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## Discovery of second new species of the genus *Spiniphilus* Lin & Bi, and female of *Heterophilus scabricollis* Pu with its biological notes (Coleoptera: Vesperidae: Philinae: Philini)

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### Abstract

A new philine species of the genus *Spiniphilus* Lin & Bi, 2011, *S. xiaodongi* sp. nov. is described from Yunnan, China. The female of *Heterophilus scabricollis* Pu, 1988 is described for the first time with its biological and ecological data.

**Key words:** new species, Philini, China, taxonomy, biology, description

### Introduction

The genus *Spiniphilus* was established for *S. spinicornis* from Yunnan, China by Lin & Bi (2011). In 2011, two additional males of this species were collected, along with one quite different male believed to be congeneric, from a lower altitude locality in Yunnan. This peculiar specimen, having the process of antennomeres III to X much longer than the type species, was discussed with Dr. Petr Švácha and mentioned as “one undescribed species” of the genus (Švácha & Lawrence 2014). This second species has not been described until now due to a lack of sufficient material. Additional specimens confirming the validity of the second new species were collected from the same locality in 2013. The species is described herein as *S. xiaodongi* sp. nov. This new species is the 12<sup>th</sup> species from the subfamily Philinae to be reported from China (Löbl & Smetana 2010; Lin & Bi 2011).

In addition, the female of *Heterophilus scabricollis* Pu, 1988 is described for the first time. Although two female specimens of the genus *Heterophilus* were described by Lin & Bi (2011), they were in poor condition and their species identity was uncertain. During the same expedition in 2013, several additional specimens were collected of both sexes of *Heterophilus scabricollis* Pu, 1988, from the type locality. Phenological and habitat information was recorded and reported for the first time herein.

### Materials and methods

The depositories of the specimens examined are abbreviated as follows: Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZAS); Personal collection of Chang-Chin Chen, Tianjin, China (CCCC); and Personal collection of Wen-Xuan Bi, Shanghai, China (CBWX).

Specimens of males were collected by light trap. The females of *Heterophilus scabricollis* Pu, 1988 were hand-collected from emergence holes. Holes were excavated using a pickax (Fig. 12) and females were then extracted from the emergence hole using long forceps.

## Results

### Genus *Spiniphilus* Lin & Bi, 2011

#### *Spiniphilus* Lin & Bi, 2011: 54.

**Type species.** *Spiniphilus spinicornis* Lin & Bi, 2011, by original designation.

**Remarks.** Only the type species was known prior to this study.

**Distribution.** China: Yunnan.

### *Spiniphilus spinicornis* Lin & Bi, 2011

(Figs. 1 & 3)

*Spiniphilus spinicornis* Lin & Bi, 2011:55, figs. 1–2.

**Remarks.** There is a mistake in Lin & Bi (2011). Fig. 9a is dorsal view while Fig. 9b is ventral view.

**Distribution.** China: Yunnan.

**Material examined.** Holotype (26.0 mm long), male, China, Yunnan Prov., Yingjiang (24°46'N, 97°58'E), 1700 m, 1980.IV.15, leg. Ping Gao (IZAS, IOZ(E) 1859320). Paratypes: 1 female (37.0 mm long), same data as holotype but 1980.IV.21, IOZ(E) 1859322; 2 males, Yunnan prov., Tengchong County, Longchuanjiang (24°55'N, 98°42'E), alt. 1050 m, 2006.V.16, leg. Ping Zhao by light trap (IZAS, IOZ(E) 1859321 & CCCC). **Additional material.** 2 males, Yunnan, Tengchong County, Mt. Laifengshan (25.019°N, 98.485°E), alt. 1700 m, 2011.V.6, leg. Wan-Gang Liu (IZAS, specimens in alcohol, with one male sent to Petr Švácha for molecular study).

### *Spiniphilus xiaodongi* sp. nov.

(Figs. 2 & 4–7)

**Description (Male).** Length (from clypeus to elytral apex): 18.5–25.0 mm, humeral width: 4.0–6.0 mm. Body uniformly reddish testaceous, covered with short tawny pubescence.

Head (including the protruding eyes) as wide or wider than prothorax, covered with moderately long pubescence. Eyes protuberant, protruding beyond the temples; upper eyelobes (Fig. 2a) closer to each other than lower eyelobes (Fig. 2b). Antennae 11-segmented, pectinate, slightly longer than body, with only half to the whole of last antennomere surpassing elytral apex; antennomeres III–X hardly flattened and bearing a long process (lateroapical spine, sensu Lin & Bi, 2011); scape stout, without a carina, last antennomere flat and long; antennomeres III–X subequal in length, processes gradually extended apically in antennomeres III–VII, subequal in VII–IX and reduced in X; relative lengths of segments from base to apex (with length of process when present) 10: 3: 18(9): 20(15): 19(21): 20(25): 19(30): 20(31): 22(31): 22(25): 50. Relative length of antennomere VII variable, usually slightly longer than VI while slightly shorter than VIII, but sometimes slightly shorter than VI or longer than VIII.

Prothorax weakly tapering anteriorly, very finely punctured, with a weak lateral marginal carina extended anteriorly from base, approaching but not reaching procoxal cavity, and then curving back to apical margin. Elytra densely punctured, much broader than prothorax, nearly three times as long as humeral width; gradually tapering apically; each elytron with two or three longitudinal carinae, medial carina begins near base while the lateral 2 carinae begin more posteriorly, all carinae fail to reach narrowly rounded elytral apex. Procoxal cavities widely open posteriorly, intercoxal process broad, expanded (bearing secondary procoxal articulation), deeply impressed medially and then abruptly truncate with a bifurcate apex.

Abdomen with ventrite V (sternite VII) wider than length with rounded apex.

Legs moderately flattened, with dense pubescence; hind femur reaching apex of second abdominal ventrite; pro- and mesotibiae with short, blunt teeth (shorter than surrounding pubescence) on outer side; first hind tarsal segment shorter than following two segments combined; apical margin of second tarsomere shallowly emarginate (to 1/10 to 1/5), third tarsomere deeply cleft to 1/2 of the length; claws simple, plurisetose empodium present.

Male terminalia with tegmen (Figs. 5a–c) about 2.2 mm in length with a dorsally membranous short roof; lateral lobes (Fig. 5c) slender, less than 1/4 of tegmen length, tapering apically, setae on basal area shorter than that on apical part, of which longest setae is subequal to lateral lobe in length; ringed part converging basally. Median lobe plus median struts (Figs. 6 a–c) slightly curved in apical half, longer than tegmen; median struts about 5/7 of the whole length of median lobe; dorsal plate shorter than ventral plate; apex of ventral plate (Fig. 6c) rounded; median foramen not elongated; internal sac without armature, delimited from unpaired ejaculatory duct only by constriction. Tergite VIII (Fig. 7) trapeziform with rounded or truncated apex.

**Diagnosis.** *Spiniphilus xiaodongi* sp. nov. can be easily separated from *S. spinicornis* by a combination of characters summarized in Table 1.

**TABLE 1.** Differences of *S. spinicornis* Lin & Bi and *S. xiaodongi* sp. nov.

| Species Characters                                | <i>S. spinicornis</i> Lin & Bi (n=5)   | <i>S. xiaodongi</i> sp. nov. (n=10)   |
|---|--|---|
| Body size   | length: 22.8–26.0 mm, humeral width: 5.8–6.8 mm.   | length: 18.5–25.0 mm, humeral width: 4.0–6.0 mm.  |
| Length of pectinate process to the antennomere    | Always shorter   | III & IV shorter, V to X longer.  |
| Antennomeres                                      | IV to X flattened and distinctly widened apically (Fig 1a); XI subdivided at apical third (Fig. 3) | IV to X hardly flattened and slightly widened apically (Fig 2a); XI not subdivided (Fig. 4) |
| Width of head / humeral width                     | ca. 5/9  | ca. 2/3=6/9   |
| Length of head + pronotum / elytral length        | Slightly < 1/3   | Slightly > 1/3  |
| Shape of pronotum, and apical width / basal width | Tapering anteriorly, ca. 3/4   | Nearly quadrate, ca. 1/1  |
| Elytral length / humeral width                    | Slightly < 3   | Slightly > 3  |
| Pubescence of body                                | Longer and denser (Figs. 1 a & 1b )  | shorter and sparser (Figs. 2 a & 2b )   |
| Apex of ventral plate of median lobe              | Strongly projected (Fig. 7 in Lin & Bi, 2011)  | Rounded (Fig. 6c)   |
| Distributional range of altitude                  | 1050–1700 m  | 300–570 m   |

**Etymology.** The species is named after Mr. Xiao-Dong Yang, who collected the first specimen of the type series and many other important longhorn beetles.

**Remarks.** All the type specimens were collected at light traps setup in low altitude areas (alt. 300–570 m) and allopatric with *S. spinicornis*, which has only been collected at altitudes greater than 1000 m above sea level.

**Distribution.** China: Yunnan.

**Material examined.** Holotype (20.0 mm long), male, Yunnan, Yingjiang, Nabang, alt. 300 m, 2013.V.11, leg. Wen-Xuan Bi (IZAS, IOZ(E) 1905298). Paratypes: 1 male, same locality as holotype, 2013.V.9, leg. Xiao-Dong Yang (IZAS, IOZ(E) 1905299); 3 males, same data as holotype, (CBWX); 1 male, same data as holotype, 2013.V.18 (CBWX); 1 male, same data as holotype, 2013.V.23 (CBWX); 2 males, Yunnan, Yingjiang, Nabang, Rongshuwang, alt. 508 m, 2013.V.19, leg. Xiao-Dong Yang (CCCC); 1 male, same data but alt. 570 m, 2011.IV.30 (CCCC).

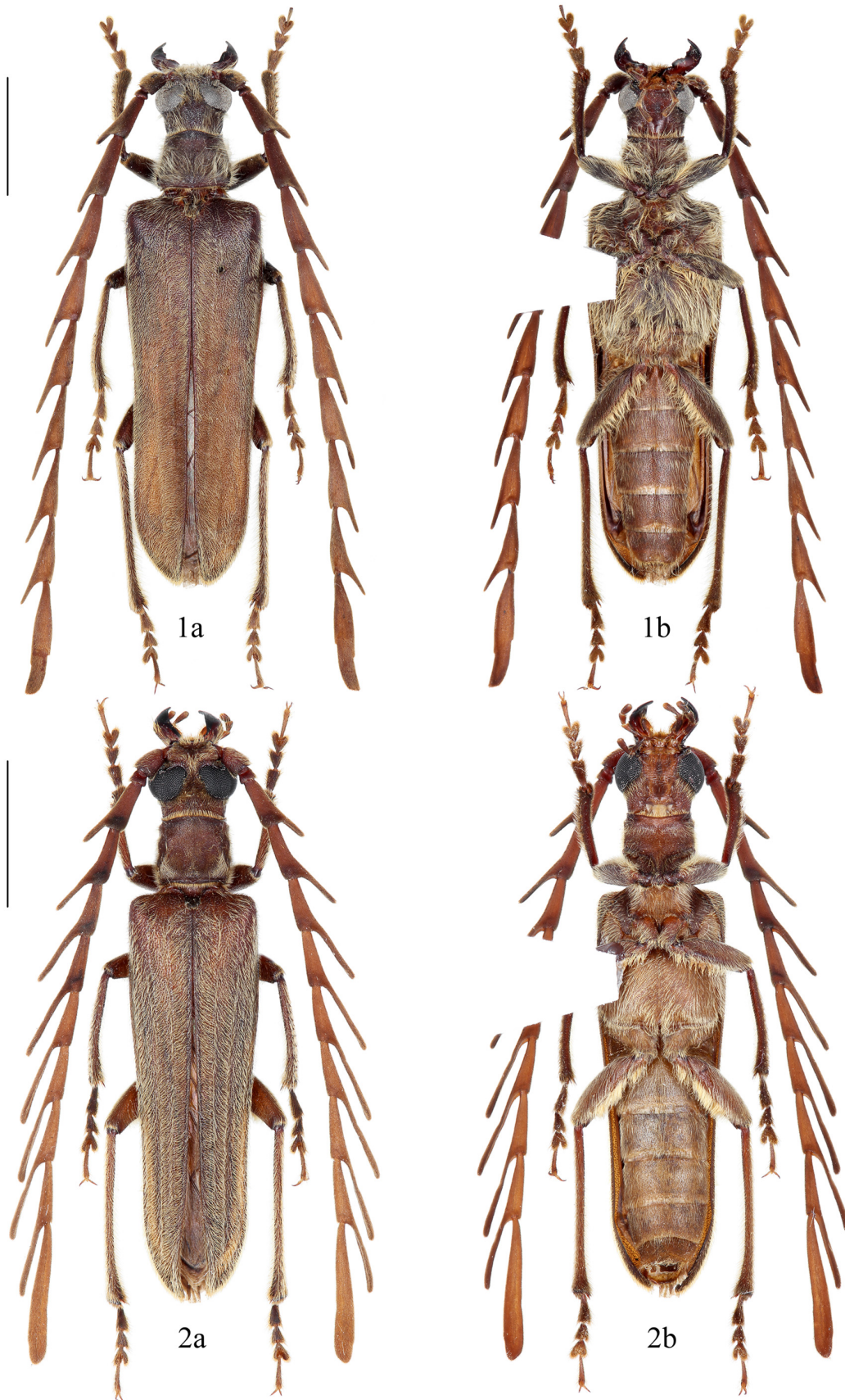
## Genus *Heterophilus* Pu, 1988

*Heterophilus* Pu, 1988: 302. Type species: *Heterophilus scabricollis* Pu, 1988, by original designation.

*Heterophilus*; Chiang *et al.*, 1996: 109; Švácha *et al.*, 1997: 366; Wu & Chiang, 2000: 83; Lin & Bi, 2011: 59.

**Remarks.** Three species are known from Xizang (Tibet) Autonomous Region, all described based on males only: *H. scabricollis* Pu, 1988; *H. dentitibialis* Chiang *et al.*, 1996; and *H. punctulatus* Chiang *et al.*, 1996 (larvae described in Chiang & Chen, 1996 and Švácha *et al.*, 1997; male genitalia analyzed in Wu & Chiang, 2000). Two female specimens recorded by Lin and Bi (2011) were unidentifiable to species and only briefly described.

**Distribution.** China: Xizang (Tibet) Autonomous Region.



**FIGURES 1–2.** Dorsal and ventral habitus of *Spiniphilus* spp. **1)** *S. spinicornis* Lin & Bi, 2011, male from Yunnan; **2)** *S. xiaodongi* sp. nov., holotype male from Yunnan. a = dorsal view, b = ventral view. Scale bars = 5 mm.





**FIGURES 3–13.** Antennomeres and terminalia. **3–4)** last four antennomeres of male. **3)** *S. spincornis* Lin & Bi; **4)** *S. xiaodongi* sp. nov. **5–7)** male terminalia of *S. xiaodongi* sp. nov. **5)** tegmen; **6)** median lobe; **7)** tergite VIII and sternites VIII & IX. **8–13)** female terminalia of *Heterophilus scabricollis* Pu, 1988. **8)** sternite VIII, including spiculum ventral; **9–10)** ovipositor; **11–13)** spermatheca. a = ventral view, b = lateral view, c = ventral view. Scale bars = 1 mm. Figs. 3, 4 and 11–13 not to scale.

## *Heterophilus scabricollis* Pu, 1988

(Figs. 8–21)

*Heterophilus scabricollis* Pu, 1988: 294, 303, fig. 1.

**Description (Female).** Body length (from clypeus to elytral apex): 22.5–29.0 mm, maximum width (at humeri): 7.5–9.2 mm. Head and pronotum black, with some moderately long grayish pubescence. Scutellum black. Elytra, ventral surface of body and legs (femora and tibiae) black-brown to black with short grayish or brownish pubescence, antennae and tarsi usually lighter brown to red brown.

Head subvertical in front; mandibles rather long, with sharp apex, crossed when closed; maxillae relatively reduced, palpus long, four-segmented, of which third the shortest, terminal segment tapering distally (apex appears truncated or sunken in dry specimens), apex with setae; galea with dense setae, lacinia reduced; eyes moderate in size, slightly emarginated, lower lobes larger than upper lobes. Antennae short, never extending to the middle of elytra, antennomeres slightly flattened but not serrate; scape stout, third the longest; fourth slightly shorter than fifth and slightly longer than sixth; fifth to tenth very slightly diminishing, last antennomere longer than tenth; relative lengths of segments from base to apex 8: 3: 12: 9: 10: 8: 8: 7: 7: 8.

Prothorax with weak lateral carinae extending from base to apex, but hardly visible in dorsal view (Fig. 15); procoxal cavities widely open posteriorly, intercoxal process broad, expanded (bearing the secondary procoxal articulation) and deeply medially impressed in its lowest part and then abruptly declivous with broadly bifurcate apex. Mesonotum without median line, stridulatory plate present. Elytra about 2.5 times as long as the maximum width of prothorax near base, widest near middle, then gradually narrowed apically with rounded apices, and slightly dehiscent apically. Hind wings strongly abbreviated.

Abdomen with ventrite V (sternite VII) wider than length with rounded apex and a small medial sinus; apical half of tergite VII exposed from elytral apex.

Legs rather long, fringed with feeble hairs; pro- and mesotibiae with short and blunt teeth (shorter than surrounding hairs) on outer side; tibial spur formula 1/2/2; tarsi with third tarsomere cleft to 1/4 of the length, first tarsomere subequal to second and third combined. Fore coxae prominent, strongly transverse.

Female genitalia (Figs. 8–13) with paraproct long, its baculi quite thick, long and almost straight; valvifer indistinct; coxite narrowed posteriorly, each baculum broadened both inwardly and laterally at the base, though tapered towards apex, about 3/4 of the length of paraproct baculi; coxite lobes short but not very narrow, sclerotized except for basal and apical portions, with tactile hairs at the apices; stylus apical in position, much smaller than coxite lobes, sclerotized except for apex which bears tactile hairs; dorsal baculi short and thick, not so straight but curved outwards; proctiger long, with two pairs of thin baculi, inner pair longer than paraproct baculi, outer pair about one third the length of inner (variable, sometimes subequal to inner). Vagina long and moderate narrow, swollen at base; vaginal plates and bursa copulatrix absent; spermatheca existing as a moderate large membranous pouch (capsule), with a spermathecal gland, of which the size and shape are variable (Figs. 11–13); spermathecal duct not clearly distinguished from membranous spermathecal capsule, narrowed towards swollen part of vagina. Sternite VIII (Fig. 8) with two quite strongly sclerotized lateral “baculi”, which followed two patches of apical setae, and attached to speculum ventrale at base. Anterior apodeme of sternite VIII (= spiculum ventrale = tignum, Fig. 8) much shorter than abdomen, ca 1/3 of abdominal length.

**Distribution.** China: Xizang (Tibet) Autonomous Region.

**Material examined.** **China, Xizang (Tibet):** holotype (21.0 mm long), male, Xizang, Milin, Paiqu, alt. 3000 m, 1983. VII.15, leg. Yin-Heng Han (IOZ(E) 217595). 3 males & 4 females, Xizang, Linzhi, Milin, Pai, 3200 m, 2013. VII.9, leg. Wen-Xuan Bi (CBWX & IZAS, IOZ(E) 1896962); 3 males & 5 females, same data but leg. Chao Wu (CBWX & IZAS, IOZ(E) 1896963); 9 females, same data but leg. Jian Hao (CCCC); 1 female, same data but leg. Xiao-Dong Yang (CCCC).

**Remarks.** Females are considerably larger than males (Figs. 14–15) and Švácha *et al.* (1997) estimated that the size of females (of *H. punctulatus*) may be 30 mm or more based on the size of the larvae. Body size of males examined was 19.0–21.0 mm and width (at humeri) was 5.6–6.6 mm. The largest female measured 31.5 mm from tip of mandible to elytral apex. The spermathecal gland is described for the first time for any member of Philinae in the present study, suggesting that Saito (1990) was correct to interpret the petiolate membranous sac as a desclerotized spermatheca. Sperm was observed in the spermatheca (Figs. 12–13). We dissected females of *Philus antennatus* (Gyllenhal), 1817, and *Mantitheus pekinensis* Fairmaire, 1889, but neither had a gland, again



14a



14b



15a



15b

**FIGURES 14–15.** Dorsal and ventral habitus of *Heterophilus scabricollis* Pu, 1988. **14)** male; **15)** female. a = dorsal view, b = ventral view. Scale bars = 5 mm.



consistent with the findings of Saito (1990). Thus, the present of spermathecal gland might be considered a generic character of *Heterophilus*. The following characters of female genitalia of *Heterophilus scabricollis* Pu are quite variable according to our observations: 1) the length of proctiger buculi are variable, usually the outer pair shorter than inner pair but sometimes the outer pair subequal to inner pair, and begins at the same point (Fig. 10); 2) the position, size and shape of spermathecal gland are very variable (Figs. 11–13).



**FIGURES 16–21.** Biotope of *Heterophilus scabricollis* Pu, 1988. **16)** grassland and nearby vegetation of collecting site in Xizang, China; **17)** emergence hole; **18)** excavated soil gallery; **19)** showing the depth at which the females are usually found; **20)** one female dragged out of the hole; **21)** one male attracted by light.

**Biology and ecology.** The habitat of this species occurs at an altitude of ca. 3000 m, near Pai town of Xizang (Tibet) Autonomous Region located on the last section of the middle reaches of the Yarlung Zangbo River. The main vegetation at the collecting site is mixed coniferous and broadleaf tree forest in alpine grasslands with the primary herbaceous species being *Imperata cylindrica* (Linnaeus) Palisot de Beauvois, Poaceae (Figs. 16–18) and the dominant tree species around the collecting grassland being *Quercus semecarpifolia* Smith, Fagaceae. Adults are predominantly nocturnal. Males (Fig. 21) are attracted by light, and females hide in the emergence holes in the ground during the daytime. One female was found walking on the ground at night. A number of females (but no



males) were found in ca. 1.5 cm diameter emergence holes at depths of 10–20 cm. The soil galleries are usually vertical or slightly oblique. The expedition team searched three grasslands of similar vegetative composition, and about 60% of the holes (n= 42) of 1.5 cm diameter contained a single female. However, no beetles were recovered from holes less than 1.0 cm diameter (n>10), although spiders and wasps were often found instead. This size specificity suggests the holes which females hide in during the daytime are most likely also their emergence holes, though there were some deeper holes that could not be completely excavated. Females cannot fly because the hind wings are strongly reduced in spite of well-developed elytra. Copulation and oviposition were not observed but likely occurs at night in the grassland. They may lay eggs before July because all females collected on 9 July, 2013 did not contain eggs, presumably because they had already oviposited as this would be very late for an unmated female to be found. Larvae were not found, but are likely to be subterranean and feed on the roots of cogongrass (*i.e. Imperata cylindrica*) based on the location of holes in grassland areas with cogongrass (Figs. 16–20). Larva of a congener, *Heterophilus punctulatus* has been recorded feeding on the roots of cogongrass (Chiang & Chen 1996; Švácha *et al.* 1997; Švácha & Lawrence 2014).

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