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A new ectoparasitic crustacean, *Argulus sindhensis* sp. Nov. (Branchiura: Argulidae) from Pakistan

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Abstreact: A new species of an ectoparasitic crustacean, *Argulus sindhensis* is being described from a major Carp, *Labeo rohita*. Body of male is narrower then that of female, carapace is oval in shape and does not cover the last thoracopod. Abdominal lobes are comparatively narrow and elongated in male as compared to those in female. Ventrally anterior half of the carapace bears many rows of small spines. *A. sindhensis* differs from other argulids due to its peculiar banana shaped respiratory areas, and notatory lobe of female, having a conical spine. Two groups have been proposed, on the basis of shape and location of respiratory areas for separation of various species of *Argulus*. (a) Fish lice having small anterior and large posterior respiratory area situated one above the other (b) fish lice with elongated respiratory areas located adjacent to each other.

Keywords*: Argulus sindhensis* ectoparasitic**, Fish** lice.

1. INTRODUCTION

Fish lice are well known crustacean ectoparasites of Cyprinids and Salmonids (Yamaguti, 1963; Kabata, 1985). About 100 species of genus *Argulus* (described earlier), have world wide distribution. These parasitize mostly the fresh water fish. Few have been recorded from marine fish (Devraj and Hamza,1977; Cressey, 1978).Ten species of fish lice have been reported from India (Natrajan,1982), while only two have been reported from Pakistan (Jafri and Ahmed ,1991).This new species is an addition to already recorded fish lice of this region.

2. MATERIALS AND METHODS

The parasites were collected (about 200) from a major carp, *Labeo rohita* (Cyprinidae), obtained from a fish farm in Thatta district of Sindh. The specimens were preserved in alcohol and were brought to laboratory. The specimens were than stored in 2% formalin for detailed study. Drawings of entire specimen and various body parts were made with the help of a Camera Lucida.

3. RESULT

Argulidae (Leach, 18 19)
Argulus (Muller, 17 85)
Argulus sindhensis sp. nov.
Site: Body surface
.Colour: Dirty white (preserved)
Host*: Labeo rohita*
Locality: Thatta District.
Etymology: The name refers to the province of Sindh, from where this new species has been recorded for the first time.

Material examined:
.Holotype: Female
Total length: 4.3 mm
Carapace length: 2.9”
Carapace width: 2.5”
Length of abdomen: 1.4”
Width of abdomen: 0.8”
Androtype: Male
Total length: 3.1 mm
Carapace length: 2.0”
Carapace width: 1.6”
Length of abdomen: 1.2”

Width of Abdomen: 0.5” (Several allotypes and nymphs are also present in collection).

Diagnostic features:
Carapace:

Oval shaped, longer than wide (1.16 times in female and 1.25times in male) **(Tab. 1)** do not cover the last pair of thoracic legs in smaller individuals but just touches these legs in large specimens. On the dorsal side of carapace in the middle, two vertical, parallel ridges are present, which start from the level of eyes to the origin of first pair of leg **(Fig.1)**. On the ventral side, along the margin of carapace, few rows of sharply pointed spines are present from sucker to the level of first pair of legs **(Fig.2)**. Posterior lobes of carapace are rounded. Mesial sinus is broad in both sexes.

Respiratory areas:

Anterior and posterior respiratory areas are sub-equal in length. Both are long, narrow and slightly curved (Fig.1). Anterior end of outer area is club shaped and slightly touches the anterior end of the posterior respiratory area **(Fig.3)**. Length of posterior area does not go beyond that of anterior area. Both the respiratory areas are of almost equal width.

Abdomen:

Shape and length of the abdomen differs in both sexes.

Female: In female the abdominal lobes are short, 1.75 times longer then wide **(Tab.1, Fig.4).** Outer margin of lobes curved, terminal portion subacute, with a short anal sinus, having small uropodes. Outer margin of lobes bear short, scattered setae. A pair of oval seminal receptacles is also present.

Male: Abdominal lobes long and pointed, 2.4 times longer then wide **(Table.1,Fig.5).**Outer margin slightly curved. Anal sinus is much shorter as compaired to that of female, having small uropods.

Antennule: Antennule is two segmented. Basal part has a posterior, blunt projection, a blunt dorsal and ventral process, and a large gradually tapering anterior process which terminates into a large, pointed recurved spine **(Fig.6)**. A long sharp pointed internal spine is visible in the anterior process. Terminal segment of antennule has few very short spines in distal half and also some short terminal setae.

Antenna: Antenna is four segmented. Basal segment is broad and long, having a ventral blunt spine in posterior region **(Fig.6)**. Remaining few segments bear few spines. Terminal segment has three spines. Two post antennal, spines which are long and blunt, are located in the medial position.

Eyes: The compound eyes are located at the based of post antennular spines **(Fig.2)**. No median eye is present.

Proboscis: The proboscis (mouth tube) is located between the suckers on the mid ventral line of the body. Anterior half of the tube is narrow, while the posterior half is somewhat expanded and rounded. Anterior to proboscis lies the stylet. It consists of a long tapering spine, which can be retracted into its sheath. The stylet is used to puncture the skin of host.

Suckers: A pair of suckers, which are the modified first maxillae, are located above the maxilipeds **(Fig.2)**. Diameter of sucker is 0.5 mm. It consists of nineteen ribs. Each sclerite contains 5-6 imbricate plates. Basal plate is larger, others diminish in size and terminal one is of oblong shape **(Fig.8).**

Maxiliped: The maxilipedes are stout and five segmented **(Fig.9)**. The basal segment bears three blunt, spines at its dorsal margin. A row of small marginal spines is also present. A roughly triangular pad of strong, tripartite spines is present on the basal segment. Second segment appears largest while other three diminish in size .The second segment also bears a circular pad of spines. Similary other three segments are also armed with typical strong spines. The number of these spines also decreases toward the terminal segment, which bears two large and two smaller spines. The last three segments also bear pointed marginal spines.

Eggs: A few uterine eggs were found in this mature female (Fig.2). The eggs are oblong capsule shaped (1.5 X 1 mm) and are brown in colour. The eggs appear to be attached in the form of string. The yolk is of uniform consistency (Fig.9).

Thoracic legs:

Female: Legs 1-4 are biramus. Both rami bear long setae on their ventral margin. Few setae are also present on sub-terminal segment. These long setae also bear very small seteols on their ventral margin. The basal segment of 4th leg has a typical notatory lobe (**Fig.10**) which consists of a rounded portion and a laterally projected conical spine. The rounded extended portion of the lobe also bears a row of marginal spines and a long seta, while spinose portion of the lobe has a single long seta near its base.

Male: First leg is similar to that of female. On the ventral margin of second segment of 2nd leg there is a row of small spines (Fig.1). Second segment of 3rd leg bears a pair of rounded adhesive pads on the dorsal side and a long pad on ventral side (**Fig.12**). Second segment of 4th leg do not bear any notatory lobe as found in female.

3. DISCUSSION

Systematics of genus *Argulus* has been studied earlier in detail by various workers from different parts of the world. (Yamaguti, 1963; Cressey, 1978; Fryer, 1982; and Kabata, 1988). Recently Lester and Roubal (1995) have presented an excellent discussion about the morphology and biology of crustacean parasites of fish. By comparing the morphology of various species of *Argulus*, we consider that these may be distinguished in to two distinct taxonomic groups.

Species having small anterior and large posterior respiratory area, located one above the other, such as, *A. japonicus*, (Thiel, 19 04). Species having, elongated respiratory areas, located adjacent to each other, such as *A. siamensis*, (Wilson,1926). Eleven species of fish lice including *A. sindhensis* sp.nov. reported from Indo-Pak region, have been separated on the basis of above mentioned grouping **(Tab.2)**. This new species from Pakistan shows some affinities to other species of *Argulus.* Shape of the abdomin is similar to that of *A. pugettensis* (Yamaguti, 1963). Respiratory areas are somewhat similar to those of *A. siamensis* (Wilson, 19 26; Kabata, 1985), but in *A. sindhensis*, the posterior area does not extend beyond the tip of anterior area, the clubbed end of anterior area does not curve around the posterior one. Moreover both the areaa are of equal width. The description of species described from India as *A. siamensis* (Ramakrishna, 1951), without a diagram, does not tally with the figure and description of *A. siamensis* given by Kabata (1985) after Wilson (1926), it appears to be a case of misidentification.

Similarly the position of *A. (siamensis) peninsularis* (Ramakrishna,1951) is also doubtful, as only the drawing of respiratory area has been given. Some of the morphological features described for *A. siamensis* from India, do agree with present new species. Jafri and Ahmed (1991) recorded *A. japonicus* from Pakistan. A close examination of that material now has clearly shown that those lice also belong to *A. sindhensis*, so the record of *A. japonicus* from Pakistan is to be considered as invalidated. The maxiliped in present species is well ornamented with strong, thorn-like spines in the form of pads and marginal spines. Such structure of maxilipedes has been found in *A. bicolor*, *A .schoutedeni* (Yamguti, 1963), *A. fluviatilis* and *A. cauvereinsis* (Thomus and Devraj, 1975), *A. manglorensis* (Natarajan,1982), *A. australiensis* and *A. diversicolor* (Byrnes, 1985).

Natotary lobe on 4th thoracopods in female of genus Argulus are of variable shape. In *A. indicus*, a typical boot shapes lobe has been described, while in *A. japonicus*, it is a simple rounded lobe (Seng, 1986). In the present species this lobe is rounded with an outward extending, large conical spine. In *A. salmine*, the whole lobe appears to have the shape of a broad based spine (Yamaguti, 1963). In *A. monadi*, this lobe is very similar to that of present species. In *A qudristriatus* (Devraj and Ameer Hamza, 1977), *A. manglorensis* (Natrajan, 1982), a boot shaped lobe has been reported, while in *A. fluriatilis* and *A. cauvrrinsis* (Thomas and Devraj 1975), this lobe has a thorn like portion. In case of *A. bengalensis* (Ramakrishna, 1951), a boot shaped lobe has been reported but the accompanying diagram shows a notatory lobe, with a distinct curved spine. Similarly, the diagram of *A. cavereinsis* shows notatory lobe having a spine, but the authors, (Thomas and Devraj 1975) have stated, a boot-shaped lobe. This is our inference that fish lice belonging to group II (**Table 2**) have a lobe distinctly projected into a spine. There is an exceptional case of *A. divericolor* (Byrnes, 1985) which has unequal respiratory areas, but the accompanying diagram shows the notatory lobes with downward extending long, curved spines.

A.sindhensis sp. nov. can b differentiated from other species of genus *Argulus* due to, (a) typical shape of carapace, (b) number of imbricate plates in the sucker, (c) banana shaped respiratory areas and (d) notatory lobe of female with a conical spine.

Table: 1 Body measurement of *A. sindhensis* (in mm)

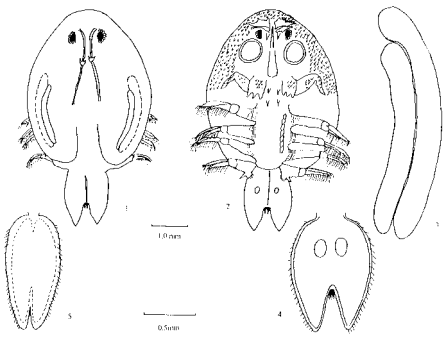
S.No	Specimen No.	1	2	3	4	5	Mean	1	2	3	4	5	Mean
1	Sex	F	F	F	F	F		M	M	M	M	M	
2	Total length	3.5	3.9	4.3	3.3	2.9	3.5	4.0	2.9	2.7	2.4	3.1	3.0
3	Length of Carapace	2.5	2.8	2.9	2.2	2.1	2.5	2.6	1.9	1.6	1.6	2.0	1.9
4	Width of Carapace	1.4	2.2	2.5	1.4	1.5	1.8	2.1	1.5	1.3	1.2	1.6	1.5
5	Abdomen length	1.0	1.2	1.4	0.9	0.8	1.0	1.2	1.0	0.9	0.8	1.2	1.0
6	Abdomin width	0.7	0.8	0.8	0.6	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.5

Table 2. Comparison of various species of *Argulus* reported from Indo-Pak region.

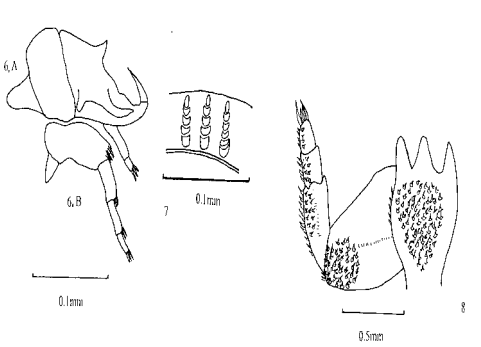
Species	*A. gigantius*	*A. japonicus*	*A. indicus*	*A . qudristriatus*	*A .mangalorensis*
Authors	Ramakrishna, 1951	Seng, 1986	Seng, 1986	Devraj & Ameer Hamza, 1977	Natarajan,1982
1.Body length (mm)	19.5	6.0	9.4	9.1	8.0
2. Colour	-	-	Yellow to light green	4 brown stripes dorsally	-
3. Carapace	Ovate	Eliptical	Suborbicular	Longer then wide	Longer than wide
4.Cephalic area	Distinct with notches	Not distinct	Not distinct	Distinct with notches	Distinct with notches
5.Sucker (No. of plates)	25-26	7	4	9-11	38-40
6.Abdomen	Broader then long	Longe than wide	Wider then long	Longer then wide	Longer than wide
7.Notatory lobe (female)	Boot shaped	Rounded	Boot shaped	Boot shaped	Boot shaped

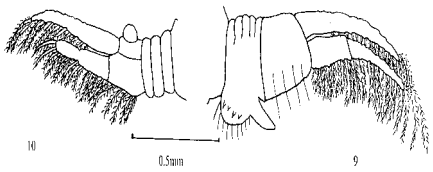
Group. 2: Fish lice with elongated (anterior and posterior) respiratory area, situated adjacent to each other.

A.siamensis	*A. puthenvelinsis*	*A. caveriensis*	*A. fluriatils*	*A. bengalensis*	*A. sindhensis*
Kabata1985 ; Ramakrishna, 1951	Ramakrishna,1962	Thomas & Devraj1975	Thomas & Devraj, 1975	Ramakrishna, 1951	Present study
6.5	?	6.2	6.7	4.4	4.3
Green	-	-	-	-	Golden yellow
Sub-oval	Longer than wide	Longer than wide	As broad as long	Ovate	Oval
Distinct with notches	?	Not distinct	Distinct with notches	Distinct with notches	Not distinct
4-5	5	8-9	7-8	5-6	5-6
Wider than long	Longer than wide	As long as broad	As long as broad	Wider than long	Longer then wide
Boot shaped ?	?	Rounded with a blunt spine	Rounded with a blunt spine	Boot shaped ?	Rounded with a conical spine



Group.I : Fish lice with small anterior and large posterior area, situated one above the other.





Group. II: Fish lice with elongated (anterior and posterior) respiratory area, situated adjacent to each other.

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