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Dung Beetles (Coleoptera: Scarabaeidae: Scarabaeinae) of Lanyu

Keh-Miin Chen[1], Man-Miao Yang[2*], and Jing-Fu Tsai[2]

[1]Department of Compilation & Translation, Government Information Office, 2, Tientsin Str., Taipei, Taiwan 100, R.O.C.
[2]Department of Entomology, National Chung Hsing University, Taichung, Taiwan 402, R.O.C.

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Abstract. Nine species of Lanyu dung beetles are reported. They covered most of the recorded species and include three new records, i.e. *Onthophagus armatus, O. sakainoi,* and *Caccobius unicornis*. Sources of the specimens were mainly the collection from a large joint project of Lanyu biodiversity in the past few years and also the examination of museum collections. A brief description of each species, type information, diagnosis, distribution, biological information, and pictures are provided. The biogeography of each species is also discussed.

Key words: Biogeography, Dung beetles, Lanyu, New records, Scarabaeinae.

INTRODUCTION

Lanyu, or Orchid Island, is located in the southeast of Taiwan (Fig. 1) and has an area of approximately 45 km^2. It has been a focus of biological study due to its geographical location. Being part of the Luzon Arc, Lanyu sits at the juncture of the Philippine and Eurasia Plates, and the modified Wallace's line also passes nearby (Kano 1933a, b, c). Kano (1931) discussed the Coleoptera fauna of Lanyu and its biogeography. However, none of the Scarabaeinae was listed in his paper.

Miwa (1930) in his catalogue of coprophagous Coleoptera from Taiwan only recorded two species from Lanyu, which are *Copris* (*Microcopris*) *reflexus* (Fabricius, 1787) and *Paraphytus dentifrons* Lews, 1895. Nevertheless, five species from Lanyu were recorded by Nomura (1973). They are: 1) *Caccobius tsunoellus* Matsumura, 1938 (syn. of *Caccobius* (*Caccophilus*) *tortus matsudai* Ochi & Aryaya 1996); 2) *Copris* (*Paracopris*) *cariniceps* Felsche,1910; 3) *Onthophagus* (*Strandius*) *kuraruanus* Matsumura (Balthasar (1963) treated this species as a synonym of *Onthophagous* (*Strandius*) *lenzi* Harold, 1874); 4) *Onthophagus* (*Colobonthophagus*) *tragus* Fabricius1972; and 5) *Onthophagus* (s.str.) *terminatus* Eschscholtz 1822.

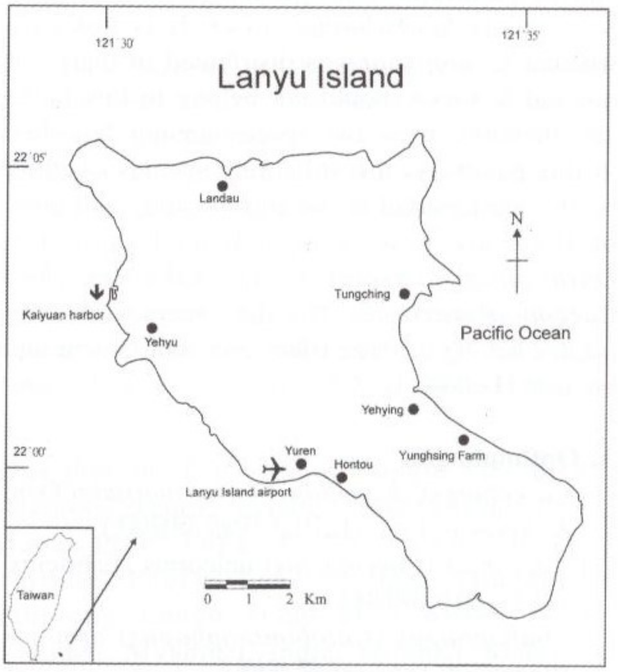

Fig. 1. Map of Lanyu showing its location and the sites where dung beetles found.

Three other species were recorded by Masumoto (1976) : 1) *Onthophagus* (*Gibbonthophagus*) *taurinus* White, 1844, 2) *Onthophagus terminatus* Eschscholtz 1822. Also, Fujioka (2001), 3) *Paragymnopleurus sinuatus* (Olivier, 1789), and in his list of the Japanese lamellicornia, mentioned that the species *Onthophagus trituber* (Wiedemann, 1832) is distributed in Lanyu.

As part of a large joint project on the biodiversity of Lanyu since 1997, our field work

*Corresponding author. E-mail: mmyang@dragon.nchu.edu.tw

found eight species of Scarabaeinae either by hand collection or pitfall traps. These pitfall traps were general purpose ones with no baits insides. They were 500 ml plastic cups filled with half 70% alcohol for preservation and run for 3 to 5 days each season. Five of the eight species we found were the same as those recorded by Nomura and Masumoto, however, the *Copris reflexus, Paraphytus dentifrons, Onthophagus taurinus,* and *Onthophagus trituber* recorded by Miwa, Masumoto and Fujioka, were not found. We then also examined the collections of dung beetles in the National Museum of Natural History (NMNS) and Taiwan Agricultural Research Institute (TARI) for further possible materials and a comparison of previous identified specimens. Several specimens were included in the previous eight species but another new record, *Onthophagus sakainoi,* was found in the collection of TARI. However, four specimens determined by Shiraki as *Copris reflexsus* turned out to be *Copris propinquus* and another unidentified specimen labeled from Kotosho is *Scarabaeus sacer.* It is not sure whether *C. propinquus* is distributed in Lanyu or not and *S. sacer* should not belong to this fauna and, therefore, those two species are not described in this paper. As a result, nine species of dung beetles are reported in the current study and three of them are new records from Lanyu, i.e. *Onthophagus armatus, O. sakainoi,* and *Caccobius unicornis.* The nine species of dung beetles belong to three tribes and four genera and are listed bellow.

A. Onthophagini

(1) *Caccobius* (*Caccophilus*) *tortus matsudai* Ochi & Aryaya , 1996 (松田氏彎緣溷棲蜣)

(2) *Caccobius* (*Caccophilus*) unicornis (Fabricius, 1782) (獨角溷棲蜣)

(3) *Onthophagus* (*Colobonthophagus*) *armatus* Blanchard, 1853 (兜鍪漯蜣)

(4) *Onthophagus* (s. str.) *sakainoi* Masumoto, 1991 (境野氏漯蜣)

(5) *Onthophagus* (s. str.) *terminatus* Eschscholtz, 1822 (端斑漯蜣)

(6) *Onthophagus* (*Colobonthophagus*) *tragus* (Fabricius, 1792) (羶漯蜣)

(7) *Onthophagus* (*Strandius*) *kuraruanus* Matsumura, 1938 (恆春漯蜣)

B. Copriini

(8) *Copris* (*Paracopris*) *cariniceps* Felsche, 1910 (稜頭餔糞蜣)

C. Gymnopleurini

(9) *Paragymnopleurus sinuatus* (Oliver, 1789) (曲拱衍裸側蜣)

In this paper, we provide a description of each species, information of types, diagnosis, biological information, and pictures. Discussions on their biogeographical distribution are presented.

Caccobius* (*Caccophilus*) *tortus matsudai Ochi & Araya , 1996 (松田氏彎緣溷棲蜣)
(Fig. 2)

Synonymy: *Caccobius tortus matsudai* Ochi & Araya, 1996, G. It. Ent. 8:4-5.

C. tsunoellus Matsumura: Nomura, 1973, Ent. Rev. Japan. Osaka, 25:47.

C. tortus Sharp: Masumoto, 1976, Elytra, Tokyo, 4(1):2.

Holotype: male, Taiwan, Lanyu Is., 24, III, 1971, K. Matsuda leg. The holotype is preserved in the Osaka Museum of Natural History (OMNH).

Description (abstracted from Ochi & Araya 1996 with modifications):

Body small, oval, strongly convex; black, with head and pronotum weakly cupreous or greenish tinge, mouth parts, palpi and antennal basal segment reddish-brown, antennal club yellowish-brown.

♂. Clypeus wide, notched in the middle, surface sparsely covered with coarse punctures, forehead of male suddenly and strongly produced upright with lateral sides protruding upward into long and divergent horns; pronotum convex, with a vague longitudinal hollow along midline in the basal half, anterior margin strongly sinuate near sides; elytra striae broadly, distinctly hollowed and finely ridged either side, intervals weakly convex, sparsely covered with one to three irregular rows of small setigerous asperate punctures, interspace among punctures a little microrugose to microgranulose; pygidium well convex and shining, sparsely and strongly puncate; metasternum with a distinct longitudinal hollow along midline; median part sparsely and strongly punctate, lateral parts sparsely and ocellately punctuate; legs short and compact, tibia stout and broad, with distal end forming an almost truncate edge, and with 4 lateral teeth.

♀. Head with clypeal margin deeply notched; clypeal teeth more strongly reflected; frontal-

Fig. 2. *Caccobius* (*Caccophilus*) *tortus matsudai* Ochi & Aryaya, 1996 (松田氏彎緣涸棲蜣)

clypeal suture well raised, surface punctate; vertex with a strongly elevated transverse carina, the summit of which is angulate anteriad in the middle and toothed on either side; pronotum with a small transverse tubercle in middle behind anterior margin, shining on edge.

Length: 4.3-5.2 mm.

Specimens examined: 3 male 2 female, 08.VIII.2001, Lanyu: Landau Village, J. F Tsai. leg.; 1male 3 female, 06.X.2002, Lanyu: Tungching, M. M. Yang leg.

Distribution: Lanyu Island (Landau Village, Tungching)

Biology: Feeds on cow and swine excrement.

Diagnosis: Ochi noted that this subspecies could be distinguished from the nominotypical one by the following characters: 1) dorsal side less shining with very weak metallic tinge; 2) punctures on pronotum finer and a little sparser; 3) elytra with intervals almost flat and distinctly microgrannulose; 4) in the male, cephalic horns well developed; 5) in the female, the pronotal tubercle more distinct.

Caccobius* (*Caccophilus*) *unicornis (Fabricius, 1798) (獨角涸棲蜣)
(Fig. 3)

Synonymy: *Copris unicornis* Fabricius, 1798, Ent. Syst. Suppl.: 33. Felsche,1910, D. Ent. Ztshr.: 348; Balthasar,1933: 272; Balthasar, 1935:79.
Onthophagus nitidiceps Fairmaire, 1893, Ann. Soc. Ent. Belg. 37: 304.
Caccobius yamauchii Matsumura, 1936, Ins. Matsumura 11:66.

Type depository: Zoologisk Museum, Kobenhaven, Denmark.

Description (abstracted from Arrow 1931 with modifications):
Black or pitchy, commonly with the clypeus,

Fig. 3. *Caccobius* (*Caccophilus*) *unicornis* (Fabricius, 1782) (獨角涸棲蜣)

elypeus, and legs dark red; antennae and mouth organs yellow, upper and lower surfaces with minute pale setae; head short and broad, with clypeus slightly bilobed in front, rounded at sides; pronotum evenly and strongly punctured, front angles blunt, lateral margins round in front sinuate behind, base rounded; elytra finely striate, 7th stria strongly curved, interval flat and minutely and sparingly punctured; pygidium finely and not closely punctured; metasternal shield nearly smooth in the middle, bearing a few large punctures in front, behind, and at the sides of the metasternum; legs short, hind tibia board at the extremity.

♂. Head shining, with only a few scattered punctures, bearing one short, erect horn with a depression behind.

♀. Head with mixed large and small punctures, having a short, straight, posterior carina.

Length: 3-3.5mm.

Specimens examined: 1 male 1 female, Lanyu: Landau Village, 08. VIII. 2001, J. F. Tsai leg.; 1male, Lanyu: Yehying, 07.VIII.2002, J. F. Tsai leg.

Distribution: This species is quite widespread. Recorded records include China (Shanhsi Prov., Hunan Prov., Fujian Prov.), Taiwan (Hualien, Taitung, Fenchi Lake in Jiayi, Oluanbi in Pingtung, Lanyu island ,etc.), Korea, Japan, Vietnam, Myanmar, India, Srilanka, Malaysia, Philippines, Sumatra, Java, Borneo, Sunda Is.

Biology: Feeds on human feces, swine and cow excrement, rotten fish.

Diagnosis: Balthasar V. (1963) noted that this widespread species is very similar to the species *Caccobius fukiensis* Balthasar 1941, which distributed in Southeast China and some data of collecting sites might be confused with the latter, however, they can be distinguished from each other by following morphological characters: 1) The body of the latter is a little bit stouter, elytra always brownish-black and at its extremity never yellowish-red; 2) head and elytra of the latter are more strongly densely and strongly punctured.

Onthophagus (Colobonthophagus) armatus Blanchard, 1853 (兜鍪漯蜣)
(Fig. 4)

Synonymy: *Onthophagus armatus* Blanchard, 1853, Voy. Pôle Sud: 98, Tf. 7, Fg.9,10; Boucomont, 1914: 305; Boucomont et Gillet, 1921: 52; Boucomont, 1924a: 371; Arrow, 1931: 279, 293; Balthasar,1935d: 337; Paulian, 1945: 110.
O. luzonicus Lansberge, 1883, Not. Leyden Mus. V: 51.
O. pseudoarmatus Balthasar, 1933/34 Acta. Ent. Mus. Nat. Prage, 21-22:93.

Type depository: Museum National d'Histoire Naturelle , Paris.

Description (abstracted from Arrow 1931 with modifications):
Black, shining, without hair or setae above, antennae and mouth-organs yellow, tarsi reddish; body broadly oval and compact, moderately convex; head large, broad, with eyes rather large; pronotum finely punctured; front with angles blunt, lateral margins straight in front and very feebly sinuate behind, base slightly rounded; elytra deeply striated, striae strongly punctured, intervals convex with minute, sparse punctures.

♂. Clypeus finely punctured, with front margin strongly reflexed and bluntly bi-angulate in the middle, separated by a nearly straight carina from the flat and feebly punctured forehead; head with posterior margin produced backward as a broad smooth lamina, gently curving upward, outer angles forming two short horns strongly curved toward each other; pronotum convex in front with slight smooth depression on each side

♀. Clypeus closely transversely rugose, separated by curved carina from forehead, usually with another feebler carina nearby; head with strongly elevated vertical carina in posterior margin; pronotum with front margin narrow, abruptly vertical in the middle.

Length: 7-8mm.

Specimens examined: 1male, Lanyu: Hontou, 22.VIII.1988, C. S. Lin leg. (NMNS); 2 male, Lanyu: Tungching, 06.X.2002, M. M. Yang leg.

Distribution: Assam, Myanmar, Taiwan (Tainan, Nantou, Kenting, Green Is., Lanyu Is.), Philippines.

Biology: Feeds on cow and swine excrement and human feces.

Onthophagus* (s.str.) *sakainoi Masumoto, 1991 (境野氏漯蜣)
(Fig. 5)

Synonymy: Onthophagus sakainoi Masumoto, 1991, Ent. Rev. Japan, 46 (2):155-156.

Locality and depository of the holotype: Nanshanhsi, Nantou, 1. IV. 1976, H. Sakaino leg; National Science Museum (Nat. Hist.), Tokyo.

Description (abstracted from Masumoto 1991 with modifications):
Body ovate, thickened. Piceous, with apical margin of head and legs brownish black, antennae and mouth parts yellowish brown, hairs on surfaces pale yellow; fore body above strongly shining and bearing somewhat purplish or violet reflexion, elytra moderately shining and feebly bearing bluish lustre, ventral surface moderately shining in the middle, gently so in lateral and posterior portions.

♀: Clypeus arcuate apicad and gently reflexed along outer margin, slightly truncate in front; fronto-clypeal border gently raised, forming short transverse ridge in middle; genae distinctly, roundly produced laterad; frons with a pair of transverse protuberances in front of each eye; vertex with a triangular protuberance; pronotum transverse, punctate, sparsely clothed with short hairs, hind angles indistinct; disc strongly, transversely convex,

Fig. 4. *Onthophagus* (*Colobonthophagus*) *armatus* Blanchard, 1853 (兜鍪漯蜣)

Fig. 5. *Onthophagus* (s. str.) *sakainoi* Masumoto, 1991 (境野氏漯蜣)

without any distinct characteristic; elytra shallowly punctato-striate, punctures on the striae rather transverse, extended to intervals; intervals slightly convex and very feebly micro-shagreened, each with one or two rows of coarse punctures bearing fine bent hairs; pygidium gently convex, scattered with strong punctures, each bears a short hair; basal border finely ridged; protibia distinctly dilated towards apex, with 4 outer teeth; apical spur slender, bent downwards; first segment of metatarsus a little shorter than terminal spur of metatibia.

Length: 3-3.5mm.

Specimens examined: 1 female, Lanyu, 13-18.IV.1981, K.S. Lin, L.Y. Chou, T. Lin & S. C. Lin leg. (TARI).

Distribution: Taiwan (Nanshanhsi, Nantou; Shoufong, Hualien; Lanyu, Taitung)

Biology: Feeds on rat excrement.

Onthophagus*（s. str.）*terminatus Eschscholtz, 1822 (端斑㵍蜣)
(Fig. 6)

Synonymy: *Onthophagus termi-natus* Eschscholtz, 1822, Entomogr.: 32

Depository of the holotype: Unknown.

Description (translated from Balthasar 1963 with modifications):

Oval, not very convex, dull brown to black, the head and pronotum with very slight metallic luster, elytra with 1 to 3 reddish-brown spots near the lateral margins and with apical spots transversely binding together, pygidium totally or partly yellowish-red, antennae club brown, dorsal side clothed with very short but stiff, bristle-like hairs.

Front of head bearing some rugoses, in between mingled with coarse punctures; frons sparsely punctured, with distinct but short and fine carina; middle of clypeus deeply notched with distinct teeth on each side; vertex with a longer but not so obviously tooth, front margin of eyes with one clear carina and two weak, short carinae obliquely near eyes; pronotum sparsely bear ocellae-like punctures, rather big but simple, mixed with scattered small punctures; front angles rectangular, sides behind not produced, basal part rounded with median part distinct and fine; elytra with strong striae, deeply and obliquely punctured, 7th stria a little elevated, intervals shagreened, slightly elevated, sparsely and granularly punctured; pygidium dull, base rounded, sparsely and shallow punctured.

Length：3.5-4.5mm.

Specimens examined: 145 adults, Lanyu: Yehying, Yunghsing Farm, IV. 2001. Pitfall.; 1 male, Lanyu: Yehying, Yunghsing farm, 05.VIII.2001, J. F. Tsai & T. C. Wang leg.

Distribution: Philippines (Luzon Is., Mindanao Is.), Taiwan (Lanyu Is., Green Is.)

Biology: Feeds on swine excrement.

Onthophagus (Colobonthophagus) tragus (Fabricius, 1792) (羶㵍蜣)
(Fig.7)

Synonymy: *Scarabaeus tragus* Fabricius 1792, Ent. Syst. I: 56

Depository of the holotype: Zoologisk Museum, Kobenhaven, Denmark.

Description (abstracted from Arrow 1931 with modifications):

Body broadly oval, not very convex; shining black, sometimes with head and thorax slightly metallic, antennae and mouth orange-yellow, tarsi red; lower surface clothed with extremely scanty pale setae, upper surface entirely without clothing.

Head broad; eyes fairly large (seen from above), sides of head bluntly angular, clypeal margin feebly blobbed in the middle; pronotum distinctly, but neither very strongly nor very closely, punctured.

♂. Clypeus finely punctured and shining,

Fig. 6. *Onthophagus* (s. str.) *terminathus* Eschscholtz, 1822 (端斑㵍蜣)

Fig. 7. *Onthophagus* (*Colobonthophagus*) *tragus* (Fabricius, 1792) (羶㵍蜣)

separated by a strongly curved carina from the smooth area; forehead finely and sparsely punctured; inner margin of each eye with a slightly compressed, inclined a little backward, but nearly straight horn, the two horns parallel and entirely separate; pronotum vertical and nearly smooth at front margin, upper edge rounded; front tibia armed with four rather short external teeth, edge straight; terminal spur very broad and flat.

In certain males a minute tooth appears between two horns, and in others produced into a median process, lateral horns correspondingly reduced; median tooth of the front tibia occasionally oblique and long, spur elongate and strongly curved.

Length: 7-9.5mm.

Specimens examined: 3 male, 1female, Lanyu: Yehying, Yunghsing farm, 05.VIII. 2001, J. F. Tsai & T. C. Wang leg.; 6 adults, Lanyu: Landau Village, 07. VIII. 2001, J. F. Tsai & T. C. Wang leg.; 2male 2 female, Lanyu: Tungching, 06.X.2002, M. M. Yang leg.

Distribution: Spreaded in a wide range, from central India to Bengladesh and Myanmar, Northern Vietnam, and up to Northern China (Hopei Province, Shanhsi Province) Taiwan, Malaysia, Java, Sulawesi.

Biology: Feeds on cow and swine excrement.

Onthophagus* (*Strandius*) *kuraruanus Matsumura, 1938 (恆春漈蜣)
(Fig. 8)

Synonymy: *Onthophagus kuraruanus* Matsumura,1938. Ins. Matsumurana 12 : 58.
Onthophagus lenzi Harold, 1874: Balthasar, 1963.

Depository of the holotype: Probably in the University Museum of Hokkaido University.

Description:
Body oval, very convex, black and opaque, with head and pronotum slightly shining; elytra fairly dark; club of antenna black; lateral margins and pygidium clothed with greyish-yellow and inconspicuous fine hairs.
Head broadly oval, with front clypeus evenly rounded but not emarginated; clypeus rather transversely rugose, otherwise head strongly and densely punctured; cephalic carina more or less strongly curved, nothing bearing on vertex; pronotum of ♂ strongly elevated, nearly curved with sharp front angles and lateral margins steep ; smooth impressions under edges besides lateral margins; pronotum moderately but not densely punctured, punctures simple not extend to front, closely near the basal part ocellae-like; base only in the median part with a faint indication of emargination; carina on both sides and tubercles of ♀ not clear, especially the latter; pygidium with fine, shallow but not dense punctures; metasternal shield with clear middle groove, near sides with bigger punctures.

Length: 8 -9mm.

Specimens examined: 11 male, 5 female, 07.VIII.2001& 08.VIII.2002, Lanyu: Landau Village, J. F. Tsai leg.

Distribution: Taiwan (Kenting, Lanyu Is.).

Biology: Feed on cow and swine excrement.

Diagnosis: *Onthophagus* (*S.*) *kuraruanus* Matsumura resembles *O.* (*S.*) *lenzi* Harold very well, so that Balthasar (1963) treated the former as a synonym of the latter. Actually, it is a good species (Nomura (1973), Masumoto (1976), etc.). With the help of Dr. Kimio Matsumoto, the speciemens of these two species from Lanyu and Taiwan (Kuanziling, Hualiankang, Kenting, and Hengchun) at the collection of National Science Museum, Tokyo, were examined. As compared with *O.* (*S.*) *lenzi*, the species *O.* (*S.*) *kuraruanus* possesses a smaller (8-9 mm) and a little narrower body. Male: Clypeus more strongly produced anteriad; pronotum more strongly impressed from sides, disc more irregularly punctate, lateral margins more strongly produced and distinctly angulate, front angles less noticeably projected. Female: Pronotum more noticeably convex anteriad, disc more strongly punctate, front angles less noticeably projected.

Fig. 8. *Onthophagus* (*Strandius*) *kuraruanus* Matsumura, 1938 (恆春漈蜣)

Copris* (*Paracopris*) *cariniceps Felsche, 1910 (稜頭餔糞蜣)
(Fig. 9)

Synonymy: *Copris carniceps* Felsche, 1910, D.

Ent. Ztschr.: 348; -Balthasar, 1933: 272; Balthasar, 1935: 79.

Depository of the holotype: Staatliches Museum fur Tierkunde, Dresden, Germany.

Description (translated from Balthasar 1963 with modifications):
Body elongate-oval, slightly convex in shape, black. Genae, frons and vertex of head with moderately dense and strong punctures; clypeus smooth, clypeal margin of male broadly and deeply notched in the middle and sharply bidentate, middle of front margin feebly but sharp knotted, behind it stretched a sharp carina to the middle of head and forming there a fine but slightly curved and pointed prominence; middle of frons between eyes erect a forwardly curved carina, in the middle on it finely prominent, vertex behind that deeply impressed, basal part of female's clypeus roundly notched frons bearing a carina-like triangle prominence, bluntly on the top; small female without prominence.

Length: 11-13 mm.

Specimens examined: 3male, 4 female, Lanyu: Landau Village, 09. VIII. 2001 & 08.VIII.2002, J. F. Tsai leg.; 1 male, Lanyu, 13-18.IV.1981, K. S. Lin, L. Y. Chou, T. Lin & S. C. Lin leg.

Distribution: China (Chiang-hsi Province, Yunan Province), Hongkong, Taiwan (Kaohsiung, Kenting, Lanyu Is.)

Biology: Active from April to August, found in agricultural fields and hills; feeds on cow and swine excrement.

Paragymnopleurus sinuatus Oliver, 1789 (曲拱衍裸側蜣)
(Fig. 10)

Synonymy: *Scarabaeus sinuatus* Oliver, 1789, Entom. 1: 160; Fg. 189; 1790, Encycl. method. V:174.
Scarabaeus leei Danovan, 1789, Epit. ins. China, Tf. I, Fig. 4.

Type depository : The Museum National d'Histoire Naturelle, Paris.

Description (abstracted from Arrow 1931 with modifications):
Black or very dark coppery black, entirely opaque above, with the club of antenna bright yellow; body rather broad and flat, with long and slender legs, front tibia armed with three acute teeth placed close together in the terminal third of the tibia, the remaining two-thirds finely serrate, the front femur with a small tooth placed about three fourths of its length from the base, the front edge forming a single sharp curving carina from the base to the tooth, and flattened and a little hollowed from the tooth to the extremity, the lower half of the external carina of the middle tibia loosely, and of the hind tibia closely, serrate Head broad, rugosely granular, with clypeus acutely notched in middle, produced into acute and rounded tooth on each side, sides nearly straight, without lateral teeth or ocular lobes; pronotum feebly convex, finely and fairly closely punctured, lateral margins not rounded but abruptly angulate in middle and nearly straight in front and hind angles, strongly convergent; elytra finely striate, with minute remote punctures, intervals flat and coriaceous; lateral margins strongly excised, exposing the metasternal epimera, as well as the base of the abdomen; sides of the latter completely and sharply carinate, pygidium sparsely with coriaceous, minute puncture.

♂. Hind angles of the pronotum with slightly produced lobes, front tibia a little elongate with a slight internal lobe at the end, terminal spur truncate and bidentate at the end; hind tibia strongly curved at its extremity.

♀. Front tibia a little broader, terminal spur slender and acute.

Length: 14-22mm.

Specimens examined: 3 male, Lanyu: Landau Village, 07.VIII.2001, J. F. Tsai; 14 male 3 female, Lanyu: Landau Village, 08.VIII.2002, J. F. Tsai leg.; 2 males 1 female, Formosa: Kotohso (Lanyu Is.), III-IV.1932, S. Hirayama leg. (TARI).

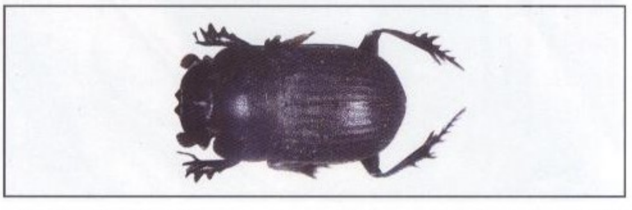

Fig. 9. *Copris (Paracopris) cariniceps* Felsche, 1910 (稜頭餔糞蜣)

Fig. 10. *Paragymnopleurus sinuatus* (Oliver, 1789) (曲拱衍裸側蜣)

Distribution: India, Nepal, Sikkim, Myanmar, Laos, Java, Flores, Bali, South China, Taiwan.
Biology: The species occurrs in all the seasons and is only distributed in the north and west part of Lanyu island. It feeds on human feces and swine's excrement and is a ball-roller (Fig. 11-12).

Diagnosis: Paragymnopleurus sinuatus is morphologically similar to the another species distributing in Taiwan, which is *Paragymnopleurus ambiguus* Janssens. However the formor is easily distinguishable from the latter by the following characters : 1) mesotibia with only one apical spur, instead of two in the latter ; 2) punctures on the shagreened pronotum more distinct; 3) very dark or dark coppery black and the latter dull black and very often with coppery lustre ; 4) in male, hind angles of pronotum with produced lobes and front tibia is a little elongate with a slight internal lobe at the end in the former, pronotum without produced lobes and front tibia not elongate and much broader in the latter.

DISCUSSION

These nine species of dung beetles are from three tribes and four genera. Of these nine species of Scarabaeinae, five are typically found in the Oriental Region: *Onthophagus* (s. str.) *terminatus, O.* (s. str.) *sakainoi, O.* (*Colobon-thophagus*) *armatus, Caccobius* (*Caccophilus*) *tortus, and matsudai, and Paragymnopleurus sinuatus.* The species distributed in both the Palearctic and Oriental Regions are *Caccobius unicornis, Copris* (*Paracopris*) *cariniceps, Onthophagus* (*Colobonthophagus*) *tragus.* and *Onthophagus* (*Strandius*) *kuraruanus*.

The noticeable species is *O. kuraruanus* an endemic species of Taiwan. Except from Lanyu, the distribution of this species has been recorded in Kenting of Taiwan, which is in the southernmost part of the island and has a tropical climate. There are three other species of the subgenus *Strandius* occur on the island of Taiwan: *O.* (*S.*) *hiurai* , *O.* (*S.*) *taiwanus* and *O.* (*S.*) *japonicus*. The last one, *O. japonicus,* is still a doubtful record of Taiwan. This species is mainly distributed in Northeast Asia and the first two species are distributed in mountains with an elevation of 1,500-2,500m above sea level in areas with mild climate. *O. kuraruanus* is apparently the only species of this subgenus that has adapted to the tropical climate and appears on the lowlands and hills. It is very closely related to the species *Onthophagus* (*Strandius*) *lenzi*. *O.* (*S.*) *lenzi* has its main distribution area in Palearctics, which is an area with a mild climate, but they have also spread to northeastern part of Orientalisis (South China). Altogether, the subgenus *Strandius* has a total of 17 species. Most species are mainly distributed in the Palearctic region such as China and Japan. The south boundaries for the distribution of *Strandius* extend to North Vietnam, Laos, and Cambodia (*O. tonkineus*). Some species, such as *O. obliquus* and *O. plebejus*, are distributed in the Ethiopian region.

According to our correspodence with Dr. Kimio Masumoto Otsuma Women's University, Tokyo, it is highly possible that several additional species occur in Lanyu Island. If their occurrence can be confirmed, the number of species of dung beetles in Lanyu can be up more than 10. It covers nearly one sixth of the total species in Taiwan. In comparison with Taiwan, Lanyu is only a small island and has an area of only 45 square kilometers which is approximately one eight-hundredth of Taiwan. Lanyu is thus very plentiful of its dung beetle fauna, especially considering

Fig. 11. *Paragymnopleurus sinuatus* attracted by humen feaces

Fig. 12. The process of ball-making by *Paragymnopleurus sinuatus*

about the poor mammal fauna on the island.

The food sources used by the dung beetles of Lanyu consist primarily of swine, cow or human feces. Swines are everywhere in the island while cows are rare. The cows in Tungching are supposed to be imported from Taiwan in 1950s (Song, 1955). Since local people do not use them for either farming or meat purpose, the population of the cow was limited. On the contrary, swine is highly associated with the life of local people and are used often for ceremonies. The population remains high. There are different opinions on the origin of the livestocks in Lanyu. Some Japanese believe that the swine was brought there by the Yami (Tao) people when they moved from Badan, Philippines, to Lanyu, but the prevalent opinion is that the swine was imported directly from Taiwan (Song, 1955). Whether the dung beetles came to Lanyu when the livestocks were imported remains unknown. However, the fact that these nine species of dung beetles belong to a widespread higher taxa and the incongruence of geographical distribution for different species, suggest that the dung beetle of Lanyu have multiple origins.

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蘭嶼的糞金龜(鞘翅目:金龜子科:金龜子亞科)

陳克敏[1] 楊曼妙[2] 蔡經甫[2]

[1]行政院新聞局資料編譯處

[2]國立中興大學昆蟲學系

本文報導九種蘭嶼糞金龜，包含多數已紀錄之種類並有三種新紀錄種，即*Onthophagus armatus, O. sakainoi,* 與 *Caccobius unicornis*。標本主要來源爲過去數年參與蘭嶼生物多樣性調查研究採集所得與檢視國內標本館之蒐藏。文中提供各種的特徵簡要描述、模式標本資料、診斷特徵、分布情形、生物學資訊與圖片，並針對其生物地理分布進行討論。

關鍵詞：生物地理，糞金龜，蘭嶼，新紀錄種，金龜子亞科。