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A new cavernicolous assassin bug of the genus *Bagauda* Bergroth (Heteroptera: Reduviidae: Emesinae) from the Western Ghats, India

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Abstract

A new cavernicolous, thread-legged assassin bug, *Bagauda ernstmayri* **sp. nov.** (Hemiptera: Heteroptera: Reduviidae: Emesinae), collected from a cave near Satara, in the Western Ghats of Maharashtra, India, is described. Its interaction with the web of an uloborid spider *Zosis geniculata* (Olivier, 1789) (Araneae: Uloboridae) is discussed.

Key words: Heteroptera, Emesinae, new taxon, *Bagauda*, Uloboridae spider

Introduction

During a survey of three adjacent caves in Satara district, Maharashtra State, India, in October 2015, one of us (SSK) came across a slender bug with extremely long legs, in association with a spider web. An additional visit within a week revealed more adults and nymphs associated with the spider web, some nymphs and adults were also moving on bare rocks. The cave, from which the bug and the spider were collected, is in lateritic rocky outcrop and it opens eastwards (altitude 1000 m ASL) (Figure 1). It is naturally formed, quite likely to have been enlarged and inhabited by people in the past, now abandoned. Presently, the cave is inhabited by bats, Blanford's rat *Madromys blanfordi* (Thomas, 1881) (Muridae), spiders [*Spariolenus* sp. (Sparassidae), *Loxosceles* sp. (Sicariidae), *Zosis geniculata* (Olivier, 1789) (Uloboridae)], two species of emesine bugs (*Myiophanes greeni* Distant, 1903 and a *Bagauda* species described as new below), and is attended daily by cattle for shade and salts that have leached over the years, also adding dung to the proximal part of the cave system. There are three caves with a common opening, the middle one of which is now converted into a temple by local people. The other two caves are deep inside and accessible up to 40 m only, beyond which the cave height and the width is reduced so that one can only crawl. This cave is one of the several such caves in nearby areas that are inaccessible due to dense forest and presence of wild animals.

One of the emesine bugs was identified as a species of the genus *Bagauda* Bergroth, 1903 belonging to the tribe Leistarchini (Wygodzinsky 1966, Rédei & Tsai 2010). Nomenclatural problems in connection with the generic name were highlighted by Rédei (2007, 2008); *Bagauda* is potentially a junior synonym of *Pleias* Kirkaldy, 1901. As the type species of *Pleias*, *P. ritsemae* Kirkaldy, 1901 differs from all other *Bagauda* in some characters (Rédei 2007), and the name *Bagauda* is widely used in the literature, we consider the name *Bagauda* as valid. We also consulted Dispons (1965) and Villiers (1970), references that provide brief but useful notes and keys on the Oriental species of *Bagauda*.

Twelve species of *Bagauda* are known from India and adjacent countries and eight from tropical Africa (Wygodzinsky 1966, Rédei & Tsai 2010); thus the genus is Oriental and African in distribution. Only four species are so far known from India: *B. avidus* Bergroth, 1903 (western India), *B. cavernicola* Paiva, 1919 (Assam), *B. similis* Wygodzinsky, 1966 (West Bengal and Tamil Nadu) and *B. splendens* Distant, 1906 (south India and Madhya Pradesh). All these Indian species as well as the other Oriental species of the genus are quite different in coloration from the one we have described here, as is evident from the available descriptions and illustrations of

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these four species. According to Wygodzinsky (1966), the coloration is quite stable for all species of this genus. This fact, plus the knowledge that most of the species of this genus appear to be restricted to a single or a few caves, also indicates that the species collected in Satara is an undescribed species. We therefore describe this *Bagauda* as a new species, provide digital colour images for various important characters and compare it with the other well-known species. This is the first species of *Bagauda* described with so many digital colour images, including those of the live insects.

The present paper is an output of our ongoing survey of the various bugs found around Pune, and Maharashtra. Earlier results of the survey include the papers by Ghate (2013, 2015), Ghate & Jadhav (2015), Kocorek & Ghate (2012), and Kulkarni & Ghate (2016).

Methods

Live emesine bugs (two males, one female, one nymph) were collected from a cave located at Chalkewadi road near Sajjangad fort, Satara, Maharashtra, India. Bugs were studied under a Leica stereozoom (MZ6) microscope and also photographed with attached Canon Powershot S50 camera. Several images were stacked using Combine ZM software and the images were processed with Adobe Photoshop CS5. Measurements were done with Erma stage and ocular micrometer and an accurate scale. The pygophore was dissected after treating the last 3 abdominal segments with hot 10% KOH, the phallic complex was dissected and the parameres and phallus were separated and mounted in polyvinyl lactophenol (PVLP) with lignin pink dye, and photographed using Axiocam ER65S attached to Zeiss microscope.

Description

Bagauda Bergroth 1903

Bagauda ernstmayri sp. nov.

Taxonomic placement. Family Reduviidae, subfamily Emesinae and tribe Leistarchini, as per the latest classification of the genus.

Type material. Holotype: male, Chalkewadi road near Sajjangad fort, Satara, Maharashtra, India, 20.x.2015, leg. S. Kulkarni; deposited at the Zoological Survey of India (ZSI), Western Regional Station, Pune. **Paratypes**: 1 male and 1 female from the same locality, 25.x.2015, collected by the same collector; deposited in the personal collection of H.V. Ghate at Modern College (Shivajinagar, Pune).

Description. Macropterous male and female. Total length (apex of head to tip of abdomen): male (n=2) 13.0–13.3 mm, female (n=1) 12.8 mm.

Other measurements in mm: (character: female paratype / male holotype): total length: 12.8 / 13.0; length of head: 1.2 / 1.25; length of pronotum (measured in lateral view): 3.8 / 3.6; humeral width 2.8 / 2.7; length of abdomen (from base to apex): 8.3 / 8.4; length of fore wing: 8.2 / 8.3; length of hind wing: 7.0 / 7.0; lengths of antennal segments I: 10.8 /10.5, II: 8.0 /8.2, III: 3.0 / 3.0, IV: 2.1 / 2.1; length of fore coxa: 2.40 / 2.25, femur: 4.0 / 4.1, tibia: 2.4 / 2.25, tarsus: 1.2 / 1.3; length of mid femur: 11.6 / 11.0, tibia: 15.0 / 15.5, tarsus: 0.5 / 0.5; length of hind femur: 14.4 / 13.0, tibia: 21.0 / 20.0, tarsus: 0.5 / 0.5; lengths of labial segments: 1st visible segment: 0.4 / 0.4 , 2nd visible segment: 0.5 / 0.5, 3rd visible segment 0.5 / 0.5.

Coloration. Body and appendages generally pale brown to dark brown; whitish areas present on posterior half of anterior lobe of prothorax, at base of fore coxae, on distal third of fore femur (except its apex), on basal third of fore tibia, and on femur-tibia junctions of mid and hind legs (in one specimen, whitish areas becoming pale yellowish brown, except femur-tibia junctions). Head pale at base of antenniferous tubercle, on transverse sulcus (= interocular furrow), at base or 'neck' and below eyes laterally. Antennae dark brown. Labium with first two visible segments brownish and third segment pale. Meso- and metathorax brownish. Hemelytra smoky, semi-transparent; corium with large whitish area apically; membrane with whitish veins discaly and dark veins along margin, and with pale oval spot near base; hind wings transparent. Fore tibia light brown on distal part; tarsal segments II and III lighter than segment I. Abdomen with several areas pale brown (Figs. 2–10).

FIGURES 1–2. Habitat and habitus of *Bagauda ernstmayri* sp. nov. 1, Habitat showing entrance to the cave; 2, a living individual.

FIGURES 3–4. ***Bagauda ernstmayri*** **sp. nov.** 3, Lateral view of whole body; 4, lateral view of head and prothorax.

Structure. Head elongate ovoid, dorsally distinctly convex, partly setose, finely granular, ventrally flattish, slightly longer than its width, with deep transverse sulcus between eyes. A fine, longitudinal, median sulcus present in front of transverse sulcus, meeting transverse sulcus. Anteocular area narrowed considerably, slightly declivous; post-ocular area slightly narrowed, gently constricted near middle and tumescent above. Clypeus prominently raised; mandibular plates shorter than clypeus. Antenniferous tubercles large, situated on top of head, slightly divergent (Fig. 11). Eyes moderately large, semi-globular, coarsely granular. Antennae with antennomeres very thin. Labium extending up to fore coxae, moderately stout; first visible segment not extending up to anterior border of eye; second visible segment reaching almost up to base of head.

Pronotum long; anterior lobe more or less smooth, covered with a few fine setae, convex in anterior half, flattened in posterior half, distinct from posterior lobe by constriction, slightly longer than posterior lobe, and with lateral margins almost parallel-sided, anterior margin concave and anterior angles tubercular and projecting outward; posterior lobe bell-shaped, finely punctured and rugulose, sloping forward, broader than anterior lobe, humeral angles bluntly triangular and posterior margin concave (Fig. 12). Prosternum slightly concave. Scutellum sub-triangular, with lateral borders gently sinuate (Fig. 13).

Hemelytra fully covering abdomen, surpassing apex of abdomen, its venation more or less typical (Fig. 14); hind wings small, very thin, delicate.

Fore legs with coxa much longer than its width, projecting in front of head; trochanter short; femur longer than coxa, almost as long as tibia and tarsus combined, ventrally with 2 rows of spine-like setae; anteroventral (inner) row slightly curved at base, starting far from base of femur; posteroventral (outer) row starting at base of femur; basal setae somewhat stronger and longer than remaining setae; tibia shorter but more than half as long as femur,

ventrally with slightly thick setae bent and pointed towards apex, and dorsally with very fine setae; tarsus with fine curved claw at tip (Figs. 5–7).

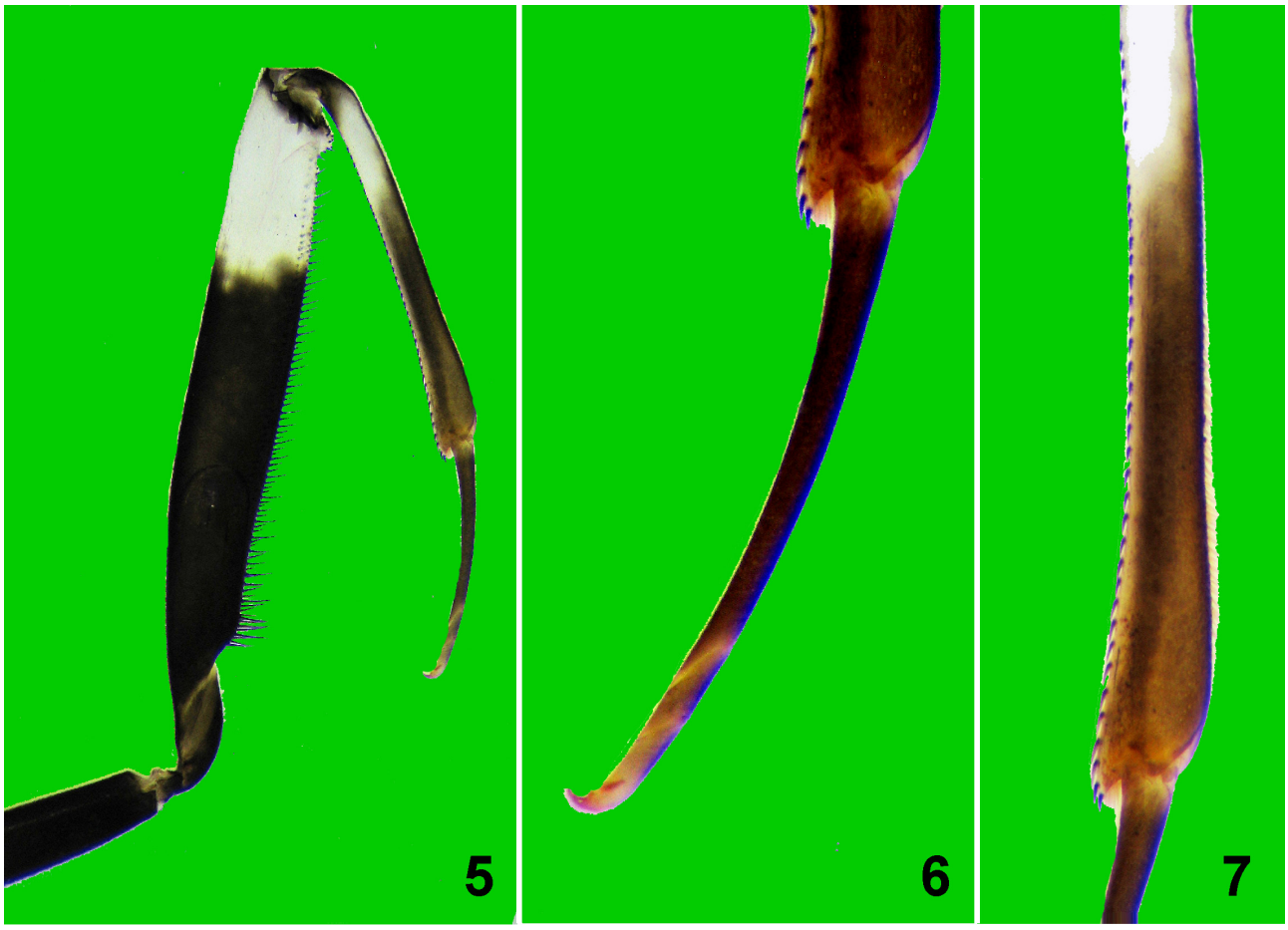
Mid and hind legs very thin, very long; mid femur extending beyond abdominal apex by 3.5 mm; hind femur surpassing abdominal apex by almost 8 mm.

Male genitalia: Pygophore about 1.5 mm long, ventrally convex, dorsally flat (Figs. 15, 16). Parameres visible outside, curved apically as in other species of *Bagauda*, slightly swollen around middle, with beak-like apex, setose (Fig. 17). Phallus weakly sclerotized; endosoma with very fine spines and spinules of complex arrangement (Figs. 18–21).

Female genitalia: genital segments in dorsal and ventral views, respectively, are shown in Figs. 22 and 23.

Etymology. The species is named after the late Ernst Mayr, a most respected theorist of systematic zoology and a foremost evolutionary biologist of the 20th Century.

Distribution. Presently known only from the type locality-Satara, Maharashtra State, India.



FIGURES 5–7. ***Bagauda ernstmayri*** **sp. nov., fore leg.** 5, Femur, tibia and tarsus showing color and relative proportions; 6, tarsus showing dark, longest basal segment; 7, tibia showing a ventral row of adpressed dark spines.

Discussion

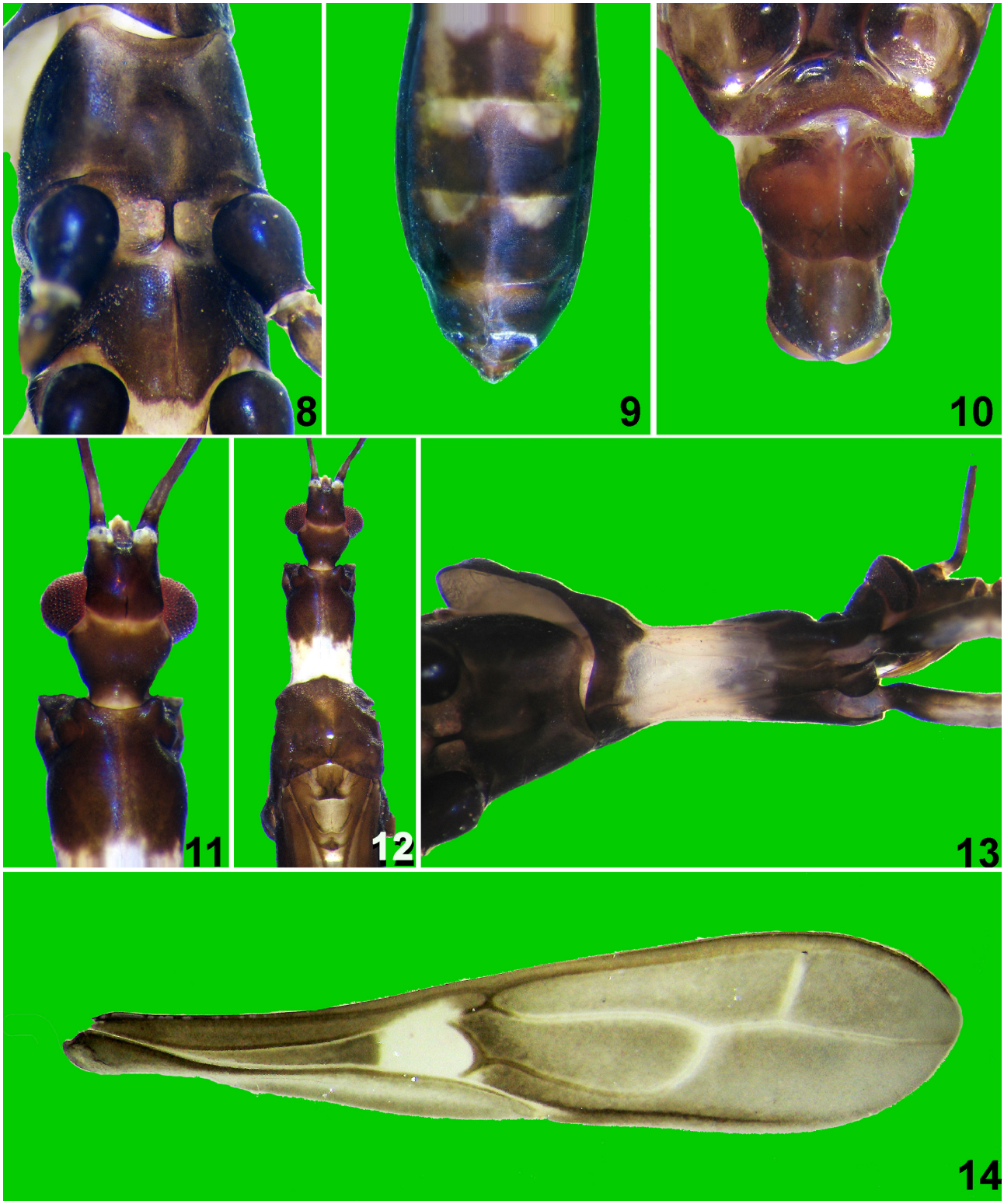
Comparison with related species. A comparison with other adequately described and illustrated species of *Bagauda* is presented below.

Bagauda avidus Bergroth, 1903. Type locality: Bombay. The original description (Bergroth 1903) is brief and inadequate, the redescription by Distant (1903) probably pertains to a different species (Wygodzinsky 1966). This species differs conspicuously from *B. ernstmayri* **sp. nov.** by the lack of contrasting markings on its pronotum and fore leg (Bergroth 1903, Wygodzinsky 1966).

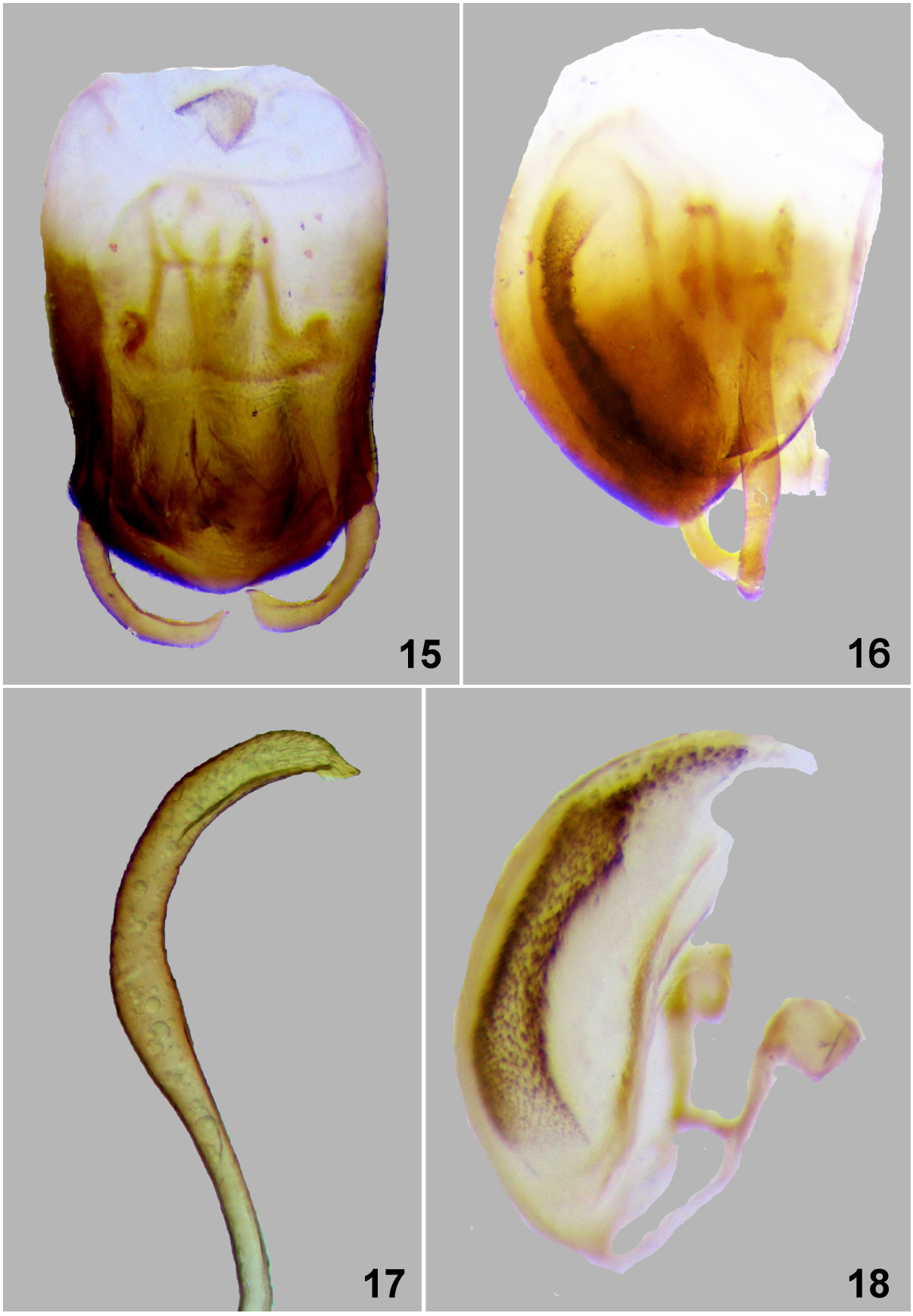
Bagauda splendens Distant, 1906. Type locality: Ceylon (now Sri Lanka); subsequent record: Madhya

Pradesh, India (Chandra et al. 2015). This species differs from *B. ernstmayri* sp. nov in the fore femur being black except at base, the fore tibia being completely black, and the anterior lobe of pronotum being completely yellow, with exception of anterior margin (Wygodzinsky 1966).

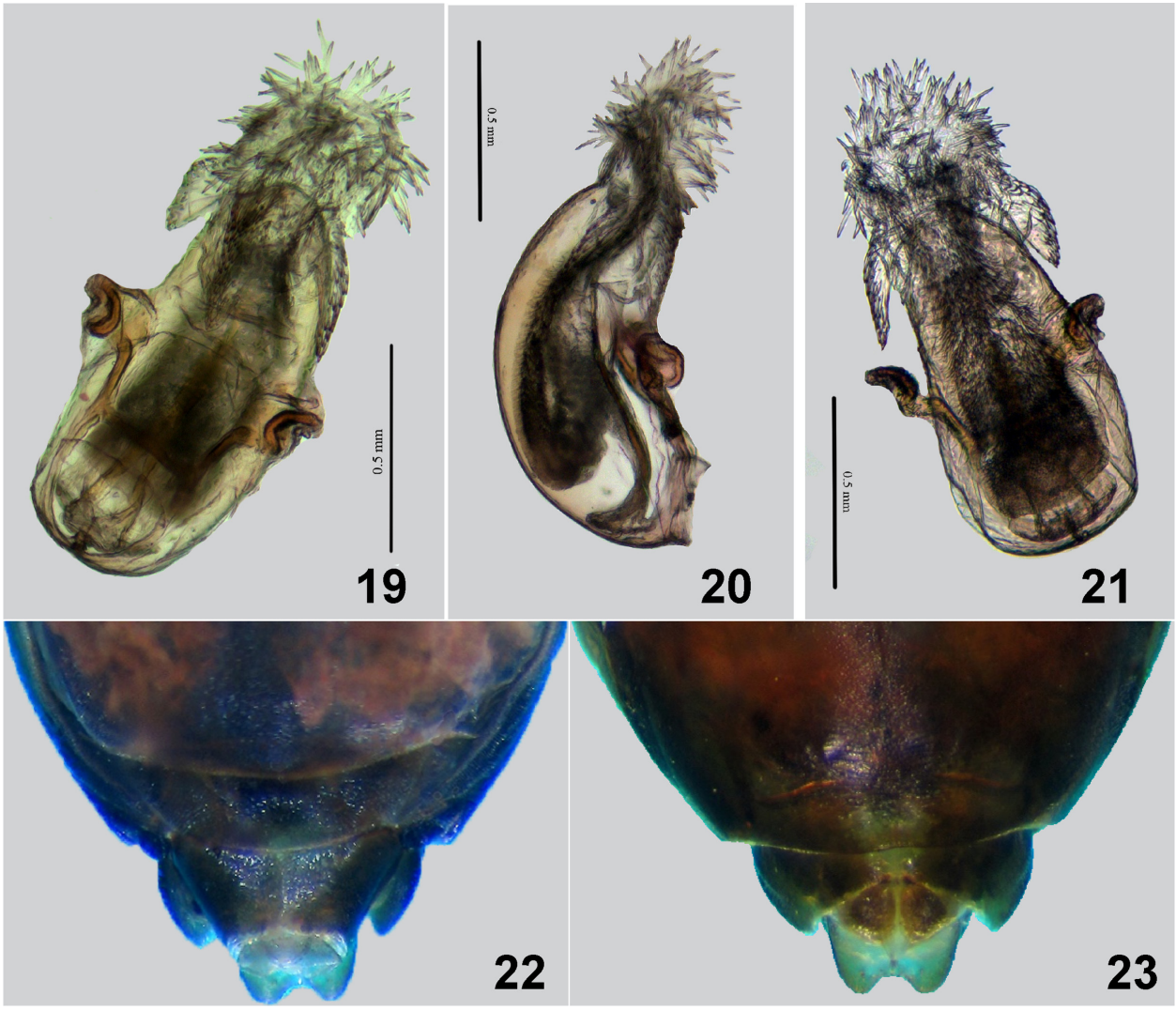
Bagauda cavernicola Paiva, 1919. Type locality: Garo Hills in Assam. This species is apparently rather similar to *B. ernstmayri* **sp. nov.** but the posterior lobe of the pronotum is provided with extensive pale markings (Paiva 1919).



FIGURES 8–14. ***Bagauda ernstmayri*** **sp. nov.** 8, Thoracic sterna; 9, abdominal sternites in female; 10, pygophore in ventral view; 11, head in dorsal view; 12, head, pronotum and scutellum; 13, prothorax in ventrolateral view, 14, hemelytra.



FIGURES 15–18. ***Bagauda ernstmayri*** **sp. nov., male genitalia.** 15, pygophore in dorsal view; 16, pygophore in lateral view; 17, paramere; 18, phallus in lateral view.



FIGURES 19–22. ***Bagauda ernstmayri*** **sp. nov., phallus and female terminalia.** 19, Phallus in dorsal view; 20, same in lateral view; 21, same in ventral view; 22, female genital segments in dorsal view; 23, same in ventral view.

Bagauda similis Wygodzinsky, 1966. Type locality: Bengal and Coimbatore, South India. Images of the holotype (male, NHM, London) were seen. The colour of the pronotum of the male of this species is somewhat similar to that of *Bagauda ernstmayri* **sp. nov.** but with a much narrower white area on posterior lobe, while the female is entirely different in coloration. No similar sexual dimorphism occurs in *Bagauda ernstmayri* **sp. nov.** Besides, *B. similis* has different coloration of fore legs, with the femur possessing a small, incomplete pale annulus distally (Wygodzinsky 1966).

Thus, all the four species of *Bagauda* so far reported from in India are quite distinct, and *Bagauda ernstmayri* **sp. nov.** is easily differentiated from them.

Villiers (1970) described two additional cave-inhabiting species of *Bagauda* from Sri Lanka, *B. aelleni* Villiers, 1970 and *B. strinatii* Villiers, 1970. The original descriptions and accompanying illustrations leave no doubt that none of these species are morphologically similar to *B. ernstmayri* **sp. nov.**

Other cave dwelling species of *Bagauda* reported from the other parts of the Oriental Region include *B. lucifugus* McAtee & Malloch, 1926 (Batu Cave, Malay Peninsula), *B. furcosus* Ribes, 1987 (Borneo), and *B. zetteli* Rédei, 2005 (Borneo). The detailed descriptions and/or illustrations provided by Wygodzinsky (1966), Ribes (1987) and Rédei (2005) allow an easy differentiation of these species from *B. ernstmayri* **sp. nov.** *Bagauda zigzag* Rédei & Tsai, 2010 (Taiwan) is a species not associated with caves, but occurring in tree holes and crevices. It has an entirely different coloration, especially on the dorsal part of the pronotum; but in the fore legs also coxa are different in colour; shape of the pronotum, pygophore and overall phallic complex is also different (Rédei & Tsai 2010).

FIGURES 24–25. ***Bagauda ernstmayri*** **sp. nov. in its natural environment.** 24, Live animal on cave wall and 25, on spider web with spider.

Habitat and bionomics. There is another emesine bug, *Myiophanes greeni* Distant, 1903, living in the same caves (Kulkarni & Ghate 2016). Coexistence of other *Bagauda* and *Myiophanes* species has also been reported by earlier authors (Paiva 1919, Kemp & China 1924, Wygodzinsky 1966, Villiers 1970).

Both of these emesines were found on the rocky wall (Fig. 24) of the cave or moving on the periphery of the webs of the spider *Zosis geniculata* (Fig. 25, seen in ventral view on web with some unidentified material, possibly an exuvium). The image of the habitat, showing entrance to the cave, is shown earlier (Fig. 1). None of these emesine bugs were seen to feed on adults, juveniles or eggs of spiders. The long legs allow these bugs to move easily and, coupled with very narrow body, possibly allow these bugs to distribute body weight on the web, and help effortless movement on spider silk, as it was suggested by Wygodzinsky (1966). Spiders were not attracted to their slow movement and were not seen to attack bugs. The bugs were not resorting to flight when disturbed or picked up. Similar observations on another emesine, *Phasmatocoris labyrinthicus* Pape, 2013, have been reported from Arizona, USA (Pape 2013).

It is interesting that many emesines are associated with caves and spider webs (Wygodzinsky 1966), and many possess a pattern of pale white coloration. The loss of pigments might be an adaptation to or an evolutionary consequence of the cavernicolous life habits.

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References

Chandra, K., Biswas, B., Kushwaha, S., Mukherjee, P. & Bal, A. (2015) First record of *Bagauda splendens* Distant (Heteroptera: Reduviidae) from India. *Prommalia*, 3, 74–78.

Dispons, P. (1965) La lignée des *Bagauda* asiatiques (Heteroptera Reduviidae Emesinae). *Bulletin et Annales de la Société Royale d'Entomologie de Belgique*, 8, 97–103.

Distant, W.L. (1903) *The fauna of British India, Rhynchota, 2 (1)*. Taylor and Francis, London, x+242 pp.

Ghate, H. (2013) *Eurysaspis flavescens* Distant, a new Pentatomidae member for Indian Territory. *Prommalia*, 1, 45–48.

Ghate, H. & Jadhav, S. (2015) First record of two color forms of a jewel bug *Tetrarthria variegata* Dallas, 1851 (Pentatomoidea: Scutelleridae: Scutellerinae: Scutellerini), from Phansad, Raigad Dist., Maharashtra. *Prommalia*, 3, 95–99.

Ghate, H. (2015) Rediscovery of the shieldbug *Menedemus vittatus*, with notes on *M. hieroglyphicus* (Heteroptera: Pentatomidae : Pentatominae: Sciocorini), from Pune, Maharashtra, India. *Entomon,* 40 (4), 243–248.

Kemp, S. & China, W. (1924) Rhynchota of the Siju Cave, Garo Hills, Assam and description of a new species of reduviid. *Records of the Indian Museum*, 26, 93–97.

Kocorek, A. & Ghate, H. (2012) *Megymenum distanti*, a new remarkable species of the Dinidoridae subfamily Megymeninae (Hemiptera: Heteroptera: Dinidoridae) from India. *Zootaxa*, 3218, 31–39.

Kulkarni, S. & Ghate, H. (2016) First record of the thread-legged assassin bug *Myiophanes greeni* Distant, 1903 (Heteroptera: Reduviidae: Emesinae) from India. *Biodiversity Data Journal,* 4, e7949. http://dx.doi.org/10.3897/bdj.4.e7949

McAtee, W.L. & Malloch, J.R. (1926) Philippine and Malayan Ploiariinae (Hemiptera, Reduviidae). *Philippine Journal of Science*, 30 (1), 117–152.

Pape, R. (2013) Description and ecology of a new cavernicolous, arachnophilous threadlegged bug (Hemiptera: Reduviidae: Emesini) from Kartchner Caverns, Cochise County, Arizona. *Zootaxa,* 3670 (2), 137–156.
http://dx.doi.org/10.11646/zootaxa.3670.2.2
Paiva, C. A. (1919) Rhynchota from the Garo Hills, Assam. *Records of the Indian Museum*, 16, 350–377.
http://dx.doi.org/10.5962/bhl.part.25927
Rédei, D. (2005) *Bagauda zetteli* sp.n., a new cavernicolous thread-legged bug (Insecta: Heteroptera: Reduviidae: Emesinae) from Borneo. *Annalen des Naturhistorischen Museums in Wien*, 106B,135–140.
Rédei, D. (2007) The identity and taxonomic position of *Pleias* Kirkaldy, 1901 (Hemiptera: Heteroptera: Reduviidae: Emesinae). *Zootaxa*, 1583, 59–64.
Rédei, D. (2008) *Bagauda* Bergroth, 1903 (Insecta, Heteroptera): proposed precedence over *Pleias* Kirkaldy, 1901. *Bulletin of Zoological Nomenclature*, 65 (2), 93–96.
Rédei, D. & Tsai, J. (2010) A survey of the emesine assassin bugs of the tribes Collartidini, Leistarchini, Emesini, and Metapterini of Taiwan (Hemiptera, Heteroptera, Reduviidae). *Deutsche Entomologische Zeitschrift,* 57 (1), 11–36.
Ribes, J. (1987) Un nouvel Emesinae troglophile indo-malais (Heteroptera, Reduviidae). *Revue Suisse de Zoologie,* 94 (2), 251–256.
http://dx.doi.org/10.5962/bhl.part.79718
Villiers, A. (1970) Emesinae des grottes de Ceylan (Hem. Heter. Reduviidae). *Revue Suisse de Zoologie,* 77 (2), 321–325
http://dx.doi.org/10.5962/bhl.part.75899
Wygodzinsky, P. (1966) A monograph of the Emesinae (Reduviidae, Hemiptera). *Bulletin of the American Museum of Natural History,* 133, 1–614.