJIWARA; 1 ex. (AF), Kouji-gawa, Kouji, Okinoshima-chô, 9.VIII.2005, MHa; 1 ex. (AF), Mimiura, Nishinoshima-chô, 16.X.2010, H. KADOWAKI; 5 exs. (AF), Chichii, Ama-chô, 26.VIII.2009, H. KADOWAKI; 46 exs. (AF), Nibu, Chiburi-mura, 10.V.2013, MHa; 10 exs. (AF), same locality, 24.VIII.2009, H. KADOWAKI; 1 ex. (AF), Chichi I, Kaishi-chô, 26.VIII.2009, H. KADOWAKI; 3 exs. (AF), Ooyama, Nishinoshima-chô, 26.VIII.2009, H. KADOWAKI; 12 exs. (AF), Mita-dam, Nishinoshima-chô, 5.VI.2009, H. KADOWAKI.

*Additional specimens examined.* See appendix.

*Descriptions.* Adults. Male. Body (Fig. 5A, B) obovate, convex dorsally. Coloration of head and pronotum entirely black, but mouth part and frontal margin of pronotum brown; elytra coloration variable, red, reddish brown or black; antennae, legs, and sternites of meta-, meso-thoracies, and abdomen reddish brown. Head entirely rounded, almost flat in dorsal surface, densely covered with minute setae. Eyes moderate in size, slightly prominent. Pronotum (Fig. 7A) finely punctate, shiny and smooth; antero-lateral angles produced anteriorly; postero-lateral angles almost rectangular; sublateral grooves extending from the base to basal 1/2; median groove extending from the base to just before anterior margin. Prosternum densely covered with minute setae in lateral parts; prosternal process converging posteriorly. Scutellar shield small, subtriangular. Elytra (Figs. 6A, 8A, B) obovate, widest at basal 2/3; elytral carinae (Fig. 6C, D) extending from base to basal 4/5; lateral margins distinctly serrate.

Aedeagus (Fig. 11A, B, Table 2) long, about 0.54 mm (in BL+CL+LB), moderately sclerotized; phallobase short, oval; parameres completely confused to penis; penis long, straight and gently curved dorsally in apical part, pointed at apex, punctate in apical part, with a pair of small apical teeth. Endophallus (Fig. 3) entirely membranous, dorso-basal and ventral area covered by minute teeth-like projections; apical area with a ostium of ejaculatory duct and a pair of needle-like sclerites; rounded processes on dorso-basal area on both sides; branched process on apical-ventral area.

Female. Sexual dimorphism indistinct, somewhat larger than male.

Larvae (Figs. 14–16). Body length of mature larvae about 3.0 mm in expanded specimen preserved in 70 % ethanol; about 2.5 mm in dry condition. Body elongate, gradually narrowing middle to apex; convex dorsally and flattened ventrally; slightly prominent spiracles on mesothorax and abdominal segment I to VIII; middle suture present on thorax and abdominal segment I to VI; body color entirely brown.

Head visible from above, well exposed from prothorax; width as long as length; clypeus trans-



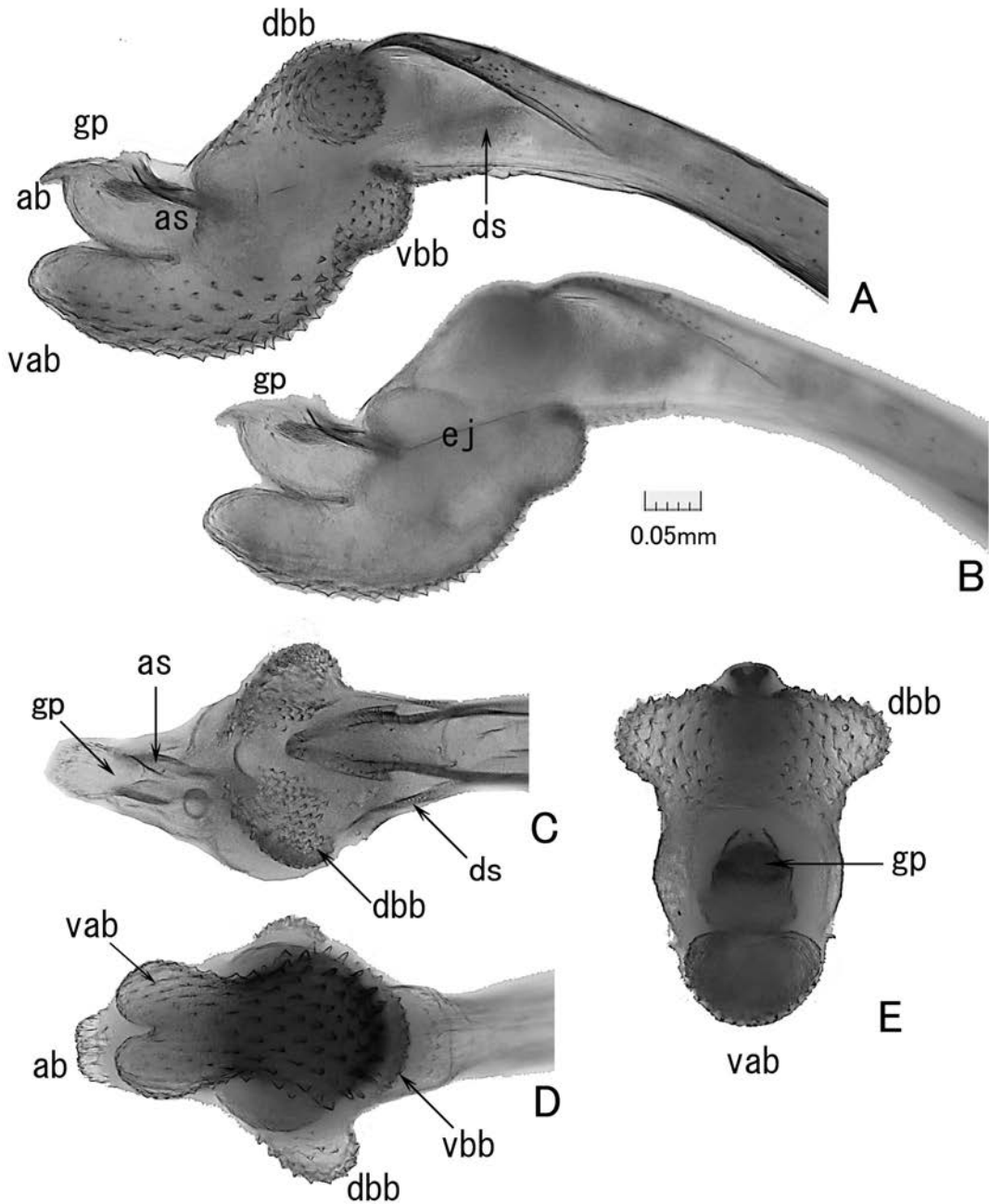


Fig. 3. Fully everted endophallus of *Zaitzeviaria sotai* sp. nov. (A–B, D–E, Hikawa, Izumo, Shimane Pref.; C, Chibu, Oki Is., Shimane Pref.). — A–B, Lateral view (A, surface structure; B, inner structure); C, dorso-basal view; D, ventro-frontal view; E, frontal view. All photographs by light microscope.

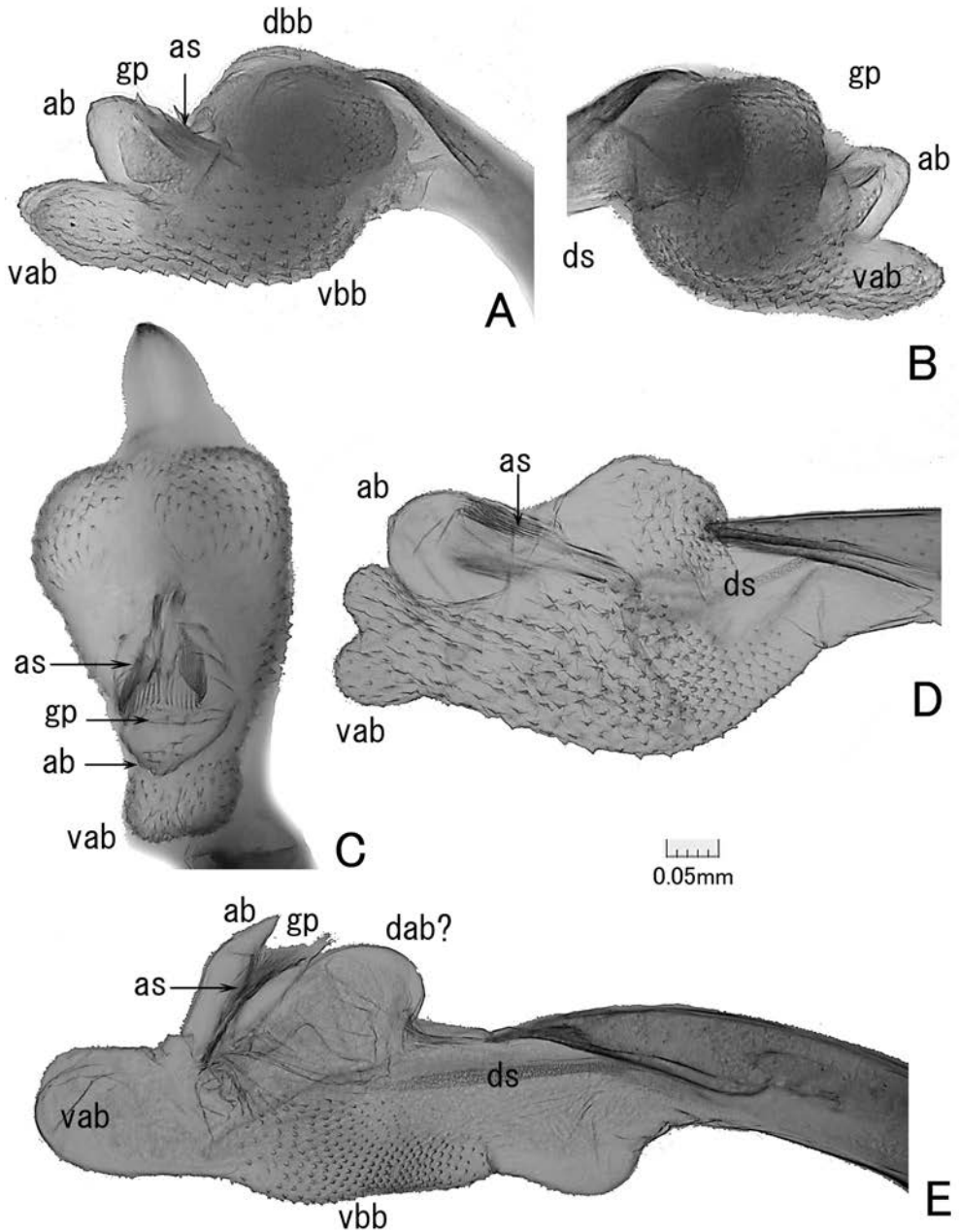


Fig. 4. Everted endophallus of *Zaitzeviaria ovata* (A–B, Miyama, Izumo, Shimane Pref.; C, Nishihayashigi, Izumo, Shimane Pref.; D, Kimi-tôge, Kawachinagano, Osaka Pref.) and *Z. gotoi*. (E, Karakawa, Izumo, Shimane Pref.). — A, Lateral view; basal-lateral view; dorso-frontal view. A–C, Fully everted; D–E, not fully everted. All photographs by light microscope.



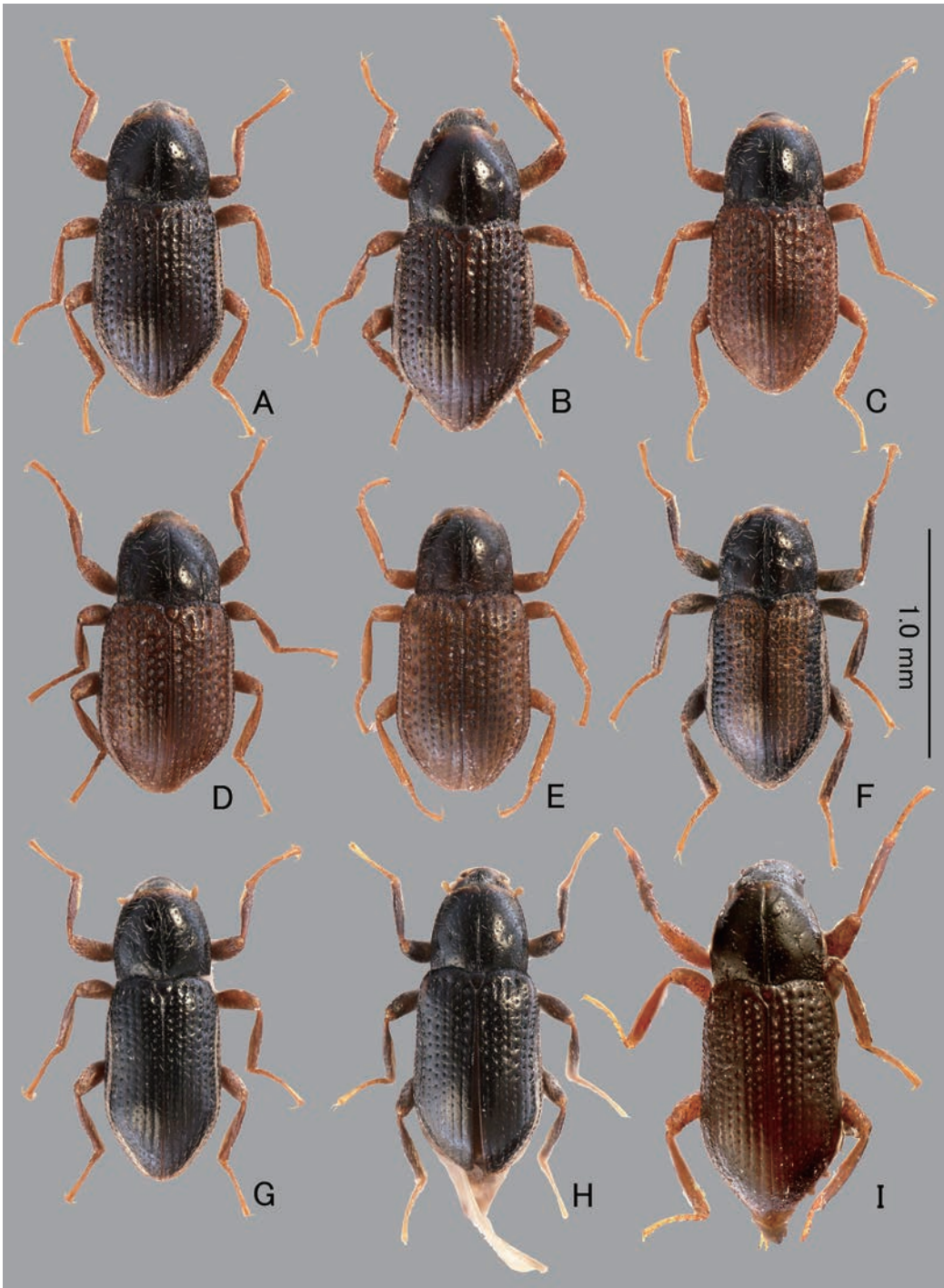


Fig. 5. *Zaitzeviaria* spp. — A–B, *Z. sotai* sp. nov.; C–E, *Z. ovata*; F, *Z. brevis*; G–H, *Z. gotoi*; I, *Z. kuriharai*.  
 — E, H, Macropterous; others, apterous. — A, C, F, G, H, Male; D, E, I, female.

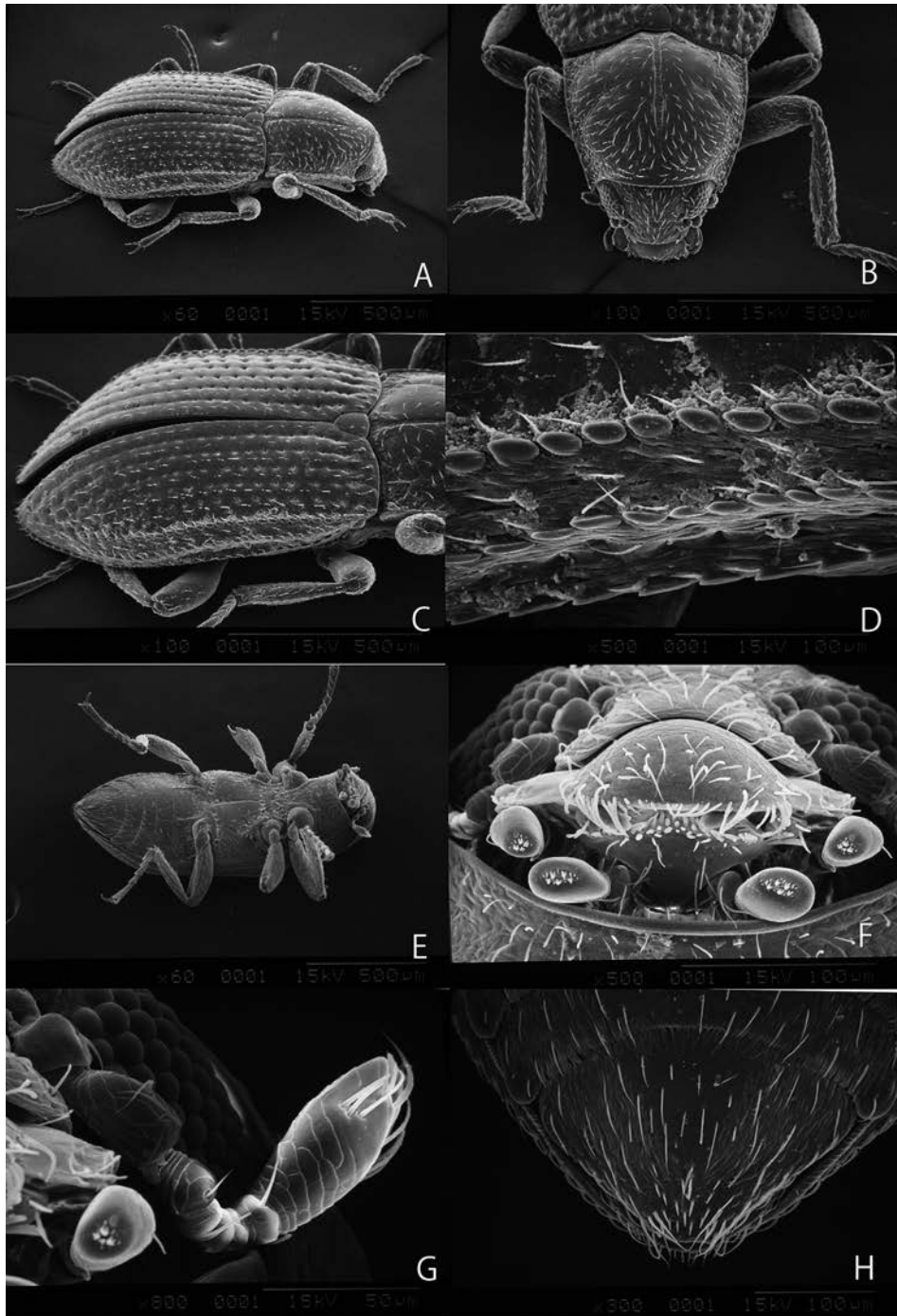


Fig. 6. SEM photographs of *Zaitzeviaria sotaï* sp. nov. (A–D) and *Z. gotoï* (E–H). — A, Habitus in dorso-lateral view; B, head and pronotum in front view; C, elytra in dorso-lateral view; D, elytral carinae; E, habitus in ventro-lateral view; F, labrum and maxillary and labial palpi; G, antenna; H, sternite VII.

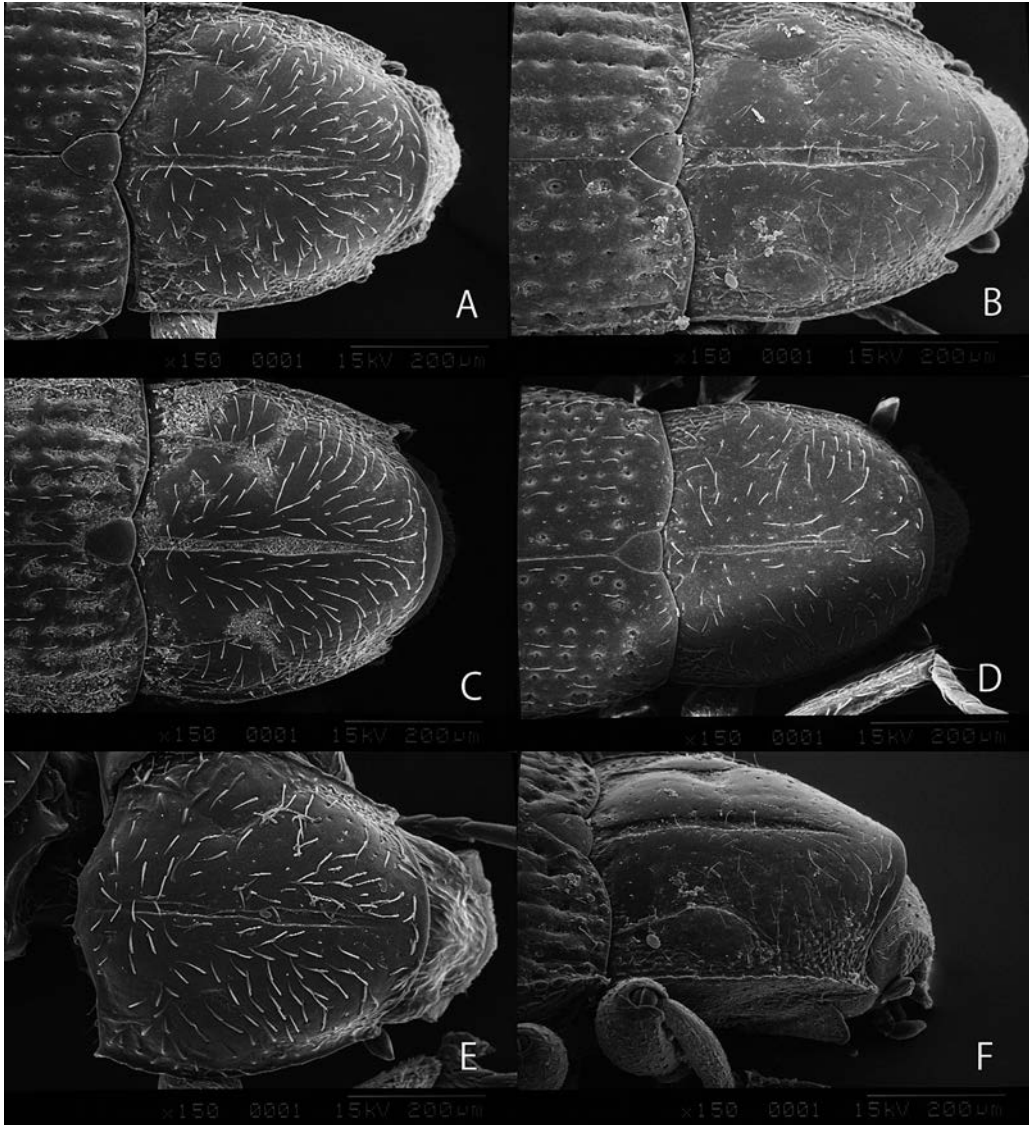


Fig. 7. Pronotum of *Zaitzeviaria* spp. in dorsal (A–E) and dorso-lateral (F) aspects. — A, *Z. sotai* sp. nov.; B, F, *Z. ovata*; C, *Z. brevis*; D, *Z. gotoi*; E, *Z. kuriharai*.

verse, without setae on front; vertex with granules and branched setae; epicranial stem short; frontal suture distinct; frontoclypeal suture indistinct. Antenna 3-segmented; 1st shorter than 2nd; 2nd with slender and elongate sensorial appendage; 3rd short. Labrum transverse and short, with long, simple and branched setae along frontal margin; epipharynx with dense setae. Mandible tridentate at apex. Maxilla and labium forming a unit (maxillolabial unit). Maxilla with 4-segmented palpus; cardo small; stipes large; galea and lacinia separate, setose apically. Labium narrow with 2-segmented palpus; ligula short; mentum long; submentum short and transverse.

Thorax slightly serrated on lateral sides; dorsum covered by coarse and fine granules, more or



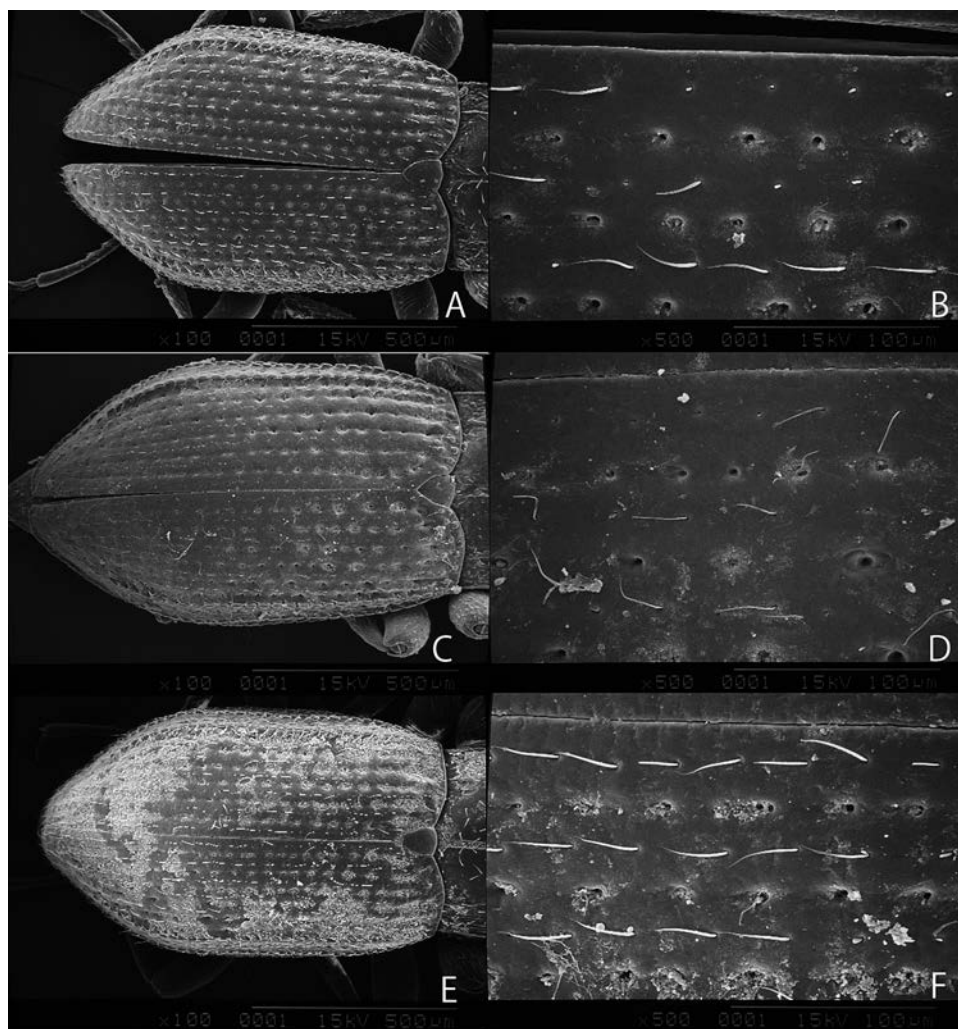


Fig. 8. Elytra (A, C, E) and their close up (B, D, F) of *Zaitzeviaria* spp. — A, B, *Z. sotai* sp. nov.; C, D, *Z. ovata*; E, F, *Z. brevis*.

less sparsely, each coarse granules with a feather-like seta. Prothorax broad, width longer than length, 1.7 times as long as mesothorax; hind margin dentate with feather-like setae; six ventral sclerites, procoxae not closed posteriorly. Meso- and metathoraces transverse; metathorax longer than mesothorax. Mesothorax with five ventral sclerites. Legs 5-segmented, with long setae.

Abdomen 9-segmented; cross section of abdomen triangular; segments I–VIII transverse, dorsum covered by coarse and fine granules, more or less sparsely, coarse granule with a feather-like seta; pleural sclerites on segments I–VII; last segment (segment IX) longer than width, gradually narrowing to apex, dorsum with longitudinal ridge, apex without v-shaped notch and spines; ventral operculum, opercular claws, and anal gills present.

*Identification of larvae.* The larvae described in this study were collected from Nibu, Chiburi Island of Oki Islands. The larvae are easily determined the new species because the elmidae fauna of

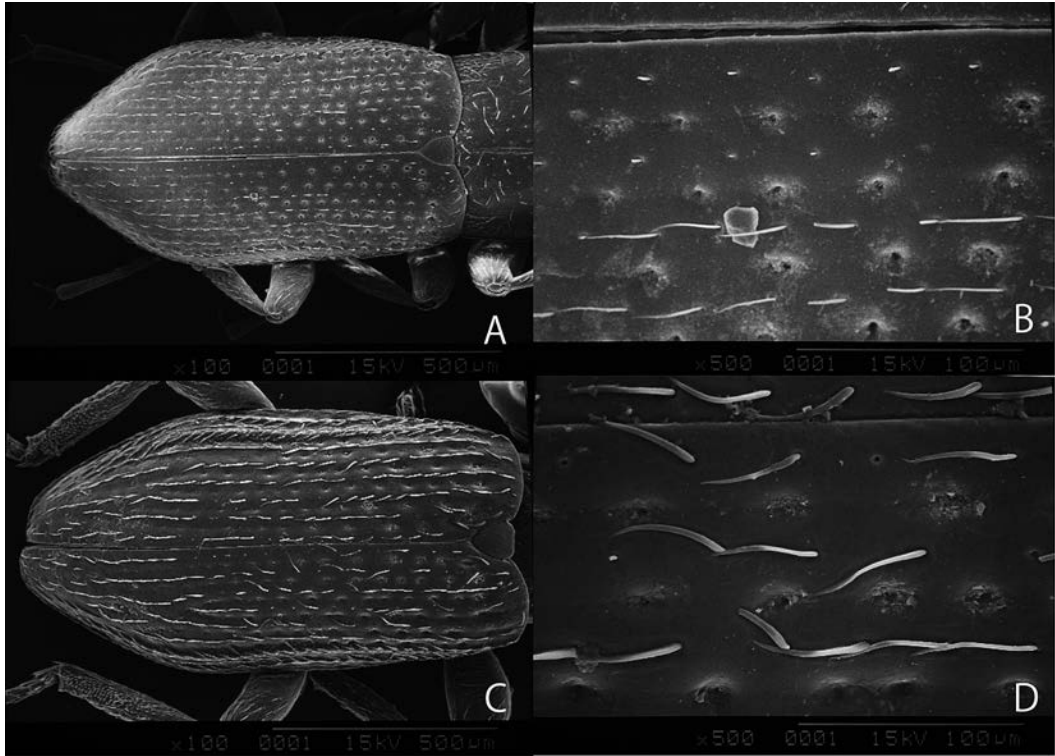


Fig. 9. Elytra (A, C) and their close up (B, D) of *Zaitzeviaria* spp. — A, B, *Z. gotoi*; C, D, *Z. kuriharai*.

Chiburi Is. includes one species only.

*Remarks.* The new species is closely similar to *Z. ovata*, but differs from it by the following characteristics: 1) body slender; 2) elytral intervals shiny; 3) apical shape of aedeagus likes arrowhead; 4) full expanded endophallus entirely slender in lateral view.

*Etymology.* The new species is named after Dr. Teiji SOTA, Kyoto University, who pointed out the existence of this new species by the molecular analysis.

*Biological notes.* The new species lives in small streams in hilly or low mountain area in Sanin region and Oki Islands (Fig. 13E–H). The adults and larvae are found in all seasons. In the Oki Islands, the new species usually coexist with *Z. gotoi* in streams of Dogo and Nishinoshima Isls. but it is no coexistent Elmidae in Nakanoshima and Chiburi Isls. In the Sanin region of Honshu, the new species coexist with *Z. brevis* or *Z. ovata* or *Z. gotoi*, or all of them but *Z. ovata* and *Z. gotoi* tend to live more upstream.

*Distribution.* Japan: western Honshu (Sanin region) and Oki Islands (Dogo, Nishino-shima, Nakano-shima, Chiburi-jima Isls.).

***Zaitzeviaria ovata* (NOMURA, 1959)**

[Japanese name: Maru-himetsuya-doromushi]

(Figs. 4 A–D, 5C–E, 7B, F, 8C, D, 11C, D, 12B, 13B, 16D–F)

*Zaitzevia* (*Zaitzeviaria*) *ovata* NOMURA, 1959, 35; NOMURA, 1960, 36.



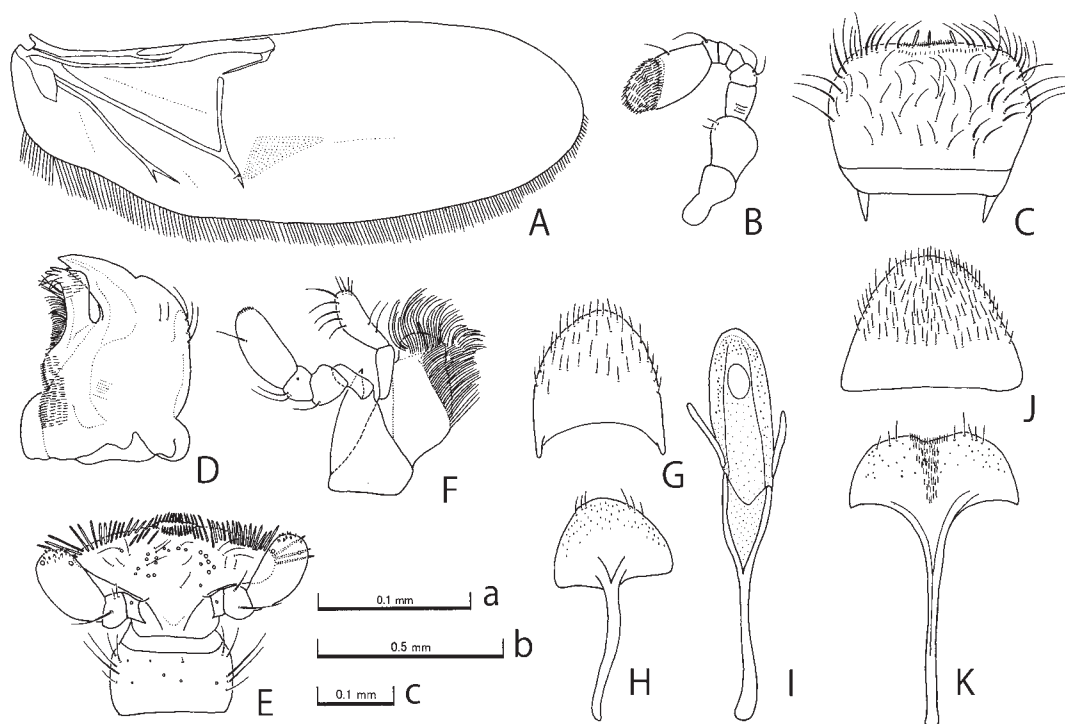


Fig. 10. *Zaitzeviaria brevis* in male (A–I) and female (J, K). — A, Hind wing in MF; B, antenna; C, labrum; D, mandible in dorsal view; E, labium; F, maxilla; G, J, tergite VIII; H, K, sternite VIII; I, sternite IX. Scale a for G–K; b for A; c for B–F.

*Zaitzeviaria ovata*: NOMURA, 1961, 3; SATÔ, 1977, 5; SATÔ, 1985, 439; HAYASHI & SOTA, 2010, 420, fig. 13 [figure of larva].

*Type specimen examined.* Holotype is not decided by this study. NOMURA (1959) designated that the holotype of this species was collected from Kimi-tôge, Wakayama Pref. and the paratypes were collected from the type locality, Mt. Kasuga, Nara Pref. and Nebamura, Nagano Pref. In our specimens examined, the type is labeled with collected from Mt. Kasuga, Nara Pref. The “Holotype” is labeled as follows: 1 ♂, Mt. Kasuga / Nara-Pref. / 6.VI.1969 / Coll. Mitsuo Goto // No. 2 / 奈良 // ♂ // Shizumu / NOMURA / Bequest, 1981 // HOLOTYPE / *Zaitzevia* / (*Zaitzeviaria*) / *ovata* / Nomura (1959) (red label: handwriting by Sizumu Nomura) // (blue label) (NSMT). We recognized that the type is one of the paratypes.

*Additional specimens examined.* See appendix.

*Descriptions.* Adults. Elytra (Fig. 8C, D) ovate, widest at basal 3/4, bearing short fine setae in intervals.

Aedeagus (Fig. 11C, D, Table 2) rather stout, about 0.49 mm (in BL+CL+LB), moderately sclerotized, evenly curved; phallobase short, oval; parameres shortly recognized in apical 1/3; penis long, gently curved dorsally, pointed at apex, punctate in apical part, without apical teeth. Endophallus (Fig. 4) not elongate; apical bladder prominent; ventro-apical bladder developed, apex notched; dorso-api-

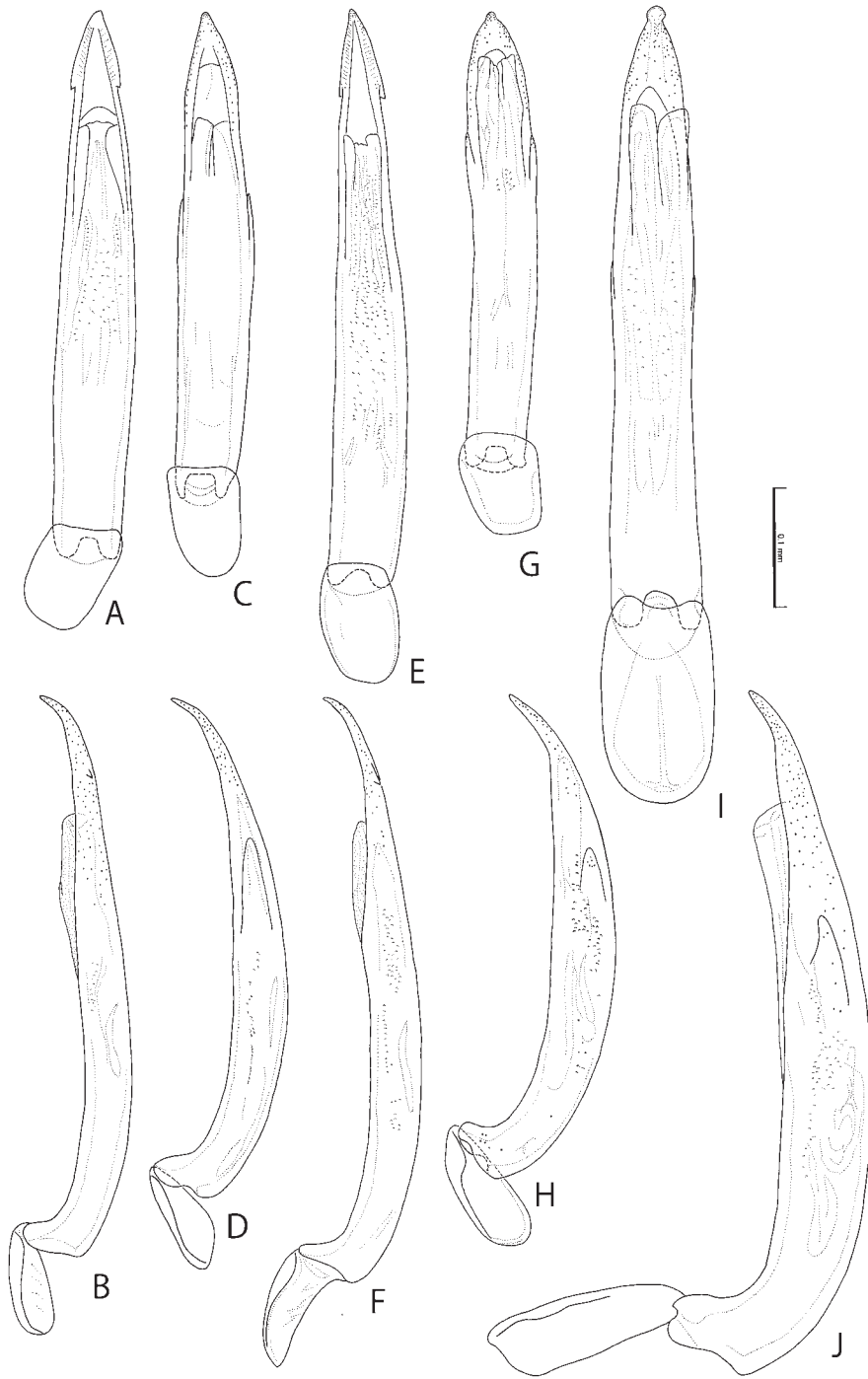


Fig. 11. Aedeagus of *Zaitzeviaria* spp. in dorsal (A, C, E, G, I) and lateral (B, D, F, H, J) aspects. — A, B, *Z. sotai* sp. nov.; C, D, *Z. ovata*; E, F, *Z. brevis*; G, H, *Z. gotoi*; I, J, *Z. kuriharai*.

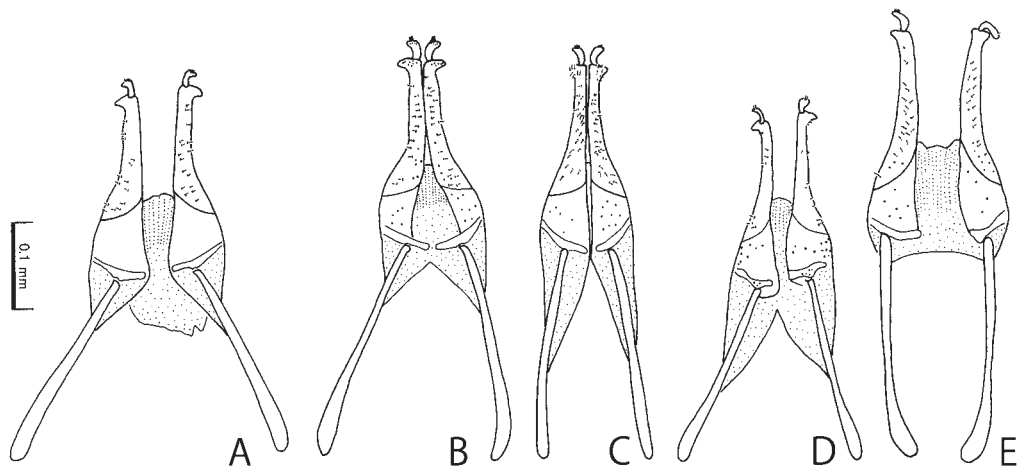


Fig. 12. Ovipositor of *Zaitzeviaria* spp. — A, *Z. sotai* sp. nov.; B, *Z. ovata*; C, *Z. brevis*; D, *Z. gotoi*; E, *Z. kuriharai*.

cal bladder indistinct; dorso-basal bladders swollen; ventro-basal bladder not prominent; surface with tooth-like spines, except for apical bladder and base.

*Distribution.* Japan: Hokkaido, Honshu, Shikoku, Kyushu.

***Zaitzeviaria brevis*** (NOMURA, 1958)

[Japanese name: Himetsuya-doromushi]

(Figs. 2, 5F, 7C, 8E, F, 10, 11E, F, 12C, 13C)

*Zaitzevia brevis* NOMURA, 1958, 49.

*Zaitzevia (Zaitzeviaria) brevis*: NOMURA, 1960, 36.

*Zaitzeviaria brevis*: NOMURA, 1961, 3; SATÔ, 1977, 5; 1985, 439.

*Type specimen examined.* Holotype (NSMT): 1 ♂, “Nagara-River / Gifu-City / 19-VI-1957 / Col. Masa. Sato”, “Sizumu / Nomura / Bequest, 1981”, “*Zaitzevia / brevis / Nomura / HOLOTYPE*” (red label).

*Additional specimens examined.* See appendix.

*Descriptions.* Adults. Elytra (Fig. 8E, F) obovate, subparallel-sided near base to apical 1/3, bearing short fine setae in intervals.

Aedeagus (Fig. 11E, F, Table 2) long, about 0.56 mm (in BL+CL+LB), moderately sclerotized; phallobase short, oval; parameres completely confused to penis; penis long, straight and gently curved dorsally in apical part, pointed at apex, punctate in apical part, with a pair of small apical teeth. Endophallus (Fig. 2) more or less elongate; apical bladder prominent; ventro-apical bladder developed, apex rounded; dorso-apical bladder present; dorso-basal bladders present; ventro-basal bladder prominent; surface with tooth-like spines, except for apical bladder and base.

*Distribution.* Japan: Hokkaido, Honshu, Shikoku, Kyushu, Awaji-shima (TOMINAGA, 2010).

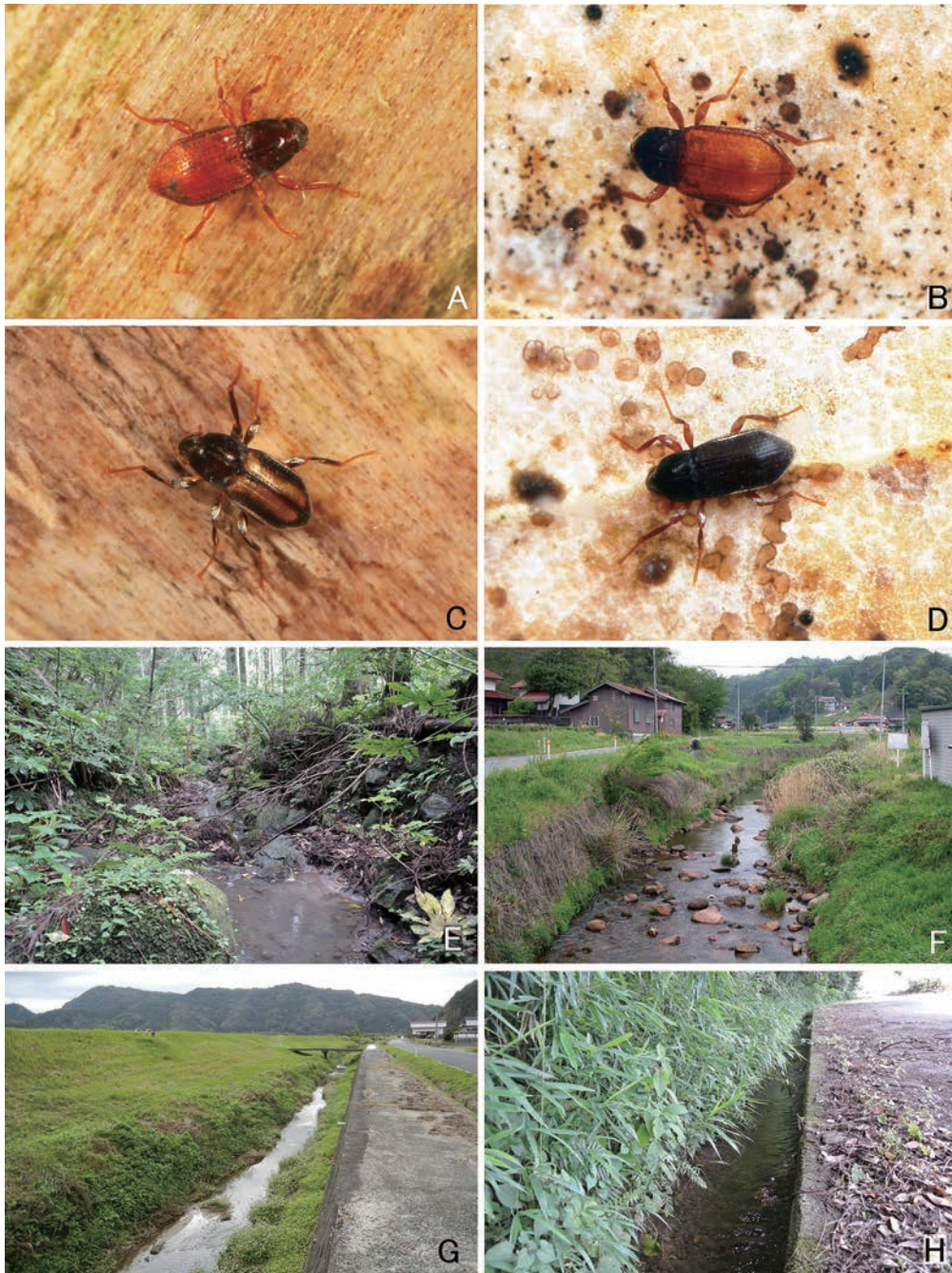


Fig. 13. *Zaitzeviaria* spp. (A–D) and habitats of *Z. sotai* sp. nov. (E–H). — A, *Z. sotai* sp. nov.: Ibo, Hikawa, Izumo, Shimane Pref.; B, *Z. ovata* (NOMURA): Inudani, Nishihayashigi, Izumo; C, *Z. brevis* (NOMURA): Ibo, Hikawa; D, *Z. gotoi* (NOMURA): Inudani, Nishihayashigi; E, Hobomi, Ama, Nakanoshima Is., Shimane Pref. (type locality); F, Enjo, Daito, Unnan, Shimane Pref.; G, Ibo, Hikawa; H, Odaka, Yonago, Tottori Pref.



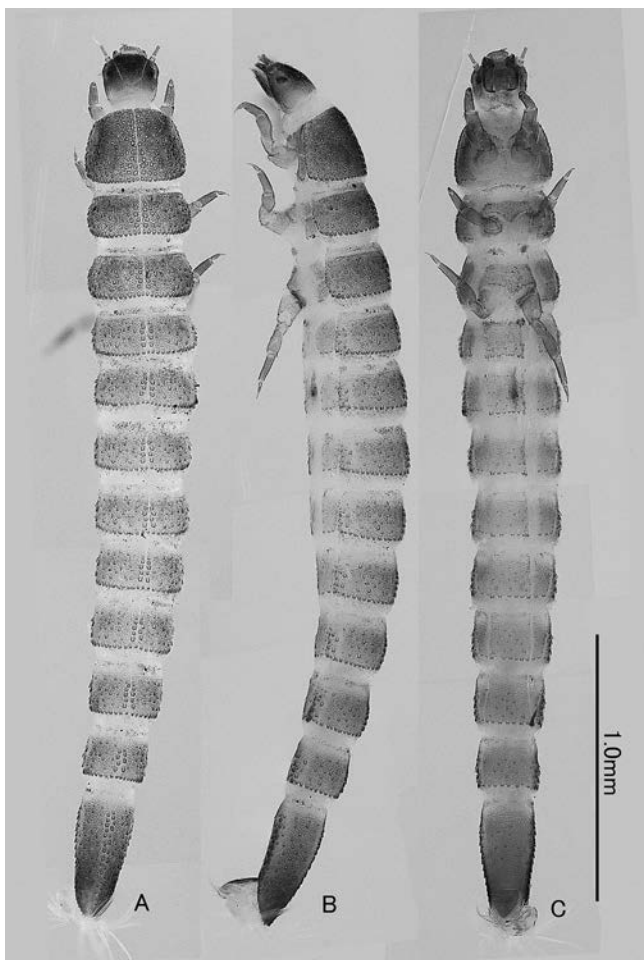


Fig. 14. Larva of *Zaitzeviaria sotoi* sp. nov. from Chiburi Is., Oki Iss., Shimane Pref. — A, Dorsal view; B, lateral view; C, ventral view.

***Zaitzeviaria gotoi*** (NOMURA, 1959)

[Japanese name: Hosohimetsuya-doromushi]

(Figs. 4E, 5G, H, 6E–H, 7D, 9A, B, 11G, H, 12D, 13D)

*Zaitzevia* (*Zaitzeviaria*) *gotoi* NOMURA, 1959, 36; 1960, 36.

*Zaitzeviaria gotoi*: NOMURA, 1961, 3; SATÔ, 1977, 5; SATÔ, 1985, 439.

*Type specimen examined.* Holotype (NSMT): 1 ♂, “Kimitoge / Wakayama-Pref. / 24.V.1959 / Coll. Mitsuo Goto”, “♂”, “Sizumu / Nomura / Bequest, 1981”, “HOLOTYPE / *Zaitzevia* / (*Zaitzeviaria*) / *gotoi* Nomura”.

*Additional specimens examined.* See appendix.

*Descriptions.* Adults. Elytra (Fig. 9A, B) oblong, subparallel-sided near base to apical 1/4, bearing relatively long setae in intervals.

Aedeagus (Fig. 11G, H, Table 2) rather stout, about 0.48 mm (in BL+CL+LB), moderately scler-



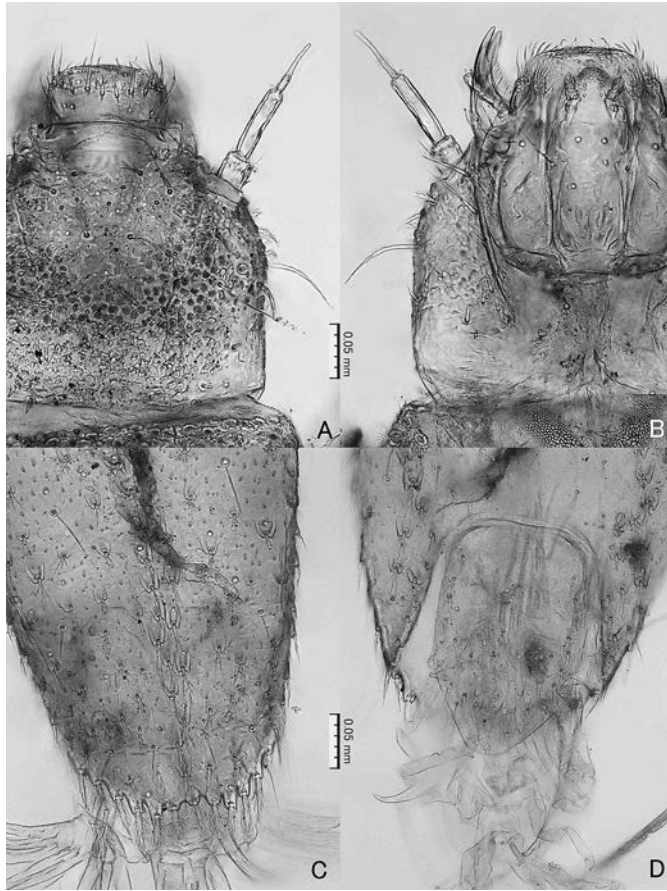


Fig. 15. Larva of *Zaitzeviaria sotai* sp. nov. from Chiburi Is., Oki Iss., Shimane Pref. — A–B, Head; C–D, abdominal segment IX. A, C, dorsal view; B, D, ventral view.

rotized, evenly curved; phallobase short, oval; parameres shortly recognized in apical 1/3; penis long, gently curved dorsally, pointed at apex, punctate in apical part, without apical teeth. Endophallus elongate; apical bladder prominent; ventro-apical bladder remarkably developed, apex rounded; dorso-apical bladder present; dorso-basal bladders lacking; ventro-basal bladder flat with tooth-like spines; surface entirely smooth.

*Distribution.* Japan: Hokkaido, Honshu, Shikoku, Kyushu, Kunashir Is. (PALATOV, 2014), Oki Isls.

***Zaitzeviaria kuriharai* KAMITE, OGATA et M. SATÔ, 2006**

[Japanese name: Tsushima-himetsuya-doromushi]

(Figs. 5I, 7E, 9C, D, 11I, J, 12E)

*Zaitzeviaria kuriharai* KAMITE, OGATA et M. SATÔ, 2006, 149.

*Zaitzeviaria brevis*: YOSHITOMI, 1996, 9 [misidentification].

*Type series.* Holotype (EUMJ): 1 ♂, “Holotype / *Zaitzeviaria kuriharai* / Kamite, Ogata et Satô / 2006” (red label), “[Nagasaki Japan / Seta Kamiagata-chô / 12. VI. 2002 (対馬) / T. Kurihara leg.”, EUM type No. 90.

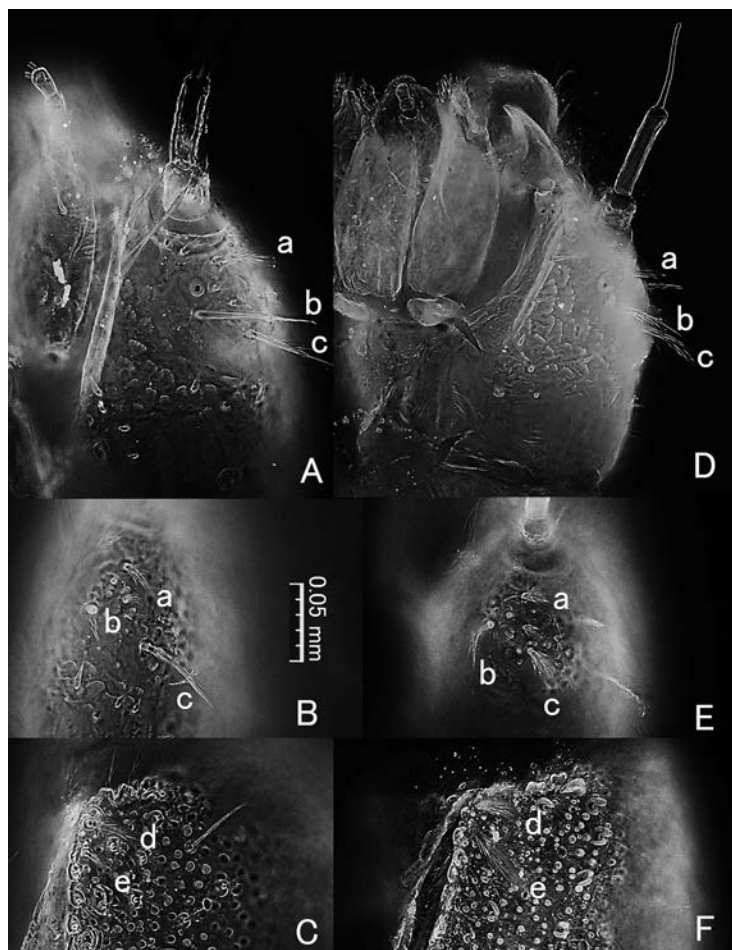


Fig. 16. Comparisons of larva of *Zaitzeviaria sotai* sp. nov. (A–C) and *Z. ovata* (D–F). — A–B, D–E, Setae of lateral side of head; C–D, setae of antero-lateral side of prothorax. "a" to "e" showing homologous setae of both species.

*Additional specimens examined.* See appendix.

*Descriptions.* Adults. Elytra (Fig. 9C, D) oblong, subparallel-sided near base to apical 1/4, bearing long setae in intervals.

Aedeagus (Fig. 11I, J, Table 2) rather stout, about 0.69 mm (in BL+CL+LB), moderately sclerotized, evenly curved; phallobase rather long, oblong; parameres shortly recognized in apical 1/3; penis long, gently curved dorsally, expanded laterally at apex, punctate in apical part, without apical teeth.

*Distribution.* Japan: Tsushima Isls.

#### Key to Species of the Genus *Zaitzeviaria* NOMURA from Japan

- 1a. Body obovate (EL/EW about 1.2–1.6, mainly 1.4). ..... 2  
 1b. Body slender (EL/EW about 1.5–2.0, mainly 1.6), subparallel-sided. .... 3  
 2a. Elytral intervals more or less shiny; apex of aedeagus with a pair of barb-like spines. ....  
 ..... *Z. sotai* sp. nov.

Table 1. Measurement data and ratio of *Zaitzeviaria* spp.

	<i>Z. sotai</i> sp. nov. N = 20	<i>Z. gotoi</i> N = 20	<i>Z. kuriharai</i> N = 20	<i>Z. ovata</i> N = 20	<i>Z. brevis</i> N = 20
TL (mm)	1.15–1.37 (1.26)	1.23–1.42 (1.32)	1.48–1.78 (1.60)	1.10–1.45 (1.30)	1.28–1.60 (1.47)
PW (mm)	0.42–0.48 (0.45)	0.38–0.45 (0.42)	0.48–0.54 (0.51)	0.42–0.52 (0.48)	0.44–0.54 (0.48)
PL (mm)	0.38–0.45 (0.42)	0.38–0.45 (0.41)	0.47–0.60 (0.52)	0.36–0.48 (0.44)	0.39–0.50 (0.45)
EL (mm)	0.74–0.95 (0.84)	0.83–0.99 (0.91)	1.00–1.26 (1.09)	0.74–0.98 (0.86)	0.88–1.10 (1.02)
EW (mm)	0.53–0.62 (0.58)	0.50–0.60 (0.54)	0.58–0.70 (0.63)	0.53–0.68 (0.62)	0.54–0.70 (0.63)
PW/PL	0.98–1.13 (1.06)	0.91–1.13 (1.04)	0.87–1.08 (0.99)	1.05–1.17 (1.10)	1.02–1.14 (1.07)
EL/EW	1.34–1.58 (1.44)	1.56–1.81 (1.69)	1.59–2.03 (1.73)	1.25–1.48 (1.39)	1.53–1.70 (1.62)
EW/PW	1.64–2.26 (1.98)	2.02–2.48 (2.23)	1.67–2.42 (2.11)	1.76–2.10 (1.99)	2.12–2.46 (2.25)
EL/PL	1.25–1.35 (1.29)	1.14–1.38 (1.27)	1.15–1.40 (1.24)	1.23–1.35 (1.30)	1.20–1.40 (1.30)
TL/EW	2.07–2.29 (2.17)	2.30–2.64 (2.45)	2.39–2.87 (2.55)	1.97–2.20 (2.10)	2.22–2.47 (2.34)

Table 2. Morphometric details of the aedeagi of *Zaitzeviaria* spp.

	<i>Z. sotai</i> sp. nov.	<i>Z. ovata</i>	<i>Z. brevis</i>	<i>Z. gotoi</i>	<i>Z. kuriharai</i>
MH/ML	0.19	0.28	0.20	0.31	0.28
BL/CL	0.38	0.60	0.39	0.55	0.39
ML/LB	5.06	3.95	4.56	3.26	3.10
LCP/LBP	2.23	1.47	2.15	1.53	1.99
ML (mm)	0.44	0.39	0.45	0.36	0.52
LB (mm)	0.09	0.10	0.09	0.11	0.17
C	130°	118°	127°	113	114°

- 2b. Elytral intervals dull; apex of aedeagus without spine. .... *Z. ovata* (NOMURA)
- 3a. Elytra bicolored (except for 7th and outer intervals), broad yellowish strip on middle to sutural area; apex of aedeagus with a pair of barb-like spines. .... *Z. brevis* (NOMURA)
- 3b. Elytra monocolored (except for 7th and outer intervals), entirely black or dark rufous; apex of aedeagus without spine. .... 4
- 4a. TL 1.23–1.42 mm; dorsum with fine setae\*; pronotum finely punctate; elytral striae punctures moderate. .... *Z. gotoi* (NOMURA)
- 4b. TL 1.48–1.78 mm; dorsum with long setae\*; pronotum distinctly punctate; elytral striae punctures coarse. .... *Z. kuriharai* KAMITE, OGATA et M. SATÔ
- \*The setae are usually missing in old individuals.

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## 要 約

林 成多・吉富博之：ヒメツヤドロムシ属 *Zaitzeviaria* の雄交尾器内袋および日本産種の再検討（鞘翅目ヒメドロムシ科）。—— ヒメツヤドロムシ属 *Zaitzeviaria* の雄交尾器内袋は、膜質で硬化した部位をほとんど欠くが、反転・膨張させた状態で観察すると各種の特徴が明瞭に現れる。今回、ヒメツヤドロムシ属のタイプ種であるヒメツヤドロムシ *Z. brevis* (NOMURA) を含む4種の内袋について観察し、その構造を比較検討した。さらに、隠岐諸島を含む山陰地方から本属の新種サンインヒメツヤドロムシ *Zaitzeviaria sotai* sp. nov. を記載した（タイプリカリエー：島根県隠岐郡海士町保々見）。本新種は体形や体色がマルヒメツヤドロムシ *Z. ovata* (NOMURA) に似ているが、より体形が細く、上翅間室に光沢があり、オス交尾器の先端部が鋸型になることにより区別ができる。新種の雄交尾器形態は、内袋も含めてヒメツヤドロムシとの共通点が多いことも判明した。本新種は、低山や丘陵地の流れの緩い小規模な河川に生息しており、山陰本土の河川ではマルヒメツヤドロムシやヒメツヤドロムシ、ホソヒメツヤドロムシ *Z. gotoi* と同地点で確認されている場所もある。野外では成虫と幼虫は同時に得ることができ、本新種のみが生息する隠岐の知夫里島産の標本に基づき幼虫も記載をした。あわせて本属の既知種についても再検討を行い、内袋以外の形態について記載をした。

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### Appendix. Additional Specimens Examined.

The following list is available on the author's site: <https://sites.google.com/site/donaciinae/open-files>.

Abbreviation for wing forms: AF, apterous form; MF, macropterous form.

Abbreviation for collectors: EY: E. YAMAMOTO; GO: G. OKAFUJI; HK: H. KADOWAKI; HN: H. NAKANISHI; HNA: H. NAKANO; HO: H. OOYAMA; HY: H. YOSHITOMI; JK: J. KANTOH; JN: J. NAKAJIMA; KA: K. AITA; KB: K. BABA; KE: K. EMOTO; KI: K. ISHIDA; KK: K. KUWATA; KKA: K. KAMIYA; KS: K. SATOH; KT: K. TAKAHASHI; MF: M. FUJITA; MG: M. GOTO; MHa: M. HAYASHI; MHA: M. HASEGAWA; MK: M. KIMURA; MS: M. SATÔ; MSA: M. SAKAI; MT: M. TOMOKUNI; NK: N. KATO; NO: N. OHBAYASHI; OY: O. YAMAJI; SH: S. HAYAKAWA; SN: S. NAKAMURA; YA: Y. AKIYAMA; YAR: Y. ARITA; YH: Y. HORI; YI: Y. IWATA; YM: Y. MORIMOTO; YN: Y. NOTSU; YU: Y. UTSUNOMIYA; ZN: Z. NARUSE.



*Zaitzeviaria sotai* sp. nov.

## HONSHU:

[Shimane Pref.] 2 exs. (1AF, 1MF), Ibokawa, Hikawa-chô, 22.X.2013, MHa, (EUMJ, in alc., E101).

OKI ISLANDS: 100 exs. (AF), Hobomi, Chichii, Ama-chô, 20.X.2014, MHa & HK, (EUMJ, in alc., E100); 12 exs. (AF), Koji, Okinoshima-chô, 12.X.2014, HY, (EUMJ, in alc., E107).

*Zaitzeviaria brevis* (NOMURA, 1958)

## HOKKAIDO:

3 exs. (AF), Akkeshi, 18–VII–VII.1976, MS, (EUMJ); 11 ex. (AF), ditto, 7–VIII–VIII.1985, MS, (EUMJ); 1 ex. (AF), Rebun-tô, 5–IX–IX.2001, KE, (EUMJ); 4 exs. (AF), Shimoebekorobetsu-gawa, Totomi-chô, 10–VI–VI.2007, HY, (EUMJ); 5 exs. (AF), Shô-tonbetsu, 26–VIII–VIII.1976, MS, (EUMJ).

## HONSHU:

[Akita Pref.] 7 exs. (AF), Fukai, Omonogawa-machi, 7.VI.1978, KB & NK, (EUMJ).

[Miyagi Pref.] 2 exs. (AF), Ohtaki-gawa, 5.VI.1978, MS, (EUMJ); 2 exs. (AF), Yakurai-onsen, 21.VIII.1978, MS, (EUMJ).

[Tochigi Pref.] 1 ex. (AF), Nagaoka-chô, Utsunomiya-shi, 1.XI.1993, KS, (EUMJ); 3 exs. (MF), Nishinasuno, 9.VIII.1985, KT, (EUMJ); 2 exs. (1AF, 1MF), Ohira-san, Tochigi-shi, 30.III.1994, HY, (EUMJ).

[Gifu Pref.] 2 exs. (AF), Akou, 17.VIII.1967, MS, (EUMJ); 1 ex. (MF), Nagara-gawa, 26.VI.1957, ZN, (EUMJ); 1 ex. (AF), Wara-gawa, 24.VIII.1967, MS, (EUMJ).

[Aichi Pref.] 3 exs. (AF), Asuke-chô, 14.IV.1963, ZN, (EUMJ); 2 exs. (AF), Higashi-Omi, Asuke-chô, 12.IX.1994, HY, (EUMJ); 1 ex. (AF), Meidai-enshurin, Inabu-chô, 8.VIII.1960, (EUMJ); 3 exs. (AF), Okazaki, 2.X.1953, HO, (EUMJ); 2 exs. (AF), ditto, 20.VIII.1955, HO, (EUMJ); 25 exs. (AF), ditto, 22.VIII.1953, HO, (EUMJ); 1 ex. (AF), ditto, 22.VIII.1953, HO, (EUMJ); 8 exs. (AF), Toyota, 25.IV.1976, MS, (EUMJ).

[Tottori Pref.] 1 ex. (MF), Amida-gawa, Boryo, Daisen-chô, 10.III.2007, HK, (HOWP); 5 exs. (AF), Miya-kawa, Syoda, Daisen-chô, 12.VIII.2006, HK, (HOWP); 10 exs. (AF), Odaka-suiro, Okanari, Yonago-shi, 10.III.2007, HK, (HOWP); 45 exs. (AF), Syojin-kawa, Ichinotani, Daisen-chô, 17.VIII.2006, HK, (HOWP).

[Shimane Pref.] 2 exs. (AF), Inashi-gawa, Furukawa-chô, Yasugi-shi, 12.VIII.2006, MHa, (HOWP); 1 ex. (AF), Iu-gawa, Motoda, Yakumo-chô, Matsue-shi, 23.VIII.2006, MHa, (HOWP); 7 exs. (AF), Kimachi-gawa, Kamikimachi, Shinji-chô, Matsue-shi, 24.IV.2005, MHa, (HOWP); 1 ex. (AF), Hata-gawa, Kamigumi, Sada-chô, Izumo-shi, 11.IX.2007, MHa, (HOWP); 1 ex. (MF), Hii-kawa, Shimamura, Izumo-shi, 20.VIII.2006, MHa, (HOWP); 1 ex. (AF), Hii-kawa, Mizuho-ohashi, Hikawa-chô, Izumo-shi, 24.IX.2006, MHa, (HOWP); 2 exs. (AF), Hosodani, Hikawa-chô, 14.IV.2005, MHa, (HOWP); 5 exs. (AF), Ibo-kawa, Hikawa-chô, Izumo-shi, 14.IV.2005, MHa, (HOWP); 2 exs. (AF), Aka-gawa, Daito, Daito-chô, Unnan-shi, 16.IV.2005, MHa, (HOWP); 1 ex. (AF), Aka-gawa, nr. Ushio-chugakkou, Minamimura, Daito-chô, Unnan-shi, 22.IX.2006, MHa, (HOWP); 7 exs. (AF), Ayou-gawa, Sakejinjya, Daito-chô, Unnan-shi, 27.XI.2005, MHa, (HOWP); 5 exs. (4AF, 1MF), Enjo-gawa, Nakaenjo, Daito-chô, Unnan-shi, 29.IV.2005, MHa, (HOWP); 1 ex. (AF), Kuno-gawa, Shimokuno, Daito-chô, Unnan-shi, 22.VI.2005, MHa, (HOWP); 1 ex. (AF), Yamada-gawa, Arai, Daito-chô, Unnan-shi, 29.IV.2005, MHa, (HOWP); 1 ex. (MF), Hii-kawa, Hirata, Kisuki-chô, Unnan-shi, 30.IV.2005, MHa, (HOWP); 1 ex. (MF), Shakunouchi-kôen, Yamakata, Kisuki-chô, Unnan-shi, 28.IV.2005, MHa, (HOWP); 1 ex. (AF), Mitoya-gawa, Awadani, Mitoya-chô, 9.IV.2005, MHa, (HOWP); 2 exs. (AF), ditto, 12.VIII.2006, MHa, (HOWP); 1 ex. (AF), Kamedake-gawa, Kamedake, Okuizumo-chô, 24.VIII.2005, MHa, (HOWP); 1 ex. (AF), Omaki-gawa, Yokota-chô, 9.VIII.2004, MHa, (HOWP); 1 ex. (MF), Akagawa-goryu, Sentu-zan, Hii-kawa, Yokota, Okuizumo-chô, 23.XI.2005, MHa, (HOWP).

[Hiroshima Pref.] 1 ex. (AF), Nakadaira, Jinsekikôgen-chô, 6.VI.2007, YA, (HOWP).

[Yamaguchi Pref.] 4 exs. (AF), Ichinomata-onsen, Toyota-chô, Shimonoseki-shi, 17.VIII.2008, MHa, (HOWP).  
SHIKOKU:

[Tokushima Pref.] 1 ex. (AF), Obara, Anan-shi, 12.X.2000, KA, (EUMJ).

[Ehime Pref.] 11 exs. (AF), Daimyojin-kawa, Saijô-shi, 23.IX.2014, HY, (EUMJ, in alc., E73–E75); 3 exs. (AF), Gotanji, 3.XI.1955, KK, (EUMJ); 1 ex. (AF), Kume-gawa, 21.VII.1957, KK, (EUMJ); 2 exs. (1AF, 1MF), Matsuyama, 6.VIII.1952, KKA, (EUMJ); 7 exs. (2MF, 5AF), Oomishima, 16.VII.1959, MS, (EUMJ); 26 exs. (AF), Tannoue, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E88).

KYUSYU:

[Kumamoto Pref.] 8 exs. (AF), Aitouji, Yamato-chô, 3.XII.2011, JN, (EUMJ, in alc., E98).

[Miyazaki Pref.] 1 ex. (AF), Aoidake, 25.VII.1974, MSA, (EUMJ).

### *Zaitzeviaria ovata* (NOMURA, 1959)

HOKKAIDO:

2 exs. (AF), Kannon-zawa, Sapporo-shi, 20.V.2001, HY, (EUMJ); 1 ex. (AF), Shôtonbetsu, 26.VIII.1976, MS, (EUMJ); 7 exs. (AF), Kamibepo, Kushiro-chô, 15.VIII.2006, HY, (EUMJ, in alc., E110).

HONSHU:

[Akita Pref.] 1 ex. (AF), Fukai, Omonogawa-machi, 7.VI.1978, KB & NK, (EUMJ); 2 exs. (AF), Ooyu-onsen, Kazuno, 19.X.1982, MT, (EUMJ).

[Fukushima Pref.] 14 exs. (AF), Seaburi pass, Minato-machi, Aizuwakamatsu-shi, 27.IX.2007, YI, (HOWP).

[Tochigi Pref.] 1 ex. (AF), Itabashi, Shioya-machi, 11.XI.1993, KS, (EUMJ); 2 exs. (AF), Kurakake, Yaita-shi, 29.X.1993, KS, (EUMJ); 2 exs. (AF), Nagaoka-chô, Utsunomiya-shi, 1.XI.1993, KS, (EUMJ); 30 exs. (AF), Ohira-san, Tochigi-shi, 1.IV.1994, HY, (EUMJ, in alc., E99); 48 exs. (44AF, 4MF), ditto, 30.III.1994, HY, (EUMJ).

[Gunma Pref.] 4 exs. (AF), Harunashirakawa, Nishiakiya, Misato, Takasaki-shi, 3.I.2008, MHa, (HOWP).

[Saitama Pref.] 1 ex. (AF), Oppori-gawa, Omiya, Chichibu-shi, 13.IV.2007, YI, (HOWP); 1 ex. (AF), ditto, 24.IV.2007, YI, (HOWP); 1 ex. (AF), ditto, 28.VIII.2007, YI, (HOWP); 8 exs. (AF), Tomaru, Hanno-shi, 13.III.1999, HY, (EUMJ).

[Tokyo Metropolis] 9 exs. (AF), Asakawa, 14.VIII.1949, KKA, (EUMJ).

[Niigata Pref.] 3 exs. (AF), Haige, Ozumi, Nagaoka-shi, 29.VIII.2010, YI, (HOWP); 2 exs. (AF), Ozumi-haige-machi, Nagaoka-shi, 25.VII.2010, YI, (HOWP).

[Nagano Pref.] 1 ex. (AF), Fujimi-machi, Suwa-gun, 14.VIII.2006, JK, (HOWP); 2 exs. (AF), Shiojiri-toge, 3.VIII.1975, MS, (EUMJ).

[Shizuoka Pref.] 1 ex. (AF), Yugashima, Ito-shi, 2.VII.2007, YI, (HOWP); 2 exs. (AF), ditto, 3.VII.2007, YI, (HOWP).

[Aichi Pref.] 2 exs. (AF), Hirokute-chô, Seto-shi, 25.II.1994, HY, (EUMJ); 4 exs. (AF), Kaisho-chô, Seto-shi, 25.II.1994, HY, (EUMJ); 3 exs. (AF), Akazugawa, Seto-shi, 16.VII.1994, HY, (EUMJ); 1 ex. (AF), Asuke-chô, 14.IV.1963, ZN, (EUMJ); 27 exs. (AF), Higashi-Omi, Asuke-chô, 12.IX.1994, HY, (EUMJ); 23 exs. (AF), Hirohata-chô, Toyota-shi, 25.II.1994, HY, (EUMJ); 64 exs. (AF+MF), ditto, 7.III.1994, HY, (EUMJ); 1 ex. (AF), Hongu-san, 15.VI.1960, MS, (EUMJ); 1 ex. (AF), Meidai-enshurin, Inabu-chô, 8.VIII.1960, (EUMJ); 3 exs. (AF), Uradani, Shitara-chô, 5.VI.1993, MHA, (EUMJ).

[Mie Pref.] 1 ex. (AF), Nabari, 26.V.1998, YU, (EUMJ).

[Kyoto Pref.] 1 ex. (AF), Kibune, 6.VIII.1980, MSA, (EUMJ).

[Nara Pref.] 27 exs. (AF), Kasuga-yama, 10–11.III.1994, HY, (EUMJ).

[Osaka Pref.] 2 exs. (AF), Chihaya-guchi, 13.III.1960, MG, (EUMJ); 1 ex. (AF), Kimotoge, Kawachinagano-shi, 1.IV.2013, MHa, (HOWP); 3 exs. (AF), Kongo-san, Chihayaakasaka-mura, 28.X.2007, MHa, (HOWP).

[Wakayama Pref.] 2 exs. (AF), Kimi-tôge, 17.V.1959, MG, (EUMJ).

- [Okayama Pref.] 2 exs. (AF), Iwayadani, Bittyu-chô, Takahashi-shi, 20-V-.V.2007, OY, (HOWP); 12 exs. (AF), Toyonaga-uyama, Niimi-shi, 12-VI-.VI.2010, OY, (HOWP).
- [Tottori Pref.] 2 exs. (AF), Shimura-kawa, Kamiotachi, Kurayoshi-shi, 5.XI.2006, HK, (HOWP); 4 exs. (AF), Amida-gawa, Boryo, Daisen-chô, 13.X.2008, HK, (HOWP); 1 ex. (AF), Amida-gawa, Fukuo, Daisen-chô, 4.IV.2008, HK, (HOWP); 8 exs. (6AF, 2MF), Syojin-kawa, Daisen-bashi, Akamatsu, Daisen-chô, 28.XII.2008, HK, (HOWP); 5 exs. (AF), ditto, 4.IV.2008, HK, (HOWP); 5 exs. (AF), Hossyoji-gawa, Kannonji, Yonago-shi, 2.XI.2008, HK, (HOWP); 17 exs. (AF), Odaka-suiro, Okanari, Yonago-shi, 13.XII.2006, HK, (HOWP); 1 ex. (AF), ditto, 28.XII.2008, HK, (HOWP); 1 ex. (AF), Otani-gawa, Ihara, Hino-chô, 10.XI.2007, HK, (HOWP); 2 exs. (AF), Sugitani-gawa, Kamisaka, Hino-chô, 4.XI.2007, HK, (HOWP); 5 exs. (AF), Tochitani-rido, Ookiya, Nanbu-chô, 2.XI.2008, HK, (HOWP); 3 exs. (AF), Yobiko, Nichinan-chô, 9.XI.2008, HK, (HOWP).
- [Shimane Pref.] 1 ex. (AF), Fube-dam, Hirose-chô, Yasugi-shi, 25.II.2006, MHa, (HOWP); 6 exs. (AF), Makuragi-san, Matsue-shi, 11.II.2006, MHa, (HOWP); 1 ex. (AF), ditto, 24.IX.2006, MHa, (HOWP); 6 exs. (AF), Mitarai-taki, Shimane-chô, Matsue-shi, 19.II.2006, MHa, (HOWP); 2 exs. (AF), ditto, 9.IV.2006, MHa, (HOWP); 1 ex. (MF), St. 2, Shimizu-gawa, Shimane-chô, Matsue-shi, 24.III.2006, MHa, (HOWP); 2 exs. (AF), St. 4, Shimizu-gawa, Shimane-chô, Matsue-shi, 9.IV.2006, MHa, (HOWP); 9 exs. (AF), Okudani, Taisha-chô, Izumo-shi, 5.III.2006, MHa, (HOWP); 5 exs. (AF), Suzutani-gawa, Karakawa-chô, Izumo-shi, 15.V.2005, MHa, (HOWP); 23 exs. (AF), Miyama, Manda-chô, Hirata-shi, 3.V.2005, MHa, (HOWP); 29 exs. (AF), ditto, 24.II.2006, MHa, (HOWP); 6 exs. (AF), ditto, 3.V.2006, MHa, (HOWP); 4 exs. (AF), ditto, 6.I.2008, MHa, (HOWP); 3 exs. (AF), St. 1, Aishiro-gawa, Kozu-chô, Hirata-shi, 28.X.2004, MHa, (HOWP); 10 exs. (AF), Aishiro-gawa Jyoryu, Kozu-chô, Izumo-shi, 8.V.2005, MHa, (HOWP); 6 exs. (AF), Aishiro-gawa, Kozu-chô, Izumo-shi, 8.V.2005, MHa, (HOWP); 3 exs. (AF), Hosodani, Hikawa-chô, 14.IV.2005, MHa, (HOWP); 2 exs. (AF), Enjo-gawa, Nakaenjo, Daito-chô, Unnan-shi, 29.IV.2005, MHa, (HOWP); 3 exs. (AF), Yamao-gawa, Shinjo, Daito-chô, Unnan-shi, 25.IX.2006, MHa, (HOWP); 1 ex. (MF), ditto, 8.I.2007, MHa, (HOWP); 1 ex. (AF), Monsaka, Oyorogi-san, Tonbara, Iinan-chô, 4.V.2006, MHa, (HOWP); 2 exs. (AF), Sentu-zan-tozando, Hii-kawa, Yokota, Okuizumo-chô, 16.IV.2006, MHa, (HOWP); 1 ex. (AF), Tamamine-san, Nita, Okuizumo-chô, 30.IV.2005, MHa, (HOWP); 2 exs. (AF), Shigaku, Sanbe-san, Oda-shi, 23.IX.2006, MHa, (HOWP); 1 ex. (MF), Inutani-gawa, Nishihayashiki-machi, Izumo-shi, 19.X.2014, MHa, (EUMJ, in alc., E102).
- [Hiroshima Pref.] 2 exs. (AF), Kannoki-yama, Fukutomi-chô, Higashihiroshima-shi, 7.V.2006, YA, (HOWP); 1 ex. (MF), Kurome, Soryo-chô, 16.IX.2002, YA, (HOWP); 1 ex. (AF), Kushiro, Tojyo-chô, 31.VII.2003, YA, (HOWP); 1 ex. (AF), Shinichi-chô, Fukuyama-shi, 13.IV.2003, YA, (HOWP); 1 ex. (AF), Soumori, Chiyoda-chô, 14.X.2003, YA, (HOWP); 1 ex. (AF), Takasaka-chô, Mihara-shi, 17.IV.2004, YA, (HOWP); 1 ex. (AF), Tenda-gawa, Toyomatsu-son, 8.VIII.2002, YA, (HOWP); 1 ex. (AF), Ueno, Yuki-chô, 8.IX.2002, YA, (HOWP).
- [Yamaguchi Pref.] 6 exs. (AF), Kitagawa-no-ana, 26.XII.1964, GO, (EUMJ); 5 exs. (AF), Sumitomo-shindo, 23.IX.1964, GO, (EUMJ); 6 exs. (AF), Terayama-no-ana, 20.XII.1964, GO, (EUMJ).

## SHIKOKU:

- [Ehime Pref.] 1 ex. (AF), Daimyojin-kawa, Saijô-shi, 23.IX.2014, HY, (EUMJ, in alc., E72); 133 exs. (AF), Fukubukou, Saijô-shi, 12.XI.2014, HY, (EUMJ, in alc., E91); 4 exs. (AF), Furuta, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E86); 4 exs. (AF), Hoino, Saijô-shi, 20.VIII.2014, HY, (EUMJ, in alc., E52); 18 exs. (AF), Ichinokawa, Saijô-shi, 12.XI.2014, HY, (EUMJ, in alc., E93); 1 ex. (AF), Kamitoishi, Saijô-shi, 23.VIII.2014, HY, (EUMJ, in alc., E57); 11 ex. (AF), Kawane, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E85); 65 exs. (AF), Kawanouchi, Saijô-shi, 23.IX.2014, HY, (EUMJ, in alc., E68-E71); 2 exs. (AF), Kojima-gawa, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E87); 6 exs. (AF), Kurase, Tanbara-chô, Saijô-shi, 20.VIII.2014, HY, (EUMJ, in alc., E51); 1 ex. (AF), ditto, 28.X.2014, HY, (EUMJ, in alc., E83); 9 exs. (AF), Nakayama-gawa, Tanbara-chô, Saijô-shi, 28.IX.2014, HY, (EUMJ, in alc., E81); 10 exs. (AF), Kurotani, Saijô-shi,

28.X.2014, HY, (EUMJ, in alc., E90); 1 ex. (AF), Kusukubo, Saijô-shi, 23.VIII.2014, HY, (EUMJ, in alc., E59); 36 exs. (AF), Nishikawane, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E84); 2 exs. (AF), Oohama, Saijô-shi, 12.XI.2014, HY, (EUMJ, in alc., E95); 1 ex. (AF), Ootani-ike, Saijô-shi, 24.VIII.2014, HY, (EUMJ, in alc., E66); 7 exs. (AF), Shika-gawa, Saijô-shi, 23.VIII.2014, HY, (EUMJ, in alc., E61); 1 ex. (AF), Shimokage, Saijô-shi, 20.VIII.2014, HY, (EUMJ, in alc., E54); 12 exs. (AF), Tannoue, Saijô-shi, 28.X.2014, HY, (EUMJ, in alc., E88); 2 exs. (AF), Ususaka, Tanbara-chô, Saijô-shi, 28.IX.2014, HY, (EUMJ, in alc., E82); 1 ex. (AF), Aonamidani, Matsuyama-shi, 5.XII.1986, MF, (EUMJ); 1 ex. (AF), Fukumi-gawa, Matsuyama-shi, 5.V.1985, SN, (EUMJ); 4 exs. (AF), Higashikawa-chô, Matsuyama-shi, 4.IV.2012, HY, (EUMJ, in alc., E26); 1 ex. (AF), Komeno-chô, Matsuyama-shi, 20.VI.1976, YN, (EUMJ); 5 exs. (AF), ditto, 29.IV.1974, MSA, (EUMJ); 1 ex. (AF), ditto, 31.X.1986, SN, (EUMJ); 35ex. (AF), ditto, 4.IV.2012, HY, (EUMJ, in alc., E23–E25); 1 ex. (AF), ditto, 8.VI.1974, YN, (EUMJ); 15 exs. (AF), Kyukawa, Matsuyama-shi, 2.IV.2012, HY, (EUMJ, in alc., E20); 12 exs. (AF), Ooino, Matsuyama-shi, 2.IV.2012, HY, (EUMJ, in alc., E21, E22); 4 exs. (AF), Shukuno-machi, Matsuyama-shi, 4.IV.2012, HY, (EUMJ, in alc., E27); 2 exs. (AF), Futami-chô, 8.VII.1975, MSA, (EUMJ); 3 exs. (AF), Hontani, Odamiyama, 20.VIII.1994, EY, (EUMJ); 3 exs. (AF), Rokuro-dani, Odamiyama, 22.VII.1994, EY, (EUMJ); 3 exs. (AF), ditto, 29.VII.1994, EY, (EUMJ); 2 exs. (AF), Saragamine, 1.VII.1962, MS, (EUMJ); 1 ex. (AF), Kaisho, 26.VI.1975, MSA, (EUMJ).

[Kochi Pref.] 1 ex. (AF), Ryuga-do (cave), 27.III.1958, YM, (EUMJ); 1 ex. (AF), ditto, 29.X.1970, S. Ueno, (EUMJ); 45 exs. (43AF, 2MF), Takano, Yusuhara, 14–15.VI.1997, HN, (EUMJ); 1 ex. (AF), ditto, 14–15.VI.1997, SH, (EUMJ); 18 exs. (16AF, 2MF), ditto, 14–15.VI.1997, NO, (EUMJ).

KYUSYU:

[Nagasaki Pref.] 3 exs. (AF), Ikiriki-gawa, 14.IV.1994, MK, (EUMJ).

### *Zaitzeviaria gotoi* (NOMURA, 1959)

HOKKAIDO:

4 exs. (AF), Shotonbetsu, 26.VIII.1976, MS, (EUMJ).

HONSHU:

[Akita Pref.] 9 exs. (AF), Fukai, Omonogawa-machi, 7.VI.1978, KB & NK, (EUMJ).

[Miyagi Pref.] 1 ex. (AF), Ohtaki-gawa, 5.VI.1978, MS, (EUMJ); 1 ex. (AF), Yakurai-onsen, 21.VIII.1978, MS, (EUMJ).

[Tochigi Pref.] 1 ex. (MF), Nishinasuno, 21.VIII.1985, KT, (EUMJ).

[Tokyo Metropolis] 6 exs. (AF), Asakawa, 4.IX.1949, KKA, (EUMJ).

[Niigata Pref.] 1 ex. (AF), Kurokawa, 20.IV.1961, KB, (EUMJ); 5 exs. (AF), ditto, 21.IX.1960, KB, (EUMJ); 1 ex. (AF), Murakami, 6–11.VIII.1961, MS, (EUMJ).

[Shizuoka Pref.] 1 ex. (MF), Suzuno-gawa, 22.XII.1998, HY, (EUMJ).

[Gifu Pref.] 4 exs. (AF), Akou, 17.VIII.1967, MS, (EUMJ); 1 ex. (MF), Hirugano, 11.VIII.1980, MS, (EUMJ); 1 ex. (AF), Kurokawa, 17.VIII.1967, MS, (EUMJ); 1 ex. (MF), Ohguchi, 22.VII.1967, MS, (EUMJ); 4 exs. (AF), Oppara, 15.VI.1978, MS, (EUMJ); 1 ex. (AF), Soshino, 25.VIII.1967, MS, (EUMJ); 4 exs. (AF), Wara-gawa, 24.VIII.1967, MS, (EUMJ).

[Aichi Pref.] 8 exs. (AF), Asuke-chô, 20.VII.1978, MS, (EUMJ); 5 exs. (AF), Fujioka, 3.V.1983, MS, (EUMJ); 12 exs. (AF), Hasso, Inuyama-shi, 10.VII.1978, MS, (EUMJ); 2 exs. (1AF, 1MF), Kurishima, Shitara-chô, 18.IV.1993, MHA, (EUMJ).

[Mie Pref.] 2 exs. (AF), Kawabuchi-gawa, 18.VIII.1967, MS, (EUMJ); 3 exs. (AF), Okube, 28.XI.1965, MS, (EUMJ).

[Tottori Pref.] 1 ex. (AF), Amida-bashi, Kuraoka, Daisen-chô, 10.III.2007, HK, (HOWP); 1 ex. (AF), ditto,

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