

Record of Deep-Sea Shrimp of *Pasiphaea sivado* Species Group (Decapoda:Caridea:Pasiphaeidae) in the Western Indian Ocean Collected by R/V Anton Bruun (IIOE Cruise)

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Abstract: This paper deals with a deep sea pelagic shrimp species of the genus *Pasiphaea* in *Pasiphaea sivado* species group which was collected by the vessel Anton Bruun (IIOE cruise) in the northwestern waters of the Indian Ocean from Cruise 4A station 185 20°39'N, 64°41'E, night 3173, dated 30, October 1963. No specimen of *Pasiphaea sivado* group has been reported from the given coordinates of the Indian Ocean. The present record would seem to be the first record of *P. sivado* from these coordinates and therefore constitutes new data on the biogeographical distribution of *Pasiphaea sivado* species group. As already documented that the deep sea is the largest biome on earth and hosts the majority of as yet undescribed or not correctly reported species. This specimen might turn out a new species yet to be discovered. Careful examination of more material collected in the northwestern Indian Ocean could result in the recognition of taxonomically cryptic species, as in the case of the pelagic shrimp *Pasiphaea sivado*. This specimen is illustrated and its comparative descriptive information, taxonomic comments and horizontal distribution is given. The introduction includes a summary of work done by other scholars on the zooplankton species, based on information obtained from the samples collected by Anton Bruun in the Indian Ocean. A large number of papers relating to synthesis of zooplankton of IIOE in Indian ocean region have appeared since IIOE was originally envisioned, one of the first multi-national ocean research projects.

Keywords: *Pasiphaea sivado*, Vessel Anton Bruun (IIOE Cruise), Northwestern Waters of the Indian Ocean, Description

1. Introduction

From 1959 to 1965 nine countries participated in a cooperative scientific investigation of the Indian Ocean. They were Australia, India, Japan, Pakistan, South Africa, the United Kingdom, the United States, the USSR, and West Germany. This investigation, known as the International Indian Ocean Expedition (acronym IIOE), carried out many projects, one of which was a survey of the zooplankton of the upper 200 m. The International Indian Ocean Expedition (IIOE) of 1960-1965 was arguably the first attempt to describe the quantitative geographic distribution and abundance of zooplankton as a multinational program in which 19 ships from nine countries participated. The expedition began on April, 1960 and came to an end in April,

1965. These Zooplankton samples collected during International Indian Ocean Expedition 1960-65 were by far the largest and the most important collections from the Indian Ocean in the world. Ships collected 1548 plankton samples using the Indian Ocean Standard Net (IOS) [11]. Plankton samples collected over this period during nine cruises, in the northern and western Indian Ocean. Most of the samples were collected in uniform numbers with stations, using the Indian Ocean Standard net. The net was towed vertically at a depth of 200 m to the surface. During the International Indian Ocean Expedition one of its ships, the R/V Anton Bruun, undertook nine cruises in the northern and western Indian Ocean.

The staff of the Indian Ocean Biological Centre (IOBC) at Cochin, now Kochi, India, sorted a large collection of

Sergestids which was loaned to and studied at the Marine Reference Collection and Resource Centre, University of Karachi, Pakistan. The findings were first presented as PhD dissertation [70], then covered by [29, 30, 71, 72, 73] on these sergestids.

Other published reports covering pelagic fauna collected by Anton Bruun during 1960-1965 survey are –on caridean shrimps (reports on Pasiphaeidae not included) [5, 6, 10]; on other decapods [2, 10, 11, 30, 34, 35, 38, 67, 68]; on amphipods [4, 17]; on pelagic and benthic cumaceans [51]; on copepod distribution [14, 16, 28, 45, 56, 64]; on holoplanktonic heteropod mollusks [1]; on cephalopods [27, 47]; on pelagic polychaetes [13]; on chaetognaths [44]; on cnidarians [41]; on pelagic fish, snakes and shrimps [50]; on fish *Pseudos caroliniae* [63]; on shark *Paragaleus randalli* [9] (see references).

As mentioned earlier the International Indian Ocean Expedition obtained a large collection of samples of sergestids, were studied at the Marine Reference Collection and Resource Centre, University of Karachi. While returning the collection of sergestids to the Smithsonian Institution, Washington a single unreported pasipheid specimen belonging to the genus *Pasiphaea* was noticed in one sample. Careful examination revealed that this species was near to *Pasiphaea sivado* [53], which has not been reported from the given coordinates. Identification was not satisfactorily determined. The same is being reported here.



Figure 1. Cruise track, R/V ANTON BRUUN, Cruise 4A.

2. Material

One specimen probably female (individual was not sexed before sending it back by checking the presence/absence of appendix masculina on the endopod of the second pleopod, as is usual in caridean shrimps. But it looks a female as all five pleopod protopods are thinner and elongated [59].

Cruise Anton Bruun 4A station 185 20°39'N, 64°41'E, night 3173, dated 30, October, 1963.

3. Results

Pasiphaea sivado species group

Synonyms

Alpheus sivado [53].

Pasiphaea brevirostris [43].

Pasiphaea distincta [18].

Pasiphaea sivado [7, 11, 15, 24, 25, 46, 49, 52, 57, 58, 60, 61, 62, 70, 79, 80].

Pasiphaea neapolitana [25]. *Pasiphaea savignyi* [43].

Not *Pasiphaea sivado* [53]. [29].

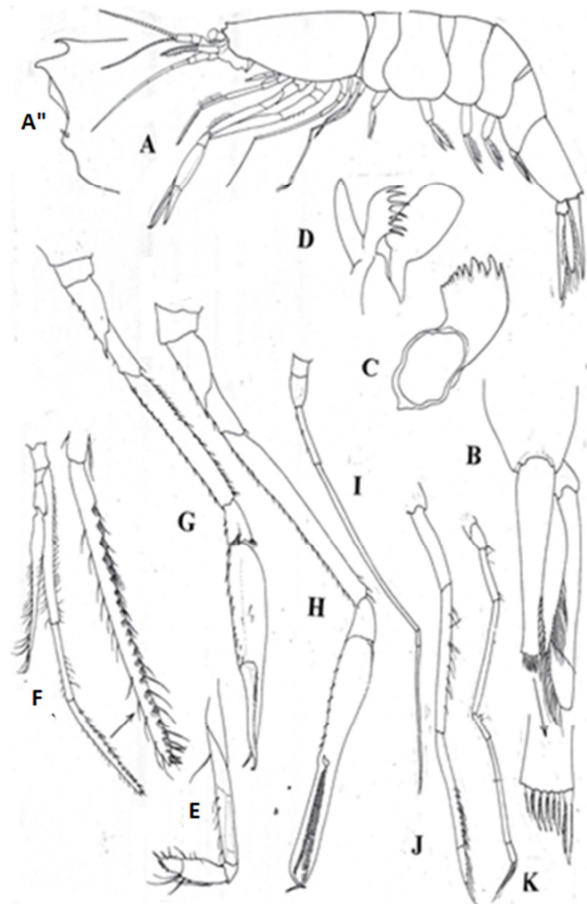


Figure 2. *Pasiphaea sivado* A. entire; A'', rostrum and front; B. telson and right uropod; C. maxillula; D. mandible; E. second maxilliped; F. third maxilliped; G. first leg; H. second leg; I. third leg; J. fourth leg; K. fifth leg.

Description: Carapace with prominent branchiostegal spine (figure 2A). Rostrum short, triangular and upturned with pointed apex; arising behind anterior margin of carapace (figure 2A). Only sixth abdominal segment with poster dorsal

spine. Stylocerite twisted, acutely pointed with spine at apex. Outer margin of scaphocerite slightly convex, apical spine stout, exceeding lamellar portion. Mandible (figure 2C) without palp or molar process, but with incisor process. Maxillula (figure 2D) large; proximal endite small, obliquely truncate distally with one or few short simple setae (broken in present specimen); distal endite with 7 acute teeth; endopod oblong, with stout simple seta (missing here) on mesial margin near distal end. Second maxilliped (figure 2E) simple, pediform; epipod and exopod absent. Third maxilliped (figure 2F) about 1.25 x length of scaphocerite; exopod present. All pereopods (figure 2G-J) with well-developed exopods (missing here), but no epipods. Pereiopods 1 and 2 with slender chelae, cutting edges pectinate. Pereiopods 1-5 with exopods. Basis of pereopod 2 with single spine; merus denticulate, with 19-22 spines, occasionally less. Pleonites without dorsal carina; pleonite 6 with posterior directed spine on posterior dorsal border. Telson (figure 2B) slightly convex at apex, with eight terminal spines outer pair longest (left one missing in the present specimen); inner pairs shorter than outer, abruptly decreasing in size. Uropod elongate; exopod much longer than endopod. (Modified from 19).

Horizontal distribution

Eastern Atlantic and the Mediterranean: from Scotland and Norway, south to Canary Islands and east to Turkey, Morocco, eastern Mediterranean, Japan. Also reported from the Red Sea and Bay of Bengal, India, but these records are probably based on other species.

4. Discussion

The family Pasiphaeidae has a worldwide distribution, includes about 100 species, distributed in seven genera, of which *Pasiphaea* is the most species-rich genus represented by 72 species [54]. This family is one of the systematically controversial families in Caridea. Thus, in the genus *Pasiphaea*, the identification of species is sometimes a hard task, because several species still await rediscovery or redescription. Even the molecular phylogeny of Pasiphaeidae reveals systematic incongruence of the current classification and suggests the classification within the family to be urgently revised [40].

Three informal species groups were recognized in the genus, viz., the *P. sivado* [53] group [18], the *P. cristata* [3] group [20] and the *P. alcocki* [74] group [21] based on the posterior margin of the telson, spinulation pattern of the first pereopod and the number of pleurobranches on the eighth thoracic somite. However, these three informal species groups do not cover all the species in the genus. The *P. sivado* group is characterized by the possession of a sharp poster dorsal tooth on the sixth pleonite, the truncate posterior margin of the telson, the presence of two or more spines on the ventral margin of the first pereopod, and the pleurobranch on the eighth thoracic somite reduced or absent [37]. In the *Pasiphaea sivado* group [21] the carapace is usually not carinate dorsally, the abdominal somites 1-5 are

not carinate dorsally [54]. *P. sivado* is the best known and the representative species of the genus as well as this species group. [21, 22].

The present specimen collected at 20°39'N, 64°41'E in the Indian Ocean is close to species *P. sivado*, sharing the following characters: rostrum triangular with pointed apex, arising behind frontal margin of carapace; sixth pleonite armed with poster dorsal median tooth; posterior margin of telson truncate, armed with four pairs of spines differing in having inner pairs though shorter than outer, but not gradually decreasing in size. It matches with *Pasiphaea japonica* [48], *Pasiphaea arabica* [69] and *Pasiphaea exilimanus* [37], in the absence of pair of terminal spinules on the telson end. The dorsal margin of the sixth abdominal somite is produced as a "pointed end", not as a true spine like *P. truncata* [55] and *P. longitaenia* [36]. *Pasiphaea orientalis* [57] exhibits strong affinity to species of the *P. sivado* group though [22] did not include it in that group) by [37] sharing the following characters: rostrum triangular with pointed apex, arising behind frontal margin of carapace; sixth pleonite armed with poster dorsal median tooth; posterior margin of telson truncate, armed with four pairs of spines..

We have based our identification on rostral shape (although the rostrum is said to be rather variable in shape depending on growth, or presence or absence of ellobiospid parasites [19]. Several *Pasiphaea* species have been recorded from the Western Indian Ocean [7, 23]. Mistakenly given from Pakistan as *P. sivado* [29], actually it was *P. alcocki* which was recorded from Sindh [74], now included in Pakistan coast.

5. Conclusion

The present specimen fits in the group of *Pasiphaea* which do not have v-shape notch in the middle of telson. It is documented that the only *Pasiphaea* that has no v-notch in the tip of the telson is *P. sivado* as given in the figure by [33]. More material is required from these coordinates to establish the species identification.

Anyhow the present record of the *P. sivado* group does not fall within the geographical range given in the literature for this species group. It is a new record or may turn out a species of *Pasiphaea* new to science.

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