https://doi.org/ 10.33307/entomon.v48i2.887
Entomon 48(2): 167-184 (2023)
Article No. ent. 48202

A new species of *Purana* Distant, 1905 (Hemiptera, Cicadidae), from the Western Ghats, with comments on the erroneous records of *Purana tigrina* (Walker, 1850) in south India

Kalesh Sadasivan[1,2*], Jebine Jose[1,3], Bernad M Thampan[4], P.V. Muralimohan[5], Baiju Kochunarayanan[1,6], Anzil Shereef[7] and Mick Webb[8]

[1]*Travancore Nature History Society (TNHS), Jyothis, Mathrubhumi Road, Vanchiyoor 695035, Thiruvananthapuram, Kerala, India.*
[2]*Greeshmam, BN 439, Bapuji Nagar, Medical College, Thiruvananthapuram 695011, Kerala, India.*
[3]*Kaduvathookil House,Elikulam, Kottayam 686577, Kerala, India.*
[4]*Alampallil House, Manamkara, Kambakallu, Nilambur, Malappuram 679333, Kerala, India.*
[5]*Chapters, Alagappanagar Post, Trissur 680302, Kerala, India.*
[6]*Sreerangam, Puravoorkonam, Karakulam 695564, Kerala, India.*
[7]*Chandini, Padinjattekizhakku Sooranad, Kollam 690522, Kerala, India.*
[8]*Department of Life Sciences, The Natural History Museum, London, UK.*
Email: kaleshs2002in@gmail.com; jebinkj2002in@gmail.com; bernardvr@gmail.com; muralimohangnome@gmail.com; baijupaluvally@gmail.com; anzilshereef77@gmail.com; m.webb@nhm.ac.uk.

ABSTRACT: A new species of cicada is described from south India. The new taxon, *Purana cheeveeda* Sadasivan **sp. nov.** is easily differentiated from all the other known species of the *Purana tigrina* species group based on its operculum apex not reaching beyond the anterior margin of sternite 3; tubercles on sternite 4 black and almost as large as those on sternite 3; relatively short rostral length reaching unction of abdominal sternite II and sternite III; the absence of dark fasciae on the transverse grooves of postclypeus, forewing venation, basal lobes of pygofer with large diverging triangular spines and the characteristic pentagonal uncus of the male. The status of *Purana tigrina* (Walker, 1850) from South India is discussed. The topotypes of the taxon commonly identified as *P. tigrina* from south India did not match the morphology of the holotype of *P. tigrina*. In addition, the study of the type specimen of *P. tigrina* demonstrated that the external morphology and male genital characters of the holotype of *P. tigrina* match that of *P. tigrina* from the Malayan region. Hence the type locality is mislabelled. This common taxon from southern India which has been traditionally misidentified is described here as a new species of *Purana*. As per Articles 76A.1.4 and 76A.2, of the *International Code of Zoological Nomenclature* (1999), the type locality of *P. tigrina* is hereby corrected as Malaysia. Based on the findings, *P. tigrina* is removed from the south Indian cicada fauna. The new species has some features common to both the *Purana carmente* group and *Purana tigrina* group, but most characters agree to *Purana tigrina* group, hence is tentatively placed in this group. The characters based on coloration may not be useful in species group classification in *Purana*, hence structural features like male genitalia and venation are taken to revise the existing species group keys. A modified key to the *Purana* species groups and members of the *P. tigrina* species group is also provided.

KEY WORDS: Cicada, Auchenorrhyncha, Leptopsaltriini, cryptic species

* Author for correspondence

© 2023 Association for Advancement of Entomology

INTRODUCTION

Purana Distant (1905) is a speciose Oriental genus of cicadas distributed from Sri Lanka and south India to Malaysia and the Philippine Islands (Distant, 1906; Sanborn, 2013). This genus comprises many cryptic species with high endemism and is distinguishable based only on the morphology of male genitalia and their singing calls, as exemplified in the works of Boulard (2006, 2007, 2013). Price *et al.* (2016) on the distribution of cicadas in the Indian subcontinent, listed four known species from the genus namely *P. tigrina* (Walker, 1850) ranging from south India to Sumatra, *P. morrisi* (Distant, 1892) limited to south India, *P. guttularis* (Walker, 1858) from north-eastern India to Sumatra, and *P. campanula* Pringle, 1955 from Sri Lanka. *Purana tigrina* was described as *Dundubia tigrina* "From Mr. Walker's collection" in the then British Museum of Natural History (NHM) and the type locality was given as 'Malabar' (Walker, 1850: 70). Later, it was treated as *Leptopsaltria tigrina* by Distant, (1889), and the distribution was mentioned as Continental India (Malabar and Trivandrum), and Malay Peninsula (Province Wellesley) as per Distant (1889–1892). Later in 1905, Distant placed the species in the newly erected genus *Purana* and designated it as the type species (Distant 1905). Distant (1906), mentioned the localities of specimens of *P. tigrina* as Malabar, Trivandrum, Tibet, and the Malay Peninsula. Another species from south India, *P. morrisi* (Distant, 1892) was described as *L. morrisi* Distant, 1892. The type specimen of *P. morrisi* BMNH(E) 1009417 was collected from Shivarai Hills, Salem district, Tamil Nadu (Distant, 1906; Price *et al.,* 2016). This species is known only from Madras Province (Tamil Nadu), as per Distant (1906) and Price *et al.* (2016). The Western Ghats and south India thus far have only two known species *viz. P. tigrina* and *P. morrisi*.

Walker's (1850) original description of *P. tigrina* provides only a basic account of its coloration and morphology with no illustrations or any mention of the male genitalia. Similarly, Distant (1889–1892) in his *Monograph of Oriental Cicadidae*, and later in Rhynchotal Notes (Distant 1905), and the Fauna of British India series (Distant 1906) did not examine or describe the male genitalia. It is possible that species lumping was committed by Distant (1905), wherein he used the same name for all similar-looking species from Malabar, Travancore, and Malaya, thus expanding the distribution of that taxon from south India to the Indo-Malayan sub region. Price *et al.* (2016) provided a provisional catalogue, regional checklist, and bibliography of cicadas of the Indian Subcontinent. Price *et al.* (2016), and their online catalogue of images of species and types from the NHM London accessible at https://www.indiancicadas.org (Marathe *et al.,* 2022), does not illustrate the male genitalia of any of the *Purana* species, nor did they discuss the taxonomic validity of any of these taxa.

A similar taxonomic issue in another cicada species from south India was resolved recently by Sadasivan (2021), where, taxonomic lumping had occurred with *Pomponia linearis* (Walker, 1850). Although *P. linearis* was said to occur in the Western Ghats as per Distant (1906) and Price *et al.* (2016), taxonomic confirmation was lacking. It was observed that none of the early descriptions of *Pomponia* from the Western Ghats were complete, and details of male genitalia were absent in Walker (1850) and Price *et al.* (2016). It was finally established that the records of *Pomponia linearis* from the Western Ghats, were erroneous (Sadasivan 2021), and this taxon, which was a hitherto undescribed species, was described as *P. pseudolinearis* Sadasivan, 2021.

During the documentation of cicadas of Kerala State in south India, noted a very common morphotype of cicada similar to *P. tigrina* in external appearance, but differed considerably from the holotype in the structure of the male genitalia and operculum. This species commonly referred to as *P. tigrina* in the published literature on cicadas from the region (Marathe *et al.,* 2022) is very common and abundant throughout Kerala. Of the specimens examined from Kerala, none matched

the holotypes of *P. tigrina* or *P. morrisi* previously said to inhabit the area as per Distant (1905) and Price *et al.* (2016). Moreover, Duffels *et al.* (2007) had established that *P. tigrina* is a taxon inhabiting the Malayan region. On comparing the morphotype with the holotype and specimens of *P. tigrina* from Malaya in NHM London, along with the illustrations of the genitalia of Malayan specimens of *P. tigrina* from Duffels *et al.* (2007) with those of the holotype and that of our taxon, it was observed that specimens from Malabar, Cochin, and Travancore regions of Kerala State differed considerably from the type of *P. tigrina* and Malaysian material of this species in numerous morphological characteristics, especially the male genitalia. Hence it is described here as a new species. Correcting the nomenclature of this extremely common species is important for other taxa awaiting description from the region.

MATERIALS AND METHODS

During the faunal exploration of the state of Kerala in the Western Ghats of south India, numerous cicadas were documented, including a few morphotypes of the *Purana tigrina* species group. Of them, the commonest and most abundant morphotype matching the descriptions of *P. tigrina* was found to be extensively distributed throughout the lowlands of the state and was the only species found to inhabit the previous collection localities of *P. tigrina* in Kerala, as per published data from Distant (1906) and Price *et al.* (2016). Specimen sampling was done from the locations representing the erstwhile state of British Malabar (the apparent type locality of *P. tigrina*), and the old kingdoms of Cochin and Travancore. The study locations were Nilambur in Malappuram District in northern Kerala representing Malabar; Mukundapuram, Trichur district, and Pala in Kottayam district from central Kerala representing Cochin region; and Palode and Kulathupuzha in Trivandrum District representing the erstwhile Travancore (Fig. 1). Images of the male genitalia of the type specimen of *P. tigrina* were obtained from NHM London with the following labels: "Malabar" NHMUK 013585498 (formally BMNH(E) # 1009413). Reference was also made to the type of *P. morrisi* (Distant, 1906) (NHMUK 013585498, formally BMNH(E) # 1009413), also from south India. Field photographs were taken with a Canon 70D Digital SLR camera, Canon 180 mm macro lens, and MPE 65 f 2.8 1–5x Lens. The morphology was studied and measurements were taken with a HEADZ Model HD81 stereomicroscope. Terminology for morphological description and venation follows Moulds (2005). The basic cicada taxonomy follows Dmitriev *et al.* (2021). Measurements follow a modification of morphometrics from Sarkar (2019) and Sadasivan (2021). Orientation of spines as per their mid-axis and their attachment to the body is referred to as 'erect', 'semi-erect', 'semi-decumbent', 'decumbent' and 'adpressed' (Sadasivan, 2021). The structure of the male genitalia was studied in situ for the type specimens, and for detailed illustrations, they were dissected and treated with 10 per cent KOH overnight and later preserved in glycerol. Illustrations were hand-drawn by the first author and then digitalized. The original descriptions, type specimens, and field photographs were analysed.

Measurements (in mm taken in the dorsal view, unless specified) and indices used in descriptions as per Sadasivan (2021) are as follows (arranged in cephalocaudal order) –

HL—Head length; length of the head in the midline from the anterior-most point of the postclypeus to the mid-posterior margin of the head, measured dorsally.

HW—Head width; width of the head including the compound eye, measured between the lateral-most points of convexity of the compound eye in dorsal view in the transverse plane.

EL—Eye length in the dorsal view.

PL—Pronotum length at the mid-dorsal line.

PW—Pronotum width; maximum width, measured in dorsal view.

ML—Mesonotum mid-dorsal length to the cruciform elevation, in dorsal view.

MW—Mesonotal width.

FWL—Forewing length; the maximum expanse of the forewing from its medial most attachment to the mesonotum to the most convex part of its apex.

FWW—Forewing width; distance between the node and the tornus across the forewing.

HWL—Hindwing length; the maximum expanse of the hindwing from its medial most attachment to the mesonotum to the most convex part of its apex.

AL—Abdomen length; mid-dorsal length of the abdomen measured from the posterior-most point on the cruciform elevation to the tip of the pygofer or anal style, whichever is the farthest, in the freshly killed insect.

AW—Abdomen width; the maximum width measured in the transverse plane in dorsal view, in the freshly killed insect.

OPL—Operculum length, in lateral view.

RL—Rostrum length.

ABL—Anterior body length; length of the specimen from the anterior tip of postclypeus to the posterior of scutellum in the midline, HL + PL + ML.

TL—Total Length; HL + PL + ML + AL.

CI—Cephalic Index; (HW/HL) × 100.

OI—Ocular Index; (EL/HW) x 100.

PI—Pronotal Index; (PW/PL) × 100.

MI—Mesonotal Index; (MW/ML) × 100.

OPI—Opercular Index; (OPL/ABL) × 100.

API—Anteroposterior Index; ABL/AL × 100.

RI—Rostral Index; (RL/ABL) × 100.

FAR—Forewing Aspect Ratio; high aspect ratio indicates long, narrow wings, and a low aspect ratio indicates short, wide wings (FWL/FWW) × 100.

FI—Forewing Index; (FWL/ABL) × 100.

IWR—Inter-Wing Ratio; (FWL/HWL) × 100.

GI—Gastral Index; AW/AL x 100, high index value indicates a relatively wider abdomen.

RESULTS

On the misidentification of *Purana tigrina* in south India

Duffels *et al.* (2007), in their revision of the *Purana tigrina* species group, stated that they had examined the holotype of *P. tigrina* but the collections studied by them revealed no further specimens of *P. tigrina* from India or adjacent areas and they concluded that the type specimen may have been mislabelled. While the holotype may be mislabelled, Price *et al.* (2016) recorded the type locality as Malabar itself. None of the early works mentioned male genitalia morphology in species descriptions and hence we think that species lumping (taxonomic lumping) occurred in Distant (1905), where he used the same taxon name for similarly looking taxa from Malabar, Travancore, and Malaya, thus expanding the distribution to southeast Asia. This was reiterated later in Distant (1889–1892, 1905, 1906) and Price *et al.* (2016) due to the lack of examination of male genitalia. Many morphological features, including the male genitalia, of any of the known south Indian species from the *P. tigrina* species group, did not match that of the type specimen of *P. tigrina* which matches specimens of *P. tigrina* from the Malayan region (see Fig. 2 in Duffels *et al.*, 2007). Similarities include, elongated triangular uncus (compared to trapezoidal uncus in south Indian specimens) and slightly converging, ridge-like basal pygofer lobes, compared to spine-shaped basal pygofer lobes in south Indian specimens. This implies that the original type locality as "Malabar" is erroneous, and the *P. tigrina* holotype is mislabelled. Despite extensive efforts in Trivandrum over a decade, we were able to collect only a single morphotype described as a new species below, the male genitalia of which significantly differed from that of the type specimen of *P. tigrina*.

A similar error was recently corrected on the identity of *Pomponia linearis* (Walker, 1850) from south India (Sadasivan, 2021) where taxonomic lumping had occurred with species from northeast India to Vietnam and southeast Asia, and the misidentified one turned out to be a new species *Pomponia pseudolinearis* Sadasivan, 2021. Similar-looking species from a large geographical area were taxonomically lumped into a single taxon due to a lack of study of the male genitalia.

According to Duffels *et al.* (2007), *P. tigrina* is a common species in the Malayan Peninsula, Bunguran Island, South Borneo (Kalimantan Timur),

Sumatra, and Nias. Distant (1905) used the same species name for similar-looking taxa from Malabar, Travancore, and Malaya, thus expanding the distribution to South India. This was followed later by Distant (1906) and Price *et al.* (2016) who did not examine the male genitalia. In agreement with Duffels *et al.* (2007), the older records of occurrence of *P. tigrina* from south India must be treated as misidentifications of the very common and widespread new species of the region described below. As per Articles 76A.1.4 and 76A.2, of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), the type locality of *P. tigrina* is corrected to be Malaysia. Based on these findings *P. tigrina* is removed from south Indian cicada fauna, while the exact limits of distribution in north-east India need to be delineated with extensive fieldwork and study of male genitalia.

Systematic Part

Family Cicadidae Latreille, 1802

Subfamily Cicadinae Latreille, 1802

Tribe Leptopsaltriini Moulton, 1923

Subtribe Puranina Lee, 2013

Genus *Purana* Distant, 1905

Type species: *Purana tigrina* (Walker, 1850), as per Distant (1905).

Type locality: Malaysia (fixed in this paper as per Articles 76A.1.4 and 76A.2, of the *International Code of Zoological Nomenclature*, 1999).

Diagnosis. Head including eyes about as wide as mesonotum; vertex long, its anterior end situated far beyond the level of anterior margin of eyes; lateral margin of pronotum anteriorly dentate; forewing with marginal areas narrow; anterior longitudinal vein (alv) of apical cell 5 as long as that of apical cell 7; bases of apical cell 2 & 3 strongly infuscated; timbal cover well-developed, without black patch; male operculum small, scale-like, short, reaching or just passing posterior margin of sternite II; male abdomen about as long as the distance from head to cruciform elevation; a pair of tubercle-like projections on abdominal sternites III and IV with projection on each posterolateral surface nearly longitudinally protruding posteriorly; uncus lobes fused and undivided; basal lobe of pygofer (blp) distinct with apex spine-shaped; aedeagus thin (Walker 1850; Distant 1905; Lee 2009; Lee and Emery 2013).

Purana cheeveeda Sadasivan **sp. nov.** (Fig. 2–5)

LSIDurn:lsid:zoobank.org:act:43B6F099-DC3F-45C1-AF60-3E787470D7B1

Holotype—Male, Pala, Kottayam District, Kerala State, India. Col. Jebine Jose 15. vi.2021, 100m A.S.L., from a private estate, male located by its call. Dry pinned specimen. Holotype number THRG 0039. Will be deposited in the National Center for Biological Sciences (NCBS), Bengaluru, India.

Paratypes (4 males and 3 females)—Female THRG 0040; bearing the same data as the holotype; dry pinned specimen; will be deposited in the National Center for Biological Sciences (NCBS), Bengaluru, India. Male THRG 0042, THRG 0049, and female THRG 0050; Mukundapuram, Trichur District, Kerala State, India; Col. Muralimohan; 26.v.2021; 20m A.S.L., dry pinned specimens; will be deposited in National Center for Biological Sciences (NCBS), Bengaluru, India. Male THRG 0041 & female THRG 0048; Palode, Trivandrum District, Kerala State, India; Col. Kalesh Sadasivan; 21. vii.2019; 50m A.S.L.; Dry pinned specimens; will be deposited in the Western Ghats Regional Station, Zoological Survey of India (ZSI), Calicut. Male THRG 0043 (wet specimen in ethanol) and THRG 0047 (dry pinned specimen); Nilambur, Malappuram District, Kerala State, India; Col. Bernard M Thampan; 10. vi.2021; 400m A.S.L.; will be retained as voucher specimens in TNHS collections.

Description of the Holotype (male, THRG 0039). (Fig. 2–5)

The description of the holotype is given in the live state. Upon preservation in alcohol, the yellows and greens lose saturation and become yellow-brown, while blacks and greys become dark brown.

Head. In dorsal view, head small, postclypeus with anterior margin rounded, tip angular; head much wider than long (CI–400); general color of head dull green, with black markings; ocelli pale pink; ocular tubercles dark greenish-black; distance between lateral ocelli and medial margin of eyes twice distance between lateral ocelli; cephalic spots small, black (inconspicuous in dry pinned specimen), epicranial suture with its anterior arms black; vertex on each side bears an L-shaped black patch; ocular socket bordered with black; eyes anteriorly brown, posterolaterally dark green; scape and pedicel black, and flagella brown; frons green, marked with a V-shaped black mark extending anterolaterally from frontal ocelli bordering anterior arms of frontoclypeal suture; supra-antennal plate black; frontoclypeal suture unmarked; dorsum of postclypeus brownish-green with dark greenish-black lines in transverse grooves (Figs. 2A, D).

In anteroventral view, eyes prominent, brown anteriorly, superolaterally greenish-blue, inferolaterally yellowish-white; postclypeus unmarked (Fig. 2C), vertically oval, swollen, inferior aspect triangular, tapering towards anteclypeus on its inferior third, transverse grooves on frons unmarked; lorum green, with sparse greyish pruinescence, its junction with postclypeus and anteclypeus has a thin black streak; anteclypeus green, tipped with black on its region near labrum and with paramedian black streak on superior half, whole surface covered with greyish pruinescence; genae yellowish-green, marked with a thin black transverse black line extending from postclypeus towards eyes; labrum and mentum pale brownish and centrally streaked with dark brown; mentum tipped with brown; labium pale brown with median groove dark brown, with black apex; rostrum reaches junction of abdominal sternite II and sternite III (Figs. 2B, E). In lateral view, posteroinferior border of eyes bluish yellow, superior two-thirds brown.

Pronotum. Pronotal width almost thrice its length (PI–266.67) and its general color green; lateral margin of pronotum dentate; lateral angle of pronotal collar broad and rounded and its posterolateral margin well-developed, rest of collar thinner (Fig. 2D). Median hourglass-shaped black mark prominent, its arms run anteriorly and expand bilaterally along suture with head; a short black streak runs parallel to paramedian fissure; paramedian fissures not prominently marked, lateral fissures marked with an irregular black band; medial and lateral lobes of pronotum brownish-green; lateral lobe bounded with irregular black band; ambient fissure marked with thin brown line; pronotal collar green, a squarish patch of black near lateral angle and a small black spot just dorsal it; posterior margin of collar thinly lined with black (Figs. 2A, D).

Mesonotum. In dorsal view, mesonotum marginally wider than long (MI–116.67), greenish-brown; a mid-dorsal black band with prominent expansions at its middle and on its termination on anterior border of cruciform elevation; submedian sigillum (ssig) brown, bounded by a black vertical lateral streak reaching almost half length of mesonotum and expands at its tip; lateral sigillum (lsig) brown, marked by a central black band which is broken into a distal black spot anterolaterally near pronotal collar and a distal J-shaped streak with a bulbous distal tip; J-shaped marks on lsig never touch black spot on scutal depression; black of scutal depression encroaches posteriorly into anterior arms of cruciform elevation; cruciform elevation greenish-brown and lateral depressions green, rest of it green. Edges of the mesonotum and sides of cruciform elevation covered with sparse silvery pruinescence, which may be lost in preservation. In ventral view, basisterum-2 bears a large black spot (Figs. 2A, D).

Operculum. Triangular, longer than broad, short reaching distal margin of sternite II (OPI–44.12); its lateral margin almost straight with small lateral convexity at its middle, thick and edged with black at its middle; lateral angle is rounded and almost square; posterior margin straight and runs parallel to sternite II; medial angle rounded and acute and medial margin oblique; medial angles of operculum separated from each other by a distance almost equal to width of one operculum; diaphanous light green, with sparse whitish pruinescence (Fig. 2C).

Fig. 1 Map showing the known distribution and type locality of *Purana cheeveeda* Sadasivan **sp. nov.**, and type locality of *P. morrisi* from south India

Wings. Wings hyaline, FW long, apex rounded; transparent with black infuscations only on basal veins of apical segments 2 and 3; very faint spot like marginal smoky infuscations on transverse veins of apical cells 1 to 5, near their junction with ambient vein, which is less discernible towards lower cells; FW apices faintly tinted with amber; HW with 6 apical cells; 9 minor transparent veinlets/folds in anal lobe space between veins 3A and 2A on magnification. Veins of FW reddish-brown and nearing the joints and distally black; anterior wing margin till node brown bordered thinly in the proximal half with black, later part brown; those of HW black. Nodes of both wings pale yellowish-white (Figs. 2A, 4A).

Legs. Brownish-green, more brownish in anteroventral aspect of coxa and femur; tibiae greenish-brown proximally with distal half brown; tarsus brown, claws black. Femur with three black spines; a primary spine on proximal aspect of femur (long, sharp-tipped, oblique, semi-erect); a secondary spine (long, sharp-tipped, semi-erect, thinner than primary spine); small tertiary spine (very short, sharp-tipped, tooth-like) present just distal to secondary spine (Fig. 2E, 4A). Meracanthus (mc) flat, elongated triangular with short base, translucent greenish-white, passes slightly distal to distal border of hind trochanter.

Abdomen. Longer than head and thorax together (AL–14.00, API–78.57); widest at distal aspect of tergite 3; sides gently tapering from 3rd to 7th tergites and thereafter truncated, including VII and VIII. General color bluish olive green marked with black lines and amber-brown to orange-brown suffusion on paradorsal regions of tergites; dorsal aspect of abdomen covered sparingly with silvery pubescence, more so on caudal end. Each tergite bordered black along distal margin, this black band thicker and ingresses into tergite at paradorsal and more so on lateral aspect, tergites 7 and 8 almost fully black. Timbal covers almost enclosing the timbal cavity, incomplete laterally, exposing timbals through a rectangular window between it and superior border of operculum; color pale pinkish-brown with basal black suffusion, lateral margins with thin black border slightly broader posteriorly;

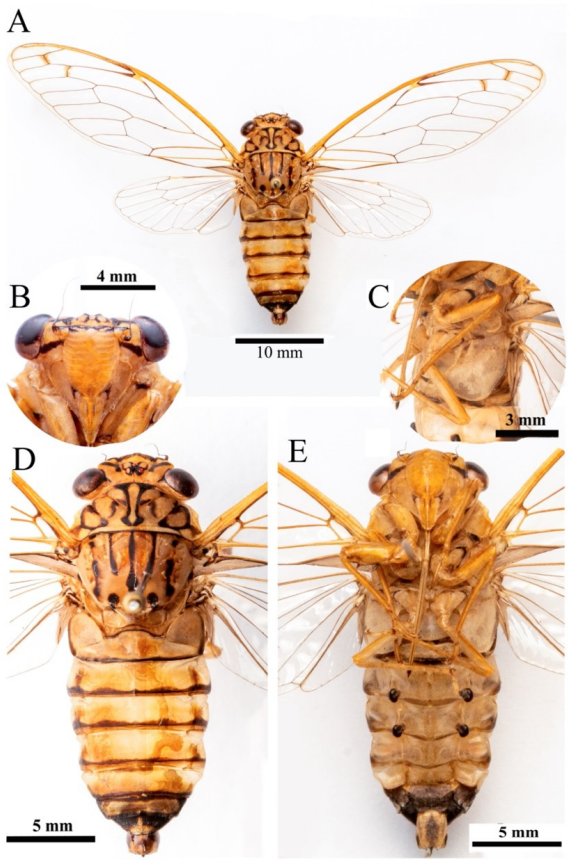

Fig. 2 *Purana cheeveeda* Sadasivan **sp. nov.**, Holotype (THRG 0039): A, dorsal view of the whole insect; B, close-up of head and postclypeus; C, lateral view of the operculum; D, close-up of the dorsum; E, closeup of ventral view. © Kalesh Sadasivan

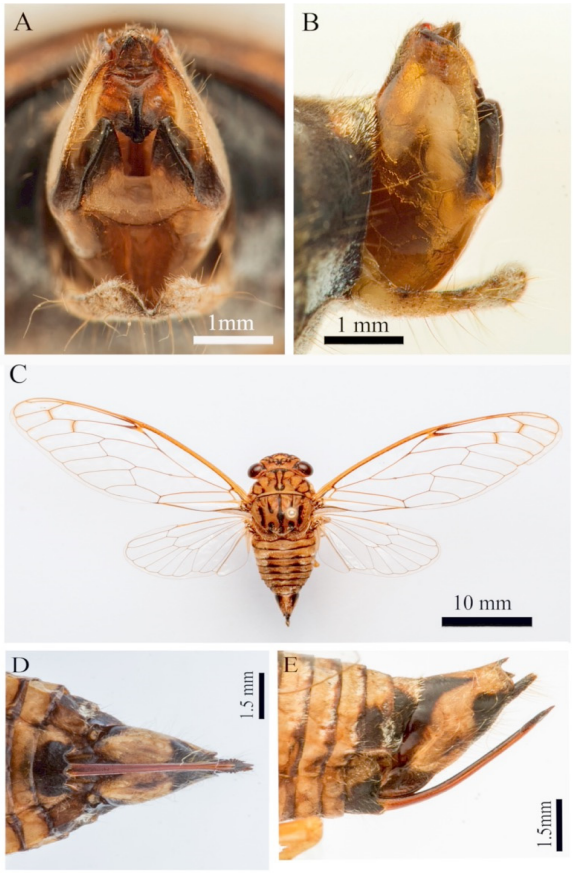

Fig. 3 *Purana cheeveeda* Sadasivan **sp. nov.**: A, male genitalia ventro-posterior view; B, male genitalia lateral view; C, dorsal view of a paratype female (THRG 0040); D, ventral view of the female terminalia (THRG 0040); E, lateral view of the female terminalia (THRG 0040). © Kalesh Sadasivan

medial margin uniformly curved, apex curved and directed towards wing base and its lateral margin straighter. In ventral view, abdominal sternites diaphanous bluish-green, covered with sparse white pubescence; sternite I is exposed in its middle between the operculum on each side; tubercles on distal end of sternite III & IV equal in size and shiny black; 7th sternite and its tergite matt black; tergite 8 similarly black; sternite VIII rounded triangular with a central V-shaped indentation presenting a bifid appearance, greyish white with a central blackish suffusion (Figs. 2A, D, E, 4A, C).

Genitalia. Male genitalia sclerotized at tip of uncus and basal lobes of pygofers. In ventro-posterior view, distal shoulder of pygofer acute, with a short sharp apex directed straight posteriorly; laterally with smooth curve; pygofer bears sparse setae; medial lobe of fused uncus pentagonal (Figs. 5A, 6F) with median incision suggesting a fusion of lobes, its tip slightly notched at exit of aedeagus; distinctly protruding well sclerotized triangular lower basal pygofer lobes directed posteriorly with their blunt apices slightly directed posterolaterally (Figs. 3A, B). In lateral view, distal shoulder with a short,

upturned tip directed dorsally with slight recurvation; basal lobes of pygofer prominent. Aedeagus fish hook-shaped, with its proximal three-fifths thicker and irregular, rest curved, tapers finely to its inwardly directed bevelled tip (Fig. 5D). In dorsal view, apex of distal shoulder of pygofer reaches short of anal style, and dorsal beak of pygofer small (Figs. 5A, C).

Description of females. General color and appearance as in males, major differences are mentioned below. The wing measurements and those of head and thorax are equal, or only marginally smaller than that in males. Length of abdomen, however, is much shorter (AL–11.50±0.71; API–110.52±13.57); operculum small (OPL–1.00±0.05; OPI–9.95±2.82) but more triangular than in males, widely separated and medial border ends at level of meracanthus (mc), posterior margin just reaches level of distal end of sternite I; tympanal covers absent; in ventral view, sternite VII shiny black with its midventral part notched; tergite IX basally orange-yellow and distally black; genitalia with an acute dorsal beak of sternite IX is much longer and prominent than in males; it reaches level of protruding ovipositor sheath. Ovipositor is marginally longer than sheath and dorsal beak together. In lateral view, tergite IX has a black triangular mark on its base and another small black triangular spot on its posterosuperior free end (Figs. 3C–E, 4B, D).

Measurements (mm).

Holotype.

Male. FWL–29.00; FWW–9.00; HWL–14.00; HL–2.00; HW–8; EL–2.00; PL–3.00; PW–8.00; ML–6.00; MW–7.00; AL–14.00; AW–8.00; OPL–3; RL–9.00; ABL–11; TL–25.00; CI–400; OI–250; PI–266.67; MI–116.67; OPI–44.12; API–78.57; RI–81.82; FAR–322.22; FI–263.63 IWR–207.14; GI–57.14.

Paratypes.

Males (n=5): FWL–29±2.00; FWW–8.67±0.58; HWL–13.67±1.53; HL–1.92±1.44; HW–7.67±0.58; EL–1.93±0.12; PL–2.83±0.29; PW–7.50±0.50; ML–5.67±0.58; MW–6.83±0.29; AL–13.67±0.58; AW–7.67±0.58; OPL–3.00±0.00; RL–9.00±1.00; ABL–10.42±1.01; TL–24.08±1.59; CI–400±.0.00; OI–25.23±0.41; PI–265.56±15.03; MI–121.11±7.79; OPI–28.99±2.98; API–76.10±4.28; RI–86.40±4.55; FAR–334.72±11.36; FI–279.11±14.32; IWR–212.93±10.45; GI–56.04±1.09.

Females (n=3): FWL–28.00±1.41; FWW–8.50±0.71; HWL–13.50±0.71; HL–1.86±0.18; HW–7.50±0.71; EL–2.00±0.00; PL–3.00±0.00; PW–7.00±0.71; ML–5.25± 1.06; MW–6.75±0.35; AL–11.50±0.71; AW–7.50±0.71; OPL–1.00±0.05; RL–9.00±0.00; ABL–10.13±1.24; TL–21.63±1.94; CI–400.00±0.00; OI–26.79±2.52; PI–233.33±23.57; MI–130.56±19.64; OPI–9.95±2.82; API–110.52±13.57; RI–76.38±8.16; FAR–321.08±11.25; FI–289.52±14.30; IWR–194.52±1.21; GI–65.15±2.14.

Variation. Individuals vary to some extent in their markings and size. Streaks and marks on the head, pronotum, and mesonotum may be heavy and smudged, and lsig and ssig may have darker brown markings obscuring the black streaks in some individuals. However, on careful observation, the lsig black marks are discontinuous. The J-shaped marks on middle aspect of lsig never touch the black spot on the scutal depression. As far as we could see, this had no particular relation to the population or time of emergence of the year and the variants are often caught together. The pronotum between central fasciae and lateral fissures was generally marked but markings were less discernible in less heavily marked specimens (1 out of 10 specimens studied). There was not much variation in black lines on transverse grooves of the postclypeus, though occasional individuals had them represented by a black medial spot on the first two transverse grooves. In venation, the black infuscations and smoky tint to FW change to amber-brown in preservation. The marginal infuscations may be less obvious in some specimens, though visible at a slanting angle. Wing lengths vary marginally, males have a FL of 29±2.00 mm and females 28.00±1.41mm. In males (n=5), the length of the abdomen (10.42±1.01) was marginally variable. The operculum length (OPL–3.00±0.00) was constant in males. The rostral length was slightly

variable with RL–9.00±1.00 in males and relatively constant in females RL–9.00±0.00. In females (n=4), the length and width of the abdomen were slightly variable (AL–11.50±0.71; AW–7.50±0.7). Variation in the anterior body length was minimal (ABL males–10.42±1.01; females–10.13±1.24), compared to the total body length (TL males–24.08±1.59; females–21.63±1.94). Regarding the male genitalia, the lateral sharp ends of the sclerotized thin black lamina on the free lower margin of the male uncus were sometimes blunted and, in some specimens, the tip of the basal lobe of pygofer was less pointed than normal. The relative position of uncus is variable probably according to the mated status of the males, the tenerals having the uncus flush and lying within the pygofer (Figs. 3A, B), and in mated males, they are conspicuously extruded (Fig. 5B).

Distribution. South-western Peninsular India. As per our observations, the species is very common in the lowlands and midlands of the western slopes of the Western Ghats of South India from Kanyakumari District in Tamilnadu State, extending northwards through all districts of Kerala State, reaching south-western Karnataka State till about Mangalore.

Ecological notes. The species is very abundant in homesteads and jungles up to 300m elevation (Fig.1). The calls start in the fall of twilight, continue into the late evenings, and end at dusk. They are heard calling from the bases of trees and stems of shrubs up to 6 meters. The call is very loud and unmistakable. A group of males will be calling from a patch of the woodland and another group of males will start calling from a different patch as the first batch of calls dies down. They will stop calling as one approach and do not fly away unless disturbed. They sit well camouflaged against the bark of trees. Both sexes are occasionally attracted to light. The main activity is centered around the southwest monsoon from May to July. They are common in cocoa and nutmeg plantations. The songs are continuously heard lasting for hours. The song consists of individual stretches (echemes), each of which lasts for about 20–25 seconds. The initial 5–88 seconds are formed by a series of echemes that increase in tempo and volume as the time progresses, becoming continuous for about 7–10 seconds, and during the last 5–7 seconds, the call decreases in volume and tempo. Each echeme then continues into the next echeme without a pause.

Etymology. The species name *'cheeveeda'* is derived from the Malayalam word *cheevedu* meaning cicada in vernacular and the name *cheevida* means *'it's a cicada!'*.

DISCUSSION

The new species differs from *P. tigrina* of the Malayan subregion as well as the holotype by the following characteristics–the opercula are short and do not extend beyond the distal margin of sternite II, the apex is not acute and is almost straight and lies parallel to the distal margin of sternite II (Figs. 7F, 8C), while the tip is acute and crosses into the proximal aspect of sternite II in Malayan specimens and holotype (Figs. 7D, E, 8C). The lateral margin is straight in the new species while it is oblique in Malayan specimens and the holotype of *P. tigrina* (Figs. 7D, E, 8C). The rostrum is longer and reaches the distal margin of sternite II in *P. cheeveeda* **sp. nov.** (while much shorter in the type specimen of *P. tigrina* only reaching just beyond the distal coxa); tubercles in sternite III and sternite IV are equal sizes (Fig. 7F), while the sternite IV tubercles much smaller than sternite III in Malayan specimens and the holotype of *P. tigrina* (Figs. 7D, E); and male genitalia with strongly sclerotized, tra-pezoidal uncus and spine-shaped basal pygofer lobes (Figs. 6A, B, 7E) in contrast to the elongated triangular uncus and slightly converging, ridge-like basal pygofer lobes with a narrow triangular apex in the type specimen of *P. tigrina* and Malayan specimens (Duffels *et al.,* 2007) (Figs. 6C, D). The length of FW apical cell 2 is half the length of apical cell 3 in *P. tigrina,* while in new species apical cell 2 is almost three-fourths of the length of apical cell 3. With respect to colouration, the new species is less prominently marked on the thoracic segments than in *P. tigrina*; has unmarked post-clypeus and hence no transverse fasciae or hourglass marking of ground color (Fig. 8B) while the transverse fasciae enclosing the hourglass pale area are seen in both Malayan specimens and the holotype of *P. tigrina* (Fig. 8A).

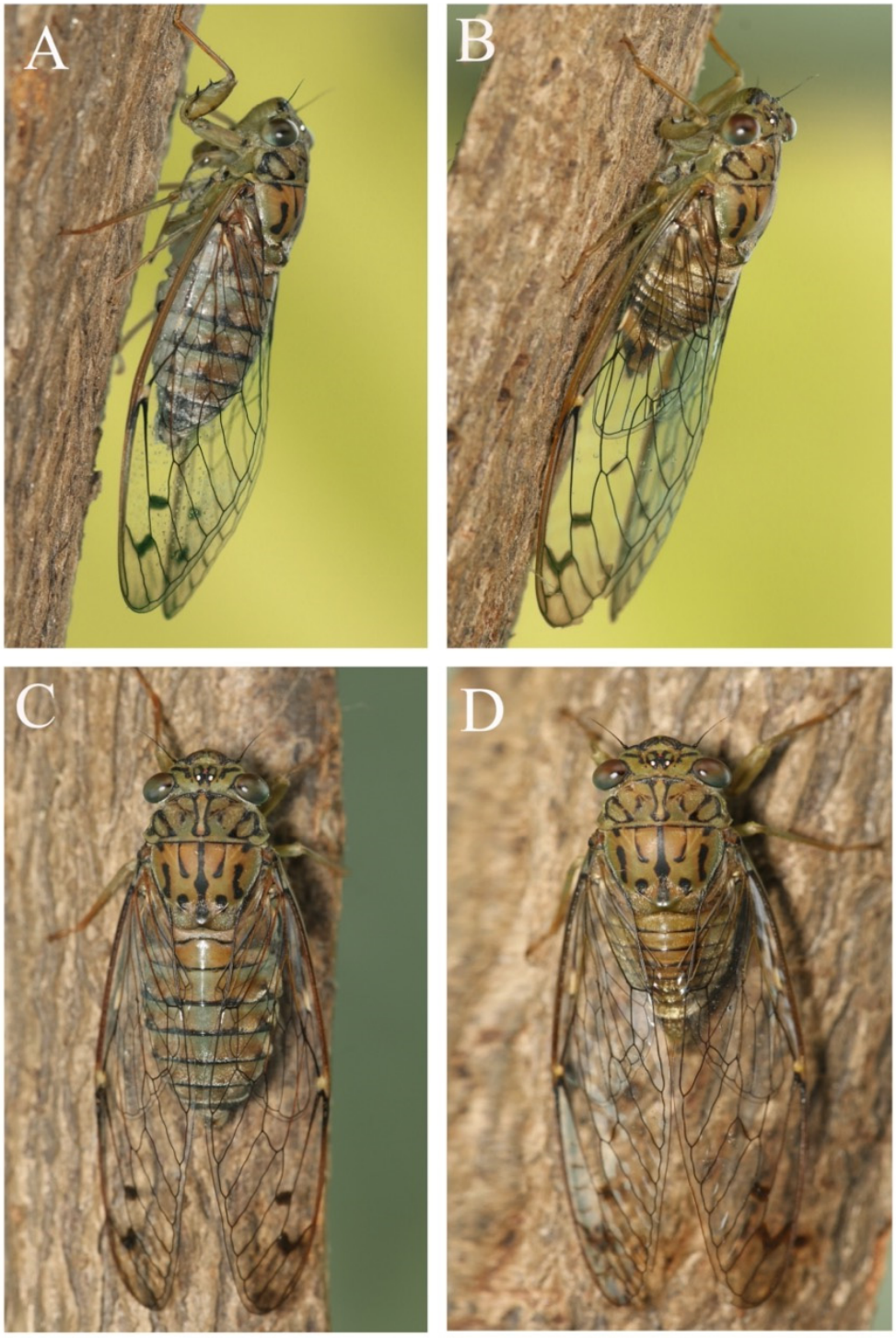

Fig. 4 *Purana cheeveeda* Sadasivan **sp. nov.**, live insect in nature: A, lateral view of the male; B, lateral view of the female; C, dorsal view of the male; D, lateral view of the female. © Kalesh Sadasivan

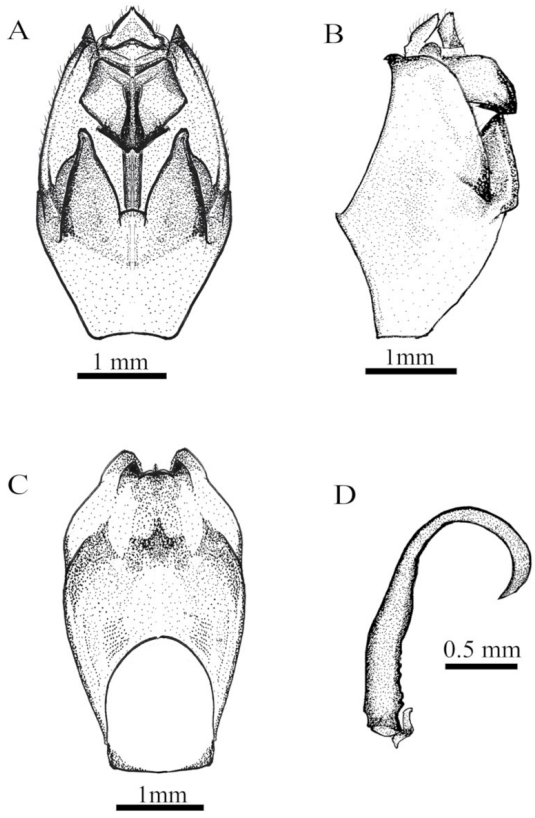

Fig. 5 *Purana cheeveeda* Sadasivan **sp. nov.**, male genitalia of paratype, KOH treated wet specimen preserved in glycerol: A, ventro-posterior view; B, lateral view; C, dorsal view; D, aedeagus left lateral view

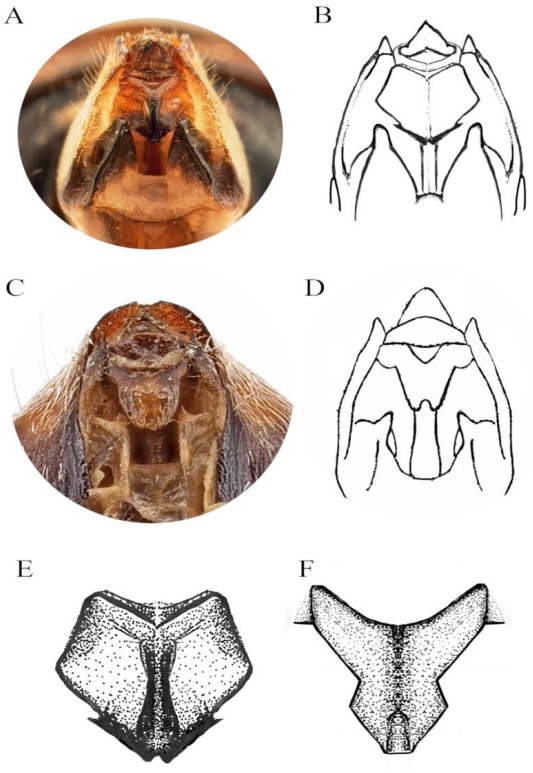

Fig. 6 Male genitalia of *Purana* species. A–B, male genitalia of *P. cheeveeda* Sadasivan **sp. nov.** holotype © Kalesh Sadasivan; C, male genitalia of *P. tigrina* (Walker,1850) holotype Image © Mick Webb; D, Illustration of the male genitalia of *P. tigrina* (Walker,1850) Malayan specimen, redrawn based on Duffels et al. (2007); E, Trapezoid uncus of *P. cheeveeda* Sadasivan **sp. nov.**; F, elongated triangular uncal lobes of *P. morrisi* © Kalesh Sadasivan

Purana morrisi another species known from south India, is easily distinguished from the new species by its long rostrum reaching just beyond the sternite III tubercles (short in the new species never reaching beyond the sternite III tubercles); the operculum in males just reaches the proximal aspect of sternite III in *P. morrisi*, while it ends just short of the distal margin of sternite II in the new species; the presence of transverse fascia on postclypeus (absent in *P. cheeveeda* **sp. nov.**); and the venation with the basal (transverse vein) of a2 (apical segment of FW) when extrapolated meets the junction of basal and middle thirds of RA1 i.e., more directed to the anterior wing margin, in *P. tigrina,* this vein, when extrapolated bisects RA1 i.e., more directed towards the wing apex. With respect to coloration, *P. morrisi* is heavily marked, with the cephalic spots joined by dark brown marks (unmarked in *P. cheeveeda*), the medial lobe of the pronotum having heavy marks (less heavily marked in *P. cheeveeda*), the mesonotum also is heavily marked with the submedian sigillae (ssig) converging to meet the median line (not meeting in *P. cheeveeda* **sp. nov.**), lateral sigillae (lsig) sinuous

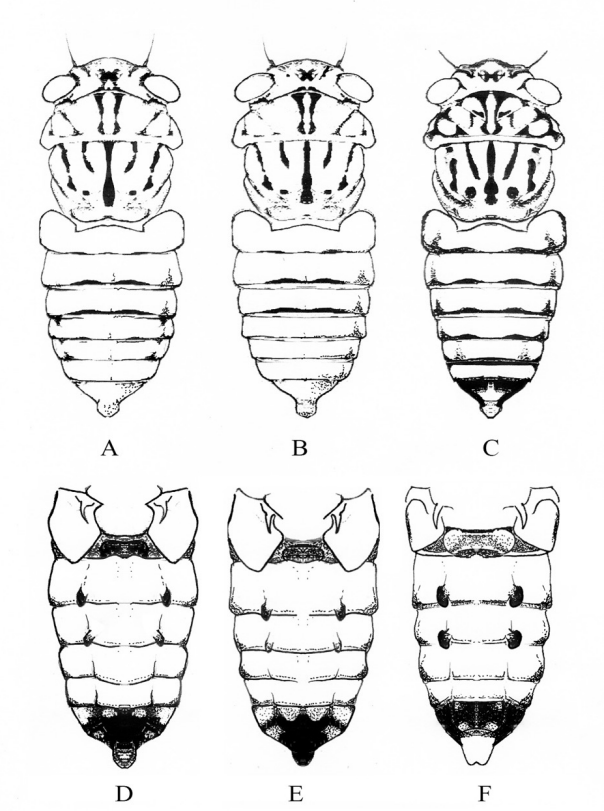

Fig. 7 Body of *Purana* species. A, *P. tigrina* (Walker, 1850) dorsal view of holotype; B, *P. tigrina* (Walker, 1850) dorsal view of the Malayan specimen, redrawn based on Duffels *et al.* (2007); C, *P. cheeveeda* Sadasivan **sp. nov.**, dorsal view; D, *P. tigrina* (Walker, 1850) ventral view of holotype; E, *P. tigrina* (Walker, 1850) ventral view of the Malayan specimen, redrawn based on Duffels *et al.* (2007); F, *P. cheeveeda* Sadasivan **sp. nov.**, ventral view. © Kalesh Sadasivan

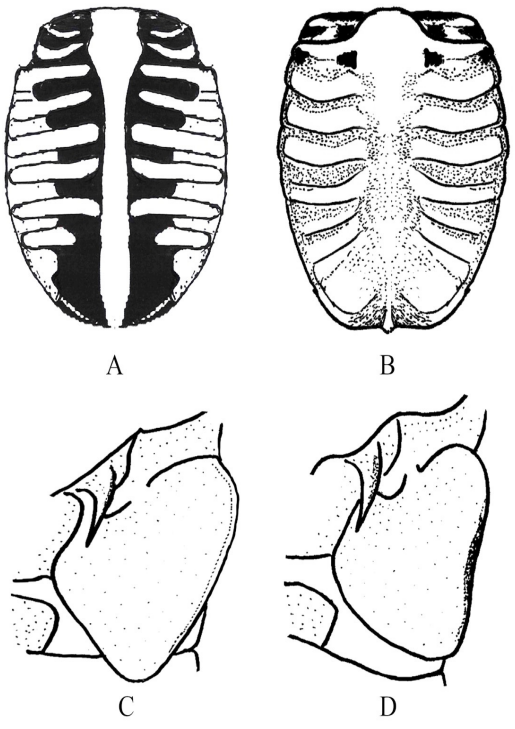

Fig. 8 Post-clypeal markings and operculum of *Purana* species. A, *P. tigrina* (Walker, 1850) Malayan specimen, postclypeus in ventral view, redrawn based on Duffels *et al.* (2007); B, *P. cheeveeda* Sadasivan **sp. nov**., postclypeus in ventral view; C, *P. tigrina* (Walker, 1850) Malayan specimen, male operculum in lateroventral view, redrawn based on Duffels *et al.* (2007); D, *P. cheeveeda* Sadasivan **sp. nov**., male operculum in lateroventral view. © Kalesh Sadasivan

and broad with its distal end bulbous and contiguous with the spot in the scutal depression (lsig is thin, the distal end is less bulbous and far away from the scutal spots in *P. cheeveeda* **sp. nov.**). Male genitalia reveal the most useful character to distinguish it from the new species as the uncus is pentagonal in *P. cheeveeda* **sp. nov.** while it is elongated triangular in *P. morrisi* (Figs. 6E, F). A redescription of *P. morrisi* is under preparation) with morphometric data based on freshly collected topotypes.

All other known species of *Purana* are extralimital to south India and are restricted to various other areas of Southeast Asia. *Purana guttularis* (Walker, 1858) from Eastern India, Myanmar, and the rest of Southeast Asia to Philippine Islands, is distinguished by the overall paucity of markings on the head and thorax; length of FW a2 is half the length of a3 (a2 is almost three-fourths of the length of a3 in *P. cheeveeda* **sp. nov.**); the three-segmented lsig of mesonotum (single thin continuous mark in *P. cheeveeda* **sp. nov.**) and the male opercula being broad, transverse, nearly together than in *P. tigrina*, *P. morrisi,* and

P. cheeveeda **sp. nov.** with inner margins oblique, apices sub-truncate and rounded. *Purana campanula* Pringle, 1955 from Srilanka is distinguished by its extremely long fused uncal lobes (Pringle, 1955), while the new species has short, fused uncus. *Purana metallica* Duffels and Schouten, 2007 and *P. kpaworensis* Boulard 2006 from Southeast Asia have simple, bilobate uncus and slightly converging, ridge-like basal pygofer lobes with a narrow triangular apex, while the new species has strongly sclerotized, triangular uncus and spine-shaped basal pygofer lobes (Duffels *et al.*, 2007; Boulard, 2006). Tubercles on sternite III and IV are equal in size and that on IV reaches the posterior margin of the segment in the new species and hence differs from *P. mulu* Duffels and Schouten, 2007 in which the tubercles on sternite IV do not reach the posterior margin of the segment and is distinctly smaller than in sternite III. Male operculum reaches beyond the anterior margin of sternite III in *P. latifascia* Duffels and Schouten, 2007, and *P. karimunjawa* Duffels and Schouten, 2007; while in the new species, the male operculum is short and does not reaching beyond the anterior margin of the sternite III. The absence of a black-brown margin of the medial aspect of the male operculum differentiates the new species from *P. usnani* Duffels and Schouten, 2007. Other species of the *P. tigrina* group such as *P. ptorti* Boulard, 2007, *P. tigrinaformis* Boulard, 2007, and *P. khaosokensis* Boulard, 2007 are locally distributed in Southeast Asia and are hence extralimital to South India (Boulard, 2007). The new taxon is easily distinguished from other similar taxa in Srilanka and Southeast Asia from the *P. tigrina* group (See Key given).

***Purana* species groups**

The key to *Purana* species groups was proposed by Lee (2009). A minor modification of the key has been attempted with the retention of stable structural characters of male genitalia, while characters of coloration, which may be relatively less reliable, are modified or deleted. We observed that the coloration character mentioned in Lee (2009) 'pronotum between central fasciae and lateral fissures unmarked' was variable in *P. cheeveda* **sp. nov**., (markings less discernible in less heavily marked specimens 1 out of 10 specimens studied, but present in all heavily marked specimens) while the structure of male genitalia was consistent. This mark was however present on *P. morrisi.* Hence, we think that utility of coloration as characters for identifying species groups may be questionable. Similarly, the coloration character 'male timbal cover with black marking' mentioned for *P. carmente* was also found to be present in a milder intensity in both *P. cheeveda* **sp. nov.** and *P. morrisi* by the lateral margin of the male timbal covers being margined in black. With these minor modifications of characters in coloration in the key, the two known south Indian taxa are comfortably placed in the *P. tigrina* group.

Revised key to species groups of *Purana* based on male morphology modified from Lee (2009)

1. Uncal lobes fused, with tip occasionally bifid (Fig. 6E); anterior longitudinal vein of FW apical cell 5 about as long as anterior longitudinal vein of apical cell 7 (Fig. 2A).....2

– Uncal lobes widely separated till its base; anterior longitudinal vein of FW apical cell 5 distinctly shorter than anterior longitudinal vein of apical cell 7…. *Purana nebulilinea* group

2. Basal lobe of pygofer either ridge-like with a small medial triangular spine (Fig. 6D) or is large triangular tooth-like with a pointed apex (Fig. 6A)...3

– Basal lobe of pygofer not ridge-like nor triangular, but instead with a curved apex, or angulate medially.....4

3. Male operculum relatively long and slender, always passing anterior margin of sternite III to reach more than 1/3rd of its length, or nearly reaching or passing posterior margin of sternite III.....*P. carmente* group

– Male operculum short, not reaching anterior margin of sternite III (Fig. 8D) or if crosses it, never more than 1/3rd of the length of sternite III (Fig. 8C).....*P. tigrina* group

4. Basal lobe of pygofer medially angulate.....5

– Basal lobe of pygofer not angulate medially, its apex curved.....6

5. Tergite 3 of male abdomen much wider than mesonotum; abdominal tubercles very long and thick; basal vein of apical cell 1 shorter than a half as long as longitudinal vein of apical cell 1.....Genus *Maua*

– Tergite 3 of male abdomen about as wide as base of mesonotum; abdominal tubercles tiny and slender; basal vein of apical cell 1 more than three-quarters as long as longitudinal vein of apical cell 1.....*P. ubina* group

6. Male pygofer spherical; uncus with a comparatively narrow apex.....Genus *Formosemia*

– Male pygofer obovate; uncus with a wide apex in ventral view.....*P. abdominalis* group

There are several overlapping characters between the species groups. Some groups seem to be heterogenous in constitution. For instance, the male genitalia with bifid uncus, ridge-like basal pygofer lobes are seen in some species of *P. carmente* group as well as the *Purana tigrina* group (Schouten and Duffels, 2002; Duffels *et al.,* 2007; Lee, 2009). This means that the current species group concepts may be provisional and a phylogenetic analysis is warranted to delineate the relations between the various species groups and decide the species nestled within them. Until such a large comprehensive phylogenetic analysis and revision of *Purana* and related genera is available, this modified and artificial species group classification may be followed.

Purana tigrina species group can be diagnosed with the members having anterior longitudinal vein of FW apical cell 5 about as long as the anterior longitudinal vein of apical cell 7; uncus undivided; basal lobe of pygofer spine-shaped with a narrow apex; male timbal cover without black marking, but may be margined with black on its lateral edge; bases of apical cells 2 and 3 of forewing prominently infuscated; male operculum short, not reaching or slightly passing posterior margin of sternite II as per Lee (2009). Amongst *Purana tigrina* species group there were two distinct sub-groups, one sub-group with ridge-like basal lobe of pygofer with a small medial triangular spine and simple (not strongly sclerotized) terminally bifid uncus, and the second subgroup with large triangular tooth-like basal lobe of pygofer with a pointed apex and strongly sclerotized triangular uncus (Schouten and Duffels, 2002). *P. morrisi* is a member of the former sub-group, while *P. cheeveda* sp. nov. falls in the latter sub-group. A phylogenetic study of this species group is warranted to decide the morphological characters useful for taxonomy. The key to members of *P. tigrina* species group is given below.

Key to the species of the *P. tigrina* species group based on males with their distribution ranges (modified from Boulard, 2007; Duffels *et al.,* 2007; Lee, 2009)

1. The apex of operculum not reaching beyond the anterior margin of sternite III (Fig. 8D).....2

– The apex of operculum reaching or extending beyond anterior margin of sternite III.....5

2. Tubercles on sternite 4 black, as almost large as those on sternite III (Fig. 2E).....3

– Tubercles on sternite 4 brownish, conspicuously smaller than those on sternite III (Sarawak and Brunei).....*P. mulu*

3. Basal lobes of pygofer with large diverging triangular spine (Fig. 3A) (South India) .....***P. cheveeda* sp. nov.**

– Basal pygofer lobes ridge-like, apical spines small 4

4. Basal pygofer lobes with apical spine divergent (Khun Pawor in North Thailand)..... .....*P. kpaworensis*

– Basal pygofer lobes with apical spine convergent (Langkawi Island and Tarutao Island west coast of the Malayan Peninsula) ..... *P. metallica*

5. Basal lobes of male pygofer consisting of large triangular projections.....7

– Basal pygofer lobes ridge-like, apical spines small and converging.....6

6. The apex of operculum rounded triangular extending beyond anterior margin of sternite III; tubercles on sternite IV brownish, much smaller than those on sternite III; rostrum short never reaching anterior margin of sternite III (Nias Island, Sumatra, Malayan Peninsula, Greater Natuna, and Borneo).....*P. tigrina*

– The apex of operculum rounded reaching anterior margin of sternite 3; tubercles on sternite 4 black, as almost large as those on sternite III; rostrum long reaching the tubercles on sternite 3 (Tamil Nadu, South India).....*P. morrisi*

7. Medial margin of male operculum black-brown. Lateral fasciae on mesonotum broken up or continuous, widest part of lateral fascia narrower than the distance between paramedian and lateral fasciae.....8

– The medial margin of the male operculum of its ground color, not marked in black-brown; lateral fasciae on mesonotum continuous, widest part of lateral fascia as wide as the distance between paramedian and lateral fasciae (Sabah, north Borneo).....*P. latifascia*

8. Lateral fasciae on mesonotum broken up into a linear part and a black dot, linear part 2–3 times as wide as the anterior part of median fascia (Karimun Archipelago north of central Java) .....*P. karimunjawa*

– Lateral fasciae on mesonotum continuous, rarely broken up into a linear part and a black dot, linear part as wide as or slightly broader than the anterior part of median fascia (Singapore, Sumatra, Bunguran, North Borneo).....*P. usnani*

A new taxon of the *P. tigrina* group is described from Kerala in southern India. The new species falls in the *P. tigrina* group following Duffels *et al.* (2007) and Lee (2009), by the following characteristics–the apex of operculum not reaching beyond the anterior margin of sternite 3; tubercles on sternite 4 black, as almost large as those on sternite 3; basal lobes of pygofer with large diverging triangular spines, along with its short rostral length, the extent of dark fascia on the transverse grooves of postclypeus, forewing venation and the characteristic pentagonal uncus of the male. The species was earlier confused with *P. tigrina* (Walker, 1850). As per our findings, *P. tigrina* must refer to the taxon distributed in the Malayan bioregion. Identification of the commonest cicada of the region, which was traditionally misidentified as *P. tigrina,* as a new species highlights the need to study male genitalia in species determination. It must be noted that in contrast to what was previously thought, cicadas may be geographically and altitudinally restricted in distribution, implying a high degree of endemism. Wider species distribution probably implies the existence of a species complex or taxonomic lumping arising out of suboptimal studies.

Abbreviations:

NHM	Natural History Museum, London
FW	Forewing
NCBS	National Center for Biological Sciences, Bengaluru
TNHS	Travancore Nature History Society, Thiruvananthapuram
UAS	University of Agricultural Sciences, Bengaluru
ZSI	Zoological Survey of India

ACKNOWLEDGEMENTS

The authors wish to thank Allen Sanborn and K.D. Prathapan for their comments during the preparation of the manuscript. The authors thank Vivek Sarkar, Young June Lee, H.M. Yeswanth, K. Gunathilagaraj, Ramaswamy Naicker, H. Sankararaman, Anoop Rajamony, Kiran Marathe and P. Manoj for their support. K. Jayakumar, M.R. Kiran, Vinay Krishnan, K. Manoj, Y. Preeti and members of TNHS Thiruvananthapuram are thankfully acknowledged for their help during the fieldwork.

REFERENCES

Boulard M. (2006) Cigales nouvelles, originaires de Thaïlande et appartenant au genre *Purana* Distant, 1905 (Rhynchota, Cicadoidea, Cicadidae). Nouvelle Revue d'Entomologie (N.S.) 23: 195–212.

Boulard M. (2007) Description et ethologie sonore de sept cigales d'Asie continent - tropicale don't six nouvelles pour la science et une jusqu'ici inedited pour la Thaïlande [Rhynchota, Cicadoidea, Cicadidae]. Revue Francaise d'Entomologie (N.S.) 29: 93–120.

Boulard M. (2013) The Cicadas of Thailand. Vol. 2. Taxonomy and Sonic Ethology, Siri Scientific Press, Manchester. 436 pp, 97 pl.

Distant W. L. (1889–1892) A monograph of Oriental Cicadidae. West, Newman & Co., R. Friedlander & Sohn. London, Berlin. I–xiv, 97–158. Pl. x–xv.

Distant W. L. (1905) Rhynchotal Notes. — XXIX, Annals, and Magazine of Natural History: Series 7, 15 (85): 58–70. doi:10.1080/03745480509443637.

Distant W.L. (1906) The fauna of British India, Including Ceylon and Burma, Rhynchota. Vol. III. Heteroptera–Homoptera. Taylor and Francis, London. 526 pp.

Dmitriev D, Sanborn A. and Takiya D. (2021) 3i Auchenorrhyncha: World Auchenorrhyncha Database (version Nov 2017). In: Catalogue of Life [author list in alphabetical order] (ed.) (2021). Digital resource at www.catalogueoflife.org. Species 2000, Naturalis, Leiden, the Netherlands. ISSN 2405–8858.

Duffels J.P., Schouten M.A. and Lammertink M. (2007) A revision of the cicadas of the *Purana tigrina* group (Hemiptera, Cicadidae) in Sundaland. Tijdschrift voor Entomologie 150: 367–387.

International Commission on Zoological Nomenclature (ICZN) (1999) International Code of Zoological Nomenclature. Fourth edition. London, U.K. [available online at http://www.iczn.org/iczn/index.jsp]: International Trust for Zoological Nomenclature. [Accessed: 15 September 2021].

Latreille P.A. (1802) Famille troisième. Cicadaires; cicadariae. Histoire naturelle, Générale et particulière de Crustacés et des insectes. Ouvrage faisant suite à l'histoire natarelle générale et particulière, composée par Leclerc de Buffon, et rédigée par C. S. Sonnini, membre de plusieurs Sociétés savants 256–263. doi:10.5962/bhl.title.15764.

Lee Y.J. (2009) Descriptions of two new species of the *Purana abdominalis* species group (Hemiptera: Cicadidae: Cicadini) from the Philippines, with a key to the species groups of *Purana*. Journal of Natural History 43: 1487–1504. doi:10.1080/00222930902941848.

Lee Y. J. and Emery D. (2013) New genera and species of Leptopsaltriini (Hemiptera: Cicadidae: Cicadinae) from India and Tibet, with the descriptions of five new subtribes. Zoosystema 35: 525–535. doi:10.5252/z2013n4a6.

Marathe K., Sarkar V., Price B.W., Roy P. and Kunte K. (2022) Cicadas of India, v. 1. Indian Foundation for Butterflies. www.indiancicadas.org [accessed: 15 September 2021].

Moulds M.S. (2005) An appraisal of the higher classification of cicadas (Hemiptera: Cicadoidea) with special reference to the Australian fauna. Records of the Australian Museum 57: 375–446. doi:10.3853/j.0067-1975.57.2005.1447.

Moulton J.C. (1923) Cicadas of Malaysia. Journal of the Federated Malay States Museums 11: 69–182.

Price B., Allan E., Marathe K., Sarkar V., Simon C and Kunte K. (2016) The cicadas (Hemiptera: Cicadidae) of India, Bangladesh, Bhutan, Myanmar, Nepal, and Sri Lanka: an annotated provisional catalogue, regional checklist, and bibliography. Biodiversity Data Journal 4: e8051. doi: 10.3897/BDJ.4.e8051.

Pringle J.W.S. (1955) The songs and habits of Ceylon cicadas, with a description of two new species. Spolia Zeylanica 27: 229–238.

Sadasivan K. (2021) A new species of *Pomponia* Stål, 1866 (Hemiptera: Cicadidae) from the Western Ghats, with notes on the status of *P. linearis* (Walker, 1850) from southern India. Zootaxa 5040(3): 388–403. doi:10.11646/zootaxa.5040.3.4

Sanborn A.F. (2013) Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha). Elsevier, viii, 1001pp. doi:10.1016/B978-0-12-416647-9.00001-2.

Sarkar V. (2019) A note on the taxonomy and natural history of the Summer Clicker *Lahugada dohertyi* (Distant, 1891) (Insecta: Hemiptera: Cicadidae) along with its distribution in northern West Bengal, India. Journal of Threatened Taxa 11 (9): 14128–14136. doi:10.11609/jott.3193.1 1.9.14128-14136.

Walker F. (1850) List of the specimens of homopterous insects in the collection of the British Museum, (Published by) Order of Trustees, London. 1: 1–260, pl. 1–2.

Walker F. (1858) Supplement, List of the specimens of homopterous insects in the collection of the British Museum. (Published by) Order of Trustees, London. 307pp.

(Received December 03, 2022; revised ms accepted April 23, 2023; published June 30, 2023)