International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 3; Issue 1; January 2018; Page No. 91-95

On the report of two species of genus *Macrobarchium* from Jammu waters

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Abstract
The present study investigates the freshwater prawn diversity of some water bodies from Jammu region of Jammu and Kashmir State of India. Jammu is located on the Southern slopes of Shivalik hills of Himalayas at an altitude of 366 metres above the sea level. In the water bodies of Jammu region, the genus *Macrobrachium* earlier was represented by two species *viz. M. dayanum* and *M. kistnense*. In the present study, a total of 4 freshwater prawn species have been reported from the surveyed areas. These *are Macrobrachium dayanum, M. kistnense, M. lamarrei lamarrei* and *M. siwalikense*. *M. dayanum* and *M. kistnense* are previously on record whereas *M. lamarrei lamarrei* and *M. siwalikense* have been reported for the first time in this region. In the present text the newly reported species *viz. M. lamarrei lamarrei and M. siwalikense* have been taxonomically described and their key identification features have been briefly discussed.

Keywords: freshwater prawns, *Macrobrachium lamarrei lamarrei, Macrobrachium siwalikense*, Jammu

1. Introduction
Biodiversity refers to the variety of life forms: the different plants, animals and microorganisms, the genes they contain and ecosystem they form. As far as the dependence of human beings for their sustenance, health and enjoyment of life on fundamental biological systems is concerned, biological diversity provides a foundation for their continued existence on this planet. Biodiversity is usually considered at genetic, species and community levels of biological organization. Jammu and Kashmir is an extensively hilly area that is bestowed with large number of both lotic and lentic water bodies which in turn are inhabited by organisms belonging to diverse taxonomic hierarchy, and crustaceans being some of them. Jammu is located on the Southern slopes of Shivalik hills of Himalayas at an altitude of 366 metres above the sea level on the banks of river Tawi. In the water bodies of Jammu region, the genus *Macrobrachium* earlier was represented by two species *viz. M. dayanum* and *M. kistnense* (Kailoo, 1984) [1]. A number of reports from this area are on record with respect to various aspects of *M. dayanum viz.* occurrence and description (Langer *et al.*, 2002) [2]; reproduction (Jyoti and Kailoo, 1985; Sharma, 2006; Samyal, 2007) [2, 5]; fecundity length weight relationship (Langer *et al.*, 2013) [7] nutrition (Langer *et al.*, 2004a; Bakhtiyar, 2008) [8]; proximate composition (Samyal, 2007; Bakthiyar, 2008) [5]; food preferences (Bakthiyar, 2008). In the present study, a total of 4 freshwater prawn species have been reported from the surveyed areas. These *are Macrobrachium dayanum, M. kistnense, M. lamarrei lamarrei* and *M. siwalikense. M. dayanum* and *M. kistnense* are previously on record whereas *M. lamarrei lamarrei* and *M. siwalikense* have been reported for the first time in this region. In the present study, the 2 newly reported species of genus *Macrobrachium* have been described taxonomically and their identification features have been characterized.

2. Material and methods
2.1 Collection areas
Regular monthly collection for a period of one year (December, 2015 to November, 2016) was done in two rivulets of river Tawi namely Pindi stream and stream at Sai. Both Pindi and Sai are located in R.S. Pura Tehsil which is on South of Jammu; at distances 20 and 25 kms with coordinates 32º 31´ North, 74º 44´ East and 32º 30´ North, 74º 43´ East; respectively. These are fed by moderately running water and have mean depth of 5-6 feet. Sai and Pindi streams are rivulets of river Tawi which is a tributary of river Chenab.


Fig 1


Fig 2

Fig 1, 2: Photographs showing Pindi and Sai streams, respectively.

2.2 Method of collection
From these lotic water bodies, prawns were collected using a cast net of mesh size 5mm x 5mm. Collection was done in the early hours of day from 6:00 am to 11:00 am. During the operation, the net was manually thrown to cover the semi-submerged bushes and then it was dragged from the underside. The entrapped individuals were separated and

transferred to the buckets (each of capacity 12-15 liters) filled with the stream water. The prawns were brought live to the laboratory where they were stocked in small ponds and then transferred to the aquarium (45-50 liters capacity) as and when required. Aquatic plants like *Eichhornia* and *Hydrilla* were also placed to provide a kind of natural environment. Live as well as compounded feed were provided to the prawns. Dead individuals were preserved in 8% formalin.

In the laboratory, various morphometric and meristic parameters *viz.* shape and size of rostrum, number and distribution of rostral teeth both on dorsal and ventral sides, carapace, shape and size of pereiopods, lengths of podomeres, structures on pleopods and uropod, arrangement of spines on telson, etc. were observed under Magnus MSZ-TR and Motic-STZ-168 stereo-microscopes. Morphometric and meristic measurements were recorded with the help of a fine divider and scale.

3. Results and Discussions

The following are the two newly reported species *viz. M. lamarrei lamarrei* and *M. siwalikense*:

Fig 3, 4: Photographs showing *M. lamarrei lamarrei* and *M. siwalikense*, respectively.

3.1. *Macrobrachium lamarrei lamarrei* (H. Milne Edwards, 1837) [17]:

Phylum	:	Arthropoda (von Siebold & Stannius, 1845)
Class	:	Crustacea (Brunnich, 1772)
Subclass	:	Malacostraca (Latreille, 1802)
Series	:	Eumalacostraca (Grobben, 1892)
Order	:	Decapoda (Latreille, 1802)
Suborder	:	Pleocyemata (Burkenroad, 1963)
Infraorder	:	Caridea (Dana, 1852)
Superfamily	:	Palaemonoidae (Rafinesque, 1815)
Family	:	Palaemonidae (Rafinesque, 1815)
Genus	:	*Macrobrachium* (Bate, 1868) [16]
Species	:	*lamarrei* (H. Milne Edwards, 1837) [17]
Subspecies	:	*lamarrei* (Jalihal, Shenoy et Sankolli, 1988)[16]

Synonymy: *Palaemon lamarrei* H. Milne Edwards, 1837 [17]; Henderson and Matthai, 1910 [9]; Kemp, 1951; Chopra and Tiwari, 1949 [10]; Tiwari, 1956 [14]; *Macrobrachium lamarrei* Holthuis, 1950 [15]; *Macrobrachium lamarrei lamarrei* Jalihal, Shenoy and Sankolli, 1988 [16].

Description: Rostrum very long and slender, reaching beyond antennal scale by 1/3 its length (Jayachandran, 2001) [11] with a small crest over the orbital region (Raghunathan and Valarmathi, 2007) [12]. Basal crest elevated and distal end upcurved. Upper margin with 6-10 teeth (usually 7-8), of which 2 teeth on proximal elevated part, followed by a wide edentulous gap and 1-2 subdistal teeth. Wide edentate gap generally interrupted by one tooth (Jayachandran, 1992) [13]. Lower margin with 6-9 teeth (usually 7-8), generally arranged below edentate part. Small setae present between teeth of both upper and lower margins (Fig.5).

Carapace smooth, mostly shorter than the rostrum and rarely equal to it (Raghunathan and Valarmathi, 2007) [12] and with antennal and hepatic spines characteristic of the genus (Jayachandran, 2001) [11].

Abdomen also smooth. The important character that which differentiate the present species from other closely related species is its longer slender appendix masculina (Fig. 7&8) which overreaches the endopod of second pleopod Tiwari, 1956 [14]; Koshy, 1969 [17]; Raghunathan and Valarmathi, 2007 [12]. Telson slender, posterior end sharply pointed and reaching as far as tip of uropodal endopod. Dorsal surface with two pairs of spines situated in posterior half of telson, of which distal pair closer to proximal pair. Distal end also with two pairs of spines, outer pair smaller and immovable, inner pair longer and movable, overreaching tip of telson. Pair of plumose setae present between inner pair of spines (Fig.10). The exopod of uropod (Fig.6) is without accessory uropodal spine (Jayachandran, 2001; Raghunathan and Valarmathi, 2007; Sharma 2015) [11, 12]

First pair of chelate legs reaching up to outer lateral spine of antennal scale. Ischium and merus slender, latter slightly longer than former. Carpus also slender, distal end somewhat thickened and longer than merus. Chela half the length of carpus and palm slightly shorter than fingers. Second chelate legs larger than first. Merus longer than chela but shorter than carpus. Carpus slender, thickened distally and about twice longer than chela. Palm only slightly longer than fingers. Non-chelate legs slender and dactyls simple (Fig.7).

Fig 5

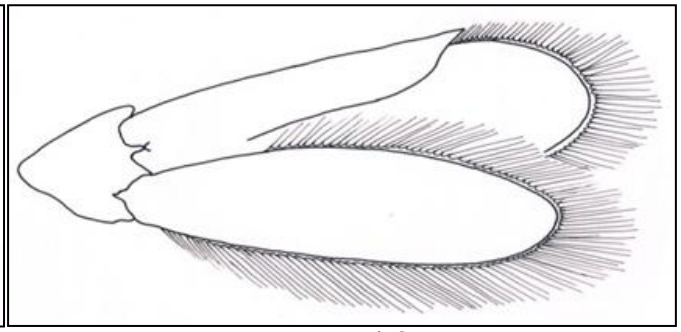

Fig6

Fig 5, 6: Rostrum and Uropod of *M. lamarrei lamarrei*, respectively.

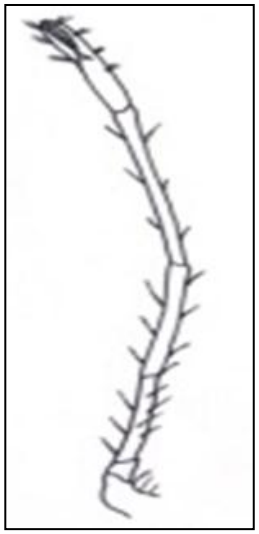

Fig 7

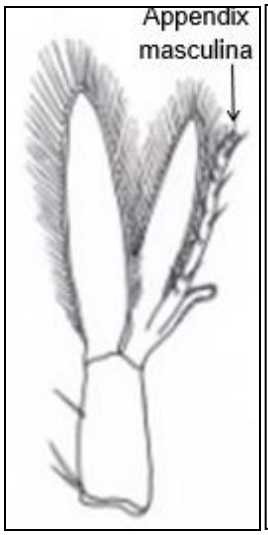

Fig 8

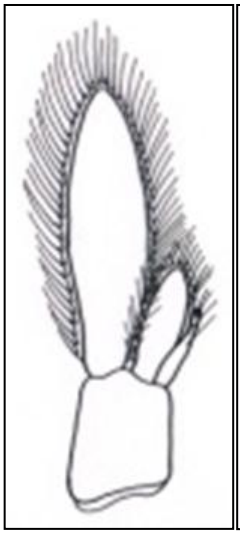

Fig 9

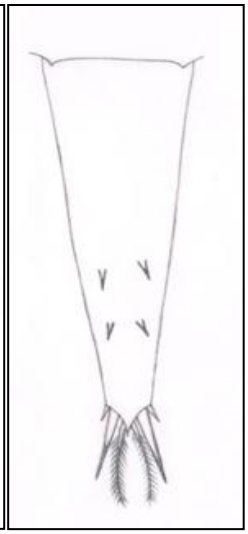

Fig 10

Fig 7, 8, 9, 10: 2nd Chelate leg, 2nd pleopod (male), 2nd pleopod (female) and telson of *M. lamarrei lamarrei*, respectively.

3.2. *Macrobrachium siwalikense* (Henderson, 1893):

Phylum : Arthropoda (von Siebold & Stannius, 1845)
Class : Crustacea (Brunnich, 1772)
Subclass : Malacostraca (Latreille, 1802)
Series : Eumalacostraca (Grobben, 1892)
Order : Decapoda (Latreille, 1802)
Suborder : Pleocyemata (Burkenroad, 1963)
Infraorder : Caridea (Dana, 1852)
Superfamily : Palaemonoidae (Rafinesque, 1815)
Family : Palaemonidae (Rafinesque, 1815)
Genus : *Macrobrachium* (Bate, 1868) [16]
Species : *siwalikense* (Tiwari, 1952) [19].

Synonymy

Palaemon siwalikensis Tiwari, 1952 [19].

Description

Rostrum very short, not extending to tip of antennular peduncle, and only half the length of carapace. Upper margin straight with 6-8 teeth, of which 2 post orbital. Arrangement of dorsal teeth characteristic of this species. First tooth separated from 2nd by wide interval; 2nd to 4th or 5th are more closely arranged. Remaining teeth again separated by wide gap. Apical tooth subdistal, thus giving rostrum a bifid appearance (Jayachandran, 2001 and Sharma, 2015) [11]. Ventral margin with 2-4 teeth (Fig. 11). Carapace smooth.

First chelate legs slender, chela somewhat longer than half length of carpus. Second chelate leg about 4/5 total length of body, strong and spinulose. Ischium stout, merus shorter than carpus and thick. Carpus cylindrical, distal end thickened; palm almost as wide as distal carpus. Fingers ¾ the length of palm and with longitudinal groove containing soft pubescence (Fig. 13). In females, 2nd leg somewhat shorter and less stout. Carpus 4-5 times as long as distal diameter. Fingers about 4/5 length of palm, with weak pubescence. Telson slender, dorsal surface with two pairs of spines situated in posterior half of telson, of which distal pair closer to proximal pair. Distal end also with two pairs of spines and a pair of plumose setae present between inner pair of spines (Fig. 14). The exopod of uropod (Fig.12) is without accessory uropodal spine (Jayachandran, 2001) [11].

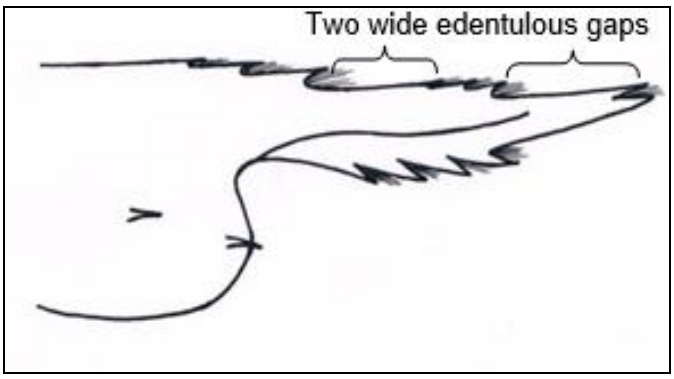

Fig 11

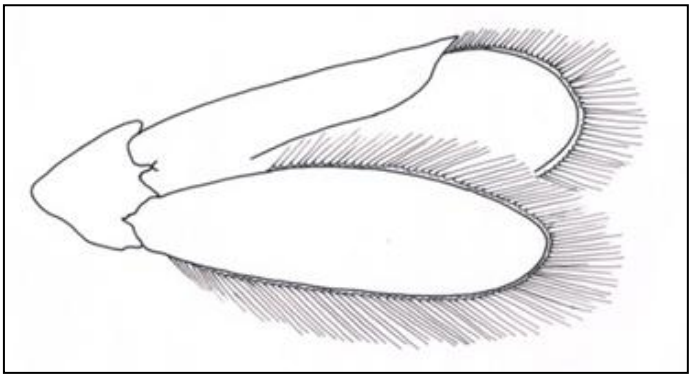

Fig 12

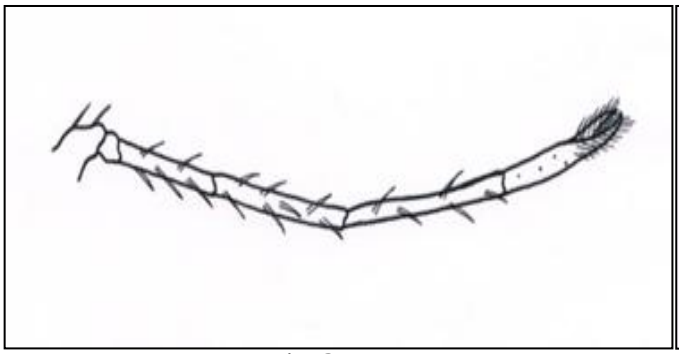

Fig 13

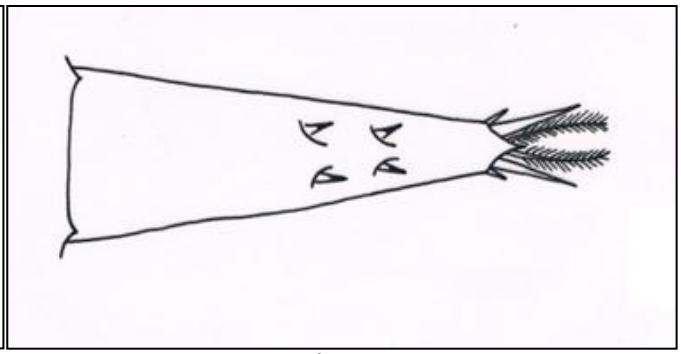

Fig14

Fig 11, 12, 13, 14: Rostrum, Uropod, 2nd Chelate leg and Telson of *M. siwalikense*, respectively.

4. Conclusion

Only a single genera of freshwater prawns, of family Palaemonidae, has been reported so far from the surveyed areas i.e. genus *Macrobrachium* Bate, 1868 [16] with a total of 4 species *viz. Macrobrachium dayanum*, *M. kistnense*, *M. lamarrei* and *M. siwalikense***.** *M. dayanum* and *M. kistnense* are previously on record whereas *M. lamarrei lamarrei* and *M. siwalikense* have been found for the first time in this region. The identification and description of species has been made on the basis of various morphological characteristics *viz.* shape of rostrum, size of rostrum with respect to antennal scale, number and arrangement of rostral teeth both on dorsal and ventral margins; size of chelate legs, size of podomeres with respect to each other and arrangement of setae on these; and structures on telson and uropod.

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