

A Review of *Phyllotreta* Chevrolat in Taiwan (Coleoptera: Chrysomelidae: Galerucinae: Alticini)

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Chi-Feng Lee, Huan-Ying Chang, Chin-Ling Wang, and Wen-Shyong Chen (2011) A review of *Phyllotreta* Chevrolat in Taiwan (Coleoptera: Chrysomelidae: Galerucinae: Alticini). *Zoological Studies* 50(4): 525-533. Species of the genus *Phyllotreta* Chevrolat in Japan and Taiwan are reviewed. *Phyllotreta striolata* (Fabricius) is redescribed based on Taiwanese specimens; *P. chotanica* Duvivier is recorded for the 1st time in Taiwan; and *P. downesi insularis* Heikertinger is raised to species level. Lectotypes and paratypes are designated for *P. downesi insularis*. <http://zoolstud.sinica.edu.tw/Journals/50.4/525.pdf>

Key words: Taxonomy, Leaf beetles, Flea beetles.

Phyllotreta Chevrolat is a worldwide alticine genus which contains about 250 species (Konstantinov and Vandenberg 1996). Members of this genus are specialist feeders on the Brassicaceae and its related groups, including the Resedaceae, Cleomaceae, Limnanthaceae, Capparaceae, and Tropaeolaceae (Jolivet and Hawkeswood 1995). Most species of this genus are known as crop pests. In Taiwan, *P. striolata* (Fabricius) is a notorious pest of cruciferous vegetables. Chen et al. (1990) published detailed information on its biology. Adults feed on the foliage of host plant and produce small round holes (Fig. 1). The species is multivoltine, and the larvae are generally root feeders. Pupation takes place in the soil. A blue-colored *Phyllotreta* recorded from Taiwan is *P. downesi* Baly. It was reported as a new subspecies, *P. downesi insularis* Heikertinger by Heikertinger (1942). However, his account seems to have been ignored by subsequent papers such as Kimoto and Chu (1996) and Kimoto and Takizawa (1997). Moreover, no additional

specimens were found since that time. In this study, its taxonomic status is reviewed, and the 1st record of its host is provided.

Recently, *P. striolata* and a blue species of the genus were found to be seriously attacking cruciferous vegetables in southern Taiwan (Fig. 1). A review of this genus was necessary in order to identify and be able to control these agricultural insect pests.

MATERIALS AND METHODS

Types and specimens available for the present study are deposited in the following collections: BMNH, The Natural History Museum (former British Museum), London, UK; DEI, Senckenberg Deutsches Entomologisches Institut Müncheberg, Müncheberg, Germany; NMNH: National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; and TARI: Taiwan Agricultural Research Institute, Wufeng,

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Taiwan.

Specimens of Taiwanese populations were collected with an aspirator. Morphological terminology follows Lee and Staines (2009). Plant associations were recorded during the course of the present study. Plants of the Capparaceae were identified by Chih-Kai Yang. Plant vouchers were deposited at the TARI.

To prepare drawings of the genitalia, the abdomen was separated and boiled in a 10% KOH solution, followed by washing with distilled water. Genitalia were then mounted on slides in glycerin, and studied and drawn using a Leica M165 stereomicroscope (Singapore). For detailed examinations, a Nikon ECLIPSE 50i microscope was used (Kyoto, Japan).

RESULTS

SYSTEMATIC ACCOUNT

Phyllotreta Chevrolat, 1836

Phyllotreta Chevrolat 1836: 391.

Letzuella Chen 1934b: 340; Konstantinov and Prathapan, 2008: 410 (synonymized).

Tanygaster Blatchley 1921: 26; Smith, 1979: 359 (synonymized).

Phyllotreta striolata (Fabricius, 1803)

(Figs. 1, 3, 4, 9-14)

Crioceris vittata Fabricius 1801: 469 (not Fabricius 1775: 122).

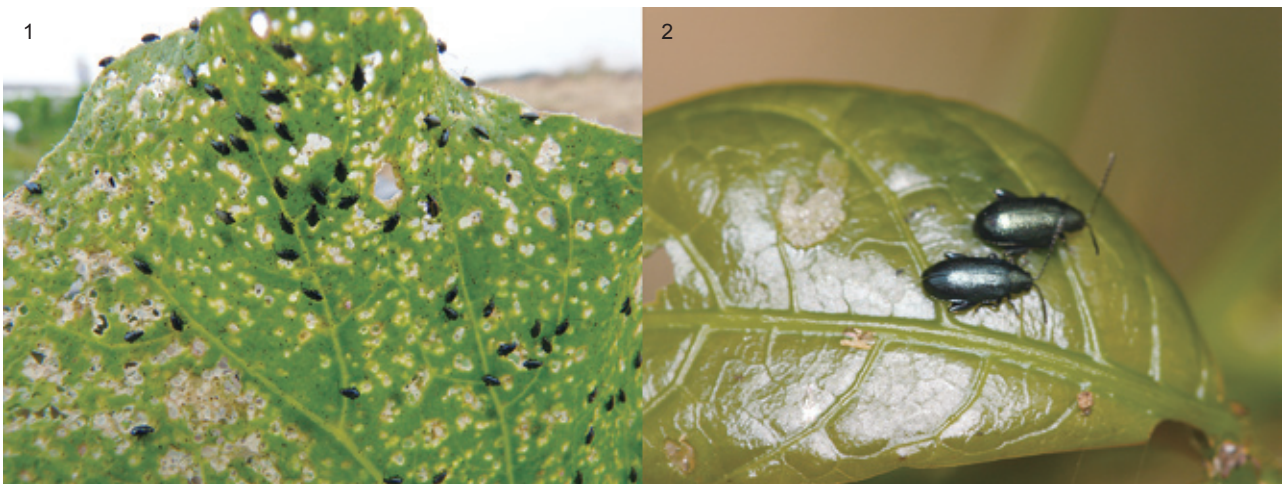
Crioceris striolata Fabricius 1803: 38. (replacement name for *Crioceris vittata* Fabricius 1801).

Phyllotreta vittata, Chen 1934a: 184 (Kankau: Changkou in Pingtung County (Co.)); Chûjô 1937: 117 (widespread in Taiwan, including the Penghu Is. and Lanyu (Orchid I.)).

Phyllotreta striolata, Kimoto 1970: 310 (Ilan Co., Puli, Sungkang, and Tsuifeng in Nantou Co., Taichung Co., Minhsiung in Chiayi Co., and Kuatzuling in Tainan Co.); Kimoto, 1991: 22 (Lanyu).

Description: Length 2.4-2.7 mm; width 1.1-1.4 mm. Black, 3 basal antennomeres, tibiae and tarsi yellowish-brown; 1 broad, longitudinal yellow stripe on elytron, outer margin strongly curved inwardly at middle (Figs. 3, 4). Vertex with dense punctures. Pronotum with dense, impressed punctures; interstices of punctures finely shagreened; elytra as densely punctuate as pronotum but interstices of punctures smooth. Antennomere V of male antenna (Figs. 3, 9) strongly swollen and longest; relative lengths of antennomeres III-XI about 1.0: 1.0: 1.5: 0.9: 1.0: 1.2: 1.1: 1.1: 1.4; female antenna similar but antennomere V slender (Figs. 4, 10). Front tarsomere I normal and similar in both sexes. Abdominal ventrite V tri-lobed in males (Fig. 13), with internal longitudinal ridge; rounded in females. Male aedeagus (Figs. 11, 12) straight, with pointed apex, strongly and ventrally curved; tectum short and slender; middle of dorsal surface with short, transverse, and parallel grooves from apex of tectum to apex of basal piece; internal sac weakly sclerotized, with 1 pair of lateral slender sclerites. Spermatheca (Fig. 14) with tubular receptacle without narrowing from head of receptacle to pump; pump moderately curved; proximal spermathecal duct short.

Diagnosis: It is easily distinguished from other



Figs. 1-2. Field observations. 1. *Phyllotreta striolata* and *P. chotanica* aggregating on cruciferous vegetables. 2. *Phyllotreta insularis* feeding on young leaves of *Crateva adansonii formosensis*.

Taiwanese species by its black coloration and yellow stripes on elytra.

Specimens examined: 66 exs., Nantou Co., Sungkang, 23 Nov. 2009, leg. I.-C. Chiu; 93 exs., Nantou Co., Wufeng, 4 Jan. 2010, leg. C.-F. Lee; 101 exs., Tainan City, Airport, 19 Jan. 2010, leg.

C.-F. Lee; 5 exs., Kaoshiang Co., Lingya, 18 Feb. 2010, leg. M.-H. Tsou; 6 exs., Pingtung Co., Chaochou; 17 Feb. 2010, leg. M.-H. Tsou; 4 exs., Ilan Co., Yuanshan, 24 Feb. 2010, leg. H. Lee; 61 exs., Hualien City, 1 Feb. 2010, leg. C.-F. Lee; 16 exs., Hualien Co., Wanjung, 2 Feb. 2010, leg. C.-F.



Figs. 3-8. Habitus of species of *Phyllotreta*. 3. *Phyllotreta striolata*, male. 4. *Phyllotreta striolata*, female. 5. *Phyllotreta chotanica*, male. 6. *Phyllotreta chotanica*, female. 7. *Phyllotreta insularis*, male. 8. *Phyllotreta insularis*, female.

Lee (all in TARI).

Host plants: Many species of cultivated Brassicaceae, such as the radish (*Raphanus sativus* L.), edible rape (*Brassica chinensis* var. *oleifera* Makino), pak-choi or ching-geen (*B. rapa chinensis* L.), mustard (*B. juncea* Cosson), and cabbage (*B. oleracea* var. *capitata* DC.) (Chen et al. 1990).

Distribution: Holarctic region, India, Nepal, Thailand, Cambodia, Vietnam, China, Taiwan, Indonesia, Japan, Korea (Kimoto 2000).

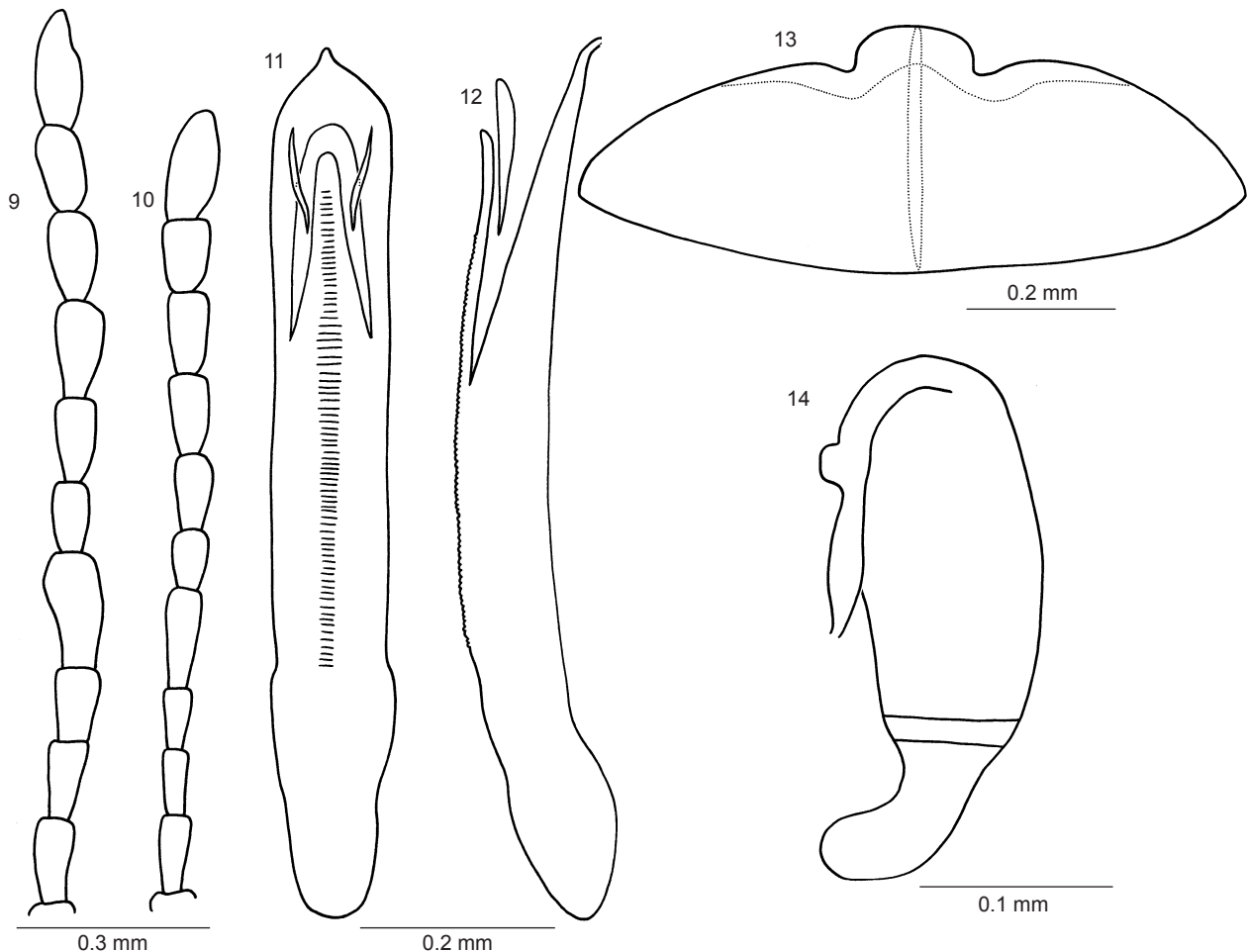
***Phyllotreta chotanica* Duvivier 1892 new record for Taiwan**

(Figs. 1, 5, 6, 15-21)

Phyllotreta chotanica Duvivier 1892: 426 (India: Kurseong); Jacoby 1896: 258 (India); Maulik 1926: 379 (India: Darjeeling); Chen, 1934b: 372 (no locality cited);

Heikertinger 1942: 147 (key); Chûjô 1961: 356 (Thailand); Scherer 1969: 37 (India: Darjeeling); Chen and Wang 1981: 501 (China: Xizang); Medvedev 1984: 49 (Nepal); Kimoto 2000: 193 (list).

Description: Length 1.9-2.2 mm; width 0.9-1.1 mm. Metallic-blue, antenna and legs, except hind femora, blackish-brown (Figs. 5, 6). Pronotum and elytra with dense, impressed punctures; interstices of punctures finely shagreened. Antennomeres VIII-X of male antenna (Figs. 5, 15) laterally widened; antennomeres III-X similar in length, but III shorter and VII longer; relative lengths of antennomeres III-XI about 0.8: 1.0: 1.0: 1.0: 1.1: 1.0: 1.0: 1.0: 1.3; female antenna (Figs. 6, 16) similar but antennomeres IX and X narrower. Front tarsomere I normal and similar in both sexes (Fig. 20). Abdominal ventrite V tri-lobed in males (Fig. 19), without an internal longitudinal ridge; rounded in females. Male aedeagus (Figs. 17,



Figs. 9-14. *Phyllotreta striolata*. 9. Antenna, male. 10. Antenna, female. 11. Male aedeagus, dorsal view. 12. Male aedeagus, lateral view. 13. Abdominal ventrite V, male, dorsal view. 14. Spermatheca.

18) straight, with widely rounded apex, slightly curved ventrally; tectum slender and curved inwardly; internal sac with strongly sclerotized basolateral sacs; apical median sclerite short and apically curved. Spermatheca (Fig. 21) with tubular receptacle without narrowing from head of receptacle to pump; pump moderately curved; proximal spermathecal duct short, swollen near apex.

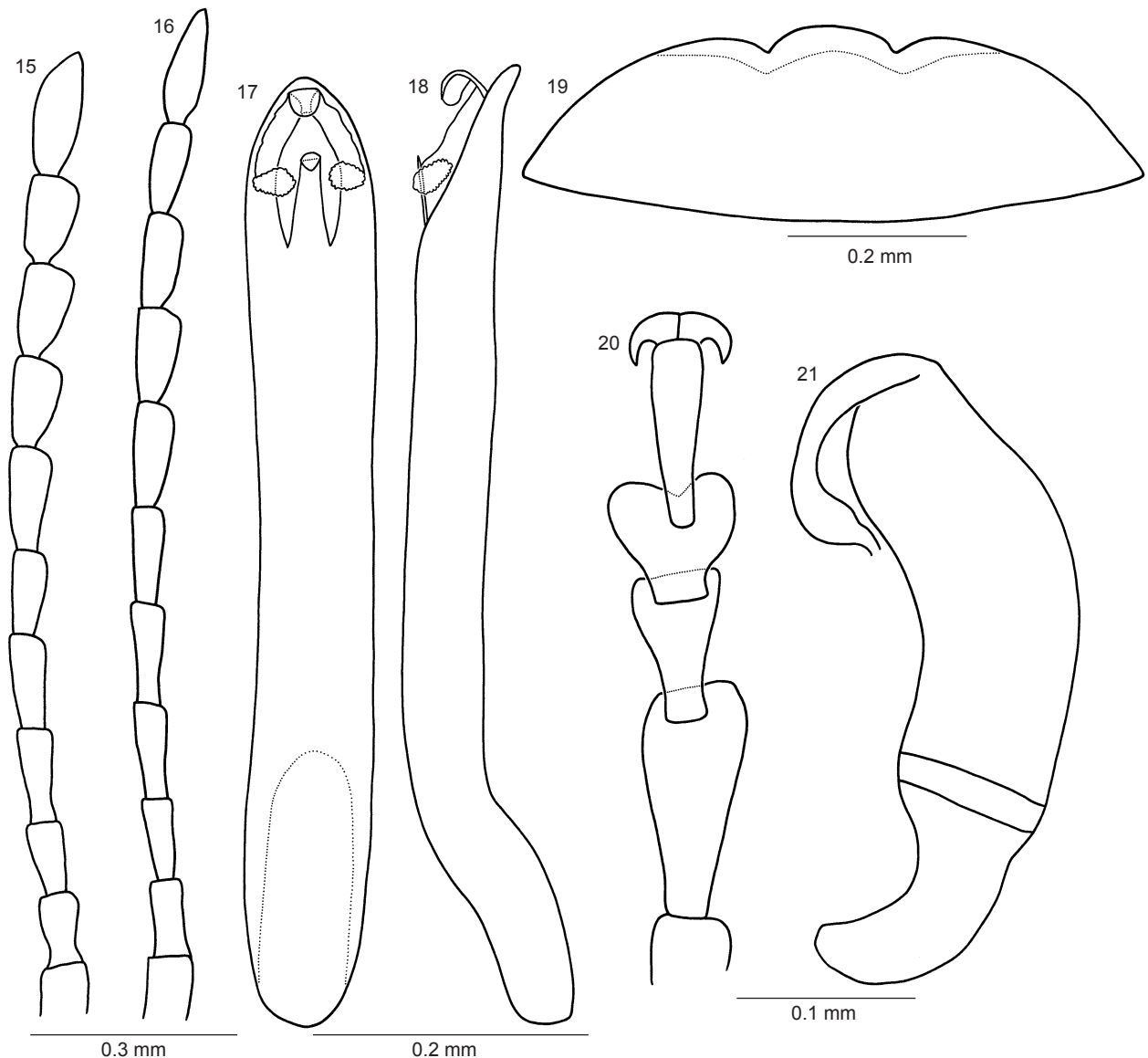
Diagnosis: *Phyllotreta chotanica* is similar to *P. insularis* with the blue coloration but is easily recognized by its smaller size, smooth elytra, and the lack of sexually dimorphic front and middle tarsomeres I.

Specimens examined: 350 exs., Taiwan: Tainan City, Airport, 19 Jan. 2010, leg. C.-F. Lee (BMNH, NMNH, TARI); 8 exs., Kaohsiung Co., Hsiaokangou, 16 Mar. 2010, leg. M.-H. Tsou (TARI) 3 exs., Pingtung Co., Chaochou, 10 Jan. 2011, leg. J.-C. Chen (TARI); 16 exs., India: Kerala, Vellayani, 21 Sept. 2010, leg. K.D. Prathapan (TARI).

Host plants: Many species of cultivated Brassicaceae; *Cleome rudosperma* DC and *C. gynandra* L. (Capparaceae).

Notes: This species was found to be a major pest on organic farms in winter 2009 in Tainan City (Fig. 1).

Distribution: India, Nepal, Thailand, China



Figs. 15-21. *Phyllotreta chotanica*. 15. Antenna, male. 16. Antenna, female. 17. Male aedeagus, dorsal view. 18. Male aedeagus, lateral view. 19. Abdominal ventrite V, male, dorsal view. 20. Front tarsus, male. 21. Spermatheca.

(Xizang), Taiwan (new record). Chen (1934b) recorded this species in Yunnan (China) or Vietnam, but without exact localities.

***Phyllotreta insularis* Heikertinger 1942, new status**

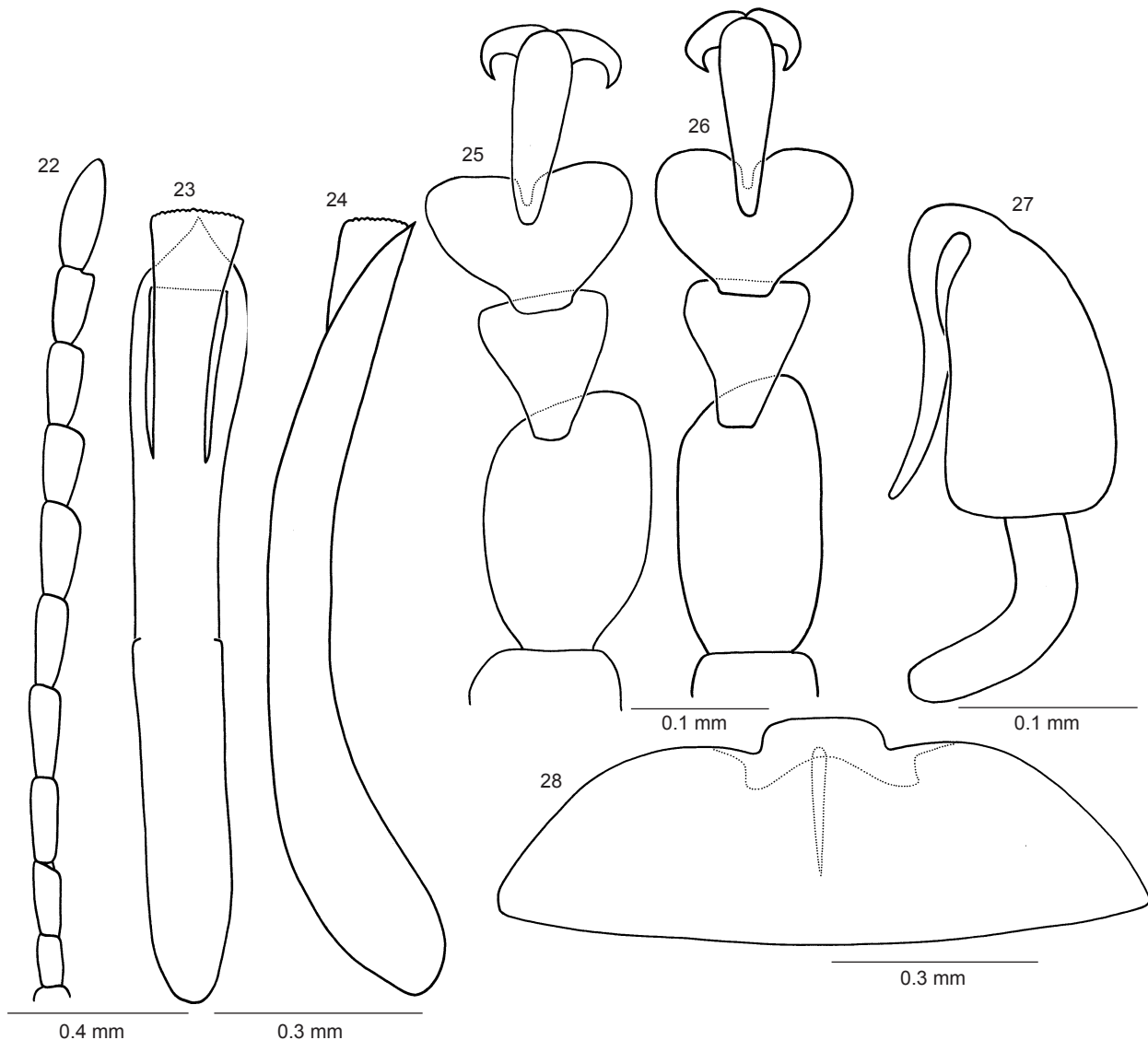
(Figs. 2, 7, 8, 22-28)

Phyllotreta downesi, Chen 1934a: 184 (misidentification); Chûjô 1937 (list): 118; Kimoto and Chu 1996: 116 (list).

Phyllotreta downesi insularis Heikertinger 1942: 145.

Type material: Lectotype ♂ (by present designation): "Kankau (Koshun) Formosa H.

Sauter VII 1912 / *Phyllotreta downesi* Baly S. H. CHEN det / *Phyllotreta Downesi insularis* m. det. Heiktgr. / Syntypus (red label) / DEI Müncheberg Col – 00090". Paralectotypes: 1 ♂: "Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00091"; 1 ♀: "Kankau (Koshun) Formosa H. Sauter V 1912 / *Phyllotreta downesi* Baly S. H. CHEN det / *Phyllotreta Downesi insularis* m. det. Heiktgr. / Syntypus (red label) / DEI Müncheberg Col – 00092"; 1 ♂: "Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Syntypus (red) / DEI Müncheberg Col – 00093"; 1 ♂: "Kankau (Koshun) Formosa H.



Figs. 22-28. *Phyllotreta insularis*. 22. Antenna, male. 23. Male aedeagus, dorsal view. 24. Male aedeagus, lateral view. 25. Front tarsus, male. 26. Middle tarsus, male. 27. Spermatheca. 28. Abdominal ventrite V, male, dorsal view.

Sauter 1912 / 7.IV. / Chen det. / ♂ / *Phyllotreta Downesi insularis* m. det. Heiktgr. / Syntypus (red) / DEI Müncheberg Col – 00094”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VI 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00095”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Syntypus (red) / DEI Müncheberg Col – 00096”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter V 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00097”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter V 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00098”; 1 ♀ : “Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00099”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00100”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter 1912 / 7.IV. / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00101”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00102”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00103”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00104”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00105”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Syntypus (red) / DEI Müncheberg Col – 00106”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Syntypus (red) / DEI Müncheberg Col – 00107”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Syntypus (red) / DEI Müncheberg Col – 00108”; 1 ♂ : “Kankau (Koshun) Formosa H. Sauter VII 1912 / Chen det. / Heikertinger det. / Syntypus (red) / DEI Müncheberg Col – 00109”; 32 paralectotypes with similar data as those above (all in DEI).

Type locality: Kanau (= Sheting Nature Park), Pingtung Co., Taiwan.

Description: Length 2.9-3.7 mm; width 1.3-1.7 mm. Metallic-blue, antenna and legs, except hind femora, blackish-brown (Figs. 7, 8). Pronotum and elytra with dense, impressed punctures; interstices of punctures finely shagreened; elytra with indistinct longitudinal ridges along

interstices of punctures. Antenna (Fig. 22) about 0.7-times as long as body, antennomeres VII-X laterally widened; antennomeres III-X similar in length, but III shorter and VII longer; relative lengths of antennomeres III-XI about 0.9: 1.0: 1.1: 1.1: 1.1: 0.9: 1.0: 0.9: 1.3; similar in both sexes. Front tarsomere I (Fig. 25) enlarged in males, middle tarsomere I (Fig. 26) elongately enlarged. Abdominal ventrite V (Fig. 28) tri-lobed in males, with short internal middle longitudinal ridge; rounded in females. Male aedeagus (Figs. 23, 24) slightly curved, apically pointed; tectum anteriorly expanded, reaching apex of aedeagus. Spermatheca (Fig. 27) with wide receptacle, narrowing around proximal spermathecal duct, pump narrow and moderately curved; proximal spermathecal duct long and slender.

Other specimens examined: 8 ♂♂, 7 ♀♀, Taiwan: Pingtung Co., Sheting 29 Mar. 2010, leg. J.-C. Chen; 1 ♂, 2 ♀♀, same data but with “19. IV.1910”; 1 ♂, 1 ♀, same data but with “7.VI.1910”; 20 ♂♂, 12 ♀♀, same locality, 8 Nov. 2010, leg. M.-H. Tsau.

Diagnosis: *Phyllotreta insularis* is very similar to *P. downesi*, specimens of which from the following localities were investigated: 1 ♂, South India, Coimbatore, 13 May 1913, Onniah Coll., 36/38, Pres. by Imp. Bur. Ent. Brit. Mus. 1928-331; 1 ♂, same data but with “14-V-(19)13, C. N. Cell”; 1 ♂, 343, Tavoy, Burma, R. N. Parker, 1.1927, Pres. By Imp. Inst. Ent. Brit. Mus. 1931-158; *Phyllotreta downesi* Baly. J.C.M. Gardner det. (BMNH). Both species share the following characters: the presence of longitudinal ridges on the elytra and enlarged tarsomeres I of the front and middle legs (Figs. 32, 33), but differ by the relatively shorter antenna (in contrast to an antenna 0.8-times as long as body in *P. downesi* (Fig. 29)), internal middle longitudinal ridge on last abdominal ventrite in males (in contrast to apically bifurcate longitudinal ridge in *P. downesi* (Fig. 34)), and elongate tectum of male aedeagus (in contrast to short tectum of male aedeagus in *P. downesi* (Figs. 30, 31)).

Host plants: *Crateva adansonii formosensis* Jacobs (Capparaceae). *Phyllotreta insularis* was transferred to a container containing only Chinese radish, but no feeding was observed for 1 wk. This result implies that this species does not feed on cruciferous vegetables.

Distribution: This species seems to be restricted its type locality, Sheting Nature Park in southern Taiwan.

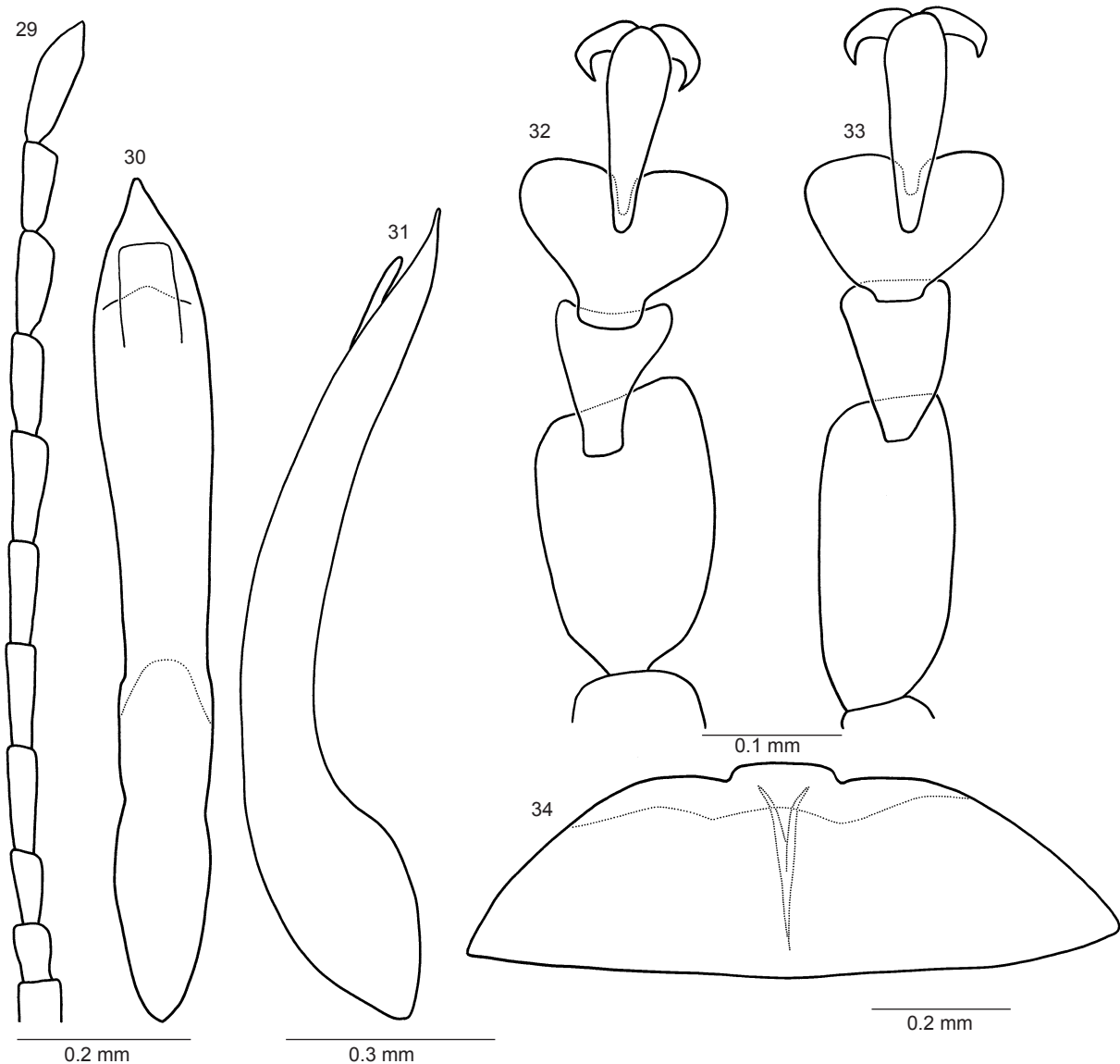
DISCUSSION

The center of diversity of the genus *Phyllotreta* Chevrolat seems to be in temperate regions; for example, 144 species were recorded from the Palearctic region (Döberl 2010). In contrast, few species occur in tropical and subtropical regions, such as the 5 species listed from Indochina (Kimoto 2000). Thus, it is not surprising that only 3 species are found in Taiwan.

The occurrence of *P. chotanica* in Taiwan is unexpected. If it is a native species, it should have been recorded much earlier because of

the damage it causes to vegetables. Thus, it is very possible that this species came from outside of Taiwan through the importation of foreign vegetables. The origin of this species could be revealed through molecular studies. In addition, field observations showed that *P. chotanica* feeds on cruciferous vegetables and also on some species of the Capparaceae. Strategies to control this species must consider the factor of substitutive food plants.

Although all of the studied species display sexual dimorphism in some morphological characters, they can be identified by the general



Figs. 29-34. *Phyllotreta downesi*. 29. Antenna, male. 30. Male aedeagus, dorsal view. 31. Male aedeagus, lateral view. 32. Front tarsus, male. 33. Middle tarsus, male. 34. Abdominal ventrite V, male, dorsal view.

appearance with the following key:

1. Dorsal surface black, elytron with a longitudinal yellow stripe (Figs. 3, 4)..... *P. striolata* (Fabricius)
- 1a. Dorsal surface metallic-blue, elytron without yellow stripes (Figs. 5-8)..... 2
2. Smaller size (1.9-2.2. mm), elytron smooth without longitudinal ridges (Figs. 5, 6) *P. chotanica* Duvivier
- 2a. Larger size (2.9-3.7 mm), elytron with longitudinal ridges (Figs. 7, 8) *P. insularis* Heikertinger

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REFERENCES

- Blatchley WS. 1921. Notes on Indiana Halticini with characterization of new genus and description of new species. *J. NY Entomol. Soc.* **29**: 16-27.
- Chen CC, WH Ko, CL Lee. 1990. Studies on the ecology and control of *Phyllotreta striolata* (Fab.) (morphology, rearing method, behaviors and host plants). *Bull. Taichung Dist. Agric. Improve. Stat.* **27**: 37-48.
- Chen SH. 1934a. Coléoptères Halticinae recueillis par M. H. Sauter a Formose. *Ann. Soc. Entomol. France* **103**: 175-185.
- Chen SH. 1934b. Revision of the Halticinae (Col. Chrysomelidae) of Yunnan and Tonkin. *Sinensia* **5**: 225-416.
- Chen SH, SY Wang. 1981. Coleoptera: Chrysomelidae – Alticinae. *Ins. Xizang* **1**: 491-516.
- Chevrolat L. 1836. *In* PE Dejean. Catalogue des Coléoptères de la collection de M. le comte Dejean. Paris: Méquignon-Marvis Père et File, 443 pp.
- Chûjô M. 1937. Studies on the Chrysomelidae in the Japanese Empire (VIII), subfamily Halticinae (10). *Trans. Nat. Hist. Soc. Formosa* **103**: 113-128.
- Chûjô M. 1961. 24. Family Chrysomelidae. *Nat. Life SE Asia* **1**: 347-357.
- Döberl M. 2010. Alticinae, *In* I Löbl, A Smetana, eds. Catalogue of Palaearctic Coleoptera, Vol. 6. Stretrup, Denmark: Apollo Books, pp. 491-563.
- Duvivier A. 1892. Les phytophages du Chotah-Nagpore. *Ann. Soc. Entomol. Belg.* **36**: 396-449.
- Fabricius JC. 1775. *Systema entomologiae*. Lipsiae. xxx + 832 pp.
- Fabricius JC. 1801. *Systema Eleutheratorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. I. Bibliopolii Academici Novi, Kiliae, XXIV + 506 pp.
- Fabricius JC. 1803. Index alphabeticus in J. C. Fabricii *Systema Eleutheratorum genera et species continens*. Helmstadii, IV + 93 pp.
- Heikertinger F. 1942. Die *Phyllotreta*-Arten des indoaustralischen Faunengebietes (Col. Chrysom. Haltic.). *Ent. Blatt.* **38**: 138-152.
- Jacoby M. 1896. Descriptions of the new genera and species of phytophagous Coleoptera obtained by Mr. Andrewes in India. *Ann. Soc. Entomol. Belg.* **40**: 250-304.
- Jolivet P, TJ Hawkewood. 1995. Host-plants of Chrysomelidae of the world: an essay about the relationships between the leaf beetles and their host-plants. Leiden, the Netherlands: Backhuys Publishers, 281 pp.
- Kimoto S. 1970. Notes on the Chrysomelidae from Taiwan V. *Kontyu* **38**: 292-313.
- Kimoto S. 1991. The Taiwanese Chrysomelidae (Insecta: Coleoptera) collected by Dr. Kintaro Baba, on the occasion of his entomological survey in 1987, 1988, and 1989. *Kurume Univ. J.* **40**: 1-27.
- Kimoto S. 2000. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and Vietnam. VIII. Alticinae. *Bull. Inst. Comp. Stud. Int. Cult. Soc.* **26**: 103-299.
- Kimoto S, YI Chu. 1996. Systematic catalog of Chrysomelidae of Taiwan. *Bull. Inst. Comp. Stud. Int. Cult. Soc.* **16**: 1-152.
- Kimoto S, H Takizawa. 1997. Leaf beetles (Chrysomelidae) of Taiwan. Tokyo: Tokai Univ. Press, 581 pp.
- Konstantinov AS, NJ Vandenberg. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). *Contr. Entomol. Int.* **1**: 236-439.
- Lee CF, CL Staines. 2009. *Hemipyxis yui*, a new species from Taiwan, with redescription of its allied species *H. quadrimaculata* (Jacoby, 1892) (Coleoptera: Chrysomelidae: Galerucinae). *Coleopt. Bull.* **63**: 62-70.
- Maulik S. 1926. The fauna of British India, including Ceylon and Burma. Coleoptera, Chrysomelidae (Chrysomelinae and Halticinae). London: Taylor and Francis, 442 pp.
- Medvedev LN. 1984. Chrysomelidae from the Nepal Himalayas. I. Alticinae (Insecta: Coleoptera). *Senckenberg Biol.* **55**: 47-63.
- Scherer G. 1969. Die Alticinae des indischen subkontinentes (Coleoptera - Chrysomelidae). *Pac. Insect Monogr.* **22**: 1-251.
- Smith EH. 1979. Genus *Tanygaster* Blatchley, a new synonym of *Phyllotreta* Chevrolat (Coleoptera: Chrysomelidae: Alticinae). *Coleopt. Bull.* **33**: 359-362.