

Rediscovery of *Philopona vibex* (Erichson, 1834) (Insecta: Coleoptera: Chrysomelidae: Galerucinae: Alticini) in Taiwan, with Notes on Its Biology

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Abstract

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Flea beetle, *Philopona vibex* (Erichson, 1834), is widespread in Asia but largely unknown from Taiwan. The first and only record in Taiwan was cited by Chûjô (1936) based on one specimen collected by J. Sonan in 1918. There has been no record of taxonomic publication since then. Here we re-described the species based on specimens collected from China, Japan and Taiwan, including two specimens from Ilan by Hou-Jay Chen on May 17, 2009, and six specimens from Taipei by Su-Fang Yu and Mei-Hua Tsou in March of 2016. The life cycle of this species is briefly described based on the successful rearing of 50 adults from eggs. Diagnostic characters are illustrated, including antenna, penis, gonocoxae, abdominal ventrite VIII in both sexes, and abdominal ventrite V in female. Its rarity in Taiwan is discussed in the context of its biology.

Key words: Leaf beetles, Taxonomy, *Hygrophila*, Endophallic sclerites.

INTRODUCTION

Philopona Weise, 1903 is a genus of flea beetles containing more than 40 species occurring in the southeastern Palearctic, Oriental region, Australia and Africa, including Madagascar (Konstantinov & Vandenberg 1996). The genus is recognized easily by the strongly dilated metatarsal claw segment, pronotum possessing a wide lateral margin and ante-basal transverse impression. *Philopona vibex* (Erichson 1834) is one of the most widespread species within the genus and a number of synonyms exist due to intraspecific variations across its broad distribution. The species was described originally from China (Erichson 1834). Its immature stages and biology were

studied in Japan (Kimoto & Takizawa 1994) and mainland China (Hua *et al.* 2014). However, it seems extremely rare in Taiwan. Chûjô (1936) was the first to record the species from Taiwan. It was collected more than hundred years ago with no further record in the intervening period. The Taiwan Chrysomelid Research Team (TCRT) started their inventory of all species of Chrysomelidae during 2005. Mr. Hou-Jay Chen, a member of TCRT, found one adult and one larva on leaves of *Plantago asiatica* L. (Plantaginaceae) during spring of 2009 from Ilan County, northeastern Taiwan. Another member of TCRT, Su-Fang Yu, found one adult on leaves of *Hygrophila salicifolia* (Vahl) Nees (Acanthaceae) on March 2, 2016

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at Kuantu (關渡), Taipei, north Taiwan. The next day, two more adults were found on leaves of *Hygrophila pogonocalyx* Hayata at Chihshanyan (芝山岩), Taipei. Two days later, more adults were collected from the same plants in the same locality by herself and Mei-Hua Tsou. They usually stayed concealed under young shoots (Fig. 16) or mating (Fig. 17) on the leaves of the host plant. Those adults were transferred to the room for rearing, and approximately 50 adults were emerged successfully rearing from eggs. This study re-described *Philopona vibex* and provides notes on its biology based on the reared insects.

MATERIALS AND METHODS

For rearing studies, larvae were placed in small glass containers (diameter 142 mm × height 50 mm) with cuttings from their host plants. When mature larvae began searching for pupation sites, they were transferred to smaller plastic containers (diameter 90 mm × height 57 mm) filled with moist soil (about 80% of container volume).

For delimiting variability of diagnostic characters, at least one pair from each locality or color form was examined. Length was measured from the anterior margin of the eye to the tip of elytra, and width at the greatest width of the elytra.

Specimens from the study are deposited in the following collections and institutions: Haruki Suenaga Private Collection (HSC), Okayama, Japan; Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin (MNHUB), Berlin, Germany; The Natural History Museum (NHMUK), London, UK; Applied Zoology Division, Taiwan Agricultural Research Institute (TARI), Taichung City, Taiwan, ROC.

Exact label data are cited for the type specimen; a double slash (//) divides the data on different labels and a single slash (/) divides the data in different rows. Other comments and remarks are in square brackets: [p]

preceding data are printed, [h] preceding data are handwritten, [b] blue label, [w] white label, [r] red label and [y] yellow label.

RESULTS

Philopona vibex (Erichson, 1834)

Haltica vibex Erichson, 1834: 273 (China).

Sebaethe vibex: Gemminger & Harold, 1876: 3519.

Oedionychis (Philopona) vibex: Heikertinger, 1922: 56.

Oedionychus [sic!] (*Philopona*) *vibex*: Csiki, 1940: 452 (catalogue); Chûjô & Kimoto, 1961: 187 (host plant).

Philopona vibex: Chen, 1934: 286 (Vietnam); Chûjô, 1936: 15 (Taiwan); Chen, 1939: 40 (China: Guanxi); Gressitt & Kimoto, 1963: 799 (China: Inner Mongolia, Sichuan, Hubei, Fujian, Guandong); Kimoto, 1965: 432 (catalogue); Scherer, 1969: 175 (catalogue); Medvedev, 1972: 185 (Sri Lanka); Kimoto & Takizawa, 1994: 478 (larval morphology and biology); Yu *et al.*, 1996: 255 (catalogue); Kimoto, 2000: 126 (Thailand); Lee & An, 2001: 174 (Korea); Hua *et al.*, 2014: 81 (larval morphology and its phylogenetic implications); Yang *et al.*, 2015: 372 (China: Beijing, Shaanxi, Jiangxi, Yunnan).

Oedionychis (Philopona) vibex var. *nigrodorsatus* Heikertinger, 1922: 58 (Japan: Kyoto); Chûjô & Kimoto, 1961: 187 [as synonym of *Oedionychis (Philopona) vibex*].

Oedionychus [sic!] (*Philopona*) *vibex* ab. *nigrodorsatus* Csiki, 1940: 452.

Philopona vibex ab. *limbatus* Weise, 1922: 123 (Japan: Kyoto); Chûjô, 1936: 17 (Japan: Honshu).

Oedionychus [sic!] (*Philopona*) *vibex* ab. *chujoi* Csiki, 1940: 452 (new name for *Philopona vibex* ab. *limbatus* Weise); Chûjô & Kimoto, 1961: 187 [as synonym of *Oedionychis (Philopona) vibex*].

Philopona vibex ab. *luzonica* Weise, 1922: 123 (Philippines: Luzon).

Philopona vibex var. *nigra* Chûjô, 1951: 44 (Japan: Shikoku); Chûjô & Kimoto, 1961:

187 [as synonym of *Oedionychis* (*Philopona*) *vibex*].

Aedionychis [sic!] *japonicus* Baly, 1874: 189 (Japan: Nagasaki); Jacoby, 1896: 261 (India: Belgaum); Heikertinger, 1922: 47 (as synonym of *Oedionychis vibex*); Maulik, 1926: 156 (as synonym of *P. signata*).

Philopona vibex ab. *japonicus*: Weise, 1922: 123; Chûjô, 1936: 16 (Japan: Honshu, Kyushu).

Oedionychus [sic!] (*Philopona*) *vibex* ab. *japonicus*: Csiki, 1940: 452.

Hyphasis signata Duvivier, 1892: 420 (India: Konbir).

Philopona signata: Maulik, 1926: 155 (faunistic records in India); Chûjô, 1936: 15 (as synonym of *P. vibex*).

Type specimen. *Haltica vibex*. Holotype (sex undetermined, MNHUB, by monotypy): “5041 [p, w] // *Haltica* / *vibex* / Er. / China / Meyen [h, y] // *vibex* / Er. * / China, Japon [h, y] // Hist.-Coll. (Coleoptera) / Nr. 5041 / *Haltica vibex* Er.* / China. Meyen / Zool. Mus. Berlin [p, y] / SYNTYPE / *Haltica* / *vibex* / Erichson, 1834 / labelled by MFNB 2018 [p, r]”.

***Aedionychis japonicus*.** Three syntypes are deposited at the NHMUK. Lectotype and paralectotypes is designated here for maintaining its nomenclatural stability since it was confused with other names. One bears a type label (holotype), but it is not the holotype. No holotype was originally designated by Baly (1874). It is designated as the lectotype (sex undetermined), with following labels: “Type / H.T. [p, w, circle label with red border] // Japan [h, w] // Baly Coll. [p, w] // *Aedionychis Japonicus* / Baly / Japan [h, w] // Examined [h] / K. Prathapan / 2005 [p, w]”. Paralectotype: 1 (sex undetermined): “Japan [h, w] // Baly Coll. [p, w]”. The third specimen with black elytra (e.g., Fig. 6) and same labels as the second one was labeled as var. A. However, it was not mentioned in the original paper.

Specimens examined. **CHINA. Jiangxi:** 1♂ (TARI), 27.VIII.1936; **Yunnan:** 1♂ (TARI), 西雙版納 (Xishuangbanna), 小勐養 (Xiaomengyang), 22.VIII.1958; 1♀ (TARI), 金平 (Jingping), 猛喇 (Mengla), 14.IV.1956, leg. 黃克仁 (Ke-Ren,

Huang) **JAPAN. Hokkaido:** 1♀ (HSC), Kamoenai-mura, Akaishi-mura Oomori, 13.VII.2011, leg. H. Suenaga; 1♀ (HSC), Shiriuchi-machi, Shiriuchi, 10.V.2000, leg. H. Yoshitomi; **Honshu:** 1♀ (HSC), Aomori, Ajigasawa-cho, Hitotomori-cho, Sauchisaw, 2.VI.2012, leg. H. Suenaga; 1♀ (HSC), Aomori, Fukaura-cho, Oirase, 2.VI.2012, leg. H. Suenaga; 1♂ (TARI), Gunma, Minakami-machi, Tanigawadake, 7.VI.2008, leg. S. Sejima; 1♂ (TARI), Okayama, Kagamino-cho, Doi, 20.VIII.2002, leg. Y. Sejima; 1♀ (TARI), same but with “9.VI.2003”; 2♀♀ (HSC), Toyama, Yatsui-machi, Oonogatani, 4.V.2009, leg. H. Suenaga; **Kyushu:** 1♀ (HSC), Oita, Hita-shi, Kamagase-rindo, 4.V.2013, leg. H. Suenaga; **TAIWAN. Ilan:** 1 ex., Toucheng (頭城), 17.V.2009, leg. H.-J. Chen; 1 ex., Yuanshan (員山), 17.V.2009, leg. H.-J. Chen; **Pingtung:** 1♀ (TARI), Koshun (= HENCHUN, 恆春), 25.IV.-25.V.1918, leg. J. Sonan, determined and recorded by Chûjô (1936); **Taipei:** 1 ex., Kuantu (關渡), 2.III.2016, leg. S. F. Yu; 1 ex., Chihshanyan (芝山岩), 3.III.2016, leg. S. F. Yu; 4 exs., same locality, 5.III.2016, leg. S. F. Yu & M. H. Tsou; 50 exs., reared from eggs laid by females collected from Chihshanyan (芝山岩), leg. M. H. Tsou.

Redescription. Length 4.2–5.2 mm, width 2.1–2.7 mm. General color (Figs. 1–2) yellowish brown; antennae blackish except two basal tarsomeres; prosternum brown; meso- and metathoracic ventrites black; abdominal ventrite I basally darkened; legs dark brown, with tibiae darker apically; vertex and pronotum with median longitudinal dark band; scutellum black; elytra with black stripe along suture, with one additional longitudinal, wide, black stripe arising from humeral calli, reduced at apical 1/3. Vertex with extremely coarse punctures, medially reduced. Antennae moniliform in males (Fig. 7), but antennomeres III–V slender, XII elongate, length ratios of antennomeres I–XI 1.0 : 0.5 : 0.7 : 0.4 : 0.4 : 0.4 : 0.5 : 0.5 : 0.5 : 0.5 : 0.5 : 0.7, length to width ratios of antennomeres I–XI 2.4 : 1.5 : 2.8 : 1.5 : 1.8 : 1.5 : 1.6 : 1.7 : 1.5 : 1.4 : 2.1; similar in females (Fig. 8), antennomeres III–X straight, length ratios of antennomeres I–XI 1.0 : 0.5 : 0.6 : 0.5 : 0.5 : 0.4 :

0.5 : 0.5 : 0.6 : 0.6 : 0.9, length to width ratios of antennomeres I–XI 2.2 : 1.8 : 2.6 : 1.7 : 1.7 : 1.4 : 1.4 : 1.5 : 1.6 : 1.5 : 2.6. Pronotum transverse, 2.1× wider than long, disc with sparse, minute punctures, lateral margin moderately rounded; apical and basal margins subtruncate, laterally depressed at basal margin. Elytra oblong, 1.4× longer than wide; disc with sparse, minute punctures. Apical margin of abdominal ventrite V in males rounded and slightly depressed at sides (Fig. 13), with internal median longitudinal ridge; similar in females, but median longitudinal ridge reduced (Fig. 14). Penis (Figs. 9–10) broad, 2.9× longer than wide; dorsal median process longitudinal, lateral margin medially concave, with erect, hook-like process at middle, directed anteriorly; oblique dorsal process adjacent to dorsal median process, apically narrowed; dorsal lateral sclerites slender, apically connected to apical median sclerites; with triangular process at middle of apical median sclerite; ventral apex reaching apical median sclerites, slightly depressed. Gonocoxae (Fig. 12) separate, moderately sinuate at apical 1/3, base subtruncate, each bearing 4–5 setae apically. Ventrite VIII (Fig. 11) broad apically; spiculum short and basally broadened. Receptacle of spermatheca (Fig. 15) strongly swollen; pump much smaller, with angular process at apex; distal spermathecal duct sclerotized, extremely long.

Variation. Japanese populations display great variation in color patterns. Some specimens are similar to the typical form, but with dark brown heads and black abdomens (Figs. 3–4). Some possess reduced dark bands on the pronotum and variably reduced bands on the elytra (Fig. 5). Some possess dark stripes on the elytra that extend mesally and connect with the suture, lack the median longitudinal black stripe of the pronotum, and possess black heads with yellowish brown clypeus, frons and base of vertex (Fig. 6).

Host plants. Plantaginaceae: *Plantago*

asiatica L. (Chûjô & Kimoto 1961; present study, Japan, Taiwan); Verbenaceae: *Vitex negundo* L. (Yu *et al.* 1996; Hua *et al.* 2014, China); Acanthaceae: *Hygrophila pogonocalyx* Hayata and *H. salicifolia* (Vahl) Nees (present study, Taiwan).

Biology. *Philopona vibex* populations are presumably univoltine. The following life cycle information is based on our (TCRT) observations. Females deposited an average of four to six eggs in each egg mass (Fig. 18) during early March. Larvae hatched in 12–23 days. The larvae fed on leaves and the period of different larval instars varied greatly, probably due to variation in temperature. First instar (Fig. 19) duration was 4–13 days, second was 2–5 days and third was 4–6 days. Mature larvae (Fig. 20) burrowed into soil and built underground chambers for pupation. Duration of the pupal stage (Fig. 21) was 13 days.

Distribution. China, India, Japan, Korea, Philippines, Sri Lanka, Thailand, Taiwan and Vietnam.

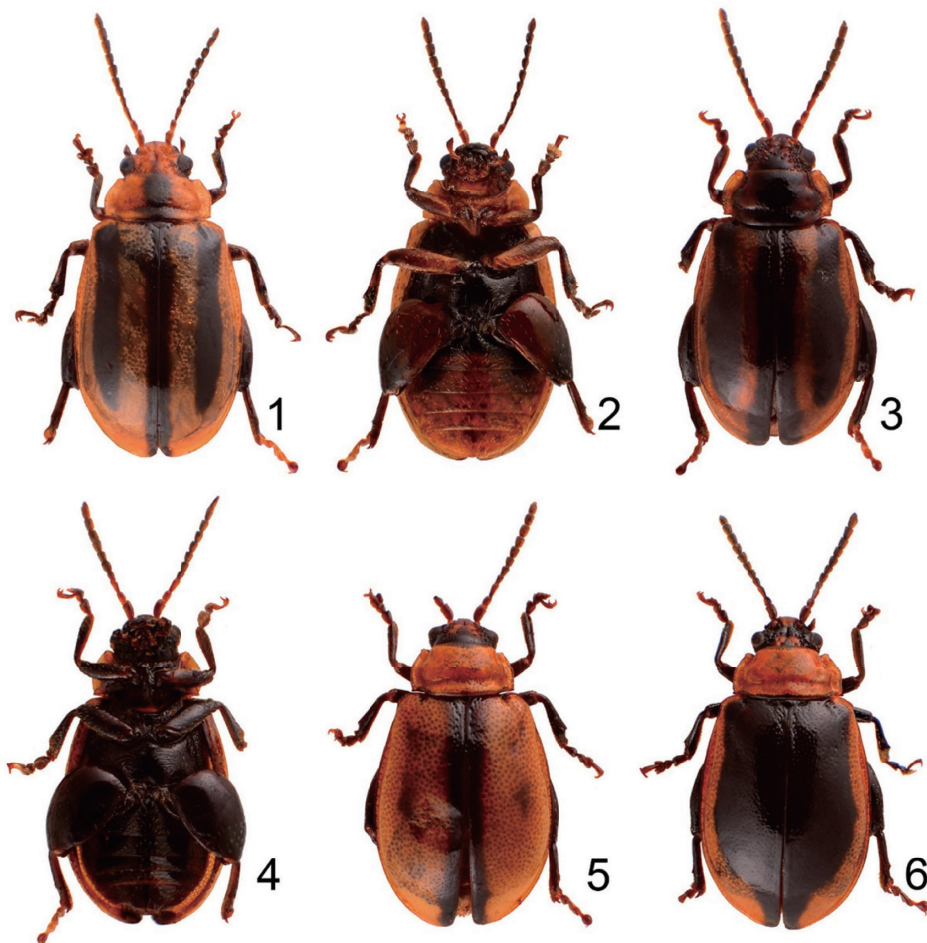
DISCUSSION

Many synonyms of *Philopona vibex* are found in literature, probably due to the broad distribution and variations in color patterns. Two color patterns within Japanese populations that differ from the typical form of *P. vibex* has prompted a number of names, including *P. japonicus* (Baly 1874), *P. vibex* var. *nigrodorsatus* (Heikertinger 1922), *P. vibex* ab. *limbatus* Weise, 1922, and *P. vibex* var. *nigra* Chûjô, 1951. Based on examination of specimens from China, Japan and Taiwan, the results confirm that these names are synonyms. As for those names from other countries, such as *P. vibex* ab. *luzonica* Weise, 1922 from Philippines and *P. signata* Duvivier, 1892 from India, further study is required.

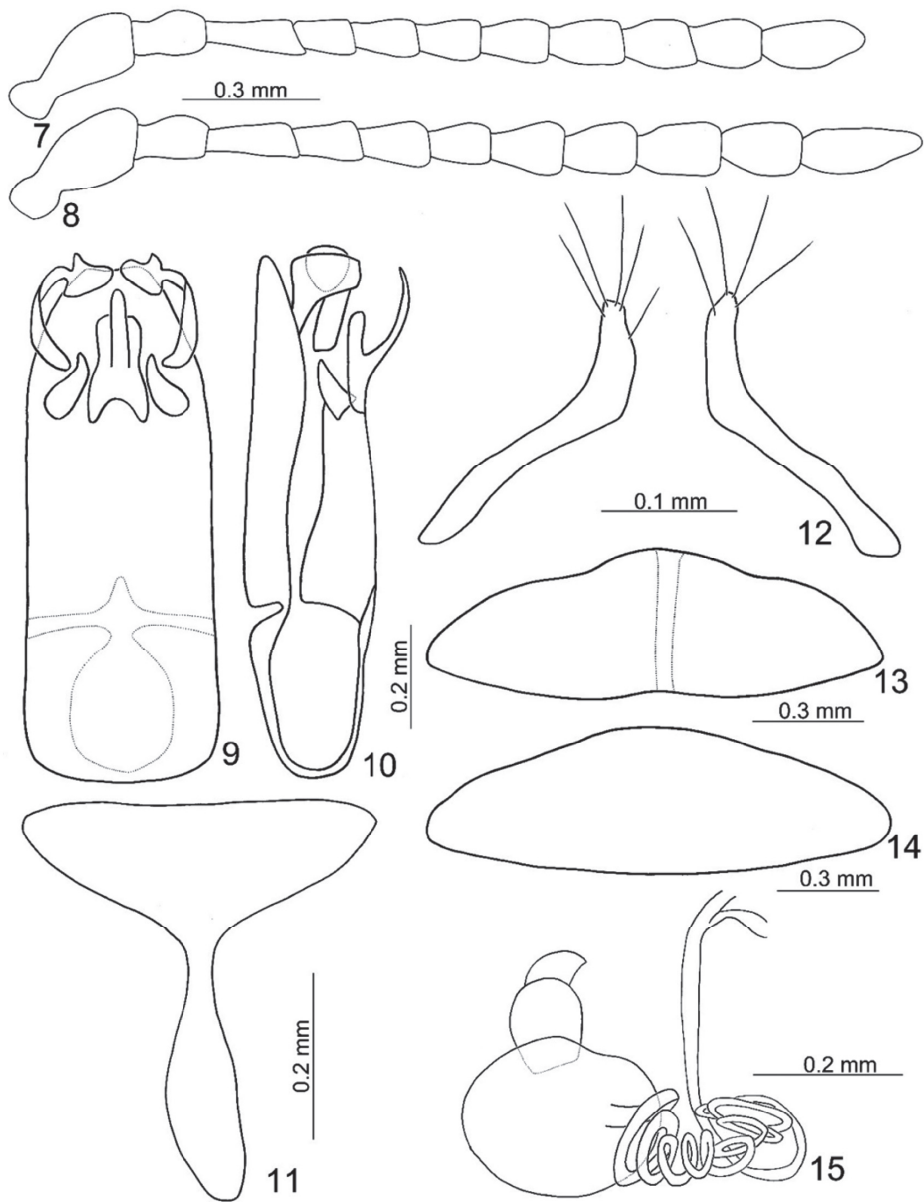
Populations of *Philopona vibex* seem uncommon in Taiwan probably because of the

host plants. Although *Plantago asiatica* L. is extremely common in Taiwan, observations of *Philopona vibex* feeding on this plant are too few to confirm whether it is the preferred host. Based on the laboratory rearing, *Hygrophila pogonocalyx* and *H. salicifolia* are its preferred hosts because females oviposited on it, and larvae fed on the leaves and successfully completed development. Both plant species are endemic semiaquatic plants in Taiwan, wild

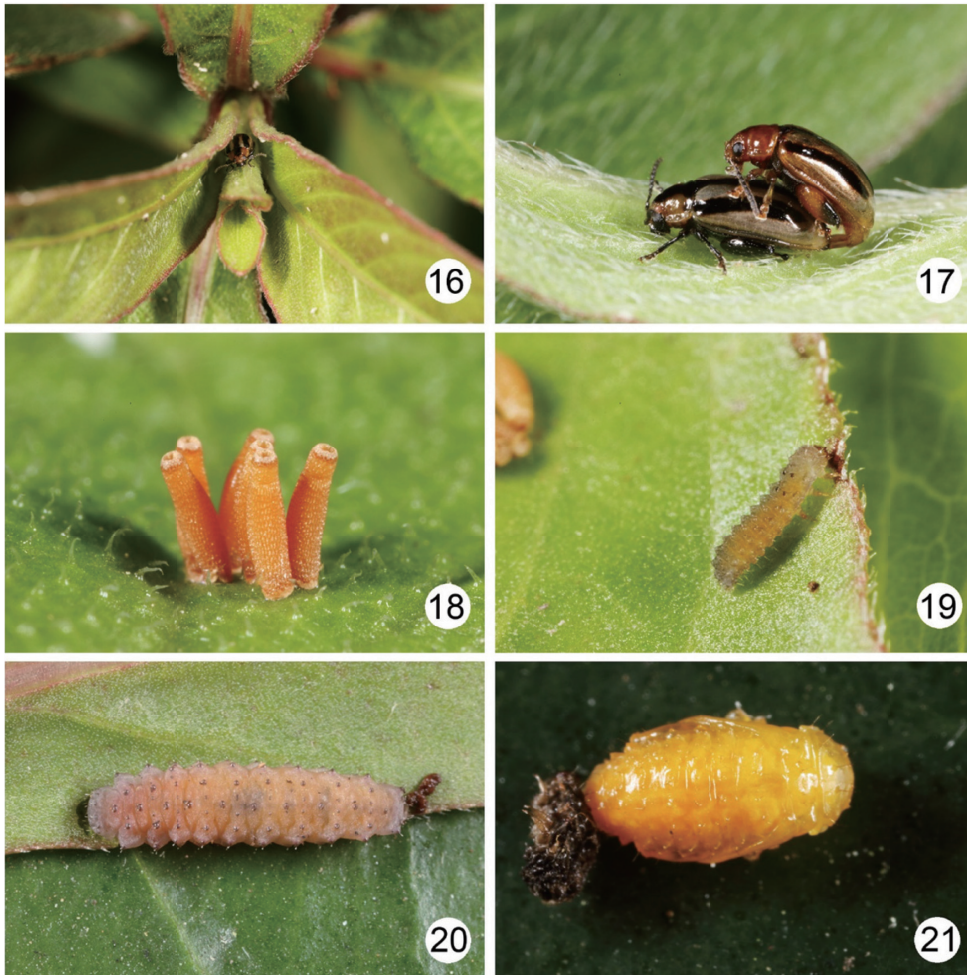
populations have become critically endangered due to wetland destruction and degradation. This is especially true for *H. pogonocalyx*, with only small wild populations left in wetlands along the coasts of Taichung City in western Taiwan (Wang *et al.* 2000). The plant has been widely cultivated all over Taiwan for restoration purposes since 1997, populations of *Philopona vibex* could be expanding with close association of the host plant.



Figs. 1–6. Habitus of adult *Philopona vibex*. 1. Female, from Taiwan, dorsal view; 2. Ditto, ventral view; 3. Female, color variation, from Japan, dorsal view; 4. Ditto, ventral view, color variation; 5. Female, color variation, from Japan, dorsal view; and 6. Female, color variation, from Japan, dorsal view.



Figs. 7–15. Diagnostic characters of *Philopona vibex*. 7. Antenna, male; 8. Antenna, female; 9. Penis, dorsal view; 10. Penis, lateral view; 11. Ventrite VIII, female; 12. Gonocoxae; 13. Ventrite V, male; 14. Ventrite V, female; and 15. Spermatheca.



Figs. 16–21. Life stages on *Hygrophila pogonocalyx*. 16. Adult hiding under young shoots of host plants; 17. Mating pair; 18. Eggs; 19. First-instar larva; 20. Third-instar larva; and 21. Pupa.

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台灣產縱紋胖爪葉蚤的再次發現與生物學注解 (鞘翅目：金花蟲科：螢金花蟲亞科：葉蚤族)

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摘要

李奇峰、曹美華。2020。台灣產縱紋胖爪葉蚤的再次發現與生物學注解 (鞘翅目：金花蟲科：螢金花蟲亞科：葉蚤族)。台灣農業研究 69(4):265–273。

縱紋胖爪葉蚤 [*Philopona vibex* (Erichson, 1834)] 是廣泛分布於亞洲的葉蚤，過去在台灣僅有楚南仁博在 1918 年採得的一隻標本紀錄。台灣金花蟲研究團隊從 2005 年開始普查台灣的金花蟲，藉由發現此葉蚤的偏好食草而找到穩定的族群；本文檢查了中國、日本及台灣的縱紋胖爪，對其重新描述，並針對診斷特徵描繪線圖，包括觸角、雄性生殖器、雌蟲生殖突基節、雌蟲受精囊、雙性的第五腹節及雌蟲的第八腹節腹板；生活史紀錄則是基於由親蟲產卵開始飼養至 50 隻子代成蟲所得的結果，並根據野外觀察與飼養經驗所得之生物學特性來探討此蟲何以在台灣如此稀少的的原因。

關鍵詞：金花蟲、分類學、水蓑衣、內囊骨。

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