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New Genus and Two New Species of Semiterrestrial Crabs (Decapoda: Brachyura: Gecarcinucidae) from the Southern Western Ghats, India

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One new genus and two new species of semiterrestrial freshwater crabs are described from the Southern Western Ghats mountain range in India: *Pavizham gavi* gen., sp. nov. and *Rajathelphusa brunnea* sp. nov. The carapace of *Pavizham* n. gen. is superficially similar to *Baratha* and *Snaha* described from the same region, but it can be distinguished from *Baratha* in having no visible postorbital cristae, complete sutures between male thoracic sternites 2 and 3, the possession of a triangular male pleon and the elongate terminal segment of the male first gonopod; and from *Snaha* by the presence of a long flagellum on the exopod of the third maxilliped, a complete suture separating male thoracic sternites 2 and 3, and its triangular male pleon. *Rajathelphusa brunnea* sp. nov. can easily be distinguished from congeners in possessing a distinctly more slender and elongate male first gonopod.

Key words: *Pavizham, Rajathelphusa*, Taxonomy, Kerala, Freshwater crab, Indian subcontinent, biodiversity.

BACKGROUND

The gecarcinucid freshwater crab diversity of the Western Ghats is very high, with new species reported at a regular rate (Pati et al. 2016 2017 2020; Rajesh et al. 2017; Pati and Thackeray 2018 2021; Kumar et al. 2017; Raj et al. 2021). Of the 71 species of freshwater crabs now known in this area, 42 species from 16 genera are harboured in Kerala, of which 22 are endemic (Pati and Sharma 2013; Pati and Sudha Devi 2015a b; Kumar et al. 2017; Rajesh et al. 2017; Pati et al. 2017 2019 2020; Raj et al. 2021; present study). The present paper

documents the description of a new genus and two new species of semiterrestrial freshwater crabs *Pavizham gavi* gen. nov., sp. nov. and *Rajathelphusa brunnea* sp. nov. collected from the Gavi region of Pathanamthitta district, and the Mattupetty region of Idukki district of the state, respectively.

MATERIALS AND METHODS

Methods of measurement and terminology follow Ng (1988) and Davie et al. (2015). The

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size of the specimens (in millimetres) refers to the maximum carapace width and length, respectively. Samples examined were deposited into the museum collections of the Department of Aquatic Biology and Fisheries, University of Kerala (DABFUK), India. The abbreviations G1 and G2 are used for the male first and second gonopods, respectively.

RESULTS

TAXONOMY

Superfamily Gecarcinucoidea, Rathbun, 1904 Family Gecarcinucidae Rathbun, 1904

Pavizham gen. nov. urn:lsid:zoobank.org:act:D0B2BC35-73B2-41AF-8C5D-5C94D6080CA4

Diagnosis: Carapace deep, dorsal surface ovate, high, swollen, smooth (Figs. 2, 3A-C,); epigastric cristae faintly discernible; postorbital cristae not visible (Figs. 2, 3A-C); external orbital tooth very broad, low (Fig. 3A, B); epibranchial tooth very small, low, just visible (Figs. 2, 3A, B). posterolateral margins distinctly converging towards posterior carapace margin (Fig. 3A, B); third maxilliped ischium relatively long, exopod with distinct flagellum extending across width of merus (Fig. 5A); inner angle of carpus of adult male cheliped with distinct curved tooth (Figs. 2, 3A); base of closed fingers of major adult male chela with small gape (Fig. 4D); ambulatory legs slender, not elongate (Figs. 2, 3A); anterior male thoracic sternum transversely broader, sternites 1 and 2 completely fused to form triangular plate, separated from sternite 3 by complete, shallow groove; sternites 3 and 4 fused, demarcated by shallow groove (Figs. 3D, 4B, 5B); male sternopleonal cavity deep, broad, reaching to imaginary line joining anterior points of cheliped coxae (Figs. 3D, 4B); male pleonal locking tubercle low, round (Fig. 4B); male pleon distinctly triangular, somite 6 broader than long; telson triangular with almost straight lateral margins (Figs. 3D, 4A); G1 almost straight, groove for G2 ventral in position; terminal and subterminal segments clearly demarcated; terminal segment relatively long, conical, gradually tapering to truncate tip (Fig. 5C-E); G2 long, with long slender distal segment, nearly half length of basal segment (Fig. 5F).

Type species: Pavizham gavi sp. nov. by present designation.

Etymology: The name is derived from the Malayalam name 'Pavizham', for a precious stone (red coral), alluding to the smooth and polished appearance

of the type species and its red colouration. Gender of name neuter.

Remarks: The swollen and smooth carapace of Pavizham n. gen. closely resembles that of Baratha Bahir & Yeo, 2007, and Snaha Bahir & Yeo, 2007. Pavizham can be separated from Baratha in having no visible postorbital cristae with the surface there smooth (Fig. 3A–C) (versus postorbital crista sharp, distinct, cf. Bahir & Yeo, 2007: figs. 19A, 21A); the external orbital tooth is very broad and low (Fig. 3B) (versus tooth acutely triangular and less wide, cf. Bahir & Yeo, 2007: figs. 19A, B, 21A, B); the third maxilliped ischium is proportionately much longer (Fig. 5A) (versus subquadrate, cf. Bahir & Yeo, 2007: figs. 19B, 21B); the suture between male thoracic sternites 2 and 3 are complete (Figs. 3D, 5B) (versus only medially visible, being completely fused laterally, cf. Bahir & Yeo, 2007: figs. 18A, 19C, 21C); the distinctly triangular male pleon (Fig. 4A) (versus T-shaped, cf. Bahir & Yeo, 2007: figs. 18B, 19C, 21C); and the G1 terminal segment is more elongate (Fig. 5C-E) (versus short, cf. Bahir & Yeo, 2007: figs. 18C-F, 20A-D). Pavizham can be separated from *Snaha* in having a very small and low epibranchial tooth, the anterolateral margin being almost entire except for a shallow cleft (Fig. 3B) (versus with small but visible epibranchial tooth, cf. Bahir & Yeo, 2007: figs. 28A, 30A); the third maxilliped exopod has a long flagellum (Fig. 5A) (versus no flagellum present, cf. Bahir & Yeo, 2007: fig. 27A); the third maxilliped ischium is proportionately much longer (Fig. 5A) (versus subquadrate, cf. Bahir & Yeo, 2007: fig. 27A); the inner angle of the carpus of the male cheliped has a distinct curved tooth (Figs. 2, 3A) (versus with low tubercle, cf. Bahir & Yeo, 2007: fig. 28A); there is a small gape at the base of the closed fingers of the major adult male chela (Fig. 4D) (versus fingers has a wide basal gape when the fingers are closed, cf. Bahir & Yeo, 2007: fig. 28A); the suture between male thoracic sternites 2 and 3 is complete (Figs. 3D, 5B) (versus only medially visible, being completely fused laterally, cf. Bahir & Yeo, 2007: figs. 28C, 29A, 30C); the male sternopleonal cavity reaches to an imaginary line connecting the anterior edges of the coxae of the chelipeds (Figs. 3D, 4B) (versus cavity reaches to an imaginary line connecting the midpoints of the coxae of the chelipeds, cf. Bahir & Yeo, 2007: fig. 28C); and the triangular male pleon is distinctly triangular (Fig. 4A) (versus T-shaped, cf. Bahir & Yeo, 2007: figs. 27B, 28C, 29B).

Pavizham is also morphologically similar to Indian genera like *Ghatiana* Pati & Sharma, 2014, *Gubernatoriana* Bott, 1970, *Inglethelphusa* Bott, 1970, and *Sahyadriana* Pati & Thackeray, 2018, but these differ in having no flagellum on the exopod of third maxilliped. *Pavizham* differs from *Liotelphusa* Alcock, 1909 in its carapace morphology, with its carapace distinctly more ovate in shape; from *Arcithelphusa* Pati & Sudha Devi, 2015 in having a prominently less arched carapace; and from *Cylindrotelphusa* Alcock,

1909 in having a much smoother one.

Distribution: The genus is known only from the southern Western Ghats Kerala (Figs. 1, 6).



Fig. 1. Map of India showing type localities of Pavizham gavi gen. nov., sp. nov. and Rajathelphusa brunnea sp. nov.

Pavizham gavi sp. nov.

(Figs. 2–5) urn:lsid:zoobank.org:act:5B4074B1-DED9-4000-B9E0-AB2B3FF462AC

Material examined: Holotype: male $(17.3 \times 12.8 \text{ mm})$ (DABFUK/AR-BR-116), from a waterfall near Gavi, Pathanamthitta district Kerala, India, 9.421056°N, 77.162659°E, coll. S. Raj, coll. 17 September 2017.

Diagnosis: As for genus.

Description of male holotype: Carapace broader than long, width 1.3 times length; dorsal surface convex (Figs. 2, 3A, B). Frontal region relatively narrow, surface smooth (Fig. 3C); lateral parts of anterolateral and posterolateral regions smooth (Figs. 2, 3A, B); suborbital region smooth; pterygostomial regions smooth, glabrous, separated from other regions by a groove; sub-branchial regions smooth (Fig. 3C). Epigastric cristae are faintly visible, medially separated by a shallow groove; postorbital cristae not visible, surface smooth (Figs. 2, 3A-C). Cervical grooves distinct, not broad, shallow, joining prominent H-shaped grooves (Figs. 2, 3A, B). External orbital tooth, very broad and low, outer margin almost straight, ca. 10 times longer than inner margin (Figs. 2, 3A, B); epibranchial tooth very small (Figs. 2, 3A, B). Anterolateral margins distinctly convex, with small striae (Figs. 2, 3A, C). Posterior lateral margin gently concave, converging to almost straight or gently sinuous posterior carapace margin (Figs. 2, 3A, B). Orbits subovate, oblique in frontal view; eyes filling up most of orbital space, eye peduncle moderately long, stout, cornea moderately large (Fig. 3C). Supraorbital margin

sinuous, complete, suborbital margin concave (Fig. 3C). Antennae short, not reaching cornea of eyes; antennules folding transversely in narrow fossa (Fig. 3C). Posterior margin of epistome with distinct median triangular tooth (Fig. 3C). Mandibular palp distinctly 2-segmented, terminal article bilobed.

Third maxilliped ischium rectangular, with distinct median sulcus; merus quadrate; exopod almost slender, not reaching midlength of merus, flagellum long, reaching about entire width of merus (Figs. 3C, D, 5A).

Chelipeds distinctly asymmetrical (Figs. 2, 3A, 4C, D). Dorsal margin of merus with small striae, appears unevenly serrated, ventral margin with low granules (Figs. 2, 3A, 4C, D). Outer surface of carpus rugose, distal angle with prominent sharp tooth (Figs. 2, 3A, 4C, D). Outer surface of chelae with small striae, fingers of major chelae curved, with median proximal gape when fingers closed, cutting margin with moderately large teeth and denticles; fingers of minor chelae curved, with small teeth and denticles (Fig. 4C, D).

Ambulatory legs slender, not elongate; P3 longest, P5 shortest (Figs. 2, 3A). Merus with sharp dorsal and ventral margins, margins unevenly serrate but low; carpus with longitudinal median crest; propodus subrectangular, with low median longitudinal crest; dactylus elongate, gently curved, lined with small sharp spines (Figs. 2, 3A).

Anterior thoracic sternum transversely broad; sternites 1 and 2 completely fused to form triangular plate with convex lateral margins; separated from sternite 3 by a complete suture; sternite 3 and 4 fused, demarcated by shallow moderate oblique grooves; sutures between sternites 4/5, 5/6 and 6/7 medially



Fig. 2. Pavizham gavi gen. nov., sp. nov., holotype male (17.3 × 12.8 mm) (DABFUK/AR-BR-116). Colour in life.

interrupted, separated by narrow space; suture between sternites 7/8 complete, joining short longitudinal groove between sternites (Figs. 3D, 4B, 5B). Sternopleonal cavity deep, broad, reaching to imaginary line joining the anterior point of cheliped coxae (Figs. 3D, 4B). Male pleonal-locking tubercle low, round, positioned on sternite 5 (Fig. 4B). Penis on condyle of coxa of last ambulatory leg, visible as short papilla with subtruncate



Fig. 3. *Pavizham gavi* gen. nov., sp. nov., holotype male (17.3 × 12.8 mm) (DABFUK/AR-BR-116). A, overall view; B, dorsal view of carapace; C, frontal view of cephalothorax; D, third maxillipeds, thoracic sternum and pleon.

tip.

Pleon triangular, all somites and telson free; somites 1 and 2 longitudinally narrow, subequal in width, somite 3, 4 and 5 trapezoidal; somite 6 broader than long, with gently concave lateral margins; telson triangular with slightly concave lateral margins (Figs. 3D, 4A).

G1 almost straight, groove for G2 ventral in position; terminal and subterminal segments clearly demarcated; terminal segment relatively long, conical, gradually tapering to truncate tip (Fig. 5C–E). G2 long, with long slender segment, nearly half the length of the basal segment (Fig. 5F).

Colour: In life most of the carapace and legs are red in colour (Fig. 2). Chelipeds light red in colour (Fig. 2).

Etymology: The species name is derived from the collection locality "gavi" in the southern Western Ghats where the species was collected. The name is used as a noun in apposition.

Distribution: The species is known only from Gavi (9.421056°N, 77.162659°E) in the Pathanamthitta

district of the southern Western Ghats, Kerala (Fig. 1).

Remarks: While *Pavizham gavi* closely resembles *Baratha peena* Bahir & Yeo, 2007 and *B. pushta* Bahir & Yeo, 2007, *Snaha aruna* Bahir & Yeo, 2007 and *S. escheri* (Roux, 1931); the generic characters discussed above easily distinguish them.

Ecology: The species was collected from a waterfall (Fig. 6) under stones and nothing more is known about its ecology. Despite several efforts, more specimens could not be collected. Its conservation status is indeterminate until more samples can be obtained and its actual range established.

Rajathelphusa Raj, Kumar & Ng, 2021

Rajathelphusa brunnea sp. nov.

(Figs. 7, 8A, 11A, 12A) urn:lsid:zoobank.org:act:FC137752-02F7-4853-84D5-5559434CFD49

Material examined: Holotype: male $(30.2 \times 22.6 \text{ mm})$ (DABFUK/AR-BR-117), Mattupetty, Idukki,



Fig. 4. Pavizham gavi gen. nov., sp. nov., holotype male (17.3 × 12.8 mm) (DABFUK/AR-BR-116). A, pleon; B, anterior thoracic sternum and sternopleonal cavity; C, right chela; D, left chela. C and D same scale.

Kerala, India, coll. S. Raj, 24 April 2018. Paratypes: 2 males (33.9 × 25.9 mm, 23.6 × 18.6 mm) (DABFUK/ AR-BR-118-119); 4 females (34.0 × 25.2 mm, 30.0 × 22.9 mm, 27.6 × 21.0 mm, 24.1 × 18.6 mm) (DABFUK/ AR-BR-120-123), Mattupetty, Idukki, Kerala, India, coll. S. Raj, 27 October 2021.

Comparative material: Rajathelphusa ala Raj, Kumar & Ng, 2021 Holotype: male (27.0 × 20.9 mm) (DABFUK/AR-BR-99/ZSI/WGR/IR.INV,/15361), Rajakumari, Idukki district, Kerala, 9.966911°N, 77.129715°E, coll. 2016. Rajathelphusa muni Raj, Kumar & Ng, 2021 Holotype: male (30.2 × 22.6 mm) (DABFUK/AR-BR-115) Kovilkadavu, Idukki district, Kerala (10.261413°N, 77.183799°E) coll. 2016.

Diagnosis: Carapace frontal region relatively wider (Figs. 8C, 11E); external orbital tooth with outer margin gently sinuous to almost straight (Figs. 7, 8A, B, 11A, B); male pleonal somite 6 subquadrate, with almost straight lateral margins, telson with concave lateral margins (Figs. 9C, 11D). G1 terminal segment relatively long, conical, curved outwards, surface lined with long and short setae, gradually tapering to truncate tip, ca. 0.2 times length of subterminal segment (Figs. 10A–C, 11F).



Fig. 5. *Pavizham gavi* gen. nov., sp. nov., holotype male ($17.3 \times 12.8 \text{ mm}$) (DABFUK/AR-BR-116). A, left third maxilliped (setae not drawn); B, thoracic sternites 1–4 and telson (setae on right side denuded); C, left G1 (ventral view); D, G1 terminal segment (ventral view); E, G1 terminal segment (dorsal view); F, left G2. Scale bars: A–C, F = 1.0 mm; D, E = 0.5 mm.

Description of male holotype: Carapace broader than long, width ca. 1.3 times length; high, inflated in frontal view, dorsal surface convex (Figs. 7, 8A, B, 11A, B). Frontal region relatively wider, surface smooth with low flattened granules (Figs. 8C, D, 11E); lateral parts of anterolateral and posterolateral regions with prominent short oblique striae, margins smoother does not appear serrated (Figs. 7, 8A, B, 11A, B); suborbital with scattered granules and striae; pterygostomial regions with distinct low granules of different sizes on margins, glabrous, separated from other regions by low ridge; sub-brachial regions with numerous short striae (Figs. 8C, 11E). Epigastric cristae low but distinct, not cristate, medially separated by shallow inverted Y-shaped furrow, slightly anterior of postorbital cristae; postorbital cristae distinct, raised, not sharp,



Fig. 6. Habitat of *Pavizham gavi* gen. nov., sp. nov.: base of waterfall, Gavi, Pathanamthitta district, Kerala, India.

confluent with epigastric cristae, joining lateral margin as granules and interrupted striae (Figs. 7, 8A, B, C, 11A, B, E). Cervical grooves distinct, not broad, joining prominent H-shaped and brachial grooves (Figs. 7, 8A, B, 11A, B) External orbital tooth low, outer margin gently sinuous to almost straight, almost 3 times longer than inner margin; epibranchial tooth small, separated from external orbital tooth by a cleft, positioned above external orbital tooth in frontal view (Figs. 7, 8A, B, 11A, B). Anterolateral margin distinctly convex, uneven, striae gives the impression of being serrated margins (Figs. 7, 8A, B, 11A, B). Posterolateral margins gently concave, gently converging to almost straight or gently sinuous posterior carapace margin (Figs. 7, 8A, B, 11A, B). Orbits subovate, oblique in frontal view; eyes filling up most of orbital space, eye peduncle moderately long, stout; cornea large, pigmented (Figs. 8C, D, 11E). Supraorbital margin sinuous, complete; suborbital margin concave (Figs. 8C, D, 11E). Antennae short, not reaching cornea of eyes; antennules folding transversely in longitudinally narrow fossa (Figs. 8C, D, 11E). Posterior margin of epistome with distinct median triangular tooth, separated from lateral concave lobe by distinct gape (Figs. 8C, D, 11E). Mandibular palp distinctly 2-segmented, terminal article bilobed. Third maxilliped ischium subrectangular, with distinct median sulcus; merus subquadrate, with raised margins, median part depressed; exopod slender, not reaching mid length of merus, flagellum long, reaching about entire width of merus (Figs. 9A, B, 11C). Chelipeds distinctly asymmetrical (Figs. 7, 8A, 9D). Dorsal margin of merus with strong striae, appears unevenly serrated, ventral margin with low granules (Figs. 7, 8A, 9D). Outer surface of carpus rugose, distal angle with prominent sharp tooth with basal tubercle (Figs. 7, 8A, 11A). Outer surface of chelae unevenly granulated, granules scattered; fingers of major chelae curved with median proximal gape when fingers closed; cutting margin with large teeth and denticles; fingers of minor chelae straighter, similar to those of major chelae except more slender, without gape (Fig. 9D). Ambulatory legs slender, not elongate; P3 longest, P5 shortest (Figs. 7, 8A, 11A). Merus with sharp dorsal and ventral margins, not cristate, margins unevenly serrate but low; carpus with low median crest; propodus subrectangular with longitudinal median crest, ventral margin serrate; dactylus elongate, gently curved, lined with sharp spines (Figs. 7, 8A, 11A). Anterior thoracic sternum transversely narrow; sternite 1 and 2 completely fused to form triangular plate with convex lateral margins, separated from sternite 3 by shallow, median groove, otherwise fused; sternite 3 and 4 fused, demarcated by shallow oblique grooves; dense short setae on grooves between sternite 2 and 4. Sutures between sternites

4/5, 5/6 and 6/7 medially interrupted, separated by narrow space; sternite 8 completely covered by closed pleon (Figs. 9B, 11F, G). Sternopleonal cavity deep, narrow, reaching to imaginary line joining median points of cheliped coxae (Figs. 9B, 11F). Male pleonallocking tubercle low, round, positioned on distal third of sternite 5 (Fig. 11F). Penis on condyle of coxa of fourth ambulatory leg. Pleon triangular, all somites and telson free; somite 1 and 2 longitudinally narrow, subequal in width, both less wide than somite 3; somite 3 trapezoidal, reaching to coxae of fourth ambulatory legs; somites 4 and 5 trapezoidal; somite 6 subquadrate, with sinuous lateral margins; slightly wider than long; telson triangular with gently concave lateral margins (Figs. 9C, 11D, G). G1 almost straight, groove for G2 ventral in position; terminal and subterminal segments clearly demarcated by membranous suture; subterminal segment with proximal part broader, gradually tapering to more slender distal half, outer margin gently sinuous, terminal segment relatively longer, conical and gently curved outwards, surface lined with rows of long and short setae, gradually tapering to truncate tip, ca. 0.2 times length of subterminal segment (Figs. 10A-C, 11F). G2 as long as G1 (Fig. 10D).

Females: The adult paratype female specimens (largest $34.0 \times 25.2 \text{ mm}$) (DABFUK/AR-BR-120) resemble the holotype in most non-sexual characters, except they have relatively smaller and more slender chelae. The pleon is ovate, with all somites and telson free, covering most of the thoracic sternum, except the lateral edges (Fig. 12A, B). The vulvae on sternite 6

is large, subovate, and positioned adjacent to sternite 5, the opening being membranous without any sternal vulvar cover (Fig. 12C).

Variations: The paratype males agree with the holotype in most aspects. The distal segment of G2 varies in shape, from straight to slightly curved in the two specimens examined.

Colour: In life most of the carapace and legs are dark brown to brown in colour, tips of fingers and legs are yellowish orange in colour. Ventral side of the body yellowish orange to dirty white in colour (Fig. 7).

Etymology: The name is derived from the Latin for dark brown, alluding to the overall dark colour of the new species alive.

Remarks: The genus *Rajathelphusa* currently contains two species R. ala Raj, Kumar & Ng, 2021, and R. muni Raj, Kumar & Ng, 2021 (cf. Raj et al. 2021). The new species differs from R. ala in that the chelipeds and ambulatory legs are dark reddish brown in life (Figs. 7, 11A) (versus chelipeds and ambulatory legs pale orange; cf. Raj et al. 2021: figs. 2A, 5A); anterolateral margin is smoother and does not appear serrate (Figs. 8A, B, 11A, B) (versus striae on anterolateral margin stronger with the margin uneven to gently serrate; cf. Raj et al. 2021: figs. 3A, 4A, B); the ischium of the third maxilliped is proportionately longer (Figs. 9A, 11C) (versus more quadrate; cf. Raj et al. 2021: fig. 4D); the median lobe of the posterior margin of the epistome has the lateral margin almost straight (Figs. 8C, D, 11E) (versus gently convex; cf. Raj et al. 2021: fig. 4C); and the overall G1 is more slender and



Fig. 7. Rajathelphusa brunnea sp. nov., holotype: male (30.2 × 22.6 mm) (DABFUK/AR-BR-117), Mattupetty, Idukki, Kerala, India. Colour in life.

more elongate, and significantly, the terminal segment is proportionately longer (Figs. 10A–C, 11F) (versus G1 overall relatively shorter and stouter; cf. Raj et al. 2021: fig. 9B–D). *Rajathelphusa brunnea* sp. nov. differs from *R. muni* in that the carapace is reddish brown with the chelipeds and ambulatory legs are dark reddish brown in life (Figs. 7, 11A, B, F, G) (versus carapace dark brown with the chelipeds and ambulatory legs pale orange; cf. Raj et al. 2021: fig. 8); the ischium of the third maxilliped is proportionately longer (Figs. 9A, 11C) (versus more quadrate; cf. Raj et al. 2021: fig. 7D); the lateral margins of the male telson are gently concave (Fig. 9B, C, 11D, G) (versus deeply concave; cf. Raj et al. 2021: fig. 7E, F); the lateral margin of male somite 6 is sinuous (Figs. 9C, 11D, G) (versus almost straight with the somite appearing rectangular; cf. Raj et al. 2021: fig. 7E); the median lobe of the posterior margin of the epistome has the lateral margin almost straight (Figs. 8C, D, 11E) (versus gently convex; cf. Raj et al. 2021: fig. 7C); and the overall G1 is more slender and more elongate, and significantly, the terminal segment is proportionately longer and gently curved outwards (Figs. 10A–C, 11F) (versus G1 overall relatively shorter and stouter with the terminal segment vertical; cf. Raj et al. 2021: fig. 9F–H).

Distribution: The species is known only from



Fig. 8. Rajathelphusa brunnea sp. nov., holotype: male ($30.2 \times 22.6 \text{ mm}$) (DABFUK/AR-BR-117), Mattupetty, Idukki, Kerala, India. A, overall dorsal view; B, dorsal view of carapace; C, frontal view of cephalothorax; D, front, antennules, antennae and epistome.



Fig. 9. *Rajathelphusa brunnea* sp. nov., holotype: male (30.2 × 22. 6 mm) (DABFUK/AR-BR-117), Mattupetty, Idukki, Kerala, India. A, left third maxilliped; B, buccal cavity, anterior thoracic sternum and pleon; C, pleon; D, outer view of chelae.



Fig. 10. Rajathelphusa brunnea sp. nov., holotype: male ($30.2 \times 22.6 \text{ mm}$) (DABFUK/AR-BR-117), Mattupetty, Idukki, Kerala, India. A, left G1 (ventral view); B, terminal segment of G1 (ventral view); C, terminal segment of G1 (dorsal view); D, left G2. Scale bars: A, D = 1.0 mm; B, C = 0.5 mm.



Fig. 11. *Rajathelphusa brunnea* sp. nov., paratype: male $(33.9 \times 25.9 \text{ mm})$ (DABFUK/AR-BR-118) A, overall view; B, dorsal view of carapace; C, left third maxilliped; D, pleon; E, frontal view of cephalothorax F, sternopleonal cavity showing G 1 in situ; G, anterior thoracic sternum, somites 4-6 and telson.

Mattupetty (10.108618°N, 77.134830°E), a tourist village in Idukki district of Kerala state (Figs. 1, 13A–F).

Ecology: The species lives in deep burrows away from a natural stream that empties into the Mattupetty dam (Fig. 13F). The holes are very deep and the hole connects to underground water channels. We observed some holes with branches at the entrance leading to a very deep pit. No crabs were noticed to live in shallow holes. The species could not be lured out with animal

bait. The current location is famous for the Meowing Night Frog, *Nyctibatrachus poocha* (Biju et al. 2011) (family Nyctibatrachidae), the distinctive sound of the frogs echoing throughout the night.

Additional remarks: Locals in the type locality use the crabs as medicine, and it is supposed to be effective in treating severe coughs for children. The crabs are cleaned, crushed and then boiled with spices before being consumed. As the type locality is very close to



Fig. 12. Rajathelphusa brunnea sp. nov., paratype: female (34.0 × 25.2 mm) (DABFUK/AR-BR-120) A, overall habitus; B, thoracic sternum and pleon; C, thoracic sternum and vulvae.



Fig. 13. A, burrow entrance of *Rajathelphusa brunnea* sp. nov.; B, dug up burrow of *R. brunnea* sp. nov.; C–E, team in search of crabs at night; F, degraded forest in type locality of *R. brunnea* sp. nov.; G, collection team (employees of Kerala Live Stock Development Board) at type locality of *R. brunnea* sp. nov. with specimens.

a public road, there are many potential threats for the new species since it is known thus far from only a small geographical area. Human activities can quickly impact the entire region, and therefore, the species must be regarded as vulnerable, and a careful assessment of its conservation status is urgently needed.

DISCUSSION

The discovery of another two semiterrestrial species of freshwater crabs in the Western Ghats highlights the remarkable diversity that is present in the highlands there as well as the difficulty in collecting them. These semiterrestrial crabs are invariably burrowers, often excavating deep holes and coming out only at night to feed, and even then, generally not wandering far beyond the openings. They are generally more active in the wet season, but field sampling is difficult and often very dangerous during this time. Digging them out is often the only way to obtain specimens, but this can be difficult even when the ground is softer. For example, the new species, Rajathelphusa brunnea, could only be caught late at night by blocking it from retreating down the burrows using a sharp object (challenging to do as they are very sensitive to light and movement), or more usually, by rigorously digging to the bottom of the burrow, and then slowly searching in the soft mud with bare hands (Fig. 13). In places where the substrate is covered with rocks and stones, it is almost impossible to dig them out. This is the case for *Pavizham gavi*, in which the holotype and only specimen known was collected at the base of a waterfall. Further efforts to find the crab there were unsuccessful, as the terrain around the type locality is hard to sample and impossible to dig (Fig. 6). These cryptic habits easily explain why the rate of discovery of semiterrestrial gecarcinucid species remains high many species simply have been missed by collectors in the past. The situation in the Western Ghats parallels the situation in Thailand, where subtropical zones that have marked wet and dry seasons have many semiterrestrial species, but were only discoverable because local villagers helped (e.g., see Ng and Naiyanetr 1993).

As already discussed in Raj et al. (2021), the seasonal climate of the Western Ghats also encourages speciation of semiterrestrial species, many of which have relatively restricted ranges. Their poor dispersal abilities (they have direct development as with all gecarcinucids) and the constraints of geography result in high speciation rates and many unrelated species possessing similar carapace morphologies.

CONCLUSIONS

Two new gecarcinucid freshwater crabs (*Pavizham gavi* gen. nov., sp. nov.; *Rajathelphusa brunnea* sp. nov.) are described from the southern Western Ghats in the Indian state of Kerala. The new genus, *Pavizham*, is superficially similar to the genera *Baratha* and *Snaha* reported from the other parts of the southern Western Ghats but is markedly different in the form of smooth carapace, third maxilliped, male pleon and gonopods. *Rajathelphusa brunnea* differs from its congeners, *R. ala* and *R. muni*, in possessing a distinctively different male gonopod structure.

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