

Pea crab *Arcotheres alcocki* (Rathbun, 1909) as endoparasite of the backwater clam *Meretrix casta* (Chemnitz, 1782)

Premalata Pati*, Biraja Kumar Sahu & R. C. Panigrahy

Department of Marine Sciences, Berhampur University, Berhampur-760007, Odisha, India

[E-mail: premalata09@gmail.com]

Received 30 September 2013; revised 31 March 2014

Occurrence of *Arcotheres alcocki* (Rathbun, 1909) (synonymous with *Pinnotheres alcocki*) in the mantle cavity of the backwater clam *Meretrix casta* (Chemnitz, 1782) of Bahuda and Rushikulya estuaries (Odisha), east coast of India is reported in this paper. It is the first record of *A. alcocki* occurring as parasite in *M. casta* from Indian coasts and also the first report on the occurrence of pea crab from Odisha coast. Visible damage to the body tissue of the infested clams was noticed which suggests that the clam fishery of this region is susceptible for parasitic attack by *A. alcocki*.

[Key words: *Arcotheres alcocki*, *Meretrix casta*, endoparasite, Bahuda estuary, Rushikulya estuary, Odisha]

Introduction

Pea crabs (Class: Decapoda; Order: Brachyura; Family: Pinnotheridae) are small crustaceans represented by several species. Genus *Pinnotheres* (Linnaeus, 1758) is the most dominant genera among the pea crabs exhibiting wide range of distribution. They lead a cryptic mode of life cycle, wherein the adult females remain as obligatory symbiont in many invertebrates¹, while the adult males, taking advantage of their small size, use to leave the hosts and move freely in water as plankton. Juveniles of both the sexes however remain as plankton. Adult *Pinnotheres* females are commonly found as endosymbiont in the mantle cavity many bivalves^{2,3}, branchial chamber of tunicates⁴ and anal cavities of sea cucumbers⁵. They could also occur ectosymbiotically on burrowing shrimps⁶, polychaete worms⁷, echinurans⁸, sand dollars⁹ and sea urchins¹⁰. The association between pea crab and their hosts was initially considered as commensalism¹¹, but later it was recognized as parasitism. It could be so because they use to harm the hosts in many ways.

Studies pertaining to the occurrence, biology and taxonomy of pea crabs in India began in 1950s¹². Silas and Algarswami (1967)¹³ have given an account of parasitic *Pinnotheres* in backwater clam *M. casta* of the Malpe region. George and Noble (1968)¹⁴ have noticed that *Pinnotheres gracilis* and *Pinnotheres modiolicolus* occurred as parasites on the edible clams *Katelysia opima* and *Macrta violacea* of the Karwar coast. Occurrence of *P. alcocki* (now *A. alcocki*) was first reported from Kakinada Bay of east coast of India with

blood clam *Anadara granosa*¹⁵. Despite the fact that Odisha coast harbours large quantities of commercially important bivalves like clams, mussels and oysters where as the presence of pea crabs was never reported earlier. The present paper reports the occurrence of *A. alcocki* as endoparasite on the backwater clam *Meretrix casta* in Bahuda and Rushikulya estuaries of South Odisha coast.

Materials and Methods

The 60 km long coastline of Ganjam district is endowed with two important estuaries namely Bahuda estuary (Lat. 19° 10' N and Long. 84° 20' E) that opens in to the Bay of Bengal near Patisunapur fishing village and Rushikulya estuary (Lat. 19° 22' N and Long. 85° 05' E) near Gokharkuda village. Both these estuaries sustain rich biodiversity and constitute important fishing grounds providing livelihood to the local fisher folk families. Harvests of *M. casta* constitute an important marine living resource of both these estuaries. While the flesh of *M. casta* is used as food by local fisher folk community, the shells are used for lime production.

A survey was conducted to prepare a check list of marine and estuarine mollusks of the south Odisha coast during August 2012–June 2013. During this survey, we encountered the occurrence of the pea crab *A. alcocki* as endoparasite living in the mantle cavity of *M. casta* of both Bahuda and Rushikulya estuaries. It was more abundant during January–February, 2013. 100 live *M. casta* shells were collected from both the estuaries each time and brought to the

Table 1. Size range and distribution of pea crabs in clams of the Bahuda and Rushikulya estuaries

Study Area Parameters	Bahuda Estuary			Rushikulya Estuary		
	Min	Max	Mean±SD	Min	Max	Mean±SD
Clam length (cm)	3.6	6.8	4.8±0.9	3.0	4.9	4.0±0.5
Female pea crabs	13			20		
Length (cm)	0.7	1.1	0.9±0.1	0.7	1.1	1.0±0.1
Width (cm)	0.8	1.4	1.1±0.2	0.9	1.3	1.2±0.1
Male pea crabs	1			10		
Length (cm)	-	-	0.5*	0.3	0.6	0.5±0.1
Width (cm)	-	-	0.6*	0.4	0.7	0.6±0.1

*Only one male crab was found in the sample

laboratory for further study. They were opened to locate the presence of pea crabs inside their body cavity (Fig.1). The crabs were removed carefully from the mantle cavity; morphological attributes were examined; size range of each organism was measured, photographed and preserved with 5% neutralized formaldehyde. Based on the detail morphological features such as body colour, shape and size variation of carapace, walking legs and dactylus and propodus length of females and males, identification was made.

Results and Discussion

The female specimens were characterized by their smooth and translucent dorsal carapaces

through which the inner pink coloured reproductive organs were visible. The males on the other hand possessed yellowish brown colour having hard and circular carapace. Most of the females were found to be egg bearing (Fig.1). The crab was identified as a species of genus *Arcotheres* because of its sub hexagonal carapace, the third pair of walking legs remained longer than other leg pairs and the dactyli of 3rd and 4th walking legs were longer than those of the 1st and 2nd walking legs¹⁶. It was finally identified as *A. alcocki* (Rathbun, 1910) owing to the fact that the ratio of fourth to third dactylus was at 5:3; dactylus of chela was 4/5th of the dorsal border of palm and propodus of third maxillipede has contracted distally as reported by Gordon (1936)¹⁷.

The size range of *M. casta* along with the population size of *A. alcocki* in host shells and size range of organisms are given in Table-1 and the photographs of male and female specimens are shown in Fig 1. Marked heterogeneity was noticed as regards to the distribution and size range of male and female crabs. While 13 clams out of 100 in Bahuda estuary were found infested with adult females of *A. alcocki*; in Rushikulya estuary, 20 were found infested. Again, only one male was encountered in 100 clams of Bahuda against 10 males in same number of clams in Rushikulya estuary. The average length and width of female *A. alcocki* in Bahuda samples were 0.9±0.1 cm and 1.1±0.2 cm there in Rushikulya samples were 1.0±0.1 cm and 1.2±0.1 cm (Table 1). Lalitha Devi (1981)¹⁵ has reported 16% infestation of *Anadara granosa* by *Pinnotheres alcocki* (now *Arcotheres alcocki*) in Kakinada bay that closely coincides with the present observation.

Parasitic crabs obtain nutrition by scraping mucous food strings of the gills of the host

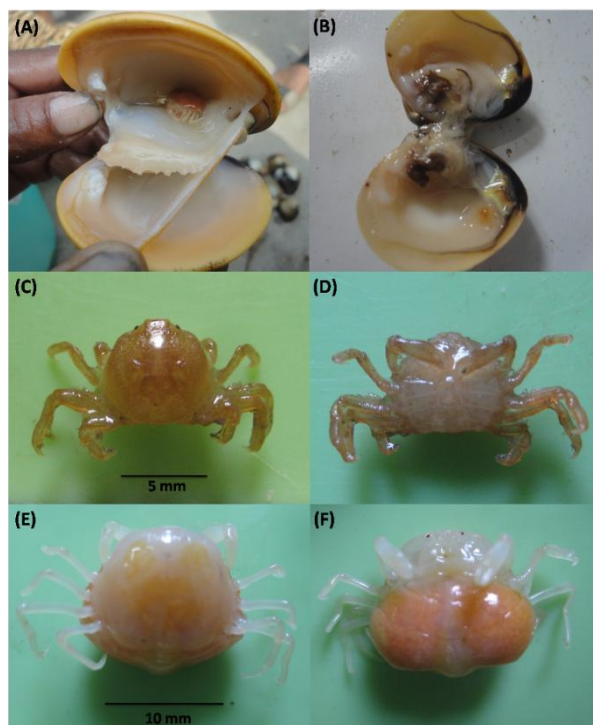


Figure 1. Photograph of pea crab *A. alcocki*: (A & B) A pea crab inside the clam (C) Dorsal view of male crab (D) Ventral view of male crab (E) Dorsal view of female crab (F) Ventral view of female crab with egg mass

organisms^{2,18,19}. Fibrous masses could also form on other soft body tissues due to the activity of these crabs^{2,20,21}. Gill damages with lowered water filtration²² and oxygen consumption²³ have also been reported with infested hosts compared to non infested one. Bierbaum and Ferson (1986)²⁴ have reported that *Pinnotheres maculatus* living in the mantle cavity of bivalves use to steal their planktonic foods during passage through the gills and reduces the growth rate of hosts. Presence of parasitic crabs significantly reducing the growth and reproductive output was noticed in several host bivalves²⁵⁻²⁸. During the present study the clams of both the estuaries have shown visible damages when infested with *A. alcocki* indicating the negative impacts on *M. casta*. The backwater clam *M. casta* being abundantly available along the south Odisha coast and constitute an important component of molluskan fisheries, pea crab infestation can be considered as potential threat to *M. casta* fishery of the region.

Acknowledgements

Authors are thankful to the Head, Department of Marine Sciences for encouragement and providing facilities. Premalata Pati and Biraja Kumar Sahu wish to acknowledge the financial support by DST, Govt. of India, New Delhi. Authors are also thankful to ZSI, Kolkata for authenticating the identification of the species.

References

- Grove, M. W., Finelli, C. M., Welthey, D. S. and Woodin, S. A. The effects of symbiotic crabs on the pumping activity and growth rates of *Chaetopterus variopedatus*. *J. Exp. Mar. Biol. Ecol.*, 246 (2000) 31-52.
- Stauber, L. A., *Pinnotheres ostreum*, parasitic on the American oyster, *Ostrea (Gryphae) virginica*. *Biol. Bull.*, 88 (1945) 269-291.
- Jose, B and Deepthi T. R., Green mussel *Perna viridis*, a new host for the pea crab *Pinnotheres placunae* along the Malabar Coast, Kerala. *Curr. Sci.*, 89 (2005), 1090-1091.
- Wass, M. L., The decapods crustaceans of Alligator Harbor and adjacent in shore areas of north western Florida. *Q. J. Fla. Acad. Sci.*, 18 (1955) 129-176.
- Takeda, S., Tamura, S and Washio, M., Relationship between the pea crab *Pinnixa tumida* and its endo benthic holothurians host *Paracaudina chilensis*. *Mar. Ecol. Prog. Ser.*, 149 (1997) 143-154.
- Pearce, A. S., Humm, H. J and Wharton, G. W., Ecology of sand beaches at Beaufort, NC. *Ecol. Monogr.*, 12 (1942) 35-190.
- Gray, I. E., Changes in abundance of the commensal crabs of *Chaetopterus*. *Biol. Bull.*, 120 (1961) 353-359.
- Boesch, D. F. On the occurrence of *Pinnixa lunzi* Glassell (Decapoda, Pinnotheridae) off Virginia, USA. *Crustaceana*, 20 (1971) 219-220.
- Bell, J. L and Stancyk, S. E., Population dynamics and reproduction of *Dissodactylus mellitae* (Brachyura: Pinnotheridae) on its sand dollar *Mellita quinquiesperforata* (Echinodermata). *Mar. Ecol. Prog. Ser.*, 13(1983) 141-149.
- De Bruyn, C., Rigaud, T., David, B and De Ridder, C., Symbiosis between the pea crab *Dissodactylus primitivus* and its echinoid host *Meoma ventricosa*: potential consequences for the crab mating system. *Mar. Ecol. Prog. Ser.*, 375 (2009) 173-183.
- Takeda, M and Konishi, K. Redescription of *Pinnotheres alcocki* Rathbun, 1909, a commensal pea crab new to Japan. *Bull. of the Nat. Sci. Mus, Tokyo, Series A*, 14 (1988) 137-144, illustr.
- Chhappgar, B. F., On two new species and a new variety of crabs (Decapoda: Brachyura) from Bombay State. *Rec. Indian Mus*, 53 (1958) 251-259.
- Silas, E. G and Alagarswami, K. On an instance of parasitisation by the pea-crab (*Pinnotheres* sp.) on the backwater clam [*Meretrix casta* (Chemnitz)] from India, with a review of the work on systematics, ecology, biology and etiology of pea crabs of the genus *Pinnotheres*, Latreille, 1802. In: *Proceedings of the Symposium on Crustacea*, 1965. Ernakulum, Symposium Series 2. *J. Mar. Biol. Assoc. India*, 3 (1967) 1161-1227.
- George, M. J and Noble, A. Occurrence of Pea crabs *Pinnotheres gracilis* (Burger) and *Pinnotheres modiolicolus* (Burger) in the Indian coast. *J. Mar. Biol. Assoc. India*, 10 (1968) 392-394.
- Lalitha Devi, S., Occurrence of pea crabs *Pinnotheres gracilis* Burger and *P. alcocki* Rathbun at Kakinada. *J. Mar. Biol. Assoc. India*, 23 (1981) 215-218.
- Campos, E., A new crab species of the genus *Arcotheres* Manning, 1993, from Thailand (Crustacea, Brachyura, Pinnotheridae) *Zoosystema*, 23 (2001) 493-497
- Gordon, I., On a few Indo-Pacific species of *Pinnotheres*, with special reference to asymmetry of the walking legs. *J of the Linn. Soc. of London*, 40 (1936) 163-180.
- Mc Dermott, J. J., The incidence and host parasite relations of *Pinnotherid* crabs (Decapoda, Pinnotheridae). *Coastal Shallow Waters Res. Conf*, 1(1962.) 162-164.
- Kruczynski, W. L., The effect of the pea crab, *Pinnotheres maculatus* Say, on growth of the bay scallop, *Argopecten irradians concentricus* (Say). *Chesapeake Sci*, 13 (1972) 218-220.
- Dix, T. G., Mantle changes in the pearl oyster *Pinctada maxima* induced by the pea crab *Pinnotheres villosulus*. *Veliger*, 15(1973) 330-331.
- Jones, J. B., Natural history of the pea crab in Wellington Harbor, New Zealand. *NZJ. Mar. Freshwater Res*, 11(1977) 667-676.
- Prezenger, C., Effect of *Pinnotheres hickmani* on neutral red clearance by *Mytilus edulis*. *Aust. J. Mar. Freshwater Res*, 30(1979) 547-550.
- Bierbaum, R and Shumway, S. E., Filtration and oxygen consumption in mussels, *Mytilus edulis*, with and without pea crabs, *Pinnotheres maculatus*. *Estuaries*, 11(1988.) 264-271.
- Bierbaum, R. M and Ferson, S., Do symbiotic pea crabs decrease growth rate in mussels? *Biol. Bull.*, 170 (1986) 51-61.
- Anderson, G. L., The effects of intertidal height and the parasitic crustacean *Fabia subquadrata* Dana on the nutrition and reproductive capacity of the California sea mussel *Mytilus edulis* Conrad. *Veliger*, 17 (1975) 299-306.

26. Lalitha Devi, S., Some aspects of biology and effect of infestation of *Pinnotheres placunae* Hornell and Southwell of Kakinnada Bay. *J. Mar. Biol. Assoc. India*, 28 (1986) 113–123.
27. O' Beirn, F. X and Walker, R. L., Pea crab, *Pinnotheres ostreum* Say, 1817, in the Eastern oyster, *Crassostrea virginica* (Gmelin, 1791): prevalence and apparent adverse effects on oyster gonad production. *Veliger*, 42 (1999) 17–20.
28. Sun, W., Suna, S., Yuqi, W., Baowena. Y and Weiboa, S, The prevalence of the pea crab, *Pinnotheres sinensis* and its impact on the condition of the cultured mussel, *Mytilus galloprovincialis*, in Jiaonan waters (Shandong Province, China). *Aquaculture*, 253 (2006.) 57–63.