



A new species of *Protosticta* Selys, 1885 (Odonata, Zygoptera, Platystictidae) from the Brahmagiri Hills, Kerala, India

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ABSTRACT: A new species of *Protosticta* Selys, 1885 is described from Brahmagiri hills of Coorg landscape of the Western Ghats in Peninsular India. The new species *Protosticta francyi* **sp. nov.**, is a congener of *P. antelopoides* Fraser, 1931 and *P. ponmudiensis* Kiran, Kalesh & Kunte, 2015, occupying a similar microhabitat, but distributed north of the major biogeographical divide, the Palghat Gap. The new taxon is distinguished from all other *Protosticta* of Western Ghats by the presence of long prothoracic spines in the males, the structure of the tip of the male cerci and genital ligula. A revised key to the species of *Protosticta* of Western Ghats is provided based on mature males.

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KEYWORDS: Damselfly, hill stream ecology, endemic species, new taxon, revised key

INTRODUCTION

The genus *Protosticta* consists of slender built damselflies commonly called reed-tails or shadow-damsels inhabiting hill streams of tropical, subtropical, and temperate jungles. The genus has 50 extant species distributed from Pakistan, through the Indian subcontinent to Indo-China and Southeast

Asian Islands (van Tol, 2009). Indian region has 16 species of *Protosticta* and of them, 13 species are known from Western Ghats (WG) (Sadasivan *et al.*, 2022). The characters useful for species identification are the synthoracic and abdominal markings, the structure of the prothorax and anal appendages in the males (van Tol, 2000). The currently known species of this genus from WG

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are *Protosticta gravelyi* Laidlaw, 1915; *P. hearseyi* Fraser, 1922; *P. sanguinostigma* Fraser, 1922; *Pantelopoides* Fraser, 1924; *P. mortoni* Fraser, 1924; *P. davenporti* Fraser, 1931; *P. rufostigma* Kimmins, 1958; *P. ponmudiensis* Kiran, Kalesh & Kunte, 2015; *P. monticola* Emiliyamma & Palot, 2016; *P. myristicaensis* Joshi & Kunte, 2020; *P. sholai* Subramanian & Babu, 2020; *P. cyanofemora* Joshi, Subramanian, Babu & Kunte, 2020 and *P. anamalica* Sadasivan, Nair & Samuel 2022 (Fraser, 1933; Kiran *et al.*, 2015; Tiple and Koparde, 2015; Emiliyamma and Palot, 2016; Joshi *et al.*, 2020; Nair *et al.*, 2021; Sadasivan *et al.*, 2022). Of these, two species – *P. antelopoides* and *P. ponmudiensis* are relatively robust and large and the males have very prominent prothoracic spines (Nair *et al.*, 2021).

During the explorations for odonates of Kerala state, the authors came across a distinct and robust *Protosticta* species from the foothills of WG, near Aaralam Wildlife Sanctuary (WLS), Kannur District from the Brahmagiri Hills of Coorg landscape. The species appeared superficially similar to *P. antelopoides* and *P. ponmudiensis* but differed significantly in the structure of prothorax, male genitalia and the tip of cerci and hence described here as a new species. A revised key to *Protosticta* of WG is provided based on males, modified from Joshi *et al.* (2020) and Sadasivan *et al.* (2022).

MATERIALS AND METHODS

The morphological description follows Garrison *et al.* (2010). Nomenclature follows Paulson *et al.* (2022). Taxonomic keys to the species are modified based on Fraser (1933), Joshi *et al.* (2020) and Sadasivan *et al.* (2022). The known distribution of the species follows Joshi *et al.* (2020) and Nair *et al.* (2021). The wing venation terminology follows Riek and Kukalová-Peck (1984). Photographs of the specimens were taken with Canon EOS 70D DSLR camera fitted with a 180mm macro lens and MPE 65 f 2.8 1–5x lens. Damselflies were collected in the field with an insect net and preserved in absolute ethanol as wet specimens. The anal appendages were studied using a stereo-zoom microscope (HEADZ Model HD81).

Measurements, morphological details, illustrations and comparison of caudal appendages were done from the specimens in voucher collections of TORG. The male prothorax, cerci and genital ligula were hand drawn and digitalized.

Abbreviations used:

| | |
|-------|---|
| Ax | Antenodal crossveins |
| FW | Forewing |
| HW | Hindwing |
| Px | Postnodal crossveins |
| Pt | Pterostigma |
| S1–10 | Segments of the abdomen |
| TL | Total length of the specimen including appendages |
| AL | Abdominal length |
| FWL | Forewing length |
| HWL | Hindwing length |
| TNHS | Travancore Nature History Society |
| TORG | TNHS Odonate Research Group |

RESULTS AND DISCUSSION

Protosticta francyi Sadasivan, Vibhu, Nair & Palot sp. nov.

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(Figs. 1, 2B, 3, 4, 5, 6A, 6D, 6G)

Types: **Holotype**-Male, TORG 1012. Elapedika, Kanichar, Near Aaralam Wildlife Sanctuary, Kannur District, Kerala, India. 29.vii.2022, 450 m a.s.l., coll. Vibhu V&Vinayan P Nair; currently with TORG collections, Trivandrum, Kerala; wet specimen in alcohol; will be deposited in the insect collection facility of National Centre for Biological Sciences, Bengaluru.

Paratypes: 1) Male, TORG 1013, bearing the same collection data as on the holotype; wet specimen in alcohol; will be deposited in the insect collection facility of Zoological Survey of India (ZSI), Pune, Maharashtra.

2) Female, TORG 1014 and Male TORG 1022, bearing the same collection data as on the holotype; wet specimen in alcohol; will be deposited in the insect collection facility of Zoological Survey of India (ZSI), Kozhikode, Kerala.

Etymology: The species is named after Dr. Francy K. Kakkassery (Retired Professor of Zoology, St. Thomas College, Thrissur), the pioneer in odonate studies in Kerala, for his contribution to odonate conservation and popularization of the subject in the state.

Suggested Common Name: Francy's Reed-tail.

Description of the male holotype

(Figs. 2B, 3, 4, 5A, 5D, 5G)

Head (Figs. 2B, 3). Eyes (in live insect) anteriorly green, anterosuperiorly dark green, postero-inferiorly pale greenish white, and inferolaterally greenish-yellow (in life). Labium pale honey-yellow and the anterior border with amber brown hairs and tooth; mandible bluish-white and inferior half bordered in black; labrum pale bluish-white, with almost a half of its free margin bordered thickly in black; anteclypeus paler bluish; postclypeus jet black; genae brownish-black; antefrons, postfrons black with faint bronze reflex; vertex black with blush reflex; occiput jet black; post-ocular lobe jet black, ocelli translucent white; antennae basal segment and half of the first segment brownish, first joint pale blush white, rest of the segments pale brown, with the color fading distally; sparse brownish hairs on lateral aspect of the anteclypeus and free edge of the labrum; longer pale brown hairs along the inferior border of anteclypeus and on the labium. Occipital bar with long brown paradorsal group of hairs; posterior border of head behind the occipital bar sinuous and having mid-dorsal convexity.

Prothorax (Fig. 3F, 6A). Anterior lobe almost half the middle lobe, posterior lobe almost same size as the middle lobe; in life the general color of prothorax bluish-white, anterior lobe with a yellowish collar like paradorsal posterior expansion on each side, middle lobe blue, posterior lobe bluish-black with collar and spines pale bluish-black; notopleural suture and adjoining aspect of the anterior lobe pale yellow; propleuron yellowish blue; pronotal collar bears a pair of medial and lateral spines; medial spines slender, sharp, straight and its tip turned outwards extending just beyond the mesostigmal plate; Lateral spines small, triangular and

rudimentary almost like an angular extension of the collar directed inferolaterally. Prolegs coloured as in the synthorax.

Synthorax (Figs. 2A, B, D). General color in life is black marked with pale yellowish-white and pale blue. In dorsal view, mesostigmal plate jet black; mid-dorsal carina black. In lateral view, the mesepisternum shiny dark green with bronze reflex; mesepimeron dorsal half black and inferiorly bluish-white, and borders with the interpleural suture black; mesinfraepisternum superiorly dark and inferior fourth yellowish-white; metepisternum superior half of the middle half bordering the interpleural suture black, rest of it pale bluish-white; metinfraepisternum pale brownish-white, metepimeron bluish-white; metathoracic spiracle brownish. In ventral view, the venter of metathorax pale yellowish-white, mid-ventrum of prothorax and synthorax are black. The coxae and trochanter of all legs yellowish-white; femora pale brownish, with tibio-femoral joint region suffused in blue; tibiae pale brownish, with its lateral aspect suffused in blue; spines of the tibial comb, tarsus and the claws brownish.

Wings (Figs. 4A, C). Hyaline; Pt of both wings brown occupying less than one and one-fourth cells, trapezoidal; anterior border straight slanting anteriorly; posterior border convexslanting posteriorly, thus making the superior border shorter than the inferior; inferior border convex. Pt length at its middle is equal to its breadth. Anal bridge absent. Ax-2 in all wings. Px-FW 15-16 and HW15.

Abdomen (Figs. 2B, 3A, 4B, 4D). General color is brownish-black and marked in pale yellowish to bluish-white as follows: S1 laterally pale bluish-white, dorsally brown; S2 below a diagonal connecting the anterosuperior to the postero-inferior edges bluish-white, rest of it brown; S3-7 marked with basal annuli, that increases in thickness towards the posterior segments, ventral part of each of them extends posteriorly for some distance; the posterior extension on annuli in S2-S3 almost reaching the posterior-fifth of its length; the annuli slightly increases in thickness in S4-S6; S6 annulus,

including its posterior extension on ventral side reaching almost one-fourth length of S6; mark on S7, largest of the annuli, extends laterally reaching mid-lateral aspect of S7, distal half of this mark suffused, gradually merging with ground colour; dorsal aspect of S7 basal annulus occupies basal third, and rest of the segment is black, and this black extends dorsally as a narrow triangular part into posterior half of annulus splitting it laterally; basal annulus on S8 incomplete dorsally it extends posterolaterally to reach the anterior thirds, and then thinly extends ventrally to cross in to its posterior-thirds but stopping short of joint with S9; S8 basal annulus half the thickness of that on S5; crescent marks on membranes between S8-9 and S9-10 colored yellowish blue dorsally. Annuli of S3 conspicuously thinner (reduced to almost a third) than on rest of segments S4–6. S8 annulus is largest of annulus and on ventrolateral aspect stops just short of its distal margin. Segments 9 and 10 are fully black.

Male ligula (Fig. 6G). Basal region of ligula sinuous, tip thick and curved, general structure as illustrated in the figure

Caudal appendages (Figs. 4E–G). Coloured dark brownish-black, except basal half of paraprocts which is coloured pale honey-yellow with a bluish hue; length of cerci three times that of S10 in lateral view. Cerci long thin and sinuous, furnished with a small blunt tooth directed postero-dorsally at junction of its basal third and middle third; middle third uniformly tapering and curved inwards, and distal-third spatulate. Spatulate tip of cerci with proximal end narrow and distal end expanded. Paraprocts uniformly curved inwards; long, ending just short of cerci; tip of paraprocts curved inwards; paraprocts bear a long thin spine like lamella directed posteromedially at its distal fourth, this lamella with a concavity posteriorly and its tip is notched superiorly.

Measurements (mm). TL- 54, AL- 45, FWL-27, HWL- 26.

Description of female paratype (Figs. 2C, 5)

Head (Figs. 5B–D). Colored exactly as male. Eyes and labium as in males; mandible bluish-white and

inferior half black; labrum pale bluish-white, a little more than lower third bordered thickly in black; anteclypeus paler bluish; postclypeus jet black; genae black; antefrons, postfrons, vertex, occiput and post-ocular lobe black as in males; ocelli translucent pinkish-white; antennae basal segment and half of first segment brownish, around first joint pale blush white, rest of segments pale brown; setae and hairs on labium and occiput as in males.

Prothorax (Fig. 5C, 5E) as in males, but spines on posterior lobes are shorter and broader.

Synthorax (Figs. 5A–C) Colour and structure as in males.

Wings (Fig. 5A). Hyaline; Pt of both wings brown occupying less than one and one-fourth cells, trapezoidal; anterior border convex and slanting anteriorly; posterior border convex and slanting posteriorly thus making superior border shorter than inferior; Pt length at its middle as long as its breadth. Anal bridge absent. Ax-2 in all wings. Px-FW 16 and HW 15.

Abdomen (Fig. 4A). Segments S1–S7 coloured as in male, but basal bluish-white rings are much shorter and almost half their size as that on corresponding segments of males.

Segment 7 bears triangular bluish-white patch, dorsolateral part of this extends till half of S7, while in ventral aspect it extends till end of S7. S8 has small inferolateral blue spot on anteroventral aspect of segment on each side. Segment 9 and 10 unmarked black, but membranes connecting them pale blue. S8 is four times length of S10, while S9 is three-fourths of length of S10.

Caudal appendages (Figs. 5F, G). Cerci dark brown, as long as length of S10, triangular in lateral view with a superior border slightly convex, tip blunt and directed posteroinferiorly; paraprocts reduced, rounded brown, half-length of cerci; valve of ovipositor black; ovipositor black, ending in a brownish-black flat-tipped style reaching well beyond level of cerci and valve.

Measurements (mm). TL- 47, AL-39, FWL-28, HWL-27.

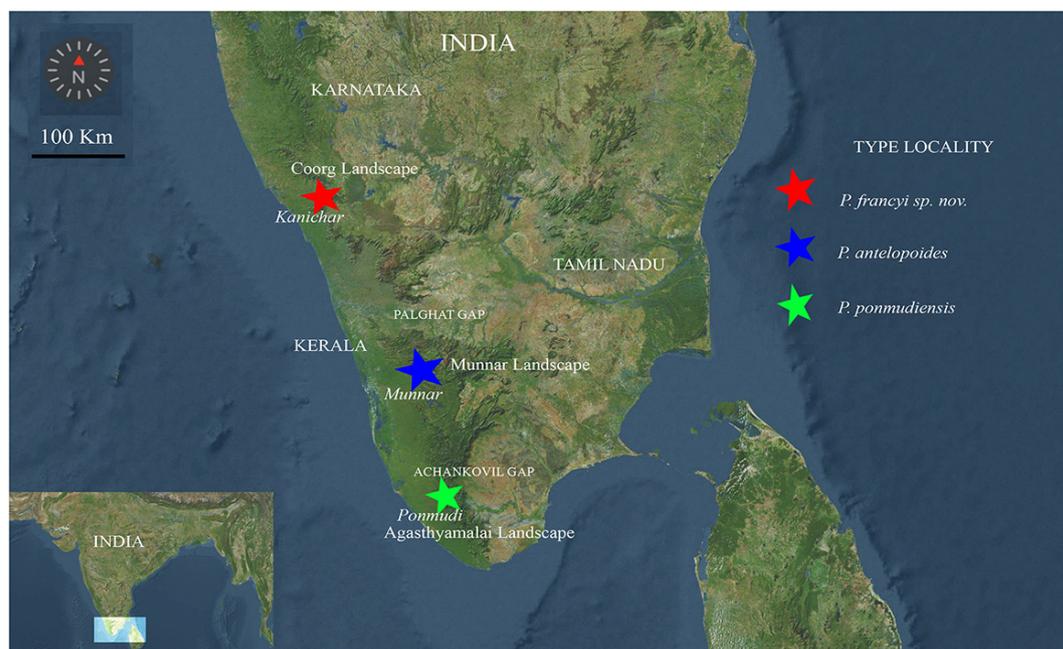


Fig. 1 Map showing the type localities of *Protosticta francyi* **sp. nov.**, *P. antelopoides* and *P. ponmudiensis*, and biogeographical gaps in the Western Ghats

Distribution, habitat and ecology: They inhabit dark forest streams at low-mid elevations (<500m). The species, as far as known, is restricted to the western slopes of Aaralam WLS, Kottiyoor WLS and the forests of north Wayanad forest division in Brahmagiri hills of Coorg landscape in central WG. This taxon is restricted north of Palghat Gap. The vegetation of the area is mainly of semi-evergreen or evergreen type with good canopy cover. All the streams are perennial with boulders and well-covered riparian vegetation. The adults spend the day perched on low-hanging shrubs and fern leaves of marginal vegetation in shady hill streams. They undertake short flights to hunt flying insects and return to their perches. Flight period as is May to October. Observed many specimens from Kottiyoor WLS, Chavachi part of Aaralam WLS, foothills of Suryamudi near Kottiyoor during these periods.

Remarks: The previous records of *P. antelopoides*, in published literature from Thusharagiri, Kozhikode (Palot and Emilyamma, 2015) and Wayanad (MJP in Nair *et al.*, 2021), possibly pertains to this new species.

The three species have peculiar distribution in WG; *P. ponmudiensis* is found in Agasthyamala is south of Achankovil Gap, *P. antelopoides* in the Anamalais are seen south of Palghat Gap, north of Achankovil Gap and *P. francyi* **sp. nov.**, in the Brahmagiri Hills (Coorg landscape), north of Palghat Gap (Fig.1). In addition to the geographical distribution, the three closely similar species *P. antelopoides*, *P. ponmudiensis* and *P. francyi* **sp. nov.**, are distinguished from other *Protosticta* of Western Ghats by the long prominent prothoracic spines, the spatulate tip of male cerci, and large size (TL > 50 mm) of the males. Superficially these three species appear similar but are distinguishable based on the length of the prothoracic spines, the structure of the spatulate process on tip of the cerci of males, and the basal portion of the male ligula and also coloration of S7.

Lateral spines on prothorax are well-developed in both *P. antelopoides* and *P. ponmudiensis*, while rudimentary in *P. francyi* **sp. nov.** In dorsal view, the tip of the lateral spine is directed laterally in *P. francyi* **sp. nov.**, while it is directed anteriorly in *P. ponmudiensis*. Medial spines on prothorax are



Fig. 2 A—Image showing the habitat at the type locality of *Protosticta francyi* **sp. nov.**, in Brahmagiri Hills © Vinayan P Nair; B—Live male *Protosticta francyi* **sp. nov.** © Vibhu V; C—Live female *Protosticta francyi* **sp. nov.** © Vibhu V.

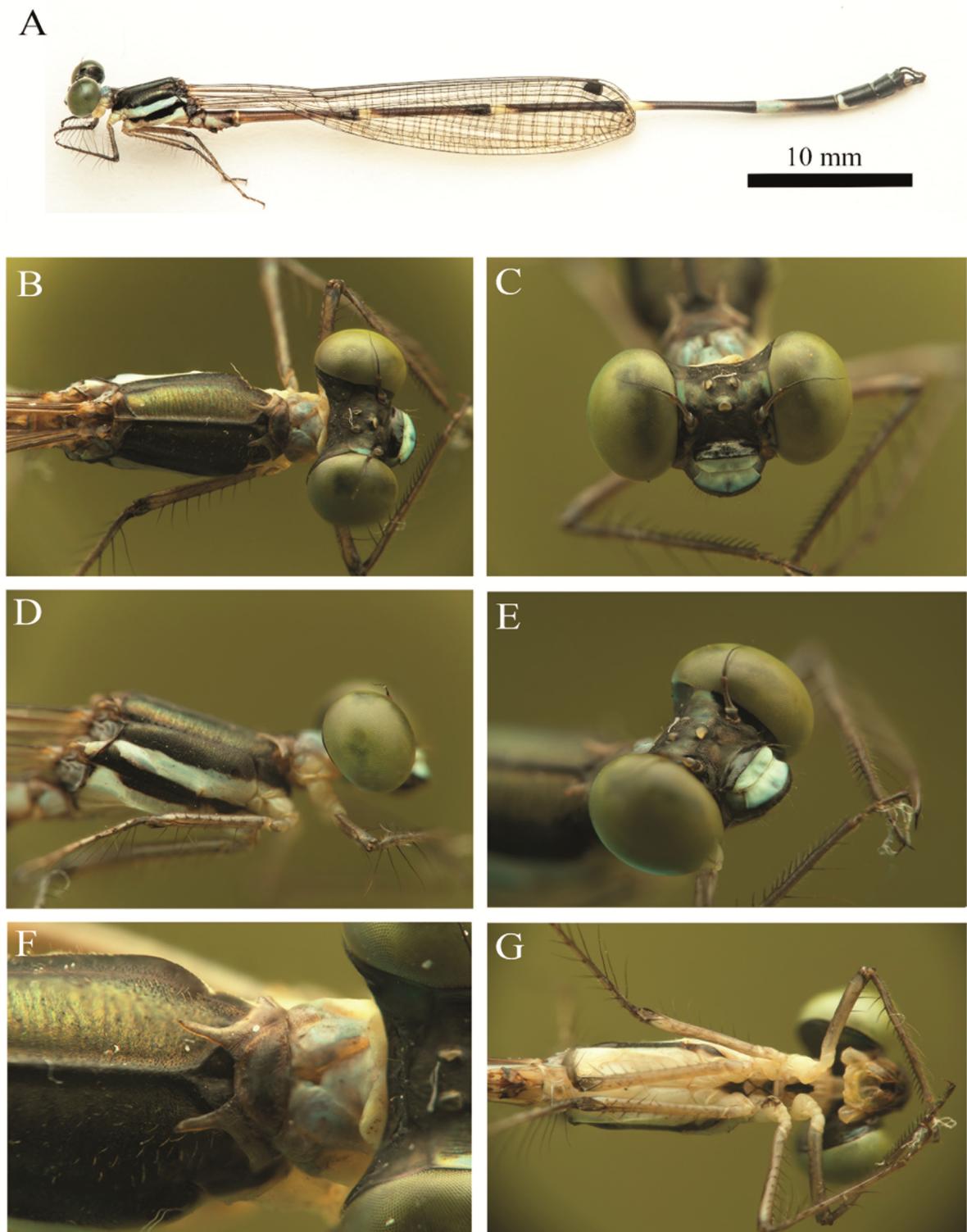


Fig. 3 *Protosticta francyi* sp. nov. Holotype male (TORG 1012). A—Whole insect lateral view; B—Dorsal view of the head, prothorax, and synthorax; C—Close-up of head anterior view; D—Lateral view of synthorax; E—Close-up of head anterio-lateral view; F—Dorsal close-up of prothoracic spines; G—Ventral view of synthorax and head © Kalesh Sadasivan.

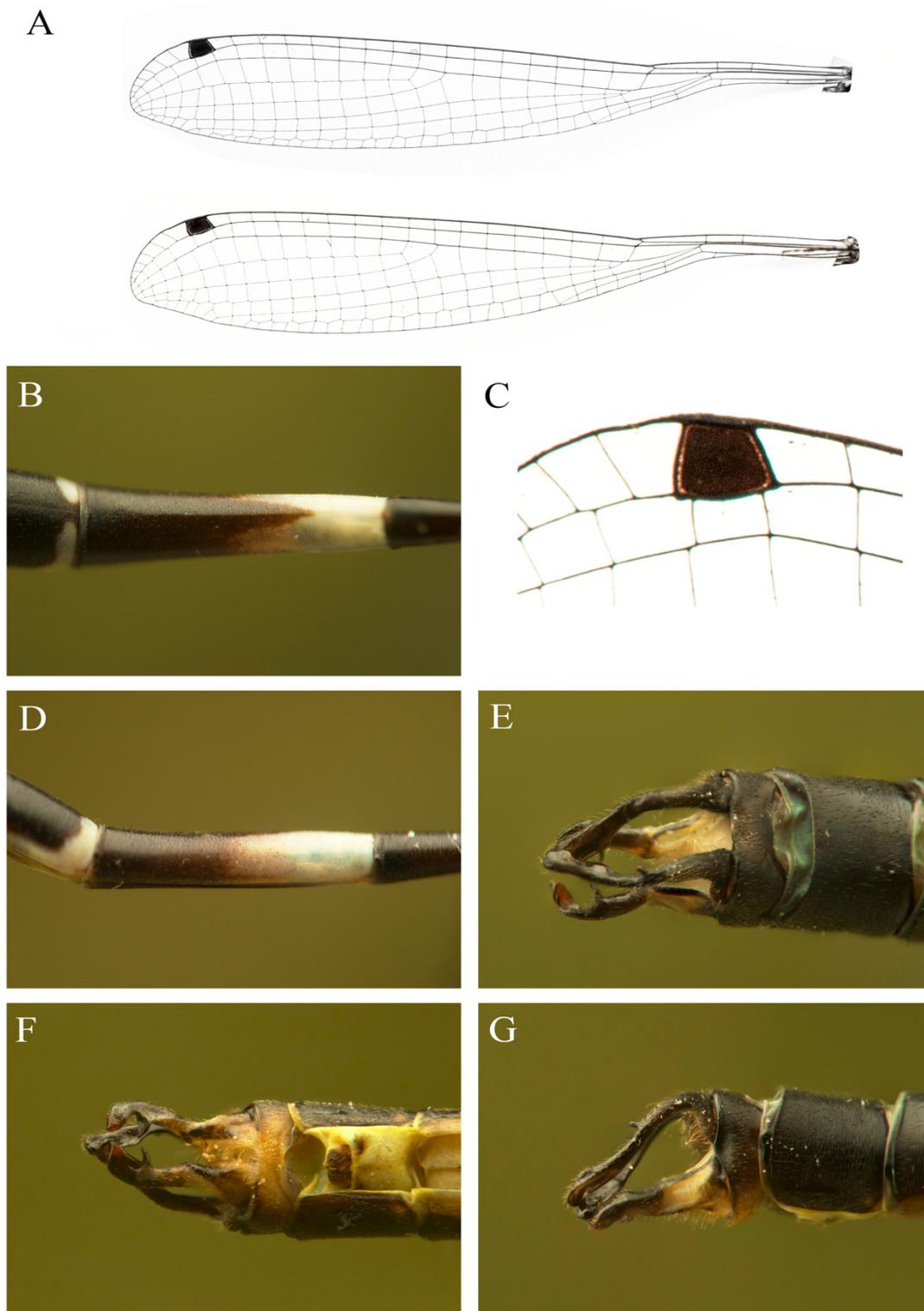


Fig. 4 *Protosticta francyi* sp. nov. Holotype male (TORG 1012).

A–Venation, forewing (top) and hindwing (bottom); B–Dorsal view of S7; C–Close-up of pterostigma of forewing; D–Lateral view of S7; E–Anteromedial view of anal appendages; F–Ventral view of anal appendages; G–Lateral view of anal appendages © Kalesh Sadasivan.

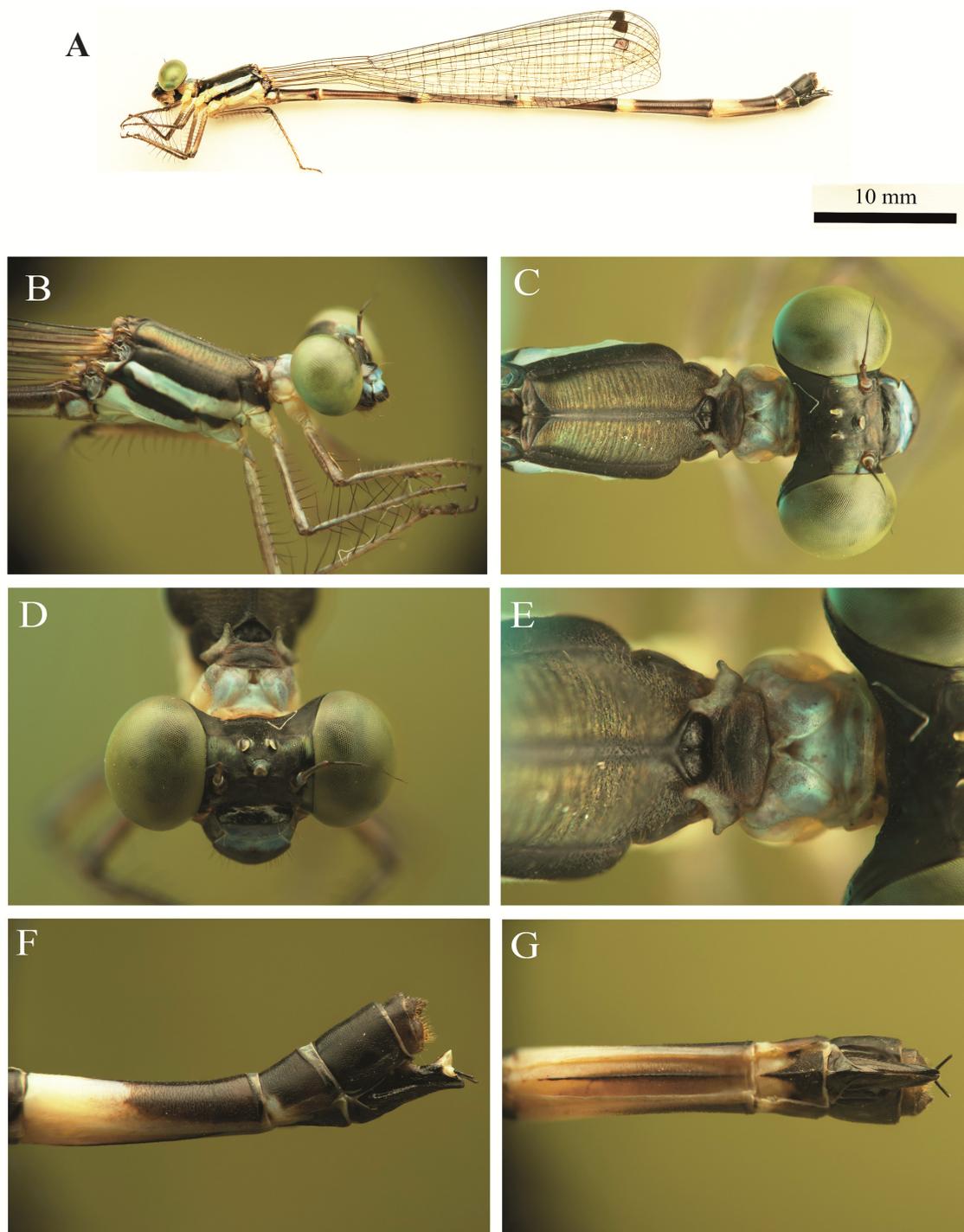


Fig. 5 *Protosticta francyi* sp. nov. Paratype female (TORG 1014). A–Whole insect lateral view; B–Lateral view of the head, prothorax, and synthorax; C–Dorsal view of the head, prothorax, and synthorax; D–Close-up of head anterior view; E–Dorsal close-up of prothoracic spines; F–Lateral view of S7-S10 and anal appendages; G–Lateral view of S7-S10 and anal appendages © Kalesh Sadasivan.

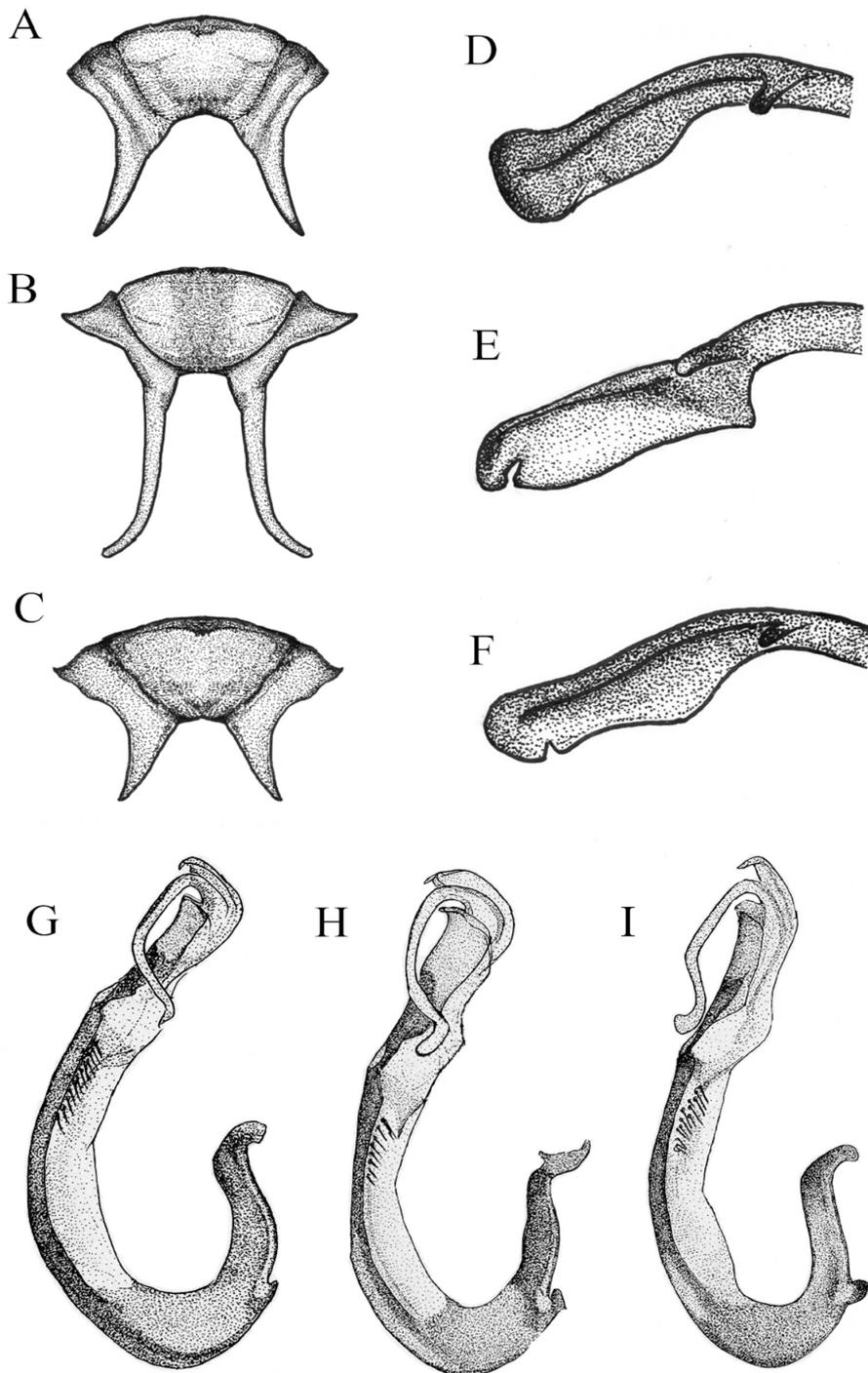


Fig. 6 Comparison of prothoracic spines, spatulate tip of cerci of males, and ligula of *Protosticta francyi* **sp. nov.**, *P. antelopoides* and *P. ponmudiensis*. A—Prothoracic spines of *Protosticta francyi* **sp. nov.**; B—Prothoracic spines of *P. antelopoides*; C—Prothoracic spines of *P. ponmudiensis*; D—Spatulate tip of cerci of males of *Protosticta francyi* **sp. nov.**; E—Spatulate tip of cerci of males of *P. antelopoides*; F—Spatulate tip of cerci of males of *P. ponmudiensis*; G—Ligula of *Protosticta francyi* **sp. nov.**; H—Ligula of *P. antelopoides*; I—Ligula of males of *P. ponmudiensis* © Kalesh Sadasivan.

very long, narrow-based, and elaborate extending posteriorly well beyond twice the length of the mesostigmal plate in *P. antelopoides*. Medial spines are short, broad-based, and never extend posteriorly beyond the apex of the mesostigmal plate in *P. ponmudiensis*; while it is short, narrow-based, and extend posteriorly just beyond the apex of the mesostigmal plate in *P. francyi* **sp. nov.**

The anal appendages of the three species are apparently similar, however, differ in the fine structure of the cerci and the disposition of spines on it. The location and structure of the dorsal spine on cerci in lateral view are different in the three species. While it is beyond the mid-cerci and directed posteriorly in *P. antelopoides*, it is located just before the middle in *P. ponmudiensis* and directed posteromedially, while it is located at the junction of proximal and middle third, and directed posterodorsally in *P. francyi* **sp. nov.** The structure of the spatulate tip of the cerci in the dorsomedial view is very different in the three species. The spatulate tip is broader at the base and tapers into the bifid apex, with the proximoventral angle being acute and extending downwards like a tooth in *P. antelopoides* (Fig. 6E). The spatulate tip is broader at the base and tapers into the rounded and notched apex and the proximoventral angle is obtuse and rounded in *P. ponmudiensis* (Fig. 6F). The

spatulate tip is narrow at the base and broadens into the expanded apex and the proximoventral angle is absent in *P. francyi* **sp. nov.** (Fig. 6D). The location of the medial spine like lamina of paraprocts in ventral view in *P. antelopoides* is at the distal-most end, however, in the other two species are more proximally at the junction of middle and distal thirds. The direction of this medial spine like lamina is posteromedial in *P. antelopoides*, while it is medial at right angles to the long axis of paraprocts in *P. ponmudiensis* and *P. francyi* **sp. nov.** (Fig. 4F).

The new species has synthorax with paradorsal yellowish bronze-green metallic reflex, while *P. ponmudiensis* and *P. antelopoides* have their dark green metallic reflex. The lateral marking on S7 is useful in distinguishing the three species, in *P. antelopoides* this is yellow and extends ventrally diagonally along the inferior half of the whole segment from the anterosuperior aspect of S7 to its posteroinferior angle; in *P. ponmudiensis* the marking is bluish-white and extends more dorsally occupying four-fifth of S7 dorsum and only half of the ventrum; while in *P. francyi* **sp. nov.**, the colour is bluish-white and on the dorsum it is restricted to the basal third and never extends beyond half of the lateral aspect of S7. S8 blue annulus is variable and hence not useful in distinguishing the three species (Table 1).

Table 1. Comparison of morphometric characters of *P. antelopoides*, *P. ponmudiensis* and *P. francyi* **sp. nov.** based on males

| Character | <i>P. francyi</i> sp. nov. | <i>P. ponmudiensis</i> | <i>P. antelopoides</i> |
|----------------------------|-----------------------------------|------------------------|------------------------|
| Total Length | 55mm | 55mm | 59mm |
| Abdominal length | 46mm | 47mm | 50mm |
| FW length | 29mm | 28mm | 30mm |
| HW Length | 28mm | 27mm | 29mm |
| Post nodal count FW and HW | 16, 15 | 17–18, 16–17 | 18, 17 |

Mean values in mm and postnodal count in Range; FW- Forewing; HW- Hindwing

Key to species of *Protosticta* Selys, 1885 of Western Ghats based on males modified from Joshi *et al.* (2020) and Sadasivan *et al.* (2022)

1. The posterior lobe of prothorax with a pair of long, divaricate horn-like medial spines.....2
 - The posterior lobe of prothorax without such long spines.....4
2. The posterior lobe of prothorax with very long medial spines (Fig. 6B), extending posteriorly to a distance more than twice the length of the mesostigmal plate.....*P. antelopoides*
 - Posterior lobe of prothorax short medials spines extending posteriorly till the apex of the mesostigmal plate or shorter.....3
3. Lateral spines on prothorax well developed, short triangular with tip directed anterolaterally; medial spines short never extending posteriorly beyond the apex of the mesostigmal plate (Fig. 6C); tip of cerci broad at base and tapering distally (Fig. 6F).....*P. ponmudiensis*
 - Lateral spines on prothorax rudimentary, reduced to an angular projection on the prothoracic collar, and its tip directed laterally; medial prothoracic spine long, thin, extending posteriorly just beyond the apex of the mesostigmal plate (Fig. 6A); tip of cerci narrow at base and expanding distally (Fig. 6D) *P. francyi* **sp. nov.**
4. Anterior 1/3rd or more of S8 bright turquoise-blue connected dorsally.....5
 - Anterior 1/3rd of S8 yellow or blue, not connected dorsally.....10
5. Apical fork of cerci deeply incised more than 1/3rd of the total length.....6
 - Apical fork of cerci shallow incised, much less than 1/3rd of total length8
6. Cerci with a small tubercle at middle of the apical fork; length of abdomen + caudal appendages < 25 mm.....*P. myristicaensis*
 - Cerci without such a tubercle at its center; length of abdomen + caudal appendages >25 mm.....7
7. Prothorax with a hexagonal black marking covering central portion of posterior lobe and a small portion of the middle lobe; cerci with a prominent laterally pointed basal spine; the paraprocts with an inner stout spine at base*P. gravelyi*
 - Anterior & middle lobes of prothorax colored blue, no hexagonal black mark; cerci with a small laterally pointed basal spine; paraprocts without an inner spine at base.....*P. mortoni*
8. Prothorax completely blue; length of abdomen +caudal appendages <30 mm; inferior lobe of cerci very short, superior lobe not expanded*P. hearseyi*
 - Anterior and middle lobes of prothorax pale yellow, posterior lobe partially or completely black; length of abdomen + caudal appendages > 30 mm; inferior lobe of cerci more than 1/3rd length of superior lobe, the latter expanded9
9. Dorsum of middle portion of posterior lobe of prothorax completely black extending as two points to the dorsum of middle lobe; inner fork of cerci thin and small, superior lobe rounded at apices and more than twice the length of inferior.....*P. davenporti*
 - Dorsum of posterior lobe of prothorax black, laterally brown; middle lobe of prothorax with a small dorsal faint black spot; inner fork of cerci thick, superior lobe ending in a quadrangle, less than twice the length of inferior*P. rufostigma*
10. S9 completely black or marked only at ventral border; posterior border of prothorax not expanded; paraprocts not clubbed at apices.....11
 - S9 laterally marked with a large yellow spot at anterior border, reaching more than 2/3rd of the

segment, not connected apically in both sexes; posterior border of prothorax expanded; paraprocts thin, long and clubbed at apices.....*P. sholai*

11. Pt red; cerci with a prominent and robust basal spine; tip of superior lobe of cerci bilobed.....*P. sanguinostigma*
 - Pt black or brown; cerci with a small blunt basal protuberance, inwardly pointed; tip of outer fork of cerci not bilobed.....12
12. Pt rectangular with length more than twice the breadth; Px in all wings always 11 or more; caudal appendages thrice the length of S10; outer margin of cerci including the superior lobe comparatively straighter on dorsal view13
 - Pt trapezoid with length twice the breadth; Px in all wings 10 or less; caudal appendages only twice the length of S10; outer margin of cerci sinuous; tip of superior lobe of cerci straight on dorsal view.....*P. anamalaica*
13. Eyes blue; femur bright blue internally; S8 with a bright blue annule extended laterally 2/3rd of its length; tip of superior lobe of cerci straight*P. cyanofemora*
 - Eyes grey and brown; femur pale yellow internally; S8 black dorsally, ventrolaterally yellow extends to its distal end; tip of the superior lobe of cerci bent inward at the apices *P. monticola*

Hill streams and the invertebrates associated are the most vulnerable in the wake of climate change (Rogers *et al.*, 2020), thus highlighting the importance of these stream-associated indicator species. The discovery of this endemic *Protosticta* from the WG raises the current number of species in this genus to 17 in India and 14 in the WG. The addition of *P. francyi* **sp. nov.** raises the Odonata species diversity of the Western Ghats to 209 species with 82 endemics, and that of Kerala to 183 species with 70 endemics.

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