



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

FRESHWATER DECAPODS (CRUSTACEA: DECAPODA) OF PALAIR RESERVOIR, TELANGANA, INDIA

Sudipta Mandal, Deepa Jaiswal, A. Narahari & C. Shiva Shankar

26 August 2020 | Vol. 12 | No. 11 | Pages: 16531–16547

DOI: 10.11609/jott.4977.12.11.16531-16547



For Focus, Scope, Aims, Policies, and Guidelines visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0>

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions>

For Policies against Scientific Misconduct, visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2>

For reprints, contact <ravi@threatenedtaxa.org>

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Member



Publisher & Host





Freshwater decapods (Crustacea: Decapoda) of Palair Reservoir, Telangana, India

Sudipta Mandal¹ , Deepa Jaiswal² , A. Narahari³ & C. Shiva Shankar⁴

¹⁻⁴Zoological Survey of India, FBRC, Plot no. 366/1, Near pillar no. 162, Attapur, Hyderguda P.O., Hyderabad, Telangana 500048, India.

¹sudiptam531@gmail.com (corresponding author), ²deepajzsi@gmail.com, ³narahariakkinapelly@gmail.com,

⁴cshivashankarchinna@gmail.com

Abstract: Recent surveys conducted in 2016–2018 from the Palair Reservoir of the Indian state of Telangana resulted in the collection of 153 specimens of freshwater decapods. These specimens are assigned to 10 species: seven prawns in three genera and three families; three crabs in two genera of one family. Among these, four species are recorded here as new records to Telangana: *Penaeus semisulcatus* De Haan, 1844, *Caridina gracilipes* De Man, 1892, *Barytelphusa guerini* (H. Milne Edwards, 1853), and *Oziotelphusa* sp.

Keywords: Brachyura, Caridea, crabs, Dendrobranchiata, freshwater, prawns, systematics.

Editor: Sameer Padhye, Zoo Outreach Organization, Coimbatore, India.

Date of publication: 26 August 2020 (online & print)

Citation: Mandal, S., D. Jaiswal, A. Narahari & C.S. Shankar (2020). Freshwater decapods (Crustacea: Decapoda) of Palair Reservoir, Telangana, India. *Journal of Threatened Taxa* 12(11): 16531–16547. <https://doi.org/10.11609/jott.4977.12.11.16531-16547>

Copyright: © Mandal et al. 2020. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

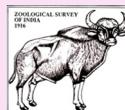
Funding: Zoological Survey of India Senior Research Fellowship (to the first author).

Competing interests: The authors declare no competing interests.

Author details: SUDIPTA MANDAL, Senior Research Fellow, Freshwater Biology Regional Centre, Zoological Survey of India, Hyderabad; working on freshwater Decapods under the guidance of Dr. Deepa J. DR. DEEPA J. Scientist-E, Freshwater Biology Regional Centre, Zoological Survey of India, Hyderabad; working on freshwater fauna. A. Narahari, Technical Assistant, Freshwater Biology Regional Centre, Zoological Survey of India, Hyderabad; working on freshwater Hemiptera. C. Shiva Shankar, Technical Assistant, Freshwater Biology Regional Centre, Zoological Survey of India, Hyderabad; working on freshwater Coleoptera.

Author contribution: SM—collector, Identifier of specimens and corresponding author; JD—guide in the project; AN & CSS—assisting in field collection and photography.

Acknowledgements: Authors are thankful to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata, and the Officer-in-charge, Freshwater Biology Regional Centre, Hyderabad for providing necessary facilities and encouragement to carry out the research programme. The first author is grateful to Dr. Sameer Kumar Pati, ZSI, Western Regional Centre, Pune and Prof. Dr. K. V. Jayachandran, Director of Research (Retd.) and (Former Dean, Faculty of Fisheries), Kerala University of Fisheries and Ocean Studies, Cochin, Kerala for literatures and guidance in identification.



INTRODUCTION

The Palair Reservoir is located near Palair Village in the Khammam District of Telangana (17.199°–17.249° N & 79.868°–79.922° E), which is about 30km from the district headquarters (Fig. 1). Palair is a large man-made reservoir that is up to 16m in depth and covers an area of 1, 748ha. It has considerable economical, ecological and biological significance, being home to many freshwater invertebrate and vertebrate populations that support local fisheries which take fin-fish and macro crustaceans like prawns and crabs (Roy et al. 2015). While ichthyofaunal resources have been properly documented, the Decapoda (crustaceans with 10 legs) are poorly known. Surveys were conducted in the Palair Reservoir between from 2016 to 2018 in order to document the diversity of decapods.

Decapoda are highly diverse, with an estimated 15, 000 species worldwide, 1, 669 recorded from freshwater. One-hundred-and-eighteen species of freshwater prawns (Valarmathi 2017) and 122 species of freshwater crabs (Pati & Thackray 2018) have been documented from India. In a recent ongoing project started in August

2016 on “Taxonomic Studies on Freshwater Decapods of Telangana”, a total of 153 specimens of Decapoda have been collected from Palair Reservoir. One species of penaeoid prawn belonging to family Penaeidae, five species of caridean prawns belonging to Palaemonidae and Atyidae families and two species of brachyuran crabs (family Gecarcinucidae) have been identified from recent collections. The earlier studies had reported two species of caridean prawns (Palaemonidae) and three brachyuran crabs (Gecarcinucidae) among 82 examples of Decapoda collections (Roy et al. 2015).

MATERIAL AND METHODS

Four surveys were conducted in the Palair Reservoir during December 2016, February 2017, July 2017 and August 2018. A total of 153 specimens of freshwater decapod crustaceans (131 prawns and 22 crabs) were collected from running waters, submerged vegetation, and muddy/rocky habitats of 10 localities surrounding the Palair Reservoir (Figure 1, Table 1).

Crabs were either handpicked from beneath stones

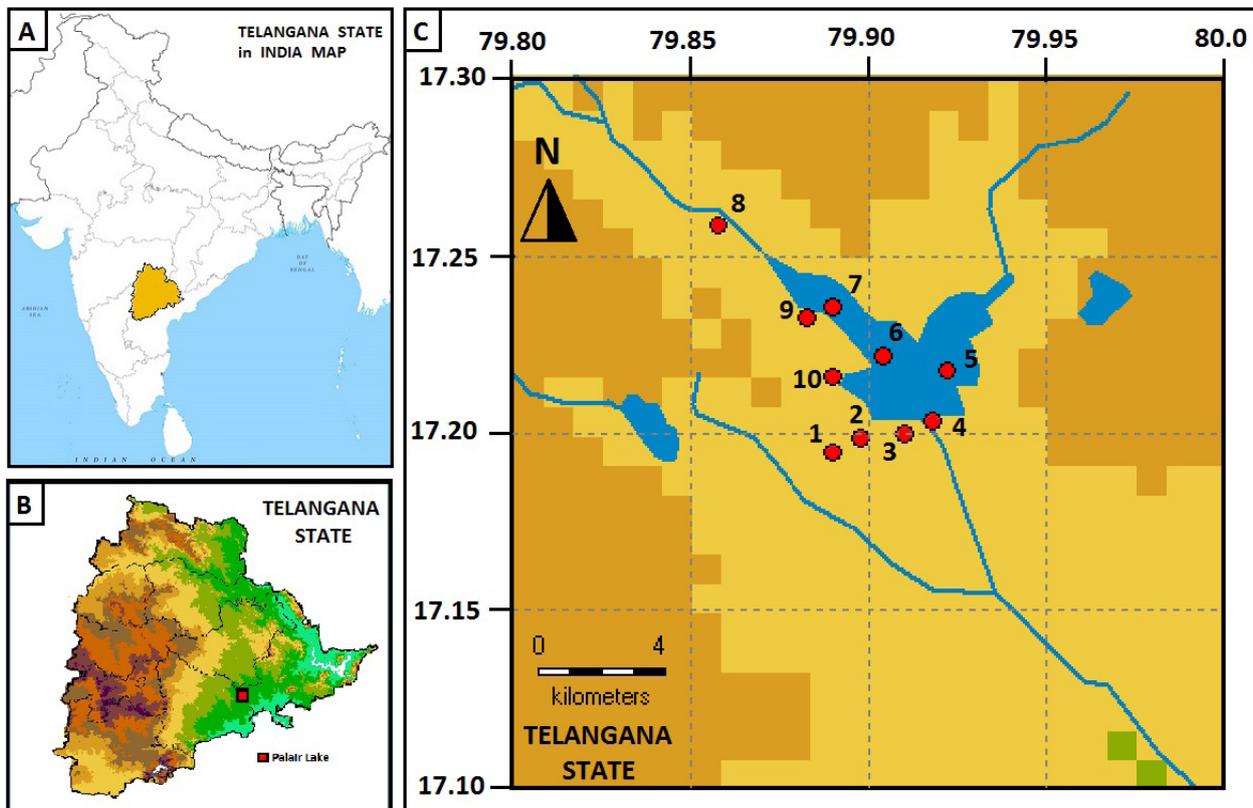


Figure 1. A—Telangana location map | B—Location of Palair in Telangana map | C—Map of the Palair Reservoir showing surveyed localities made by DIVA-GIS: 1—Naikangudem | 2—J.C. Boating and Waterpark | 3—Palair Reservoir near S.H. 42 | 4—Palair Park | 5—Kattamaisamma Temple, Palair | 6—Kotturu | 7—Neradavai | 8—Thammagudem | 9—Urlugonda | 10—Annarigudem.

Table 1. Details of the surveyed localities surrounding the Palair Reservoir.

Locality code	Locality	Nature of water body	Latitude (°N)	Longitude (°E)
1.	Naikangudem	Canal	17.195	79.890
2.	J.C. Boating and Waterpark	Reservoir	17.199	79.898
3.	Palair Reservoir near S.H. 42	Reservoir	17.200	79.910
4.	Palair Park	Reservoir	17.204	79.918
5.	Kattamaisamma Temple, Palair	Reservoir	17.218	79.922
6.	Neradavai	Canal	17.236	79.890
7.	Thammagudem	Small stream	17.259	79.858
8.	Urlugonda	Small stream	17.222	79.904
9.	Annarigudem	Reservoir	17.233	79.883
10.	Kotturu	Reservoir	17.216	79.890

and small rocks or dug out from burrows. Prawns were gathered from shallow waters using a D-shaped hand-net. Large-sized crabs and prawns were caught with cast nets. Collected specimens with proper collection data were preserved in 70–80 % ethyl alcohol (Ng 2017). The identification of penaeid, palaemonid, and atyid prawns was achieved by following Holthuis (1980), Jalihal et al. (1984), Chace & Bruce (1993), Wowor & Choy (2001), Mariappan & Richard (2006), and Jose (2013) whereas the crab identification was confirmed from Pati & Sharma (2014). An unknown species of crab, here referred as *Oziotelphusa* sp., has no affinities with the congeners (see Bahir & Yeo 2005; Pati & Sharma 2012; Raj et al. 2017). Confirmation of the species distribution has done from The IUCN Red List 2020.

All the identified specimens were deposited in the collections of the Zoological Survey of India, Freshwater Biology Regional Centre, Hyderabad, India (ZSI-FBRC). In addition, the previously collected material (six prawns and 15 crabs) from ZSI-FBRC was also examined. These specimens were collected between 2009 and 2011.

RESULTS

From the present study, a total of 10 species of decapods were recognized from the Palair Reservoir; seven species of prawns in three genera of three families (Penaeidae, Palaemonidae, and Atyidae); three species of crabs in two genera of the family Gecarcinucidae. A systematic account is provided on the decapods of the Palair Reservoir.

Systematics

Order Decapoda Latreille, 1802

Suborder Dendrobranchiata Spence Bate, 1888

Superfamily Penaeoidea Rafinesque, 1815

Family Penaeidae Rafinesque, 1815

1. *Penaeus semisulcatus* De Haan, 1844 [in De Haan, 1833–1850] (Image 1)

1844. *Penaeus semisulcatus* De Haan, in Von Siebold, Fauna Japonica, Crustacea (6/7): Pl. 46.

1900. *Penaeus ashiaka* Kishinouye

Material examined: FBRC/ZSI/INV/1810, 16.ii.2017, 6 specimens, Palair, coll. S. Mandal.

Diagnostic characters: Total length (TL) 130–132 mm, Rostrum length (RL) 27–30 mm, Carapace length (CL) 27–29 mm; rostral formula 7–8(5)/2, rostrum straight, rostral length is more or less equal to the carapace; carapace smooth, antennal spine and hepatic spine present, adrostral carina reaching almost posterior margin of carapace, gastrofrontal carina present; antennal carina meets with hepatic carina, hepatic carina inclined at an angle of 20° anteroventrally; cervical sulcus present, branchiocardiac carina shallow, postorbital carapace margin is oval-shaped; 3rd maxilliped is extending up to the half of the antenular scale. First 3 pairs of legs forming pincer, 3rd pair is comparatively larger than 1st and 2nd pair; spine on Ischia of 1st and 2nd pereopod; 5th pereopod with small exopodite. Copulatory organ on First pair of pleopod in male (petasma) and on posterior thoracic sternites in female (thelycum); abdomen with posterior part of pleura (lateral plates) covering anterior part of succeeding pleura; pleopods are with two branches.

Remarks: In India, *P. semisulcatus* occurs along both the coasts of India, including Andaman & Nicobar Islands (Samuel et al. 2016). *Penaeus semisulcatus* is predominantly marine. The species, however, is known to exist in freshwater environments. The present specimens of *P. semisulcatus* constitute a new record to Telangana.

Suborder Pleocyemata Burkenroad, 1963

Infraorder Caridea Dana, 1852

Superfamily Atyoidea De Haan, 1849 [in De Haan, 1833-1850]

Family Atyidae De Haan, 1849 [in De Haan, 1833-1850]

2. *Caridina gracilipes* De Man, 1892 (Image 2)

1892. *Caridina Wyckiivar. gracilipes* De Man: 387 Pl. 24 Fig. 29–29e [type localities: Sulawesi (Celebes), and Selajar, Indonesia].

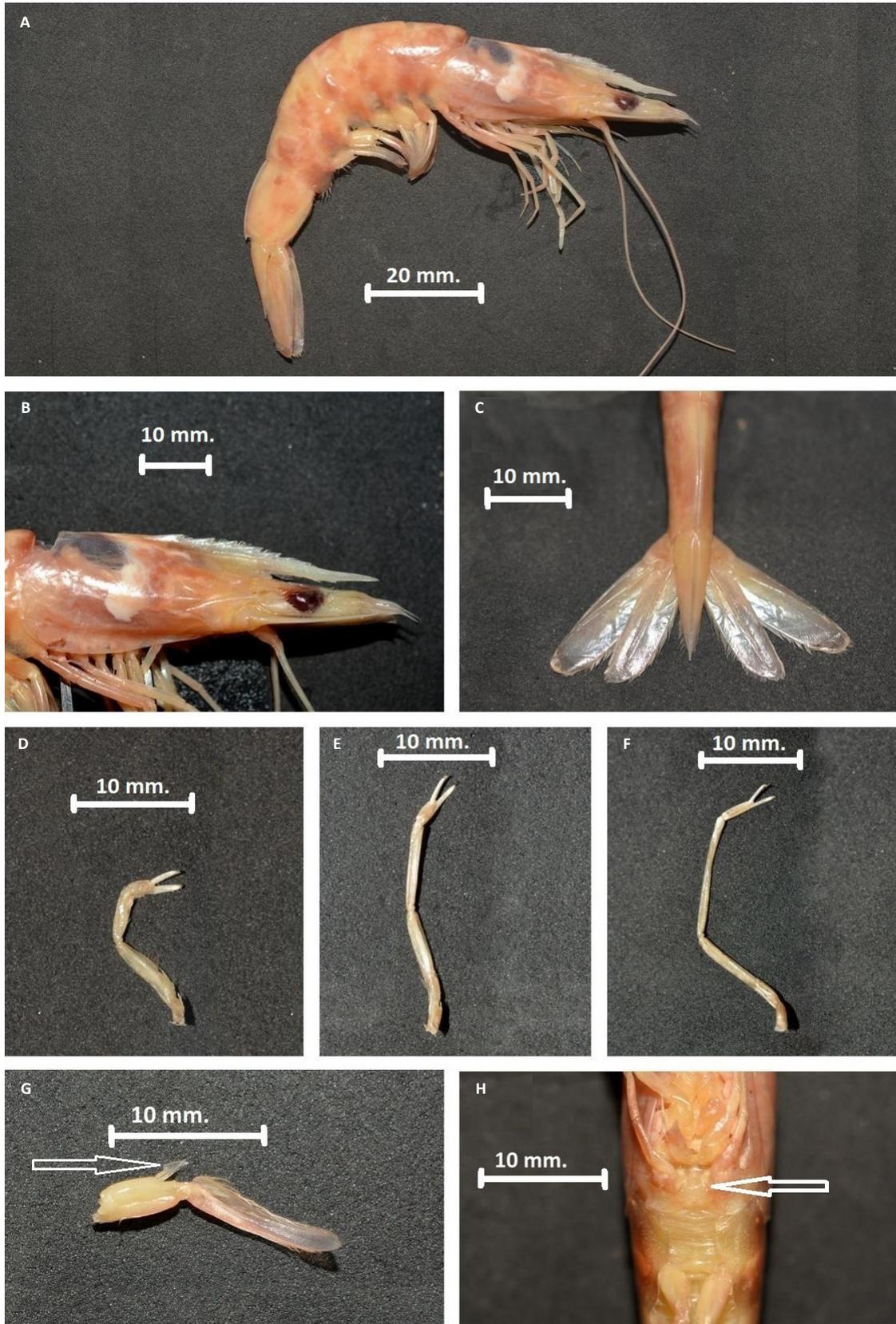


Image 1. *Penaeus semisulcatus* De Haan, 1844 from the Palair Reservoir: (FBRC/ZSI/INV/1810) A—whole animal, lateral view (female) | B—lateral view of cephalothorax | C—telson with uropods | D—first cheliped | E—second cheliped | F—third cheliped | G—petasma (male) | H—thelycum (female). Scale bars: 20mm (A), 10mm (B–H). © Sudipta Mandal.

2004. *Caridina gracilipes* - Wowor et al.: 341, Fig. 6D; Cai & Shokita 2006a: 250.

Material examined: FBRC/ZSI/INV/1979, 64 specimens, 31.viii.2018, Nayakulgudem, coll. S. Mandal.

IUCN Status: Least Concern.

Diagnostic characters: TL 18.0–19.3 mm, RL 3.5–3.8 mm and CL 3.2–3.7 mm. Rostrum formula 16–23(3)/8–11, rostrum is straight, slightly upturned distally, dorsal teeth interrupted by gap in the anterior side, rostrum longer than 3rd segment of antennal peduncle but shorter than antennal scale, carapace and rostrum equal in length; 3rd maxilliped crosses half of the antennal scale; 1st chelipeds stout, palm equal to finger, a tuft of hair with finger, carpus is half of chela and merus shorter than chela, carpus with deep anterior excavation, ischium very short and stout; 2nd chelipeds longer than 1st chelipeds, finger longer than palm with tuft of hair at the end, carpus longer than chela but sub equal to merus; 3rd to 5th pereopods similar in structure with simple dactyls, longer than 1st and 2nd pereopods; abdomen smooth, 6th segment two times as long as 5th and sub equal to telson in length, berried females carry around 120–130 eggs measuring 0.33×0.46 mm; endopod of 1st pleopod of male acutely triangular; 5–7 pairs of movable spines, terminal pair flanking the posterior-lateral angles of telson, posterior margin 'V' shaped posses 6 long plumose setae; uropods are exceeding tip of the telson, endopod is smaller than exopod, lateral margin of exopod straight, suture in exopod is across the middle with 7–9 movable spines.

Remarks: In India, *C. gracilipes* is known from Tamil Nadu, Kerala, Andhra Pradesh, and West Bengal states. The present specimen from the Palair Reservoir is a new record to Telangana. This species is exclusively a freshwater species found in lakes and rivers.

3. *Caridina shenoyi* Jalihal & Sankolli in Jalihal, Shenoy & Sankolli, 1984 (Image 3)

1984. *Caridina shenoyi* Jalihal & Sankolli Rec. Zool. Surv. India. Occ. Paper No. 69: 1–40.

2013. *Caridina shenoyi* Jalihal & Sankolli Zool. Surv. India. State Fauna Series, 21: 63–72.

IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1823, two specimens, 13.vii.2017, J.C. Boating & Water Park, Palair, coll. S. Mandal.

Diagnostic characters: TL 14.4–19 mm, RL 2.8mm and CL 7.2mm; rostrum formula 18–22(6–7)/6–7, rostrum is straight, slightly downward distally, dorsal teeth are placed equally, rostrum reaches up to the end of 2nd segment of antennal peduncle but not reaches up to

the end of the antennal scale, carapace 1.8 times as long as rostrum; 3rd maxilliped reaches up to the end of the antennal scale; 1st cheliped is stout, palm is sub equal to finger, carpus is half of palm and merus, merus is equal to palm, a tuft of hair with chela, chela 2.2–2.5 times as long as broad, carpus 1.8–2.0 times as long as broad, carpus with deep anterior excavation; 2nd cheliped is also stout and more or less equal to 1st cheliped, reaches end of antennal peduncle by chela, carpus is sub equal to merus and longer than chela, a tuft of hair with chela; finger is 1.5–1.8 times as palm; 3rd to 5th pereopods similar in structure with short and stout dactyls, longer than 1st and 2nd pereopod; abdomen smooth without any abdominal hump, 6th segment 1.48 times as long as 5th and 0.76 times as long as telson, berried females carries around 350–370 eggs measuring 0.6×0.4 mm, 6th abdominal segment less than half of carapace length; endopod of 1st pleopods of male acutely triangular, appendix masculine 0.3 times as long as endopod; six pairs of movable spines, terminal pair flanking the posterior-lateral angles of telson. Posterior margin 'V' shaped posses six long plumose setae; uropods are exceeding tip of the telson, endopod is smaller than exopod, lateral margin of exopod straight, suture in exopod is across the middle with 22 movable spines.

Remarks: In India, *C. shenoyi* is known from Kerala, Karnataka, and Telangana states. This species is generally found in submerged vegetations in shallow water.

Superfamily Palaemonoidea Rafinesque, 1815

Family Palaemonidae Rafinesque, 1815

4. *Macrobrachium equidens* (Dana, 1852)

Material examined: Reported by Roy et al. (2015).

Diagnostic Characters: Body robust, rostrum formula 10–11(2–4)/4–7, rostrum strong, reaching at end of antennal scale, dorsal teeth placed at regular interval; ridge of antennal spine extending in the direction of hepatic spine; 2nd cheliped sub equal in length, fingers covered with soft dense pubescence, not dentate on opposable margins, not gaping; out of two postero-lateral spines of telson, lower one over-reaching the telson tip.

Remarks: In India, *Macrobrachium equidens* has been reported from Kerala, Odisha, Karnataka, Andhra Pradesh, and Goa.

5. *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844) (Image 4)

1844. *Palaemon malcolmsonii* H. Milne Edwards, In: Jacquemont Voyage, Inde, 4(2): 8.

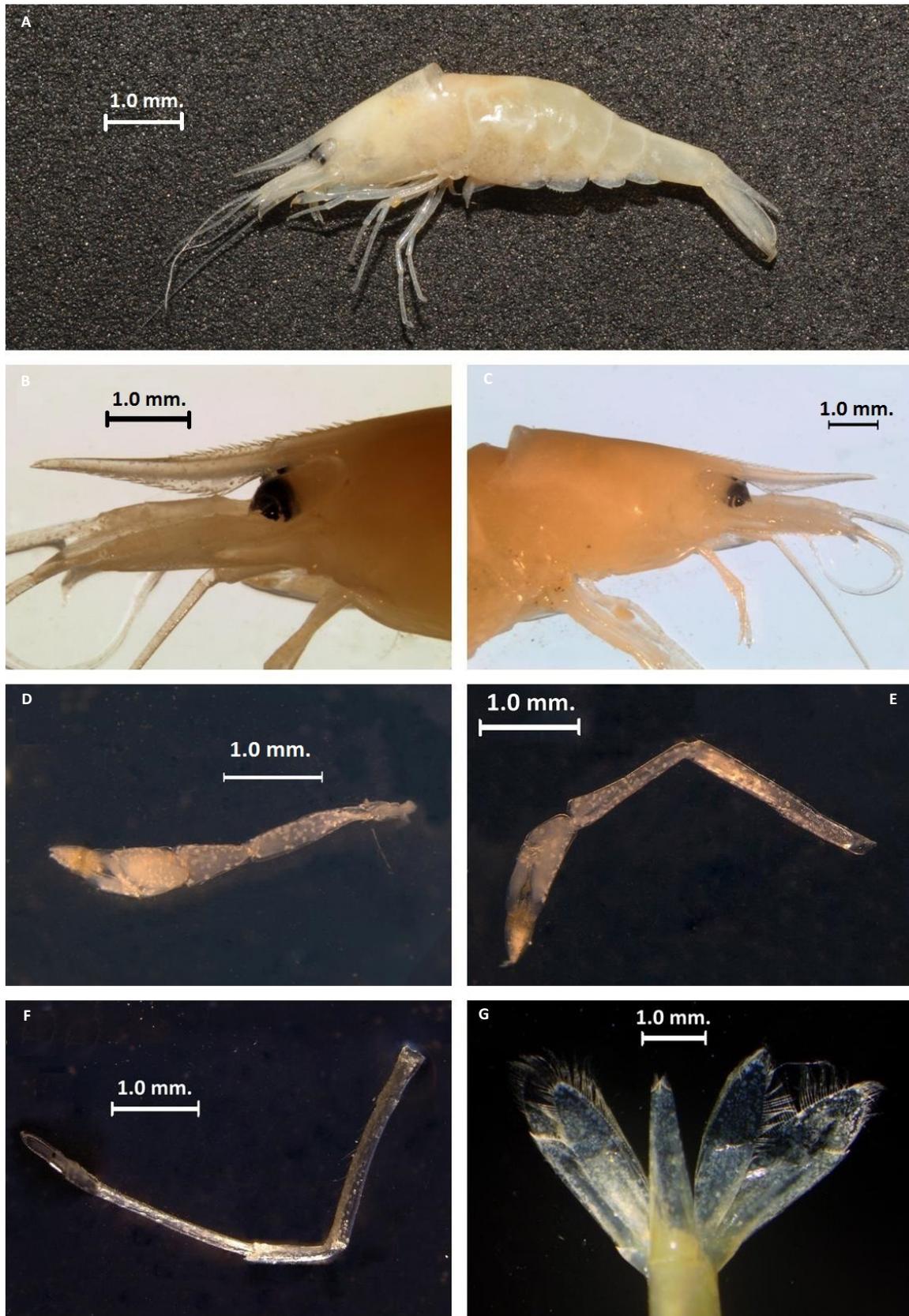


Image 2. *Caridina gracilipes* De Man, 1892 from the Palair Reservoir: (FBRC/ZSI/INV/1979) A—whole animal, lateral view | B—rostrum | C—lateral view of cephalothorax | D—first cheliped | E—second cheliped | F—fifth pereopod | G—telson with uropods. Scale bars: 1.0mm (A–G). © Sudipta Mandal.

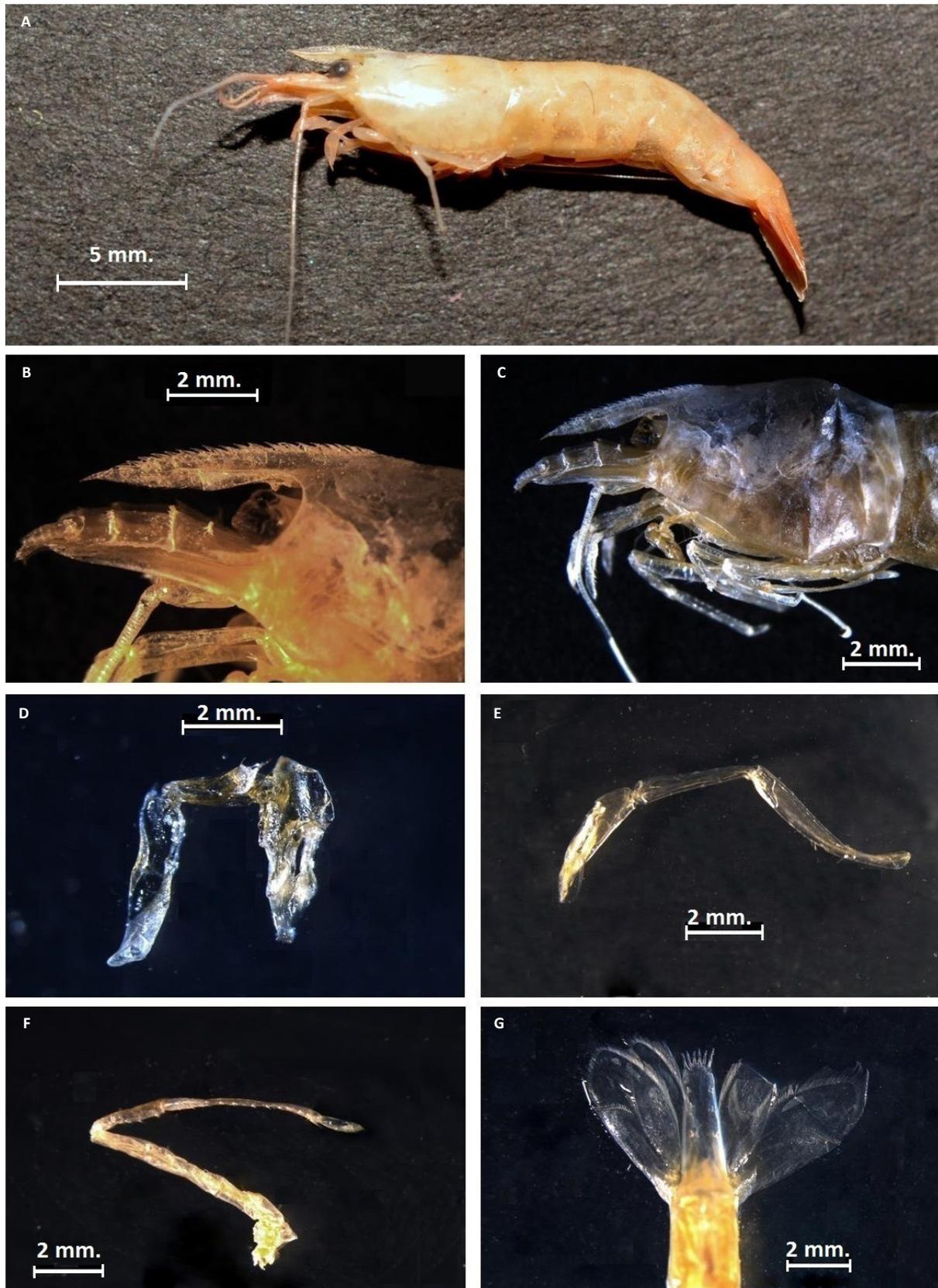


Image 3. *Caridina shenoyi* Jalihal & Sankolli, 1984 from the Palair Reservoir: (FBRC/ZSI/INV/1823) A—whole animal, lateral view | B—rostrum | C—lateral view of cephalothorax | D—first cheliped | E—second cheliped | F—fifth periopod | G—telson with uropods. Scale bars: 5mm (A), 2mm (B–G). © Sudipta Mandal.

2007. *Macrobrachium malcolmsonii* (H. M. Edwards, 1844) Rec. zool. Surv. India: 107(Part 2): 93–101.

IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1495, 1 specimen, 15.vii.2010, Neredvai, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1497, 2 specimens, 14.viii.2010, Palair, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1500, 1 specimen, 14.viii.2010, Annarigudem, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1524, 1 specimen, 16.viii.2010, Kottura, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1525, 1 specimen, 16.viii.2010, Uralakonda, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1368, 23 specimens, 7.xii.2016, J.C. Boating & Water park, Palair, coll. S. Mandal; FBRC/ZSI/INV/1405, 7 specimens, 7.xii.2016, Palair, coll. S. Mandal; FBRC/ZSI/INV/1439, 7 specimens, 13.vii.2017, Palair, coll. S. Mandal; FBRC/ZSI/INV/1886, 3 specimens, 30.viii.2018, Palair Park, Palair, coll. S. Mandal; FBRC/ZSI/INV/1891, 4 specimens, 31.viii.2018, near S.H. 42, Palair, coll. S. Mandal.

Diagnostic characters: TL 140–180 mm, RL 38–59 mm, CL 38–60 mm; rostral formula 9–11(2–4)/5–6, rostrum slightly upturned distally, proximal portion convex; two sub distal teeth present in dorsal arm, rest are evenly placed, rostrum more or less equal to antennal scale but longer than 3rd antennular peduncle; carapace smooth, antennal spine and hepatic spine present, post antennular carapace margin evenly rounded; 3rd maxilliped does not reach up to half of antennular scale; 1st cheliped very short, equal and slender, palm equal to fingers, a dance row of setae in the lower side of palm, carpus 2.5 times as long as chela and 1.3 times as long as merus; 2nd cheliped strong, equal and well developed, movable finger covers with velvety pubescence in adults, fingers are longer than half of the palm, palm not swollen, carpus 0.8 as long as chela, 1.3 as long as merus; 3rd to 5th pereopod in structure with simple dactylus; abdomen smooth, 6th segment 1.5 as long as 5th and 0.63 as long as to telson; telson with two pairs of dorsal movable spines and two pairs of posterior spines with 12–14 plumose setae, posterior apex exceed the tips of longer posteriolateral spines; uropods are exceeding tip of telson, endopod shorter than exopod in length, lateral margin of exopod straight, overreached by blunt angular lamellar end. The mobile mesial spine of exopod is absent.

Remarks: In India this species is distributed in Andhra Pradesh, Karnataka, Kerala, Maharashtra, Odisha, Tamil Nadu, Tripura, and West Bengal. Apart from India it has been reported from Indonesia, Kenya, Madagascar, Mozambique, and Sri Lanka. This species is collected from the deep water of large reservoirs or rivers.

6. *Macrobrachium rosenbergii* (de Man, 1879) (Image 5)

1879. *Palaemon rosenbergii* de Man: 167.

1950a *Macrobrachium rosenbergii* Holthuis: 111. Fig. 25.-Kuris, Ra'anan, Sagi, and Cohen, 1987: 219.

IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1420, 3 specimens, 16.ii.2017, Palair, coll. S. Mandal.

Diagnostic characters: TL 132–145 mm, RL 48–51 mm, CL 35–40 mm; rostral formula 12–16(3–4)/10–11, rostrum upturned distally, proximal portion convex, all teeth are evenly placed; rostrum longer than antennal scale and antennular peduncle; carapace smooth, antennal spine and hepatic spine present, post antennular carapace margin evenly rounded; 3rd maxilliped reaches half of antennular scale; 1st chelipeds equal, slender, shorter than 2nd cheliped, palm equal to fingers, carpus two times as long as chela and 1.3 times as long as merus; 2nd chelipeds strong, equal and well developed, carpus shorter than chela but longer than merus, palm swollen, fingers longer than half of the palm, legs entirely covered with very small dense spinules; 3rd to 5th pereopod in structure with simple dactylus; abdomen smooth, 6th segment 1.85 times as long as 5th and equal to telson; telson with two pairs of dorsal movable spines and two pairs of posterior spines with 14–16 plumose setae, posterior apex exceed the tips of longer posteriolateral spines; uropods are exceeding tip of telson, endopod shorter than exopod in length, lateral margin of exopod straight, overreached by blunt angular lamellar end, mobile mesial spine of exopod is absent.

Remarks: *M. rosenbergii* has been reported from all over India. This species is also collected from the deep water of large reservoirs or rivers along with *M. malcolmsonii*.

7. *Macrobrachium scabriculum* (Heller, 1862) (Image 6)

1862a. *Palaemon scabriculum* Heller: 527 [type locality: Sri Lanka].

1950a. *Macrobrachium scabriculum*. - Holthuis: 224. IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1887, 5 specimens, 30.viii.2018, Palair Park, Palair, coll. S. Mandal; FBRC/ZSI/INV/1890, 7 specimens, 31.viii.2018, near S.H. 42, Palair, coll. S. Mandal.

Diagnostic characters: TL 9.8cm.; rostrum formula 12–15(2–3)/2–3, rostrum straight, long as 3rd segment of peduncle and 0.75 times as long as carapace; carapace rough posteriorly, antennal spine and hepatic spine present, post antennular carapace margin evenly

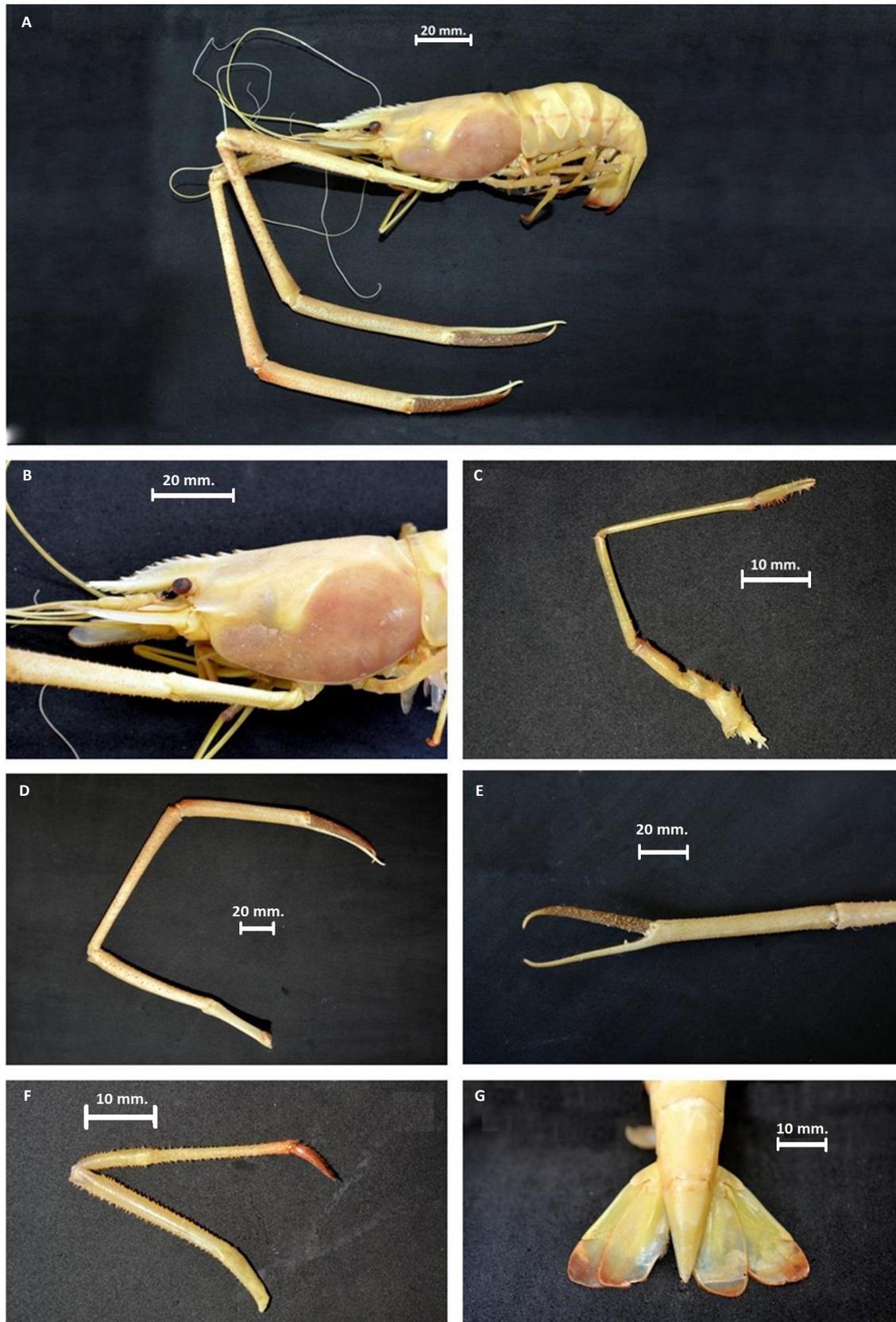


Image 4. *Macrobrachium malcolmosonii* (H.M. Edwards, 1844) from the Palair Reservoir: (FBRC/ZSI/INV/1891) A—whole animal, lateral view | B—lateral view of cephalothorax | C—first cheliped | D—second cheliped | E—chela of second cheliped | F—fifth pereopod | G—telson with uropods. Scale bars: 20mm (A, B, D, E), 5mm (C, F, G). © Sudipta Mandal.

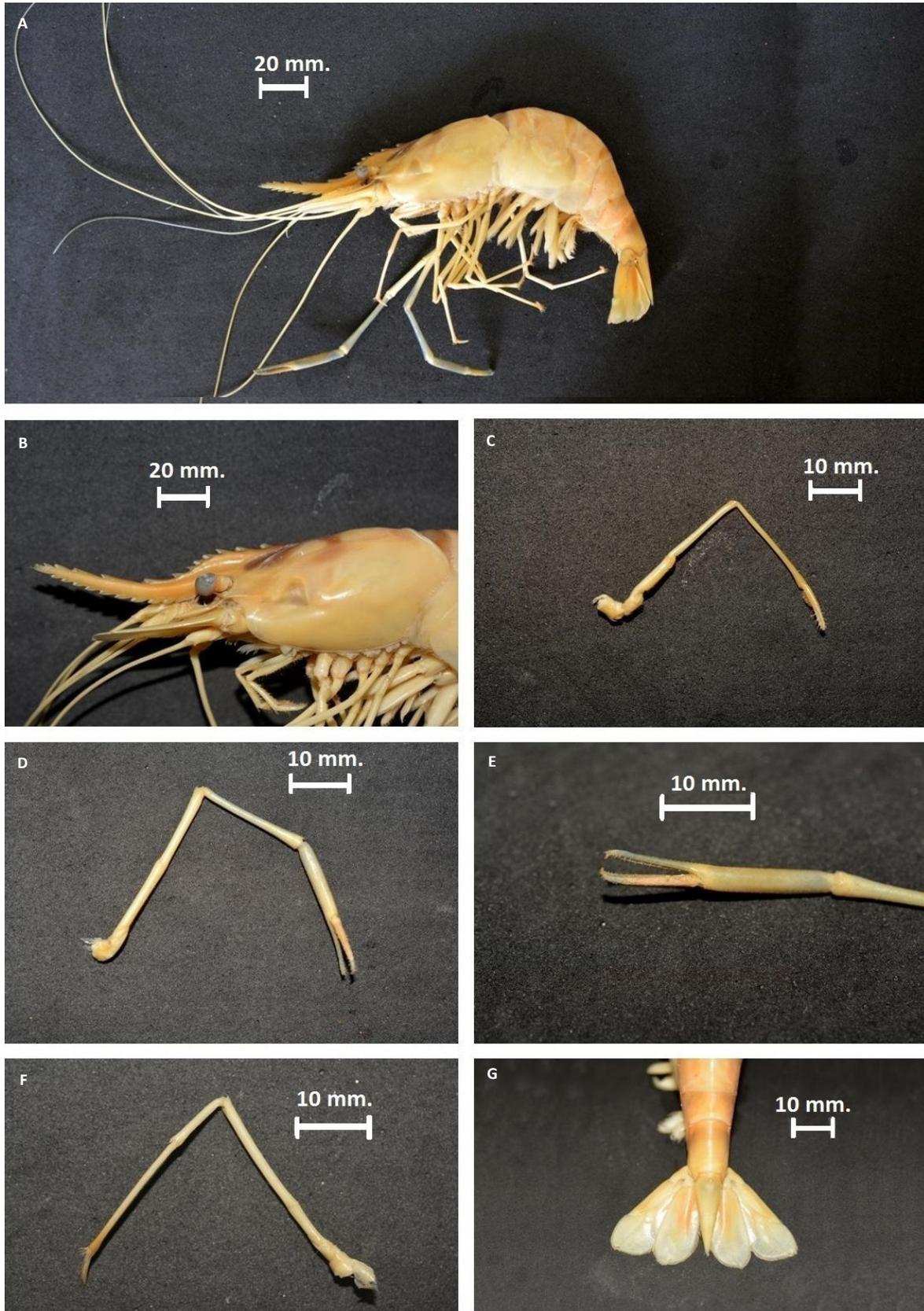


Image 5. *Macrobrachium rosenbergii* (De Man, 1879) from the Palair Reservoir: (FBRC/ZSI/INV/1420) A—whole animal, lateral view | B—lateral view of cephalothorax | C—first cheliped | D—second cheliped | E—chela of second cheliped | F—fifth pereopod | G—telson with uropods. Scale bars: 20mm (A, B), 10mm (C–G). © Sudipta Mandal.

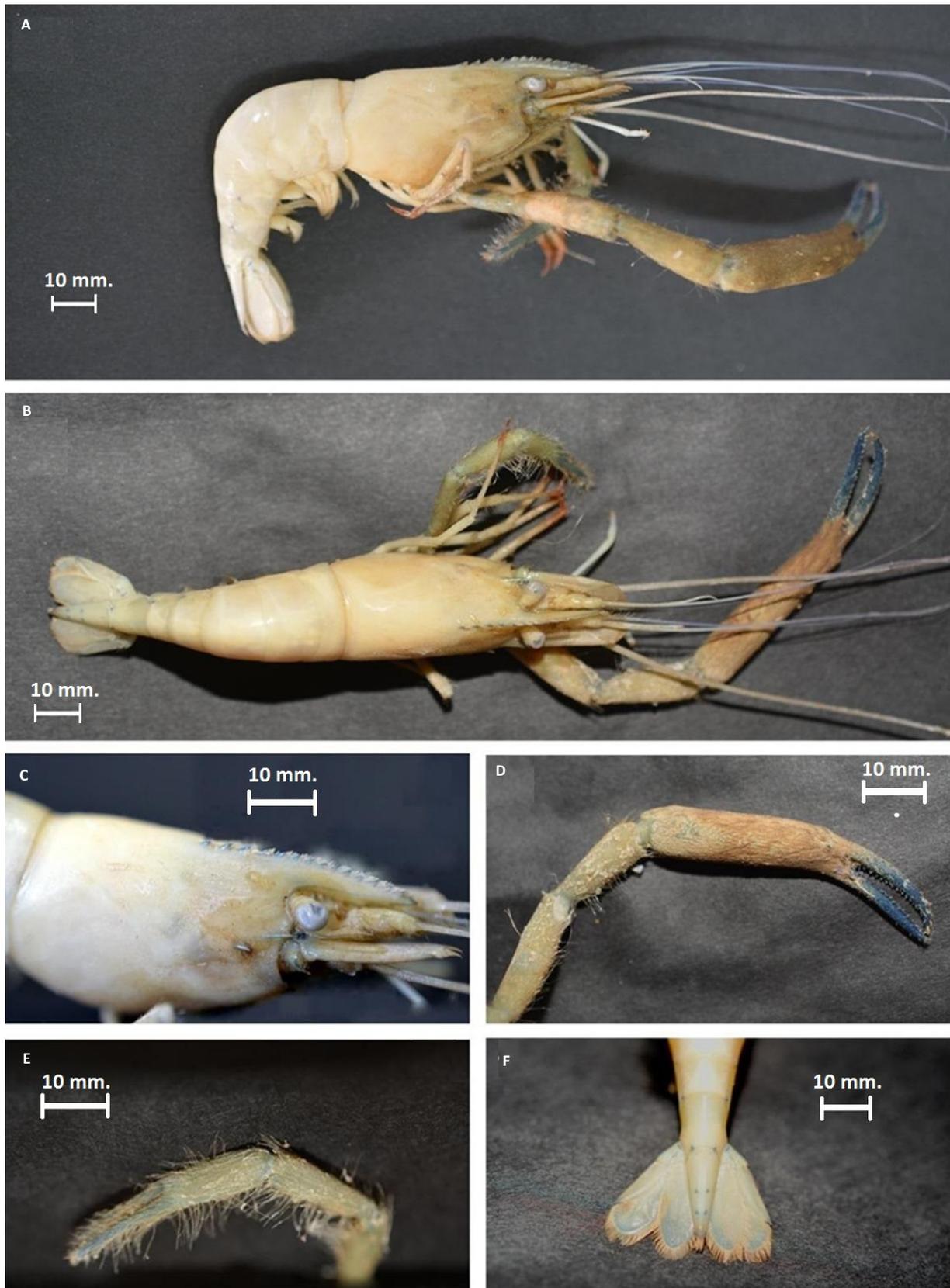


Image 6. *Macrobrachium scabriculum* (Heller, 1862) from the Palair Reservoir: (FBRC/ZSI/INV/1890) A—whole animal, lateral view | B—whole animal, dorsal view | C—lateral view of cephalothorax | D—larger 2nd cheliped | E—smaller 2nd cheliped | F—telson with uropods. Scale bars: 10mm (A–F). © Sudipta Mandal.



Image 7. *Barytelphusa cunicularis* (Westwood in Sykes, 1836) from the Palair Reservoir: (FBRC/ZSI/INV/1365) A—whole animal, dorsal view | B—whole animal, frontal view | C—whole animal, ventral view (male) | D—whole animal, ventral view (female) | E—third maxillipeds | F—male first gonopod (G1) | G—left male second gonopod (G2). Scale bars: 10mm (A–D), 5mm (E, F), 2mm (G). © Sudipta Mandal.

rounded; 3rd maxillipeds cross half of antenular scale; 1st cheliped is slender, equal and extending over the tip of the antennal scale; 2nd Cheliped stout, exhibiting sexual dimorphism in adult, in male unequal in size and shape, larger one longer than the body, much stouter than the smaller Cheliped and characterized by the

presence of velvety pubescence on palm, palm longer than fingers with equal thickness, cutting edge of the fingers armed with a row of tubercles which gradually decreased in size distally, Carpus shorter than both palm and merus; smaller Cheliped shorter than the body and less pubescent, fingers longer than palm, cutting edges

plane, palm shorter than Carpus, Carpus sub equal to merus; 3rd to 5th pereopods similar in structure with simple dactylus; abdomen smooth, 6th segment 1.25 as long as 5th and 0.55 as long as to telson; telson with two pairs of dorsal movable spines and 2 pairs of posterior spines with 6–7 plumose setae, posterior apex do not exceed the tips of longer posteriolateral spines; uropods are exceeding tip of telson, endopod equal to exopod in length, lateral margin of exopod straight, overreached by blunt rounded lamellar end, mobile mesial spine of exopod present.

Remarks: In India *M. scabriculum* is known from Andhra Pradesh, Karnataka, Kerala, Maharashtra, Odisha, Tamil Nadu, Tripura, Telangana, & West Bengal; Indonesia; Kenya; Madagascar; Mozambique; and Sri Lanka. This species is generally found in crevices or beneath the stones and small rocks in shallow water.

Infraorder Brachyura Latreille, 1802

Superfamily Gecarcinoidea Rathbun, 1904

Family Gecarcinidae Rathbun, 1904

8. *Barytelphusa cunicularis* (Westwood in Sykes, 1836) (Image 7)

1836. *Thelphusa cunicularis* Westwood, in Sykes & Westwood: 183; H. Milne Edwards, 1853: 209.

1970a. *Barytelphusa (Barytelphusa) cunicularis*–Bott: 335; 1970b: 31; Srivastava, 2005: 118, Pl. 1 Fig. 3.

IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1413, 1 specimen, Annarigudem, 14.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1455, 1 specimen, Urlakonda, 16.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1465, 1 specimen, Kotturu, 16.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1493, 15.viii.2010, 3 specimens, Neredvai, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1498, 2 specimens, Neredvai, 12.iv.2011, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1572, 2 specimens, Narasimhulugudem, 11.iv.2011, Coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1365, one specimen, J.C. Boating & Water park, Palair, 7.xii.2016, coll. S. Mandal; FBRC/ZSI/INV/1383, 4 specimens, J.C. Boating & Water park, Palair, 16.ii.2017, coll. S. Mandal; FBRC/ZSI/INV/1889, 1 specimen, near S.H. 42, Palair, 31.viii.2018, Coll. S. Mandal.

Diagnostic characters: Carapace width 76–95 mm, CL 57–70 mm, Carapace height 19–38 mm; carapace wider than long, dorsal surface is slightly convex anteriorly and flat posteriorly; anteriolateral borders of carapace convex and cristiform, posteriolateral borders ill-defined and convergent posteriorly, cervical groove is distinct,

meets with postorbital crest, H-groove is clear; frontal width 16–20 mm. Anteriolateral margin and branchial region raised in frontal view, frontal median triangle incomplete, epistome bilobed, without median tooth; post orbital and epigastric cristae strongly developed, fused with latter slightly anterior to former, forming gentle concave ridge in dorsal view, external orbital tooth blunt and not separated from the lower border of the orbit, external orbital angle broadly triangular with outer margin, ca. 2–3 times length of inner margin, epibranchial tooth broad, blunt, separated from external orbital angle with visible cleft; 3rd maxilliped exopod with long flagellum; suture between thoracic sternites 2–3 distinct and suture between 3–4 slightly visible as grooves; Chelipeds unequal in both the sexes, carpus has a strong sharp spine with a small accessory cusp at its inner angle, one big tooth in the middle of the immovable finger, rest of all apposed moderately; ambulatory legs smooth, compressed dorsoventrally, more or less same size with the chelipeds, dactylus subequal in length with propodus narrowly triangular, 6th segment broader than long with concave lateral margin, telson is tongue-shaped, equal to 6th segment in length, abdominal cavity deep, female pleon broadly tongue-shaped, vulvae oval-shaped, situated just beside the margin with thoracic sternite 5; G1 long, narrow, curving slightly outwards, terminal segment long with pointed tip; G2 short, distal segment short.

Remarks: *Barytelphusa cunicularis* was so far known from the states of Maharashtra, Kerala, Karnataka, Tamil Nadu and West Bengal as well as Andhra Pradesh and Telangana. This species is generally found in small pit at the bank of river or lake or reservoir.

9. *Barytelphusa guerini* (H. Milne Edwards, 1853) (Image 8)

1853. *Thelphusa guerini* H. Milne Edwards, Ann. Sci. Nat. Zool., 1853: 210.

1970a. *Barytelphusa (Barytelphusa) guerini* Bott, Abh. senckenb. naturforsch. Ges.: 33.

IUCN Status: Least Concern.

Material examined: FBRC/ZSI/INV/1411, 2 specimens, Annarigudem, 14.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1464, 1 specimen, Erragaddathanda, 16.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1496, 1 specimen, Nayakangudem, 14.viii.2010, coll. Dr. S.V.A. Chandrasekhar; FBRC/ZSI/INV/1499, 1 specimen, Neredvai, 12.iv.2011, coll. Dr. S.V.A. Chandrasekhar; ZSI/INV/1406, 3 specimens, J.C. Boating & Water park, Palair, 13.vii.2017, coll. S. Mandal, FBRC/; FBRC/ZSI/INV/1888, 7 specimens, Canal 1, beside Palair

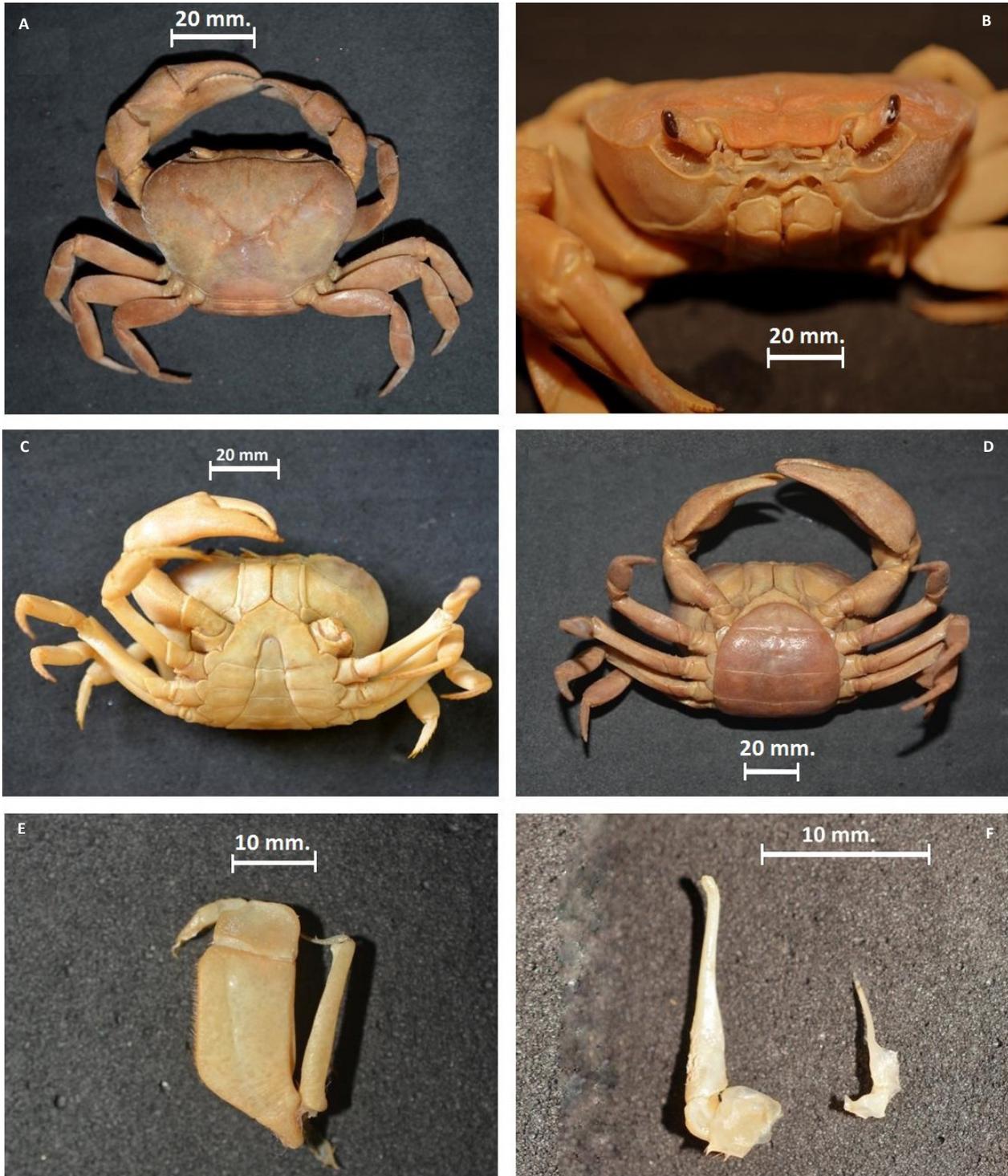


Image 8. *Barytelphusa guerini* (H. Milne Edwards, 1853) from the Palair Reservoir: (FBRC/ZSI/INV/1406) A—whole animal, dorsal view | B—whole animal, frontal view | C—whole animal, ventral view (male) | D—whole animal, ventral view (female) | E—third maxilliped | F—male first gonopod (G1) | G—left male second gonopod (G2). Scale bars: 20mm (A–D), 10mm (E–F). © Sudipta Mandal.

Park, 30.viii.2018, coll. S. Mandal; FBRC/ZSI/INV/1911, 1 specimen, Katta Maisamma temple, Palair, 31.viii.2018, coll. S. Mandal; FBRC/ZSI/INV/1885, 5 specimens, Small stream near agricultural field, Thammagudem,

31.viii.2018, coll. S. Mandal.

Diagnostic characters: Carapace width 49–56 mm, CL 39–43 mm, Carapace height 12–19 mm; carapace wider than long, dorsal surface is convex; anteriolateral borders



Image 9. *Oziotelphusa* sp. from the Palair Reservoir: (FBRC/ZSI/INV/1696) A—whole animal, dorsal view | B—whole animal, ventral view (male) | C—whole animal, frontal view. Scale bars: 10mm (A–C). © Sudipta Mandal.

of carapace convex and cristiform, posteriolateral borders ill-defined and convergent posteriorly; cervical groove is distinct, meets with post orbital crest (does not touch the antero lateral line); H-groove is clear; frontal width 12–16mm, frontal median triangle incomplete, epistome bilobed, without median tooth; post orbital and epigastric cristae strongly developed, fused as a continuous line, post-orbital crests trenchant, sinuous and separated from Epibranchial tooth by clearly visible cleft, external orbital tooth blunt and not separated from the lower border of the orbit, external angle of frontal median triangle cristiform, epibranchial tooth well formed but blunt, postero-lateral borders ill-defined and convergent posteriorly; 3rd maxilliped exopod with long flagellum; suture between thoracic sternites 2–3 distinct, between 3–4 slightly visible as shallow grooves on sides; chelipeds unequal in both the sexes, Carpus has a strong sharp spine with a small accessory cusp at its inner

angle, 2/3 bigger teeth in both movable and immovable fingers, rest of all apposed moderately; ambulatory legs smooth, compressed dorsoventrally, more or less same size with the chelipeds; male abdomen broad-based triangular, 6th segment broader than long, trapezoidal in shape with straight lateral margin, telson tongue-shaped, equal to 6th segment in length, abdominal cavity deep; female pleon oval-shaped, vulvae oblong, situated attached with the margin of thoracic sternite 5; G1 long, narrow, curving slightly outwards, terminal segment very long with bulged tip; G2 short, distal segment short.

Remarks: *Barytelphusa guerini* was so far only known from the states of Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh (Pati & Thackeray 2018). The species is reported herein for the first time from Telangana based on the material from the Palair Reservoir. This species is collected from beneath the stones and small rocks in

shallow water.

10. *Oziotelphusa* sp. (Image 9)

Material examined: FBRC/ZSI/INV/1696, 1 specimen, 15.viii.2010, Palair Reservoir, Neradavai, coll. Dr. S.V.A. Chandrasekhar.

Diagnostic characters: Carapace greatest width 30.2mm, CL 21.4mm, carapace height 12.7mm, carapace wider than long. Dorsal surface strongly convex, surface very smooth; anteriolateral borders of carapace convex, smooth and sheet-like without serration; the cervical groove distinct, disappears in a distance behind post-orbital crest, H-groove clear; frontal median triangle complete but not as broad as frontal margin, epistome trilobed, epistomal medial tooth sharp; orbit broad, external orbital tooth blunt and not separated from the lower border of the orbit, external orbital angle triangular; epigastric crest sub-trenched and slightly in advance and separated from post-orbital cristae; post-orbital crests trenchant, sinuous, separated from epibranchial tooth with visible cleft. Epibranchial tooth blunt; 3rd maxilliped exopod with strong flagellum; abdomen of the male T-shaped, suture between anterior thoracic sternites 2–3 visible as shallow, narrow groove not reaching lateral margins, but suture between sternite 3–4 indiscernible.

Remarks: The present lone male specimen from the Palair Reservoir is here referred to *Oziotelphusa* sp., and it has no affinities with the congeners *Oziotelphusa aurantia* and *Oziotelphusa kerala* (Bahir & Yeo 2005; Pati & Sharma 2012; Raj et al. 2017); and this unknown species are found to be new records from Telangana (cf. Pati & Thackeray 2018).

DISCUSSION

Decapods of Palair Reservoir were poorly studied until the present work. In total, 10 decapod species are currently known from the Palair Reservoir as a result of present and previous collections. Among these, four species stand as new state records: *P. semisulcatus*, *C. gracilipes*, *B. guerini*, and *Oziotelphusa* sp. Previous researchers reported 82 examples of Decapoda collected from the reservoir during the survey period of July 2009 to April 2011 (Roy et al. 2015). Among them there were two species of caridean prawns of Palaemonidae family *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844) and *M. equidens* (Dana, 1852), along with three species of brachyuran crabs of Gecarcinucidae family, namely, *Barytelphusa cunicularis* (Westwood in Sykes, 1836),

B. guerini (H. Milne Edwards, 1853), and *Barytelphusa jacquemnotii* (Rathbun, 1905). *B. jacquemnotii*, which had a different species identity in the paper of Roy et al. (2015), has been synonymised with *B. cunicularis* (Pati & Sharma 2014).

In the present study, one species of Penaeid prawn and five species of caridean prawn were encountered along with two brachyuran crabs. One of the previously reported species *Macrobrachium equidens* has not been found in the current study period. In addition to the earlier reported prawn species *Macrobrachium malcolmsonii*, two other species of Palaemonidae family, i.e., *M. scabriculum* (Heller, 1862) and *M. rosenbergii* (De Man, 1879) have been encountered this time. Two species of Atyidae family, i.e., *Caridina gracilipes* De Man, 1892 and *C. shenoyi* Jalihal, Shenoy & Sankolli, 1984 have also been recorded this time. Further discussion on Genus *Caridina* will be provided elaborately in near future. Importantly, none of the species of *Oziotelphusa* were present in the current sampling, however, one specimen of the previous collections identified up to the genus level (*Oziotelphusa* sp.), barely has affinities with the congeners *Oziotelphusa aurantia* and *Oziotelphusa kerala*. Further identification up to the species level of this *Oziotelphusa* specimen requires further collections from the location, which will be conducted in the near future.

REFERENCES

- Chace, F.A., Jr. & A.J. Bruce (1993). The caridean shrimps (Crustacea:Decapoda) of the Albatross Philippine Expedition 1907-1910, Part 6: Superfamily Palaemonoidea. *Smithsonian Contributions to Zoology*: 1–152. <https://doi.org/10.5479/si.00810282.543>
- Ghatak, S.S., S.K. Ghosh & M.K.D. Roy (2010). Crustacea: Decapoda: Palaemonidae and Gecarcinucidae, pp. 51–56. In: The Director (ed.), *Limnological and faunistic studies of Pocharam Reservoir, Nizamabad-Medak districts, Andhra Pradesh. Wetland Ecosystem Series 13*. Zoological Survey of India, Kolkata, 181pp.
- Holthuis, L.B. (1980). *FAO species catalogue. Vol. 1. Shrimps and prawns of the World. An annotated catalogue of species of interest to fisheries. FAO Fisheries Synopsis No. 125, Volume 1*. Food and Agriculture Organization of the United Nations, Rome, 271pp.
- IUCN (2020). The IUCN Red List of Threatened Species. Version 2020-2. <https://www.iucnredlist.org>. Downloaded on 09 July 2020.
- Jalihal, D.R., S. Shenoy & K.N. Sankolli (1984). Five new species of freshwater atyid shrimps of the genus *Caridina* H. Milne Edwards from Dharwar area (Karnataka State, India). *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper* 69: 1–40.
- Jose, J. (2013). Penaeus, pp. 45–69. In: *Manual on Taxonomy and Identification of Commercially Important Crustaceans of India*, Central Marine Fisheries Research Institute, Kerala, 169pp.
- Mariappan, N. & J. Richard (2006). Studies on freshwater prawns of family Atyidae and Palaemonidae from Kanchipuram and Thiruvallur districts, Tamil Nadu, India, including one new species of the Genus *Caridina* H. Milne Edwards, 1837. *Records of the Zoological Survey*

of India, Occasional Paper No. 243: 1–80.

Ng, P.K.L. (2017). Collecting and processing freshwater shrimps and crabs. *Journal of Crustacean Biology* 37(1): 115–122.

Pati, S.K. & R.M. Sharma (2012). *Oziotelphusa ganjamensis*, a new species of freshwater crab (Brachyura: Gecarcinucidae) from south Odisha (Orissa) state, eastern India. *Zootaxa* 3528: 49–56.

Pati, S.K. & R.M. Sharma (2014). Freshwater crabs (Crustacea: Decapoda: Brachyura: Gecarcinucidae) in the collection of the Western Regional Centre, Pune. *Records of the Zoological Survey of India, Occasional Paper, No. 363*: 1–44.

Pati, S.K. & T. Thackeray (2018). The freshwater crab genera *Ghatiana* Pati & Sharma, *Gubernatoriana* Bott, and *Inglethelphusa* Bott (Crustacea: Decapoda: Brachyura: Gecarcinucidae) revisited, with descriptions of a new genus and eleven new species. *Zootaxa* 4440: 1–73.

Raj, S., A.B. Kumar & P.K.L. Ng (2017). A new species of freshwater crab of the genus *Oziotelphusa* Müller, 1887 (Crustacea: Decapoda: Brachyura: Gecarcinucidae) from Tamil Nadu, southern India. *Zootaxa* 4363(2): 225–236. <https://doi.org/10.11646/zootaxa.4363.2.3>

Roy, M.K.D., S. Rath & S. Mitra (2015). Faunistic and Limnological studies on Palair Lake, Wetland Ecosystem Series 18. Published by Zoological Survey of India, 63–68pp.

Valarmathi, K. (2017). Crustacea: Decapoda (Prawns and Crabs), pp. 313–331. In: *Current Status of Freshwater Faunal Diversity in India*. Published by Zoological Survey of India.

Wowor, D. & S. Choy (2001). The freshwater prawns of the genus *Macrobrachium* Bate, 1868 (Crustacea: Decapoda: Palaemoniidae) from Brunei Darussalam. *The Raffles Bulletin of Zoology* 49: 269–289.





PLATINUM
OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

August 2020 | Vol. 12 | No. 11 | Pages: 16407–16646

Date of Publication: 26 August 2020 (Online & Print)

DOI: 10.11609/jott.2020.12.11.16407-16646

www.threatenedtaxa.org

Article

Use of an embedded fruit by Nicobar Long-tailed Macaque *Macaca fascicularis umbrosus*: II. Demographic influences on choices of coconuts *Cocos nucifera* and pattern of forays to palm plantations

– Sayantan Das, Rebekah C. David, Ashvita Anand, Saurav Harikumar, Rubina Rajan & Mewa Singh, Pp. 16407–16423

Communications

Habitat preference and current distribution of Chinese Pangolin (*Manis pentadactyla* L. 1758) in Dorokha Dungkhag, Samtse, southern Bhutan

– Dago Dorji, Jambay, Ju Lian Chong & Tshering Dorji, Pp. 16424–16433

A checklist of mammals with historical records from Darjeeling-Sikkim Himalaya landscape, India

– Thangsuanlian Naulak & Sunita Pradhan, Pp. 16434–16459

Golden Jackal *Canis aureus* Linnaeus, 1758 (Mammalia: Carnivora: Canidae) distribution pattern and feeding at Point Calimere Wildlife Sanctuary, India

– Nagarajan Baskaran, Ganesan Karthikeyan & Kamaraj Ramkumaran, Pp. 16460–16468

Suppression of ovarian activity in a captive African Lion *Panthera leo* after deslorelin treatment

– Daniela Paes de Almeida Ferreira Braga, Cristiane Schilbach Pizzutto, Derek Andrew Rosenfield, Priscila Viau Furtado, Cláudio A. Oliveira, Sandra Helena Ramiro Corrêa, Pedro Nacib Jorge-Neto & Marcelo Alcindo de Barros Vaz Guimarães, Pp. 16469–16477

Spatial aggregation and specificity of incidents with wildlife make tea plantations in southern India potential buffers with protected areas

– Tamanna Kalam, Tejesvini A. Puttaveeraswamy, Rajeev K. Srivastava, Jean-Philippe Puyravaud & Priya Davidar, Pp. 16478–16493

Innovative way of human-elephant competition mitigation

– Sanjit Kumar Saha, Pp. 16494–16501

New locality records and call description of the Resplendent Shrub Frog *Raorchestes resplendens* (Amphibia: Anura: Rhacophoridae) from the Western Ghats, India

– Sandeep Das, K.P. Rajkumar, K.A. Sreejith, M. Royaltata & P.S. Easa, Pp. 16502–16509

First record of a morphologically abnormal and highly metal-contaminated Spotback Skate *Atlantoraja castelnaui* (Rajiformes: Arhynchobatidae) from southeastern Rio de Janeiro, Brazil

– Rachel Ann Hauser-Davis, Márcio L.V. Barbosa-Filho, Lucia Helena S. de S. Pereira, Catarina A. Lopes, Sérgio C. Moreira, Rafael C.C. Rocha, Tatiana D. Saint’Pierre, Paula Baldassin & Salvatore Siciliano, Pp. 16510–16520

Butterfly diversity in an organic tea estate of Darjeeling Hills, eastern Himalaya, India

– Aditya Pradhan & Sarala Khaling, Pp. 16521–16530

Freshwater decapods (Crustacea: Decapoda) of Palair Reservoir, Telangana, India

– Sudipta Mandal, Deepa Jaiswal, A. Narahari & C. Shiva Shankar, Pp. 16531–16547

Diversity and distribution of figs in Tripura with four new additional records

– Smita Debbarma, Biplab Banik, Biswajit Baishnab, B.K. Datta & Koushik Majumdar, Pp. 16548–16570

Member



Short Communications

Open garbage dumps near protected areas in Uttarakhand: an emerging threat to Asian Elephants in the Shivalik Elephant Reserve

– Kanchan Puri, Ritesh Joshi & Vaibhav Singh, Pp. 16571–16575

A preliminary checklist of spiders (Araneae: Arachnida) in Jambughoda Wildlife Sanctuary, Panchmahal District, Gujarat, India

– Reshma Solanki, Manju Siliwal & Dolly Kumar, Pp. 16576–16596

Preliminary checklist of spider fauna (Araneae: Arachnida) of Chandranath Hill, Goa, India

– Rupali Pandit & Mangirish Dharwadkar, Pp. 16597–16606

Butterfly (Lepidoptera: Rhopalocera) fauna of Jabalpur City, Madhya Pradesh, India

– Jagat S. Flora, Ashish D. Tiple, Ashok Sengupta & Sonali V. Padwad, Pp. 16607–16613

Evaluating threats and conservation status of South African *Aloe*

– Samuel O. Bamigboye, Pp. 16614–16619

Notes

The first record of Montagu’s Harrier *Circus pygargus* (Aves: Accipitridae) in West Bengal, India

– Suman Pratihar & Niloy Mandal, Pp. 16620–16621

An account of snake specimens in St. Joseph’s College Museum Kozhikode, India, with data on species diversity

– V.J. Zacharias & Boby Jose, Pp. 16622–16627

Notes on the occurrence of a rare pufferfish, *Chelonodontops leopardus* (Day, 1878) (Tetraodontiformes: Tetraodontidae), in the freshwaters of Payaswini River, Karnataka, India

– Priyanka Chakraborty, Subhrendu Sekhar Mishra & Kranti Yardi, Pp. 16628–16631

New records of hoverflies of the genus *Volucella* Geoffroy (Diptera: Syrphidae) from Pakistan along with a checklist of known species

– Muhammad Asghar Hassan, Imran Bodlah, Anjum Shehzad & Noor Fatima, Pp. 16632–16635

A new species of *Dillenia* (Angiosperms: Dilleniaceae) from the Eastern Ghats of Andhra Pradesh, India

– J. Swamy, L. Rasingam, S. Nagaraju & Pooja R. Mane, Pp. 16636–16640

Reinstatement of *Pimpinella katrajensis* R.S.Rao & Hemadri (Apiaceae), an endemic species to Maharashtra with notes on its taxonomy and distribution

– S.M. Deshpande, S.D. Kulkarni, R.B. More & K.V.C. Gosavi, Pp. 16641–16643

***Puccinia duthiei* Ellis & Tracy: a new host record on *Chrysopogon velutinus* from India**

– Suhas Kundlik Kamble, Pp. 16644–16646

Publisher & Host

