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A Taxonomic Study of *Aphelopus* Dalman from Japan, with Descriptions of Two New Species (Hymenoptera: Dryinidae: Aphelopinae)

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Abstract. The genus *Aphelopus* Dalman from Japan was taxonomically revised. *Aphelopus koreanus* Olmi and *A. camus* were newly recorded, and *A. nivealis*, n. sp. and *A. prolatus*, n. sp. were described as new to science. A key to the species found in Japan was provided.

Key words: key to species, classification, parasitoid.

Introduction

The genus *Aphelopus* Dalman, 1823 (Hymenoptera: Dryinidae), comprises small species (length ca. 1.5–2.5 mm), that parasitize typhrocybid leafhoppers (Auchenorrhyncha: Cicadellidae: Typhlocybinae). Dryinid females usually have chelae on distal apex of fore tarsi, however, the females of *Aphelopus* lack them. This characteristic is present only in two subfamilies: Aphelopinae R. Perkins 1912 and Erwiniinae Olmi & Guglielmino 2010. The sculpture of head and mesosoma except for propodeum of the most species is almost uniformly granulated.

Previously eight species were recorded from Japan (Olmi, 1995). However, further study is needed to understand their diversity. During the taxonomic works of Dryinidae in Japan, authors have recognized in total 14 species including two new species described hereby.

Material and methods

The material used in this study is from the following institutions: BMNH, Natural History Museum, London, UK; ELKU, Entomological Laboratory, Kyushu University, Fukuoka, Japan; ELMU, Entomological Laboratory, Faculty of Agriculture, Meijo University, Nagoya, Japan; NSMT, National Museum of Nature and Science, Tsukuba, Japan; TPM, Tokushima Prefectural Museum, Tokushima, Japan. The terms and abbreviations used in the descriptions follow those established by Olmi (1984, 1994, 1999). The values of the relative length of antennomeres represent the length and the width surrounded by "( )", respectively. The following abbreviations are used in descriptions: F1 – F8, flagellomere numbers; POL, distance between the inner edges of the two lateral ocelli; OL, distance between the inner edges of a lateral ocellus and the median ocellus; OOL, distance from the outer edge of a lateral ocellus to the compound eye; OPL, distance from the posterior edge of a lateral ocellus to the occipital carina. The abbreviation for collecting methods, MsT is used for Malaise trap.

Taxonomy

Aphelopus Dalman, 1823

Type species: *Dryinus atratus* Dalman, 1823 (designated by Westwood, 1840).
Diagnosis. Palpal formura 5/2; mandibles quadridentate; radial vein regularly curved, not strongly sinuate; body sculpture mostly granulated.
Host. Typhlocybinae (Cicadellidae).

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Key to the species of *Aphelopus* in Japan

(Female*)

1 Head with clypeus testaceous or whitish; and anterior part of frons and genae at least partly testaceous or whitish 2
- Head with clypeus black, rarely whitish or testaceous; and anterior part of frons and genae entirely black ... 5
2 Head entirely whitish or not blackish, at least most part of vertex and genae whitish or brownish testaceous; lateral part of pronotum entirely or almost entirely whitish or testaceous 3
- Head posteriorly blackish, at least most part of vertex and genae black; lateral part of pronotum blackish, at most with outer margin and pronotal tubercles testaceous 9
3 Notaulices longer, reaching more than 0.6 length of scutum ..... *koreanus* Olmi
- Notaulices shorter, reaching less than 0.3 length of scutum..... 4
4 Body entirely whitish with black petiole; notaulix absent; eyes (Figs. 3, 4) shorter, at most 1.2 × as long as high ..... *nivealis*, sp. nov.
- Body not entirely whitish; notaulix present or absent; eyes (Figs. 7, 8) longer, at least 1.35 × as long as high ..... *sharkeyi* Olmi
5 Notaulix absent ..... *prolatus*, sp. nov.
- Notaulices present 6
6 Notaulices longer, reaching more than 0.8 length of scutum ..... *serratus* Richards
- Notaulices shorter, reaching less than 0.7 length of scutum 7
7 Head height less than 0.60 × of the length between malar spaces and temples (Fig. 20) .... *nigriceps* Kieffer
- Head height more than 0.70 × length between malar spaces and temples (Fig. 24) 8
8 Wing conspicuously tinged with dark brown; malar spaces (Fig. 22) less than 1.6 × as long as temple in lateral view ..... *urbaini* Olmi
- Wing hyaline, at most faintly tinged; malar spaces (Fig. 26) more than 2.0 × as long as temples in lateral view ..... *nepalensis* Olmi
9 Occipital carina with a notch behind ocellar region (Fig. 31) ..... *bennetti* Olmi
- Occipital carina without a notch behind ocellar region 10
10 Eyes very large (Fig. 42); and/or dorsal margin of testaceous region on frons substraight; apical margin of clypeus wider than length of clypeus ..... *maetoi* Olmi
- Eyes not very large (Fig. 46); and dorsal margin of testaceous region of frons U-shaped, situated along with eyes; apical margin of clypeus narrower than length of clypeus ..... *melaleucus* (Dalman)

* *Aphelopus camus* and *A. querceus* were excluded from the above key, because their females were not found in Japan.

(Male**)

1 Head with clypeus testaceous; and anterior part of frons, malar spaces and genae at least partly whitish or testaceous..... 2
- Head with clypeus black, rarely whitish or testaceous; and anterior part of frons, malar spaces and genae entirely black (rarely apical margin of frons bearing dark brown spots in *urbaini* Olmi) 4
2 Head entirely whitish or not blackish, at least most part of vertex and genae whitish or brownish testaceous; lateral part of pronotum entirely or almost entirely whitish or testaceous 3
- Head blackish, at least most part of vertex and genae black; lateral part of pronotum blackish, at most with outer margin and pronotal tubercles testaceous..... 11
3 Body entirely whitish with black petiole (Fig. 67); notaulix absent ..... *nivealis*, sp. nov.
- Body not entirely whitish; notaulix present or absent ..... *sharkeyi* Olmi
4 Notaulix absent ..... *prolatus*, sp. nov.
- Notaulices present 5
5 Notaulices longer, reaching more than 0.8 length of scutum; distivolsella slender (Fig. 51), attached with basivolsella lower than at half of the length..... ..... *serratus* Richards
- Notaulices shorter, reaching less than 0.7 length of scutum; distivolsella variable, but attached with basivolsella at nearly apex..... 6
6 Outer margin of basivolsella fused with parameres (Fig. 54) ..... *nepalensis* Olmi
- Outer margin of basivolsella separated from parameres..... 7
7 Aedeagus distally producing (Fig. 57) .... *atratus* (Dalman)
- Aedeagus distally not producing 8
8 Outer process of basivolsella present (Figs. 55)..... 9
- Outer process of basivolsella absent (Figs. 52) 14
9 Basivolsella with apex bearing single bristle (Fig. 55) ..... *camus* Richards
- Basivolsella with apex bearing more than two bristles 10
10 Occipital carina with a notch behind ocellar region (Fig. 33); outer process of basivolsella located at half of the length (Fig. 56)..... *bennetti* Olmi

- Occipital carina without a notch behind ocellar region; outer process of basivolsella variable, but located higher than half of the length (Figs. 61–65)..... ..... *querceus* Olmi

11 Occipital carina with a notch behind ocellar region (Fig. 33); outer process of basivolsella present, located at half of the length (Fig. 56)..... *bennetti* Olmi

- Occipital carina without notch behind ocellar region; outer process of basivolsella present or absent, when present, located higher than half of the length 12

12 Eyes very large (as Fig. 42); and/or outer process absent (Fig. 59)..... *maetoi* Olmi

- Eyes not very large; outer process present 13

13 Apex of aedeagus slender (Fig. 60)..... ..... *melaleucus* (Dalman)

Apex of aedeagus widened (Fig. 58) ... *querceus* Olmi

14 Notaulix abasent; apex of aedeagus narrow (Fig. 50); wing hyaline..... *prolatus*, sp. nov.

- Notaulix present; apex of aedeagus not narrow (Fig. 52); wing conspicuously tinged with brown ....*urbaini* Olmi

** *Aphelopus koreanus* and *A. nepalensis* were excluded from the above key, because the male of *A. koreanus* is unknown and the male of *A. nepalensis* has not been found in Japan.

Aphelopus koreanus Olmi, 2009

(Figs. 1–2)

Aphelopus koreanus Olmi, 2009: 128. Type locality: Odaesan, Dongsan-li, near Woljeongsa (South Korea).

Specimens examined. JAPAN 1♀, Zennyûji-tô, Tokushima-shi, Tokushima, 6-18. VI. 2003 (MsT), K. Ohara & H. Otsuka leg (ELMU); 2♀, same as above, but 19. VI – 2. VII, K. Ohara & Yosuke Maeda leg. (TPM).

Distribution. Korea; Japan, new record: (Shikoku).

Hosts. Unknown.

Remarks. This species is closely related to *Aphelopus sharkeyi* Olmi, 1995 by bright body color and the globular head (approximately 0.8 × higher than long). The following three characters are important to distinguish the species: 1) relative length of head (approximately 0.7 × longer than wide in *A. sharkeyi*, whereas approximately 0.6 × longer in *A. koreanus*); 2) length of eye in lateral view (less than 1.4 × longer than height in *A. sharkeyi*, whereas more than 1.4 × longer in *A. koreanus*); 3) relative length of notaulices (less than 0.3 length of scutum in *A. sharkeyi*, whereas more than 0.5 in *A. koreanus*).

Aphelopus nivealis, new species

(Figs. 3–6, 66, 67)

Description of female. Head (Figs. 3, 4) 0.69–0.71 (mean 0.70, n = 3 when there is no annotation) × longer than wide in dorsal view, 0.80–0.85 (0.82) × higher than long in lateral view, granulated; frons 0.61–0.66 (0.64) × wider than head; frontal keel incomplete, present on anterior part of frons; OL = 4.0–4.5; POL = 6.5–7.0; OOL = 3.5–4.0; OPL = 4.0; TL = 5.0–6.0; maximum diameter of anterior ocellus 2.0; occipital carina complete; clypeus trapezoidal, with apical margin approximately 1.4 × wider than long; epistomal suture weakly rounded; antennae distally thickened; each segment showing following ratio: 3.5–5.0 (4.0); 3.0–3.5 (3.0); 4.0–4.5 (4.0); 4.0–4.5 (4.0); 4.0–5.0 (4.5); 4.5–5.0 (4.5); 4.0–4.5 (4.0); 4.0; 4.0; 5.0–5.5 (5.5); F7 2.0-2.3 × longer than wide. Eyes 1.11–1.20 (1.15) × longer than high in lateral view.

Scutum 0.58–0.63 (0.60) × longer than wide, granulated; prescutal line and notaulix absent; scutellum granulated; mesepisterna smooth excluding anterior region granulated. Metanotum weakly granulated; metapleural regions smooth. Propodeum 0.78 × longer than wide, with a pair of longitudinal keels on posterior surface, reticulate rugose excluding medial region of posterior surface finely sculptured.

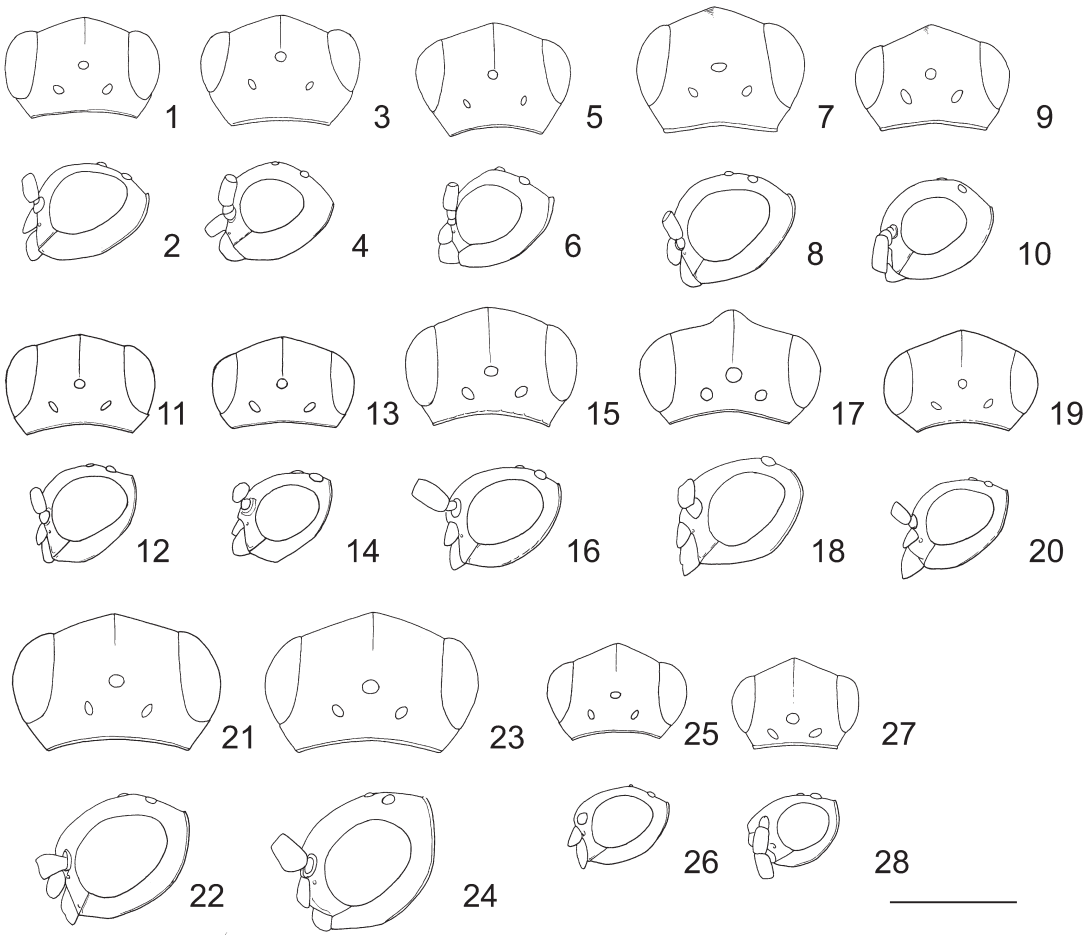
Forewings hyaline; tubular veins pigmented with whitish testaceous; radial vein weakly sinuate; distance of radial veins between proximal to distal apex 1.9–2.4 (2.2) × longer than width of pterostigma.

Metasoma elliptical, laterally weakly compressed.

Color (Fig. 66). Body white to whitish testaceous excluding brown teeth and black petiole.

Measurements (in mm). Head 0.41–0.43 (0.42) long, 0.58–0.62 (0.61) wide; antennae 1.12–1.18 (1.14); eyes 0.22–0.24 (0.23) long, 0.20 high in lateral view; mesosoma 0.68–0.78 (0.74); scutum 0.25–0.29 (0.28) long, 0.40–0.50 (0.46) wide; scutellum 0.13–0.15 (0.14); metanotum 0.08; propodeum 0.25 in full length, 0.32 wide; forewings 1.35–1.40 (1.38); metasoma 0.65–0.89 (0.77); total body length 1.74–2.09 (n = 2).

Male. Head (Figs. 5, 6) 0.67 × longer than wide in dorsal view, 0.81 × higher than long in lateral view, granulated; frons 0.67 × wider than head; frontal keel absent; OL = 4.0; POL = 7.0; OOL = 3.0; OPL = 4.0; TL = 4.0; maximum diameter of anterior ocellus 2.0; occipital carina complete; clypeus trapezoidal, with apical margin approximately 1.7 × length; epistomal suture straight; antennae not distally thickened; each segment showing the following ratio: 4.0; 4.0; 4.5; 4.5; 6.0; 6.5; 6.5; 6.0; 6.0; 7.0. Eyes 1.21 × longer than high in lateral view.



Figs. 1-28. Heads of *Aphelopus* spp. 1–2, *A. koreanus*, female from Tokushima; 3, *A. nivealis*, holotype female; 5–6, ditto, male from Aichi; 7–8, *A. sharkeyi*, female from Aichi; 9–10, ditto, male from Aichi; 11–12, *A. prolatus*, female from Tokushima; 13–14, ditto, holotype male; 15–16, *A. serratus*, female form Hokkaido; 17–18, ditto, male from Hokkaido; 19–20, *A. nigricepus*, female from Kanagawa; 21–22, *A. urbaini*, female from Hokkaido; 23–24, ditto, male from Hokkaido; 25–26, *A. nepalensis*, female form Tokushima; 27–28, ditto, male from Tokushima. Scale = 0.2 mm.

Scutum 0.64 × longer than wide, granulated; prescutal line and notaulix absent; scutellum and metanotum granulated; mesepisterna smooth excluding anterior region granulated. Metapleural region smooth with longitudinal keels on posterior part. Propodeum 0.81 × longer than wide, with two pairs of longitudinal keels on posterior surface, transversely striate excluding median region smooth with surface around the longitudinal keels rugose.

Forewings hyaline; tubular veins pigmented with whitish testaceous; radial vein weakly sinuate; distance of radial veins between proximal to distal apex 2.3 × longer than width of pterostigma.

Metasoma elliptical, laterally weakly compressed (distal apex of metasoma broken in only known specimen).

Color (Fig. 67). Head whitish testaceous excluding ocellar region testaceous; mandibles whitish testaceous with brown teeth; antennae testaceous excluding scapes white and F5–8 dark testaceous; mesosoma whitish testaceous with white tegulae excluding dorsal surface of mesonotum testaceous and metanotum, dorsal surface and median region of propodeum dark brown, and petiole black; legs whitish testaceous; metasoma whitish testaceous.

Measurements (in mm). Head 0.40 long, 0.60 wide; antennae 1.48; eyes 0.23 long, 0.19 high in lateral view; mesosoma 0.80; scutum 0.30 long, 0.47 wide; scutellum 0.15; metanotum 0.10; propodeum 0.26 in full length, 0.32 wide; forewings 1.54; metasoma broken in only known specimen.

Specimens examined. Holotype: ♀, Ichinomiya (rice paddy), Aichi, 30. IX. – 6. X. 2006 (MsT), C. Ueshima leg. (ELMU). Paratypes: 1♀1♂, same as holotype, excluding 14–20. X. 2006; 1♀, Takagi, Kasugai, Aichi, 29. VIII. 2000 (MsT), C. Mizuno & M. Suzuki leg. (ELMU); 1♀, Nokata-cho, Nisshin-shi, Aichi, 23–30. VII.2011 (MsT), R. Mizutani (ELKU).

Distribution. Japan (Honshu).
Hosts. Unknown.
Etymology. In Latin, "nivealis", meaning the whiteness as snow, referring to the body color.
Remarks. This species is similar to *Aphelopus borneanus* Olmi 1984 for the almost fully whitish or testaceous body; however, it is easily distinguishable from the latter by the longer ratio OPL/TL, whereas OPL is about as long as TL in *A. borneanus*, and the absence of notaulix, whereas they reach 0.5 length of scutum in *A. borneanus*. The distal apex of metasoma is missing in the only known male specimen (for this reason the male genitalia could not be drawn).

Aphelopus sharkeyi Olmi, 1995

(Figs. 7–10, 49)

Aphelopus sharkeyi Olmi, 1995: 4. Type locality: Tsuchiura, Ibaraki (Japan).
Specimens examined. JAPAN: 1♀, Ôshima (rice paddy), Hamamatsu-shi, Shizuoka, 2. VI. 2001 (Yellow pan trap), M. Urai leg. (ELMU); 1♀, Ichinomiya-shi (rice paddy), Aichi, 5–11. VIII. 2006 (MsT), C. Ueshima leg. (ELMU); 1♂, Aichi Agricultural Research Center, Nagakute-chô, Aichi, 30. VII. 2008, H. Nishimoto & I. Ochiai leg. (ELMU); 2♀, same as above, but 12. VIII; 1♀, same as above, but 8. X.
Distribution. Japan (Honshu).
Hosts. CICADELLIDAE: *Empoasca sakaii* Dworakowska (Mita et al., 2009).
Remarks. *Aphelopus sharkeyi* is similar to *A. koreanus*. About identification, see remarks of *A. koreanus*.

Aphelopus prolatus, new species.

(Figs. 11–14, 50, 68, 69)

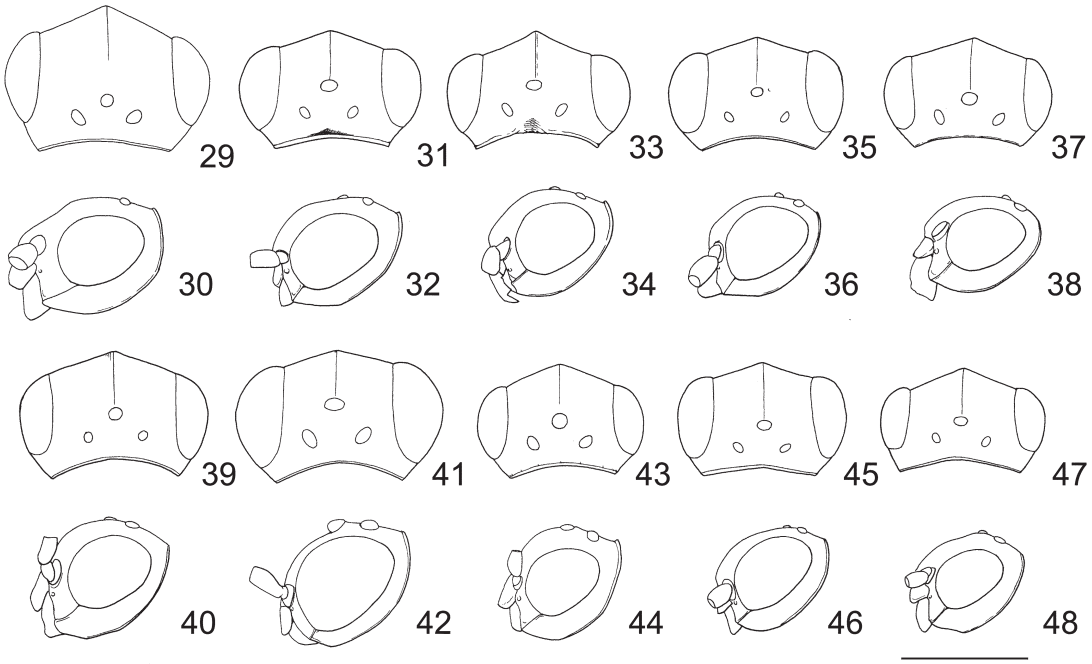
Description of female. Head (Figs. 11, 12) wide, 0.61–0.65 (mean 0.63, n = 4 when there is no annotation) × longer than wide, granulated; frons 0.57–0.60 (0.58) × wider than head; frontal keel complete, rarely effaced in front of anterior ocellus; malar space granulated; genae narrower than frons in lateral view, narrowest behind posterior corner of eye, slightly shorter or than or as long as anterior ocellus; OL = 4.0; POL = 6.0; OOL = 2.5–3.0; OPL = 2.0–2.25; TL = 2.0–3.0; maximum diameter of anterior ocellus 1.5–2.0; occipital carina complete; epistomal suture straight; antennae distally thickened; each segment showing following ratio: 3.5–4.0 (4.0); 3.5–4.0 (3.5); 3.5; 4.0–4.5 (4.5); 4.5–5.0 (4.5); 4.5–5.0 (5.0); 4.5–5.0 (4.5); 4.0–5.0 (4.5); 4.0–4.5 (4.0); 7.5–8.0 (7.5, n = 3).

Scutum granulated, 0.61-0.63 (0.61) × longer than wide; notaulices absent; scutellum granulated; mesopleura granulated excluding narrow smooth area around meso-meta pleural suture. Metanotum granulated; metapleural regions longitudinally rugose excluding anterior part smooth. Propodeum 0.70-0.80 (0.76) × longer than wide, with a pair of longitudinal keels on posterior surface, dorsal surface reticulated rugose, posterior surface reticulated rugose excluding median region smooth.

Forewings hyaline; radial veins weakly curving; distance of radial veins between proximal to distal apex 2.82–3.2 (2.96) × longer than height of pterostigma.

Metasoma elliptical, sometimes wedge-shaped, posterior margin of first to third gastral segments widest.
Color (Fig. 68). Head black; mandibles testaceous with reddish brown teeth; antennae brown to dark brown, excluding scapes and pedicels testaceous; mesosoma black with brown tegulae; legs testaceous excluding brownish testaceous apical tarsomeres; metasoma brown to brownish black, sometimes with hypopygium brown.
Measurements (in mm). Head 0.38 long, 0.58–0.62 (0.60) wide; antennae 1.22–1.27 (1.24, n = 3); eyes 0.30–0.32 (0.31) long, 0.22–0.23 (0.22) height in lateral view; mesosoma 0.76–0.78 (0.77); scutum 0.27–0.30 (0.28) long, 0.43–0.49 (0.45) wide; scutellum 0.12–0.14 (0.13); metanotum 0.10–0.11 (0.10); propodeum 0.22–0.25 (0.24) in full length, 0.27–0.33 (0.31) wide; forewings 1.43–1.57 (1.49, n = 3); total body length 1.73–1.86 (1.80).
Male. Head (Figs. 12, 13) wide, 0.56–0.64 (mean 0.59, n = 3 when there is no annotation) × longer than wide, granulated; frons 0.61–0.65 (0.63) × wider than head; frontal keel complete; malar space granulated; gena narrower than frons in lateral view, narrowest behind posterior corner of eye, as long as anterior ocellus; OL = 3.0–4.0; POL = 6.0–6.5; OOL = 2.0–3.0; OPL = 1.5–2.0; TL = 2.0; maximum diameter of anterior ocellus 1.5–2.0; occipital carina complete; clypeus trapezoidal, 0.5 × longer than wide, 0.75 × longer than malar space; each segment of antennae showing following ratio: 3.0; 3.0–4.0 (3.5); 3.0–4.0 (3.5); 4.0–4.5 (4.0) [following flagellomeres missing in holotype]; 5.0 (n = 2); 6.0 (n = 2); 6.0 (n = 1); 6.0 (n = 1); 6.0 (n = 1).

Scutum granulated, 0.60–0.68 (0.63) × longer than wide; notaulix absent (n = 2 including holotype) or partly present (n = 1), reaching 0.77 × scutum; scutellum granulated; mesepisterna granulated with anterior regions rugose, narrow area around meso-meta pleural suture smooth. Metanotum granulated; Metapleural regions weakly granulated and longitudinally rugulose with anterior part smooth. Propodeum 0.77–0.83 (0.81) × longer than wide, with a pair of longitudinal keels on posterior



Figs. 29-48. Heads of *Aphelopus* spp. 29–30, *A. camus*, male from Hokkaido; 31–32, *A. bennetti*, female from Hokkaido; 33–34, ditto, male from Hokkaido; 35–36, *A. atratus*, female from Kanagawa; 37–38, ditto, male from Kanagawa; 39–40, *A. querceus*, holotype male; 41–42, *A. maetoi*, female from Hokkaido; 43–44, ditto, male from Hokkaido; 45–46, *A. melaleucus*, female from Hokkaido; 47–48, ditto, male from Hokkaido. Scale = 0.2 mm.

surface, dorsal surface reticulated rugose, posterior surface reticulated rugose excluding median region smooth.

Forewings hyaline; tubular veins pigmented with brown; radial veins faintly curving; distance of radial veins between proximal to distal apex 2.50–3.70 (3.17) × longer than hight of pterostigma.

Metasoma oval; apical margin substraight and faintly concave medially; aedeagus (Fig. 50) with apex apically not broadened, parallel-sided; basivolsellae (Fig. 50) bearing four bristles, with outside of apex apically producing, sometimes without projection.

Color (Fig. 69). Head black; mandibles testaceous with reddish brown teeth; antennae brown to dark brown, excluding scapes, pedicels, and F1–2 testaceous, rarely antennae entirely dark brown; mesosoma black or reddish dark brown, excluding brown tegulae; legs testaceous excluding brownish testaceous apical tarsomeres; metasoma dark brown.

Measurements (in mm). Head 0.30–0.37 (0.34) long, 0.54–0.59 (0.57) wide; eye 0.24–0.26 (0.25) long, 0.19–0.21 (0.20) high in lateral view; mesosoma 0.67–0.81 (0.74); scutum 0.30–0.32 (0.31) long, 0.44–0.54 (0.49) wide; scutellum 0.13–0.15 (0.14); metanotum 0.9–0.12 (0.11); propodeum 0.25–0.27 (0.26) in full length, 0.30–0.35 (0.32); forewings 1.30–1.62 (1.42); metasoma (n = 1) 0.55 [broken in holotype]; total body length (n = 1) 1.52.

Types. Holotype: ♂, Zennyûji-tô Isl., Tokushima-shi, Tokushima, 19. VI. – 2. VII. 2003 (MsT), K. Ôhara & Y. Maeda leg. (ELMU); **Paratypes:** 6♀, same as holotype; 1♂, same as holotype, but 6–18. VI, K. Ohara & H. Otsuka leg.; 5♀, same as above; 5♀, same as above, but 7–18. VI. 2003 (MsT), K. Ôhara & K. Watatani leg. **Other specimens examined:** 1♂, Yawata (650 m alt.), Asahi-chô, Aichi, 17–26. VI. 1998 (MsT), M. Ozawa leg. (ELMU); 1♀, Tokyo University of Agriculture, Atsugi-shi, Kanagawa, 3–10. IX. 2004 (MsT), T. Ishizaki leg. (ELKU); 1♀, same as above, but 10–17. IX. 2004.

Distribution. Japan (Honshu; Shikoku).

Hosts. Unknown.

Etymology. In Latin, prolatus, meaning "elongated". This species named after the long radial veins.

Remarks. Compared to the other Palaearctic species of the genus, the male genitalia of *A. protalus* is similar to *A. melaleucus* (Dalman 1818) because of the slender apex of aedeagus, however, it is distinguished from the latter by the absence of outer process of basivolsella (It is present in *A. melaleucus* (Fig. 60)). Compared to the Oriental species, the female is leaded into *A. penanganus* Olmi 1984 using the key provided by Xu et al. (2013). However, the genae are clearly different, because they are about as

long as the width of anterior ocellus in *A. prolatus*, about twice as long as in *A. penanganus*.

Aphelopus serratus Richards, 1939

(Figs. 15–18, 51)

Aphelopus serratus Richards, 1939: Type locality: Norwood (UK).

See Olmi (1999) for other detail information of the synonymy.

Specimens examined. JAPAN: 1♂, 43°00′N 141°24′E, Hitsujigaoka, Sapporo-shi, Hokkaidô, 9–16. VI. 2008 (MsT), K. Konishi leg. (ELKU); 1♀, same as above excluding 30. VI. – 7. VII; 1♀, Uradani (beech forest, 900m alt.), Shitara-chô, Aichi, 30. V. – 5. VI. 1994 (EmT), K. Yamagishi leg. (ELMU); 1♀, Hachiman-chô, Tokushima-shi, Tokushima, 3. IX. – 9. X. 2002 (MsT), K. Ôhara & T. Ishimaru leg. (TPM).

Distribution. Europe; Cyprus; Armenia; European part of Russia; Japan (Hokkaido, Honshu, Shikoku).

Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Aphelopus nigriceps Kieffer 1914

(Figs. 19–20)

Aphelopus melaleucus (Dalman) var. *nigriceps* Kieffer in Kieffer et Marshall 1905. Type locality: Dumfries (Scotland).

See Olmi (1999) for other detail information of the synonymy.

Specimens examined. JAPAN: 1F, Yabitsu-tôge, Kiyokawa-mura, Kanagawa, 21. V. 2006. M. Satô leg. (ELKU).

Distribution. Europe; Nepal; Japan.

Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Aphelopus urbaini Olmi, 2001

(Figs. 21–24, 52)

Aphelopuus urbaini Olmi, 2001: 22. Type locality: Inland of Gorobets Bay, Shikotan Isl., Chishima Isls.

Specimens examined. JAPAN: 1♀, 43°56′N 144°29′E, Kussharo-ko L. (130 m alt.), Teshikaga-chô, Hokkaidô, 6. VIII. 2008, T. Mita leg. (ELKU); 1♂, 43°00′N 142°04′E, Ôyûbari (180 m alt.), Yûbari-shi, Hokkaidô, 10–19. VII. 2007 (MsT), A. Ueda leg. (ELKU); 1♀29♂, 42°54′N 141°16′E, Mt. Soranuma-dake, Sapporo-shi, Hokkaidô, 4–27. VII. 2007 (MsT), A. Ueda leg. (ELKU); 71♂, same as above, but 27. VII. – 21. VIII; 2♂, 42°55′N 142°45′E, Uenzaru-gara (1160 m alt.) Hidaka-chô, Hokkaidô, 10. VII. – 1. VIII. 2008 (MsT) A. Ueda leg. (ELKU); 18♀54♂, same as above, but 1-28. VIII; 1♀, Uradani (900 m alt., beech forest), Shitara-chô, Aichi, 20–26. VI. 1994 (MsT), K. Yamagishi leg (ELMU).

Distribution. Japan (Hokkaido, Honshu).

Hosts. Unknown.

Remarks. The darkened wings are unique character among Japanese species.

Aphelopus nepalensis Olmi, 1984

(Figs. 25–28, 53, 54)

Aphelopus nepalensis Olmi, 1984: 57; 1995: 9; Xu, He & Olmi, 1999: 86; Xu, Olmi & He 2013: 28. Type locality: Bokaihunde (Nepal).

Specimens examined. JAPAN: 1♀, Zennyûji-tô Isl., Tokushima, 20. VIII. – 4. IX. 2003 (MsT), K. Ôhara & Y. Maeda leg. (TPM); 1♂, same as above, but 5-17. IX; K. Ôhara & H. Otsuka leg. (ELMU);

Distribution. China; Nepal; Japan (Hokkaido, Honshu, Shikoku, Kyushu).

Hosts. Unknown.

Remarks. The male of the species is easily distinguishable from the others by basivolsella fusing with parameres. The female is similar to *Aphelopus urbaini*. However, it is distinguishable from the latter by hyaline wing (uniformly dark in *A. urbaini*).

Aphelopus camus Richards, 1939

(Figs. 29, 30, 55)

Aphelopus cauus Richards, 1939: 287. Type locality: Storey's Way (England).

See Olmi (1999) for other detail information of the synonymy.

Specimens examined. JAPAN: 1♂, 42°55′N 142°45′E, Uenzaru-gara (1160 m alt.) Hidaka-chô, Hokkaidô, 10. VII. – 1. VIII. 2007 (MsT) A. Ueda leg. (ELKU).

Distribution. Moldova; Ukraine; Russian Far East; Japan, new record (Hokkaido).

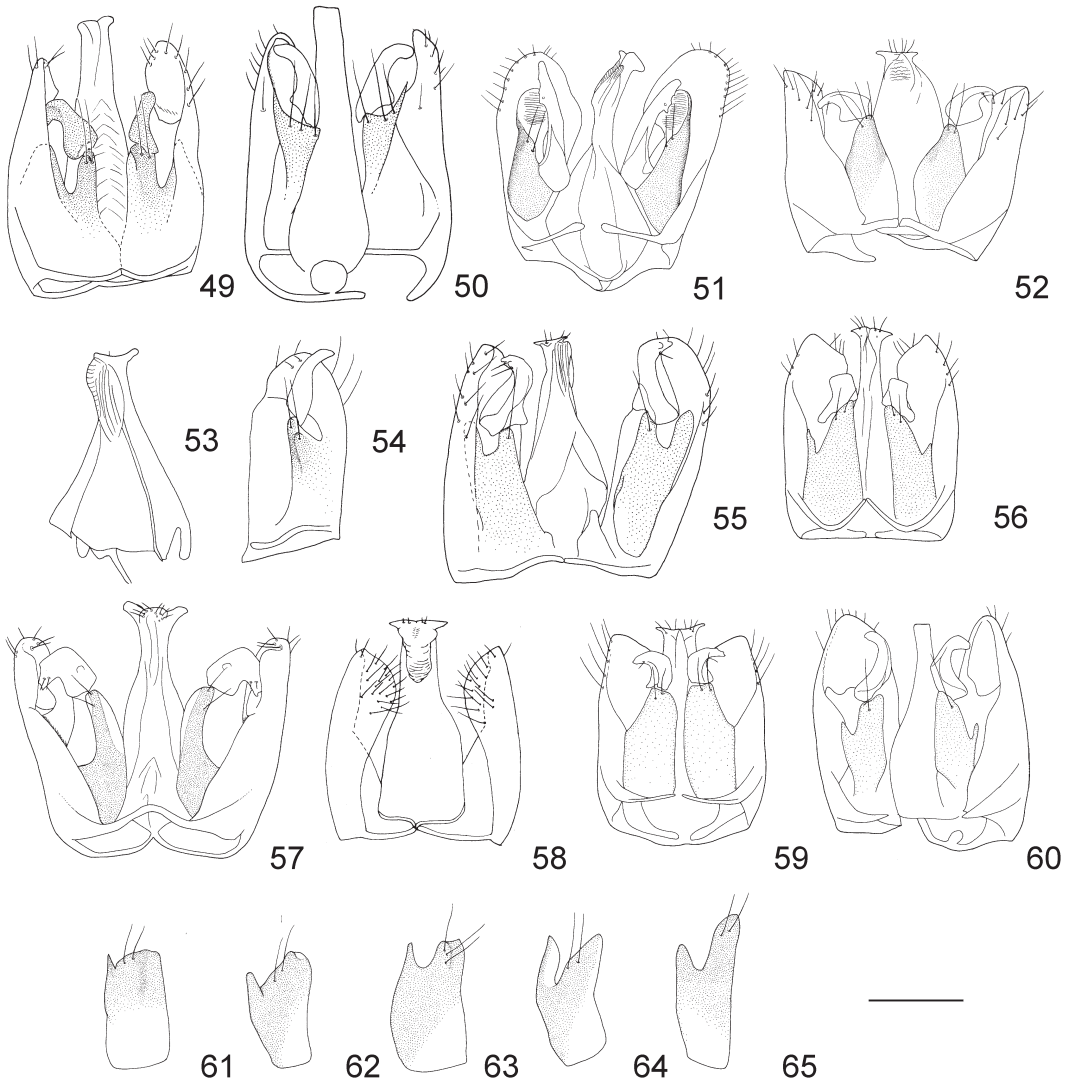
Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Aphelopus bennetti Olmi, 2004

(Figs. 31–34, 56)

Aphelopus bennetti Olmi, 2004: 301. Type locality: South part, near Sokol town, Sakhalin Isl. (Russia).

Specimens examined. JAPAN: 1♂, 43°30′N 143°54′E, Kyushu Univ. Ashoro Research Forest (200 m atl.),



Figs. 49-65. Male genitalia of *Aphelopus* spp. 49, *A. sharkeyi* from Aichi; 50, *A. prolatus*, holotype; 51, *A. serratus* from Hokkaido; 52, *A. urbaini* from Hokkaido; 53, aedeagus of *A. nepalensis* from Tokushima; 54, ditto, paramere and volsella; 55, *A. camus* from Hokkaido; 56, *A. bennetti* from Tokushima; 57, *A. atratus* from Kanagawa; 58, *A. querceus* (volsellae removed) from Hokkaido; 59, *A. maetoi* from Hokkaido; 60, *A. melaleucus* from Hokkaido; 61–63 basivolsellae of *A. querceus* from Hokkaido; 64, ditto, Aichi; 65, ditto, holotype. Scale = 0.1 mm except 49, 53 and 54 0.08 mm.

Ashoro-chô, Hokaidô, 3. VIII. 2008 (SW), T. Mita leg. (ELKU); 1♀, 43°00′N 142°04′E, Ôyûbari (180 m alt.), Yûbari-shi, Hokkaidô, 10–19. VII. 2007 (MsT), A. Ueda leg. (ELKU); 3♀1♂, 42°54′N 141°16′E, Mt. Soranuma-dake, Sapporo-shi, Hokkaidô, 4–27. VII. 2007 (MsT), A. Ueda leg. (ELKU); 2♀, same as above, but 27. VII. – 21. VIII. 2007; 1F, 42°55′N 142°45′E, Uenzaru-gara (1160 m alt.) Hidaka-chô, Hokkaidô, 10. VII. – 1. VIII. 2007 (MsT) A. Ueda leg. (ELKU); 2F, 36°N, 140°E, Ogawa (Secondary forest, age 3, 600–800 m alt.), Kitaibaraki-shi, 17.18. VI. – 2.3. VII. 2002 (MsT), FFPRI leg. (ELKU); 1♂, Kamiyu, Hakone-machi, Kanagawa, 11. VII. 2004, K. Kubo leg. (NSMT); 1♂, Yawata (650 m alt.), Asahi-chô, Aichi, 19-26. V. 1998 (MsT), M. Ozawa leg. (ELMU); 4♂, same as above, but 18–28. VII. 1998; 1♂, same as above, but 12-21. VIII. 1998; 1♂, same as above, but 15–25. IX. 1998; 5♂, same as above, but 29. VII. – 11. VIII. 1998, A. Hanai & K. Yamagishi leg.; 1♂, Sangouchi (700 m alt.), Tokushima, 9-24. VIII. 2002 (MsT), K. Ohara & A. Koide leg. (ELMU).

Distribution. Russian Far East; Japan (Hokkaido, Honshu, Shikoku).

Hosts. Unknown.

Remarks. This species was collected together with *Aphelopus querceus* at Aichi Prefecture. The body color of *A. bennetti* at the locality is much brownish, although

Figs. 66-69. Habitus of *Aphelopus* spp. 66, *A. nivealis*, male from Aichi; 67, ditto, holotype female; 68, *A. prolatus*, holotype male; 69, ditto, female from Aichi.

males from other locality show more or less blackish.

Aphelopus atratus (Dalman, 1823)

(Figs. 35–38, 57)

Dryinus (*Aphelopus*) *atratus* Dalman, 1823: 15. Type locality: Västergötland (Sweden).

See Olmi (1999) for other detail information of the synonymy.

Specimens examined. JAPAN: 1♀, 43°30′N 143°54′E, Kyushu Univ. Ashoro Research Forest (200 m alt.), Ashoro-chô, Hokaidô, 4. VIII. 2008, T. Mita leg. (ELKU); 1♀, Mt. Hakase-yama (1000 m alt., beech forest), Showa, Fukushima, 27. VII – 23. VIII. 1998 (MsT), T. Muroi leg. (ELMU); 1♀1♂, Sagami-gawa Riv., Ebina-shi, Kanagawa, 21. V. 2006, M. Ôishi & R. Watanabe leg. (ELKU); 2♀3♂, same as above, but 1. VI; 1♀, same as above, but 28. IX; 1♂, Nokata-cho, Nisshin-shi, Aichi, 3–10. IX. 2011 (MsT), R. Mitzutani (ELMU); 2♂, same as above, but 17–25.IX.2011; 1♂, same as above, but 28. X – 5. IX. 2011.

Distribution. Europe; Cyprus; Armenia; European part of Russia; Japan (Hokkaido, Honshu).

Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Aphelopus querceus Olmi, 1984

(Figs. 39, 40, 58, 61–65)

Aphelopuus querceus Olmi, 1984: 59; Xu, He & Olmi, 1999: 86; He & Xu, 2002: 64. Type locality: Bhurumche (Nepal).

See Xu et al. (2013) for other detail information of the synonymy.

Type. Holotype: ♂, (first rabel) "NEPAL, nr. Ktmd., Bhurumche 85-9500', Oak forest 7. V, Can. Nepal Exp. '67", (second red rabel) "HOLOTYPUS M#, *Aphelopus querceus* n. sp., 1981 M. OLMI DET." (BMNH). **Other specimens examined:** JAPAN: 1♂, 43°58′N 144°29′E, Kussharo-ko L. (130 m alt.), Teshikaga-chô, Hokkaidô, 6. VIII. 2008, T. Mita leg. (ELKU); 5♂, Yawata (650 m alt.), Asahi-chô, Aichi, 29. VII. – 11. VIII, 1998 (MsT), M.

Ozawa leg. (ELMU); 6♂, same as above, but 12-21. VIII; 3M, Kamikatsu (900 m alt.), Mt. Asahigamaru, Tokushima, 21. V. – 3. VI. 2002 (MsT), K. Ôhara leg. (TPM).

Distribution. Europe; Nepal; China; Japan (Hokkaido, Honshu, Shikoku,).

Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Remarks. Distivolsella and basivolsella of *Aphelopus querceus* show great variation (Figs. 61–65). Because of the unstable shape, sometimes it is difficult to distinguish the male of *Aphelopus querceus* from *A. bennetti* Olmi without observation of vertex (excavation absent in *A. querceus*; present in *A. bennetti*).

Aphelopus maetoi Olmi, 1995

(Figs. 41–44, 59)

Aphelopus maetoi Olmi, 1995: 5; 2004: 304. Type locality: Sapporo, Hokkaido (Japan).

Aphelopus hei Xu & Low, 1996: 174 (syn. by Olmi, 1999).

Specimens examined. JAPAN: 1♀, 43°00′N 142°04′E, Ôyûbari (180 m alt.), Yûbari-shi, Hokkaidô, 10–19. VII. 2007 (MsT), A. Ueda leg. (ELKU); 4♂, 43°00′N 141°24′E, Hitsujigaoka, Sapporo-shi, Hokkaidô, 23–30. VI. 2008 (MsT), K. Konishi leg. (ELKU); 2♀2♂, same as above, but 7–14. VII. 2008; 1♀, same as above, but 14–21. VII. 2008; 1♂, 42°55′N 142°45′E, Uenzaru-gara (1160 m alt.) Hidaka-chô, Hokkaidô, 1–28. VIII. 2007 (MsT) A. Ueda leg. (ELKU); 4♀6♂, 42°54′N 141°16′E, Mt. Soranuma-dake, Sapporo-shi, Hokkaidô, 4–27. VII. 2007 (MsT), A. Ueda leg. (ELKU); 2♀3♂, same as above, but 27. VII – 21. VIII. 2007; 2♀, 36°N, 140°E, Ogawa (Secondary forest, age 3, 600–800 m alt.), Kitaibaraki-shi, Ibaraki, 21, 22. V – 4, 5. VI, 2002 (MsT, M-4), FFPRI leg. (ELKU); 2♀, same as above, but (M-1); 1♀, same as above, but (M-5); 2♀, same as above, but (age 23), (M-1); 1♂, same as above, but (age 3), 17.18. VI. – 2.3. VII (M-4); 1♂, Tomioka-sôgôkôen, Yokohama-shi, Kanagawa, 17. VIII. 2002, K. Kubo leg. (NSMT); 1♀, same as above, but 14. VI. 2003; 1♀, Kamigô-chô, Sakae-ku, Yokohama-shi, Kanagawa, 24. VII. 2001, K. Kubo leg. (NSMT); 1♀, Yawata (650 m alt.), Asahi-chô, Aichi, 19–26. V. 1998 (MsT), A. Hanai & K. Yamagishi leg. (ELMU).

Distribution. Russian Far East; Japan (Hokkaido, Honshu).

Hosts. Unknown.

Remarks. Some females and males collected from Hokkaido (Japan) have quite large eyes (Fig. 42), although the other specimens examined are usual as other species (as in Fig. 44). However, both of them are classified into single species in this paper because of the following four reasons: 1) their sympatricity, 2) the same color variation, 3) the same length of notaulices, and 4) the same shape of the male genitalia. Larger females (head width longer than 0.8 mm) have different characters as follows: the shorter F7, approximately 1.8 × as long as wide; whereas those of smaller females (head width shorter than 0.8 mm) are longer, more than 2.2 × as long as wide; the roughly sculptured scutum, notaulix indistinguishable from the surface sculpture, whereas scuta of the smaller females are regularly granulated with notaulices always distinct.

Aphelopus melaleucus (Dalman, 1818)

(Figs. 45–48, 60)

Gonatopus melaleucus Dalman, 1818, 12. Type locality: Västergötland (Sweden).

Aphelopus melaleucus (Dalman): Ponomarenko & Olmi, 2007: 54.

See Olmi (1999) for other detail information of the synonymy.

Specimens examined. JAPAN: 3♀4♂, 42°55′N 142°45′E, Uenzaru-gara (1160 m alt.) Hidaka-chô, Hokkaidô, 10. VII. – 1. VIII. 2007 (MsT) A. Ueda leg. (ELKU); 1♀2♂, same as above excluding 1-28. VIII (ELKU); 2♂, 43°00′N 141°24′E, Hitsujigaoga, Sapporo-shi, Hokkaidô, 9-16. VI. 2008 (MsT), K. Konishi leg. (ELKU); 1♂, same as above, but 16-23. VI. 2008 (ELKU); 1F, Showa (1000 m alt., beech forest), Mt. Hakase-yama, Fukushima, 29. VI. – 21. VII. 1998 (MsT), T. Muroi & S. Morishita leg.; 1♂, Eigo, Hachijo-jima Isl., Izu Isls, 26. V. 1964, Y. Hirashima & M. Shiga leg.; 1♂, same as above, but 2. VI. 1964; 1♂, Sagami-gawa Riv., Ebina-shi, Kanagawa, 19. IV. 2006, T. Mita leg.; 1♀1♂, same as above, but 22. IV. 2006, M. Ôishi & R. Watanabe leg.; 1♂, Kamigô-chô, Sakae-ku, Yokohama-shi, Kanagawa, 1. VI. 2002, K. Kubo leg.

Distribution. Europe; Lebanon; Almenia; European Russia; Japan (Hokkaido, Honshu).

Hosts. Unknown in Japan. About records from other countries, see Guglielmino et al. (2013).

Remarks. The slender apex of aedeagus is one of the most important taxonomic characters of *Aphelopus melaleucus*. However, it is also present in *A. prolatus*. About identification, see the remarks of *A. prolatus*.

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