Zootaxa 3409: 47–57 (2012)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Description of a new and redescriptions of two known species of *Torymus* (Hymenoptera: Torymidae) in Taiwan with a key to Taiwanese species

KAZUNORI MATSUO[1], MAN–MIAO YANG[2], GENE–SHENG TUNG[3],
MAKOTO TOKUDA[4] & JUNICHI YUKAWA[5]

[1]*Entomological Laboratory, Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University, Fukuoka 812–8581, Japan. E-mail: k_matsuo@agr.kyushu-u.ac.jp*
[2]*Department of Entomology, National Chung Hsing University, Taichung, Taiwan, ROC*
[3]*Division of Botanical Garden, Taiwan Forestry Research Institute, Taipei, Taiwan, ROC*
[4]*Laboratory of System Ecology, Faculty of Agriculture, Saga University, Saga 840–8502, Japan*
[5]*Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka 812–8581, Japan*

Abstract

Torymus flavigastris Matsuo **sp. nov.** (Hymenoptera: Torymidae) is described as a parasitoid of unidentified gall midges (Diptera: Cecidomyiidae) that induce galls on *Litsea acuminata* (Blume) Kurata (=*Actinodaphne acuminata* (Blume) Meisner) (Lauraceae), *Machilus pseudolongifolia* Hayata (Lauraceae), and *Eurya chinensis* Robert Brown (Theaceae) in Taiwan. This is the first record of Torymidae associated with gall midges on Lauraceae and Theaceae. Redescriptions of *T. aiolomorphi* and *T. orientalis* and a key to species of *Torymus* known in Taiwan are provided.

Key words: *Torymus flavigastris*, *Torymus aiolomorphi*, *Torymus orientalis*, Lauraceae, Theaceae, Cecidomyiidae

Introduction

Torymus Dalman (Hymenoptera: Torymidae) contains at least 400 species worldwide (Grissell 1995; Noyes 2011; Matsuo & Yukawa 2009a, 2009b; Matsuo 2010). Nevertheless, only two species of *Torymus* have been known from Taiwan up to the present. One is *T. aiolomorphi* Kamijo that is known as an inquiline inhabiting galls induced by *Aiolomorphus rhopaloides* Walker (Hymenoptera: Eurytomidae) on *Phyllostachys heterocycla* (Carrière) Matsumura and *P. bambusoides* Siebold et Zuccarini (Poaceae) (Takahashi & Mizuta 1971; Yukawa & Masuda 1996; Shibata 2001), and the other is *T. orientalis* (Masi) attacking larvae of *Hypsipyla robusta* Moore (Lepidoptera: Pyralidae) (Kazmi & Chauhan 2003).

Earlier studies have demonstrated that most *Torymus* species are ectoparasitoids of cecidomyiids (Diptera) or cynipids (Hymenoptera) that induce galls on various plant families in the West Palearctic and Nearctic Regions (Grissell 1995; Graham & Gijswijt 1998; LaSalle 2005). In contrast, the host association and species diversity of *Torymus* is largely unknown in the East Palaearctic Region.

The purposes of this study are 1) to describe a new species of *Torymus* reared from cecidomyiid galls on Lauraceae and Theaceae in Taiwan, 2) to redescribe the two known congeners, and 3) to provide a key to Taiwanese species of *Torymus*.

Material and methods

Collecting, morphological studies, and depository of specimens. Cecidomyiid galls on Lauraceae were collected from various localities in Taiwan from 2008 to 2011. Adult parasitoids emerged from the galls were preserved in 70–75% ethanol for morphological observation. For microscopic study, the ethanol-stored specimens were dried out as described in Matsuo & Yukawa (2009b). Dried specimens were observed under a binocular microscope

Accepted by G.A.P. Gibson: 13 Jun. 2012; published: 6 Aug. 2012

(LEICA S8APO) and with a scanning electronic microscope (HITACHI S-3000N). Antennae and fore wings were mounted on slides in Canada balsam using ethanol and xylene. Drawings were made with the aid of a drawing tube. High resolution images were taken using a digital camera (CANON EOS 600D). Illustrations were obtained by merging an image series, covering different focal planes into a single in-focus image through the freeware Combine ZM (Hadley 2008). The final illustrations were processed for contrast and light levels in Adobe Photoshop CS4 software to crop the subject and enhance clarity. Figures were assembled using Adobe Illustrator. Adult morphological terminology follows Gibson (1997) and that for additional characters of head follows Janšta & Bouček (2006).

For describing morphological characteristics, torymid specimens in the collections of the Natural History Museum, London, UK (BMNH), Hokkaido University Museum, Japan (HUM), and Deutsches Entomologisches Institut, Germany (DEI) were examined. The holotype and some paratypes of the newly described species are deposited in the collection of the Department of Entomology, National Chung Hsing University, Taiwan (NCHU), and the remaining paratypes are in the collection of the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Japan (ELKU).

Results

Species group affinities

Two concepts of species groups have been proposed that cover species in Europe (Graham & Gijswijt 1998) and North America (Grissell 1976). Because many species are common between Asia and Europe, we followed the European species-group concept for assignment of the Taiwanese species. Based on Graham & Gijswijt (1998), all three species from Taiwan belong to the *cupreus* species-group, which is distinguished from other species-group by having three teeth on the mandible, a ventral tooth on the hind femur, and two apical spurs on the hind tibia.

Key to Taiwanese species of *Torymus*

1 Frenal area indicated by a distinct frenal line, smooth (Fig. 25). Hind coxa bare in basal one-third; hind tibia yellow in basal half. Metasoma bluish green ..... *T. orientalis* (Masi, 1926)

\- Frenal area absent or indicated by an indistinct frenal line (Figs 5, 16). Hind coxa pilose throughout; hind tibia yellowish brown or dark brown. Metasoma laterally with yellowish brown area extending from base to middle of metasoma 2

2 Frenal area absent (Fig. 5); dorsellum with median carina; propodeum with superficial striae, smoother medially (Fig. 6). Antenna clavate (Fig. 3); scape not reaching anterior ocellus; each segment bearing longitudinal sensilla arranged in one row. Ovipositor sheath 1.4–1.6× as long as hind tibia ..... *T. flavigastris* Matsuo, **sp. nov.**

\- Frenal area indicated by an indistinct frenal line, which is strongly sinuate (Fig. 16); dorsellum without median carina; propodeum with median elevated area (Fig. 17). Antenna not clearly clavate (Fig. 14); scape reaching anterior ocellus; each segment bearing longitudinal sensilla arranged in two or three irregular rows. Ovipositor sheath 2.4–2.6× as long as hind tibia ..... *T. aiolomorphi* (Kamijo, 1964)

Torymus flavigastris Matsuo, sp. nov.

Figs 1–9

Etymology. The specific name, *flavigastris*, is derived from coloration of the metasoma.

Material examined. *Holotype*: ♀, emerged on 26 March 2009 from a cup-shaped gall on *Litsea acuminata* collected by S.-F. Lin from Chinshuiying, Pingtung, Taiwan (NCHU).

Paratypes: 1♂, emerged on 26 March 2009 from a cup-shaped gall on *Litsea acuminata* collected by S.-F. Lin from Chinshuiying, Pingtung, Taiwan (NCHU); 1♀, emerged on 26 March 2009 from a slender club-shaped gall on *Machilus pseudolongifolia* collected by T.-C. Chiang and W.-N. Chen from Chinshuiying, Pingtung, Taiwan (NCHU); 2♀, emerged on 26 March 2009 from slender club-shaped galls on *M. pseudolongifolia* collected by T.-C. Chiang and W.-N. Chen from Chinshuiying, Pingtung, Taiwan (ELKU); 1♀, emerged on 26 March 2011 from a spindle-shaped gall on *Eurya chinensis* collected by G.-S. Tung from Shindian, Taipei, Taiwan (NCHU); 2♂,

emerged on 26 March 2011 from a spindle-shaped gall on *E. chinensis* collected by G.-S. Tung from Shindian, Taipei, Taiwan (ELKU).

Description. FEMALE (Fig. 1). Body length excluding ovipositor sheath 2.1–3.0 mm. Head bluish green. Scape brownish yellow, darker apically; pedicel and all flagellomeres dark brown. Mesosoma bluish green. Fore wing sometimes with brownish marking apically. Fore and mid coxae brownish yellow; hind coxa bluish green in dorsal half; all femora brownish yellow; fore and mid tibiae brownish yellow; hind tibia dark brown. Metasoma laterally with yellowish brown area extending from base to middle of metasoma.

FIGURE 1. Holotype female of *Torymus flavigastris.*

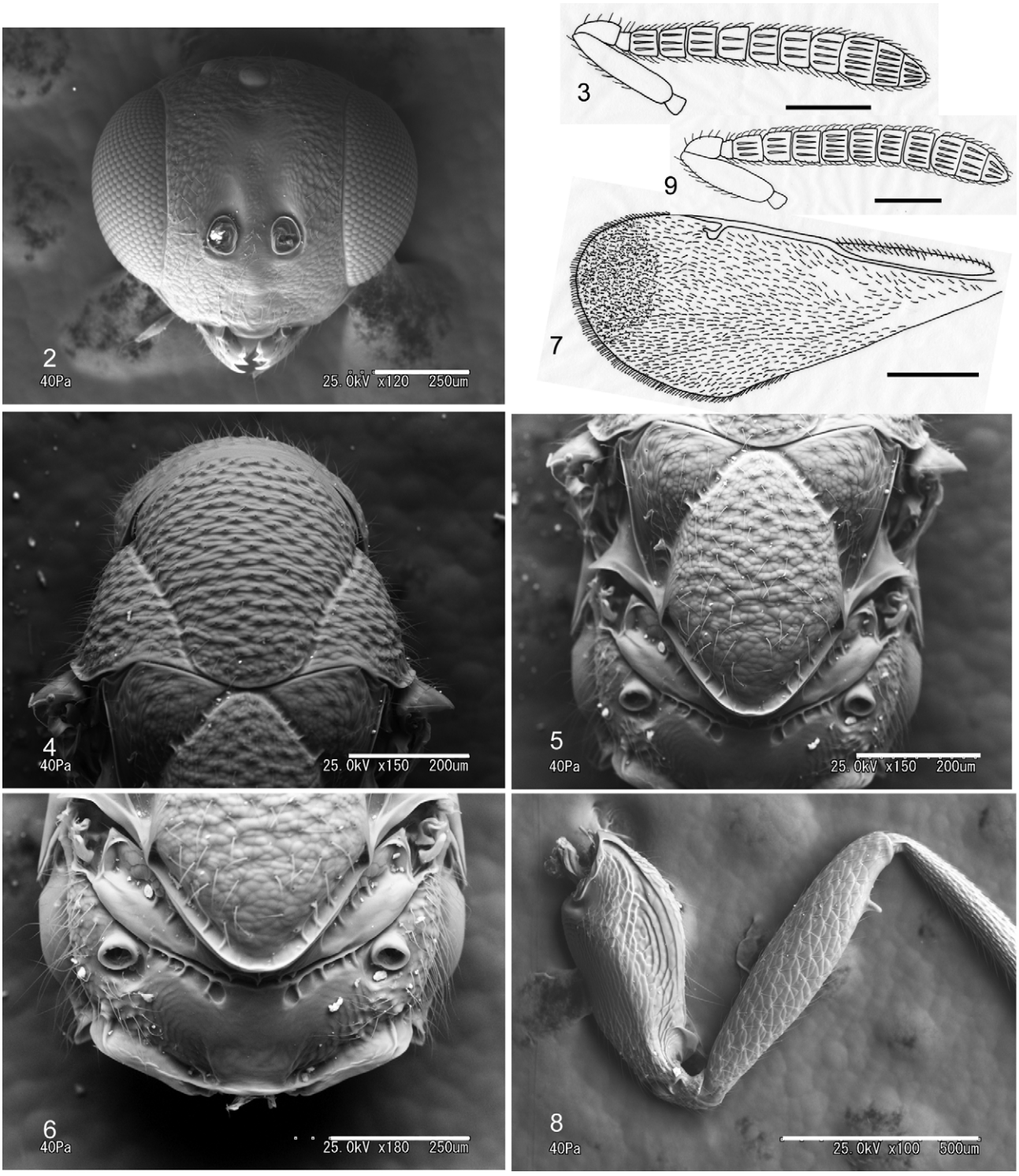
Head 1.9–2.0× as wide as long in dorsal view; temples narrow, about 0.1× as long as dorsal length of eye; POL 1.6–1.8× OOL; OOL 1.1–1.2× OD. Head 1.2–1.3× as wide as high in frontal view (Fig. 2); eyes separated 0.8–0.9× by their height; malar space 0.2–0.3× height of eye; mouth 2.4–2.6× malar space; clypeus with apical margin truncate; mandible with three teeth. Antenna (Fig. 3) clavate; scape 0.6–0.7× as long as height of eye, not reaching anterior ocellus; combined length of pedicel and flagellomeres 1.0–1.2× width of head; pedicel 1.6–1.8× as long as wide; anellus transverse, 2.0–2.5× as wide as long; F1–F3 quadrate; F4–F5 1.1–1.3× as wide as long; F6–F7 1.3–1.5× as wide as long; each segment bearing longitudinal sensilla arranged in one row.

Mesosoma 1.6–1.8× as long as wide; mesoscutum (Fig. 4) with distinct piliferous punctures; sculpture on mesoscutum in anterior half transversely reticulate; notauli distinct; scutellum (Fig. 5) 1.1–1.2× as long as wide, sculptured as posterior part of mesoscutum; dorsellum with median carina; propodeum (Fig. 6) with superficial striae, smoother medially; lower mesepimeron 1.0–1.1× as long as wide. Fore wing 2.3–2.6× as long as wide (Fig. 7); costal cell 8.5–10.0× as long as wide, on upper surface with a setal row which becomes double apically, on lower surface with scattered setae; basal cell closed below, hairy; speculum very small, closed below; relative length of marginal vein: postmarginal vein: stigmal vein = 6.5: 2.4: 1.0; stigmal vein petiolate. Hind coxa 1.8–2.0× as long as wide, dorsally with carina at base and pilose throughout; hind femur (Fig. 8) with a slender tooth ven-

trally in apical part, 4.4–4.5× as long as wide; hind tibia with longer spur 1.1–1.3× as long as width of hind tibia, about 0.5× length of basitarsus, and shorter spur 0.6–0.7× length of longer spur.

Metasoma as long as mesosoma; posterior margin of metasomal tergum five entire; tip of hypopygium situated at about 0.7 length of metasoma, with a few setae; ovipositor sheath as long as metasoma, 1.4–1.6× as long as hind tibia.

MALE. Differs from female as follows. Body length about 3.0 mm. Antenna stouter (Fig. 9); F1 and F2 quadrate; F3–F7 1.5–1.7× as wide as long. Hind coxa about 2.3× as long as wide.



FIGURES 2–9. *Torymus flavigastris*: 2, ♀ head, frontal view; 3, ♀ antenna; 4, ♀ mesoscutum; 5, ♀ scutellum; 6, ♀ propodeum; 7, ♀ fore wing, upper surface; 8, ♀ hind femur; 9, ♂ antenna. Scale bars: 2–6, 9 0.2 mm; 7, 8 0.5 mm.

FIGURE 10. A cup-shaped gall induced by an unidentified gall midge on *Litsea acuminata*.
FIGURE 11. Slender club-shaped galls induced by an unidentified gall midge on *Machilus pseudolongifolia*.

Distribution. Taiwan.

Host information. The new species was reared from cup-shaped galls on *Litsea acuminata* (Blume) Kurata (=*Actinodaphne acuminat*a (Blume) Meisner) (Lauraceae) (Fig. 10), slender club-shaped galls on *Machilus pseudolongifolia* Hayata (Lauraceae) (Fig. 11), and stem galls on *Eurya chinensis* Robert Brown (Theaceae) induced by unidentified gall midges. This is the first record of Torymidae associated with gall midges on Lauraceae and Theaceae in the world (Fulmek 1968; Grissell 1995, 1999; Matsuo & Yukawa 2009a, 2009b; Matsuo 2010; Noyes 2011).

Remarks. *T. flavigastris* has no indication of a frenal area on the scutellum whereas other species belonging to the *T. cupreus*–group have a distinct frenal area. *Torymus flavigastris* can be distinguished from other congeners by the *cupreus*–group features and the following: temple narrow, about 0.1× as long as dorsal length of eye; antenna clavate; scutellum wholly sculptured; propodeum with superficial striae, smoother medially; fore wing sometimes with brownish cloud apically; and speculum of fore wing very small.

***Torymus aiolomorphi* (Kamijo, 1964)**

Figs 12–20

Diomorus aiolomorphi Kamijo, 1964: 16.
Torymus aiolomorphi; Graham & Gijswijt, 1998: 11.

Material examined. *Holotype*: ♀, emerged on 29 May 1962 from a gall of *Aiolomorphus rhopaloides* collected by F. Kobayashi from Kyoto, Japan (HUM).

Paratype: 1♀, emerged on 5 May 1963 from a gall of *Aiolomorphus rhopaloides* collected by S. Yoshida from Kagawa, Japan (HUM).

Other specimens: 1♂, collected by I. Togashi on 5 June 1973 from Bessho, Kanazawa, Ishikawa, Japan (ELKU); 1♀, collected by S. Kamitani on 5 June 1996 from Hakozaki, Fukuoka, Fukuoka, Japan (ELKU); 1♀, collected by I. Togashi on 3 June 1973 from Kanazawa, Ishikawa, Japan (ELKU); 3♀ and 2♂, collected by S. Okudera on 27 May 2010 from Kumura, Taki, Izumo, Shimane, Japan (ELKU); 2♀, collected by F. Takahashi in May 1969 from Kyoto, Japan (HUM); 1♀, collected by A. Matsunaga on 18 May 2001 from Motooka, Fukuoka, Fukuoka, Japan (ELKU); 1♂, collected by K. Kubo on 2 June 2002 from Yokohama, Kanagawa, Japan (HUM).

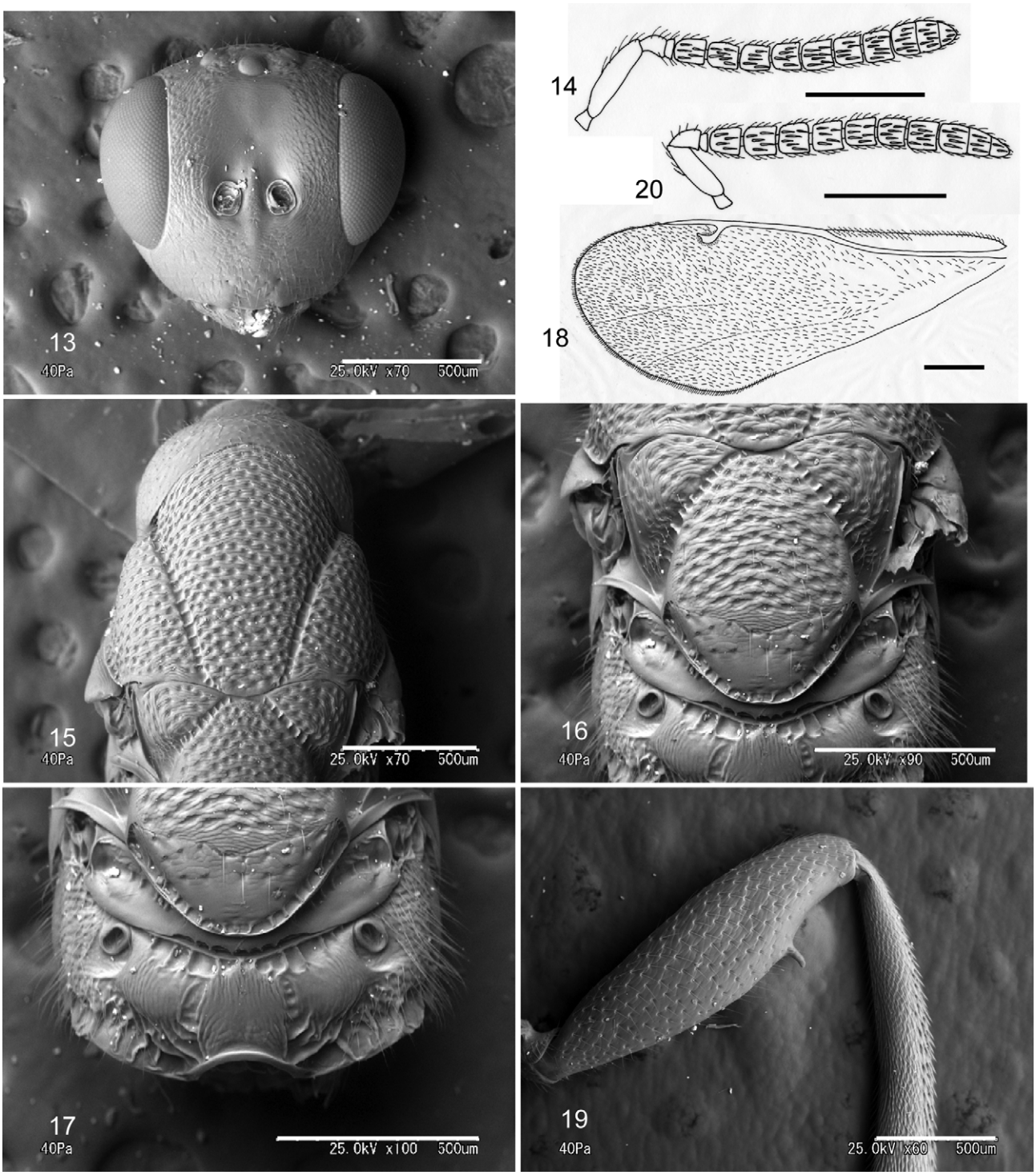
Redescription. FEMALE (Fig. 12). Body length excluding ovipositor sheath 4.5–5.5 mm. Head bluish green. Scape yellowish brown, darker apically; pedicel and flagellomeres black. Mesosoma bluish green. Fore wing with brownish marking around stigmal vein. Fore coxa yellowish brown, darker at base; mid coxa concolorous with mesosoma; hind coxa yellowish brown in apical one-third; femora and tibiae yellowish brown. Metasoma laterally with yellowish brown area extending from base to middle of metasoma.

FIGURE 12. Female of *Torymus aiolomorphi*.

Head 2.3–2.4× as wide as long in dorsal view; temples about 0.2× as long as dorsal length of eye; POL 1.3–1.4× OOL; OOL 1.2–1.3× OD. Head 1.2–1.3× as wide as high in frontal view (Fig. 13); eyes separated about 1.1× by their height; malar space 0.3–0.4× height of eye; mouth 1.9–2.1× malar space; clypeus with apical margin truncate; mandible with three teeth. Antenna (Fig. 14) not clearly clavate; scape 0.6–0.7× as long as height of eye, reaching anterior ocellus; combined length of pedicel and flagellomeres 1.2–1.3× width of head; pedicel 1.5–1.6× as long as wide; anellus transverse, about 2.0× as wide as long; F1–F3 1.3–1.5× as long as wide; F4–F7 1.0–1.1× as long as wide; each segment bearing longitudinal sensilla arranged in two or three irregular rows.

Mesosoma 1.7–2.0× as long as wide; mesoscutum (Fig. 15) with large piliferous punctures; sculpture on mesoscutum transversely wrinkled; notaulus distinct; scutellum (Fig. 16) about 1.3× as long as wide; frenal line indistinct, strongly sinuate; frenal area with sparse piliferous punctures, smoother posteriorly; dorsellum without median carina; propodeum (Fig. 17) with median elevated area which is longitudinally striate; lower mesepimeron 1.3–1.5× as long as wide. Fore wing 2.6–2.8× as long as wide (Fig. 18); costal cell 8.5–9.1× as long as wide, on upper surface with a setal row, which becomes double apically, on lower surface with scattered setae; basal cell closed below, hairy; speculum small, closed below; relative length of marginal vein: postmarginal vein: stigmal vein = 5.1: 2.7: 1.0; stigmal vein petiolate. Hind coxa 1.6–1.7× as long as wide, dorsally with carina and pilose throughout; hind femur (Fig. 19) with a slender tooth ventrally in apical part, 3.5–3.8× as long as wide; hind tibia with longer spur 1.1–1.3× as long as width of hind tibia, 0.4–0.5× length of basitarsus, and shorter spur 0.7–0.8× length of longer spur.

Metasoma as long as mesosoma plus head; posterior margin of metasomal tergum five incised; tip of hypopygium situated at about 0.6 length of metasoma; ovipositor sheath as long as metasoma plus half of mesosoma, 2.4–2.6× as long as hind tibia.



FIGURES 13–20. *Torymus aiolomorphi*: 13, ♀ head, frontal view; 14, ♀ antenna; 15, ♀ mesoscutum; 16, ♀ scutellum; 17, ♀ propodeum; 18, ♀ fore wing, upper surface; 19, ♀ hind femur; 20, ♂ antenna. Scale bars: 0.5 mm.

MALE. Differs from female as follows. Body length 2.1–3.7 mm. Temple about 0.3× as long as dorsal length of eye; OOL 1.5–1.6× OD; eyes separated 1.2–1.3× by their height. Antennal (Fig. 20) scape dark green, not reaching anterior ocellus; pedicel 1.2–1.3× as long as wide; F1–F7 quadrate. Metasoma dark green.

Distribution. This species has been recorded from Japan (Honshu, Shikoku, Kyushu), Taiwan (Kamijo 1964), and People's Republic of China (Sun *et al*. 1994).

Host information. *Torymus aiolomorphi* is an inquiline of *Aiolomorphus rhopaloides* inducing galls on *Phyllostachys heterocycla* and *P. bambusoides* (Takahashi & Mizuta 1971; Yukawa & Masuda 1996; Shibata 2001).

Remarks. Among other members of the *T. cupreus*–group, *T. aiolomorphi* is most similar to *T. cupreus* because of the following shared features: dorsal surface of hind coxa pilose throughout, dorsellum without median carina, antenna not clearly clavate, and each funicle segment bearing longitudinal sensilla arranged in two or three irregular rows. Females of *T. cupreus* have a straight frenal line and a polished frenal area on the scutellum, large depressions on the propodeum, and a shorter antennal scape that does not reach the anterior ocellus. *Torymus aiolomorphi* is distinguished from *T. cupreus* by the following features: frenal line strongly sinuate, frenal area with a several setae, propodeum with median elevated area which is longitudinally striate, and scape reaching anterior ocellus.

Torymus orientalis (Masi, 1926)

Figs 21–29

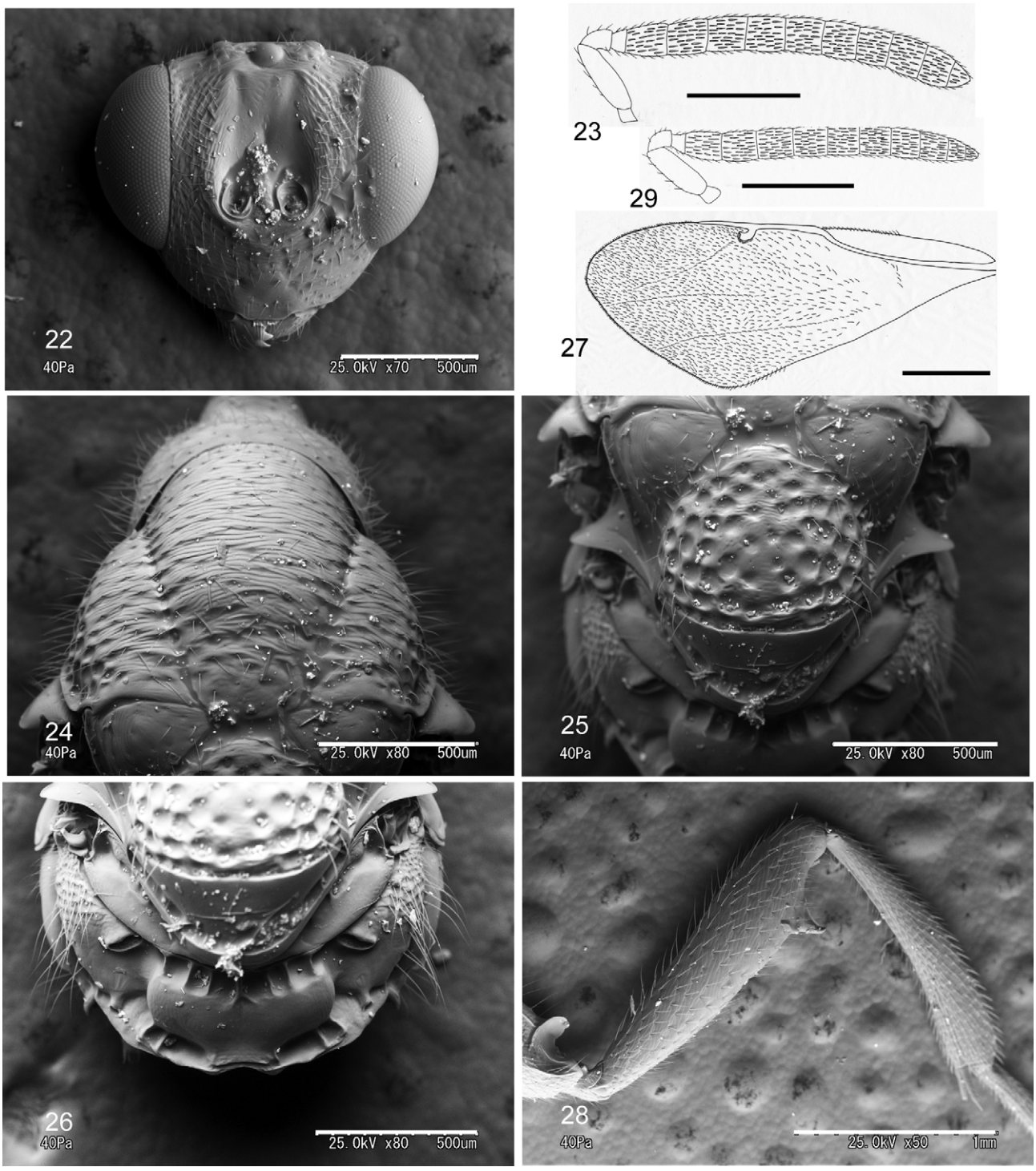
Diomorus orientalis Masi, 1926: 2; Bouček, 1988: 147.
Macrodontomerus silvifilia Girault, 1927: 555.
Diomorus silvifilia; Baltazar, 1966: 136.

Material examined. *Lectotype*: 1♀, collected by H. Sauter on 7 July 1911 from Taihorin, Taiwan (DEI).

Paralectotypes: 1♂, same data as the Lectotype (DEI); 1♀, collected by H. Sauter from Taihorin, Taiwan (DEI); 1♂, collected by H. Sauter in 1912 from Kankau, Koshun, Taiwan (DEI).

Other specimens: 1♀, collected by M. Hayat on 29 March 1966 from Aligarh, India (BMNH); 1♀, collected by Y.-C. Lin on 5 January 2010 from Hsinchu Co, Cyonglin, Taiwan (ELKU); 2♀, collected by R. Turner from Mackay, Queensland, Australia (BMNH); 1♀, collected by Z. Bouček on 20 December 1982 from Port Moresby, Papua New Guinea (BMNH).

FIGURE 21. Female of *Torymus orientalis.*



FIGURES 22–29. *Torymus orientalis*: 22, ♀ head, frontal view; 23, ♀ antenna; 24, ♀ mesoscutum; 25, ♀ scutellum; 26, ♀ propodeum; 27, ♀ fore wing, upper surface; 28, ♀ hind femur; 29, ♂ antenna. Scale bars: 22–26, 29 0.5 mm; 27, 28 1.0 mm.

Redescription. FEMALE (Fig. 21). Body length excluding ovipositor sheath 4.6–5.0 mm. Head bluish green. Scape yellow; pedicel and flagellomeres black. Mesosoma bluish green. Fore wing with brownish cloud around stigmal vein. All coxae and femora concolorous with mesosoma; fore and mid tibiae yellow; hind tibia yellow in basal half. Metasoma bluish green.

Head 2.4–2.5× as wide as long in dorsal view; temples about 0.2× as long as dorsal length of eye; POL 1.5–1.7× OOL; OOL 1.3–1.4× OD. Head 1.2–1.3× as wide as high in frontal view (Fig. 22); eyes separated by their height; malar space 0.3–0.4× height of eye; mouth 1.7–2.1× malar space; clypeus with apical margin truncate; mandible with three teeth. Antenna (Fig. 23) not clearly clavate; scape 0.5–0.6× as long as height of eye, not reach-

ing anterior ocellus; combined length of pedicel and flagellomeres about 1.2× width of head; pedicel 1.3–1.5× as long as wide; anellus 1.1–1.3× as wide as long; F1–F5 1.0–1.2× as long as wide; F6 and F7 quadrate; longitudinal sensilla numerous, each segment bearing longitudinal sensilla arranged in three or four irregular rows.

Mesosoma 1.9–2.0× as long as wide; mesoscutum (Fig. 24) with distinct piliferous punctures, transversely striate; axilla smooth with distinct piliferous punctures; notaulus distinct; scutellum (Fig. 25) 1.1–1.3× as long as wide, with large piliferous punctures; frenal area indicated by a distinct frenal line, smooth; dorsellum without median carina; propodeum (Fig. 26) smooth; lower mesepimeron 1.0–1.3× as long as wide. Fore wing 2.5–2.6× as long as wide (Fig. 27); costal cell 7.0–8.5× as long as wide, on upper surface with a setal row in distal half, on lower surface with a setal row and scattered setae apically; basal cell completely open below, bare; speculum widely open below; relative length of marginal vein: postmarginal vein: stigmal vein = 6.8: 4.2: 1.0; stigmal vein weakly petiolate. Hind coxa 2.4–2.7× as long as wide, dorsally with carina extending half length and with sparse setae, bare in basal one-third; hind femur (Fig. 28) with a tooth ventrally in apical part, 4.2–4.5× as long as wide; hind tibia with longer spur 0.8–1.1× as long as width of hind tibia, 0.3–0.5× length of basitarsus, and shorter spur about 0.8× length of longer spur.

Metasoma slightly shorter than mesosoma; posterior margin of metasomal tergum five entire; tip of hypopygium situated at about 0.5 length of metasoma; ovipositor sheath as long as mesosoma, 1.3–1.5× as long as hind tibia.

MALE. Differs from female as follows. Body length 4.0–4.2 mm. POL about 2.0× OOL; OOL 1.0–1.2× OD. Antenna (Fig. 29) not clearly clavate; combined length of pedicel and all flagellomeres 1.3–1.6× width of head.

Distribution. This species has been recorded from Australia, Papua New Guinea (Bouček 1988), India (Farooqi 1986), Philippines (Girault 1927), and Taiwan (Masi 1926).

Host information. *Torymus orientalis* attacks larvae of *Hypsipyla robusta* (Lepidoptera: Pyralidae), which is one of the most serious pests of the Australian red cedar, *Toona ciliata* Max Roemer (Meliaceae) (Kazmi & Chauhan 2003; Cunningham *et al*. 2005; Cunningham & Floyd 2006).

Remarks. *Torymus orientalis* is most similar to *T. cupreus* because of the following shared features: antenna not clearly clavate and scape not reaching anterior ocellus. Females of *T. cupreus* have two or three irregular rows of longitudinal sensilla on the each funicle segment, dense setae on the dorsal surface of the hind coxa, a ventrally closed and sparsely setose basal cell, a small and ventrally closed speculum, and brownish hind tibia. *Torymus orientalis* can be distinguished from *T. cupreus* by the following features: each funicle segment with longitudinal sensilla arranged in three rows; dorsal surface of hind coxa with sparse setae, except bare in basal one-third; basal cell of fore wing completely open below, bare; speculum widely open below; and hind tibia yellow in basal half.

Acknowledgements

We wish to express our sincere gratitude to Dr. J. LaSalle (CSIRO) for reviewing an early draft of this paper. We extend our thanks to Dr. J. Noyes, Dr. G. Broad (BMNH), and Dr. M. Ohara (HUM) for providing us opportunities to examine the specimens of *T. orientalis*; Prof. O. Tadauchi (ELKU) and Dr. A. Taeger (DEI) for arranging a loan of type specimens of *T. orienralis*; Mr. S.-F. Lin, T.-C. Chiang, W.-N. Chen, and Y.-C. Lin (NCHU) for their help in collecting cecidomyiid galls in the field and rearing adults of *Torymus* in the laboratory; and Dr. S. Kamitani, Dr. L. Westover, and Mr. D. Yamaguchi (ELKU) for their support in various ways. This study was supported in part by the following grants: a grant to KM from the Global COE Program (Center of excellence for Asian conservation ecology as a basis of human-nature mutualism), Ministry of Education, Culture, Sports, Science and Technology, Japan, a grant-in-aid to KM from the JSPS Institutional Program for Young Researcher Overseas Visits, and a grant from the Interchange Association, Japan to MT for Japan-Taiwan Joint Research Program. This study is a contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (series 6, No. 101).

References

Baltazar, C.R. (1966) A catalogue of Philippine Hymenoptera (with a bibliography, 1758–1963). *Pacific Insects Monograph*, 8, 1–488.

Bouček, Z. (1988) *Australasian Chalcidoidea (Hymenoptera). A biosystematic revision of genera of fourteen families, with a*

reclassification of species. CAB International, Wallingford, Oxon, 832 pp.
Cunningham, S.A., Floyd, R.B., Griffiths, M.W. & Wylie, F.R. (2005) Patterns of host use by the shoot-borer *Hypsipyla robusta* (Pyralidae: Lepidoptera) comparing five Melicaceae tree species in Asia and Australia. *Forest Ecology and Management*, 205, 351–357.
Cunningham, S.A. & Floyd, R.B. (2006) *Toona ciliata* that suffer frequent height-reducing herbivore damage by a shoot-boring moth (*Hypsipyla robusta*) are taller. *Forest Ecology and Management*, 225, 400–403.
Farooqi, S.I. (1986) Family Torymidae. *In*: Subba Rao, B.R. & Hayat, M. (Eds), *The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries. Part II*. Association for the study of Oriental Insects, Gainesville, pp. 259–277.
Fulmek, L. (1968) Parasitinsekten der Insektengallen Europas. *Beiträge zur Entomologie*, 18, 720–952.
Gibson, G.A.P. (1997) Chapter 2. Morphology and terminology. *In*: Gibson, G.A.P., Huber, J.T. & Woolley, J.B. (Eds), *Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera)*. NRC Research Press, Ottawa, pp. 16–44.
Girault, A.A. (1927) Four new chalcid flies from the Philippines. *Philippine Journal of Science*, 32, 553–555.
Graham, M.W.R.deVere & Gijswijt, M.J. (1998) Revision of the European species of *Torymus* Dalman (Hymenoptera: Torymidae). *Zoologische Verhandelingen, Leiden*, 317, 1–202.
Grissell, E.E. (1976) A revision of western Nearctic species of *Torymus* Dalman (Hymenoptera: Torymidae). *University of California Publications in Entomology*, 79, 1–120.
Grissell, E.E. (1995) *Toryminae (Hymenoptera: Chalcidoidea: Torymidae) a Redefinition, Generic Classification, and Annotated World Catalog of Species*. Memoirs on Entomology, International, Associated Publishers, Gainesville, 474 pp.
Grissell, E.E. (1999) An annotated catalog of world Megastigminae (Hymenoptera: Chalcidoidea: Torymidae). *Contributions of the American Entomological Institute*, 31, 1–92.
Hadley, A. (2008) Combine ZM. Available from: www.hadleyweb.pwp.blueyonder.co.uk/ (accessed 15 November 2011)
Janšta, P. & Bouček, Z. (2006) A new species of *Eridontomerus* with taxonomic and faunistic notes on some other taxa (Hymenoptera: Chalcidoidea: Torymidae). *Acta Entomologica Musei Nationalis Pragae*, 46, 211–218.
Kamijo, K. (1964) A new species of the genus *Diomorus* Walker (Hymenoptera: Torymidae). *Insecta Matsumurana*, 27, 16–17.
Kazmi, S.I. & Chauhan, N. (2003) Chalcidoid parasitoids (Hymenoptera: Chalcidoidea) of *Hypsipyla robusta* (Lepidoptera: Pyralidae), a pest of cedars and mahogany *Oriental Insects*, 37, 261–275.
LaSalle, J. (2005) Biology of gall inducers and evolution of gall induction in Chalcidoidea (Hymenoptera: Eulophidae, Eurytomidae, Pteromalidae, Tanaostigmatidae, Torymidae). *In*: Raman, A., Schaefer, C.W. & Withers, T.M. (Eds), *Biology, ecology, and evolution of gall-inducing arthropods*. Science Publishers, Inc., Enfield, New Hampshire, USA, pp. 507–537.
Masi, L. (1926) H. Sauter's Formosa - Ausbeute. Chalcididae (Hymenoptera). *Konowia*, 5, 1–20.
Matsuo, K. & Yukawa, J. (2009a) Host insect records and distributional information for *Torymus* species (Hymenoptera: Torymidae) in Japan. *Japanese Journal of Environmental Entomology and Zoology*, 20, 133–135. (In Japanese with English summary.)
Matsuo, K. & Yukawa, J. (2009b) Two new species of *Torymus* Dalman, 1820 (Hymenoptera: Torymidae) parasitizing *Celticecis japonica* Yukawa & Tsuda, 1987 (Diptera: Cecidomyiidae) that induces leaf galls on *Celtis* species (Ulmaceae) in Japan. *Entomological Science*, 12, 261–269.
Matsuo, K. (2010) A redescription of *Torymus sapporoensis* Ashmead and description of a new species of *Torymus* Dalman (Hymenoptera: Torymidae) parasitizing *Paratephritis fukaii* (Diptera: Tephritidae) in Japan. *Zootaxa*, 2410, 53–58.
Noyes, J.S. (2011) Universal Chalcidoidea Database. WWW electronic publication. Available from: http://www.nhm.ac.uk/chalcidoids (accessed 15 November 2011).
Shibata, E. (2001) Synchronization of shoot elongation in the bamboo *Phyllostachys heterocycla* (Monocotyledoneae: Gramineae) and emergence of the gall maker *Aiolomorphus rhopaloides* (Hymenoptera: Eurytomidae) and its inquiline *Diomorus aiolomorphi* (Hymenoptera: Torymidae). *Environmental Entomology*, 30, 1098–1102.
Sun, P.L., Shi, J.M. & Xu, Z.H. (1994) Research on the biological properties of *Diomorus aiolomorphi* and its control. *Journal of Zhejiang Forestry Science and Technology*, 14, 5–8.
Takahashi, F. & Mizuta, K. (1971) Life cycles of a Eurytomid wasp, *Aiolomorphus rhopaloides*, and three species of wasps parasitic on it. *Japanese Journal of Applied Entomology and Zoology*, 15, 36–43.
Yukawa, J. & Masuda, H. (1996) *Insect and Mite Galls of Japan in Colors*. Zenkoku Nôson Kyôiku Kyôkai, Tokyo, 826 pp. (In Japanese with English explanation for color plates.)