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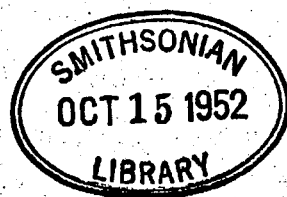
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ON SOME SPECIES OF *ACETES* (CRUSTACEA, SERGESTIDAE)
FROM TRAVANCORE¹

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INTRODUCTION.

The present paper is the outcome of a systematic study of the different species of *Acetes* occurring along the Travancore coast. These are fished on a large scale and are of considerable commercial importance. The work, on which this paper is based, was taken up at the suggestion of Dr. C. C. John, Professor of Marine Biology and Fisheries, and the identification of the specimens was conducted partly in the Marine Biological Laboratory, Trivandrum, and partly in the Zoological Survey of India, Calcutta.

The collection consists of four species, out of which one is a new variety of *Acetes serrulatus* (Kroyer). The remaining three species are *A. erythraeus* Nobili, *A. sibogae* Hansen and *A. dispar* Hansen.

As stated by Kemp (1917), usually two species are found together in most of the collections. The new variety described in the present paper is often found in association with *A. erythraeus*, while in the collection of *A. dispar*, stray specimens of *A. erythraeus* are also seen. This mingling of species renders the isolation of specimens according to species rather a tedious process. But the same difficulty is not experienced in separating the sexes of the various species, since, except in *A. erythraeus*, the males possess an elongated antennular peduncle.

Kemp (1917, p. 45) in describing the characters of the genus *Acetes* says: 'the precise distribution of the red pigment is perhaps different in different species, but on this point nothing precise is known'. In all the specimens I have examined so far the red spots, described as tail-organs by Okada (1928), are present. They could be seen as bright red spots when fresh, but in preserved specimens the red colour fades and disappears, the region of the red spots alone, being distinguishable as dense white patches. In all species there are two pairs of these tail-organs, one pair on each side. One spot is large and more or less circular and is situated on the basal segment, while the other is slightly smaller and occupies the proximal region of the endopodite of the uropod (Text-fig. 2e). The precise location of these spots is the same in all the individuals and in all the species so far examined and hence the presence of the tail-organs may be regarded as a generic character. The function of these organs is unknown, but Okada thinks it may be photogenic.

The clasping spine present on the outer antennular flagellum of the male in all the species (Text-fig. 1d & Text-figs. 2a, b, c & d) is not a regular solid spine as the meaning of the term would imply, but it is grooved longitudinally from apex to base along its inner aspect.

¹ Part of Thesis submitted for the M.Sc. degree of the University of Travancore and published with the permission of the Director, Zoological Survey of India.

The groove becomes broader and shallower towards the tip. The inner surface of this groove is studded with a varying number of spinules or tubercles in the different species. This grooved condition of the clasping spine is visible only under high magnification. In addition, it may also be mentioned that the tip of the clasping spine is somewhat curved in all species, and the degree of curvature varies in different species.

The breeding season of the new variety of *A. serrulatus* and of *A. erythraeus* is from January to April, since all the specimens collected during these months are seen to possess mature gonads. This is further evidenced by the fact that the plankton collections from April to July are rich in the larval forms (Menon, 1933) of *Acetes*. During this breeding season the adults appear in large shoals in the coastal waters drifting with the current, along with *Mysids*, *Alima* larvae of *Squilla* and young forms of *Sepia*, *Loligo* and fish fry. It is during these months that they are invariably found in the stomach contents of the different edible shoal fishes, such as *Lactarius*, Horse-mackerels and *Trichiurus*. Occasionally *Acetes* forms the food of Sardines and Mackerels which are essentially plankton feeders. From June to September *Acetes* forms the chief food of *Lactarius* and *Trichiurus*.

Acetes serrulatus (Kroyer)¹ var. *johni*², nov.

The eye-stalks are about one-third the length of the carapace, and the diameter of the cornea is about half as long as the distal joint of the eye-stalk.

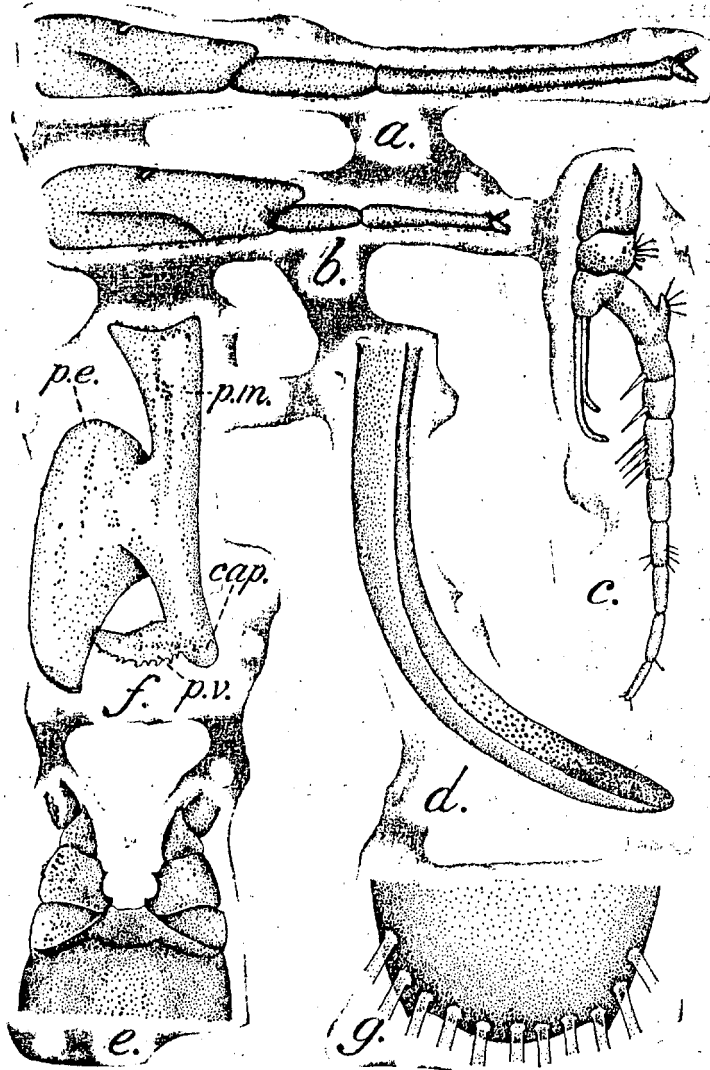
The basal segment of the antennular peduncle of the female is about 1.2 times the length of the two ultimate segments combined; the second segment is about 3.3 to 3.6 times and the third from 6 to 6.5 times as long as broad (Text-fig. 1b). In the male the basal segment is slightly less than half the length of the two ultimate segments combined; the second segment is from 3.2 to 3.5 times as long as broad; the third segment is greatly lengthened and is from 10.5 to 12.5 times as long as broad, and is seldom less than 10 times (Text-fig. 1a).

The outer antennular flagellum of the male (Text-fig. 1c) bears two clasping spines, one longer than the other, and both of them are curved inwards at their tips resembling a hockey stick. On the inner surface of these clasping spines there is a narrow longitudinal groove originating from the base and extending right up to the tip where it becomes broader and shallower. The terminal flattened portion of the groove and the tubercles are visible only under high magnification. The distal basal segment of the flagellum is rather short.

In *A. serrulatus*, Hansen (1919) describes a 'conspicuous protuberance' on the side remote from the clasping spine in the segment in advance of that which bears the two clasping spines. This 'conspicuous protuberance' occurs in the present variety as well, but it is larger and more prominent. As in *A. serrulatus*, it carries a few minute hairs on its angular portion. The segment opposite the tip of the large clasping spine bears 4 to 5 long spinules near its distal end.

¹ *Sergestes serrulatus* Kroyer, *Kgl. D. Vid. Selsk. Skrifter, Math. naturv. Afdeling*, IV, p. 268, Tab. IV, fig. 12a-g. Also see Hansen 1919, p. 41.

² Named after Dr. C. C. John, Professor of Marine Biology and Fisheries, University of Travancore, Trivandrum, under whom the present work was done.



TEXT-FIG. 1.—*Acetes serrulatus* (Kroyer) var. *johni*, nov.

a. antennular peduncle of male (x ca. 15); b. antennular peduncle of female (x ca. 15); c. outer antennular flagellum of male (x ca. 60); d. longer clasp ing spine of the outer antennular flagellum of male (x ca. 800); e. third and fourth thoracic sternite of female (diagrammatic); f. right half of petasma of male (x ca. 40); g. tip of telson of male (x ca. 200).

cap. Capitulum; p.e. Pars externa; p.m. Pars media; p.v. Processus ventralis.

The external maxillipeds in the females reach almost to the tip and in some cases even extend beyond the tip of the third antennular segment. In males they reach only to about the middle of the second segment. In both males and females the external maxilliped is always slightly shorter than the third pereopod.

The third thoracic sternite of the female is broadly triangular in shape, it is gently grooved and the anterior margin is slightly depressed. The fourth thoracic sternite, unlike that of the other species of the genus, is acutely pointed at both ends, while the median region is broadly grooved (Text-fig. 1e).

The coxae of the third pair of legs of the male are devoid of any teeth on their distal inner angles.

There is a small bluntly pointed process between the bases of the first pleopods.

The petasma is of the typical simplified form with the two primary divisions, *viz.*, the pars externa and pars media. Pars astringens is absent. The pars externa is a large flat plate, with a greatly expanded proximal end and a slightly narrower distal end, the posterior border of which is conspicuously emarginate. Pars media is somewhat long and slender, with a more or less broad and gently depressed proximal end. Distally the pars media is differentiated into the capitulum and the processus ventralis. The capitulum is hemispherical and devoid of spines. The processus ventralis originates from a little distance above the hemispherical capitulum and is placed at right angles to the long axis of the pars media, with its small and rounded tip directed towards the pars externa. The capitulum and the processus ventralis together have the appearance of a well-defined human foot. The ventral or the external margin of the processus ventralis is beset with a few short modified spines (Text-fig. 1f).

The telson reaches almost to the middle of the inner uropod. The angular termination of the lobe at the proximal end of the inferio-lateral margin is placed almost midway between the base and the apex. The tip is generally straight but sometimes it is slightly convex (Text-fig. 1g), and bears on either side a small tooth. Though both these teeth are present in the majority of the specimens examined, occasionally in some of the specimens the right or the left may be missing.

The ciliated and non-ciliated portions of the external border of the outer uropod are separated by a small tooth, which is longer and more pointed in the females than in the males. In adults the non-ciliated part is from 1.6 to 1.8 times the length of the ciliated part.

Mature males measure from 15 to 20 mm. and the latter appears to be the maximum size of this new variety.

Live specimens are semi-transparent, the only coloured parts being the cornea which is black and the tail-organs which are bright red.

Affinities.—The present variety closely resembles *A. serrulatus* in the possession of a conspicuous protuberance on the outer antennular flagellum of the male, in the shape of the telson and in the presence of a small bluntly pointed process between the bases of the first pleopods. It, however, differs from *A. serrulatus* in the presence of four to five spines opposite the tip of the large clasping spine of the outer antennular flagellum of the male, in the relative measurements of the different joints of the antennular peduncle, in the absence of a tooth on the distal inner angle of the coxa of the third leg in the male, in the shape of the petasma and in the shape of the female genital area.

The 'conspicuous protuberance' on the outer antennular flagellum of the male is a distinctive feature of *A. serrulatus* and is met with in no other species of *Acetes*. Since the specimens under consideration possess this structure, they cannot but be assigned to *A. serrulatus*. At the same time, the differences enumerated above suggest that the present examples represent a variety quite distinct from the typical form.

Locality.—This new variety is found abundantly in the coastal waters of Travancore from the middle of December to the middle of April along with *A. erythraeus*.

Type-specimens.—No. C2554/1 in the Zoological Survey of India.

Acetes erythraeus Nobili.

1917. *Acetes erythraeus*, Kemp, *Rec. Ind. Mus.* XIII, pp. 51-54.

Acetes erythraeus occurs in large quantities along the Trivandrum coast, from the middle of December to the middle of April. It is usually found in association with *A. serrulatus* var. *johni*, nov.

The present specimens agree in all details with the description and figures given by Kemp. Though there are slight differences in the proportions of the antennular segment, with regard to the more important specific characters no marked differences have so far been noticed. But a few minor differences which, though not of any specific importance have been noted and these are :—(1) the tuberculiform eminences on the anterior edge of the third thoracic sternite of the female is rather sharp and pointed and (2) in the male there is a longitudinal groove on the inner surface of the clasping spine when seen under high power of the microscope. This groove becomes wider and shallower towards the curved tip and is studded with numerous tuberculiform processes which become fewer towards the base (Text-fig. 2a).

The proportion of the males to females in the collection is in the ratio of 1 : 3. Large mature males measure about 20 mm. and the females about 24 mm. In all the specimens examined the gonads are well developed. The tail-organs are very distinct and prominent.

Live specimens are semi-transparent, the only coloured parts are the cornea of the eye and the tail-organs. The cornea is black and the tail-organs are bright red.

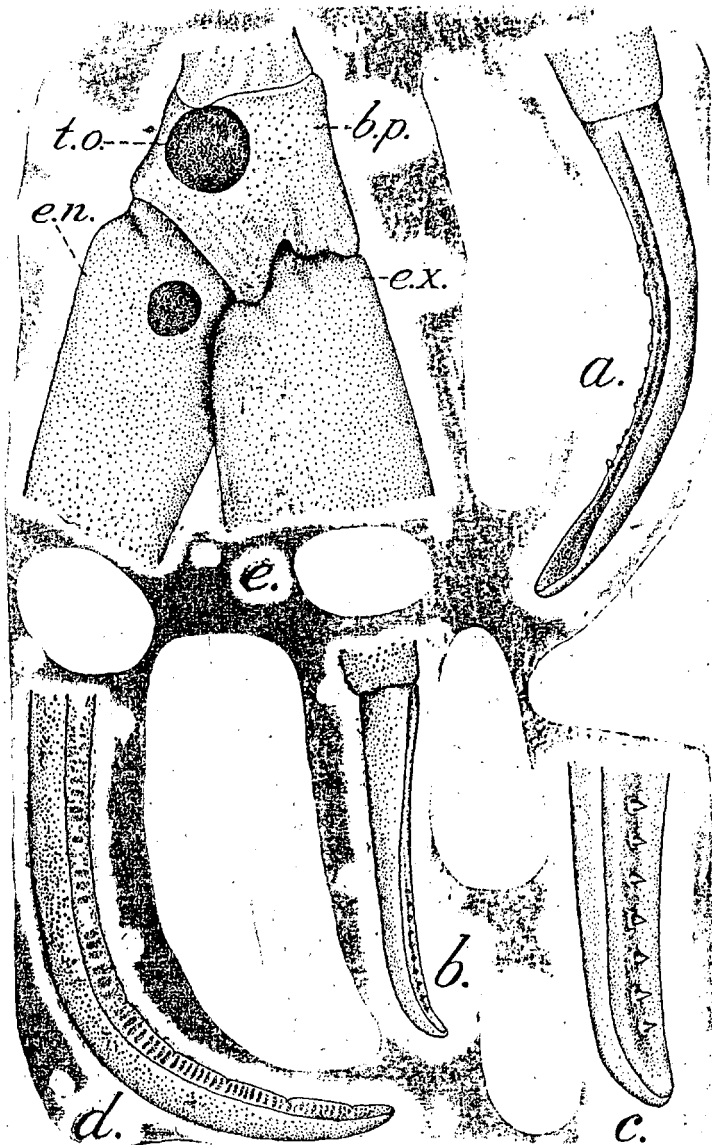
Distribution. Colefax (1940) gives the distribution of the species as Red Sea, western side of the Bay of Bengal, Penang and the Gulf of Siam and French Somaliland.

Acetes sibogae Hansen.

1919. *Acetes sibogae*, Hansen, *Siboga Exped. Rep.* XXXVIII, pp. 38-39, pl. iii, figs. 4a-h.

While engaged in my investigations at Trivandrum, the Professor of Marine biology and Fisheries placed at my disposal a collection of *Acetes* from Quilon, which was in a very good state of preservation. This collection was made at Neendakara near Quilon, some twenty years ago by one of the staff of the Department of Fisheries, posted at that station. The specimens had remained unidentified all these years.

The specimens agree in all details with the description and figures of Hansens' *A. sibogae*. An additional observation made, with regard to the clasping spine of the outer antennular flagellum of the male is, that the inner curved surface of the clasping spine is traversed by a longitudinal groove from the top to the base, with a single median row of prominent spines which could be seen under high magnification (Text-figs. 2 *b* & *c*).



TEXT-FIG. 2.—*Acetes erythraeus* Nobili.

a. clasping spine of male (x ca. 200); *b.* *Acetes sibogae* Hansen, clasping spine of male (x ca. 200); *c.* *Acetes sibogae* Hansen, the distal portion of the clasping spine of male (x ca. 660); *d.* *Acetes dispar* Hansen, the distal portion of the longer clasping spine of male (x ca. 660); *e.* *Acetes dispar* Hansen, portion of uropod showing tail-organs (x ca. 15).

b.p. Basipodite; *e.n.* Eniopodite; *e.x.* Exopodite; *t.o.* Tail-organ.

Forty-five specimens were selected at random from the collection and the following additional measurements were made.

1. The basal segment of the antennular peduncle in the female is from 1.1 to 1.2, and never more than 1.2 times the length of the two terminal segments combined; in males it is nearly 1.5 times.
2. The second segment in both males and females is from 2.5 to 3.5 times as long as broad.
3. The third segment in males is from 8 to 9 times and in the females from 5 to 6 times as long as broad.
4. The non-ciliated portion of the outer uropod is nearly 1.5 times the length of the ciliated part but never more than 1.5 times.
5. The third maxillipeds in the males reach to about half the length of the terminal segment of the antennular peduncle whereas in the females they extend beyond the terminal segment by about half to three-fourths their length.

Large mature males measure from 14 to 18 mm. The largest female in the collection measures 23.2 mm.

The tail-organs have lost their colour completely, yet they could be seen distinctly as dense white patches and occupy the same relative position as that in the rest of the species recorded in the present paper.

Distribution.—Colefax (1940) in the distribution table of the different species of *Acetes* states that *A. sibogae* occurs in the Bay of Bima, Flores sea and Sangkapura-roads Bawean Islands, Java sea. Now that the species has been recorded from Quilon in Travancore, the range of the species appears to be quite extensive.

Acetes dispar Hansen¹.

1919. *Acetes dispar*, Hansen, *Siboga Exped. Rep.* XXXVIII, pp. 39-41, pl. iii, figs. 5a-f & pl. iv, fig. 1a.

Two Collections of this species were made from the Trivandrum coast in July 1941. My specimens agree fairly closely with Hansen's, but a few additional points which I observed during the examination of the present examples are given below.

The eyes are slightly more than one-third the length of the carapace. The basal region of the eye-stalk is very narrow compared with the other species of the genus.

The basal segment of the antennular peduncle of the female is from 1.2 to 1.4 times (generally 1.3 times) the length of the second and third segments combined; the second segment, in 16 out of the 21 specimens examined and measured, is either 3 or slightly over 3 times; and the third about 5.5 times as long as broad. In males the combined length of the two ultimate segments is from 1.8 to 2 times the length of the basal segment; the second segment is from 2.5 to 3.3 times as long as broad; and the third segment, in 15 out of the 19 specimens measured, is about 12 times as long as broad.

¹ According to Burkenroad and Colefax (see references at the end of this paper), *A. dispar* Hansen appears to be synonymous with *japonicus* Kishinouye. *B. N. Chopra.*

The outer antennular flagellum of the male resembles that of *A. japonicus* in the possession of two clasping spines, except in a single individual in which three spines were present. The two clasping spines are grooved longitudinally on their inner margin, the groove becoming broader and shallower towards the tip. The entire groove is studded with closely arranged tubercles which becomes fewer towards the base (Text-fig. 2d). The segments opposite the tip of the clasping spines do not bear any blunt processes.

The external maxilliped is always slightly shorter than the third pereopods and reaches almost to about the tip of the antennal scale.

The third thoracic sternite of the female carries a large backwardly directed plate which posteriorly overlies the fourth sternite. It is depressed in the middle line, its lateral edges are posteriorly convergent and its distal margin is free and emarginate. The posteriorly directed plate is easily visible in a side view. Females of this species could be easily isolated from those of other species of *Acetes* (except *A. japonicus*) by viewing the specimens laterally, when the backwardly directed plate of the third thoracic sternite could be seen distinctly.

There is a small pointed process between the bases of the first pleopods.

The pars media of the petasma is truncate at its proximal end. The capitulum is bulbous at the tip and is set with numerous minute hooks; the processus ventralis is a long and pointed process which usually exceeds the bulbous portion, but occasionally it is seen to be short. The entire petasma agrees with Hansen's description.

The sixth abdominal segment is nearly twice as long as broad.

In males the ciliated and non-ciliated portions of the external border of the outer uropod are more or less equal in length, while in females the non-ciliated portion is always slightly longer than the ciliated part.

Large mature females of this species measure about 22 mm. while adult males reach a maximum length of 16 mm.

In life the entire body is semi-transparent as in the other species of *Acetes*, the only coloured portions being the cornea of the eye which is black and the tail-organs which are bright red.

The seasonal occurrence of *A. dispar* appears to be different from that of the other species which occur along the Trivandrum coast. The several collections of *Acetes* made from this coast from January to April consist only of the two species, *A. erythraeus* and *A. serrulatus* var. *johni*, nov., and there is not a single individual of *A. dispar* found among them. But the July collection from the same coast is mainly composed of *A. dispar*.

Distribution. Hansen (loc. cit.) examined specimens of *A. dispar* from Cheribon, Java and Lem Ngob, Gulf of Siam. It appears from the distribution table given by Colefax (loc. cit.) that this species has not been recorded so far from any other locality. The present is the first record of the species from the Travancore coast.

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