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AN AUSTRALIAN SPECIES OF *ACETES* (CRUSTACEA MACRURA, SERGESTIDAE), WITH REMARKS ON THE DISTRIBUTION AND LITERATURE OF THE GENUS.

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(Figures 1-19.)

Introductory.—The genus *Acetes* was established by Milne Edwards in the year 1830 (*A. indicus*), and since that time sixteen species and one subspecies have been added; these are set forth in the distribution table given below, and the present species, which is described for the first time, brings the total up to eighteen.

Distribution.—*Acetes* is one of the Sergestidae, a notably planktonic group, and, whilst *Acetes* may be taken in the tow-net at times, it also appears to frequent the shallow brackish flats found in estuaries, where salinity is low and the bottom muddy. To quote Kemp (1917): "The species of *Acetes* are found gregariously swimming in great numbers in mid-water or near the surface. They are apparently met with only in coastal waters; they occur near the shore in the open sea, and are frequently common in estuaries and backwaters. They are often found in water of low salinity and occasionally in places where it is quite fresh, but penetrate little if at all beyond the reach of tidal influence. The species are fished commercially in India and Japan, the small size of the individuals being evidently compensated by the great abundance in which they are taken."

To this may be added a note by Hansen (1933): "With bobbinet around the tip of the otter trawl, this *Acetes* [*A. carolinae*] sometimes is obtained in gallons at a time, especially in late summer and early fall."

Hansen (1919) records *A. dispar* from a mangrove swamp in the Gulf of Siam, and some specimens of *A. australis* were taken in a shallow muddy bay in Port Jackson (Sydney Harbour), using a bottom dredge.

The following table gives the distribution of all the species that the author has been able to discover in the available literature:

Acetes indicus Milne Edwards.

Ganges Delta (Milne Edwards, 1830); Gulf of Siam (Kemp, 1917); S. end of Durian Strait, East Indies (Boone, 1935).

A. erythraeus Nobili.

Red Sea (Nobili, 1905); W. side of Bay of Bengal, Penang, Gulf of Siam (Kemp, 1917); French Somaliland (Burkenroad, 1934).

A. insularis Kemp.

Rajang R., Sarawak, Borneo (Kemp, 1917).

- A. japonicus* Kishinouye.
Inland Sea of Japan, Korea (Kishinouye, 1905); W. and S. coasts of India, Bay of Bengal, and Gulf of Siam (Kemp, 1917); Port Swettenham, Selangor (Burkenroad, 1934).
- A. americanus* Ortmann.
Mouth of Amazon Estuary (Ortmann, 1893).
- A. americanus limonensis* Burkenroad.
Limon Bay, Canal Zone, Panama (Burkenroad, 1934).
- A. carolinae* Hansen.
Beaufort Inlet, Nth. Carolina (Hansen, 1933); Louisiana coast (Burkenroad, 1934).
- A. vulgaris* Hansen.
Djangkar Java, Bay of Bima, Sumbawa, Surabaya and Cheribon Java, Malakka, and Gulf of Siam (Hansen, 1919).
- A. sibogae* Hansen.
Bay of Bima, Sangkapura-roads Bawean Is. (Hansen, 1919).
- A. serrulatus* Kroyer.
Surabaya, Cheribon, "Indo-Chinese Sea" (Hansen, 1919).
- A. dispar* Hansen.
Cheribon Java, Gulf of Siam (Hansen, 1919).
- A. spiniger* Hansen.
Surabaya Java, Rangoon, Indo-China Seas (Hansen, 1919).
- A. chinensis* Hansen.
Formosa Channel, Lat. 33 10 N. by 129 18 E. (Hansen, 1919).
- A. brasiliensis* Hansen.
Brazil (Hansen, 1919).
- A. paraguayensis* Hansen.
Rio Paraguay, Rio de la Plata (Hansen, 1919).
- A. sp.* Hansen.
Bay of Bima (Hansen, 1919).
- A. binghami* Burkenroad.
Bella Vista Beach Panama City (Burkenroad, 1934).

Literature.—As may be expected, a moderately extensive taxonomic literature on *Acetes* has been published, and as this is scattered through many different periodicals, it has been considered worth while to give a complete list for the assistance of those who may be working on this genus at any time.

Apart from records of occurrence of *A. indicus* by Dana (1852), Walker (1890), Henderson (1893), and Pearson (1905), the literature is distributed among nine authors as set out below.

Acetes indicus Milne Edwards.

Milne Edwards, Ann. Sci. Nat., Paris, xix, 1830, p. 351, pl. xi, figs. i-ix; and Hist. Nat. Crustacea, ii, 1837, p. 430. *Id.*, Dana, U.S. Explor. Exped., Crustacea, 1852, i, p. 608. *Id.*, Walker, Journ. Linn. Soc. Zool., xx, 1890, p. 112. *Id.*, Henderson, Trans. Linn. Soc. Zool., (2) v, 1893, p. 452. *Id.*, Pearson, Ceylon Pearl Oyster Fisheries, Rep. iv, 1905, p. 75. *Id.*, Kemp, Rec. Ind. Mus., xiii, 2, 1917, p. 47, figs. 1a, 1b, 2a, 3a. *Id.*, Boone, Bull. Vanderbilt Marine Museum, vi, 1935, pp. 101-105, pl. 25, text-fig. 9.

Acetes erythraeus Nobili.

Nobili, Bull. Mus. d'Hist. Nat., Paris, 1905, p. 394, fig. 1. *Id.*, Nobili, Ann. Sci. Nat. Paris (9), 1906, p. 23, pl. i, figs. 5, 5a-f. *Id.*, Kemp, Rec. Ind. Museum, xiii, 2, 1917, text-figs. 1c-e, 2b, 3b, 4b, 5a-d and 7b.

Acetes insularis Kemp.

Id., Kemp, *loc. cit.*, text-figs. 1f, 1g, 2c, 3c, 4c, 4b, 4e, 7c.

Acetes japonicus Kishinouye.

Kishinouye, Annot. Zool. Japon., v, 1905, p. 163, figs. (2). *Id.*, Kemp, *loc. cit.*, figs. 1h, 1i, 2d, 3d, 4d, 5f, 6, 7d. *Id.*, Burkenroad, Bull. Amer. Mus. Nat. Hist., lxviii, 1934, p. 127.

Acetes americanus Ortmann.

Ortmann, Ergebn. Plankton Expedition der Humboldt Stiftung, ii, Gb, 1839 (Decapoden und Schizopoden), p. 39, pl. 2, fig. 2. *A. americanus* (*limonensis*, sub-sp. nov.) Burkenroad, Bull. Bingham Oceanographical Coll., iv, 1934, art. 7.

Acetes carolinae Hansen.

Hansen, Journ. Washington Acad. Sci., xxiii, 1, 1933, pp. 30-34, text-figs. 1-8. *Id.*, Burkenroad, Bull. Amer. Mus. Nat. Hist., lxviii, 1934, art. 2, p. 128, fig. 15. *A. sp.* Brookes, Phil. Trans. Roy. Soc. London, clxxiii, 1882, art. 2.

Acetes vulgaris Hansen.

Hansen, Siboga, Mon. xxxviii (Sergestidae), 1919, pp. 35-7, pl. iii, figs. 2a-2r.

Acetes sp. Hansen.

Hansen, *loc. cit.*, pp. 37-8, pl. iii, fig. 3a.

Acetes sibogae Hansen.

Hansen, *loc. cit.*, pp. 38-9, pl. iii, figs. 4a-h.

Acetes dispar Hansen.

Hansen, *loc. cit.*, pp. 39-41, pl. iii, figs. 5a-f and pl. iv, fig. 1a.

Acetes spiniger Hansen.

Hansen, *loc. cit.*, pp. 43-4, pl. iv, figs. 5a-h.

Acetes chinensis Hansen.

Hansen, *loc. cit.*, p. 41, pl. iv, figs. 3a, 3b.

Acetes brasiliensis Hansen.

Hansen, *loc. cit.*, pp. 45-6, figs. 1-7.

Acetes paraguayensis Hansen.

Hansen, *loc. cit.*, pp. 46-8, text-figs. 8-14.

Acetes serrulatus Kroyer.

Kroyer, Kgl. d. Vid. Selsk. Skrifter, Math-nat Afdeling, iv, 2, 1859, p. 268, tab. 4, figs. 12a-g. *Id.*, Hansen, *loc. cit.*, pp. 41-3, pl. iv, figs. 4a-4h.

Acetes binghami Burkenroad.

Burkenroad, Bull. Bingham Oceanographical Coll., iv, art. 7, 1934.

Of the above papers, that of Burkenroad (1934) is specially worthy of mention, for in addition to some valuable data on *A. carolinae* and *A. japonicus*, he points out that many of the so-called valid species are probably synonyms:—

Acetes carolinae Hansen and *A. americanus* Ortmann, and *A. brasiliensis* Hansen, may be regarded as forming a subdivision of *Acetes* distinguished from the remaining species of the genus by the lack of a second rostral tooth between the rostral tip and the posterior tooth, the absence of a stout distally directed spine or spines from the proximal part of the inferior antennular flagellum of the male, and the absence of a podobranch from the second maxillipeds. Hansen has stated that a podobranch is present on this somite throughout the genus. Kemp (1917) finds this description applicable to the Indo-Pacific species, but Ortmann (1893)

states that a podobranch is absent from the second maxillipeds of *A. americanus*. I do not find a podobranch in *A. carolinæ*. The second division seems to contain eight species of which one, *A. paraguayensis* Hansen, occurs in the American South Atlantic. The remaining species of the second division occur in the Indo-Pacific, and may be listed as follows:

1. *A. serrulatus* (Kroyer) Hansen, 1919, with which *A. insularis* Kemp, 1917, seems synonymous.

2. *A. indicus* M.E., with which *A. spiniger* Hansen seems synonymous.

3. *A. sibogae* Hansen, which perhaps includes the specimens reported by Kemp as dimorphic males of *A. erythraeus* Nobili, with elongate third segment of the antennular peduncle.

4. *A. erythraeus* Nobili, Kemp, 1917, with which *Acetes species* Hansen seems synonymous. I have examined a male of this species from French Somaliland.

5. *A. vulgaris* Hansen, which seems to differ somewhat from *A. erythraeus* by its more numerous series of spines of different arrangement on the fifth joint of the lower antennular flagellum of the male, and the absence of a lobule from the segment in front of the clasping spine; the presence of a spine at the distal inner angle of the coxa of the third legs of the male and the absence as figured of a spine from the outer margin of the exopod of the uropod; and the longer median lobe of the capitulum of the petasma which bears three large spines and lacks the numerous smaller ones of *A. erythraeus* except near the tip. Hansen reports that the female bears a pair of sternal protuberances between the coxae which are absent in *erythraeus*, but faint elevations in this position are figured by Kemp for the latter species.

6. *A. chinensis* Hansen, apparently related to *A. japonicus*, but of which the characters are as yet incompletely known.

7. *A. japonicus* Kishinouye, Kemp, 1917, with which *A. dispar* Hansen seems to be synonymous. A negative distinction is made by Hansen between his form and Kishinouye's; that the sexual difference in the third segment of the antennular peduncle of *A. dispar* could not have been overlooked by Kishinouye if present in *A. japonicus*. This means of differentiation seems to be doubtful in view of Kemp's examination of the Japanese material, which he finds identical with the Indian specimens, and which therefore displays differences in the antennular peduncle. Kemp further notes variations in the length of processus ventralis of the petasma sufficient to obscure the differences mentioned by Hansen.

The larval development of *Acetes* is described in papers by Brookes,¹ Soyejima,² and Menon.³ The paper by Soyejima was unfortunately unprocurable, a fact to be regretted because it appears to be very important, whilst that of Menon gives admirable figures and descriptions of the development of *A. erythraeus*, and reveals the interesting fact that in the larvae the chelae of the walking legs are very prominent. In the adult, as will hereafter be described, they are so minute that they easily escape notice at first.

Material.—The actual material on which this paper is based came from Mr. G. L. Kesteven, B.Sc., of the Council for Scientific and Industrial Research, Fisheries Branch, to whom I should like to express my thanks. He provided a series of eight females and four males that he dredged up in Homebush Bay, Port Jackson (Sydney Harbour), in June, 1937. He provided a further series of 97 females and 150 males which were collected at Folly Point, Middle Harbour, Port Jackson, in 1922, by an inspector of the State Fisheries Branch and labelled "Prawn Fry".

I am also indebted to Miss Isobel Bennett of the Zoology Department, University of Sydney, for three females and four males from the Clarence River, North Coast of New South Wales, and finally to Mr. T. C. Roughley, B.Sc., of the

¹ Brookes.—Roy. Soc. Lond., Phil. Trans., clxxiii, 1883, p. 101.

² Soyejima.—Suisan Gakkwai Ho, iv, 1926, p. 15.

³ Menon.—Madras Govt. Museum, Bull. (n.s.), iii, 3.

State Fisheries, Chief Secretary's Department, who sent along large numbers of males and females collected at Tuggerah Lake, 50 miles north of Port Jackson. They were reported as being very numerous in that locality during the month of May, 1939.

It is quite likely that the species ranges along most of the coast of New South Wales.

SERGESTIDAE Dana.

SERGESTINAE Bate.

Acetes H. Milne Edwards.

Body rather slender. Carapace produced into a short rostrum behind which is a crest armed with one or two denticles. Hepatic and supraorbital spines well developed. Antennules with second peduncular joint somewhat short; third joint in female considerably longer than, in the male from twice to three times as long as, the second; outer antennular flagellum of male modified into a clasping organ. Mandibles with long three-jointed palp, the first segment of which is very inconspicuous, and the second elongate. Maxillules with only two lobes. Maxillae with undivided protopodite, and with well-developed endopodite and exopodite. First pair of maxillipeds two-lobed and jaw-like, with epipodite but no gill. Second pair of maxillipeds more leg-like, with or without gill (podobranch). Third pair of maxillipeds long and slender, but shorter than the third pair of legs; the second joint usually, but not always, fused with the third; the two distal joints not subdivided; a single pseudobranch above these third maxillipeds. First pair of legs comparatively short and stout and provided with a "clasping organ" at the junction of propodos and carpos; a minute chela present partially concealed by a brush of bristles. Second pair of legs longer than the first, but shorter than the third pair; latter very long and slender, and both pairs with minute chelae as in the first. All three pairs with the full number of seven segments, but devoid of exopodite, epipodite, or gill. Fourth and fifth legs lacking, but in the male a pair of blunt protuberances immediately behind the third pair represent rudimentary fifth legs, for they carry the genital apertures. Four pleurobranches present, three above the corresponding legs and the fourth one behind these. Petasma reduced; pars externa has no processus uncifer, pars astringens often absent, whilst pars media usually has only a capitulum and processus ventralis of simple form.

The males can be readily distinguished from the females by the slender elongate third peduncular segment of the antennule, the "clasping organ" formed by the modified outer flagellum of the same, the genital coxae (rudimentary fifth legs), the petasma between the first pleopods and the lamella present in some, if not all, cases at the base of the endopodite of the second pleopods.

DIVISION 2, BURKENROAD, 1934.

Epipodite of second maxilliped with podobranch. Rostrum with two denticles behind terminal point. Third joint of outer antennular flagellum of male with distally directed spine or spines. Coxae of female third legs with distomedian

Acetes australis, sp. nov.

Female (Fig. 1). The carapace is translucent and a little less than a quarter of the total length (35:8). The rostrum (Fig. 1*a*) is very similar to that of *A. indicus*, terminating in a sharp point behind which are two sharp denticles;

the anterior margin is very steep—almost at right angles to the body, and rather convex in outline. It does not project very far forwards.

Just in front of the rostrum between the bases of the eyestalks there is a vertical fleshy protuberance, of triangular shape and terminating in a blunt point; it is particularly well seen in lateral aspect projecting above the base of the eyestalk (Fig. 1, x).

Supraorbital and hepatic spines well developed; from the base of the latter a groove curves downwards and backwards for a short distance, finally becoming more or less horizontal; it terminates rather indistinctly near the posterior border of the carapace.

The eyestalks are long and slender and about one-third of the carapace length. They are conspicuously more slender than the cornea, which is of oval shape. In the figure of the female *Acetes* (Fig. 1) the eyestalks have been drawn a little foreshortened, so that their true length is not shown.

The antennules (Figs. 2 and 2a) have prominent statocysts which are easily visible toward the outer margin of the basal peduncular segment. The aperture of the statocyst is covered over by a thin transparent flap of cuticle that can be lifted with a fine dissecting needle. The basal peduncular segment is very flattened in a horizontal plane and somewhat hollowed out to fit the contour of the eyestalk, but it has a thick fleshy part (FL) which is vertical and which lies against its fellow at the proximal part of the inner edge of the segment. The outer margin of the segment has a deep indentation, which is flanked externally by a large tooth; a totally erroneous idea is obtained of the shape of this tooth by examination from the one aspect only, for when viewed from above it appears as in Fig. 2a, but if the antennule is held with the outer margin uppermost the tooth is seen to be a very broad flat lamella terminating in a sharp point. The basal peduncular segment is beset with strong bristles, of which there is a characteristic group of curved outline near the distal end. The second segment is the shortest of the three and cylindrical; it is about $2\frac{1}{4}$ times as long as broad. The slender third segment is about eight times as long as broad, and the proportions of the three segments are 22:7:16.

Of the two flagella, the inner one is by far the longer, being two-fifths of the body length; it has a thick proximal portion subdivided into about twenty-four very short segments, which are thickly beset with aesthetascs (AES). The whole structure is very prominent in both sexes. The outer flagellum is hardly longer than the third segment of the peduncle and consists of twenty-four short segments.

The antennae (Figs. 3, 3a-3b): The scale is three times as long as the peduncle and almost as long as the peduncle of the antennule (7:8). The outer margin is smooth and terminates in a sharp spine that projects beyond the anterior margin. The end and inner edge are clothed with long movable plumed bristles. The upper surface of the scale has a strong ridge that starts just distal to the base and is produced backwards as a stout bifid tooth (A, Fig. 3a), and standing opposite this is another tooth on the basal segment of the antenna (B, Fig. 3a). The basal segment has two other teeth (D and C), the former of which is long, curved and sharp. These teeth are best seen in side view.

The antennary flagellum is notable for its great length, being twice the length of the body (75:35), and it shows the remarkable flexion first described by

Kishinouye (1905) in *A. japonicus*. Fig. 3*b* shows the condition in *A. australis* and the description corresponds closely with that given by Kishinouye and also by Burkenroad (1934) for *A. carolinae*. The segments of the flagellum proximal to the flexion have short stiff hairs along one side and long paired setae along the other; the actual flexion is formed by six segments, which are naked except for a few short hairs, but the segments distal to the flexion are beset with strong plumed bristles which are arranged similarly to those of *A. carolinae*. On each segment is a pair of setae arched over toward one another to form a wide hollow cylinder and into this projects a short straight seta. This configuration is repeated on every segment distal to the flexion. Both Kemp (1917) and Boone (1935) are mistaken in saying that the flexion occurs in the flagellum of the antennule (in *A. indicus*).

The mouth is bounded in front by the labrum, at the sides by the mandibles and posteriorly by the "lower lip", which is bifid.

The labrum (Fig. 4) is roughly quadrangular in shape, with the two lower corners produced into a pair of "ears". It is very thick and fleshy, and the arrangement of the muscles suggests that it must be capable of a considerable degree of independent movement. On its anterior face it has long thin setae, whilst on the posterior (internal) face there is a conical elevation beset with powerful spines (SP.PR.).

The "lower lip" (Fig. 5) is a bifid structure, the halves of which are relatively much thinner than the labrum. They are heavily bristled along their inner edges, especially toward the base, and must constitute an efficient straining apparatus.

The mandible (Fig. 6) has a long three-jointed palp which is notable for the inconspicuousness of the first segment. The second segment is by far the longest, and, like the third, clothed with long plumed setae. The incisor region (IN, Fig. 6) consists of a single sharp tooth, the base of which continues around to the molar region (MOL) as a sharp serrated ridge. The latter terminates in another tooth, and the rest of the molar region is constituted by three short blunt teeth situated on the inner "grinding surface" of the appendage. The mandible is attached to the head by a long thin boat-shaped plate of chitin (INS), the base only of which is shown in the figure. This part is easily broken off and requires careful dissection.

The maxillules (Fig. 7), which lie immediately behind the lower lip, are each bilobed. The working surface of each lobe carries strong stiff bristles, some of which are spiny.

The maxillae (Fig. 8) are notable for the undivided protopodite (PROT), the inner edge of which is beset with closely placed bristles. The endopodite (RI) is small and undivided, and has near its base a small conical process (X) with short bristles. The exopodite (RE) is of typical form.

The first maxillipeds (Fig. 9) are decidedly jaw-like and have an epipodite (EP) but no gill. The two rami are flattened and heavily bristled. The exopodite (RE) has a short spiny projection on its inner margin.

The second maxillipeds (Fig. 10) are leg-like and have no exopodite. An epipodite (EP) with attached podobranch (POD) is present, and in this respect they are unique, for none of the other limbs carries a gill. The first three segments of the endopodite are all stout, but the carpos and dactylos are slender.

The third maxillipeds (Figs. 11 and 11a) are very long and slender, and have the full number of seven segments. They extend forward beyond the antennal scale by about the length of the dactylos. They are non-chelate and all the segments are heavily bristled.

The first legs (Figs. 12, 12a-12b) are relatively short and stout. There is a clasping organ (CL OR) formed by stout spiny bristles at the articulation of propodos and carpos; the group of bristles on the latter is distinctly U-shaped, whilst on the former they are in a straight line (Fig. 12b). The limb terminates in a minute but perfect chela which is partly concealed by a "Pinsel" of bristles, half of which are borne on the propodos and half by the dactylos (Fig. 12a).

The second legs (Fig. 13) are much longer than the first, and extend as far forwards as the distal third of the antennal scale. Like the first and third pairs, they have minute chelae.

The third legs (Figs. 14 and 14a) are the longest of all and reach as far forwards as the end of the antennal scale. The distal inner margin of the coxa is produced into a strong blunt tooth, whilst the proximal part of the margin is expanded into a thin semi-transparent flap, on the anterior surface of which is the genital aperture. The basis terminates in a blunt projection (Fig. 15, BAS PR.), and not in a tooth as in *A. indicus*.

The female genital area (Fig. 15) is broadly similar to that of *A. indicus* as figured by Kemp (1917); the third thoracic sternite (ST III) has a wide shallow groove which is continuous with a still wider groove on the fourth sternite. On the third sternite there are two pairs of small rounded projections, one pair lying near the anterior margin, and the others behind these in contact with the thin coxal expansions (LAM) mentioned above. If the third leg be carefully dissected off, along with portion of the sternite, further features can be made out. On the inner side of the coxa there is a thick fleshy lamella (FL LAM, Fig. 15a) which is apparently the structure referred to by Burkenroad (1934) in his description of the genital area of *A. carolinae*. Immediately mesial to this lamella there is a very deep pocket, which is bounded posteriorly by the coxal expansion and the hinder sternal projection; the medial and anterior margins are formed by the sternum, whilst the lateral wall is overhung by the base of the fleshy lamella. In the floor of this pocket can be made out a still deeper cavity, which is presumably the sperm sac, although this feature was rather indefinite in all of the specimens examined. It was also found very difficult to see the actual position of the genital aperture. It may be mentioned in passing that the only way to get a really adequate picture of the female genital area is to examine it from all aspects; it is recommended that the third and fourth thoracic segments, with the third legs attached, be dissected away from the body as a unit, after which excess muscular tissue is removed and the whole structure cleared in glycerine. Light staining in borax carmine or chlorazol black is also helpful, as is the employment of various types of lighting during the examination.

In the female *Acetes* the fourth and fifth legs are wanting, but the male retains vestiges of the fifth pair.

The abdomen is 2.7 times the length of the cephalothorax and of typical sergestid form. The proportions of the segments are as follows 9:8:9:11:9:19, and each segment with the exception of the sixth has prominent pleura. The

sixth pleurae are very much reduced, although quite visible as a pair of thin plates near the point of articulation of the uropods. The telson (Fig. 16) is as long as the fourth abdominal segment and devoid of any spines; it is fringed over its distal part with plumed movable setae and terminates in a point as in *A. indicus*.

The uropods (Fig. 1) are of typical form, and the outer margin of the exopodite has a proximal smooth region, which terminates distally in a tooth; the latter divides the margin in the proportion 60:43, the part distal to the tooth carrying the usual plumed setae.

The pleopods (Fig. 1). With the exception of the first pair these are all biramous; the first pair is uniramous. The protopodites decrease in length and increase in width from before backwards, those of the first pair being long and slender, whilst those of the fifth pair are short and stout. There is no large procurved tooth on the sternum between the first pair as in *A. indicus* and *A. erythraeus*.

The males are shorter and more slender than the females, their average length being in the vicinity of 22–25 cm. The sexual dimorphism is further indicated by the modified antennules, the genital coxae (vestigial fifth legs), the petasma between the first pleopods, and the modified endopodite of the second pleopods.

The antennule (Figs. 17, 17a–17b) has the typical three-jointed peduncle, the basal segment of which is shaped as in the female with the thick fleshy vertical part and the thin excavated horizontal portion. The statocyst is very prominent and the aperture as in the female covered by a thin flap of cuticle. The second peduncular segment is long compared with that of the female, whilst the third joint is very long and slender; this appears to be an almost constant character for the males of *Acetes*. The proportions of the peduncular segments are 3:2:3½.

The outer flagellum is 11-segmented; the first two are unusually long as in *A. indicus*. The third joint has a long, curved, serrate, clasping spine (CL), and just near the base of this there is an accessory spine (AC.S) arising from the same segment, which overlaps a group of three on the following segment. The end of the clasping spine reaches almost as far as a group of four stout spines on the seventh segment. The segment carrying the group of three spines mentioned above also has an angular projection similar to that of *A. erythraeus* (PROJ), but this can be seen only if the antennule is carefully held in the right position with a dissecting needle. The inner flagellum is similar to that of the female in having a thickened proximal part which consists of about eighteen very short segments carrying aesthetascs; this thickened part is six-sevenths the length of the outer flagellum, whilst the whole of the inner flagellum is two-fifths the length of the body.

The genital coxae lie immediately behind the third legs, but are regarded as vestigial fifth legs because they carry the genital apertures. Each one is a sharp conical projection with the anterior surface slightly indented.

The petasma (Fig. 18) is of the typical simplified *Acetes* form with three primary divisions, viz., pars externa (P.EX), pars media (P.M.) and pars astringens (P.A.S.). Pars externa is a broad flat plate with the distal part of the outer margin notably thickened. Pars astringens is a thin membrane folded upon itself and carrying a row of fine coupling hooks that interlock with corresponding

hooks on the other half of the petasma. The outer proximal corner of pars media is produced, whilst distally it divides into capitulum (CAP) and processus ventralis (PV.). The latter is pointed and devoid of spines, whilst the former has a single large falcate spine (F.SP.), which in some specimens projects beyond the margin and in others is very difficult to see because it may partially invaginate into the cuticle. The distal part of the capitulum has a warty appearance due to the presence of fine invaginated spines.

The second pleopods (Figs. 19–19a) have the endopodite slightly modified in that the latter has at its base a flat lamella (RI LAM), the distal edge of which has four or five curved short hooks. This feature is not found in the females.

The remaining appendages are similar to those of the female. The very long antennary flagellum, which is twice as long as the body, shows the characteristic flexure at about a quarter of its length from the base. The mouth parts, maxillipeds, and legs agree closely, even to the presence of a strong tooth on the distal inner margin of the coxa of the third legs. The telson is also quite similar in both sexes and like that of *A. indicus*.

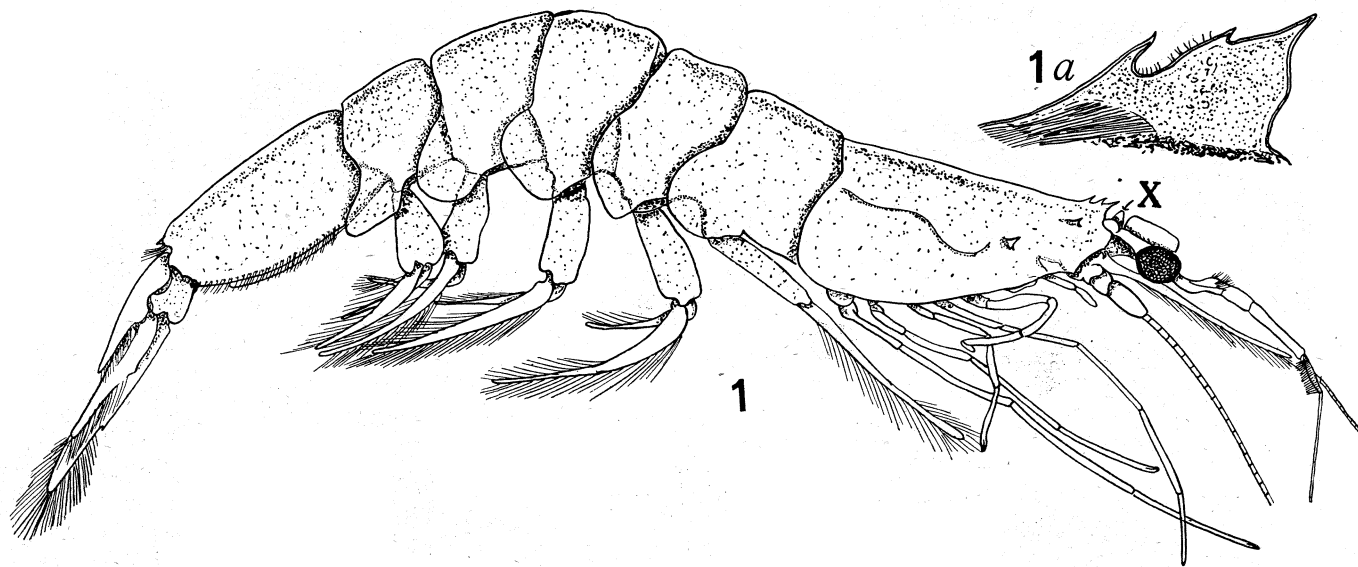
Gills. The branchial formula for *A. australis* is the same as that given by Kemp (1917) for the species, which are described in his paper and is set forth below.

	vii	viii	ix	x	xi	xii	xiii	xiv
Podobranchiae	ep.	I ep.	—	—	—	—	—	—
Arthrobranchiae	—	—	—	—	—	—	—	—
Pleurobranchiae	—	—	I	I	I	I	I	—

It will be noticed that five pleurobranchs are present, although Hansen (1919) in his generic diagnosis states that four is the typical number.

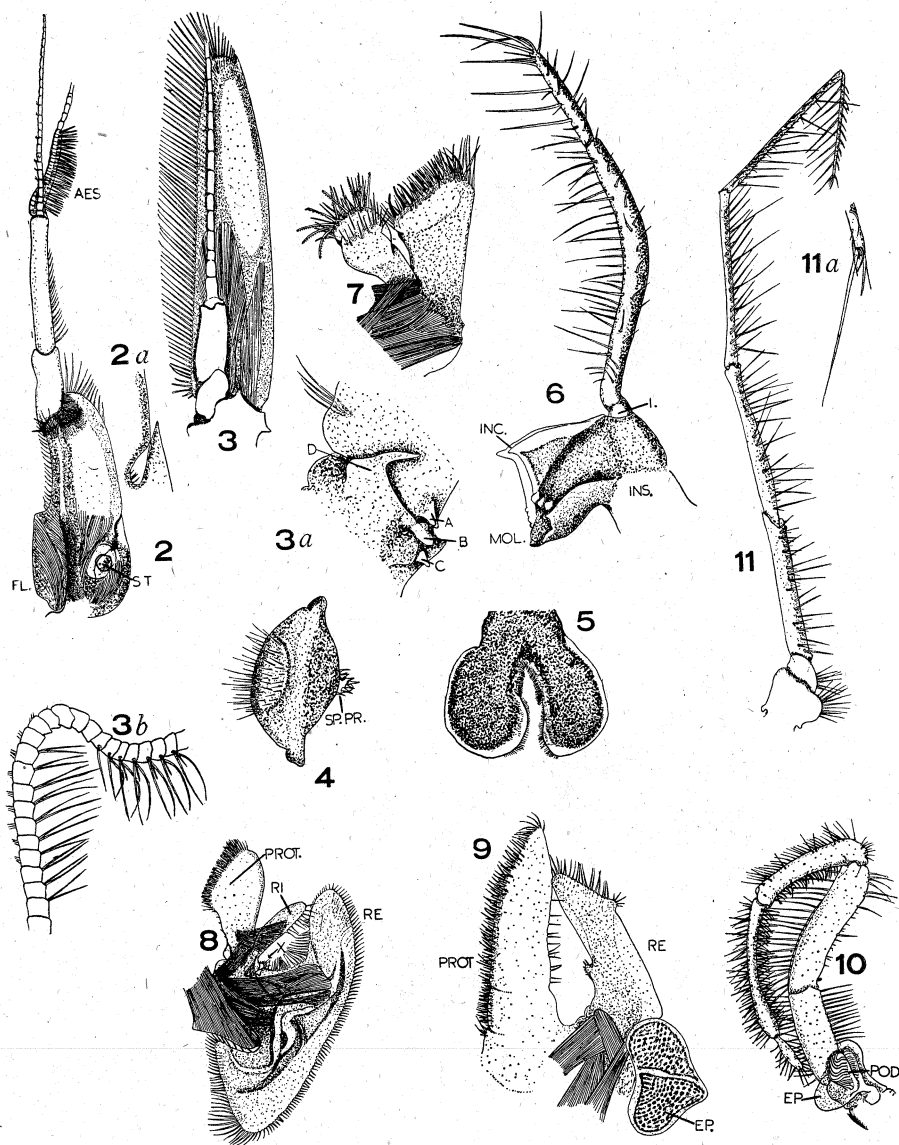
Affinities. The present species shows close affinities with the Asiatic species, and of these it comes closest to *A. erythraeus* and *A. indicus*. The female genital area is very like that of *indicus*, but the basis of the third legs terminates at its distal margin in a blunt projection and not in a sharp tooth; furthermore, there are differences in the respective thoracic sternites.

The petasma is extraordinarily like that of *erythraeus*, with the exception of the capitulum with its single falcate spine; in every other detail it agrees closely. The male antennule of *australis* is, however, quite distinctive, with its accessory spine near the main clasping spine, and the group of three spines together with the angular projection on the segment following the one which carries the clasping spine. A further important difference lies in the fact that *australis* lacks the large procurved spine that occurs between the first pleopods in both *indicus* and *erythraeus*.



Acetes australis, sp. nov.

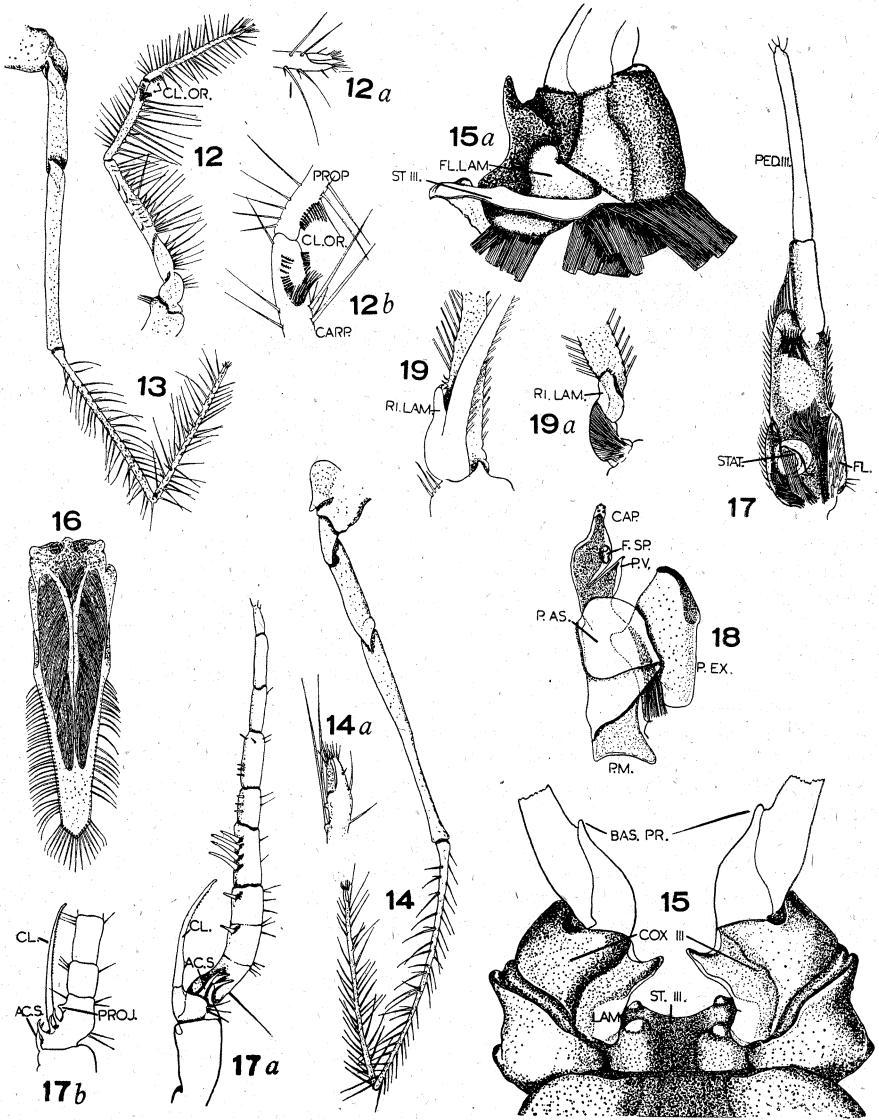
Figs. 1-1a.—1: 34 mm. female, lateral view; X, fleshy projection in front of rostrum. 1a: Rostrum.
A.N.C., del.



Acetes australis, sp. nov.

Figs. 2-11a.—1: Female antennule; FL, vertical fleshy part; ST, statocyst; AES, aesthetascs. 2a: Lateral tooth of antennule. 3: Antenna. 3a: Base of scale of antenna; A, B, C, D, see text. 3b: Region of flexure in antennal flagellum. 4: "Upper lip", seen from below; SP.PR., spinous projection. 5: "Lower lip", anterior view. 6: Mandible; I, first segment of palp; INC., incisor region; MOL., molar region; INS., base of chitinous insertion. 7: Maxillule. 8: Maxilla; PROT., protopodite; RE, exopodite; RI, endopodite; X, projection at base of endopodite. 9: First maxilliped; PROT, protopodite; RE, exopodite; EP., epipodite. 10: Second maxilliped; EP., epipodite; POD, podobranch. 11: Third maxilliped. 11a: End of dactylos of same.

A.N.C., del.



Acetes australis, sp. nov.

Figs. 12-19b.—12: First leg; CL.OR., clasp- ing organ. 12a: Chela of same. 12b: Clasp- ing organ enlarged; CL.OR., clasp- ing organ; CARR., carpos; DACT., dactylos. 13: Second leg. 14: Third leg. 14a: Chela of same. 15: Genital area; COX III., coxa of third leg; BAS.PR., projection on basis; ST.III., third thoracic sternite; LAM., coxal expansion. 15a: Inner aspect of coxa of third leg; ST.III., third thoracic sternite; FL.LAM., fleshy coxal lamella. 16: Telson. 17: 22 mm. male antennule; STAT., statocyst; FL., vertical fleshy portion; PED.III., third peduncular segment. 17a: Outer flagellum of same; CL., clasp- ing spine; AC.S., accessory spine. 17b: Another view of base of same; PROJ., projection. 18: Petasma, right half; P.A.S., pars astringens; P.EX., pars externa; P.M., pars media; CAP., capitulum; F.SP., falcate spine; P.V., processus ventralis. 19: Base of second pleopod; R.I.LAM., lamella at base of endopodite. 19a: Another view of the lamella.

A.N.C., del.