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43/2 Varadarajulu Nagar, 5<sup>th</sup> Street West, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
Email: [sanjay@threatenedtaxa.org](mailto:sanjay@threatenedtaxa.org)

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Cover: Mixed media illustration of a Blue bird and Sunbird. © Lakshmi Niranjana.



## INTRODUCTION

The creeping water bugs are subaquatic, but some species are present in the water covering a rock surface (hygropetric). Most Indian species present adjacent to the streams. The genus *Heleocoris* Stål (1876) was first included in the division Laccocoraria, which later was raised to the subfamily Laccocorinae, Montandon (1897). *Heleocoris* contains 29 species, of which 11 are known from India (Polhemus & Polhemus 2013). The recent decade witnessed the discovery of a new species: *Heleocoris mcphersoni*, Sites and Vitthepradit, 2011 from Thailand. Globally, the Naucoridae consists of 401 species while the Indian sub-region consists of 20 species under seven genera (Chandra et al. 2017). There are few taxonomic records of *Heleocoris* in the southern part of India, and faunal surveys in waterfalls, streams of mountain ranges, and forests are still required. *Heleocoris stephanus* sp. nov. from Kollam District of Kerala state, is described as new to science in the present paper. This species was generally found associated with plant debris on the edge of the rivers. A diagnosis and comparison with congeners in Kerala, Tamil Nadu and other states congeners is presented..

## MATERIALS AND METHODS

Bug samples were collected by hand-picking with either fingers or soft forceps and use of an aquatic net

to sweep through submerged vegetation and organic debris along shorelines of river Urukunnu, Kerala (Image 1). Specimens were placed into vials with 90% ethyl alcohol and brought to the laboratory of Zoology Research Centre, St. Stephen's College, Pathanapuram. Morphological terminology in the description mostly follows that of Xie & Liu (2015) and Sites & Vitthepradit (2011). All measurements are given in mm. Olympus CX33 and Weswox SZM-105 microscopes were used to obtain images and followed by its preparation with Photoshop CS5 (Adobe Systems Inc., San Jose, CA). The holotype (ZSI/WGRC/I.R.-INV.26976) was deposited in the Zoological Survey of India, Western Ghats Regional Centre (WGRC), Kozhikode, Kerala, India. Paratypes (SSCDZ/Hem01/2024 and SSCDZ/Hem02/2024) were deposited in the Department Museum, Zoology Research Centre, St. Stephen's College, Pathanapuram.

## RESULTS

### *Heleocoris stephanus* sp. nov. (Image 2)

urn:lsid:zoobank.org:act:D01E304C-38E9-412A-A296-09DFEB97BE86

**Material examined:** Holotype (ZSI/WGRC/I.R.-INV.26976): 07 October 2023, macropterous male, India: Urukunnu station, Kollam District, Kerala, 8.5905 °N & 77.0124 °E, 45 m, upstream Kallada River, coll. Dani & Arya, Paratypes (SSCDZ/Hem01/2024 and SSCDZ/



Image 1. Urukunnu Station in the upstream of Kallada River, Kollam District, Kerala, India, the type locality of *Heleocoris stephanus* sp. nov.



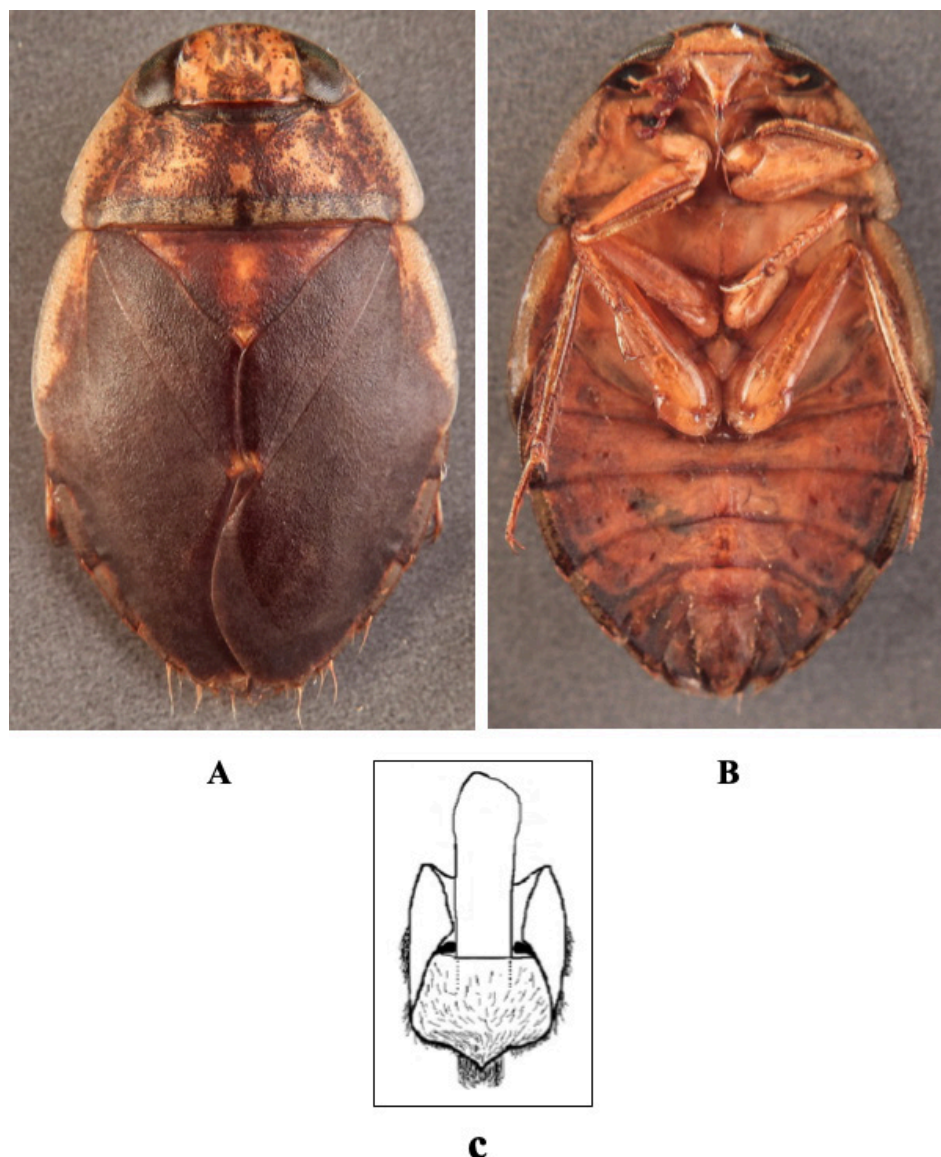


Image 2. Diagnostic features of *Heleocoris stephanus* sp. nov. (holotype): A—dorsal habitus | B—ventral habitus | C—phallosome. © Dani Benjamin.

Hem02/2024): same data as primary type.

**Description:** Macropterous male. Holotype, length 9.78; width 6.20. Paratypes (n = 4), length 9.44–9.88 (mean = 9.69); maximum width 6.09–6.29 (mean = 6.17). General shape is ovate, slightly flattened; widest across embolia. Description of *Heleocoris stephanus* sp. nov. and other congeners are presented in Table 1.

**Coloration:** Overall body color is anteriorly yellowish with black mottling, scutellum dark brown with irregular yellow apex, yellowish, and thick median longitudinal patch. Head with black spotting, generally over the entire yellowish dorsal surface; patterns coalescent at the posterior margin, reducing anteriorly as black spots adjoining anterior margin, eyes blackish with

pale yellowish anterolateral margin, rostrum last two segments dark brownish. Pronotum with black markings scattered over the entire dorsal surface; laterally reduced to a few black spots; black coalescent patches in the mid-anterior region; a yellowish transverse band with irregular black blotches at the posterior margin. Hemelytra black. Forelegs and hindlegs are dorsally brownish and ventrally pastel yellowish. Connexiva yellowish-brown antero-posterior, showing checkered appearance (Image 2B). Ventrally yellowish cephalothorax, brownish abdomen, and pygophore (Image 2B).

**Head:** Densely punctured with black. Single sclerite at posterior corner of eye, directed ventrad, anterior

end simple. Dome-shaped, blackish spot on the base of the head in between the eyes. Compound eyes blackish, convergent anteriorly, convex on lateral posterior margin. Broad semi-circular labrum, rostrum short with three visible segments, first segment partially covered with labrum, each following segment progressively narrower, reaching to near anterior prothoracic coxae. Antennae, thickened and hairy: not extending to lateral margin of head.

**Thorax:** Pronotum broad and maximum width at rounded posterolateral corners; tuft of setae in anterior end, transverse sulcus band ending at anterior end of clavus with ventral tuft of setae; ventro-lateral margins with blackish punctations; tuft of elongate sensory setae on anterior surface behind eye. Scutellum is finely granulose, tumescent, and elevated above level of wings; sinuated lateral margins. Well-developed hindwings. Hemelytron blackish-brown; largely yellowish embolium with black spots.

**Legs:** Foreleg with large femur, strongly widened antero-basally, lateral margins with thick bunch of setae; tibia narrow, with bunch of setae at lateral margins; tarsus bristled and two-segmented with two razor shaped claws. Hindleg with wide femur have small bulbous projections at its posterior end, tibia narrow with a profusion of swimming hairs; tarsus with small dorsal bristles and ventral elongated tuft of setae.

**Abdomen:** Abdomen ventrally covered with appressed hair; large blackish spots; ventrally with heavy marginal spines on laterotergites III–VI and elongate light-coloured hair.

**Genitalia:** Pygophore brownish and hairy, posterior margin acuminate with dense brush; parameres reduced, blackish, and symmetrical; phallosoma elongate, linear, widest & rounded triangular at apex (Image 2C).

**Female:** Unknown

**Diagnosis:** *Heleocoris stephanus* sp. nov. is similar to the congener *H. vicinus* (Montandon, 1910), by size, and overall coloration. However, *H. stephanus* is notably different from *H. vicinus* by the finely granulose, dark brown scutellum with irregular yellow apex and thick median longitudinal yellowish patch. *H. majusculus* (Montandon, 1908) and *H. rotundatus* (Montandon, 1908) are other congeners reported from the neighbouring state of Tamil Nadu. The former drastically differs from *H. stephanus* by its entirely black scutellum and overall body size, while the latter differs from *H. stephanus* by its black coloured body beneath with greyish pilose and body size. *H. breviceps* (Montandon, 1897) is another congener reported from the Indian

states such as Andhra Pradesh, Himachal Pradesh, Maharashtra, and Tamil Nadu. This congener differs from *H. stephanus* by largely blackish abdomen beneath and brownish scutellum. As the name implies, *H. elongatus* (Montandon, 1897) differs from *H. stephanus* by its body shape. Additionally, *H. elongatus* can be distinguished from *H. stephanus* by its entirely yellowish body beneath. *H. elongatus* was reported from the Indian states Bihar, Madhya Pradesh, Maharashtra, and West Bengal. *H. acutus* (Spinola, 1837) was reported only from Maharashtra and it can be distinguished from *H. stephanus* by its distinct acute posterior angles of pronotum. *H. bengalensis* (Montandon, 1910) was reported from the central states such as Madhya Pradesh, Uttar Pradesh, and West Bengal. *H. stephanus* can be distinguished from this congener by the distinct characteristics of genitalia such as brownish & hairy pygophore, posterior margin acuminate with dense brush, and blackish & reduced parameres. *H. bergrothi* (Montandon, 1897), reported from the southern Indian states of Karnataka, Kerala, and Tamil Nadu is similar to *H. stephanus* in a few characteristics such as body size, shape, and v-shaped discal spot in scutellum. *H. stephanus* differs from *H. bergrothi* by its distinct colouration of scutellum, such as, dark brown with irregular yellow apex, thick & yellowish median longitudinal patch, and distinct black mottling of head & pronotum. Lastly, the closest congener *H. indicus* (Montandon, 1897) shares a few similar features with *H. stephanus* like flavescent with brown punctures on head and pronotum, overall coloration, and v-shaped discal spot in scutellum. *H. indicus* has a number of contrasting characteristics such as entirely yellowish underbody, pronotum with blackish transverse colouration on the posterior margin, while the *H. stephanus* has a ventrally yellowish cephalothorax, brownish abdomen and pygophore, pronotum with irregular black blotches on the posterior transverse margin, embolium of the hemelytra yellowish with distinct blackish colouration, and abdomen with appressed hairs and large blackish spots, heavy marginal spines on laterotergites III–VI, and elongate light-colored hair.

**Etymology:** This specific epithet “stephanus” refers to the Institution where this significant research was conducted at the Zoology Research Centre, St. Stephen’s College, Pathanapuram. St. Stephen’s College was founded in 1964 after the name of St. Stephen, one of the first seven ordained Deacons and the first Martyr of Christianity.

**Table 1. Comparison among the congeners in the genus *Heleocoris* reported from Kerala, Tamil Nadu, and central states of India.**

Taxon	Size	Shape	Head	Pronotum	Scutellum	Hemelytron	Abdomen
<i>H. bergrothi</i>	Length 9.7; width 6.8 mm	Oval	Palely yellow with indistinct brown spots	Colouration same as head, the lateral margins arcuate, the lateral posterior angles acute, the surface densely and finely punctate	Black with yellow apex, very finely granulose, with a yellow v-shaped discal spot	Blackish-brown with largely yellowish embolium	Connexivum, abdomen, and legs entirely pale yellowish
<i>H. vicinus</i>	Length 9–10	Oval	Twice as broad at base between eyes, rounded in front, ochraceous with black speckles	Ochraceous with black speckles, the lateral margins pale ochraceous, distinctly subamplicate, the posterior margin a little paler than the disk	Black with ochraceous apex	Black, lateral margin of corium pale ochraceous with two blackish macular suffusions	Connexivum pale ochraceous with the posterior margins black; abdomen and legs pale ochraceous, left sixth ventral laterotergite is completely flat
<i>H. breviceps</i>	Length 9.5; width 6.5 mm	Oval	Ochraceous; intraocular area marked on each side by two small foveations	Ochraceous	Blackish-brown with the disk narrowly yellow	Hemelytra brownish; embolium ochraceous	Abdomen beneath largely blackish with yellowish apex; legs entirely yellow
<i>H. indicus</i>	Length 8; width 5 mm	Oval	Brown punctures more or less dense forming small ill- defined shadings	Colouration same as head	Dark brown with a median longitudinal line.	Embolium yellowish with a medial brown spot on its inner margin and another spot at its apex	Connexivum yellow, very narrowly darkened on the outer edge of the posterior angles of each segment; underside of body entirely yellowish
<i>H. majusculus</i>	Length 13; width 8.8 mm	Oval	Surface superficially punctate, two impressions, one before the other on each side near the eyes	Very transverse, yellowish, finely granulose, punctured on all the surface, with the anterior margin obtusely sinuate on each side behind the eyes	Entirely black; claval commissure nearly as long as the scutellum	Embolium very much dilated behind	Connexivum yellow, with the posterior angles of the segments a little acuminate; underside of body pitchy brown
<i>H. rotundatus</i>	Length 12; width 9.4 mm	Oval	Thick, finely granulose, brownish- ochraceous, centrally blackish	Brownish- ochraceous much suffused with blackish except on the lateral margin areas which are distinctly rounded	Black with apex ochraceous, strongly and mostly transversely wrinkled; clavalsuture longer than scutellum and apically spotted with ochraceous	Black, thick, finely punctate, lateral margins of embolium ochraceous.	Connexivum ochraceous; under side of the body blackish; legs ochraceous; abdomen beneath with a central longitudinal series of black spots, the lateral margins ochraceous.
<i>H. acutus</i>		Oval		Shape is not perceptibly "flange" with no marginal furrow, the posterior angles acute			
<i>H. elongatus</i>	Length 8; width 4.5 mm	Oval	Clear yellow tint densely punctured with black	Colouration same as head; lateral margins very slightly arcuated nearly straight, the lateral posterior angles rounded, not prominent behind, the posterior edge straight	Brownish; claval suture a little longer than half the length of the scutellum	Embolium little enlarged and largely yellowish and along the outer margin, the yellow margin bisinuated at its inner edge by two brown spots	Connexivum yellow, with a straight transverse brown fascia on the posterior margins of the segments; underside of the body entirely yellow

Taxon	Size	Shape	Head	Pronotum	Scutellum	Hemelytron	Abdomen
<i>H. bengalensis</i>	Length 8 mm	Oval	Posterior margin with brown punctures coalescent and dark punctation and associated maculation denser	Dark punctation and associated maculation denser; posterior margin with longitudinal marks		Large yellow patch on embolium.	Abdomen laterally slightly surpassing hemelytra in males; ventral laterotergites II–VII each light anteriorly, dark posteriorly
<i>H. stephanus</i> sp. nov.	Length 9.78; width 6.20 mm	Oval	Densely punctured with black. Single sclerite at posterior corner of eye, directed ventrad, anterior end simple. Goblet shaped black colouration in the dorsal surface	Finely granulose, broad and maximum width at rounded posterolateral corners; tuft of setae in anterior end, transverse sulcus band ending at anterior end of clavus with ventral tuft of setae	Finely granulose, tumescent and elevated above level of wings, sinuated lateral margins.	Blackish-brown, largely yellowish embolium with distinct black colouration	Abdomen ventrally covered with appressed hairs; heavy marginal spines on laterotergites III–VI and brush of elongate light-coloured hairs; legs brownish with setae and bristles.

## DISCUSSION

This species was found in the upstream of Kallada River, Kerala, India. The type locality is located in the Western Ghats of the southwestern region of the country. The sampling area of the present investigation was characterized by partially decomposed plant parts. Studies on saucer bugs are scanty in our country, and the sampling area is an undisturbed and unexplored area of Kallada River. There were no detailed recent taxonomical reports on creeping water bugs from the freshwater ecosystems of Kerala. As part of our macroinvertebrate sampling, we explored several ignored parts of the upstream forested area of Kallada River with a rich diversity of creeping water bugs. No additional *Heleocoris* species were collected. Males of this species are most similar to *H. bergrothi* and *H. indicus* based on some external features like coloration pattern, though, these species are clearly distinct from *H. stephanus* in several aspects. Previously, 11 species were reported in India. The present discovery brings the total number of *Heleocoris* species in India to 12.

## CONCLUSION

*Heleocoris stephanus* sp. nov. shows close morphological similarity with *H. bergrothi*, and *H. indicus*; The latter species are differentiated by distinctive morphological and genital features.

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c/o Wildlife Information Liaison Development Society,  
43/2 Varadarajulu Nagar, 5<sup>th</sup> Street West, Ganapathy, Coimbatore,  
Tamil Nadu 641006, India  
ravi@threatenedtaxa.org

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