

**Description of a new species of *Anthocoris***  
**(Hemiptera: Heteroptera: Anthocoridae)**  
**from southern India, associated with striped mealybug**  
**on purple orchid tree**

Kazutaka YAMADA<sup>1)</sup>, Chandish R. BALLAL<sup>2)</sup>, Tripti GUPTA<sup>2)</sup> &  
Janakiraman POORANI<sup>2)</sup>

<sup>1)</sup>Tokushima Prefectural Museum, Bunka-no-Mori Park, Hachiman-chô, Tokushima, 770-8070 Japan;  
e-mail: yamada.kaz@gmail.com

<sup>2)</sup>National Bureau of Agriculturally Important Insects, H. A. farm P. O, Bellary Road,  
Bangalore 560 024, Karnataka, India; e-mail: ballalchandish@rediffmail.com (CB);  
tripti123gupta@rediffmail.com (TG); pooranij@gmail.com (JP)

**Abstract.** *Anthocoris muraleedharani* Yamada, sp. nov. is described from Karnataka State, southern India, and is distinguished from its allies, *A. dividens* Bu & Zheng, 2001 and *A. miyamotoi* Hiura, 1959, by the coloration of hemelytra and legs and structure of male genitalia. *Anthocoris muraleedharani* Yamada, sp. nov. feeds on striped mealybug, *Ferrisia virgata* (Cockerell, 1893) (Coccoomorpha: Pseudococcidae), which attacks purple orchid tree, *Bauhinia purpurea* Linnaeus (Fabaceae). Biology of the new bug is briefly discussed. A key to the Indian species of *Anthocoris* Fallén, 1814 is also given.

**Key words.** Heteroptera, Anthocoridae, *Anthocoris*, new species, *Ferrisia virgata*, *Bauhinia purpurea*, predator, biological control, India

### Introduction

*Anthocoris* Fallén, 1814 is the second largest genus in the family Anthocoridae, comprising more than 70 species worldwide (e.g., PÉRICART 1996, 2007; CARPINTERO 2002; BU & ZHENG 2001; KE & BU 2007). The majority of species occur in the Holarctic Region, but the genus is most speciose in Asia, as about 40 species have been reported from China (BU & ZHENG 2001). In India, POPPIUS (1909) described *A. annulipes* Poppius, 1909 and *A. indicus* Poppius, 1909, both from Sikkim, northeastern territory of the country. Subsequently, MURALEEDHARAN (1977) described *A. nilgiriensis* Muraleedharan, 1977 from Tamil Nadu, southern India.

Species of the genus *Anthocoris* are commonly found on broad-leaved plants, particularly on trees, where they appear to feed on aphids, psyllids, thrips, mites, and other small arthropods. Some species have been known as economically important predators on agricultural

pests (LATTIN 2000, HORTON 2008). In the western Palearctic Region, *A. nemoralis* (Fabricius, 1794) and *A. nemorum* (Linnaeus, 1761) have been well studied as major predators on pear and apple (LATTIN 2000). In India, however, almost nothing is known about the biology of the genus.

During recent field investigations in agro-ecosystems of Karnataka, southern India, numerous specimens of *Anthocoris* representing an undescribed species, were collected from Bangalore. The bugs were associated with striped mealybug, *Ferrisia virgata* (Cockerell, 1893) (Coccomorpha: Pseudococcidae), on purple orchid tree, *Bauhinia purpurea* Linnaeus (Fabaceae). In this paper, we describe *A. muraleedharani* Yamada, sp. nov. as a fourth member of the genus from India and provide biological information about this new species. A key is also given to distinguish among the four Indian species of the genus.

### Materials and methods

All specimens were killed and preserved in 70–80% ethyl alcohol just after collecting. They were then dried and mounted for examination of various structures. Examination and illustration of genitalia and other detailed external structures such as ostiolar peritreme and evaporatorium were made from specimens macerated in 10% hot KOH solution for 5–7 minutes. Specimens were dissected with micro-pins in glycerin on a glass slide beneath a binocular microscope (Nikon Stereoscopic Zoom Microscope SMZ1500). Illustrations were made with use of a binocular microscope and aid of an eyepiece grid. Photographs were taken using a Hirox digital microscope KH-7700. All measurements are given in millimeters.

Depositories of the type specimens are abbreviated as follows:

- MNHN Muséum National d'Histoire Naturelle, Paris, France;  
 NBAIL National Bureau of Agriculturally Important Insects, Bangalore, India;  
 NPCI National Pusa Collection, Indian Agricultural Research Institute, New Delhi, India;  
 TKPM Tokushima Prefectural Museum, Tokushima, Japan;  
 USNM U. S. National Museum of Natural History, Smithsonian Institution, Washington, D. C.

### Taxonomy

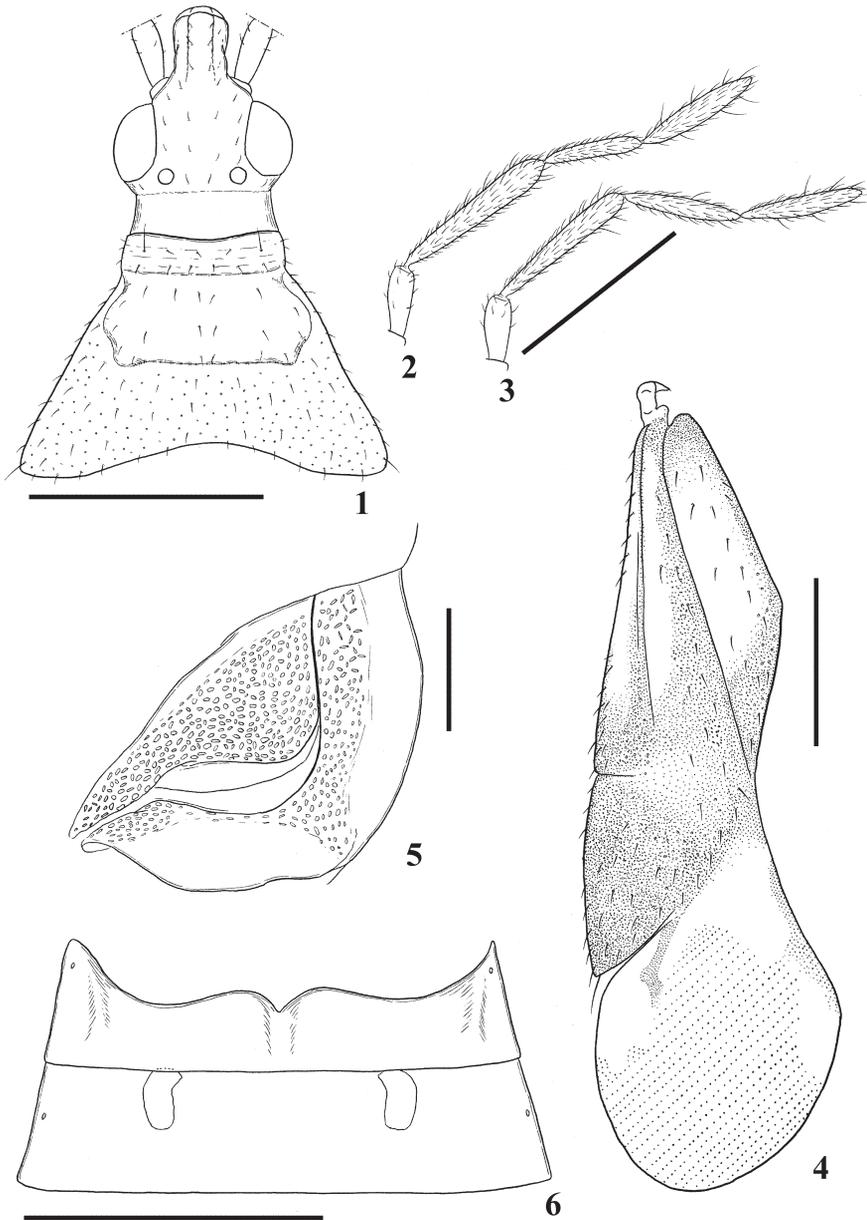
#### *Anthocoris muraleedharani* Yamada, sp. nov.

(Figs. 1–20)

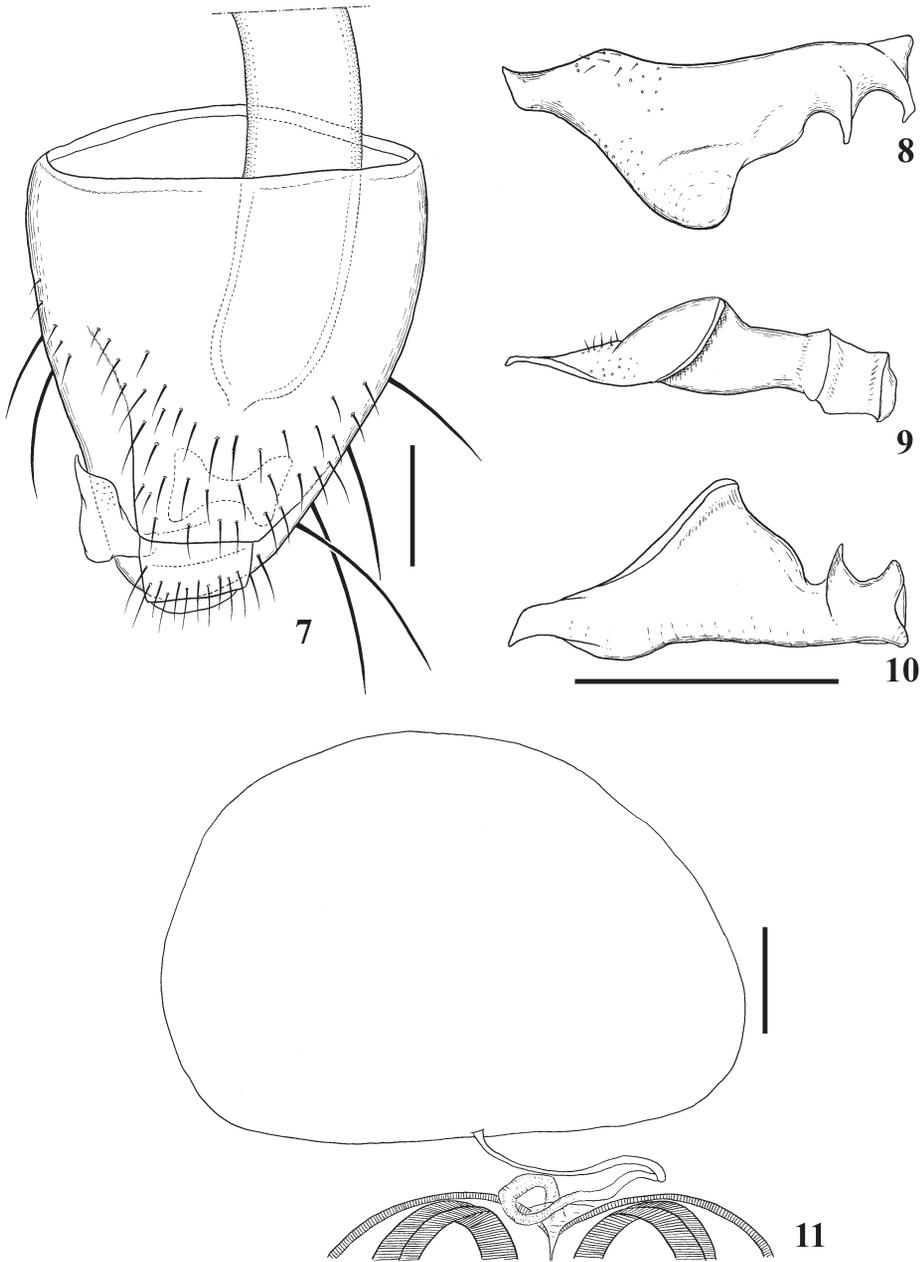
**Type locality.** India, Karnataka, Bangalore.

**Type material.** HOLOTYPE: ♂ (TKPM-IN-13227, with glass slide for genitalia; Figs. 7, 12–13), progeny of the specimens originally collected at 'INDIA: Karnataka / Bangalore, ix. 2008 / N13°01'62.2" / E77°35'05.3" / 932 m above MSL / C. R. Ballal leg.' [white square] // 'Host Insect: / *Ferrisia virgata* / Host Plant: / *Bauhinia purpurea* / [Lab. reared culture]' [white square] (TKPM). PARATYPES: **INDIA:** 32 ♂♂ (one shown in Figs. 1–2, 14; other in Figs. 5–6, 8–10) and 33 ♀♀ (one shown in Figs. 3, 15; other in Fig. 16; other in Figs. 4, 11), same data as for holotype (all in TKPM except for 2 ♂♂ 2 ♀♀ in NBAIL, 1 ♂ 1 ♀ in MNHN, 1 ♂ 1 ♀ in USNM); 16 ♂♂ 11 ♀♀, same locality as for holotype, ii.2009 (TKPM); 5 ♂♂ 5 ♀♀, same locality as for holotype, vi.2010, Laboratory reared on *Phenacoccus solenopsis* and *Ferrisia virgata*, C. R. Ballal (NPCI).

**Description. Measurements.** [♂♂ (n = 10) / ♀♀ (n = 10), holotype in parentheses]. Body length 2.95–3.63 (3.23) / 3.20–3.45; head length (excl. neck) 0.44–0.48 (0.45) / 0.45–0.48; head width across eyes 0.46–0.50 (0.48) / 0.47–0.48; vertex width 0.25–0.27 (0.27) / 0.27–0.30;



Figs. 1–6. *Anthocoris muraleedharani* Yamada, sp. nov., paratypes, male (1–2, 5–6) and female (3–4). 1 – head and pronotum, dorsal view; 2–3 – antennae; 4 – left fore wing, dorsal view; 5 – ostiolar peritreme and evaporatorium, left lateroventral view; 6 – abdominal sterna II–III, ventral view. Scale bars = 0.5 mm for 1–4, 6; 0.1 mm for 5.



Figs. 7–11. *Anthocoris muraleedharani* Yamada, sp. nov., male (7–10) and female (11) genitalia. 7 – pygophore with paramere, dorsal view; 8–10 – paramere, three different orientations; 11 – copulatory tube, dorsal view. 7 – holotype; 8–11 – paratypes. Scale bars = 0.1 mm.

width between ocelli 0.18–0.22 (0.20) / 0.19–0.22; length of antennal segments I – 0.15–0.19 (0.16) / 0.15–0.18, II – 0.41–0.49 (0.45) / 0.41–0.45, III – 0.28–0.30 (0.29) / 0.26–0.30, and IV – 0.30–0.33 (0.32) / 0.31–0.35; length of labial segments II – 0.14–0.17 (0.15) / 0.15–0.18, III – 0.50–0.59 (0.52) / 0.55–0.60, and IV – 0.26–0.32 (0.31) / 0.29–0.32; anterior pronotal width 0.37–0.42 (0.40) / 0.39–0.44; mesal pronotal length 0.46–0.54 (0.52) / 0.51–0.56; basal pronotal width 0.88–0.99 (0.96) / 0.96–1.05; length of embolial margin 0.84–1.08 (0.96) / 0.99–1.08; length of cuneal margin 0.50–0.59 (0.52) / 0.53–0.58; maximum width across hemelytra 0.92–1.03 (0.98) / 1.00–1.05.

**Coloration.** Body (Figs. 12–13) generally black to blackish brown. Head and pronotum (Figs. 12, 14–15) blackish brown, sometimes vertex and callus tinged with reddish brown; eyes reddish black; margin of ocellus red to reddish brown. Antenna (Figs. 12, 14–15) blackish brown, sometimes base of segment III tinged with reddish brown. Labium (Fig. 13) uniformly black to blackish brown. Scutellum (Fig. 12) overall black to blackish brown. Clavus (Figs. 4, 12) with basal portion, inner margin and apex blackish brown; endocorium (Figs. 4, 12) with basal portion, inner margin and apical portion mostly blackish brown; embolium with apical portion and along inner margin narrowly blackish brown; cuneus (Figs. 4, 12) wholly blackish brown; outer part of median portion in clavus and endocorium and remaining area of embolium whitish and subhyaline; area around cuneal fracture sometimes subhyaline; membrane (Figs. 4, 12) smoky dark brown, with basal and innermost portion and area behind apex of cuneus greyish white. Legs black to blackish brown; trochanter pale yellow; apical half or apical two-thirds of fore tibia and apical one-third of mid tibia pale yellow to brown; tarsus pale yellow, tinged with fuscous apex. Venter of thorax (Fig. 13) uniformly blackish brown. Abdomen black to blackish brown. Pygophore blackish brown with pale yellow paramere.

**Structure.** Body (Fig. 12) elongate, shiny on dorsal and ventral surfaces. Head (Figs. 1, 12, 14–15) cylindrical, impunctate, slightly shorter than width across eyes, sparsely covered with short, suberect setae; pairs of long, erect seta on each side of tylus and anteriorly between eyes; anteocular region as long as or slightly longer than length of eye in dorsal view; vertex 2.6–2.8 times as wide as eye in dorsal view; postocular region constricted, demarcated by transverse shallow furrow; neck long, smooth, highly polished; eye oblong, not exceeding level of dorsal and ventral surface of head in lateral view. Antenna (Figs. 2–3, 12, 14–15) densely covered with short reclining setae interspersed with long, erect setae, of which the longest are as long as or slightly shorter than width of corresponding segment; segment I (Figs. 14–15) just reaching apex of head, sparsely with short setae; segment II (Figs. 2–3, 14–15) gradually thickened toward apex, male thicker than female, about 0.9 times as long as head width across eyes; segment III about 0.65 times as long as segment II; segment IV somewhat flattened, slightly longer than segment III. Labium (Fig. 13) slightly exceeding fore coxae, sparsely covered with short, suberect setae; segment III about 3.5 times as long as segment II; segment IV about 0.5 times as long as segment III.

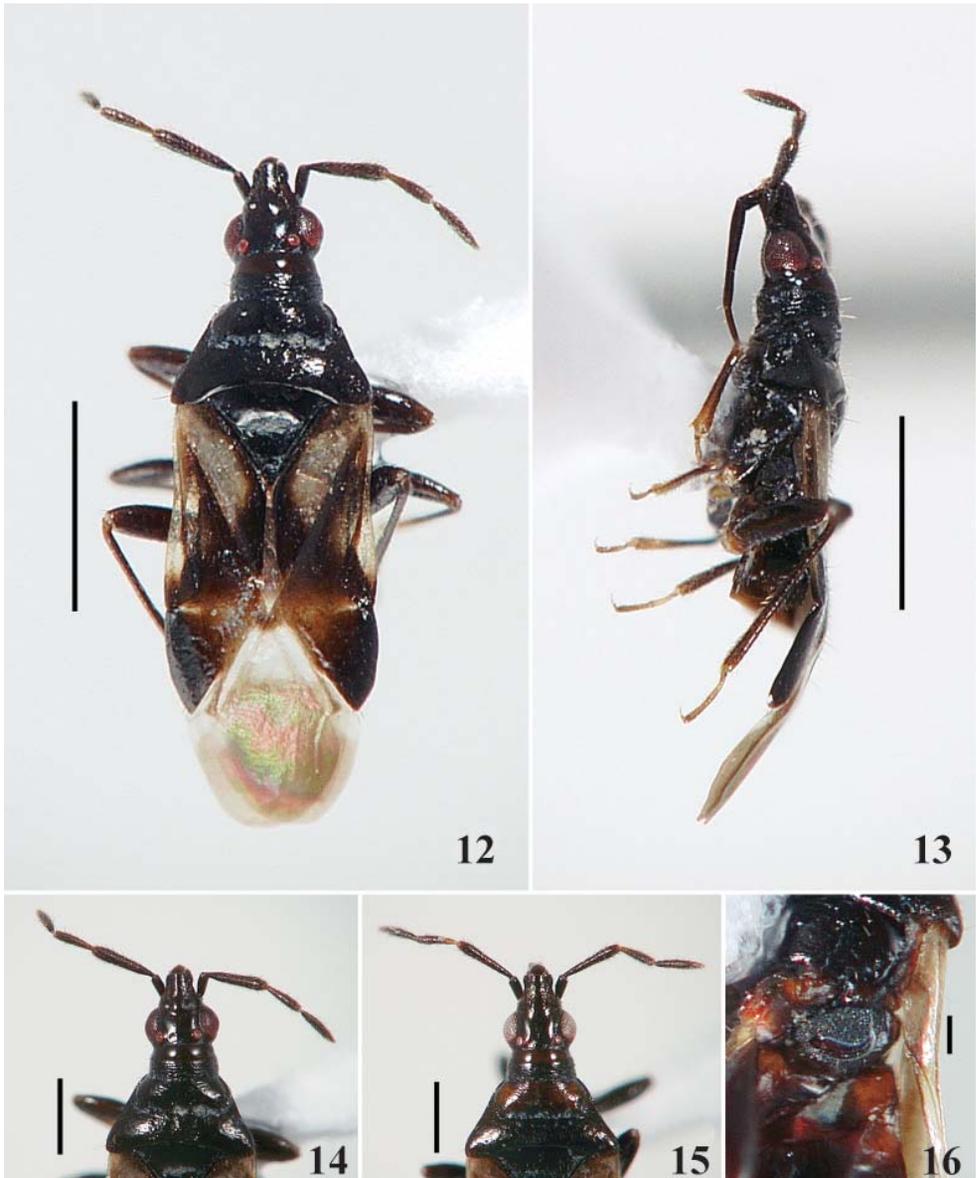
Pronotum (Fig. 1) sparsely covered with short, erect, silky setae, and with pairs of long, erect setae on midline of collar and on posterolateral corner; anterior margin concave, about 0.8 times as long as mesal length; lateral margin nearly straight; lateral carina expanded anteriorly, more obscure posteriorly; posterior margin concave inwardly, about 2.4 times as wide as anterior margin; collar about 0.3 times as long as mesal pronotal length, transversely rugose,

with scattered short setae; callus extremely swollen, polished, impunctate, sides strongly bulging, demarcated posteriorly by deep impression; deep impression with short parallel carinae and coarse punctures; posterior lobe behind callus densely covered with minute punctures. Scutellum (Fig. 12) smooth, slightly wider than long, anteriorly swollen and gradually more depressed posteriorly. Hemelytra (Fig. 4) sparsely covered with short, erect, silky setae, and with minute punctures on corium and along inner margin of clavus; costal margin slightly sinuate; endocorium about 1.7 times as wide at maximum as embolium; cuneal margin about 0.5 times as long as embolial margin; membrane with three veins, outermost vein distinct and slightly curved, inner two veins obscure and nearly straight. Ostiolar peritreme (Figs. 5, 16) broad, nearly straight, gradually curved anteriorly and acute toward apex, continued to a fine carina which reaches anterior margin of metapleura; outer margin of ostiolar peritreme weakly raised above level of surrounding evaporatorium. Legs densely covered with short, suberect setae; male fore tibiae without teeth on ventral side; fossula spongiosa present on apex of all tibiae, enlarged on fore tibia and small on mid and hind tibiae. Abdomen ventrally covered with short, reclining, silky setae; sternum III with a pair of kidney-shaped membranous areas near anterior margin, membranous area a little bent internally near apex (Fig. 6); scissure on abdominal tergite reaching posterior margin of third segment.

Male genitalia (Figs. 7–10): Pygophore (Fig. 7) rather pointed apically, covered with 6–8 long, stout setae intermixed with short, suberect setae along outer margin and on posteroventral surface, of which the longest are about as long as length of pygophore; midventral surface very hirsute with short, suberect setae; paramere (Figs. 8–10) lamellate, approximately 2.5 times as long as maximum width, with several minute punctures and very short, erect setae on subapical portion, outer margin extremely expanded and slightly rounded on median portion, inner margin nearly straight and weakly convex on subapical portion, a little bent inwardly at apex.

Female genitalia (Fig. 11): Genital segments (segments VII to IX) laterally covered with long, stout setae; copulatory tube (Fig. 11) fused on middle of intersegmental membrane between sternum VII and VIII; duct length about 0.6 mm, attached to middle of lower surface of intersegmental membrane, apical two-thirds smooth, basal one-third with weak rugosities.

**Differential diagnosis.** *Anthocoris muraleedharani* Yamada, sp. nov. is similar in general appearance to *A. dividens* Bu & Zheng, 2001 and *A. miyamotoi* Hiura, 1959, from which it can be distinguished by the following characters: apical portion of endocorium and whole of cuneus blackish brown (Figs. 4, 12) (in *A. dividens* and *A. miyamotoi*, areas before and behind cuneal suture and area around inner apex of the latter pale in color and subhyaline); embolium with apical portion and along inner margin narrowly blackish brown (Figs. 4, 12) (in *A. dividens* and *A. miyamotoi*, basal and apical portions mostly blackish brown); fore tibia blackish brown except apical half or apical two-thirds pale yellow to brown (in *A. dividens*, uniformly purplish brown, sometimes inner sides of tibiae apically yellowish brown; in *A. miyamotoi*, light brown or black). The paramere of this new species somewhat resembles that of *A. dividens*. However, it differs from the latter by the inner margin of paramere nearly straight and weakly convex on subapical portion (Figs. 8, 10) (in *A. dividens*, inner margin rounded) and apex of paramere a little bent inward (Figs. 8, 10) (in *A. dividens*, not bent, gradually acute toward apex).



Figs. 12–16. *Anthocoris muraleedharani* Yamada, sp. nov. 12–13 – habitus of holotype, dorsal and lateral views; 14–15 – head and pronotum, male (14) and female (15), dorsal view; 16 – ostiolar peritreme and evaporatorium, female, left lateroventral view. Scale bars = 1.0 mm for 12–13; 0.5 mm for 14–15; 0.1 mm for 16.



Figs. 17–20. *Anthocoris muraleedharani* Yamada, sp. nov. 17 – adult habitus; 18 – mature nymph feeding on sole-nopsis mealybug; 19 – young nymph feeding on solenopsis mealybug; 20 – eggs inserted into plant tissue (arrows show exposed operculum of egg).

**Etymology.** Dedicated to Dr. Narayanannair Muraleedharan who has worked extensively on taxonomy and biology of Indian Anthocoridae.

**Distribution.** Southern India (Karnataka State).

**Remarks.** KE & BU (2007) proposed thirteen species groups in the genus *Anthocoris* based on the body form, color pattern of fore wing, morphology of sternum II and III, and male and female genitalia. *Anthocoris muraleedharani* Yamada, sp. nov. is undoubtedly assigned to *miyamotoi* group, consisting of *A. dividens* and *A. miyamotoi*, by sharing of the following characters: body narrowly elongate; collar area relatively extensive and strongly swollen; hemelytron blackish brown, but outer part of median portion in clavus and endocorium, median portion of embolium light in color and transparent; sternum III of abdomen with a pair of kidney-shaped membranous areas; paramere lamellate or sinuate, without longitudinal groove; duct in copulatory tube attached to middle of intersegmental membrane between sterna VII and VIII, apical part of duct or the whole duct except basal part extremely thin. However, *A. muraleedharani* Yamada, sp. nov. has blackish brown areas around cuneal suture in fore wing and the basal one-third of duct in copulatory tube with weak rugosities, which are differentiated from other members of *miyamotoi* group.

## Biology

*Anthocoris muraleedharani* Yamada, sp. nov., originally collected from *Ferrisia virgata* colonies infesting *Bauhinia purpurea* trees in Bangalore, Karnataka, India, could be cultured in the laboratory on both solenopsis mealybug *Phenacoccus solenopsis* Tinsley, 1898 and *F. virgata*. The life stages of *A. muraleedharani* are depicted in Figs. 17–20.

The biology of this new anthocorid was studied on *P. solenopsis*, which in turn was reared on sprouted potatoes. *Anthocoris muraleedharani* laid its eggs either inside bean pieces (which were provided in the rearing containers) or in the potato sprouts. The mean incubation period was 4.7 days, nymphal period 16.3 days and total developmental period from egg to adult 21.0 days. The mean adult longevity was 29.0 days and the mean fecundity was 22.5 eggs.

Morphometric studies were also done on all stages. The length and maximum width of the egg are 0.55 and 0.26 mm, respectively and diameter of the egg operculum is 0.13 mm. The body length of 7.0 days old nymph is 1.23 mm and maximum thoracic and abdominal width 0.28 and 0.39 mm, respectively. The body length, maximum thoracic and abdominal width of the mature nymph is 2.38, 0.63 and 0.63 mm, respectively.

### A key to the species of *Anthocoris* from India

- 1 Femora yellowish brown with blackish brown annulation near apex; antennal segment II pale yellow with fuscous apex. .... *A. annulipes* Poppius, 1909
- Femora generally blackish brown; antennal segment II blackish brown. .... 2
- 2 Hemelytra with embolium, endocorium and clavus yellowish brown, cuneus deep brown. .... *A. nilgiriensis* Muraleedharan, 1977
- Hemelytra blackish brown with whitish or subhyaline markings on embolium, endocorium and clavus. .... 3
- 3 Labium black except paler apex; hind tibiae yellow except fuscous base. ....
- Labium uniformly black to blackish brown; hind tibiae black to blackish brown. ....
- Labium uniformly black to blackish brown; hind tibiae black to blackish brown. .... *A. indicus* Poppius, 1909
- Labium uniformly black to blackish brown; hind tibiae black to blackish brown. .... *A. muraleedharani* Yamada, sp. nov.

### Acknowledgements

Special thanks are due to N. Muraleedharan for his interest in and encouragement for our study. Yamada is also indebted to T. Hirowatari (Osaka Prefecture University, Osaka, Japan), T. Yasunaga (American Museum of Natural History, New York, USA) and M. Tomokuni (National Museum of Nature and Science, Tokyo, Japan) for their continuous advice and encouragement. This study was partly supported by Grant-in-Aid for Young Scientists (B) from the Japan Ministry of Education, Culture, Sports, Science and Technology to the first author (No. 20780043).

## References

- BU W.-J. & ZHENG L.-Y. 2001: *Hemiptera: Lasiochilidae, Lyctocoridae, Anthocoridae. Fauna Sinica. Insecta Vol. 24*. Science Press, Beijing, 267 pp (in Chinese, English summary).
- CARPINTERO D. L. 2002: Catalogue of the Neotropical Anthocoridae (Heteroptera). *Revista de la Sociedad Entomológica Argentina* **61**: 25–44.
- HORTON D. R. 2008: Minute Pirate Bugs (Hemiptera: Anthocoridae). Pp. 2402–2412. In: CAPINERA J. L. (ed.): *Encyclopedia of Entomology, 2<sup>nd</sup> edition, Vol. 3*. Springer Science + Business Media B. V., Germany, 4346 pp.
- KE Y.-L. & BU W.-J. 2007: Female copulatory tubes and subdivision of the genus *Anthocoris* (Heteroptera: Anthocoridae: Anthocorini). *European Journal of Entomology* **104**: 89–98.
- LATTIN J. D. 2000: Chapter 26, Minute Pirate Bugs (Anthocoridae). Pp. 607–637. In: SCHAEFER C. W. & PANIZZI A. R. (eds.): *Heteroptera of Economic Importance*. CRC Press, Boca Raton, FL, 828 pp.
- MURALEEDHARAN N. 1977: Some genera of Anthocorinae (Heteroptera: Anthocoridae) from South India. *Entomon* **2**: 231–235.
- PÉRICART J. 1996: Family Anthocoridae Fieber, 1836 – Flower bugs, minute pirate bugs. Pp. 108–140. In: AUKEMA B. & RIEGER Ch. (eds.): *Catalogue of the Heteroptera of the Palaearctic Region Vol. 2. Cimicomorpha I*. The Netherlands Entomological Society, Amsterdam, xiv + 361 pp.
- PÉRICART J. 2007: A new species of *Anthocoris* from Iran: *Anthocoris guentheri* n. sp. (Heteroptera: Anthocoridae). Pp. 109–111. In: RENKER C. (ed.): Festschrift zum 70. Geburtstag von Hannes Günther. *Mainzer Naturwissenschaftliche Archiv, Beiheft* **31**: 1–339.
- POPPIUS B. 1909: Beiträge zur Kenntnis der Anthocoriden. *Acta Societatis Scientiarum Fennicae* **37(9)**: 1–43.