

ISOMETOPINE PLANT BUGS (HETEROPTERA:
MIRIDAE), PREFERABLY INHABITING *FRAXINUS*
GRIFFITHII ON ISHIGAKI ISLAND OF THE RYUKYUS,
JAPAN

Yasunaga, T., 2005. Isometopine plant bugs (Heteroptera: Miridae), preferably inhabiting *Fraxinus griffithii*, on Ishigaki Island of the Ryukyus, Japan. – Tijdschrift voor Entomologie 148: 341-349, figs. 1-36. [ISSN 0040-7496]. Published 1 December 2005.

Seven species of the isometopine plant bugs were confirmed to co-occur on bark or trunk of a broadleaved ash, *Fraxinus griffithii* C. B. Clarke on Ishigaki Island of the Ryukyus, a subtropical island group of Japan. Three species are described as new, one of them representing a new genus, *Isometopus ishigaki* sp. n., *I. takaii* sp. n., and *Kohnmetopus fraxini* gen. n. et sp. n. Habitat preferences of these species are discussed.

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Key words. – Heteroptera; Miridae; Isometopinae; new genus; new species; habitat; *Fraxinus griffithii*; Japan.

The plant bug subfamily Isometopinae is characterized by the presence of ocelli on the vertex. Since the other species of the Miridae do not possess ocelli, the isometopine plant bugs are considered to be the most plesiomorphic group within the family. Isometopinae may be confused with certain species of the Anthocoridae, but isometopine bugs are readily distinguished by the rounded, closed venation on the hemelytral membrane.

The isometopine mirids are considered to be predominantly predaceous, and are known particularly to inhabit bark of various trees and to prey on scale insects and other tiny arthropods (Wheeler 2001, Yasunaga 2001). All Japanese isometopine species also appear to inhabit the bark of broadleaved trees, although *Isometopus japonicus* Hasegawa, 1956 has been found on *Picea* conifers as well (Yasunaga 2001, Yasunaga & Hayashi 2002).

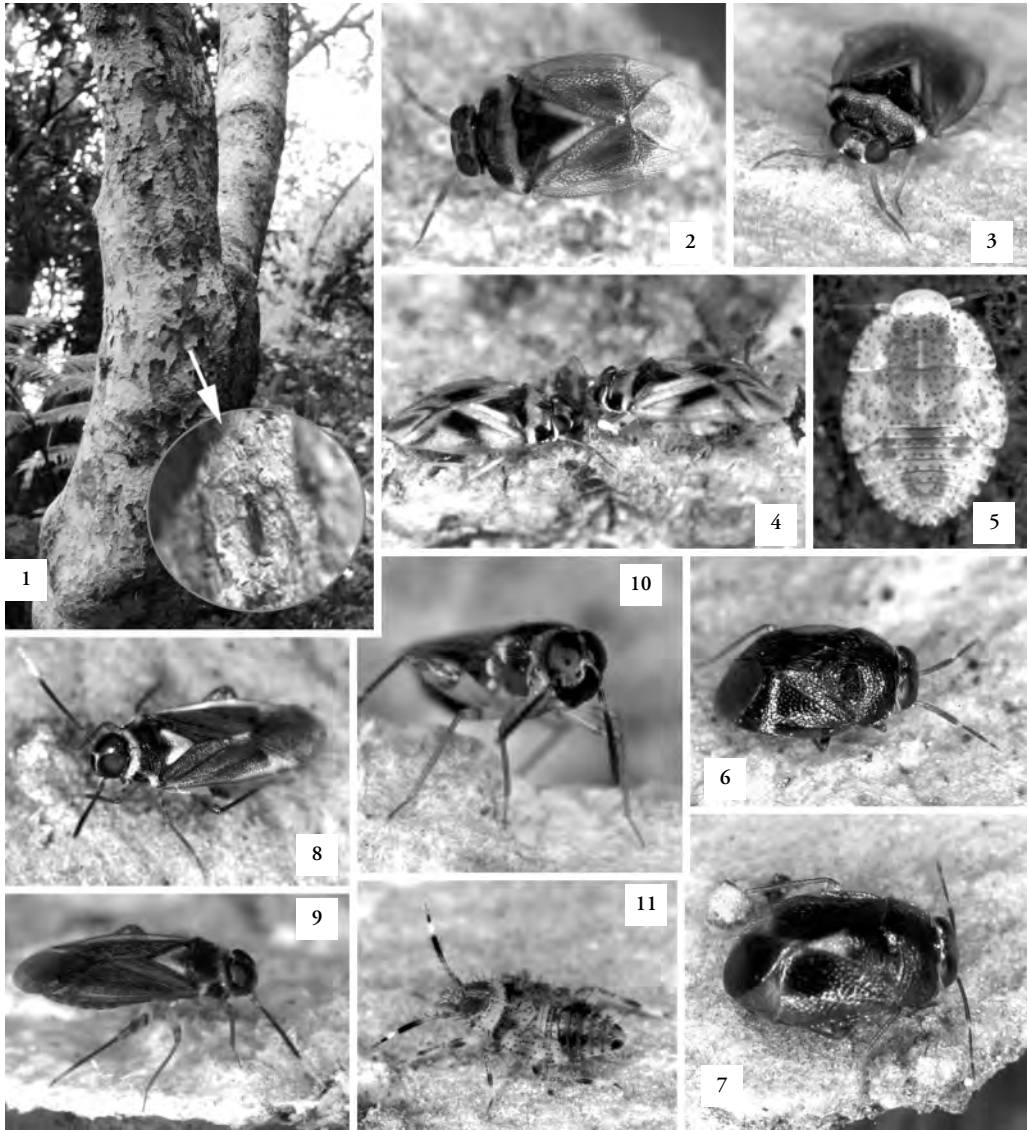
In our previous works, nine species in four genera of Isometopinae were documented from Japan (Yasunaga 2001, Yasunaga & Hayashi 2002). Subsequent investigations by the author and colleagues were carried out on Ishigaki Island of the Ryukyus, a subtropical island group in the southern part of Japan. Eight species were discovered, seven of them predominantly on or under bark of a species of ash,

Fraxinus griffithii C. B. Clarke (Oleaceae), growing in subtropical forests. Three species appeared to be undescribed, one of them representing a new genus. These new taxa are described and figured in the present paper, and the habitat preferences of the ash-inhabiting species are discussed.

MATERIAL AND METHODS

Investigations in Ishigaki Island were attempted throughout almost a whole year in 2001 and 2002 by the author himself and several enthusiastic colleagues, with a pinpoint search on bark and/or trunk of *Fraxinus griffithii*. Fifty-five specimens including immature forms were collected, and are now preserved in the author's collection unless otherwise mentioned. Their capture was performed basically by hand challenging.

All measurements are given in mm. Synonymic lists for known species are not cited, because comprehensive catalogues are now available (Kerzhner & Josifov 1999, Schuh 1995). Habitus photographs of live individuals were primarily made by means of an Olympus OM-System (OM-4Ti 35 mm reflex camera body with T10 macro ring flash and 38mm/f2.8 macro lens connected with auto extension tube).



Figs. 1-11. Isometopine plant bugs from Ishigaki Island. – 1, An ash tree, *Fraxinus griffithii*, at Fukami-Omoto, Ishigaki Island, with a *Kohnmetopus fraxini* female sitting on the bark (in circle); 2-5, *Isometopus ishigaki*; 2 & 3, holotype male; 4, female; 5, final instar nymph (same individual as holotype). 6-7. *I. takaii*; 6, holotype male; 7, female. 8-11. *Kohnmetopus fraxini*; 8, male; 9-10, female; 11, final instar nymph.

Other digital photographic images were made with a Canon EOS Kiss Digital reflex camera body adapted to an Olympus SZX-12 binocular stereoscopic microscope.

LIST OF SPECIES FOUND

Astroscometopus gryllocephalus (Miyamoto, Yasunaga & Hayashi, 1996)
Isometopus hasegawai Miyamoto, 1965
Isometopus ishigaki sp. n.
Isometopus takaii sp. n.
Kobnometopus fraxini gen. n. & sp. n.
Myiomma minutum Miyamoto, 1965
Myiomma samuelsoni Miyamoto, 1965
Myiomma takahashii Yasunaga & Hayashi, 2002

DESCRIPTIONS OF NEW TAXA

Isometopus ishigaki sp. n.
 (figs. 2-5, 12-14, 22-25)

Isometopus mahal Yasunaga, 2001: 120, pl. 92 (diag., dist., host); Yasunaga & Hayashi 2002: 100, fig. 16 (list, dist.) [not Distant, 1910: 294].

Type material. – Holotype ♂, JAPAN: Ryukyus, Ishigaki Is., Mt. Fukami-Omoto, on bark of *Fraxinus griffithii*, 28. xi. 2001, M. Takai. – Paratypes: 2♀, Ishigaki Is., Mt. Banna, on *Cinnamomum japonicum*, 19. iii. 1973, S. Kawai (National Institute of Agro-Environmental Sciences, Tsukuba); 1♀, same locality and collector as for holotype, 18. v. 2002; 2♀, same locality as for holotype, 28. ix. 2002, T. Yasunaga.

Diagnosis. – Recognized by the yellowish brown dorsal coloration with the significant dark markings in ♀, narrow head with the height about half as long as the width across eyes, and short metafemur that is as long as the metatibia. The final instar nymph of the present new species is easily recognized by the generally grayish white coloration, flattened, rounded body, and a flat, semicircular anterior projection of the head.

Description. – Male: Body generally pale ochreous, ovate; dorsal surface weakly shining, with uniformly distributed, pale, reclining pubescence. Head with a black, semi-circular mark along ventral margin of a compound eye; head height about half as long as width across eyes; frons with a mesal, black, pentagon mark below. Antenna yellowish brown; lengths of segments I-IV: 0.13, 0.63, 0.38, 0.20. Rostrum short, not reaching apex of mesocoxa. Pronotum darkened anteriorly, weakly shining, uniformly punctate, less than half as long as basal width, with wound, mesally

arched posterior margin; mesoscutum blackish brown, with paler lateral margin; scutellum blackish brown, with continuously pale brown apical part and lateral margin forming V-shape; pleura dark brown; propleuron darkened anteriorly, shining. Hemelytron pale yellowish brown, semitransparent; membrane pale grayish brown, semitransparent. Leg yellowish brown; each femur with an apical, oblique ring near apex; metatibia subequal in length to metafemur; lengths of metafemur, tibia and tarsus: 1.00, 1.04, 0.29. Abdomen dark castaneous, shining. Male genitalia: figs. 22-25. Setae on genital segment short and sparse. Left paramere with rather tumid sensory lobe. Vesica almost simply membranous, a little pigmented. Female: Similar to male in overall appearance but significantly darkened. Body pale yellowish brown, tinged with gray; dorsal surface provided with dark marks. Lengths of antennal segments I-IV: 0.13, 0.56, 0.38, 0.21. Pronotum darkened anteriorly, with three spots anteromesally and anterolaterally. Hemelytron with a dark, square mark on corium and a medial dark stripe on metaneus; membrane darkened mesally. Lengths of metafemur, tibia and tarsus: 1.13, 1.13, 0.31.

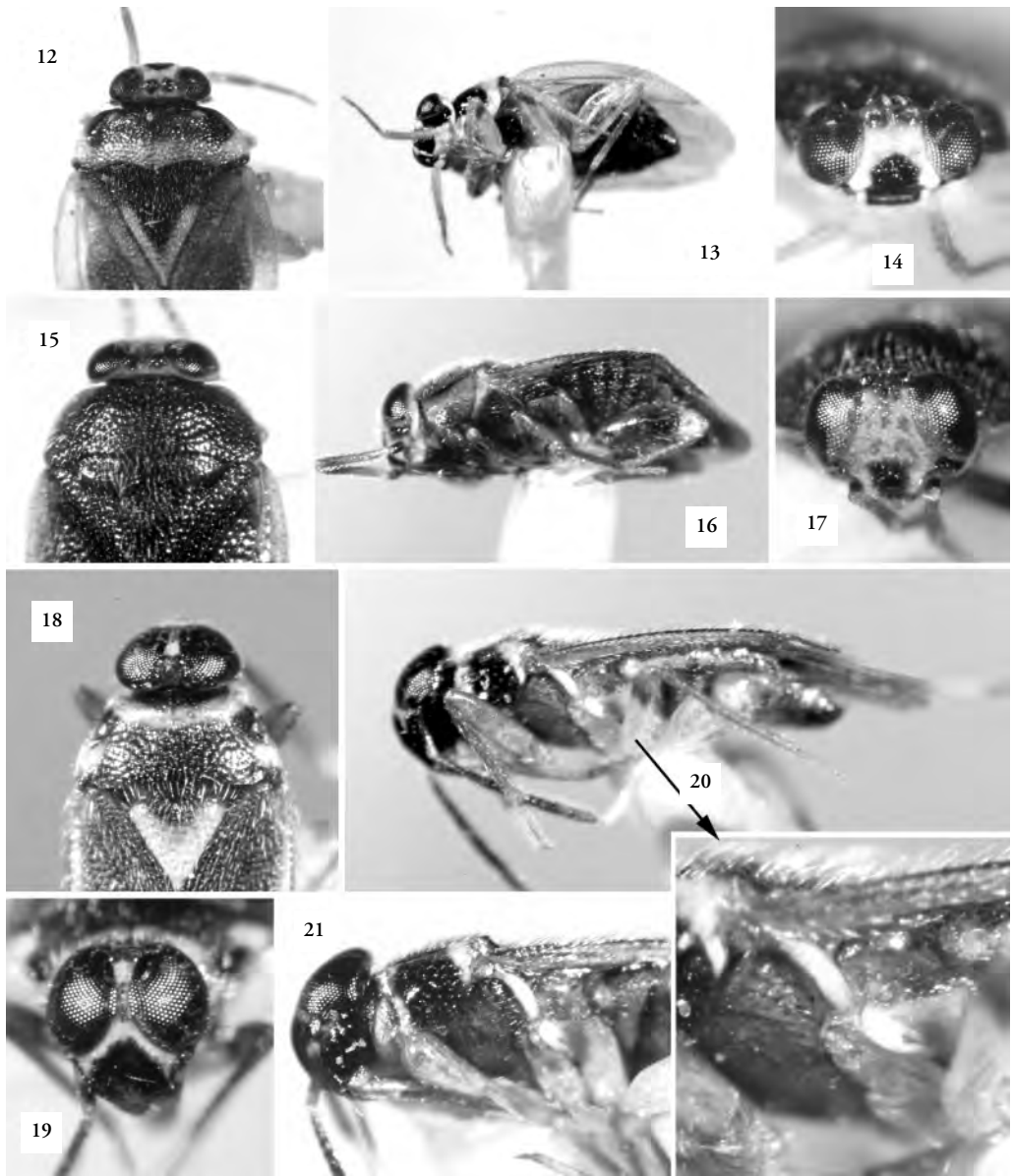
Dimensions. – ♂/♀: Body length 3.17/3.10; head width across eyes 0.88/0.91; vertex width 0.25/0.31; mesal pronotal length 0.48/0.53; basal pronotal width 1.56/1.64; and width across hemelytra 1.92/2.10.

Etymology. – Named after Ishigaki Island, type locality of this new species; a noun in apposition.

Distribution. – Japan (Ryukyus: Ishigaki Is.).

Discussion. – This new species was tentatively reported from Japan as *I. mahal* (Distant, 1904) described from Kurseong, North India (Yasunaga 2001, Yasunaga & Hayashi 2002). Only two female specimens were available at the moment. *Isometopus mahal* and *I. ishigaki* sp. n. are closely related, but *I. ishigaki* can be distinguished by the different pattern of dark marks on the pronotum and hemelytron; a mesal dark stripe on the pronotum and a large fuscous spot on the exocorium are obliterated, and a cuneal dark mark is also forming a narrow stripe in this new species. Another close relative of *I. ishigaki* is considered to be *I. nigrosignatus* described on a single female from Yunnan Prov., continental China by Ren (1987). The new species can be distinguished from this Chinese congener by the frontal head lacking a dark, independent circular spot below the compound eye, and continuous lateral pale area of the scutellum that is not narrowed towards its base.

The final instar nymph of *I. ishigaki* is similar in general appearance to that of European congeners, *I. intrusus* (Herrich-Schaeffer, 1835) and *I. milificus* (Mulsant & Rey, 1879), judging from excellent figures presented by Wachmann et al. (2004). Although



Figs. 12-21. Isometopine plant bugs from Ishigaki Island. – 12-14, *Isometopus ishigaki*, holotype male; 15-17, *I. takaii*, holotype male; 18-21, *Kohnmetopus fraxini*; 18-20, holotype male; 21, female. – 12, 15 & 18, Anterior part in dorsal view; 13, 16, 20 & 21, left lateral view; 14, 17 & 19, frontal view.

no other report or observation on immature forms of Asian *Isometopus* species is currently available, the flattened, rounded body and semicircular projection of the head appear to be common characters shared by many members of the genus. I have confirmed *I. hananoi* Hasegawa, 1956, a temperate Japanese species, also possesses these characters (Yasunaga, unpublished data).

All available specimens of *I. ishigaki* were found on *Fraxinus griffithii* bark during our subsequent investigations, although the two previously collected females came from a cinnamon, *Cinnamomum japonicum* (Lauraceae). *Isometopus ishigaki* may have a wider range of host plants than other isometopines occurring on Ishigaki Island.

Isometopus takaii sp. n.
(figs. 6-7, 15-17, 26-30)

Type material. - Holotype ♂, JAPAN: Ryukyus, Ishigaki Is., Omoto-Takeda, under bark of *Fraxinus griffithii*, 28. xi. 2001, T. Yasunaga. - Paratypes: 3 ♀, same data as for holotype; 1♂1♀, Ishigaki Is., Mt. Fukami-Omoto, on bark of *F. griffithii*, 28. ix. 2002, M. Takai; 10 ♀, Mt. Yarabudake, 1. vi. 2002, T. Nakata; 1 ♀, same locality and collector, 8. vii. 2002.

Diagnosis. - Recognized by the small size, generally fuscous body, and sexually dimorphic coloration and body shape; female has somewhat paler general coloration with the yellowish brown apical half of scutellum and base of cuneus, and larger, somewhat constricted body.

Description. - Male: Body generally fuscous, ovoid, short; dorsal surface subshining, with uniformly distributed, silky, semierect pubescence. Head ochreous, flattened in front; frons with a dark, square median spot below. Antenna dark brown; basal half and apex of segment II yellowish brown; segments III and IV short, slender; lengths of segments I-IV: 0.14, 0.63, 0.38, 0.25. Rostrum brown, reaching apex of metacoxa; apical part of segment IV infuscate. Pronotum uniformly punctate; basal margin somewhat arched and pointed mesally; scutellum weakly swollen; pleura ochreous; propleuron shining, punctate; ostiolar peritreme somber grayish brown. Hemelytron shallowly punctate; membrane pale grayish brown. Leg dark brown; metafemur rather tumid; each tibia and tarsus somber brown; lengths of metafemur, tibia and tarsus: 0.88, 1.06, 0.25. Abdomen almost entirely dark brown. Male genitalia: Figs. 26-30. Genital segment with densely distributed, long setae. Left paramere bearing long sensory setae, with strongly bent, apically broadened hypophysis. Abdomen dark chestnut brown. Vesica almost wholly membranous. Female: Similar to male. Body

fuscous but generally castaneous, somewhat constricted near base of forewing. Lengths of antennal segments I-IV: 0.15, 0.63, 0.43, 0.25. Apical half of scutellum and base of cuneus yellowish brown. Lengths of metafemur, tibia and tarsus: 0.94, 1.06, 0.31.

Dimensions. - ♂/♀: Body length 2.59/2.74; head width across eyes 0.84/0.90; vertex width 0.24/0.25; mesal pronotal length 0.56/0.66; basal pronotal width 1.34/1.40; and width across hemelytra 1.65/1.85.

Etymology. - Named in honor of my colleague, Mr. Mikio Takai, who continuously supports my study in various ways; a noun in the genitive case.

Distribution. - Japan (Ryukyus: Ishigaki Is.).

Discussion. - This new species is similar in general appearance to *I. hasegawai* Miyamoto, from which *I. takaii* sp. n. is easily distinguished by the fuscous, not transparent hemelytron (♂), and yellow apical half of scutellum and base of cuneus (♀).

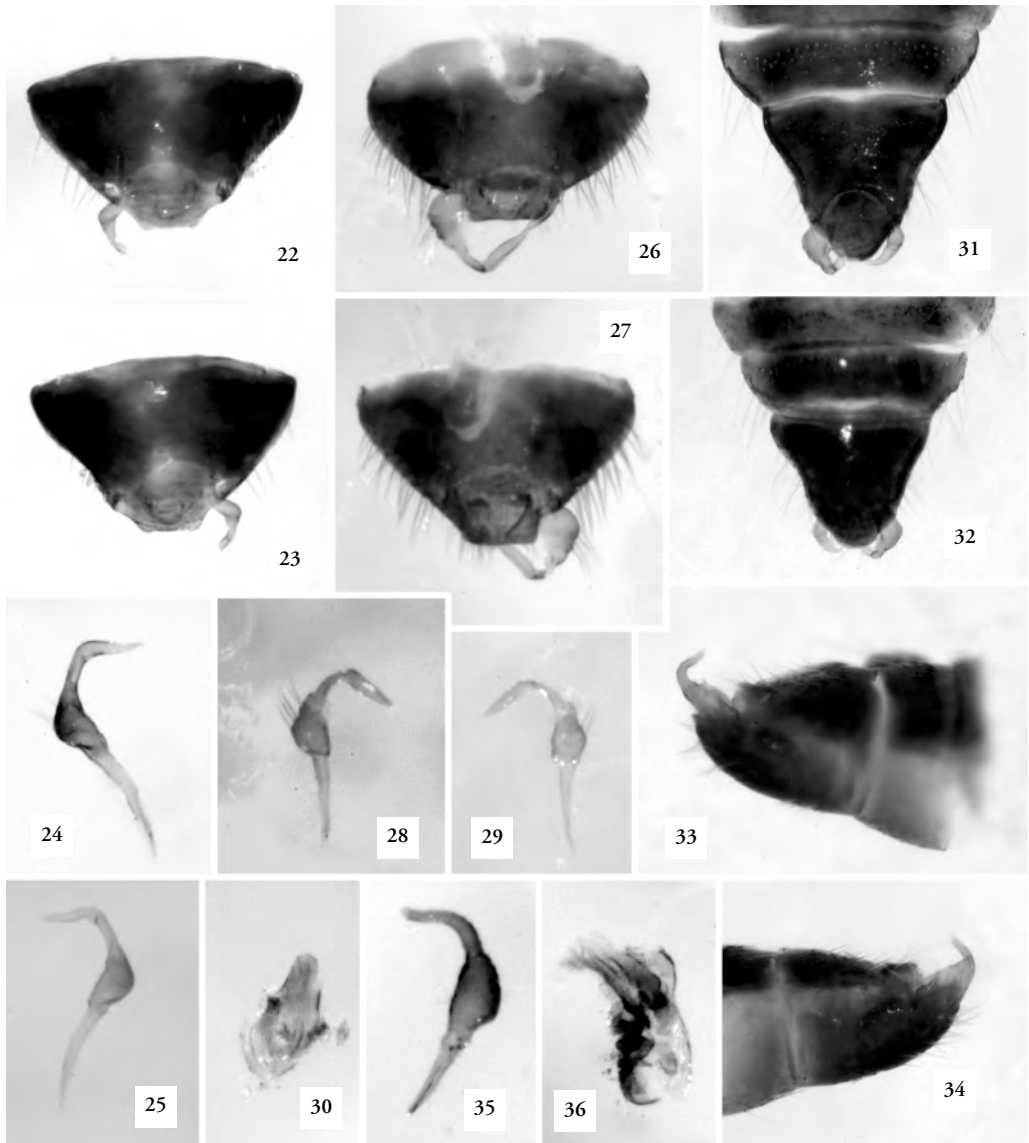
Adults of *I. takaii* were found in June, July and late November. At least bivoltine life cycles are assumed. The individuals collected in late November were all found under bark of *Fraxinus griffithii*, where the adult of *I. takaii* appears to hibernate. Immature stages of *I. takaii* remain unknown.

Kobnometopus gen. n.

Type species. - *Kobnometopus fraxini*, new species.

Diagnosis. - Recognized by the elongate, subparallel-sided body, hemispherical head, enlarged compound eyes that are contiguous to each other and not projected dorsally, relatively long antenna, elongate rostrum that is reaching the genital segment, a keel along posterior margin of the epimeron, narrow embolium, and a broad sclerotized plate on the vesica.

Description. - Body elongate, subparallel-sided, not sexually dimorphic both in general coloration and shape; dorsal surface shallowly punctate, with uniformly distributed, silky reclining pubescence. Head hemispherical, with its height almost equal to width across eyes; compound eyes contiguous to each other, not strongly projected dorsally; vertex narrow; ocelli nearly touching each other mesally. Antenna relatively long; segment II slightly broadened toward apex, about as long as basal pronotal width; segments III and IV short, filiform. Rostrum elongate, reaching genital segment. Pronotum margined laterally, not much shortened, even more than half length of basal width; calli narrowed, impunctate, shiny; scutellum flat; propleuron impunctate, shiny; epimeron shagreened, impunctate, with a keel along its posterior margin. Hemelytron shallowly and densely punctate; embolium narrow. Metafemur tumid. Male genitalia:



Figs. 22-36. Male genitalia of isometopine plant bugs. – 22-25, *Isometopus ishigaki*; 26-30, *I. takaii*; 31-36, *Kohnmetopus fraxini*. – 22, 26 & 31, Genital segment in dorsal view; 23, 27 & 32, ditto, in ventral view; 33, ditto, in right lateral view; 34, ditto, in left lateral view; 24, 25, 28, 29 & 35, left paramere; 30 & 36, vesica.

figs. 31-36. Genital segment elongate, furnished with long setae. Left paramere tumid basally, with not apically broadened hypophysis. Vesica distinctly sclerotized, with a broad sclerotized plate.

Etymology. – Named in honor of Dr. Katsuyuki Kohno, who first discovered the type species of this new genus, combined with a mirine generic name *Isometopus* Fieber; gender masculine.

Discussion. – Based on the tribal level classification proposed by Herczek (1993), this new genus appears to fit best in the Myiommatini. The final instar nymph is also similar in general appearance to those of *Myiomma* species. However, Schuh (1995) does not recognize any tribes in the subfamily Isometopinae, since he did not find any synapomorphy for these subdivisions. In general, all isometopine members share the presence of a pair of ocelli and similar left paramere shape. A definitive placement of this new genus is beyond the scope of this study. A much broader, world level survey on the male genital structures as well as immature forms is required to redefine the subdivisions of the Isometopinae properly.

The new genus is currently considered to be closest to *Isometopidea* Poppius, 1913, known from Sri Lanka, from which it can be distinguished by the following characters: compound eyes much larger, contiguous; rostrum longer, much exceeding apex of the metacoxa; pronotum shorter; calli shiny, narrowed; epimeron shagreened, impunctate, with a keel along its posterior margin; and embolium narrower. In contrast to *Isometopus* or *Myiomma*, no significant sexual dimorphism is recognizable in the type species of this new genus.

Kohnometopus fraxini sp. n.
(figs. 1, 8-11, 18-21, 31-36)

Type material. – Holotype ♂, JAPAN: Ryukyus, Ishigaki Is., Mt. Fukami-Omoto, on bark of *Fraxinus griffithii*, 28. ix. 2002, T. Yasunaga. Paratypes: 6 ♀, same locality as for holotype, 22. v. 2002, M. Takai; 1 ♀, Mt. Yarabudake, 1. vi. 2002, T. Nakata; 2 ♂ 6 ♀, same data as for holotype; 1 ♀, same locality and collector, 2. x. 2002.

Diagnosis. – Adults are easily recognized by the characters mentioned in generic diagnosis. Final instar nymphs are characteristic in having the grayish, oval, somewhat flattened body, densely spinulate dorsum furnished with reddish brown markings on the mesonotum and abdominal terga, and dark brown annulations of the antenna and each leg.

Description. – Body somber brown, somewhat tinged with green; dorsal surface with uniformly distributed, pale, reclining pubescence. Head shiny fuscous; vertex, and inner margin of compound eye

yellowish brown. Antenna dark brown; segment I somewhat reddish; segments III and IV creamy white; lengths of segments I-IV (♂/♀): 0.31/ 0.30, 1.13/ 1.24, 0.34/ 0.36, 0.25/ 0.25. Rostrum pale brown; apical part of segment IV darkened. Pronotum yellowish brown anteriorly and laterally, roughly and densely punctate, except on shiny calli; scutellum widely whitish brown except for dark, semicircular, anteromesial mark; pleura brown; propleuron shiny fuscous; keel of epimeron and ostiolar peritreme creamy yellow. Hemelytron dark brown; embolium and cuneus paler; membrane smoky brown. Coxa and leg pale brown; femur brown apically; tibia sometimes darkened; lengths of metafemur, tibia and tarsus (♂/♀): 1.13/ 1.35, 1.75/ 1.86, 0.44/ 0.48. Abdomen brown, in some specimens tinged with yellow. Male genitalia as described above.

Dimensions. – ♂/♀: Body length 3.48/4.01; head width across eyes 0.79/0.83; vertex width 0.13/0.13; mesal pronotal length 0.84/0.90; basal pronotal width 1.25/1.40; and width across hemelytra 1.37/1.56.

Etymology. – Named after the generic name of broadleaved ash, *Fraxinus*, referring to the plant association of this new species; an adjective.

Distribution. – Japan (Ryukyus: Ishigaki Is.).

Discussion. – All specimens were collected on two trees of *Fraxinus griffithii*. Both adults and final instar nymphs were observed sitting or crawling on bark or trunk of the ashes. Collection and observation records suggest a bi- or multivoltine life cycle for this new species.

OTHER SPECIES FOUND

Astroscometopus gryllocephalus (Miyamoto, Yasunaga & Hayashi)

This peculiar isometopine had been known only by three adults until Dr. M. Hayashi confirmed its exact habitat (tree shown in fig. 1). Both adults and nymphs have been found from March to May, and, therefore, one generation per year is assumed for this species. A female adult was recently discovered from the root of an unidentified broadleaved tree on Iriomote Island of the same island group on March 2, 2002 by Dr. T. Ishikawa.

Isometopus hasegawai Miyamoto

Amongst the eight species discovered in Ishigaki Island, only this species has not been found on *Fraxinus griffithii*. Its host association is yet to be confirmed, but I captured a male and a female adult by sweeping branches of the subtropical pine *Pinus luchuensis* Mayr at Mt. Maese of Ishigaki Island on March 8, 2002.

Myiomma minutum Miyamoto, *Myiomma samuelsoni* Miyamoto and *Myiomma takahashii* Yasunaga & Hayashi

These three species were observed to co-occur on *Fraxinus griffithii* bark. In addition to the adults, we collected more than ten immature forms of *Myiomma* species at three localities on Ishigaki Island (Omoto-Takeda, Shiramizu and Mt. Fukami-Omoto). However, reliable identifications of such nymphs are currently very difficult, as we could not rear them successfully into adults. As a matter of course, closer observation is required to correctly associate the adult and immature forms, and ascertain interspecific variation between these species.

DISCUSSION

The subtropical Ishigaki Island, part of the Ryukyus which are located in the most southwestern part of Japan fosters a rich fauna of Isometopinae. Eight out of the twelve Japanese species are known to occur on this small island. Seven of these apparently prefer bark or trunks of an ash, *Fraxinus griffithii*, an oleaceous broadleaved tree, commonly growing everywhere on Ishigaki Island. Only *Isometopus hasegawai* Miyamoto has not yet been found on this ash, although random sweeping or beating branches of other species of broadleaved trees and a pine, *Pinus luchuensis*, provided some specimens of *I. hasegawai*.

Apparently not all ash trees provide a suitable isometopine habitat. During the two years of our investigations, specimens were found only on some of the trees. The occupied trees are usually well developed (more than 30 cm trunk diameter), but no isometopine were discovered on mossy bark. Excess humidity appears to be less favourable. The most preferred tree, first discovered by one of my colleagues, Dr. M. Hayashi, is shown in fig. 1. All seven species listed above were found together on this attractive tree.

All ashes, on which isometopines were found, are located near streams but not very mossy, and more or less exposed to direct sunshine. In conditions without direct sunshine throughout the day, only a few individuals of two species, *Isometopus takaii* and *Myiomma samuelsoni*, could be confirmed. Isometopine plant bugs are presumably all predators, and possibly diurnal as no individuals have not been captured by light traps. Their activity, especially seeking preys, most probably requires daylight conditions.

However, we have never seen feeding behavior of any isometopine, although quite a few individuals including immature stages were observed. In addition, we observed ants, a few individuals of bristletails, scale insects, psocids, embiopterans, and some small dipteran flies occasionally sitting on bark. There are

usually many half-detached fragments and cracks on the ash bark surface as in fig. 1, which may provide suitable hiding zones or refuges against their natural enemies. However, their food or prey seems never to be abundant, even on the above mentioned favourite tree, on which all seven species were observed. Our observations are still fragmental due to the remote location of this island. Further observations are required to solve the mystery why these isometopine species prefer such habitats, which at first sight appear to be 'barren'.

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REFERENCES

- Distant, W. L., 1910. The fauna of British India, including Ceylon and Burma, Rhynchota, 5, Heteroptera Appendix. – Taylor & Francis, London. xii+362 pp.
- Herczek, A., 1993. Systematic position of Isometopinae Fieb. (Miridae, Heteroptera) and their interrelationships. – Prace Naukowe Uniwersytetu Śląskiego w Katowicach 1357: 1-86.
- Kerzhner, I. M. & M. Josifov, 1999. Miridae Hahn, 1833. – In Aukema, B. & C. Rieger (eds.), Catalogue of the Heteroptera of the Palearctic Region, 3, Cimicomorpha 2. – The Netherlands Entomological Society. 576 pp.
- Poppus, B., 1913. Zur Kenntnis der Miriden, Isometopiden,

- Anthocoriden, Nabiden und Schizopteriden Ceylons. – Entomologisk Tidskrift 34: 239-260.
- Ren, S.-z., 1987. New species and a newly recorded genus of Isometopidae from China (Hemiptera: Heteroptera). – Acta zootaxonomica sinica 12: 398-403. [In Chinese with English descriptions for new taxa]
- Schuh, R. T., 1995. Plant bugs of the world (Insecta: Heteroptera: Miridae). Systematic catalog, distributions, host list and bibliography. – The New York Entomological Society, xii+1329 pp. [Continuing updated catalogue available on webpage 'Plant Bugs of the World' – <http://research.amnh.org/invertzoo/Miridae/index.php>]
- Wachmann, E., A. Melber. & J. Deckert, 2004. Wanzen. 2. Cimicomorpha: Microphysidae (Flechtenwanzen), Miridae (Weichenwanzen). Neubearbeitung der Wanzen Deutschlands, Österreichs und der deutschsprachigen Schweiz. – Die Tierwelt Deutschlands 75: 1-288. Goecke & Evers, Keltern.
- Wheeler, A. G. jr., 2001. Biology of the plant bugs (Hemiptera: Miridae), pests, predators, opportunists. – Cornell University Press, Ithaca & London. xv+507 pp.
- Yasunaga, T., 2001. Family Miridae, plant bugs. – In T. Yasunaga, M. Takai & T. Kawasaki (eds.), A field guide to Japanese Bugs 2: 112-276, figs. 2-331. – Zenkoku Noson Kyoiku Kyokai, Tokyo. [In Japanese]
- Yasunaga, T. & M. Hayashi, 2002. New or little known isometopine plant bugs from Japan (Heteroptera: Miridae: Isometopinae). – Tijdschrift voor Entomologie 144: 95-101.

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