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Cover: A female Javan Leopard *Panthera pardus melas* in rehabilitation phase at Cikananga Wildlife Center. © Yayasan Cikananga Konservasi Terpadu.



A new species of *Protosticta* Selys, 1885 (Odonata: Zygoptera: Platystictidae) from Western Ghats, India

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Abstract: A new species of *Protosticta* Selys, 1885 is described from Anamalai Hills of southern Western Ghats in peninsular India. The new species is distinguished from its regional congeners by the posterior lobe of the prothorax being devoid of spines; anterior 1/3rd of S8 pale yellow, the marking not connected dorsally; S9 completely black; caudal appendages short, sinuous, and only twice the length of S10, cerci with a small blunt basal tooth; the tip of the superior lobe of cerci not bilobed but straight, paraprocts beveled at the tip, not clubbed; pterostigma of both wings trapezoidal with maximum length less than twice the breadth, forewing with nine & hindwing with eight postnodals, and the structure of male genital ligula. The new species is described from Peechi Wildlife Sanctuary on the northwestern flanks of the Anamalai hills. A key to the identification of *Protosticta* of the Western Ghats is provided based on mature males.

Keywords: Anamalai Hills, damselfly, endemic species, Kerala, new description, Peechi Wildlife Sanctuary.

Abbreviations: Ax—antennodal crossveins | Fw—forewing | Hw—hindwing | Px—postnodal crossveins | Pt—pterostigma | S1–10—abdominal segments | TL—total length of the specimen including appendages | AL—abdominal length | FL—forewing length | HL—hindwing length | TNHS—Travancore Nature History Society | TORG—Travancore Odonate Research Group | KS—Kalesh Sadasivan.

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Author contributions: KS discovered the species in field and wrote the manuscript. VPN did fieldwork and edited the drafts. AS helped with the drafting and edits of the final manuscript.

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INTRODUCTION

The genus *Protosticta* Selys, 1885 consists of slender built damselflies commonly known as reed-tails or shadow-damsels. They inhabit hill streams in tropical, subtropical, and temperate jungles of the Indian subcontinent and southeastern Asia. In India, they are distributed in the Western Ghats and northeastern region towards Myanmar (Fraser 1933). The genus was described from Sulawesi (formerly the Celebes) in Indonesia, with *Protosticta simplicinervis* Selys, 1885, as the type species. The genus has 53 extant species distributed from Pakistan, through the Indian subcontinent to Indo-China and southeastern Asian islands (Paulson et al. 2022). There are 15 species of *Protosticta* in the Indian region and 12 of them inhabit the Western Ghats: *P. gravelyi* Laidlaw, 1915, *P. hearseyi* Fraser, 1922, *P. sanguinostigma* Fraser, 1922, *P. antelopoides* Fraser, 1924, *P. mortoni* Fraser, 1924, *P. davenporti* Fraser, 1931, *P. rufostigma* Kimmins, 1958, *P. ponmudiensis* Kiran, Kalesh & Kunte, 2015, and *P. monticola* Emiliyamma & Palot, 2016 (Kiran et al. 2015; Emiliyamma & Palot 2016; Joshi et al. 2020). *Protosticta myristicaensis* Joshi & Kunte, 2020; *P. sholai* Subramanian & Babu, 2020; and *P. cyanofemora* Joshi, Subramanian, Babu & Kunte, 2020 were recently described from the Western Ghats (Joshi et al. 2020).

Odonates of this genus have relatively small interspecific differences which are as follows: the coloration of the head, thoracic and abdominal markings, the structure of the prothorax, and anal appendages in the male. Diagnostic characters of females include the structure of prothorax and anal appendages (van Tol 2009; Bedjanič et al. 2016; Joshi et al. 2020). During the faunal exploration of Anamalais near the Palghat gap in the southern Western Ghats, the authors came across an undescribed species inhabiting the mid-elevation streams. This taxon is here described as new to science. In addition, a key to the males of all known species of *Protosticta* from the Western Ghats is provided. Image 1 shows the type locality of the new species.

MATERIALS AND METHODS

Damselflies were collected in the field with an insect net and preserved in absolute ethanol as wet specimens. Nomenclature follows Subramanian & Babu (2017) and Paulson et al. (2022). Taxonomic keys to the species have been modified based on Fraser (1933) and Joshi et al. (2020). The morphological description follows Garrison et al. (2010). The known distribution of the species follows Subramanian et al. (2018) and Joshi et al. (2020). The wing venation terminology follows Riek & Kukalová-



Image 1. Map showing the type locality of *Protosticta anamalaica* sp. nov. in Anamalai hills.

Peck (1984). Measurements and morphological details of all species mentioned and compared in the text are based on specimens in voucher collections of TORG. Photographs of the specimens were taken with Canon EOS 70D DSLR fitted with 180 mm macro lens and MPE 65 f 2.8 1–5x lens. The anal appendages have been studied by dissecting them and illustrated by KS using a stereo-zoom microscope (HEADZ Model HD81). Comparison of caudal appendages were done from fresh material with the exception of *P. antelopoides* and *P. hearseyi*, which were referred from Fraser (1933), Emiliyamma & Palot (2016), and Joshi et al. (2020). The superior division/fork of the male cerci is termed as the superior lobe and the inferior is termed the inferior lobe. The genital ligula of the holotype is preserved and the illustration is based on another male paratype in TORG collection.

RESULTS

Protosticta anamalaica sp. nov.

(Image 2D, 3, 5A–C,H,I)

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Material Examined

Holotype: TORG 1001, 26.xi.2021, male, Ponmudi Hill, Peechi Wildlife Sanctuary, Thrissur District, Kerala, India. 950 m, coll. Kalesh Sadasivan. Currently with TORG collections, Trivandrum, Kerala.

Paratype: (TORG 1002, 26.xi.2021, female, same data as of the holotype).

Holotype and paratype, both wet specimens, will be deposited in the insect collection facility of Zoological Survey of India (ZSI), Kozhikode.

Additional material studied: TORG 1003, male; TORG 1004 & 1005, females—all wet specimens in ethanol, bearing the same collection details as the holotype no. TORG 1001. These will be retained as voucher specimens in TORG collections. Two males and females were observed and photographed in the field but not collected, at the type locality.

Etymology: The species is named ‘*anamalaica*’ after the Anamalai hills, on which lies Peechi Wildlife Sanctuary, the type locality.

Suggested common name: The Anamalai Reedtail is the common name suggested for this species based on its distribution in the Anamalai Hills.

Description of male holotype

(TORG 1001) (Image 1, 2, 3, 5A–E, 5 H & I)

Head (Image 3A,C,E). Eyes anteriorly greyish-blue,

antero-dorsally black, greenish-brown postero-dorsally, and infero-laterally greenish-white. Mandible bluish-white, its inferior border, black, up to a third of its height. Labium pale translucent brown and anteriorly brown. Labrum is pale bluish-white, slightly darker compared to the antefrons, its entire free edge bordered in black which extends to one-fourth of the height of the labrum. Genae blackish-brown. Vertex dark bronze. Anteclypeus pale bluish-white. Postclypeus bronze metallic lustre. Antefrons and postfrons with dark metallic bronze lustre, extending into the ocular margin. Occiput matte brownish-black with an occipital bar having bronze tinge. Post-ocular lobe black. Ocelli waxy white. Antennae basal segment and half of the first segment translucent white, rest of the segments dark brownish-black. Sparse brownish hairs on the lateral aspect of the anteclypeus and free edge of the labrum. Long pale brown hairs along the inferior border of anteclypeus and on the labium.

Prothorax (Image 3E). The anterior lobe is almost half the length of middle lobe, posterior lobe is almost 2/3rd the length of the middle lobe. The general colour is brown but the notopleural suture and adjoining aspect of the anterior and middle lobe is demarcated in a suffused blackish band that extends vertically along the middorsal aspect. Superior two-thirds of propleuron are brown while its inferior third is pale brownish-white. There are no expansions or spines on the lobes of the prothorax. On ventral view, there is a central band of black on its posterior edge, between the coxae. The foreleg coxae, trochanter, femur, and tibia are pale brownish-white. The lateral aspect of the femur and tibia are stippled in brown. The spines, ends of the femur near the tibiofemoral joint, and the claws black.

Synthorax (Image 3C–E). General colour is brown marked with pale yellowish-white and black. On dorsal view, mesostigmal plate black. Mid-dorsal carina brown anteriorly and the posterior fourth is blackish. On the lateral view, the mesepisternum is shiny bronze and the mesepimeron brown. Mesinfraepisternum centrally dark brownish-black, superior fourth brown and inferior fourth brownish-white; markings suffused. Metepisternum with superior half pale yellowish-white, inferior half brown which turns black anteriorly. Metepimeron with the superior half of the anterior 3/4th brown, the rest pale yellowish-white. Metinfraepisternum brown and inferiorly margined in pale brownish-white. Metathoracic spiracle brown. On ventral view, venter of the metathorax is pale brownish-white, the rest matte black. The mid and hindleg coxae, trochanter, femur, and tibia are pale brownish-white.

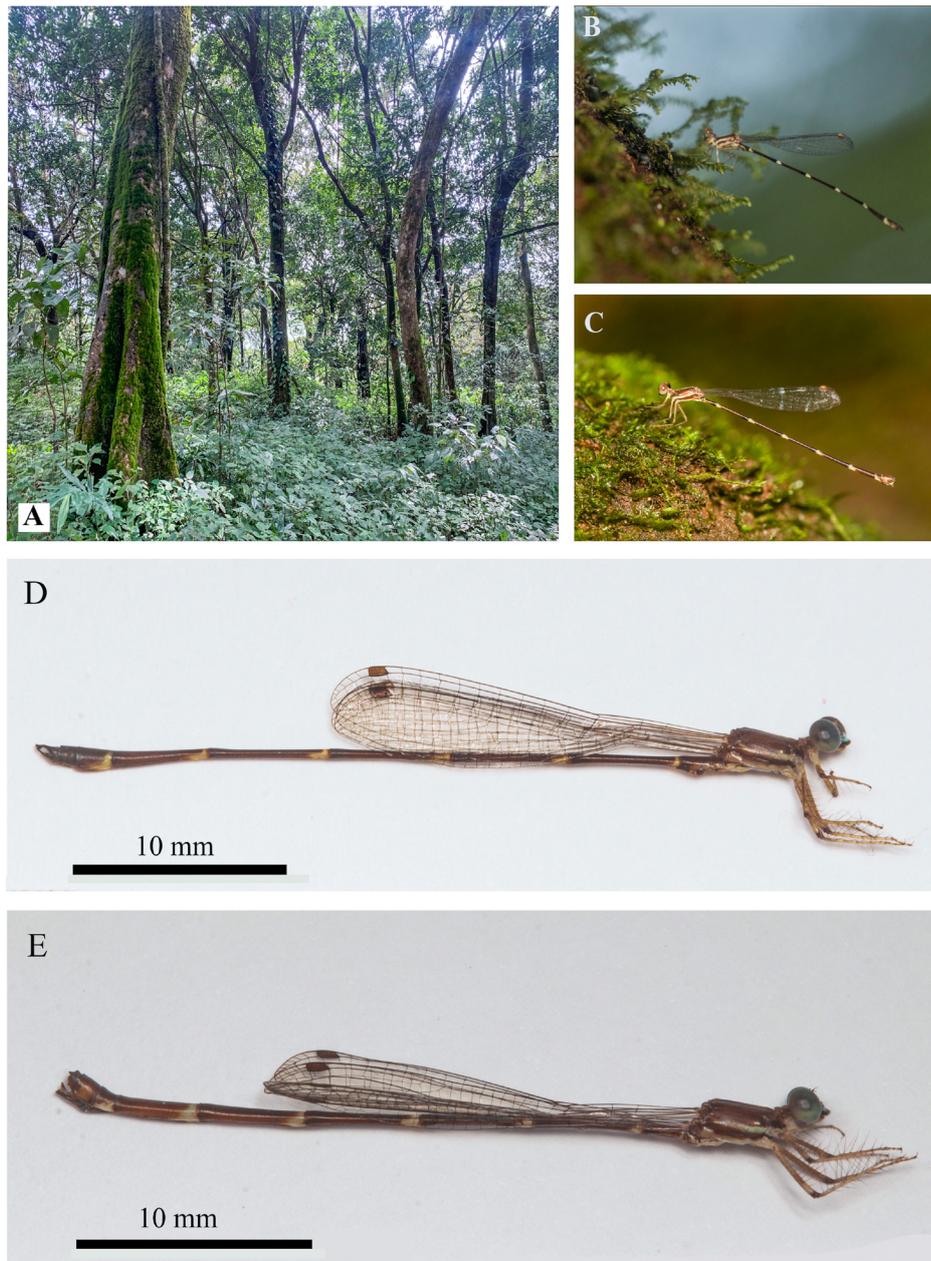


Image 2. *Protosticta anamalaica* sp. nov.: A—habitat, semi-evergreen forest | B—immature male in field | C—immature female in field | D—holotype male (TORG 1001) | E—paratype female (TORG 1002). © Kalesh Sadasivan.

The lateral (extensor) aspect of the femur and tibia are stippled in brown. Spines, ends of the femur near the tibiofemoral joint, and the claws dark brownish-black. Flexor aspect pale amber brown.

Wings (Image 5B,C). Hyaline; Pt of both wings brown occupying less than one and one-third cells, trapezoidal; anterior border slanting posteriorly; posterior border vertical thus making the superior border shorter than the inferior; inferior border almost straight. Pt length at its middle twice its breadth. Anal bridge absent. Ax-2

in all wings. Px- Fw 9 and Hw 8. The number of cells between the bifurcation of R2 and origin of IR2 in Fw is 1 and in Hw is 2.

Abdomen (Image 2D, 3A). General colour dark blackish-brown and marked in pale yellowish-white as follows: S1 laterally pale yellowish-white smudged in brown; S2 below a diagonal connecting the anterosuperior to the posteroinferior edges; S3-7 marked with very thin basal annuli, ventral part of them extending posteriorly than laterally; the mark on

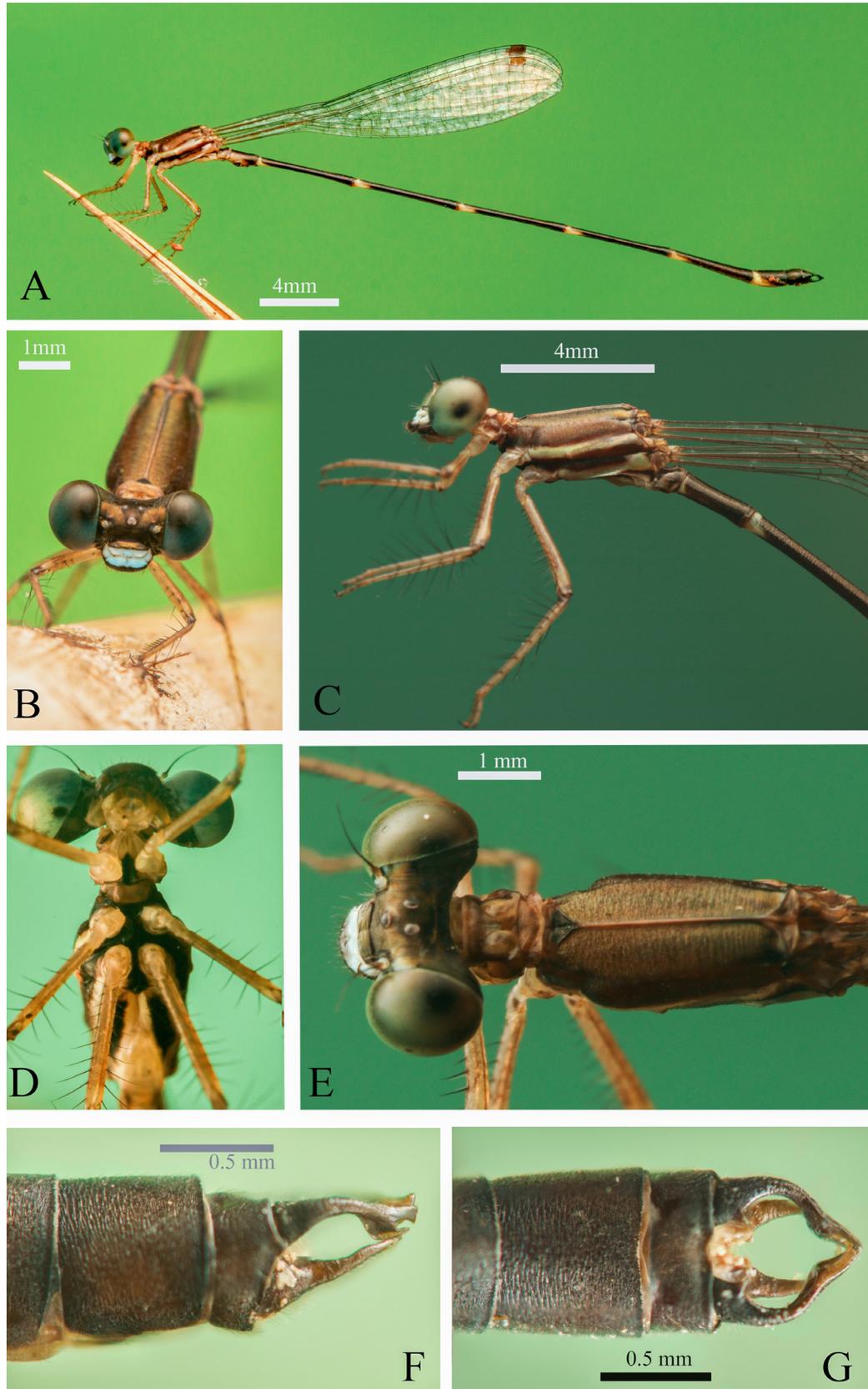


Image 3. *Protosticta anamalaica* sp. nov., holotype male (TORG 1001): A—lateral view of the whole insect | B—close-up of face | C—close-up view of lateral aspect of head, prothorax and synthorax | D—ventral side of synthorax | E—dorsal images of prothorax and synthorax | F—left lateral view of the caudal appendages of male | G—dorsal view of the caudal appendages of male. © Kalesh Sadasivan.

S7 extending thinly ventrally on its anterior thirds; the annuli of S3 conspicuously thinner (reduced to almost half) than on the rest of the segments. Annuli on S7 & S8 incomplete dorsally. S8 annulus is the largest of the annuli and on the ventrolateral aspect stops just short of its distal margin. S9 & S10 are fully black. Genital ligula as illustrated bearing very minute setae on either side of the shaft of the distal end of the first segment (Image 5 D, E), based on male paratype (TORG 1003).

Caudal appendages (Image 3F,G, 5H,I) Coloured black, the thinner tips of cerci and paraprocts brown. Length twice that of S10 on dorsal view. Cerci widest at the base; furnished with a small triangular tooth at the basal fourth of the cerci; middle third uniformly tapering and curved inwards. The distal third expands into the forcipate tip, with a superior and inferior lobe. The superior lobe is thick, with the tip straight and blunt, not incurved. The inferior lobe is thin and slightly shorter than the superior lobe. Outer margin of cerci sinuous with a depression/concavity at the origin of the superior lobe of cerci. Paraprocts uniformly curved inwards; long, ending just short of the distal end of the inferior lobe of the cerci. Paraprocts with tip bevelled dorso-ventrally and truncated not bulbous.

Measurements (mm). Total length (TL) 38.5 mm, abdominal length (AL) 33 mm, Fw length (FL) 19 mm, Hw Length (HL) 18 mm.

Description of female paratype

(TORG 1002) (Image 2E, 5F,G).

Head (Image 4B–E) Exactly as in the male. Labrum pale blue, its distal free margin jet black, this black extends to about half of its height in the midline. Mandible pale blue and its free end (distal third) jet black, the borders between the colours smudged. Anteclypeus pale bluish-white; postclypeus shiny bronze. Rest of the head the genae, vertex bronze. Occiput as in males. Eyes bluish as in males but slightly greener. Ocelli and antennae as in males.

Prothorax (Image 4E) as in males, no spines or ornamentations.

Synthorax (Image 4A–E) as in males.

Wings (Image 4A). Hyaline; Pt of both wings brown occupying less than one and one-third cells, trapezoidal; anterior border slanting posteriorly; posterior border vertical thus making the superior border shorter than the inferior; inferior border much more convex than in male. Pt length at its middle twice its breadth. Anal bridge absent. Ax–2 in all wings. Px– Fw 10 and Hw 10. The number of cells between bifurcation of R2 and origin of IR2 in Fw 1 and Hw 1.

Abdomen (Image 4A). Segments S1–S7 coloured as in the male, but shinier bronze with the caudal end of each segment almost black. Segment 8 bears the lateral triangular pale yellowish-white patch. Lateral aspect of S9 including its middle third reddish-brown, rest of it dark brown. Segment 10 dark brownish-black. S8 is twice the length of S10, while S9 is thrice the length of S10.

Caudal appendages (Image 5F,G). Cerci brownish-black, broader at the base, 0.6 times the length of S10, triangular in lateral view with a superior border slightly concave, tip blunt; paraprocts reduced, rounded brown, less than a third of the length of cerci; dorsal half of valve of ovipositor brown, ventral half dark brown, terebra brown, triangular, twice as long as cerci; ovipositor brown, ending in a brownish-black style reaching just beyond cerci and valve.

Measurements (mm). Total length (TL) 34.5 mm, abdominal length (AL) 27 mm, Fw length (FL) 19 mm, Hw Length (HL) 18 mm.

Variation in paratypes. In males, the variation was observed in the size total length (TL) 36.55 ± 2.90 (n = 2). The Px is always 10 less than in both sexes but an occasional aberrant may have 11, unilaterally in Fw of females (n = 6).

Diagnosis The new species is distinguished from its congeners in the Western Ghats by the combination of posterior lobe of prothorax devoid of spines and its posterior border not expanded; anterior 1/3rd of S8 pale yellow and the marking not connected dorsally; S9 completely black; pterostigma dark brown, trapezoidal with a length twice the breadth, and Fw and Hw with 10 or less Px; cerci with a small blunt basal protuberance; paraprocts not clubbed at apices, the outer fork of cerci not bilobed, its tip being straight and not incurved.

Habitat and Ecology

The species was first collected from a mid-elevation semi-evergreen forest at 950 m bordering a secondary grassland in Peechi Wildlife Division on the western flanks of Anamalais in November 2021 (Image 2A). The females were first discovered perched on dark trunks of trees at heights less than 2 m above the forest floor (Image 2C). They flew to higher levels of the trunk when disturbed. The males were also found in the same habitat on tree trunks (Image 2B). The females generally outnumbered the males (males: female, 1:2). A small shallow perennial seepage (50 cm wide, 10 cm depth) was found within 150 m of the forest where the males and females were first sighted. Males were seen perched on the low fringing vegetation and twigs (<10 cm high)



Image 4. *Protosticta anamalaica* sp. nov., paratype female (TORG 1002): A—lateral view of the whole insect | B—close-up of face | C—dorsal images of prothorax and synthorax | D—close-up view of lateral aspect of head, prothorax, and synthorax. © Kalesh Sadasivan.

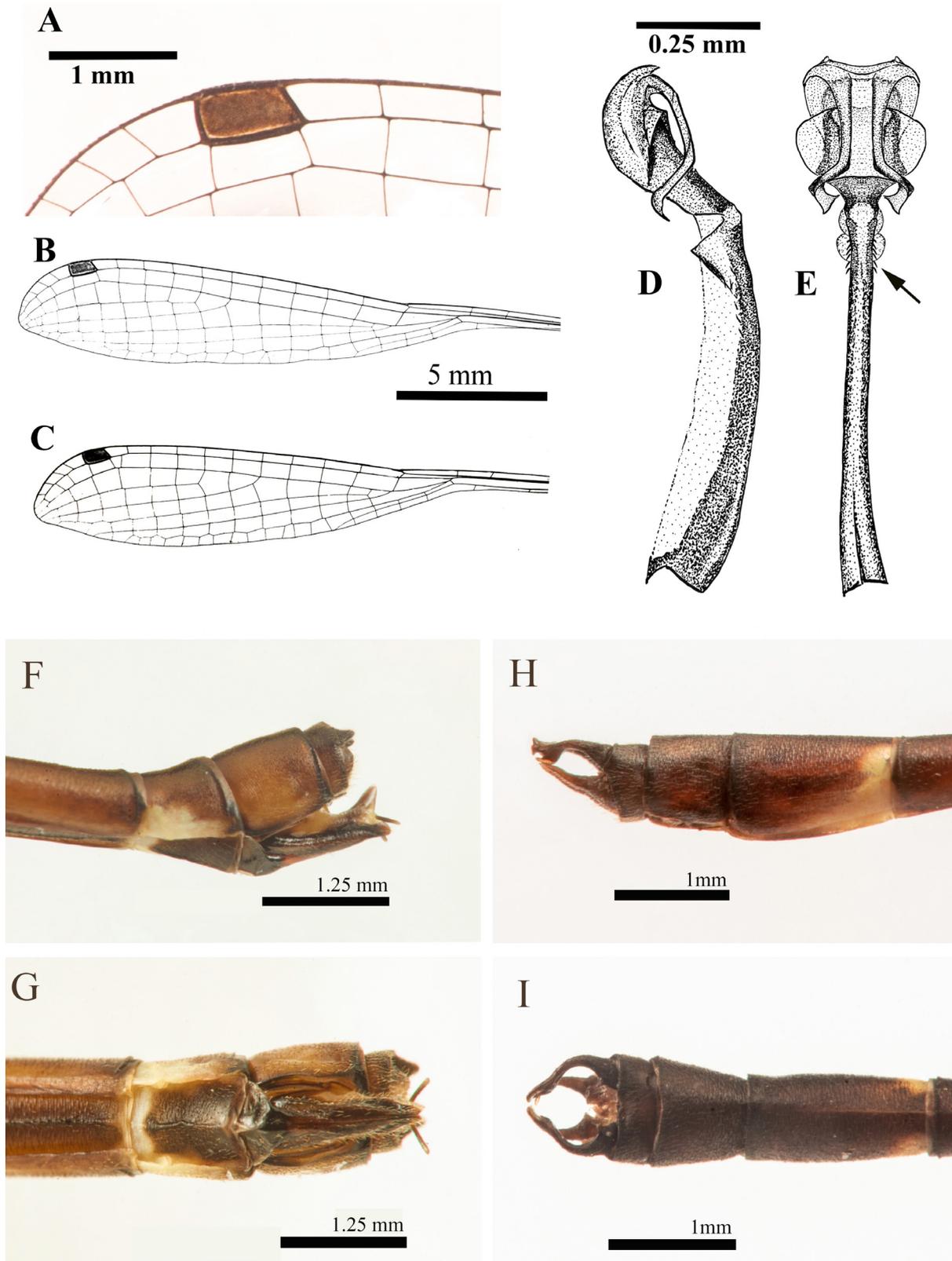


Image 5. *Protosticta anamalaica* sp. nov.: A—pterostigma of left forewing of male (TORG 1001) | B—venation left forewing of male (TORG 1001) | C—venation left hindwing of male (TORG 1001) | D—lateral view of the genital ligula (TORG 1003) | E—ventral view of the genital ligula, black arrow pointing to the setae (TORG 1003) | F—left lateral view of female caudal appendages (TORG 1002) | G—ventral view of female caudal appendages (TORG 1002) | H—right lateral view of male caudal appendages and terminal segments S8–10 (TORG 1001) | I—dorsal view of male caudal appendages and terminal segments S8–10 (TORG 1001). © Kalesh Sadasivan.

very close to the edge of the water defending their very small territories (roughly 25 cm²). Males from adjacent territories were seen fighting head-on to protect their waterfront. The females were seen perched on dark shady pockets of the vegetation along the edges of the hill stream. Teneral were also seen during the last week of November 2021. The damselflies sought shelter in the adjacent forest in windy weather.

DISCUSSION

Based on the structure of the male cerci, structure & coloration of prothorax, shape & colour of Pt, colour & pattern of eyes, labrum, mandibles, femur, and spot in S8 the new species can be easily separated from its congeners.

The new species of *Protosticta* is easily differentiated from *P. antelopoides* and *P. ponmudiensis* by the absence of any spines on its prothorax.

The recently described *P. myristicaensis* is small (TL <25 mm), has postclypeus bright blue and mandibles brown, while the new species is larger (TL >38 mm) postclypeus bronze colour and mandibles blue with black margins in *P. anamalaica* sp. nov.; anterior 1/3rd or more of S8 marked with bright turquoise-blue, the markings connected dorsally (S8 marking pale yellowish-white and incomplete dorsally in *P. anamalaica*); apical fork of cerci deeply incised more than 1/3rd of the total length and cerci with a small tubercle at the middle of the apical fork (shallow incision with no such tubercles in *P. anamalaica*).

From *P. gravelyi* and *P. mortoni*, the new species is diagnosed by the shallowly incised apical lobe of cerci, while the other two have them deeply incised more than 1/3rd of the total length. In addition, *P. gravelyi* has a hexagonal black marking covering the central portion of posterior lobe and a small portion of the middle lobe on the prothorax and *P. mortoni* has anterior and middle lobes of prothorax blue while no such marks or blue colour is seen in *P. anamalaica*, which has a brown prothorax with the notopleural suture and adjoining part of the anterior lobe suffused in black.

Protosticta hearseyi another small species (TL <30 mm), has blue prothorax and the caudal appendages are characterized by the very short inferior lobe of cerci, and superior lobe not expanded, while *P. anamalaica* has brownish prothorax and the inferior lobe of cerci only a little short of the superior.

P. davenporti and *P. rufostigma* has a different structure of male caudal appendages with the distal end

of the superior lobe of cerci being consciously expanded on dorsal view, while it appears straight and rounded in the new species. The color of the prothorax is also different with the anterior and middle lobes of prothorax pale yellow, posterior lobe partially or completely black, while it is brown with black suffusion in the new species. The Pt in *P. rufostigma* is almost squarish with the length always less than twice the breadth, while the length of Pt is twice the breadth in *P. anamalaica*. The markings in S8 connected dorsally in *P. davenporti* and *P. rufostigma* (S8 marking pale yellowish-white and incomplete dorsally in *P. anamalaica*).

The S8 with the basal markings unconnected dorsally is a feature common to *P. sholai*, *P. sanguinostigma*, *P. cyanofemora*, *P. monticola*, and the new species. The recently described *P. sholai* has S9 laterally marked with a large yellow at the anterior border, reaching more than 2/3rd of the segment and paraprocts thin, long, and clubbed at apices, while it is unmarked and the paraprocts are not clubbed in *P. anamalaica*. Further, the mandibles are black and postclypeus bright blue in *P. sholai*, while mandibles are blue with black margins and postclypeus bronze in *P. anamalaica*. The downcurved cerci with a long robust basal spine, the bilobed tip of the superior lobe of cerci, and the brown equatorial band of eyes are characters of *P. sanguinostigma*, which the new species lack. Besides, the blood-red colour of the Pt and an elongated spot in S8 are also characteristics that *P. anamalaica* lacks. *Protosticta cyanofemora*, has eyes and flexor surface of femur bright blue (greyish-blue eyes and pale brownish legs in *P. anamalaica*). The mandibles and postclypeus are black in *P. cyanofemora* while the mandible is pale blue with a black margin, and postclypeus is bronze coloured in *P. anamalaica*. The prothorax purple, marked extensively with black in *P. cyanofemora*, while it is brown with a black smudge in *P. anamalaica*. The caudal appendage of the new species is similar to *P. cyanofemora*, but is shorter. The caudal appendages are more uniformly curved and only twice the length of S10 in *P. anamalaica*, while it is comparatively straighter and thrice the length of S10 in *P. cyanofemora*. The outer margin of the superior lobe of cerci in *P. cyanofemora* is relatively straight compared to the conspicuously convex margin of *P. anamalaica*. In field *P. anamalaica* superficially resembles *P. monticola*, from which it is diagnosed by the long Pt (length > twice the breadth) and the higher Px (always >10) in both wings of the latter. The caudal appendages are more uniformly curved and only twice the length of S10 in *P. anamalaica*, while it is comparatively straighter and thrice the length of S10 in *P. monticola*. Moreover, the tip of the superior

Key to species of Protosticta Selys, 1885 from Western Ghats based mature males modified from Joshi et al. (2020)

- 1 The posterior lobe of prothorax with spines 2
- Posterior lobe of prothorax without spines (Image 3E) 3

- 2 The posterior lobe of prothorax with a pair of long, divaricate horn-like spines; S7 faintly marked at base or unmarked; paraprocts bifid at apex *P. antelopoides*
- Posterior lobe of prothorax with a pair of short lateral spines and internally two medial spines; S7 with extensive blue markings; paraprocts twisted and curved inwards, not bifid at apex *P. ponmudiensis*

- 3 Anterior 1/3rd or more of S8 bright turquoise blue, connected dorsally 4
- Anterior 1/3rd of S8 yellow or blue, not connected dorsally (Image 5I) 9

- 4 Apical fork of cerci deeply incised more than 1/3rd of the total length 5
- Apical fork of cerci shallow incised, much less than 1/3rd of total length (Image 3F) 7

- 5 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 6

- 6 Prothorax with a hexagonal black marking covering central portion of posterior lobe and small portion of middle lobe; cerci with a prominent laterally pointed basal spine; paraprocts with an inner stout spine at base *P. gravelyi*
- Anterior and middle lobes of prothorax colored blue, no hexagonal black mark; cerci with a small laterally pointed basal spine; paraprocts without an inner stout spine at base *P. mortoni*

- 7 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 expanded 8

- 8 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*

- 9 S9 completely black or marked only at ventral border; posterior border of prothorax not expanded; paraprocts not clubbed at apices 10
- S9 laterally marked with a large yellow 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*

- 10 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 11

- 11 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 view 12
- Pt trapezoid with length twice the breadth (Image 5A); Px in all wings 10 or less (Image 5B,C); caudal appendages only twice the length of S10 (Image 5H, I); outer margin of cerci sinuous; tip of superior lobe of cerci straight on dorsal view *P. anamalaica sp. nov.*

- 12 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, ventro-laterally yellow extends to the distal end; tip of superior lobe of cerci bent inward at apices *P. monticola*

Table1. Comparison of morphometric characters of Protosticta monticola, P. cyanofemora and P. anamalaica sp. nov., based on data from Emiliyamma & Palot, 2016, Joshi et al. (2020) and TORG specimens.

	Character of males, measurements in mm	<i>P. monticola</i>	<i>P. cyanofemora</i>	<i>P. anamalaica sp. nov.</i>
1	Total Length (TL)	41.0–44.0	37.3	38.5
2	Abdominal length (AL)	33.0–35.0	37.0	33.0
3	Fw length (FL)	23.0–24.0	22.6–23.0	19.0
4	Hw Length (HL)	21.0–22.0	21.9–22.2	18.0
5	Post nodal count Fw, Hw (Px)	12, 11	13, 11–12	9, 8

lobe of the tip of cerci is incurved in *P. monticola*, while it is straight in *P. anamalaica*. The two species are also niche separated, *P. monticola* is a montane species seen >1,600 m of the subtropical temperate forests while the new species is from the mid-elevations below 1,000 m as far as known in the tropical semievergreen forest belt. See Table 1 for a comparison of morphometric characters of the closely similar *P. monticola*, *P. cyanofemora*, and *P. anamalaica*.

CONCLUSION

The species *P. anamalaica* sp. nov. is an inhabitant of the first-order streams of mid-elevation forests of Anamalais in the Western Ghats. These species from seepages, streamlets, and hill streams are the most vulnerable in the wake of climate change (Rogers et al. 2020). As per Nair et al. (2021), the checklist of odonates of Western Ghats currently stands at 207 species with 80 endemics. The state of Kerala has 181 odonate species with 68 endemics (Nair et al. 2021). Thus, the addition of *P. anamalaica* raises the Odonata species diversity of Western Ghats to 208 species with 81 endemics, and that of Kerala to 182 species with 69 endemics. The discovery of a new species reiterates the fact that more systematic exploration of this biodiversity hotspot should be carried out in the southern Western Ghats, especially in the light of increasing anthropogenic influences and habitat transformations.

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Articles

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