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A new species of *Platypleura* Amyot & Audinet-Serville, 1843 (Hemiptera: Cicadidae: Cicadinae) from the Eastern Ghats of Andhra Pradesh, India

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Abstract

We here describe a new cicada species, *Platypleura poorvachala* sp. nov., (Hemiptera: Cicadidae: Cicadinae) from the Eastern Ghats of India. The combination of following characters distinguishes this species from its platypleurine relatives: (a) transverse continuous infuscation along the nodal line and in the central area of the forewings, and (b) opaque hindwings, which are indochine-coloured with two prominent sub-distal black bands. We illustrate the male and female types and the male genitalia, and present a photographic plate for comparison of this species with other Indian and Southeast Asian *Platypleura* species with respect to its morphology and distribution.

Key words: Platypleurini, Hamzini, species discovery, morphotaxonomy, biodiversity inventory, Peninsular India

Introduction

Cicadas of the genus *Platypleura* Amyot & Audinet-Serville, 1843 (Cicadidae: Cicadinae: Hamzini) are the most speciose within the tribe, and are distributed across Africa (Villet 1997), the Indian subcontinent (Distant 1906b), Southeast Asia (Lee 2008, 2009, 2010), and East Asia (Hayashi 1974; Lee & Hayashi 2003). The genus comprises 101 taxonomically valid species in the world (Sanborn 2014), of which 21 are reported from the Indian subcontinent (Price *et al.* 2016). A *Platypleura* species found during our ongoing Indian cicada surveys did not match descriptions of any known Indian cicadas (Distant 1889, 1891, 1892, 1906a; b, 1916; Price *et al.* 2016) and other Southeast Asian Platypleurines, so we describe it below.

Materials and methods

Specimen collection. We collected three male and one female specimens on 25.vi.2016 in a scrub and dry deciduous forest patch (13.4000°N 79.7833°E; Image 1) near Nagalapuram, a village in Chittoor District of Andhra Pradesh in peninsular India (Map 1), and one male in the Jagamarla village, also in Chittoor District, on 4.vii.2013.

Specimen processing. We pinned four specimens (three males: UASB01219049, NCBS-AW142, NCBS-PT550, and one female: NCBS-AW141), which are illustrated below (Figures 1–9). We also pinned the fifth (male) specimen (UASB01219050) with its wings closed, which we subsequently used for dissecting the male genitalia and legs, because of which this specimen is no longer intact but all the dissected body parts have been kept together in a glycerol vial for reference. We preserved tissue sample (all three legs from the left side and thoracic muscle) from the male paratype NCBS-PT550 in absolute (100%) ethanol for molecular sequencing, which is stored in a -40°C freezer.

Dissections. We cleared the last two abdominal segments of the male paratype (UASB01219050) using 10% KOH to dissect the genitalia, which were then preserved in a vial containing anhydrous glycerol. Right foreleg and hindleg were also dissected from the same paratype.

Imaging. We photographed dissected organs using Leica DFC425 digital camera mounted onto a Leica M250 C stereomicroscope. We used Labomed Luxeo 2SA microscope to examine specimens for morpho-taxonomic work. We photographed a single live specimen (Image 2) and pinned specimens (Figure 1) using a Canon EOS 7D DSLR camera body and a 100mm macro lens, using Zerene Stacker to stack multiple photographs of pinned specimens to achieve extended depth of field.

Measurements. We used ImageJ (Schneider *et al.* 2012), an open source Java image-processing program to obtain morphometric measurements from images of pinned specimens.

Morpho-taxonomy. We adopted the terminology from Moulds (2005, 2012) for this species description.

Type material details. Holotype: An adult male (UASB01219049; Figure 1A); 25.iv.2016; Nagalapuram village in Chittoor District, Andhra Pradesh, India (13.4000°N 79.7833°E, Map 1); leg. Yeshwanth H. M.; deposited in the Entomology Department, University of Agricultural Sciences (GKVK), Bengaluru (previously popularly known as Bangalore), India.

Paratypes: (i) Adult female (allotype, NCBS-AW141; Figure 1B) with the collection data same as the holotype, (ii) adult male (NCBS-AW142; Figure 1C) with the collection data same as the holotype, and (iii) adult male (NCBS-PT550); 4.vii.2013; Jagamarla, Chittoor District, Andhra Pradesh; leg. K. Kunte. These three paratypes are deposited in the research collections of the National Centre for Biological Sciences, Bengaluru, and (iv) adult male (UASB01219050) with the collection data same as the holotype, now deposited in the Entomology Department, University of Agricultural Sciences (GKVK), Bengaluru, India.

Diagnosis. *Forewings* of *Platypleura poorvachala* **sp. nov.** are largely opaque with few hyaline patches. A transverse continuous infuscation along the nodal line, a small hyaline patch distal to the nodal line and a large transverse infuscation patch in the centre are characteristics of the species. *Hindwings* are completely opaque and indochine-coloured (yellowish brown; colour approximation, #C27400, <http://chir.ag/projects/name-that-color/#C27400>), with two distinctive black bands in the sub-distal parts. *Thorax* lateral sigilla posteriorly merges with discal black spots in scutal depression.

Platypleura poorvachala **sp. nov.** is clearly distinct from its sympatric relatives *P. basialba* (Walker, 1850), *P. capitata* (Olivier, 1790), *P. hampsoni* (Distant, 1887), *P. octoguttata octoguttata* (Fabricius, 1798), *P. octoguttata* var. yellow (unpublished), *P. polita polita* (Walker, 1850) in many morphological traits such as size, characters on the forewings and hindwings hence *poorvachala* **sp. nov.** can easily be separated from the aforementioned species. However, *Platypleura watsoni* Distant, 1897 (Figure 2G), reported from Myanmar and Indochina, *P. mira* Distant, 1904 (Figure 2H), known from Indochina, and *P. nigrosignata* Distant, 1913 (Figure 2I), a possibly endemic species from Vietnam (Pham 2009), appear morphologically somewhat similar to *P. poorvachala* **sp. nov.** However, *Platypleura poorvachala* **sp. nov.** can be distinguished from its non-sympatric relatives based on the following traits:

(i) *forewings* are coriaceous in *mira* and *nigrosignata* with very few transparent areas whereas they are glassy and have more transparent areas in *poorvachala* **sp. nov.** (also, in *watsoni*). The basal half until the nodal line of *poorvachala* **sp. nov.** is more opaque than *watsoni*. *Platypleura poorvachala* **sp. nov.** has very narrow forewings among all other species: the node to anal angle distance is about 7.5mm in *poorvachala* **sp. nov.**, about 9.5mm in *watsoni* and *nigrosignata*, and about 12mm in *mira*. (ii) *hindwings*: completely opaque, indochine-coloured with two distinctive black bands at the sub-distal parts. These bands merge at the costal margin of the 1st apical cell in *poorvachala* **sp. nov.** (also, in *nigrosignata*) whereas the bands remain almost separated in *mira* and are fused at the 1st and 6th apical cells in *watsoni*. (iii) *thorax*: the width of pronotal collar in *poorvachala* **sp. nov.** (10mm) is greater than *watsoni*, *mira*, and *nigrosignata* (9mm in each). The lateral angle of pronotal collar is pronounced in *poorvachala* **sp. nov.** whereas it is rather rudimentary in *watsoni*, *mira*, and *nigrosignata*. Lateral sigilla posteriorly merges with discal black spots in scutal depression which is not seen in the other species.

Systematics

Family Cicadidae Latreille, 1802

Subfamily Cicadinae Latreille, 1802

Tribe Hamzini Distant, 1905

Genus *Platypleura* Amyot & Audinet-Serville, 1843

= *Cicada* (*Platypleura*) = *Platypleura* (*Platypleura*) = *Patypleura* (sic) = *Plathypleura* (sic) = *Platypeura* (sic) = *Platypleure* (sic) = *Rlatypleura* (sic) = *Poecilopsaltria* Stål, 1866 = *Poecilopsaltria* (sic) = *Paecilopsaltria* (sic) = *Poecilopsaltera* (sic) = *Platypleura* (*Poecilopsaltria*) = *Systophlochius* Villet, 1989 (Sanborn 2014).
Type-species: *Cicada stridula* Linnaeus, 1764

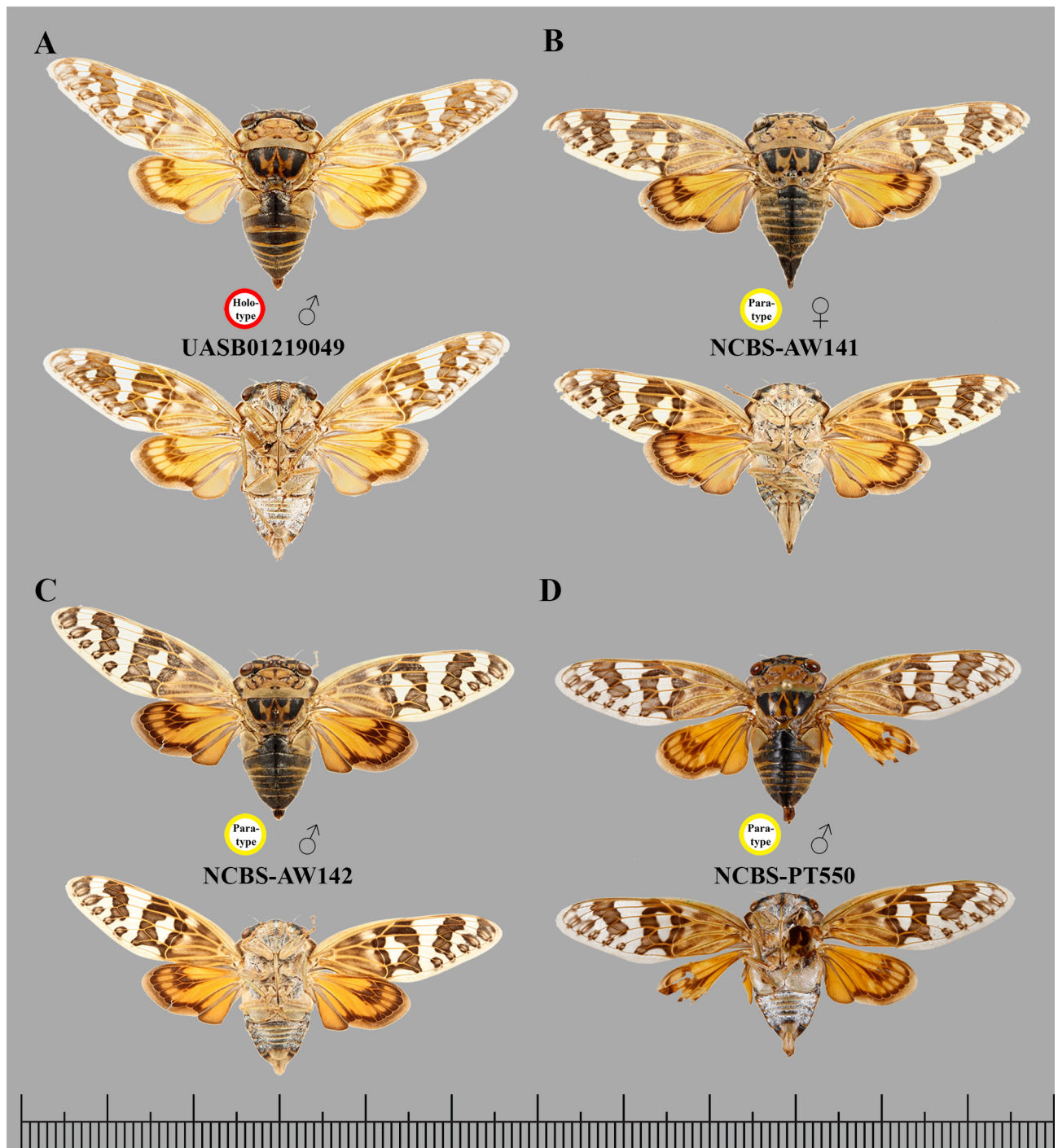


FIGURE 1. Type specimens of *Platypleura poorvachala* sp. nov. A millimeter-scale is at the bottom. Top images show dorsal sides and bottom images show ventral sides of the same specimens, with specimen codes, type labels and sex shown in the centre.

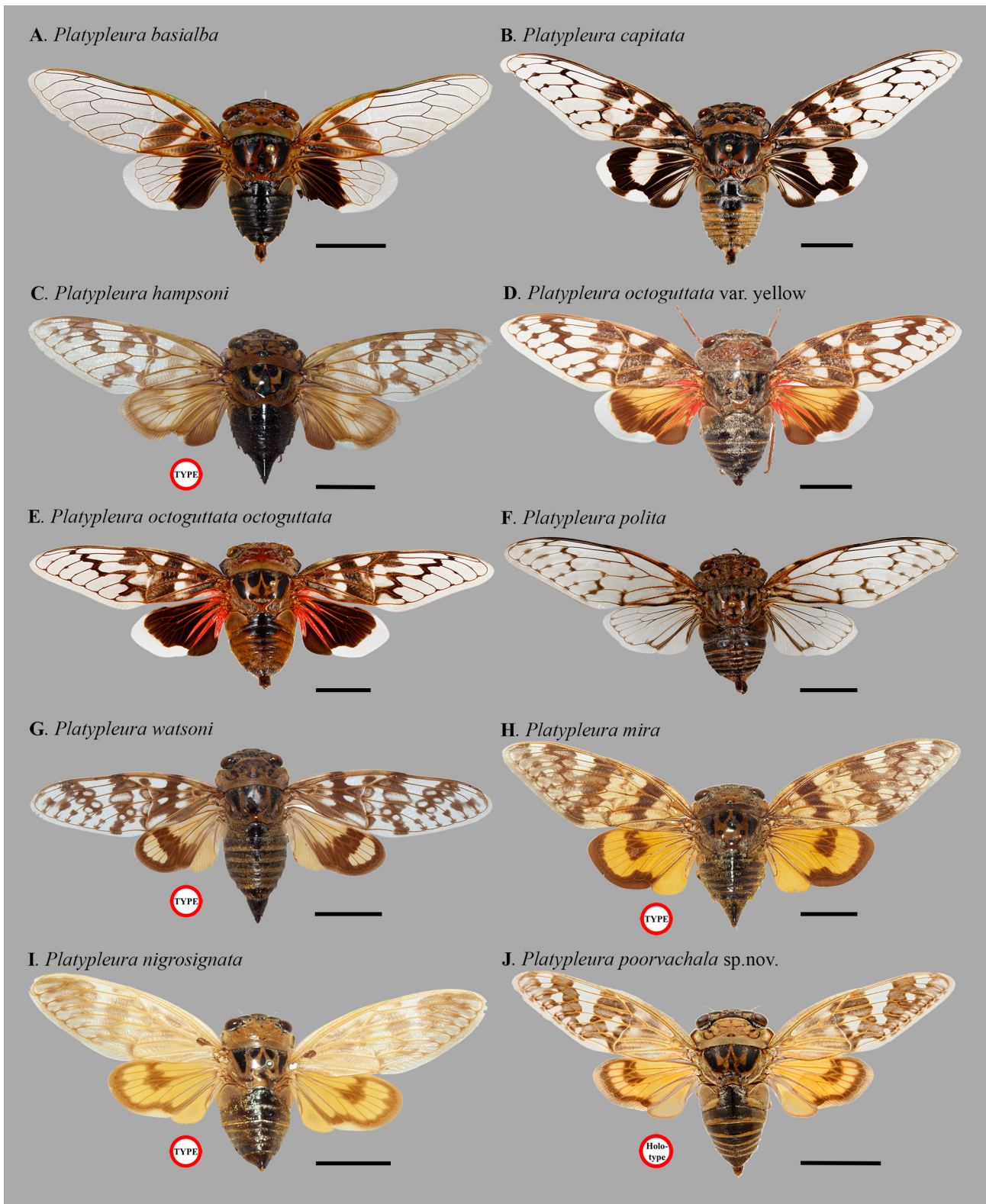


FIGURE 2. A comparison of sympatric (A-F), possibly sympatric (G), and morphologically similar but allopatric Hamzini (H-I) with *Platyleura poorvachala* sp. nov. Location of specimens: A,B,E,F: NCBS research collections, C,D,G,H,I: Benjamin W. Price (copyright Natural History Museum, London), J: Entomology Department, University of Agricultural Sciences (GKVK). A ten-millimeter scale is given with each species.

Amyot & Serville, 1843 described the genus *Platypleura* comprising cicadas with squat, hairy bodies. *Head* is very broad and short, bearing epicranial suture. Eyes are round and large, and usually protrude out. *Pronotum* is wide and short, dilated on either side, making it wider than the head including eyes. *Mesothorax* has a cruciform elevation and scutal depression. Basal half of *forewing* is coriaceous and remaining part of the wing is more or less transparent with a transverse vein (nodal line) separating the coriaceous and membranous (transparent) areas. These characters match the species described below.

***Platypleura poorvachala* sp. nov.**

(Figures 1–9; Table 1; Image 2)

Etymology. *poorvachala* is amalgamation of two Sanskrit words: *poorva*=east, and *achala*=mountains. We name this species *poorvachala* because it occurs in the Eastern Ghats mountains of peninsular India.

Description of the male holotype (UASB01219049; Figure 1A): **Forewings** (Figure 3) 25mm in length, with 8 apical cells, and no significant difference between the dorsal and ventral surfaces. Basal 1/3rd wing (from the anterior side); basal cell, radial cell, proximal part of 3rd ulnar cell from the nodal line, proximal part of medial cell (**mc**) from the nodal line, cubital cell (**cuc**), and clavus, are opaque and brownish in appearance. Infuscation is seen along the nodal line (starting from **n** until **CuA₂**); the proximal and distal parts of 1st and 2nd ulnar cells are infuscated, leaving a patch of hyaline area in the middle; infuscation is seen in the middle along with the extremities of the 3rd ulnar cell, leaving hyaline patches in between the infuscated areas; the junctions of ulnar cells to their corresponding apical cells (1st to 5th) and the junctions of **mc**, **cuc** to their corresponding apical cells (6th to 8th) are infuscated, too; on the distal side, at the junctions of ambient veins of ulnar cells to marginal area is infuscated. At these junctions, a slight spillover is seen in the marginal area. The infuscation produces two lateral continuous patches on forewings. The first one is distal to the opaque area, merging with the latter on the side, leaving a small hyaline patch in the middle. The second infuscated patch leaves hyaline areas in between the first one to itself and distal area of apical cells. Nodal line is distally convex in the 3rd ulnar cell and medial cell. A slight dilation is seen between costa (**C**) and radius+subcostal vein (**R+Sc**). **C** and **R+Sc** are greenish in appearance. Ambient veins appear convex in marginal area. Veins are ochraceous-brown. Dilation of subcostal membrane is seen from near the node, dilation gradually increasing closer to the base of the wing. Denticulation is seen along the apex of costal membrane from its base until the node, and continues further through the length of subcostal vein (**Sc**) till the junction of RA₁ and Sc. Costal membrane is uninterrupted. It merges with the junction of marginal area at the subcostal and radius anterior vein. Apex of the wing is opposite to the 2nd apical cell. Marginal area is hyaline and uneven, which makes it appear wavy. Wings are covered with numerous microtrichia.

Hindwings (Figure 4) 14mm in length, with 6 apical cells, and no significant difference between the dorsal and ventral surfaces. They are opaque and indochine. Distal end of costal cell (**cc**), radial cell, medial cell (**mc**) and the proximal end of their corresponding apical cells (1st to 5th) are black. The distal end of all the apical cells, cubital cell 1, cubital cell 2, anal cell 1, anal cell 2, anal lobe are black. In the 1st to 4th apical cells the lateral margins are also black, thus making the black colour continuous, leaving indochine colored central area. Proximal side of the **cc** and **mc** are grey. Claval fold, anal cell 1, anal lobe (anal cell 2/ vannus, jugal fold, anal cell 3/ jugum) are grey as well. Ambient veins appear convex in marginal area. Marginal area (**ma**) is greyish; **ma** and wing margin is uneven, which makes it appear wavy. Veins are indochine-colored.

Head—dorsal side—including eyes is slightly wider than the base of pronotum (**pro**). It is ochraceous in appearance. There are three prominent black transverse and short longitudinal fasciae. Of the three transverse fasciae, the first fascia is continuous, connecting the pedicels through supra-antennal plate and dorsal part of the postclypeus (**pc**). The second fascia is the broadest, covering major portion of the vertex. It becomes thicker, giving it a blobby appearance in the middle where the ocelli are situated. The third fascia is between the eye-pronotum junctions. Of the three longitudinal fasciae, one on epicranial suture is slightly broader than lateral ocelli and has two parallel fasciae on both sides of the epicranial suture. Antennae are olivaceous. Junctions of pedicel and flagella of antenna are brownish, but the tips of the flagella are black.

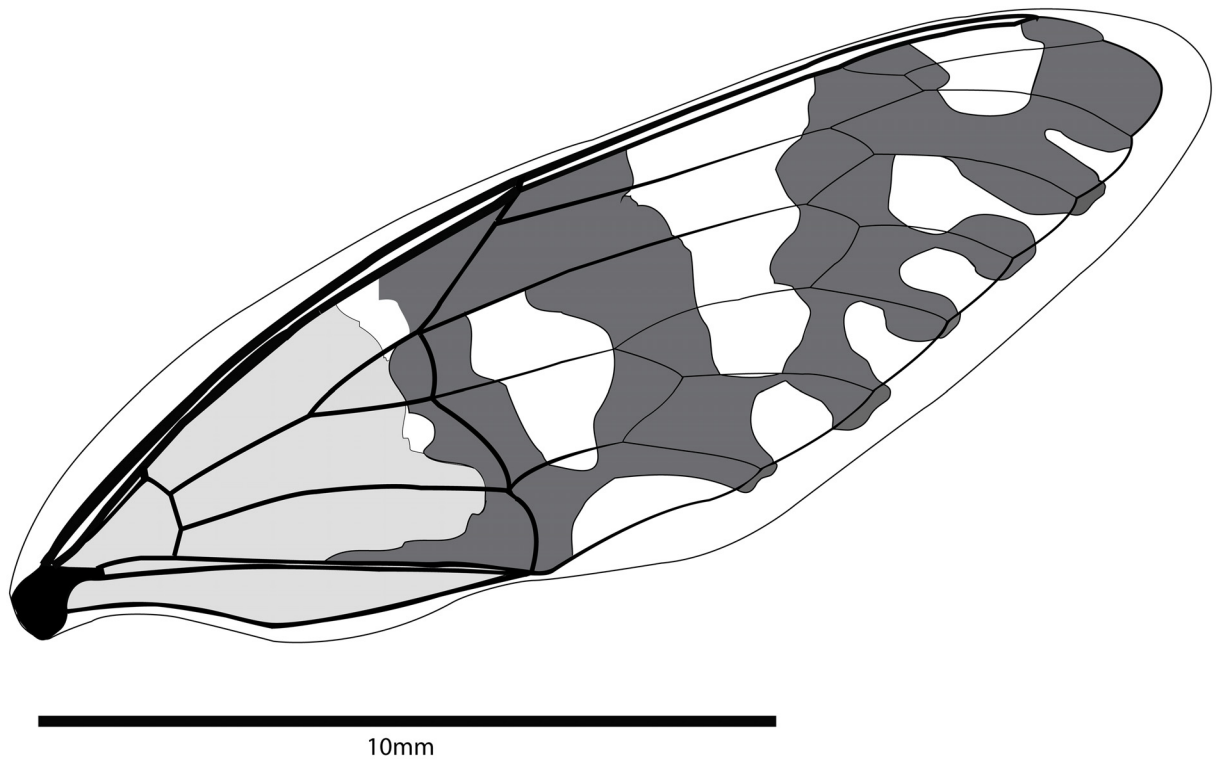


FIGURE 3. Forewing venation and markings of *Platypleura poorvachala* sp. nov. (male holotype UASB01219049).

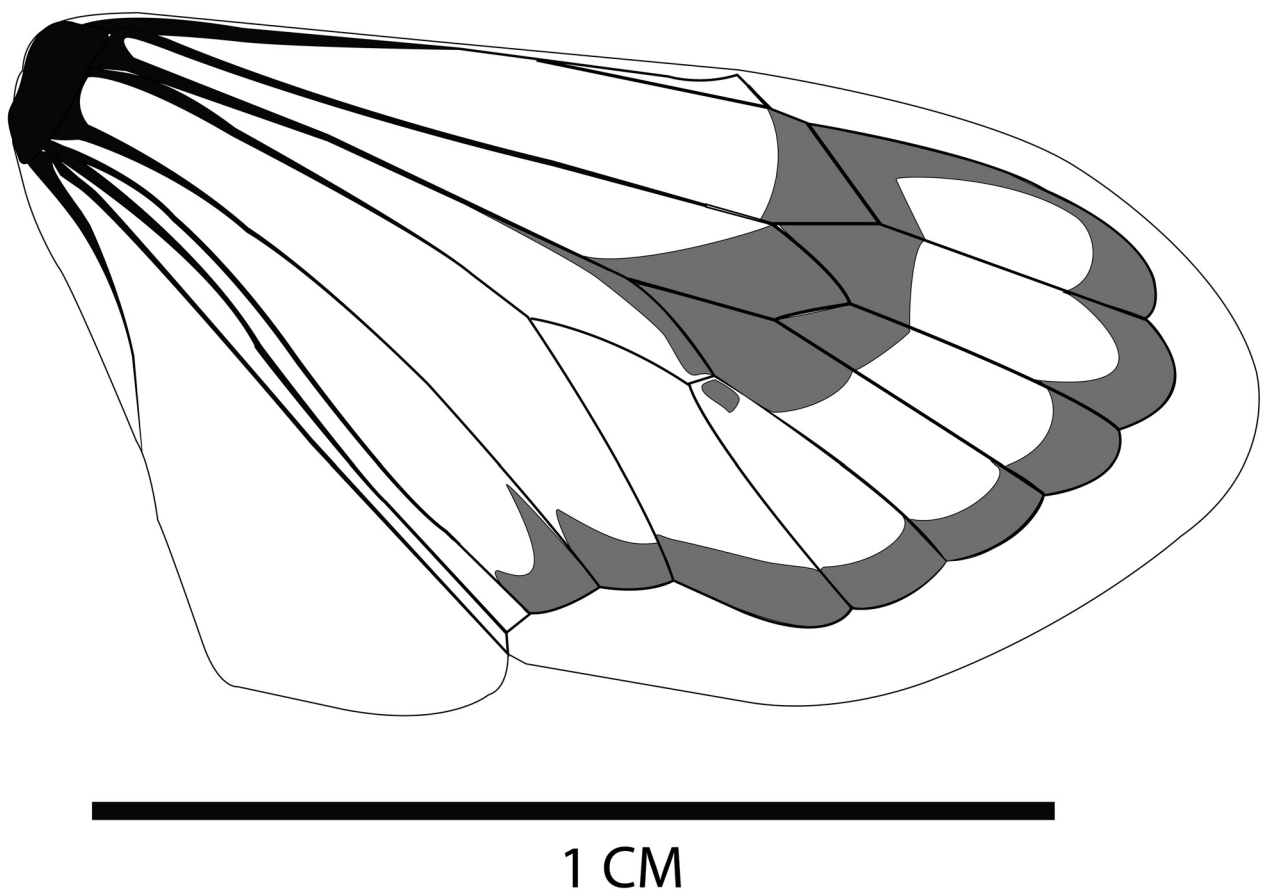


FIGURE 4. Hindwing venation and markings of *Platypleura poorvachala* sp. nov. (male holotype UASB01219049).



10mm

FIGURE 5. Head and thorax of *Platycleura poorvachala* sp. nov. (male holotype UASB01219049).

TABLE 1. Morphometric measurements (in mm) of the type specimens of *Platycleura poorvachala* sp. nov. UASB01219050 is not mentioned since it was used for dissections before it could be measured. Pro+pc=pronotum including pronotal collar, Mes=mesonotum.

	Length							Width			
	Body	Head	Thorax	Abdomen	Proboscis	Forewing	Hindwing	Head	Pro+pc	Mes	Wingspan
Holotype male UASB01219049	20	0.99	7.98	11.31	6.35	24.74	13.52	8.71	10.21	7.23	56.66
Paratype male NCBS-AW142	18.0	1.38	7.22	9.47	6.15	23.44	12.68	8.11	9.52	6.62	53.54
Paratype male NCBS-PT550	19.5	1.42	7.75	10.36	5.35	23.13	12.64	8.26	9.45	7.82	54.2
Paratype female NCBS-AW141	20.1	0.48	7.7	11.92	6.15	24.75	14.12	8.72	10.48	7.5	57.4

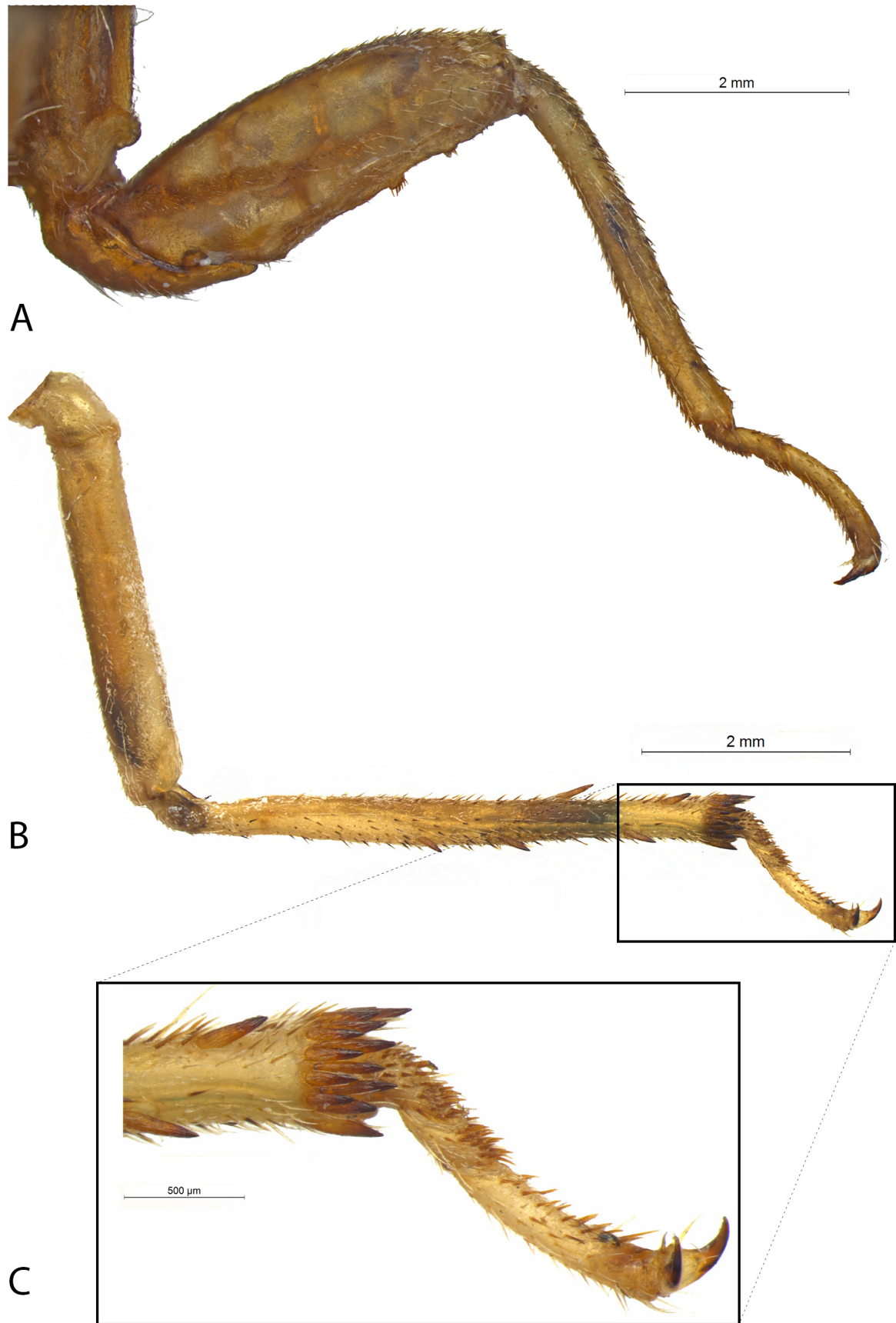


FIGURE 6. Legs of *Platypleura poorvachala* sp. nov. A: foreleg, B: hindleg, C: enlarged portion of hindleg showing tibial comb and tarsus (male paratype UASB01219050).

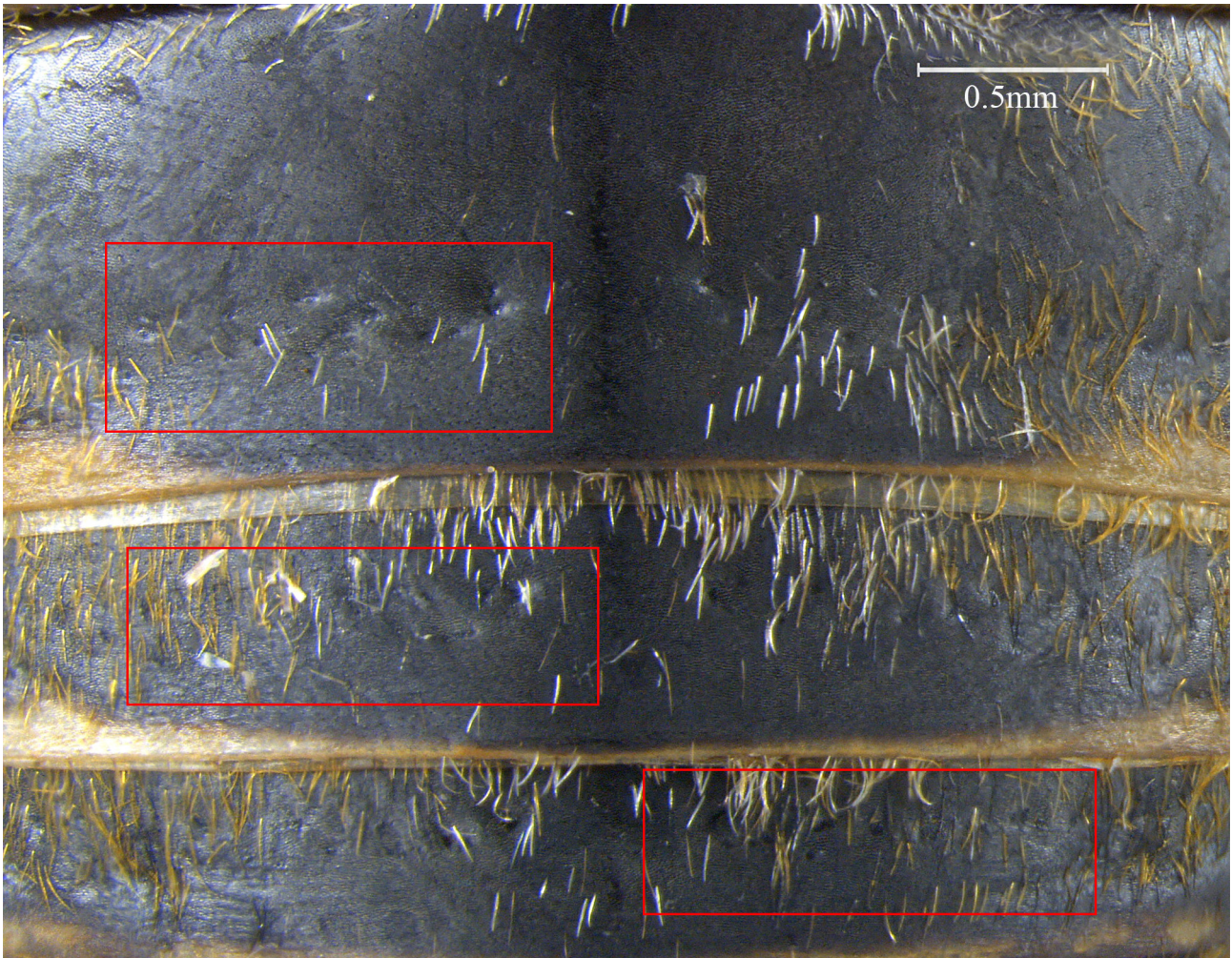


FIGURE 7. Fossae on the dorsolateral sides of abdomen (male paratype NCBS-AW142).

Anterior side of the head is partly hairy. **pc** is black. Eight pairs of olivaceous transverse grooves are present, among which seven are well developed. Gena is olivaceous and lorum is black. Extremities and median ridge of anteclypeus is olivaceous, the rest is black. The entire length of rostrum reaches 1st sternite and is olivaceous with a black tip.

Thorax—dorsal side (Figure 5)—Pronotum (**pro**) is ochraceous with several black markings. There is a slight dorso-median elevation. An obconical black mark is present on the anterior median. Two discal black spots are present on the posterior median, adjoining to ambient fissure of **pro**. Paramedian fissures (**pf**), lateral fissures (**lf**) are black. **pf** almost touches the dorso-median elevation. A black fascia branches out posteriorly close to the middle of **pf**. But in **lf**, it merges with the lateral sides of ambient fissure of **pro**. *Pronotal collar* (**pc**) is olivaceous. Interiors of the lateral angles of the **pc** (**la**) are blackened. Lateral angles of **pc** are horizontally dilated. Lateral margin **lm** anterior to **la** is half in length of **lm** posterior to **la** of **pc**. The extent of the **pc** is wider than the head and abdomen. *Mesonotum* is ochraceous but appears black due to presence of sigilla. Submedian sigilla (**ssig**) and lateral sigilla (**lsig**) are black. **ssig** are anteriorly situated, semi ovoid and not fused. **lsig** anteriorly broad, tapers posteriorly and merges with discal black spots in scutal depression due to which it appears to be continuous. An oblong or cone-shaped black mark is present on the median, between **ssig**. Cruciform elevation is olivaceous. *Metanotum* is olivaceous except for the grooves present adjacent to the cruciform elevation are black.

Thorax—ventral side—is olivaceous and waxy. The areas of basisternum, episternum and epimeron are black. Operculum is olivaceous, extending to posterior end of the 2nd sternite. **Legs** (Figure 6) are hairy and olivaceous. Tarsus, tibia and femur are partly spiny. 3rd tarsus is brown and pretarsal claw tips are black. In *Fore legs* primary and secondary spines of fore femur are rather rudimentary and characterized by the presence of spur. *Hind legs* are characterized by the presence of tibial spur and tibial comb.



FIGURE 8. Male genitalia of *Platyleura poorvachala* sp. nov. (paratype, UASB01219050). A: lateral view with intact operculum, B: dorsal view, C: ventral view, D: operculum.

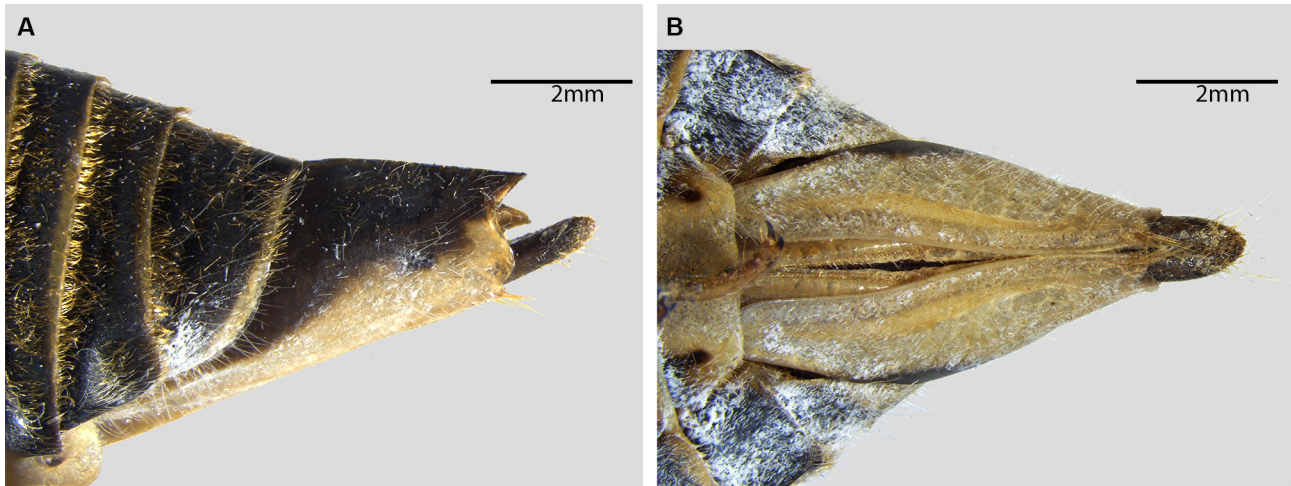


FIGURE 9. Ovipositor of *Platypleura poorvachala* **sp. nov.** (paratype, NCBS-AW141). A: lateral view, B: ventral view.



IMAGE 1. Habitat at the type locality of *Platypleura poorvachala* **sp. nov.** at Nagalapuram, Andhra Pradesh, India.

Abdomen—dorsal side—is primarily black. The 8th tergite including pygofer is brownish. Only a small part of 1st tergite in dorso-median area is visible. Timbals are invisible, covered completely by olivaceous timbal covers. The lateral junctions of 1st to 7th tergites are olivaceous. Posterior and lateral sides of tergites are covered by hairs which are ochraceous and golden, respectively. A series of fossae are present on the lateral sides of the 2nd to 8th tergites (Figure 7).

Abdomen—ventral side—is primarily black and waxy. The visible area of 2nd tergite between the opercula is olivaceous; lateral ends are black. Posterior junctions of each tergite and sternite are olivaceous, giving it a striped appearance. Posterior half and the 8th sternite are olivaceous.



IMAGE 2. *Platypleura poorvachala* sp. nov. in life.

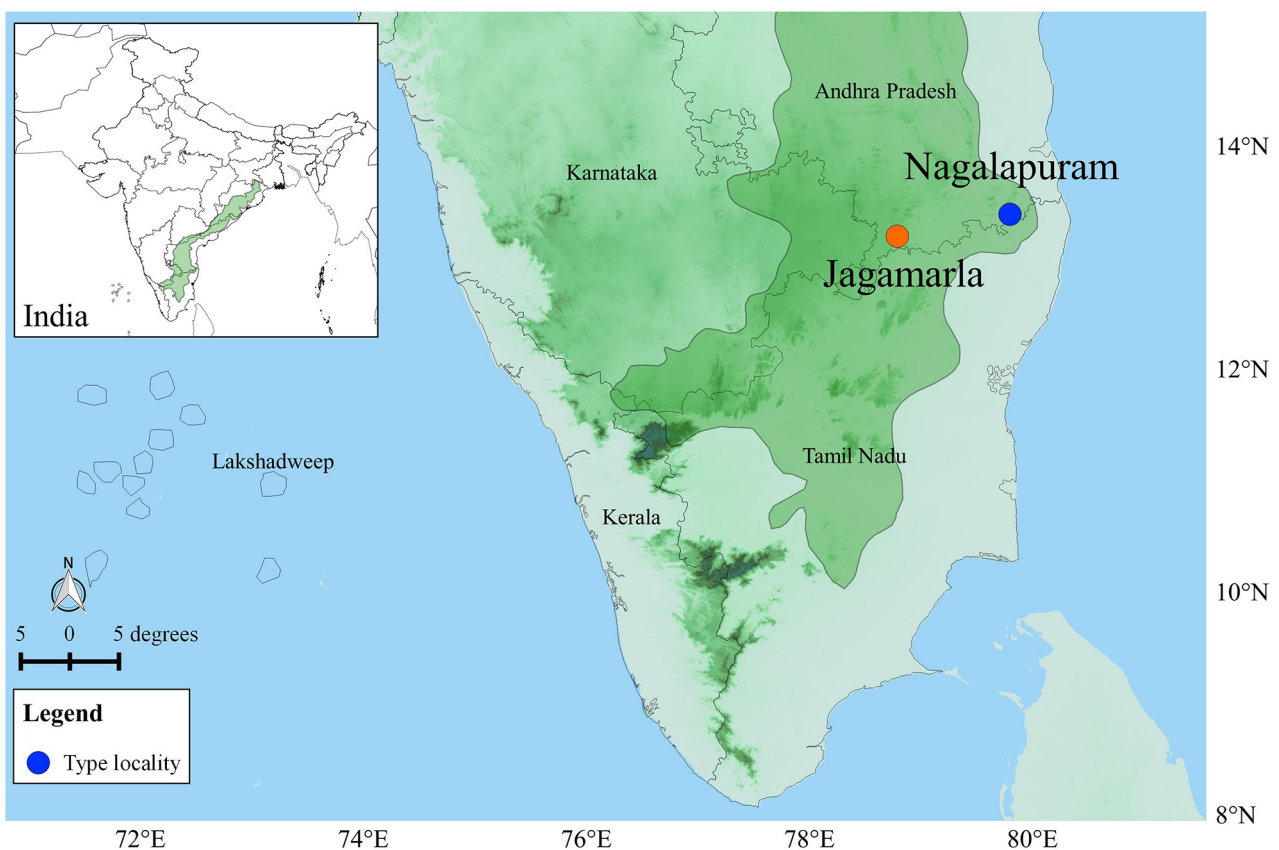
Male genitalia (Figure 8) pygophore oblong, with tapering ends. The basal lobes of pygophore are small whereas the upper lobes are rather elongated. Dorso-posterior anal styles are prominent with a tapered ventro-median uncus segment. The tips of the bifurcated uncus are recurved inward and pointed. There are no lateral processes of the uncus. The aedeagus is slender, approx. 3.4mm in length. It has a short basal plate and a hinge region with a cylindrical theca and a distal portion.

Description of paratypes. Morpho-taxonomic features of the *female* paratype (allotype, NCBS-AW141) are largely similar to the holotype. *Female* is characterized by presence of an ovipositor (Figure 9) and absence of

tymbals, which are common features of Cicadidae. *Female* specimen is slightly larger in size and less melanistic. The morpho-taxonomic features of other *male* paratypes (UASB01219050, NCBS-AW141 and NCBS-PT550) are in agreement with the *male* holotype with minor phenotypic variations (Figure 1).

Ecology and distribution. *Platypleura poorvachala* **sp. nov.** is currently known only from two localities (Nagalapuram and Jagamarla, both near Chittoor) in the southern Eastern Ghats, a loosely connected mountain chain in peninsular India. The species is common but not abundant. Male call has not been recorded but is known to be feeble. Many other ecological aspects of this species remain poorly known. As new information on this species is generated, it will be made available on the Cicadas of India website (<http://www.indiancicadas.org/sp/567/Platypleura-poorvachala>).

Note on the tribal placement of *Platypleura*: Tribe-level phylogeny suggests that *Hamza ciliaris* (Linnaeus, 1758)—the type-species of the tribe Hamzini Distant, 1905—is nested within the monophyletic tribe Platyleurini. Thus, Platyleurini Schmidt 1918 and Orapini Boulard 1985 were suggested to be synonyms of the older and available Hamzini Distant, 1905 (Price 2010). Following this suggestion, the Platyleurini was synonymized with Hamzini by Lee (2014). Therefore, we have treated *Platypleura poorvachala* **sp. nov.** under Hamzini.



MAP 1. Nagalapuram, the type locality; and Jagamarla, Chittoor District, Andhra Pradesh, India, the second known locality of *Platypleura poorvachala* **sp. nov.**

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