

## Distribution Records of the Scarabaeoidea (Coleoptera) from Iheya-jima, Noho-jima and Izena-jima Islands, the Iheya-Izena Islands in the Ryukyus, Southwestern Japan

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**Abstract** During our continuous survey, 34 scarabaeoid species belonging to four families were recognized from the Iheya-Izena Islands of the Ryukyus, southwestern Japan. Of these, two, five, and four species are newly added to the faunae of Iheya-, Noho-, and Izena-jima Islands, respectively. Including the results of previous studies, a total of 51 scarabaeoid species belonging to four families are known to occur on the islands. The number is equivalent to 63% of scarabaeoid species known from Okinawa-jima Island, including that the Iheya-Izena Islands, especially Iheya-jima Island, has the relatively rich scarabaeoid fauna despite the small area.

### Introduction

The Iheya-Izena Islands are known to be a small archipelago located north off Okinawa-jima Island of the Ryukyus, southwestern Japan, consisting an amount of small to very small islands such as Iheya-, Noho-, and Izena-jima Islands. The scarabaeoid fauna of the islands has been studied by a number of researchers (OMINE, 1963; KUSUI, 1976, 1981, 1991, 2005, 2012; SUGIMOTO, 1977; MIYAKE, 1986; SAKAI, 1989, 1998; TSUKAMOTO, 1987; HAYAKAWA *et al.*, 1995; KIUCHI & INADA, 1997; HAYAKAWA, 1998; KIMURA & INADA, 1998; ITÔ, 2000; SHIRASUGI, 2000; FUJIOKA, 2001, 2005; SASAKI *et al.*, 2002; FUJITA, 2002, 2009; DOI, 2002; HORIGUCHI, 2005; TANAKA, 2006; SIMOJI, 2009; KATAYAMA, 2011; OKAJIMA & ARAYA, 2012; MATSUMURA *et al.*, 2018; INADA, 2018; KOBAYASHI, 2018). As a result, to date, 45, one and 23 species have been recorded from Iheya-, Noho-, and Izena-jima Islands, respectively.

Iheya-jima Island, elongated in a north-south direction, is the largest in area (20.9 km<sup>2</sup>) and the richest in vegetation in the Iheya-Izena Islands, with mostly mountainous areas (DOUMAE, 1984). Many cattle are grazed in northern area with large rangelands (Fig. 1).

Noho-jima Island, adjacent to the southern part of Iheya-jima Island, is very small (1.1 km<sup>2</sup>) and flat (DOUMAE, 1984). Natural vegetation of the island is very poor due to active cultivation of sugarcane and sweet potato.

Izena-jima Island is the second largest (13.8 km<sup>2</sup>) in the Iheya-Izena Islands, being located about 5 km south off Iheya-jima Island (DOUMAE, 1984). This island is topographically divided by mountains into northwest and southeast areas. Southeast area has good vegetation with Mt. Chijin-yama (119.6 m above sea level), whereas other areas except in the mountains are lowland with sugarcane field.

Our field surveys conducted in the three islands in 2017 and 2018 resulted in recognition of a total of 34 scarabaeoid species. Of these, two, five, and four species were considered unrecorded from Iheya-, Noho-, and Izena-jima Islands, respectively. Here we first record the species from the respective islands and provide a list of all 48 scarabaeoid species confirmed in previous and present studies in these islands (Table. 1).

All the examined specimens are preserved in the Laboratory of Entomology, Tokyo University of Agriculture, Atsugi, Kanagawa, Japan (TUA). Abbreviations used for collector names as follows: NK — Naoki KANEKO, ST — Sôichirô TARU, KO — Kazuyuki OSHIMA, HN — Hiroki NAGANO, YT — Yutaka TAMADERA, YF — Yûsuke FUJISAWA, and YI — Yûto IMAFUKU. Scientific names follow the recent catalogue of AHRENS *et al.* (2016), but partially follow MATSUMOTO (2016).

## Results

The following is a list of the Scarabaeoid beetle species collected during our surveys in 2017 and 2018.

Family **Hybosoridae** ERICHSON, 1847

Subfamily **Hybosorinae** ERICHSON, 1847

***Phaeochrous emarginatus emarginatus*** (CASTELNAU, 1840) (Fig. 2)

*Specimens examined.* [Iheya-jima Is.] 6 exs., Gakiya-dam, 21.VII.2017, NK, by light trap; 11 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap; 8 exs., Mt. Tannadake, 24.VII.2017, NK, by light trap. [Izena-jima Is.] 4 exs., Jicchaku, 21.VII.2017, KO, by light trap.

*Note.* New to Izena-jima Island.

Family **Lucanidae** LATREILLE, 1804

Subfamily **Lucaninae** LATREILLE, 1804

***Aegus laevicollis doii*** FUJITA, 2002

*Specimens examined.* [Iheya-jima Is.] 7 exs. (larvae), Mt. Gayôyama, 14.III.2017, NK (eclosion: 4.VI.2017).

***Dorcus titanus okinawanus*** (KRIESHE, 1922)

*Specimens examined.* [Iheya-jima Is.] 1 ex., Mt. Tannadake, 24.VII.2017, NK, by light trap; 5 exs., Mt. Koshidake, 21–23.VI.2018, ST, by light trap. [Izena-jima Is.] 1 ex. (larva), Mt. Ônoyama, 10.III.2017, NK (eclosion: 7.VI.2017).

***Nigidius lewisi*** BOILEAU, 1995

*Specimens examined.* [Iheya-jima Is.] 2 exs., Mt. Gayôyama, 14.III.2017, NK; 1 ex., near Tanna-jinjya, 23.VII.2017, NK.

***Prosopocoilus dissimilis hayashii*** FUJITA, 2009

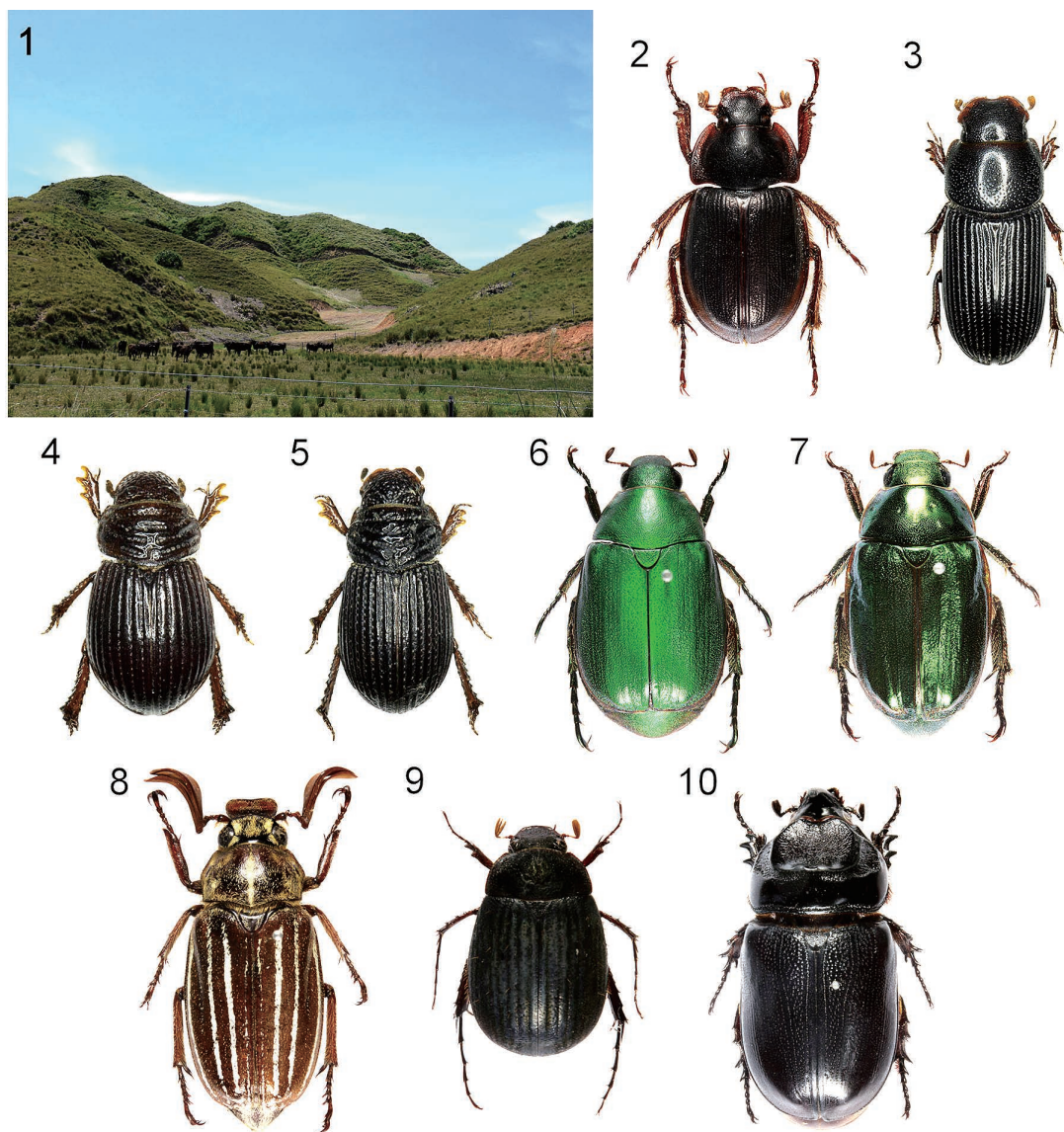
*Specimen examined.* [Iheya-jima Is.] 1 ex., Gakiya-dam, 2.VII.2017, NK, by light trap.

Family **Ochodaeidae** MULSANT et REY, 1871

Subfamily **Ochodaeinae** MULSANT et REY, 1871

***Notochodaeus interruptus kurosawai*** (OCHI et KAWAI, 2002)

*Specimens examined.* [Iheya-jima Is.] 7 exs., Mt. Koshidake, 3–6.III.2018, ST, by flight interception trap; 2 exs., Mt. Gayôyama, 3–6.III.2018, ST, by flight interception trap.



Figs. 1–10. A collecting site and dorsal habitus of scarabaeoid species from the Iheya-Izena Islands. — 1, Rangeland on the northern mountainous region in Iheya-jima Is.; 2, *Phaeochrous emarginatus emarginatus* (CASTELNAU); 3, *Ataenius picinus* HAROLD; 4, *Psammodyus kobayashii* NOMURA; 5, *Rakovicius coreanus* (KIM); 6, *Anomala albopilosa yashiroi* (SAWADA); 7, *Anomala edentula okinawana* NOMURA; 8, *Polyphylla schoenfeldti* BRENSKE; 9, *Maladera oshimana* NOMURA; 10, *Oryctes rhinoceros* (LINNAEUS).

Family **Scarabaeidae** LATREILLE, 1802Subfamily **Aphodiinae** LEACH, 1815***Aphodius marginellus*** (FABRICIUS, 1781)

*Specimens examined.* [Iheya-jima Is.] 16 exs., Mt. Tannadake, 24.VII.2017, NK.

***Aphodius sublimbatus*** MOTSCHULSKY, 1860

*Specimens examined.* [Iheya-jima Is.] 2 exs., Mt. Tannadake, 24.VII.2017, NK.

***Aphodius urostigma*** HAROLD, 1862

*Specimens examined.* [Iheya-jima Is.] 5 exs., Mt. Tannadake, 14.III.2017, YT; 49 exs., Mt. Tannadake, 24.VII.2017, NK.

***Ataenius picinus*** HAROLD, 1867 (Fig. 3)

*Specimens examined.* [Izena-jima Is.] 9 exs., Compost center, Jicchaku, 11.III.2017, NK; 3 exs., Jicchaku-kaigan, 11.III.2017, YF; 2 exs., Jicchaku, 21.VII.2017, KO, by light trap; 1 ex., Uchihana, 22.VII.2017, KO, by light trap.

*Notes.* New to Izena-jima Island as well as to the Iheya-Izena Islands. These specimens were found from huge piles of compost in a compost center. This dung beetle, an alien species widely distributed in the Ryukyus and Kyushu (KAWAI, 2000; HOSOYA, 2014), may inhabit Iheya- and Noho-jima Islands due to the presence of sufficient food resources for this species such as dung and crop remnants from activities of cattle grazing and sugarcane cultivation.

***Psammodyus kobayashii*** NOMURA, 1973 (Fig. 4)

*Specimens examined.* [Iheya-jima Is.] 5 exs., Higashi-kaigan, near Mt. Gayôyama, 14.III.2017, NK. [Izena-jima Is.] 2 exs., Izena Beach, 9.III.2017, YF; 1 ex., Nishi-kaigan, 11.III.2017, NK; 12 exs., Izena Beach, 11.III.2017, NK.

*Notes.* New to Iheya-jima Island. These individuals were collected from under a small pile of fallen leaves.

***Rakovicius coreanus*** (KIM, 1980) (Fig. 5)

*Specimens examined.* [Iheya-jima Is.] 10 exs., Higashi-kaigan, near Mt. Gayôyama, 14.III.2017, NK. [Izena-jima Is.] 5 exs., Izena Beach, 9.III.2017, YF; 2 exs., Nishi-kaigan, 11.III.2017, NK; 9 exs., Izena Beach, 11.III.2017, NK.

*Notes.* New to Iheya- and Izena-jima Islands. These specimens were collected from under a small pile of fallen leaves together with *Psammodyus kobayashii* NOMURA.

***Saprosites japonicus*** WATERHOUSE, 1875

*Specimens examined.* [Iheya-jima Is.] 14 exs., Mt. Koshidake, 24.VII.2017, NK.

Subfamily **Scarabaeinae** LATREILLE, 1802***Digitonthophagus gazella*** (FABRICIUS, 1787)

*Specimens examined.* [Iheya-jima Is.] 1 ex., Maedomari, 12.III.2017, YT; 43 exs., Mt. Tannadake, 21.VII.2017, NK; 1 ex., near Mt. Maedake, 22.VII.2017, NK, by light trap; 19 exs., Mt. Tannadake, 24.VII.2017, NK.

***Onthophagus itoi* (NOMURA, 1976)**

*Specimen examined.* [Iheya-jima Is.] 1 ex., Mt. Koshidake, 21–23.VI.2018, ST, by flight interception trap.

***Onthophagus viduus* HAROLD, 1874**

*Specimens examined.* [Iheya-jima Is.] 5 exs., Maedomari, 12.III.2017, NK & YT; 1 ex., near Mt. Maedake, 22.VII.2017, NK; 1 ex., Mt. Tannadake, 24.VII.2017, NK.

***Parascatonomus murasakianus carnarius* (NOMURA, 1976)**

*Specimen examined.* [Iheya-jima Is.] 1 ex., Mt. Koshidake, 21–23.VI.2018, ST, by flight interception trap.

Subfamily **Rutelinae** MACLEAY, 1819***Anomala albopilosa yashiroi* (SAWADA, 1950) (Fig. 6)**

*Specimens examined.* [Iheya-jima Is.] 41 exs., Gakiya-dam, 21.VII.2017, NK, by light trap; 18 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap; 4 exs., Mt. Koshidake, 21–23.VI.2018, ST, by light trap. [Noho-jima Is.] 4 exs., Iheya-mura, 23.VII.2017, NK, by light trap. [Izena-jima Is.] 5 exs., Jicchaku, 21.VII.2017, KO, by light trap; 4 exs., Uchihana, 22.VII.2017, KO, by light trap.

*Note.* New to Noho-jima Island.

***Anomala edentula okinawana* NOMURA, 1965 (Fig. 7)**

*Specimens examined.* [Iheya-jima Is.] 2 exs., Gakiya-dam, 21.VII.2017, NK, by light trap; 10 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap; 2 exs., Mt. Tannadake, 24.VII.2017, NK, by light trap. [Noho-jima Is.] 3 exs., Iheya-mura, 23.VII.2017, NK, by light trap. [Izena-jima Is.] 1 ex., Jicchaku, 21.VII.2017, KO, by light trap; 1 ex., Uchihana, 24.VII.2017, YI, by light trap.

*Note.* New to Noho-jima Island.

***Anomala triangularis* SCHÖNFELDT, 1890**

*Specimens examined.* [Iheya-jima Is.] 1 ex. (larva), Higashi-kaigan, near Mt. Gayôyama, 15.III.2017, NK (eclosion: 10.V.2017); 3 exs. (corpse), near Mt. Maedake, 22.VII.2017, NK, by light trap.

***Anomala xanthopleura* ARROW, 1913**

*Specimens examined.* [Iheya-jima Is.] 1 ex., Mt. Gayôyama, 4.III.2017, NK; 9 exs., Gakiya-dam, 21.VII.2017, NK, by light trap; 5 exs., near Mt. Maedake, 22.VII.2017, NK; 5 exs., Mt. Koshidake, 23.VII.2017, NK; 9 exs., Mt. Tannadake, 24.VII.2017, NK, by light trap. [Izena-jima Is.] 3 exs., Jicchaku, 21.VII.2017, KO, by light trap; 1 ex., Nakado, 23.VII.2017, YI.

Subfamily **Dynastinae** MACLEAY, 1819***Eophileurus chinensis okinawanus* NOMURA, 1964**

*Specimens examined.* [Iheya-jima Is.] 1 ex., Mt. Gayôyama, 14.III.2017, NK; 1 ex., Mt. Koshidake, 21–23.VI.2018, ST, by light trap.

***Oryctes rhinoceros* (LINNAEUS, 1758) (Fig. 10)**

*Specimens examined.* [Iheya-jima Is.] 2 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap;



1 ex., Mt. Koshidake, 21–23.VI.2018, ST, by light trap. [Noho-jima Is.] 1 ex., Iheya-mura, 23.VII.2017, NK, by light trap. [Izena-jima Is.] 13 exs. (larvae), Compost center, Jicchaku, 11.III.2017, NK & HN (eclosion: 11.VI.2017).

*Notes.* New to Noho- and Izena-jima Islands. On Izena-jima Island, a number of larvae of this species were found from huge piles of compost consisting of remnants of sugarcane at a compost center. This center may contribute to maintain a stable occurrence of this species.

#### Subfamily **Cetoniinae** LEACH, 1815

##### ***Gametis forticula forticula*** (JANSON, 1881)

*Specimens examined.* [Iheya-jima Is.] 7 exs., Mt. Koshidake, 13.III.2017, NK; 1 ex., Torazuiwa, 15.III.2017, NK. [Izena-jima Is.] 1 ex., Mt. Ônoyama, 10.III.2017, NK; 2 exs., Mt. Chijin-yama, 12.III.2017, YT; 3 exs., near Izena Elementary School, 12.III.2017, KO.

##### ***Protaetia exasperata iheyana*** SAKAI, 1989

*Specimens examined.* [Iheya-jima Is.] 1 ex. (larva), Mt. Gayôyama, 14.III.2017, NK (eclosion: 2.VII.2017); 1 ex. (corpse), Mt. Gayoyama, 15.III.2017, NK.

##### ***Protaetia ishigakia okinawana*** KUROSAWA, 1959

*Specimen examined.* [Iheya-jima Is.] 1 ex., near Mt. Maedake, 22.VII.2017, NK.

##### ***Protaetia lewisi lewisi*** (JANSON, 1888)

*Specimen examined.* [Iheya-jima Is.] 1 ex., near Mt. Maedomari, 22.VII.2017, NK.

##### ***Protaetia pryori pryori*** (JANSON, 1888)

*Specimens examined.* [Iheya-jima Is.] 2 exs. (larvae), Mt. Gayôyama, 14.III.2017, NK (eclosion: 29.VI.2017); 1 ex. (larva), Mt. Koshidake, 15.III.2017, NK (eclosion: 29.VI.2017); 1 ex., near Mt. Maedake, 22.VII.2017, NK; 1 ex., Mt. Koshidake, 23.VII.2017, NK; 1 ex., Dana, 24.VII.2017, NK; 46 exs., Mt. Koshidake, 21–23.VI.2018, ST, by flight interception trap. [Izena-jima Is.] 1 ex., Mt. Ônoyama, 12.III.2017, NK; 2 exs., Nakado, 23.VII.2017, KO & YI.

##### ***Nipponovalgus yonakuniensis*** SAWADA, 1941

*Specimens examined.* [Iheya-jima Is.] 3 exs., Mt. Koshidake, 15.III.2017, NK.

#### Subfamily **Melolonthinae** LEACH, 1819

##### ***Apogonia bicarinata*** LEWIS, 1896

*Specimens examined.* [Iheya-jima Is.] 1 ex., Gakiya-dam, 21.VII.2017, NK, by light trap; 4 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap; 2 exs., Mt. Tannadake, 24.VII.2017, NK; 4 exs., Mt. Gayôyama, 24.VII.2017, NK.

##### ***Apogonia major bicavata*** ARROW, 1913

*Specimen examined.* [Iheya-jima Is.] 1 ex., Mt. Koshidake, 3–6.III.2018, ST, by light trap.

##### ***Maladera oshimana*** NOMURA, 1962 (Fig. 9)

*Specimens examined.* [Iheya-jima Is.] 2 exs., Mt. Gayôyama, 21.VII.2017, NK; 5 exs., near Mt.

Table 1. List of scarabaeoid species from each islands of the Iheya-Izena Islands. The presence of the scarabaeoids is indicated by “+” and the first records by the present study is indicated by “++”. IH, NH and IZ in the Table mean the islands of Iheya-jima, Noho-jima and Izena-jima.

| Family: Subfamily<br>Species                                               | IH | NH | IZ | References                                                                                                                                                                                       |
|----------------------------------------------------------------------------|----|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Hybosoridae: Ceratocanthinae</b>                                        |    |    |    |                                                                                                                                                                                                  |
| <i>Madrasostes kazumai</i> OCHI, JOHKI et NAKATA, 1990                     | +  |    | +  | DOI (2002: IH); FUJIOKA (2005: IH); OKAJIMA & ARAYA (2012: IH & IZ)                                                                                                                              |
| <b>Hybosoridae: Hybosorinae</b>                                            |    |    |    |                                                                                                                                                                                                  |
| <i>Phaeochrous emarginatus</i><br><i>emarginatus</i> CASTELNAU, 1840       | +  |    | ++ | KUSUI (1991: IH; 2005: IH); SHIRASUGI (2000: IH); DOI (2002: IH); MATSUMURA <i>et al.</i> (2018: IH); KOBAYASHI (2018: IH); present study: IH & IZ                                               |
| <b>Lucanidae: Lucaninae</b>                                                |    |    |    |                                                                                                                                                                                                  |
| <i>Aegus laeviscolis doii</i> FUJITA, 2002                                 | +  |    |    | FUJITA (2002, IH); OKAJIMA & ARAYA (2012, IH); present study, IH                                                                                                                                 |
| <i>Aegus laeviscolis</i><br><i>nakanei</i> ICHIKAWA et IMANISHI, 1976      |    |    | +  | KUSUI (1981, IZ); FUJIOKA (2001, IZ); OKAJIMA & ARAYA (2012, IZ)                                                                                                                                 |
| <i>Dorcus titanus okinawanus</i> (KRIESCHE, 1922)                          | +  |    | +  | KUSUI (1981, IZ; 1991, IH); FUJIOKA (2001, IH & IZ); DOI (2002, IH); OKAJIMA & ARAYA (2012, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH & IZ           |
| <i>Figulus punctatus</i> WATERHOUSE, 1873                                  | +  |    |    | KIUCHI & INADA (1997, IH); FUJIOKA (2001, IH); MATSUMURA <i>et al.</i> (2018, IH)                                                                                                                |
| <i>Nigidius lewisi</i> BOILEAU, 1905                                       | +  |    |    | KUSUI (1991, IH); FUJIOKA (2001, IH); DOI (2002, IH); OKAJIMA & ARAYA (2012, IH); present study, IH                                                                                              |
| <i>Prosopocoilus dissimilis hayashii</i> FUJITA, 2009                      | +  |    |    | FUJIOKA (2001, IH); FUJITA (2009, IH); OKAJIMA & ARAYA (2012, IH); KOBAYASHI (2018, IH); present study, IH                                                                                       |
| <b>Ochodaeidae: Ochodaeinae</b>                                            |    |    |    |                                                                                                                                                                                                  |
| <i>Nothochodaeus interruptus</i><br><i>kurosawai</i> (OCHI et KAWAI, 2002) | +  |    |    | KATAYAMA (2011, IH); present study, IH                                                                                                                                                           |
| <b>Scarabaeidae: Aphodiinae</b>                                            |    |    |    |                                                                                                                                                                                                  |
| <i>Aphodius brachysomus</i> SOLSKY, 1874                                   | +  |    |    | FUJIOKA (2001, IH)                                                                                                                                                                               |
| <i>Aphodius elegans</i> ALLBERT, 1847                                      | +  |    |    | FUJIOKA (2001, IH); HORIGUCHI (2005, IH)                                                                                                                                                         |
| <i>Aphodius marginellus</i> (FABRICIUS, 1781)                              | +  |    | +  | KUSUI (1991, IH); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); KOBAYASHI (2018, IH); present study, IH                                                     |
| <i>Aphodius sublimbatus</i> MOTSCHULSKY, 1860                              | +  |    | +  | KUSUI (1981, IZ; 2005, IH); TSUKAMOTO (1987, IZ); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IZ); present study, IH                                      |
| <i>Aphodius uniformis</i> WATERHOUSE, 1875                                 | +  |    |    | KUSUI (1991, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH)                                                                                                                                 |
| <i>Aphodius uniplagiatus</i> WATERHOUSE, 1875                              | +  |    | +  | KUSUI (1991, IH); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH)                                                                                              |
| <i>Aphodius urostigma</i> HAROLD, 1862                                     | +  |    | +  | KUSUI (1981, IZ; 1991, IH; 2005, IH); TSUKAMOTO (1987, IZ); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); KOBAYASHI (2018, IH); present study, IH |
| <i>Ataenius australasiae</i> (BOHEMAN, 1858)                               | +  |    |    | KOBAYASHI (2018, IH)                                                                                                                                                                             |
| <i>Ataenius picinus</i> HAROLD, 1867                                       |    |    | ++ | present study, IZ                                                                                                                                                                                |
| <i>Psammodyius kobayashii</i> NOMURA, 1973                                 | ++ |    | +  | MATSUMURA <i>et al.</i> (2018, IZ); present study, IH & IZ                                                                                                                                       |
| <i>Rakovicius coreanus</i> (KIM, 1980)                                     | ++ |    | ++ | present study, IH & IZ                                                                                                                                                                           |

Table 1. Continued.

| Family: Subfamily<br>Species                                          | IH | NH | IZ | References                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------|----|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Rhyparus azumai</i> NAKANE, 1956                                   | +  |    | +  | KUSUI (1981, IZ; 1991, IH); TSUKAMOTO (1987, IZ); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); KOBAYASHI (2018, IH)                                                                  |
| <i>Rhyparus helophoroides</i> FAIRMAIRE, 1893                         | +  |    |    | KUSUI (1991, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH)                                                                                                                                 |
| <i>Saprosites japonicus</i> WATERHOUSE, 1875                          | +  |    |    | FUJIOKA (2005, IH); MATSUMURA <i>et al.</i> (2018, IH); present study, IH                                                                                                                                                            |
| <i>Trichiorhysssemus kitayamai</i> OCHI, 2001                         |    |    | +  | MATSUMURA <i>et al.</i> (2018, IZ)                                                                                                                                                                                                   |
| <b>Scarabaeidae: Scarabaeinae</b>                                     |    |    |    |                                                                                                                                                                                                                                      |
| <i>Digitonthophagus gazella</i> (FABRICIUS, 1787)                     | +  |    | +  | HAYAKAWA <i>et al.</i> (1995, IZ); HAYAKAWA (1998, IH); FUJIOKA (2001, IH); KUSUI (2005, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH                                |
| <i>Onthophagus itoi</i> (NOMURA, 1976)                                | +  |    |    | FUJIOKA (2005, IH); TANAKA (2006, IH); present study, IH                                                                                                                                                                             |
| <i>Onthophagus viduus</i> HAROLD, 1874                                | +  |    | +  | KUSUI (1981, IZ; 1991, IH; 2005, IH); TSUKAMOTO (1987, IZ); HAYAKAWA <i>et al.</i> (1995, IZ); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); present study, IH                                                           |
| <i>Parascatonomus murasakianus</i><br><i>carnarius</i> (NOMURA, 1976) | +  |    |    | KIMURA & INADA (1998, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH); present study, IH                                                                                                     |
| <b>Scarabaeidae: Rutelinae</b>                                        |    |    |    |                                                                                                                                                                                                                                      |
| <i>Anomala albopilosa yashiroi</i> SAWADA, 1950                       | +  | ++ | +  | KUSUI (1976, IH & IZ; 1981, IZ; 1991, IH); SUGIMOTO (1977, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH, NH & IZ |
| <i>Anomala edentula okinawana</i> NOMURA, 1965                        | +  | ++ | +  | KUSUI (1981, IZ; 1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH, NH & IZ                                                                      |
| <i>Anomala triangularis</i> SCHÖNFELDT, 1890                          | +  |    |    | FUJIOKA (2005, IH); OKAJIMA & ARAYA (2012, IH); present study, IH                                                                                                                                                                    |
| <i>Anomala xanthopleura</i> ARROW, 1913                               | +  |    | +  | OMINE (1963, IH); KUSUI (1981, IZ; 1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); KOBAYASHI (2018, IH); present study, IH & IZ                                                           |
| <i>Popillia lewisi</i> ARROW, 1913                                    |    |    | +  | KUSUI (2012, IZ)                                                                                                                                                                                                                     |
| <b>Scarabaeidae: Dynastinae</b>                                       |    |    |    |                                                                                                                                                                                                                                      |
| <i>Eophileurus chinensis okinawanus</i> NOMURA, 1964                  | +  |    |    | KUSUI (1991, IH; 2005, IH); FUJIOKA (2001, IH); DOI (2002, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH); present study, IH                                                                                    |
| <i>Oryctes rhinoceros</i> (LINNAEUS, 1758)                            | +  | ++ | ++ | KUSUI (1991, IH; 2005, IH); FUJIOKA (2001, IH); present study, IH, NH & IZ                                                                                                                                                           |
| <i>Trypoxylus dichotomus takarai</i> (KUSUI, 1976)                    | +  |    |    | ITÔ (2000, IH); FUJIOKA (2001, IH); DOI (2002, IH); OKAJIMA & ARAYA (2012, IH); KOBAYASHI (2018, IH)                                                                                                                                 |



Table 1. Continued.

| Family: Subfamily<br>Species                           | IH | NH | IZ | References                                                                                                                                                                                                                  |
|--------------------------------------------------------|----|----|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Scarabaeidae: Cetoniinae</b>                        |    |    |    |                                                                                                                                                                                                                             |
| <i>Gametis forticula forticula</i> (JANSON, 1881)      | +  | +  | +  | KUSUI (1976, IH & IZ; 1991, IH); FUJIOKA (2001, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH & NH); present study, IH & IZ                                                                                                   |
| <i>Protaetia exasperata iheyana</i> SAKAI, 1989        | +  |    | +  | SAKAI (1989, IH); KUSUI (1991, IH; 2005, IH); SAKAI (1998, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); OKAJIMA & ARAYA (2012, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH |
| <i>Protaetia ishigakia okinawana</i> KUROSAWA, 1959    | +  |    |    | SUGIMOTO (1977, IH); SAKAI (1989, IH); KUSUI (1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH                  |
| <i>Protaetia lewisi lewisi</i> (JANSON, 1888)          | +  |    |    | OMINE (1963, IH); SAKAI (1989, IH); KUSUI (1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); present study, IH                                                                               |
| <i>Protaetia orientalis sakaii</i> KOBAYASHI, 1994     | +  |    | +  | FUJIOKA (2001, IH & IZ); KUSUI (2005, IH)                                                                                                                                                                                   |
| <i>Protaetia pryeri pryeri</i> (JANSON, 1888)          | +  |    | +  | KUSUI (1976, IH & IZ; 1991, IH; 2005, IH); SUGIMOTO (1977, IH); SAKAI (1989, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH & IZ           |
| <i>Paratrichius duplicatus okinawanus</i> NOMURA, 1959 | +  |    |    | FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH)                                                                                                                                                                              |
| <i>Nipponovalgus yonakuniensis</i> SAWADA, 1941        | +  |    |    | SIMOJI (2009, IH); present study, IH                                                                                                                                                                                        |
| <b>Scarabaeidae: Melolonthinae</b>                     |    |    |    |                                                                                                                                                                                                                             |
| <i>Apogonia bicarinata</i> LEWIS, 1896                 | +  |    | +  | KUSUI (1981, IZ; 1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH                                                                      |
| <i>Apogonia major bicavata</i> ARROW, 1913             | +  |    |    | SHIRASUGI (2000, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); present study, IH                                                                                                                                     |
| <i>Maladera kusuii</i> MIYAKE, 1986                    | +  |    |    | MIYAKE (1986, IH); KUSUI (1991, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH); MATSUMURA <i>et al.</i> (2018, IH)                                                                                                     |
| <i>Maladera oshimana</i> NOMURA, 1962                  | +  | ++ | +  | KUSUI (1981, IZ; 1991, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH & IZ); KOBAYASHI (2018, IH); present study, IH & NH                                                            |
| <i>Nigrotrichia loochooana okinawana</i> NOMURA, 1959  | +  |    |    | KUSUI (1991, IH); FUJIOKA (2001, IH); OKAJIMA & ARAYA (2012, IH)                                                                                                                                                            |
| <i>Polyphylla schoenfeldti</i> BRENSKE, 1890           | +  | ++ | +  | KUSUI (1981, IZ; 1991, IH; 2005, IH); SHIRASUGI (2000, IH); FUJIOKA (2001, IH & IZ); DOI (2002, IH); OKAJIMA & ARAYA (2012, IH & IZ); MATSUMURA <i>et al.</i> (2018, IH); KOBAYASHI (2018, IH); present study, IH, NH & IZ  |
| <i>Sophrops kawadai okinawaensis</i> NOMURA, 1977      | +  |    |    | INADA (2018, IH); KOBAYASHI (2018, IH); present study, IH                                                                                                                                                                   |

Maedake, 22.VII.2017, NK, by light trap; 1 ex., Mt. Tannadake, 24.VII.2017, NK, by light trap; 164 exs., Mt. Koshidake, 3–6.III.2018, ST, by light trap; 1 ex., Mt. Koshidake, 21–23.VI.2018, ST, by light trap. [Noho-jima Is.] 1 ex., Iheya-mura, 23.VII.2017, NK, by light trap.

*Note.* New to Noho-jima Island.

***Polyphylla schoenfeldti* BRENSKE, 1890 (Fig. 8)**

*Specimens examined.* [Iheya-jima Is.] 11 exs., Gakiya-dam, 21.VII.2017, NK, by light trap; 3 exs., near Mt. Maedake, 22.VII.2017, NK, by light trap. [Noho-jima Is.] 3 exs., Iheya-mura, 23.VII.2017, NK, by light trap.

*Note.* New to Noho-jima Island.

***Sophrops kawadai okinawaensis* NOMURA, 1977**

*Specimens examined.* [Iheya-jima Is.] 6 exs., Mt. Koshidake, 21–23.VI.2018, ST, by light trap.

## Discussion

A total of 51 scarabaeoid species were recognized in previous and present studies from the Iheya-Izena Islands (Iheya-, Noho-, and Izena-jima Islands) (Table 1). The number is equivalent to 63% of the scarabaeoid species recorded from Okinawa-jima Island, which is known to be one of the richest in scarabaeoid fauna in the Ryukyus (FUJIOKA, 2001; SASAKI *et al.*, 2002; OKAJIMA & ARAYA, 2012). It is remarkable that the Iheya-Izena Islands have more than half of the scarabaeoid species inhabiting Okinawa Island despite the islands being only approximately 1/33 of Okinawa Island (1206.9 km<sup>2</sup>) in area. Among the Iheya-Izena Islands, Iheya-jima is confirmed to show the richest scarabaeoid fauna, being represented by 47 species including one species and two subspecies endemic to the island (*Maladera kusuii* MIYAKE, 1986, *Aegus laevicollis doii* FUJITA, 2002, and *Prosopocoilus dissimilis hayashii* FUJITA, 2009). On the other hand, some of *Aphodius* species have been supposed to invade to the island with livestock, and *Digitonthophagus gazella* (FABRICIUS, 1787) has actually been introduced artificially to the island. These coprophagous species may decrease in population in the future as the livestock industry declines in the islands. Two species of *Aphodius*, *A. brachysomus* SOLSKY, 1874 and *A. elegans* ALLIBERI, 1847, which were recorded only in 2001 (FUJIOKA, 2001), were not found by our enthusiastic survey, implying that these species have already drastically decreased in number.

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## 要 約

金子直樹・樽 宗一郎：伊平屋伊是名諸島の伊平屋島、野甫島および伊是名島におけるコガネムシ上科甲虫（鞘翅目）の分布記録。——伊平屋伊是名諸島は、沖縄本島の北の沖合に位置する小さな群島である。2017年から2018年にかけて、春と夏に伊平屋島、野甫島、伊是名島の3島において野外調査を行ったところ、

4科34種のコガネムシ上科甲虫が得られたのでそれらの記録を報告した。そのうち伊平屋島から2種、野平島から5種、伊是名島から4種が各島新記録であった。加えて、上記3島において過去に記録されたコガネムシ上科甲虫について、種のリストを作成するとともに、沖縄本島のコガネムシ上科相と比較を行った。その結果、伊平屋伊是名諸島には4科51種、実に沖縄本島の63%に相当するコガネムシ上科甲虫が生息することが明らかとなった。

## References

- AHRENS, D., A. BALLERIO, A. BARTOLOZZI, A. BEZDĚK, T. BRANCO, M. DELLACASA, G. DELLACASA, D. KRÁL, G. V. NIKOLAJEV, M. RAKOVIĆ, E. SPRECHER-UEBERSAX, S. ZIANI, C. ZORN & F.-T. KRELL, 2016. Lucanidae. Ochodaeidae. Hybosoridae. Scarabaeidae. Pp. 58–87, 97–412. In LÖBL, I., & D. LÖBL (eds.), *Catalogue of Palaearctic Coleoptera*, **3**. xxviii + 983 pp. Brill, Leiden.
- DOI, M., 2002. [Collecting trips for stag beetles inhabiting the remote islands: (12) Iheya-jima Island in the Okinawa Islands — the northernmost island in Okinawa Prefecture.] *Gekkan-Mushi, Tokyo*, (377): 24–31. (In Japanese.)
- DOUMAE, R., 1984. [Iheya and Izena — A geographical overview.] Pp. 3–13. In OKIU Institute of Ryukyuan Culture (ed.), *The Survey Reports on the Islands of Iheya and Izena. Area Study Series*, **5**. 129 pp. Okinawa International University, Ginowan. (In Japanese.)
- FUJIOKA, M., 2001. A list of Japanese lamellicornia. *Kogane, Tokyo, Supplement*, **1**. 293 pp. (In Japanese, with English book title.)
- FUJIOKA, M., 2005. Supplemental notes to the “A list of Japanese Scarabaeoidea” (2). *Saikaku-tsūshin, Tokyo*, (11): 35–43. (In Japanese, with English title.)
- FUJITA, H., 2002. A new subspecies of *Aegus laevicollis* SAUNDERS, 1854 (Coleoptera, Lucanidae) from Iheya-jima Is. of the Okinawa Islands. *Gekkan-Mushi, Tokyo*, (377): 22–23. (In Japanese, with English title & description.)
- FUJITA, H., 2009. A new subspecies of *Prosopocoilus dissimilis* (BOIEAU, 1898) from Iheya-jima Is. of the Okinawa Islands. *Gekkan-Mushi, Tokyo*, (463): 38–39. (In Japanese, with English title & description.)
- HAYAKAWA, H., S. IKUDOME & N. YAMASHITA, 1995. Release and establishment of introduced dung beetle *Onthophagus gazella* in the area of Okinawa Prefecture. *Bulletin of the Institute of Minami-Kyushu Regional Science, Kagoshima*, **12**: 1–7.
- HAYAKAWA, H., 1998. Ecology of *Digitonthophagus gazella* and its usefulness. *Insectarium, Tokyo*, **35** (9): 244–249 (4–9). (In Japanese, with English title.)
- HORIGUCHI, T., 2005. About *Aphodius elegans*. *Nature and Insects, Tokyo*, **40** (2): 21–24. (In Japanese, with English title.)
- HOSOYA, T., 2014. Notes on the establishment of an exotic dung beetle, *Ataenius picinus* HAROLD (Coleoptera, Scarabaeidae, Aphodiinae) in Takara-jima Island, the Tokara Islands, the Ryukyu Archipelago, Japan. *Kogane, Tokyo*, **16**: 95–98.
- INADA, S., 2018. [Records of the Coleoptera collected from Iheya-jima Island in 2018.] *Gekkan-Mushi, Tokyo*, (574): 44–45. (In Japanese.)
- ITÔ, W., 2000. [*Trypoxylus dichotomus takarai* collected from Iheya-jima Island.] *Gekkan-Mushi, Tokyo*, (347): 40. (In Japanese.)
- KATAYAMA, M., 2011. [A collecting record of *Notochodaeus interruptus kurosawai* (OCHI & KAWAI, 2002) from Iheya-jima Island, Okinawa Prefecture.] *Gekkan-Mushi, Tokyo*, (480): 40. (In Japanese.)
- KAWAI, S., 2000. New records of *Ataenius picinus* HAROLD (Scarabaeidae: Aphodiinae) from Japan (Yonaguni Is. and Ishigaki Is., Ryukyus) and Taiwan. *Saikaku-Tsūshin, Tokyo*, (1): 9–11. (In Japanese, with English title.)
- KIMURA, M., & S. INADA, 1998. [Records of dung beetles from the Ryukyu Islands.] *Gekkan-mushi, Tokyo*, (334): 34. (In Japanese.)
- KIUCHI, M., & S. INADA, 1997. [A record of *Figulus punctatus* from Iheya-jima Island, Okinawa prefecture.] *Gekkan-Mushi, Tokyo*, (316): 66–67. (In Japanese.)
- KOBAYASHI, S., 2018. [A report on insect collecting on the islands of Iheya-jima and Okinawa-jima]. *Korasana, Kurume*, (88): 128–134. (In Japanese.)
- KUSUI, Y., 1976. [Scarabaeid beetles from the Iheya Islands.] *Gekkan-Mushi, Tokyo*, (61): 26. (In Japanese.)
- KUSUI, Y., 1981. Distributional notes of Scarabaeoidea from the Islets, belonging to the Ryukyu Archipelago. I, Izena Is. and Gushikawatō Is., *Entomological Review of Japan, Osaka*, **36**: 83–84. (In Japanese, with English title.)
- KUSUI, Y., 1991. Distributional notes of Scarabaeoidea from the islets, belonging to the Ryukyu Archipelago. IV, Iheya-jima Is. *Entomological Review of Japan, Osaka*, **46**: 95–98. (In Japanese, with English title.)
- KUSUI, Y., 2005. Scarabaeid beetles collected in Iheya-jima Island, Okinawa Prefecture, in October. *Saikaku-Tsūshin, Tokyo*,

- (10): 13–14. (In Japanese, with English title.)
- KUSUI, Y., 2012. Notes on the distribution and biology of *Popillia lewisi* ARROW (Coleoptera, Scarabaeidae). *Kogane, Tokyo*, (13): 69–75.
- MATSUMOTO, T., 2016. Three new genera of the subtribe Rhizotrogina (Scarabaeidae, Melolonthinae, Melolonthini). *Kogane, Tokyo*, (18): 5–14.
- MATSUMURA, M., C. NOBAYASHI, M. NAGATA, T. KOHAMA & J. YAMAZAKI, 2018. [Records of the Coleoptera from the islands of Izena-jima and Iheya-jima in 2017.] *Insects of Loochoos, Ginowan*, (42): 8–15. (In Japanese.)
- MIYAKE, Y., 1986. Notes on some Scarabaeidae-species from the Ryukyu Islands. *Lamellicornia, Tokyo*, (2): 1–7.
- OKAJIMA, S., & K. ARAYA, 2012. The Standard of Scarabaeoid Beetles in Japan. 444 pp. Gakken, Tokyo. (In Japanese, with English book title.)
- OMINE, T., 1963. [A report on the fauna of Iheya-jima Island.] *Okidaironso, Okinawa University*, **3** (2): 86–103. (In Japanese.)
- SAKAI, K., 1989. Notes on the Cetoniinae from Iheyajima Is. of the Ryukyus (Coleoptera, Scarabaeidae). *Gekkan-Mushi, Tokyo*, (218): 18–19. (In Japanese, with English title.)
- SAKAI, K., 1998. A new subspecies of *Protaetia exasperate* (Coleoptera, Scarabaeidae, Cetoniinae) from Tokunoshima Is., Kagoshima Pref., Japan. *Gekkan-Mushi, Tokyo*, (325): 9–11. (In Japanese, with English title & description.)
- SASAKI, T., M. KIMURA & F. KAWAMURA, 2002. Coleoptera. Pp. 157–284. In AZUMA, S., M. YAFUSO, M. KINJÔ, M. HAYASHI, T. KOHAMA, T. SASAKI, M. KIMURA & F. KAWAMURA (eds.), *Check list of the insect of the Ryukyu Islands. Flora and Fauna in Okinawa (2nd ed.)*, 1. xxiv + 570 pp. The Biological Society of Okinawa, Nishihara. (In Japanese, with English book title.)
- SIMOJI, Y., 2009. [A record of *Nipponovalgus yonakuniensis* SAWADA from Iheya-jima Island.] *Gekkan-Mushi, Tokyo*, (455): 47. (In Japanese.)
- SHIRASUGI, S., 2000. [Scarabaeid beetles collected from Iheya-jima Island, Okinawa prefecture.] *Gekkan-Mushi, Tokyo*, (358): 29–30. (In Japanese.)
- SUGIMOTO, S., 1977. [A report on insect collecting in the Nansei-shotô Islands.] *Insects of Loochoos, Ginowan*, (1): 30–46. (In Japanese.)
- TANAKA, M., 2006. [A record of *Onthophagus itoi* NOMURA from Iheya-jima Island.] *Coleopterists' News, Tokyo*, (156): 14. (In Japanese.)
- TSUKAMOTO, K., 1987. Studies on dung beetles in the small islands of Japan. *Lamellicornia, Tokyo*, (3): 31–41.

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