

## New records of two species of freshwater crabs (Decapoda: Gecarcinucidae) from Kerala, India, with notes on their distribution

S.K. Pati<sup>1</sup>  [orcid.org/0000-0001-8418-7500](https://orcid.org/0000-0001-8418-7500)

P.S. Sujila<sup>2</sup>  [orcid.org/0000-0002-2072-5661](https://orcid.org/0000-0002-2072-5661)

A.R. Sudha Devi<sup>2</sup>  [orcid.org/0000-0003-4062-8073](https://orcid.org/0000-0003-4062-8073)

**1** Zoological Survey of India, Western Regional Centre, Vidyanagar, Sector 29, P.C.N.T. Post, Akurdi, Pune-411 044, Maharashtra, India.

**SKP** E-mail: [sameer\\_pati@yahoo.co.in](mailto:sameer_pati@yahoo.co.in)

**2** Department of Zoology and Research Centre, Mary Matha Arts and Science College, Vemom P.O., Mananthavady-670 645, Kerala, India.

**PSS** E-mail: [jnips333@gmail.com](mailto:jnips333@gmail.com)

**ARSD** E-mail: [arsudhadevi@gmail.com](mailto:arsudhadevi@gmail.com)

**ZOOBANK:** <http://zoobank.org/urn:lsid:zoobank.org:pub:5EA8DFEA-7C17-4F73-8DB0-AD87CB332811>

### ABSTRACT

Kerala has the highest known diversity of freshwater crabs among the Indian states, and many more species are likely to be added to the state, especially from the Western Ghats. The present specimens from the Western Ghats of Kerala add two more species records to Kerala: *Oziotelphusa wagrakarowensis* (Rathbun, 1904) and *Vanni nilgiriensis* (Roux, 1931). Although *O. wagrakarowensis* was reported from the Indian states of Andhra Pradesh, Karnataka, and Maharashtra, it has not been recorded from Kerala previously. The present record of *O. wagrakarowensis* also constitutes the first reliable report of the species from the Western Ghats. The other species, *V. nilgiriensis*, was previously known from the Western Ghats of Karnataka and Tamil Nadu. Kerala now includes 37 species of gecarcinucid crabs with the addition of these two new records whereas the Western Ghats of India currently has 59 species.

### KEYWORDS

Crustacea, Brachyura, *Oziotelphusa*, *Vanni*, Western Ghats.

#### CORRESPONDING AUTHOR

S. K. Pati  
[sameer\\_pati@yahoo.co.in](mailto:sameer_pati@yahoo.co.in)

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Kerala has the highest known diversity of freshwater crabs among the Indian states. The state was hitherto represented by 35 species in 14 genera of gecarcinucid crabs among 122 Indian species of freshwater crabs (Rajesh *et al.*, 2017; Mitra *et al.*, 2018; Pati and Thackeray, 2018; Mitra and Waikhom, 2019). The Western Ghats of Kerala is home to 27 species out of 58 species of freshwater crabs reported from the Western Ghats of India (Rajesh *et al.*, 2017).

Despite the high diversity of freshwater crabs in Kerala, many parts of the state, especially the Western Ghats, are still poorly explored for their diversity. One possible reason for this is the remoteness of these localities. Considering the small spatial scale of endemism in freshwater crabs (Klaus *et al.*, 2014), more isolated and poorly studied areas need to be investigated. Furthermore, many new taxa await descriptions as evident from the recent discoveries (Pati and Sharma, 2013; Pati and Sudha Devi, 2015a; 2015b; Kumar *et al.*, 2017; Pati *et al.*, 2017).

During the present study, specimens were collected from the Western Ghats of Wayanad district in Kerala. These specimens belong to two species that have not been reported from Kerala previously: *Oziotelphusa wagrakarowensis* (Rathbun, 1904) and *Vanni nilgiriensis* (Roux, 1931).

*Oziotelphusa wagrakarowensis* has so far been reported from the states of Andhra Pradesh (Rathbun, 1904; Bott, 1970a; Bahir and Yeo, 2005), Karnataka (Bahir and Yeo, 2005; Srivastava, 2007; 2013; Pati and Sharma, 2014), and Maharashtra (Pati and Sharma, 2012a; 2014). Most of the specimens from Karnataka (ZSI-WRC C.445, 449, 456, 563–565) reported as *O. senex senex* (Fabricius, 1798) by Srivastava (2013) were already assigned to *O. wagrakarowensis* by Pati and Sharma (2014). In this situation, all the specimens of *O. senex senex* examined by Srivastava (2013), and probably by Srivastava (2007), are likely to be conspecific with *O. wagrakarowensis*. *Oziotelphusa wagrakarowensis* has been reported from rather elevated areas (350–950 m altitude) of the Indian peninsula, including the Western Ghats mountains. It was recorded from the Western Ghats at the Bannerghatta National Park of Bangalore Urban district, Bandipur Tiger Reserve of Chamaraajanagar district, and Hosur of Uttara Kannada district (see Srivastava, 2007; 2013; Pati and Sharma, 2014). The species, however, was never included in the Western Ghats fauna (see Pati and Thackeray, 2018). The present specimens of *O. wagrakarowensis* from Wayanad district of Kerala, therefore, constitute the first reliable report of the species from the Western Ghats. On the other hand, *V. nilgiriensis* has only been recorded from Karnataka (Pati and Sureshan, unpublished data) and Tamil Nadu (Roux, 1931; Bott, 1970a; 1970b; Bahir and Yeo, 2007; Srivastava, 2009; Klaus *et al.*, 2014).

With the addition of these two new records, Kerala has 37 species of gecarcinucid crabs, including four species of *Oziotelphusa* Müller, 1887 and six species of *Vanni* Bahir and Yeo, 2007. The Western Ghats of India is now known to have 59 freshwater crab species in 18 genera (Pati and Thackeray, 2018).

The terminology is mainly after Ng (1988), with changes following Davie *et al.* (2015). All the present material is deposited at the Zoological Survey of India, Western Regional Centre, Pune, India (ZSI-WRC). The comparative material is from ZSI-WRC and the Zoological Survey of India, Western Ghats Regional Centre, Kozhikode, India (ZSI-WGRC). The abbreviations used are as follows: cw, carapace width; cl, carapace length; ch, carapace height; fw, frontal width; coll. collected by; s2, thoracic sternite 2; s3, thoracic sternite 3; s4, thoracic sternite 4; G1, male first gonopod; G2, male second gonopod.

#### Family Gecarcinucidae Rathbun, 1904

##### *Oziotelphusa wagrakarowensis* (Rathbun, 1904)

(Fig. 1)

*Potamon* (*Potamon*) *wagrakarowensis* Rathbun, 1904: 292.

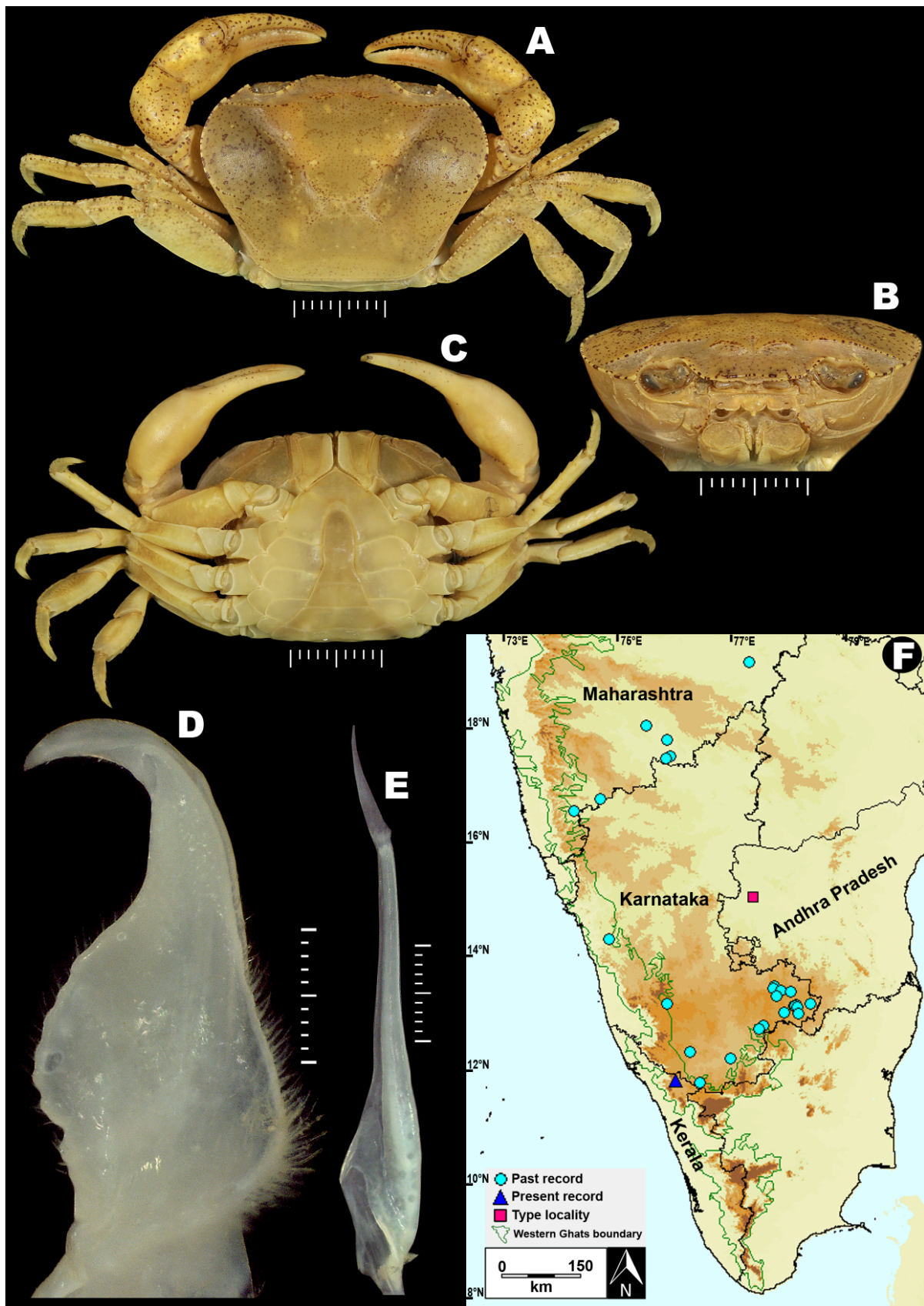
*Paratylphusa* (*Oziotelphusa*) *hydrodromus* — Alcock, 1910: 97 (part; not *Cancer hydrodromus* Herbst, 1794).

*Oziotelphusa senex senex* — Bott, 1970a: 100 (part; not *Cancer senex* Fabricius, 1798).

*Oziotelphusa wagrakarowensis* — Bahir and Yeo, 2005: 87. — Ng *et al.*, 2008 (list): 70. — Pati and Sharma, 2012a: 126 (list). — Pati and Sharma, 2012b: 365 (list). — Pati and Sharma, 2014: 35.

*Oziotelphusa senex senex* — Srivastava, 2007: 35 (not *Cancer senex* Fabricius, 1798). — Srivastava, 2013: 77 (not *Cancer senex* Fabricius, 1798).

*Material examined.* INDIA. Kerala: Wayanad district — 4 males (cw 29.18–33.92 mm, cl 20.76–22.20 mm, ch 14.35–15.81 mm, fw 8.91–9.15 mm) and 1 female (cw 32.50 mm, cl 22.28 mm, ch 17.21 mm, fw 9.67 mm), Ondayangadi, near Mananthavady (11.823°N, 76.026°E; altitude 767 m), 17 September 2018, coll. Ammini (ZSI-WRC C.1830).



**Figure 1.** *Oziotelphusa wagrakarowensis* (Rathbun, 1904), male (29.18 × 20.76 mm) (ZSI-WRC C.1830). A, overall dorsal view; B, frontal view of cephalothorax; C, overall ventral view; D, dorsal view of left G1; E, left G2; F, map showing distribution of *O. wagrakarowensis* in the Indian peninsula. Scale bar = 10 mm (A–C), 1 mm (D, E).

*Comparative material.* INDIA. Karnataka: Bangalore Rural district — 7 males and 3 females, Vijayapura Tank, Vijayapura (13.295°N, 77.801°E; altitude 885 m), 19 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.451). Chamarajanagar district — 3 males and 2 females, Pdoddane Katte and Karigonda Katte, Bandipur Tiger Reserve (11.769°N, 76.448°E; altitude 839 m), 21 September 1989, coll. G.M. Yazdani (ZSI-WRC C.606). Chikballapura district — 8 males and 2 females, Kanepalli Tank, Chintamani (13.381°N, 78.037°E; altitude 882 m), 13 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.457); 6 males and 1 female, Gavana Tank, Siddalghata (13.392°N, 77.865°E; altitude 890 m), 15 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.566); 7 males, Appayya Kunta, Chikballapura (13.426°N, 77.730°E; altitude 905 m), 17 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.449); 12 males and 9 females, Manchanpani Tank, Chikballapura (13.464°N, 77.747°E; altitude 904 m), 18 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.565). Kolar district — 11 males and 5 females, Malekar Tank, Katerpalem (13.136°N, 78.133°E; altitude 837 m), 3 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.445); 6 males and 12 females, Malekar Tank, Katerpalem (13.136°N, 78.133°E; altitude 837 m), 4 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.567); 3 males and 1 female, Malur Tank, Malur (13.007°N, 77.927°E; altitude 898 m), 5 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.450); 9 males, Abdul Ali Garden, Bangarpet (12.993°N, 78.179°E; altitude 824 m), 6 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.564); 28 males and 7 females, Mashid Basalguntha Tank, Mulbagal (13.162°N, 78.390°E; altitude 839 m), 8 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.444); 9 males and 2 females, Dodda Hassala Lake, Dodda Hassala (13.099°N, 78.166°E; altitude 812 m), 10 March 1978, coll. M. Babu Rao *et al.* (ZSI-WRC C.563). Uttara Kannada district – 6 males and 15 females, Hosur, Siddapur (14.295°N, 74.853°E; altitude 583 m), 18 September 1991, coll. R.M. Sharma *et al.* (ZSI-WRC C.456).

Maharashtra: Kolhapur district — 1 male, Nadi Kinara, Vannur (16.546°N, 74.243°E; altitude 527 m), 13 September 2012, coll. S.S. Kamble (ZSI-WRC C.1084). Nanded district — 2 males and 2 females, Kabarali (19.153°N, 77.306°E; altitude 355 m), 16 August 1971, coll. K.R. Rao (ZSI-WRC C.1002).

Sangli district — 2 males, Mhaisal, approximately 15 km from Miraj (16.752°N, 74.704°E; altitude 537 m), 27 September 1984, coll. A.S. Mahabal *et al.* (ZSI-WRC C.916). Solapur district — 3 males, Sind River, near Sindkhed (17.501°N, 75.930°E; altitude 407 m), 22 November 1978, coll. A.S. Mahabal (ZSI-WRC C.803); 1 male, Nagamma Tank, on Vizapur road (17.460°N, 75.851°E; altitude 441 m), 24 November 1978, coll. A.S. Mahabal (ZSI-WRC C.810); 2 males and 4 females, Pimpaldara Nalla, near Padasali-Madha (18.030°N, 75.508°E; altitude 488 m), 24 August 1983, coll. A.S. Mahabal (ZSI-WRC C.809); 1 male and 1 female, Banegaon, near Nannaj, Great Indian Bustard Sanctuary (17.777°N, 75.882°E; altitude 483 m), 4 October 2011, coll. P.S. Bhatnagar *et al.* (ZSI-WRC C.521).

*Diagnosis.* Carapace broader than long ( $cw/cl = 1.4-1.5$ ), moderately deep ( $ch/cw = 0.5$ ); dorsal surface distinctly convex fore and aft; frontal median triangle complete, not as broad as frontal margin; epigastric and postorbital cristae well developed; external orbital angle triangular, with short outer margin, approximately 2 times length of inner margin; epibranchial tooth moderate in size, sharp; branchial regions moderately inflated; epistomal median lobe with distinct, sharp median tooth (Fig. 1A, B). Suture between male thoracic sternites  $s2/s3$  indistinct; suture between male thoracic sternites  $s3/s4$  visible as groove medially, not reaching edge of sternum (Fig. 1C). Male pleon narrowly triangular, with strongly concave lateral margins; pleonal somite 6 trapezoidal, slightly broader than long, as long as telson, with strongly concave lateral margins (Fig. 1C). G1 highly stout, with downwardly curved, hook-like terminal segment; terminal segment subcylindrical, short, approximately 0.3–0.4 times length of subterminal segment, tip subacute; subterminal segment highly stout (Fig. 1D). G2 longer than G1, approximately 1.1–1.2 times length of G1; distal segment short, approximately 0.2–0.3 times length of basal segment (Fig. 1E).

*Remarks.* Bahir and Yeo (2005) noted that the G1 terminal segment of *O. wagrakarowensis* is about 0.3 times the length of the subterminal segment. The male lectotype of *O. wagrakarowensis* from Andhra Pradesh, however, has a slightly longer G1 terminal

segment (approximately  $0.4 \times$  length of the subterminal segment) (see Bahir and Yeo, 2005: fig. 12C). The present specimens from Wayanad districts of Kerala also have a long G1 terminal segment, approximately 0.4 times the length of the subterminal segment (Fig. 1D). While our specimens resemble the lectotype in most of the carapace features, they only differ in the relative length between G2 and G1, *i.e.*, the G2 length is about 1.2 times the length of the G1 (Fig. 1D, E) (*vs.* the G2 length is about 1.1 times the length of the G1; see Bahir and Yeo, 2005: fig. 12C, E). Other comparative material from Karnataka and Maharashtra also showed the following small variations: the G1 terminal segment is about 0.3–0.4 times the length of the subterminal segment; the G2 length is about 1.1–1.2 times the length of the G1; and the G2 distal segment is about 0.2–0.3 times the length of the basal segment. These small variations may be due to the differences in size (cw 17.30–37.92 mm) and age of the crabs.

*Geographical distribution.* *Oziotelphusa wagrakarowensis* is currently known from Andhra Pradesh (Anantapur district), Karnataka (Bangalore Rural, Bangalore Urban, Chamarajanagar, Chikballapura, Hassan, Kolar, Mysore, and Uttara Kannada districts), Kerala (Wayanad district), and Maharashtra (Kolhapur, Nanded, Sangli, and Solapur districts) of the Indian peninsula (Fig. 1F). The precise geographic range of *O. wagrakarowensis* is difficult to understand based on the known locality records. The species, however, seems to be restricted only to the highlands of the Deccan plateau and the Central Western Ghats. The wider distribution of *O. wagrakarowensis* in the highlands of the Indian peninsula — unlike the congeners with a relatively restricted distribution in lowland areas — could be associated with the geological history of the Deccan plateau and the formation of the Western Ghats. In fact, the Western Ghats are not true mountains but are faulted edge of the upraised Deccan plateau (Kuriakose and Sebastian, 2016). It is possible that *O. wagrakarowensis* was actually present in the Deccan plateau and later able to occupy some parts of the Western Ghats. Furthermore, the anthropogenic introduction of the species to newer localities cannot be overlooked since these crabs are generally associated with rice crops. If this is true, then these crabs might have been introduced to further south of Kerala as well.

In these situations, more surveys need to be conducted in the remaining part of Kerala.

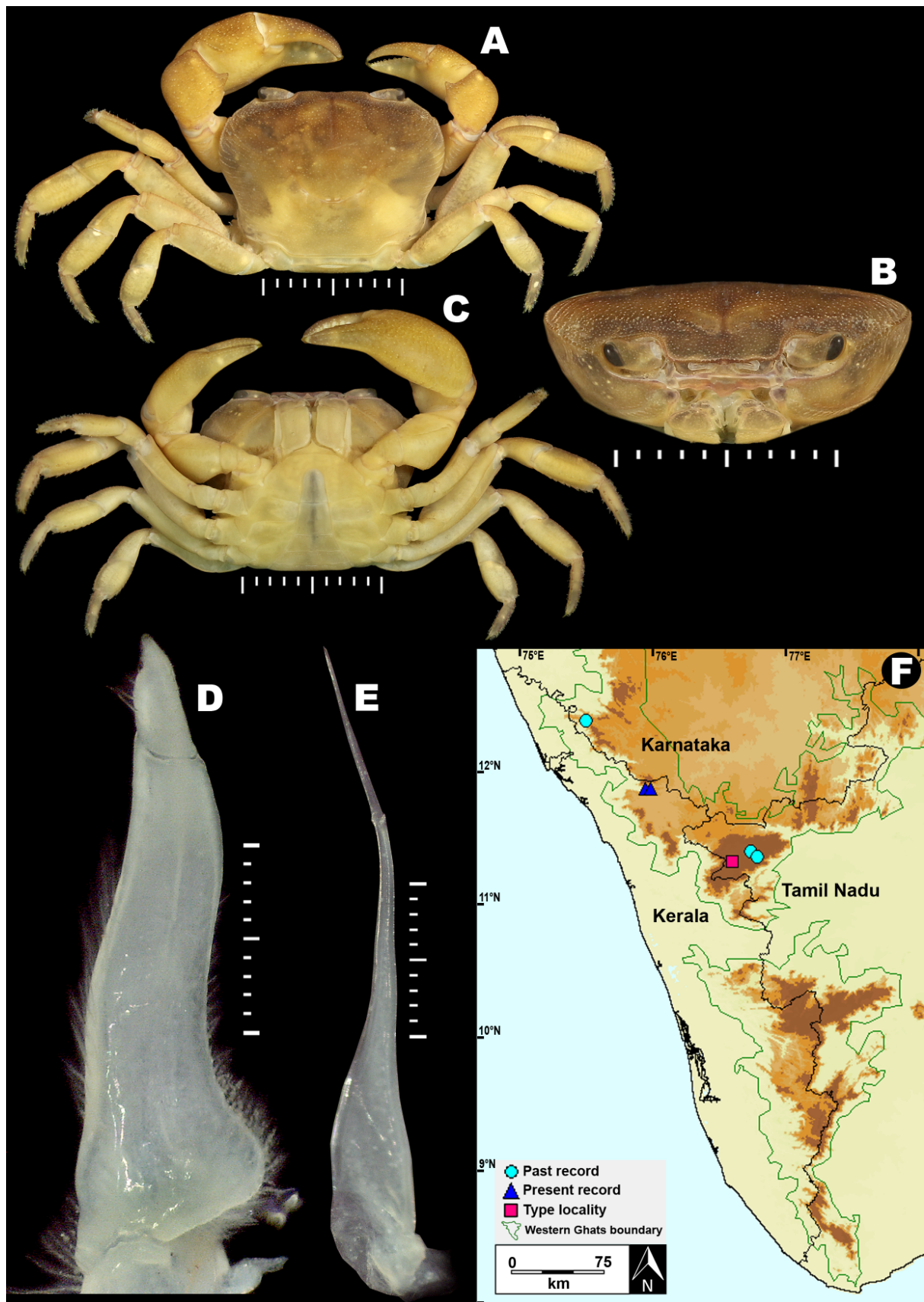
### ***Vanni nilgiriensis* (Roux, 1931)** (Fig. 2)

*Paratelphusa* (*Liotelphusa*) *nilgiriensis* Roux, 1931: 56.  
*Gubernatoriana nilgiriensis* — Bott, 1970a: 45. — Bott, 1970b: 336. — Srivastava, 2009: 29 (list).  
*Vanni nilgiriensis* — Bahir and Yeo, 2007: 341. — Ng *et al.*, 2008: 68 (list). — Dev Roy, 2012: 187 (list).

*Material examined.* INDIA. Kerala: Wayanad district — 1 male (cw 15.56 mm, cl 11.35 mm, ch 6.56 mm, fw 4.94 mm) and 3 females (cw 14.30–16.78 mm, cl 10.43–12.11 mm, ch 5.87–7.11 mm, fw 4.72–5.29 mm), Kambamala (11.869°N, 75.942°E; altitude 816 m), 26 October 2018, coll. P.S. Sujila (ZSI-WRC C.1825); 4 males (cw 13.38–18.34 mm, cl 9.80–12.60 mm, ch 5.83–8.37 mm, fw 4.24–5.46 mm) and 9 females (cw 14.62–19.08 mm, cl 10.55–13.29 mm, ch 6.41–8.10 mm, fw 4.62–5.95 mm), Pilakavu (11.867°N, 75.985°E; altitude 859 m), 9 October 2018, coll. P.S. Sujila (ZSI-WRC C.1826).

*Comparative material.* INDIA. Karnataka: Kodagu district — 1 male (cw 24.42 mm, cl 17.24 mm, ch 9.28 mm, fw 7.99 mm), Ezhilatur, Thalacauveri Wildlife Sanctuary (12.384°N, 75.494°E; altitude 1185 m), 6 November 2013, coll. P.M. Sureshan (ZSI-WGRC IR/INV/9197).

*Diagnosis.* Carapace broader than long (cw/cl = 1.4–1.5), low (ch/cw = 0.4); epigastric cristae distinct, slightly anterior to postorbital cristae; postorbital cristae rugose, not reaching epibranchial tooth; external orbital angle broadly triangular, with long outer margin, approximately 4–5 times length of inner margin; epibranchial tooth low, blunt; epistomal median lobe lacking median tooth (Fig. 2A, B). Ambulatory legs short, stout (Fig. 2A, C). Suture between male thoracic sternites s2/s3 visible as narrow groove, reaching lateral margins; suture between male thoracic sternites s3/s4 only visible as 2 short lateral grooves (Fig. 2C). Male pleon moderately broad, almost triangular; pleonal somite 6 trapezoidal, broader than long, slightly shorter than telson (Fig. 2C). Male telson narrow, longer than broad at base, with slightly concave lateral margins



**Figure 2.** *Vanni nilgiriensis* (Roux, 1931), male (15.56 × 11.35 mm) (ZSI-WRC C.1825). A, overall dorsal view; B, frontal view of cephalothorax; C, overall ventral view; D, dorsal view of left G1; E, left G2; F, map showing distribution of *V. nilgiriensis* in the Western Ghats. Scale bar = 10 mm (A–C), 1 mm (D, E).

(Fig. 2C). Male sternopleonal cavity short, extending up to imaginary line joining submedian part of cheliped coxae (Fig. 2C). G1 moderately stout, almost straight, with inner margin characteristically curved or angled just below juncture between terminal and subterminal segments; terminal segment almost conical, short, approximately 0.3 times length of subterminal segment, distal third distinctly narrower than basal two-thirds; subterminal segment moderately stout (Fig. 2D). G2 longer than G1, approximately 1.2–1.4 times length of G1; distal segment long, approximately 0.4–0.5 times length of basal segment (Fig. 2E).

**Remarks.** The present specimens of *V. nilgiriensis* from Wayanad district of Kerala are very similar to the male lectotype in carapace morphology. These specimens are relatively smaller (cw 15.56–18.34 mm) than the lectotype (cw 24.70 mm) and the paralectotype (cw 21.00 mm) from Nilgiris of Tamil Nadu. The G2 distal segment in the present specimens, however, is relatively shorter, *i.e.*, approximately 0.4 times the length of the basal segment (*vs.* relatively long, approximately 0.5 times the length of the basal segment in the lectotype; see Bahir and Yeo, 2007: fig. 35G). In addition, all the present specimens have a relatively shorter G2, approximately 1.2 times the length of the G1 (Fig. 2D, E) (*vs.* a relatively long G2 in lectotype, approximately 1.4 times the length of G1; see Bahir and Yeo, 2007: fig. 35C, G). An adult male from Kodagu district of Karnataka (ZSI-WGRC IR/INV/9197) also has a shorter G2 distal segment (approximately 0.4 times the length of the basal segment) like that of the present specimens from Kerala. The lone specimen from Karnataka, however, differs from the present specimens in the length of the G2, which is about 1.3 times the length of the G1. Despite these variations in the G2 of *V. nilgiriensis*, all the present specimens from Kerala and the material from Karnataka are conspecific with the lectotype from Tamil Nadu due to the similarity in overall carapace physiognomy and G1 structure. Although information on variations in G2 structure is unavailable for *V. nilgiriensis* and its congeners, some species (*e.g.*, *Travancoriana schirnerae* Bott, 1969) of the morphologically related genus, *Travancoriana* Bott, 1969, depict intraspecific variations in the length of the G2 distal segment (Bahir and Yeo, 2007).

**Geographical distribution.** *Vanni nilgiriensis* is currently known from the Western Ghats of Karnataka (Kodagu district), Kerala (Wayanad district), and Tamil Nadu (Nilgiris district) (Fig. 2F). Both the Coorg plateau (the Western Ghats part of Kodagu district) and Wayanad plateau are connected with each other and the Nilgiri mountains, which all together form a continuous mountain chain with similar zoogeography (Bhimachar, 1945). *Vanni nilgiriensis* is probably restricted to these mountain ranges.

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