

## VII. NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

### VIII. THE GENUS *ACETES*, MILNE-EDWARDS.

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In attempting to determine a large collection of Decapod Crustacea recently made by Dr. Annandale in Japan, China and Lower Siam, I found it impossible to come to a satisfactory decision regarding the identity of a species of *Acetes*, and it was only after examining the series of unidentified specimens in the Indian Museum that any definite conclusion was reached. It is with the results of this examination that the present short paper is concerned.

In the first of his classical memoirs on the genus *Sergestes* Dr. Hansen remarked,<sup>1</sup> "Of *Acetes* 2 species are known (one of which has not been examined since 1837), but we possess 6 species, the distinctive characters of which are very curious; it is, however, impossible to give a good idea of the species. . . without a considerable number of figures." Twenty years have elapsed since this statement was made, but Dr. Hansen has unfortunately not made any further contribution to the subject. Although two additional species have been described, their characters are very imperfectly known and no fresh account of *A. indicus*, the species for which Milne-Edwards founded the genus *Acetes*, has appeared. *Acetes indicus* has indeed been several times recorded from various localities, but it is, I believe, quite impossible to recognize the species from the original description: all definite specific records are therefore open to doubt.

The collection in the Indian Museum is not so rich as that in the University of Copenhagen, but comprises four distinct forms; three of these—all occurring in Indian waters—are in my opinion to be referred to known species, to *A. indicus*, Milne-Edwards, *A. japonicus*, Kishinouye, and *A. erythraeus*, Nobili; the fourth, obtained in Borneo, is undescribed. One described species, *A. americanus*, Ortmann,<sup>2</sup> is not represented in the collection.

The four forms examined show the closest affinity with one another and all agree in the complete suppression of the last two pairs of peraeopods—the character on which Milne-Edwards established the genus.

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<sup>1</sup> Hansen, *Proc. Zool. Soc. London*, 1896, p. 937.

<sup>2</sup> Ortmann, *Decap. Schizop. Plankton-Exped.*, p. 39, pl. ii, fig. 2 (1893).

In distinguishing the species the most important indications are those derived from adult males. The form of the petasma is a most reliable and satisfactory guide and, according to my observations, an absolute criterion of specific identity, while good characters are also to be obtained from the sexual modifications of the external flagellum of the antennule. In three of the four species the ultimate segment of the antennular peduncle of the male is always elongated to a very remarkable degree, a great contrast existing in this respect between the two sexes. It is curious that this very striking feature has not hitherto been noticed. In the fourth species (*A. erythraeus*) the ultimate peduncular segment, in the vast majority of specimens examined, is short in both sexes; but in four males of small size from the vicinity of Penang, it is elongated as in the other species. The specific identity of these individuals is proved beyond doubt by the structure of the petasma. It seems, therefore, that in *A. erythraeus* the males are dimorphic; but it is very strange that no males with a long peduncle occur among several hundreds of specimens from other localities.

The sexual characters of the female are more difficult to observe, but the third thoracic sternite offers distinctive characters in each species; in *A. japonicus* its structure differs widely from that of any of the allied forms.

The species may also be distinguished by characters other than sexual, and these, though for the most part less convenient, are useful in the determination of females and young individuals.<sup>1</sup> Such characters are to be found in the proportions of the eye, in the form of the second segment of the antennular peduncle, in the ultimate segment of the third maxillipede, in the presence or absence of a tooth on the inner margin of the basis of the third peraeopods, in the external border of the outer uropod and in the telson.

It is evident from the collection in the Indian Museum that two species are often found together. In such cases, and when the specimens are numerous, identification is a tedious process, for each individual must be separately and carefully examined.

Kishinouye was mistaken in supposing that the species can be determined by the number of teeth on the rostrum; in the forms I have examined the rostrum is almost identical in structure. This is also true of the tothing and sculpture of the carapace. The proportionate lengths of the segments of the third maxillipedes and legs afford only very slight differences, and I have not been able to find any distinctions in the number or size of the branchiae.

The species of *Achetes* are usually found gregariously, swimming in great numbers in mid-water or near the surface. They are apparently only met with in coastal waters; they occur near

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<sup>1</sup> The petasma is, however, sufficiently developed for accurate identification in specimens less than half the maximum length attained by the species.

the shore in the open sea, and are frequently common in estuaries and backwaters. They are often found where the water is 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 both in India and Japan, the small size of the individuals being evidently compensated by the great abundance in which they are taken.

In life the greater part of the body is probably transparent in all the species, but the cornea is black, and in one species at least there are red markings on the uropods. The precise distribution of the red pigment is perhaps different in different species, but on this point nothing precise is known. The only notes I possess on the colouration of living examples relate to specimens of *A. japonicus* collected in Mormugao Bay in Portuguese India, my description agreeing exactly with that given by Kishinouye. Dr. Annandale's notes on individuals caught in the Tale Sap in Lower Siam indicate an almost precisely similar colouration, but his collection contains both *A. indicus* and *A. japonicus*, and it is not clear to which of the two species the description refers.

The four species may be recognised by the following characters:—

- I. Ciliated and non-ciliated portions of external border of outer uropod separated by a small but distinct tooth; terminal segment of 3rd maxillipede not divided into sub-segments; 3rd thoracic sternite of female not produced backwards as a large plate.
  - A. Telson reaching beyond middle of inner uropod, its apex pointed, without spinules; a single clasping spine on external antennular flagellum of male.
    1. A tooth at distal end of inner margin of basis of 3rd peraeopods; 2nd segment of antennular peduncle fully three times as long as broad; petasma without membranous coupling folds, its internal lobe strongly expanded at its proximal end, the distal portion terminating simply ... *indicus*, Milne-Edwards.
    2. No tooth on basis of 3rd peraeopods; 2nd segment of antennular peduncle of female not more than two and a half times as long as broad; petasma with a pair of folded coupling membranes armed with hooks, internal lobe little expanded proximally, its distal portion terminating in two large pointed processes ... *erythraeus*, Nobili.
  - B. Telson not reaching beyond middle of inner uropod, its apex truncate with a spinule on either side; two clasping spines on external antennular flagellum of male [petasma without membranous coupling folds, its internal lobe very strongly expanded and conspicuously emarginate proximally, the distal portion terminating simply] ... *insularis*, sp. nov.
- II. Ciliated and non-ciliated portions of external border of outer uropod not separated by a tooth; terminal segment of 3rd maxillipede divided into three sub-seg-

ments; 3rd thoracic sternite of female produced backwards as a large plate, the posterior edge of which is free and emarginate [external antennular flagellum of male with two clasping spines; petasma without membranous coupling folds, its internal lobe not expanded proximally, the distal portion with bulbous termination and with a large process on its outer side]

... *japonicus*,  
Kishinouye.

In *A. erythraeus*, as already noted, the males are dimorphic, a form with a short antennular peduncle, resembling that of the female, being apparently by far the more abundant of the two. In the other three species only one type of male—a form with the ultimate segment of the peduncle greatly elongated—is known to occur.

The four species agree in the following particulars:—

The rostrum is exceedingly short and projects very little beyond the frontal margin of the carapace. It is, however, rather strongly elevated and terminates in a sharp point, behind which are two teeth, the foremost much the smallest. The anterior margin is almost vertical and is sinuous or concave.

The carapace is as long as, or rather longer than the first two and a half abdominal somites; it bears conspicuous post-orbital and hepatic spines. The cervical groove is obsolete and no trace of it exists on the dorsum of the carapace. The upper limit of the branchial region is defined posteriorly by a blunt longitudinal ridge.

The inner antennular flagellum is very long and in both sexes shows the curious flexure described in detail by Kishinouye.

The antennal scale is broadest at the base and is from 3·6 to nearly 4 times as long as wide. The outer margin is rather strongly convex and terminates in a small tooth that reaches almost to or a trifle beyond the distal end of the lamella.

The mandibular palp consists of three segments, the basal one being exceedingly small and inconspicuous. The propodus of the second maxillipedes is a trifle longer than the merus; the carpus is from two-thirds to three quarters its length and is fully three times the length of the dactylus.

The third, fourth and fifth segments of the third maxillipedes are more or less equal in length, while the fifth is from 1·25 to 1·4 times as long as the sixth.<sup>1</sup>

The first three peraeopods increase successively in length, the third pair reaching almost or quite as far as the third maxillipedes. In the first pair the merus is about as long as the chela; the latter segment being from 1·2 to 1·4 times the length of the carpus. In this pair of limbs, at the distal end of the carpus and at the

<sup>1</sup> The proportionate lengths of the segments appear to show minor specific characters. In *A. japonicus*, *A. erythraeus* and *A. insularis* the third segment is almost equal to, or a little longer than the fifth, whereas in *A. indicus* the former is decidedly shorter than the latter. In *A. erythraeus* the third and fourth segments, taken together, are 1·3 times the length of the fifth and sixth, in *A. insularis* and *A. japonicus* 1·2 times and in *A. indicus* 0·94 to 1·1 times.

proximal end of the propodus, there is (in both sexes and in all four species) a patch of short barbed spinules, which, when the segments are flexed, forms a sort of grasping organ.

The merus and carpus of the second pair are about equal in length<sup>1</sup>; the carpus is from 1.1 to 1.3 times as long as the chela. In the third peraeopods the merus is a little shorter than the carpus and a little longer than the chela. The carpus is from 1.3 to 1.4 times the length of the chela. In the male, in the position normally occupied by the fourth pair of legs, there are two bluntly pointed and forwardly directed processes.

The branchiae resemble those found in the genus *Sergestes* and do not appear to afford any specific differences in the four forms under consideration. The formula is:—

	vii	viii	ix	x	xi	xii	xiii	xiv
Podobranchiae ...	ep.	1+ep.	...	...	...	...	...	...
Arthrobranchiae ...	...	...	...	...	...	...	...	...
Pleurobranchiae ...	...	...	1	1	1	1	1	...

This formula agrees with that given by Ortmann<sup>2</sup> except that a small podobranch is present at the base of the second maxillipede. This branchia is perhaps absent in the Atlantic species that Ortmann examined.

Arranged according to length, the order of the abdominal somites is 6, 4, 1, 3, 5, 2; the sixth is about twice the length of the fifth and its greatest breadth is from 1.6 to 2.0 times its length. The sixth somite is provided with a single very small spinule, placed dorsally on the posterior margin. The telson is sulcate above and is much shorter than the inner uropod.

### Genus *Acetes*, Milne-Edwards.

1830. *Acetes*, Milne-Edwards, *Ann. Sci. nat., Paris*, XIX, p. 350.

1837. *Acetes*, Milne-Edwards, *Hist. nat. Crust.*, II, p. 429.

### *Acetes indicus*, Milne-Edwards.

(Text-figs. 1a, b, 2a, 3a, 4a, 5c, 7a.)

1830. *Acetes indicus*, Milne-Edwards, *Ann. Sci. nat., Paris*, XIX, p. 351, pl. xi, figs. 1-9.

1837. *Acetes indicus*, Milne-Edwards, *Hist. nat. Crust.*, II, p. 430.

? 1852. *Acetes indicus*, Dana, *U.S. Explor. Exped., Crust.*, I, p. 608.

? 1890. *Acetes indicus*, Walker, *Fourn. Linn. Soc., Zool.*, XX, p. 112.

? 1893. *Acetes indicus*, Henderson, *Trans. Linn. Soc., Zool.* (2), V, p. 452.

? 1905. *Acetes indicus*, Pearson, *Ceylon Pearl Oyster Rep.*, IV, p. 75.

<sup>1</sup> The merus is a shade longer than the carpus in *A. japonicus* and *A. erythraeus*, a trifle shorter than the carpus in *A. indicus* and *A. insularis*.

<sup>2</sup> Ortmann, *Decap. Schizop. Plankton. Exped.*, p. 39 (1893).

Except for the fact that fig. 9 of his illustrations shows a tooth on the outer margin of the external uropod—a character which indicates that the species is not the same as Kishinouye's *A. japonicus*—there is nothing in Milne-Edwards' description to indicate the precise identity of the form he examined. His material was, however, obtained from the mouth of the Ganges, in which, so far as I am aware, only one species exists, though three occur in the Bay of Bengal. The principal specific characters are as follows:—

The eye is longer than in the other species and is a little more than one-third the length of the carapace. The stalk is rather more slender than usual and its length, in proportion to that of the cornea, is greater.

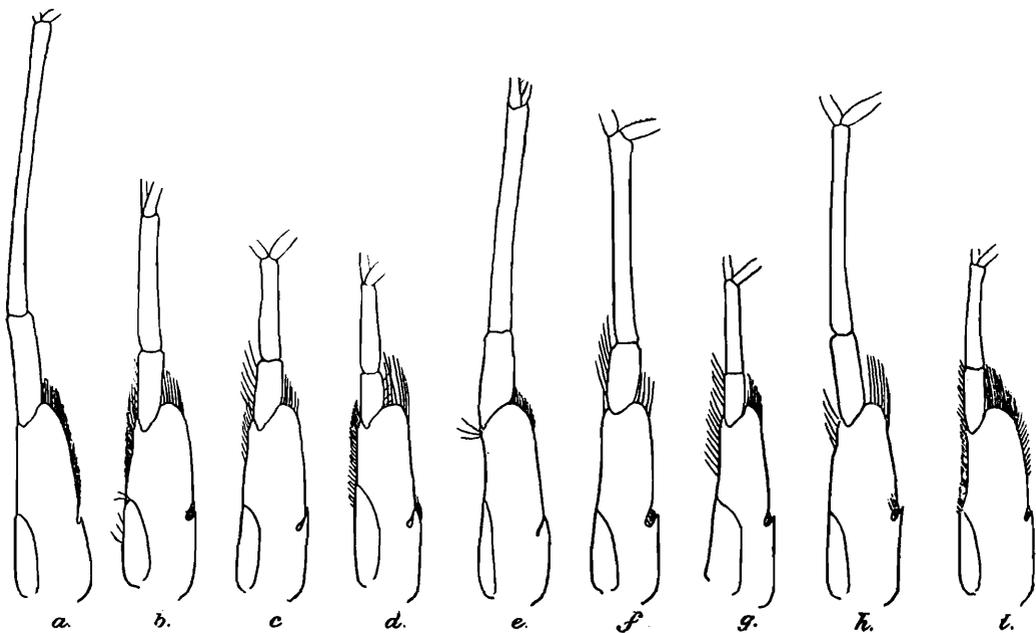


FIG. 1.—Right antennular peduncle in dorsal view.

- |  |                                 |
|--|---------------------------------|
| a. <i>Acetes indicus</i> , ♂.          | f. <i>Acetes insularis</i> , ♂. |
| b. " " ♀.                              | g. " " ♀.                       |
| c. <i>Acetes erythraeus</i> , "low" ♂. | h. <i>Acetes japonicus</i> , ♂. |
| d. " " ♀.                              | i. " " ♀.                       |
| e. " " "high" ♂.                       |                                 |

The basal segment of the antennular peduncle in the female is about the same length as that of the two distal segments combined; the second segment is from 3 to  $3\frac{1}{2}$  times, and the third segment from 6 to  $6\frac{1}{2}$  times as long as broad (text-fig. 1b). In the male the second segment is sometimes more slender than in females, but the ultimate segment is always greatly elongated, much longer than the first, and from 10 to 14 times as long as broad (text-fig. 1a).

The outer antennular flagellum of the male bears a single large clasping spine, with finely serrate inner margin; on the segment opposite the tip of this spine there is a group of 5 to 7 close-set spinules. The two basal segments of the flagellum are unusually long (text-fig. 2a).

The third maxillipedes, when extended forwards, reach a little beyond the tips of the third pereiopods and, in the female, much beyond the end of the antennular peduncle. The ultimate segment is not divided into sub-segments. The basal segments of the third maxillipedes and pereiopods are proportionately stouter than in

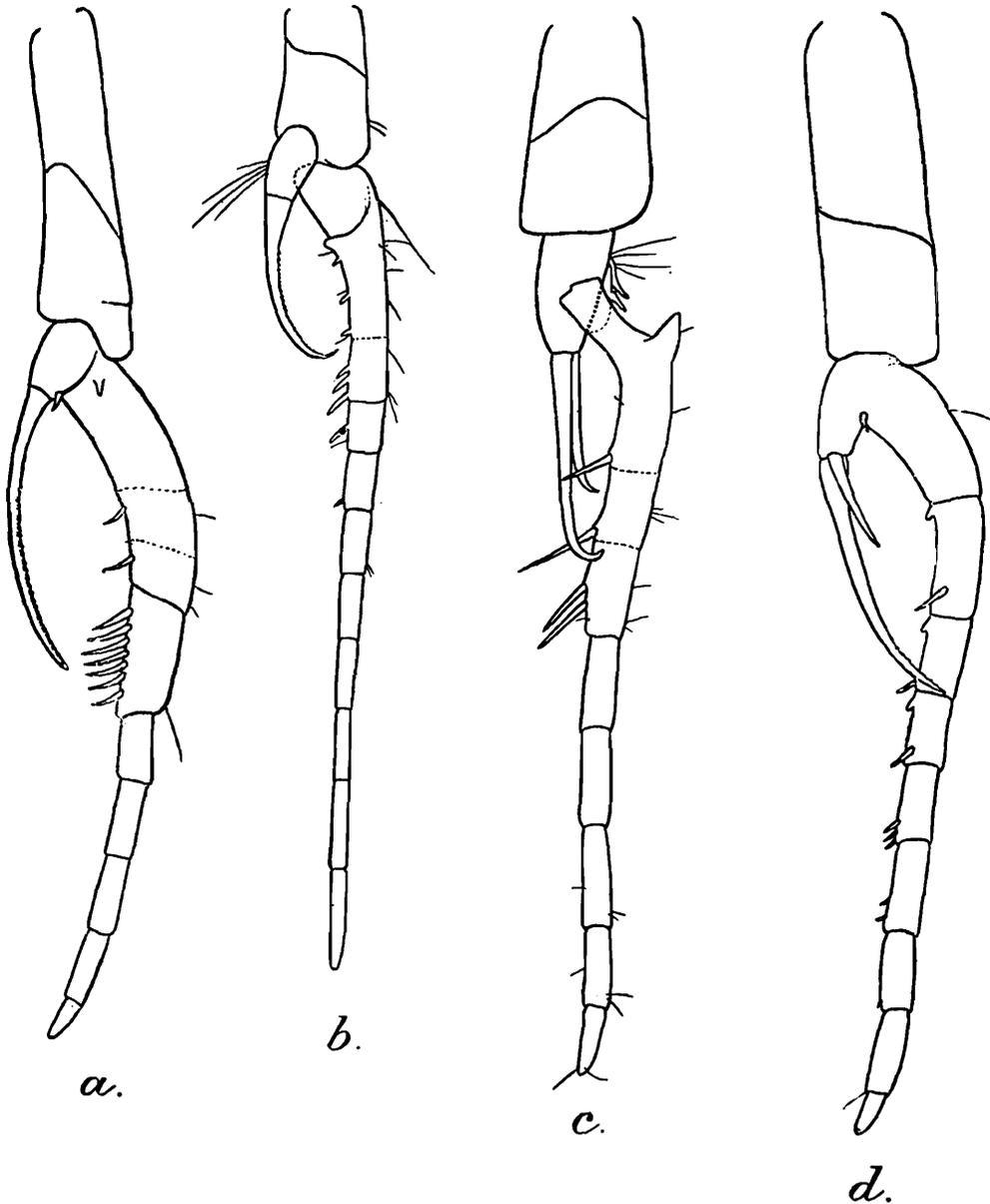


FIG. 2.—Outer antennular flagellum of male.  
*a. Acetes indicus.* *c. Acetes insularis.*  
*b. Acetes erythraeus.* *d. Acetes japonicus.*

other species, and the setae with which the limbs are clothed are longer and more numerous.

The basis of the third pereiopod bears a large tooth on its inner margin close to the insertion of the ischium (text-fig. 3*a*), a character not found in any of the other three species.

The third thoracic sternite of the female is very deeply channelled longitudinally, the channel being continued backwards on

to the anterior portion of the fourth sternite. The anterior margin of the third sternite is deeply sunk and transverse or slightly concave. Behind the inner angles of the coxae of the third legs there is, on either side, a conspicuous tubercle (text-fig. 3a).

Between the bases of the first pleopods, both in males and females, there is a large procurved tooth.

The outer lobe of each half of the petasma (that is to say the portion nearest the pleopod) is more or less crescentic in shape with the antero-external border strongly thickened; the shape of this portion is similar in all four species. The internal lobe is characteristic in form. At its proximal end it is truncate, much expanded externally and with a small process at its inner angle. Its distal portion is without any large processes, such as are found in certain allied species, and appears to consist of a central style surrounded by a thick coating, rather uneven in outline; its surface has a sort of honey-combed appearance, due to the presence of numerous small pits, each of which contains a modified hooklet (text-fig. 4a).

The telson reaches well beyond the middle of the inner uropod and is rather sharply pointed at the apex (text-fig. 5c). The angular termination of the lobe at the proximal end of the infero-lateral margin is placed decidedly nearer the base than the apex.<sup>1</sup>

The ciliated and non-ciliated portions of the external border of the outer uropods are separated by a prominent tooth. In adults the proximal non-ciliated part is from 1.1 to 1.3 times the length of the ciliated part (text-fig. 7a); in young individuals the proportionate length of the former is rather greater.

*Acetes indicus* is the largest of the four species; full grown females, measured from the tip of the rostrum to the tip of the telson, reach a length of about 40 mm.

The specimens examined are from the following localities:—

$\frac{9702}{10}$	Panvel Creek, Bombay	...	J. Caunter.	Many.
$\frac{9703}{10}$	Market at Ennur, near Madras	...	N. Annandale.	Several.
$\frac{3525-6}{7}$	Coconada, Madras Pres.	...	G. W. Wicks.	Two.
$\frac{9704}{10}$	Pratapnagore, Lower Bengal	...	Mus. Collr.	Few.
$\frac{9716}{10}$	Near Mud Point, R. Hugli, Gangetic delta	... ..	T. Southwell.	Few.
$\frac{9705}{10}$	Matla R., Gangetic delta	...	J. T. Jenkins.	Two.
$\frac{9707}{10}$	Bassein R. estuary, Burma	...	'Investigator.'	Many.
$\frac{9710}{10}$	Haingyi I., off Bassein R.	...	"	One.
$\frac{9708}{10}$	S. of Purian Pt., Burma	...	"	Many.
$\frac{9706}{10}$	Mouth of Rangoon R., Burma	...	"	Several.
$\frac{3430}{10}$	Green I., Amherst, Tennasserim	...	"	Many.
$\frac{9709}{10}$	Mergui Archipelago, 11°28' N., 98°36' E.	...	"	Few.
$\frac{9711}{10}$	Mergui Archipelago, 12°0' N., 98°20' E.	...	"	Several.
$\frac{9712}{10}$	Tale Sap, Gulf of Siam	... ..	N. Annandale.	Several.

<sup>1</sup> As in *A. erythraeus*. text-fig. 5a.

In several of these localities the species was undoubtedly obtained in brackish water, the lowest specific gravity of which I have a definite record being 1.0015 (corrected) in the case of certain specimens from the Tale Sap. On the other hand the records from Coconada, Green I. and the Mergui Archipelago indicate that the species also occurs in the open sea near land.

*A. indicus* was found in company with *A. japonicus* in the Tale Sap and in the Mergui Archipelago, and with *A. erythraeus* at Ennur.

The distribution of the species, as far as at present known, may be summarised as,—Bombay, Bay of Bengal and Gulf of Siam. The characters mentioned by Milne-Edwards being insufficient to determine the species with any exactitude, the records by Dana, Walker, Henderson and Pearson are open to doubt. Even if accepted, they would not indicate any marked increase in our knowledge of the distribution of the species.

### *Acetes erythraeus*, Nobili.

(Text-figs. 1c-e, 2b, 3b, 4b, 5a,d, 7b.)

1905. *Acetes erythraeus*, Nobili, *Bull. Mus. d'Hist. nat., Paris*, p. 394, text-fig. 1.

1906. *Acetes erythraeus*, Nobili, *Ann. Sci. nat., Paris* (9), IV, p. 23, pl. i, figs. 5, 5a-f.

The eyes are not quite so long as in *A. indicus*, being only about one-third the length of the carapace; the stalk is also stouter and, proportionately to the length of the cornea, rather shorter.

The basal segment of the antennular peduncle of the female is about 1.3 times the length of the two terminal segments combined; the second segment is decidedly stouter than in *A. indicus*, the length being not more than  $2\frac{1}{2}$  times the greatest breadth; the third segment is from 4 to  $4\frac{1}{2}$  times as long as wide (text-fig. 1d). In males a well-marked dimorphism appears to exist in respect of the proportions of the peduncular segments. In four small males from Penang, otherwise practically indistinguishable from the rest of the specimens in the collection, the ultimate segment is greatly elongated, precisely as in *A. indicus*. The second segment in these examples is about 3 times as long as broad, while the third is longer than the first and about  $9\frac{1}{2}$  times as long as broad (text-fig. 1e). All the other males in the collection differ widely from the Penang individuals and from the males of any of the other three species, the antennular peduncle bearing a close resemblance to that of the female. In such specimens the basal segment is from 1.1 to 1.3 times the length of the two following, the second segment is from 2 to  $2\frac{1}{4}$  times and the third from 4 to nearly 5 times as long as broad (text-fig. 1c).

The outer antennular flagellum of the male closely resemble that of *A. indicus*, and possesses only one clasping spine; the two basal segments are, however, shorter. In the males from Penang

the tip of the large spine is opposed by a group of 5 spinules, exactly as in *A. indicus*; in the others, as shown in text-fig. 2b, only 2 or 3 spinules occur in this position. The segment immediately in front of that bearing the clasping spine bears an angular lobule.

The third maxillipedes, when stretched forwards, reach about as far as the third peraeopods, and extend to the end of the antennular peduncle. There is no tooth on the inner border of the basis of the third peraeopods.

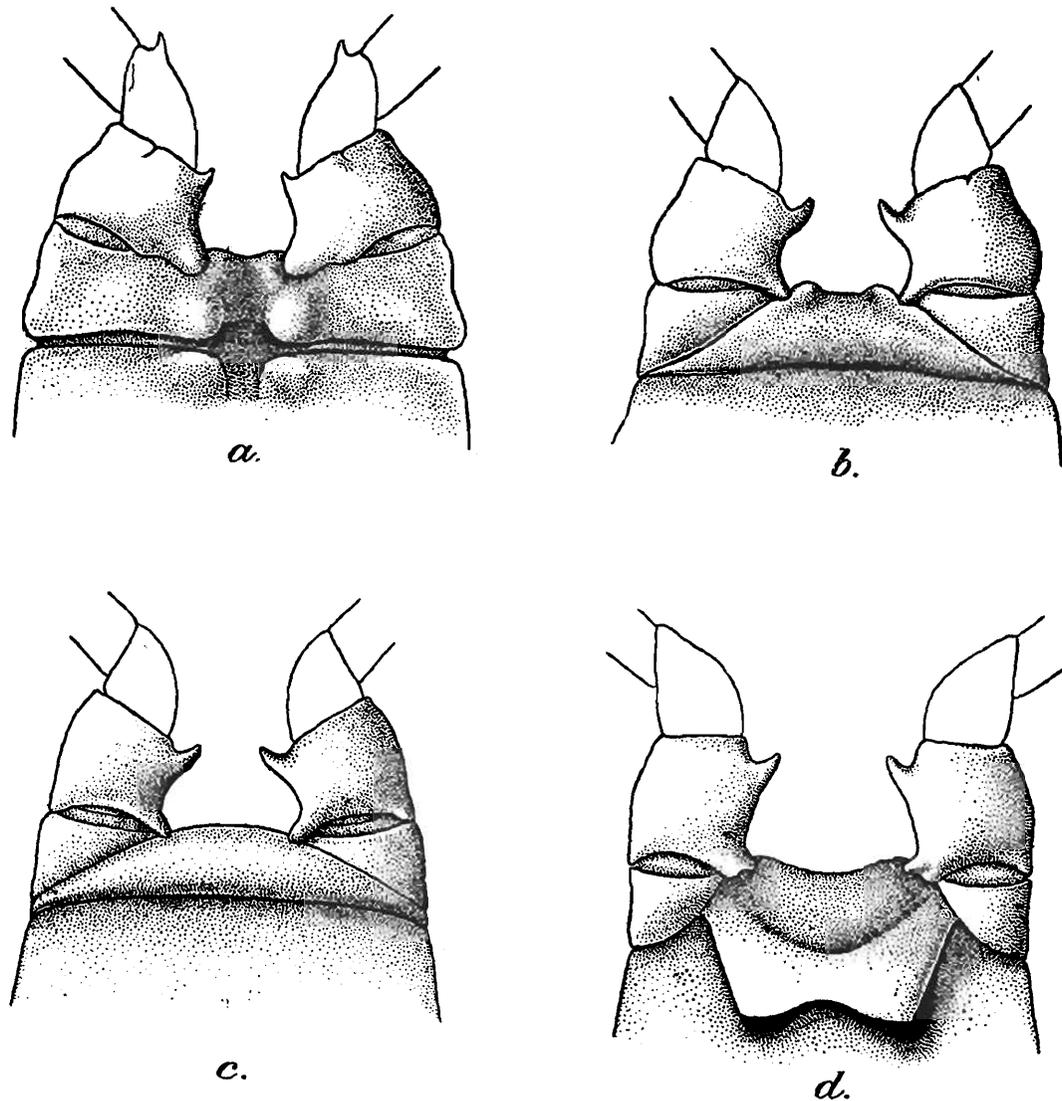


FIG. 3.—Third thoracic sternite and basal segments of third peraeopods of female.

a. *Acetes indicus*.  
b. *Acetes erythraeus*.

c. *Acetes insularis*.  
d. *Acetes japonicus*.

The third and fourth thoracic sternites of the female show only faint traces of the deep longitudinal channel found in *A. indicus* and the former does not possess the pair of tuberculiform eminences present in that species. The third sternite is broadly triangular in shape; its anterior margin is elevated and is concave in the middle with a small rounded lobe on either side (text-fig. 3b).

As in *A. indicus* there is in both sexes a large hooked tooth between the bases of the first pleopods.

The petasma differs from that of any other species examined in the possession of a pair of folded membranes on the anterior surface. The free edge of each is furnished with a series of minute hooks, by means of which the two halves of the petasma are coupled. The internal lobe is truncate and slightly concave at its proximal end, but is not broadly expanded as in *A. indicus*. The distal portion of the same lobe terminates in two large pointed processes with their apices directed obliquely outwards. The inner of these processes is larger and broader than the other and bears on its anterior surface two large falcate spines (text-fig. 4*b*).

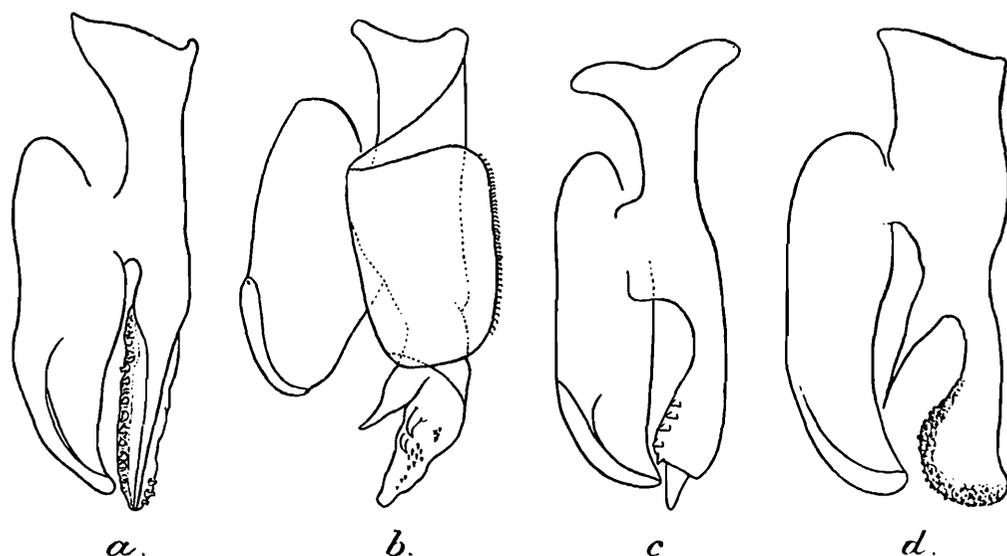


FIG. 4.—Right half of petasma, seen from in front.

a. *Acetes indicus*.

c. *Acetes insularis*.

b. *Acetes erythraeus*.

d. *Acetes japonicus*.

The telson resembles that of *A. indicus*, but the tip is not quite so sharply pointed (text-figs. 5*a*, *d*).

The ciliated and non-ciliated portions of the external border of the outer uropod are separated by a small tooth. The non-ciliated portion in adults is from 1.5 to 1.7 times the length of the ciliated part (text-fig. 7*b*), a proportion differing considerably from that found in *A. indicus*.

This species is smaller than *A. indicus*, large females being not more than 28 mm. in length. The males from Penang are only 14 mm. in length, whereas those from other localities may reach 20 mm.

The occurrence of dimorphic males in this species is a feature of considerable interest, but further information is necessary before the phenomenon can be profitably discussed: it is unfortunate that such a small number of specimens are available from Penang. The case does not appear to be one of seasonal sexual dimorphism, for the males from Penang, all of which are of the

“high” form, were caught in the month of February, whereas those of the “low” form, exclusively obtained in other localities were obtained in the months of January, February, March and April.

*Acetes erythraeus* was described by Nobili from the Red Sea; the specimens in the Indian Museum are from the following localities:—

$\frac{96.95}{10}$	Market at Ennur, near Madras...	N. Annandale.	Few.
$\frac{96.96}{10}$	Backwater at Vizagapatam, Madras Pres. ... ..	S. Kemp.	Many.
$\frac{96.97-9}{10}$	Puri, Orissa Coast ... ..	{ N. Annandale, J. Caunter & S. Kemp.	Many.
$\frac{97.00}{10}$	Mouth of the Prai R., opposite Penang ... ..	N. Annandale.	Four.
$\frac{97.01}{10}$	Patani R., below town of Patani, Siamese Malay States ... ..	„	Few.

The specimens from the Patani river were found in water that was fresh at the time of their capture, but in a situation subject to tidal influence. Those from Puri were found in the open sea in water having a specific gravity of about 1.0260 (corrected).

The distribution of the species, so far as known, may be given as,—Red Sea, west side of Bay of Bengal, Penang, Gulf of Siam.

#### *Acetes insularis*, sp. nov.

(Text-figs. 1f, g, 2c, 3c, 4c, 5b, e, 7c.)

The eyes are about one-third the length of the carapace and do not differ in any marked degree from those of *A. erythraeus*.

The basal segment of the antennular peduncle of the female is about  $1\frac{1}{2}$  times the length of the two ultimate segments combined; the second segment is about  $3\frac{1}{3}$  times, and the third from  $4\frac{3}{4}$  to 5 times as long as broad (text-fig. 1g). In the male the second segment is rather stouter than in the female, not more than  $2\frac{1}{2}$  times as long as broad. The third is greatly lengthened, longer than the first and from 9 to 10 times as long as broad (text-fig. 1f).

The outer antennular flagellum of the male bears two clasping spines in place of the single one found in *A. indicus* and *A. erythraeus*; one spine is larger than the other, and the inner margins of both are smooth. The two basal segments of the flagellum are short. There is also a curious apparatus not met with in any of the other three species. The segment in advance of that which bears the two large spines bears, on the side remote from the spines, a large angular process pointing backwards and, on the same side, behind the proximal end of the same segment are two small spinules with their tips directed forwards. Judging from their appearance these structures form a subsidiary clasping apparatus that comes into action when the main grasping organ is opened to its fullest extent. The segments opposite the tips of

the large spines bear one or two long spinules near their distal ends (text-fig. 2c).

The external maxillipedes reach barely to the end of the second segment of the antennular peduncle and are slightly exceeded in length by the third pereopods. There is no tooth on the inner margin of the basis of the latter pair of limbs.

The third thoracic sternite of the female is broadly triangular in shape; it is not grooved longitudinally and the anterior margin is elevated and more or less transverse (text-fig. 3c). The characters are difficult to see owing to the small size of the species.

The large procurved tooth found in *A. indicus* and *A. ery-*

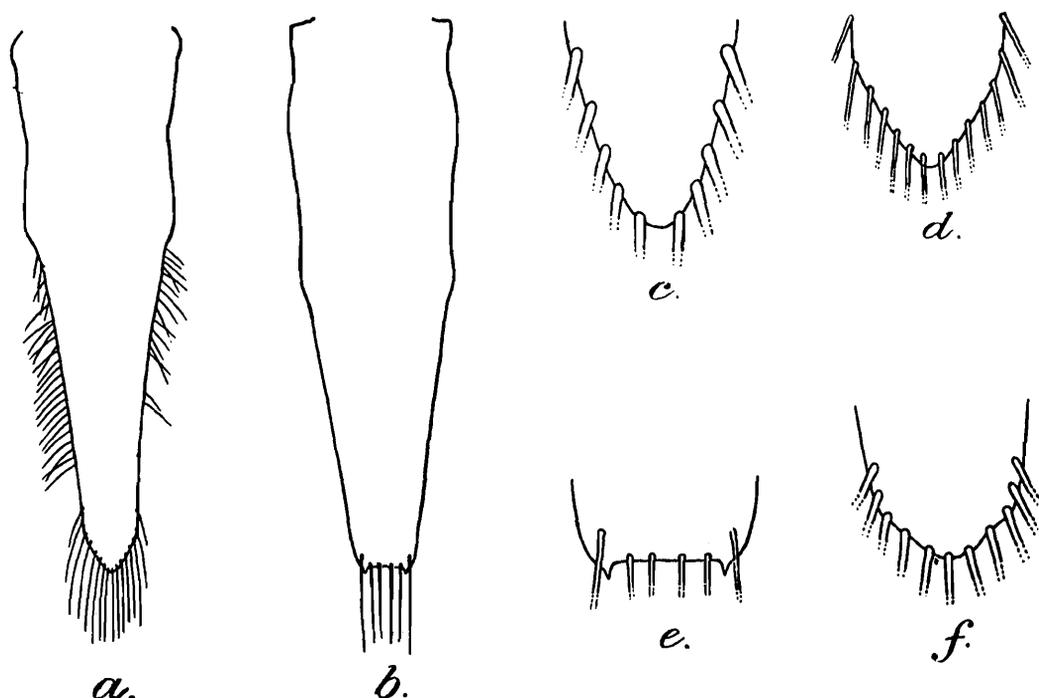


FIG. 5.--Telson in dorsal view.

a. *Acetes erythraeus.*

b. *Acetes insularis.*

Apex of telson in dorsal view.

c. *Acetes indicus.*

e. *Acetes insularis.*

d. *Acetes erythraeus.*

f. *Acetes japonicus.*

*thraeus* between the bases of the first pleopods is replaced by a small bluntly pointed process.

The internal lobe of the petasma is very greatly expanded at its proximal end, both internally and externally, and the posterior border is conspicuously emarginate. The distal portion somewhat resembles that of *A. indicus*, but is more swollen. At the tip there is a single great conical tooth and near the outer edge a series of 5 or 6 modified teeth (text-fig. 4c).

The telson is characteristic. It is shorter than in either of the two preceding species and reaches barely to the middle of the inner uropod. The angular termination of the lobe at the proximal end of the infero-lateral margin is placed midway between the base and the apex, whereas it is situated much nearer the base in the

two preceding species (*cf.* text-figs. 5*a* and *b*). The tip is truncate, straight or very slightly convex, and bears on either side a small tooth (text-fig. 5*e*). Occasionally one or other of these teeth is missing.

The ciliated and non-ciliated portions of the external border of the outer uropod are separated by a small tooth. In adults the non-ciliated part is from 1.2 to 1.4 times the length of the ciliated part (text-fig. 7*c*).

*Acetes insularis* is a small species, large females not exceeding 18 mm. in length.

The collection contains specimens from one locality only:—

$\frac{9714-6}{10}$	Mouth of Rajang R., Sarawak,			
	Borneo	...	...	Mus. Collr. Many.

The types bear the number 9714/10 in the register of the Zoological Survey of India.

### *Acetes japonicus*, Kishinouye.

(Text-figs. 1*h*, *i*, 2*d*, 3*d*, 4*d*, 5*f*, 6, 7*d*.)

1905. *Acetes japonicus*, Kishinouye, *Annot. Zool. Japon.*, V, p. 163, text-figs.

The eyes resemble those of the two preceding species but are rather shorter, a little less than one-third the length of the carapace.

The basal segment of the antennular peduncle of the female is about  $1\frac{1}{5}$  times the length of the second and third segments combined; the second segment is fully 3 times and the third  $5\frac{1}{2}$  times as long as broad (text-fig. 1*i*). In the male the proportions of the second segment are about the same; the third segment is greatly lengthened as in *A. indicus* and *A. insularis*; it is longer than the basal segment and at least 10 times as long as broad (text-fig. 1*h*).

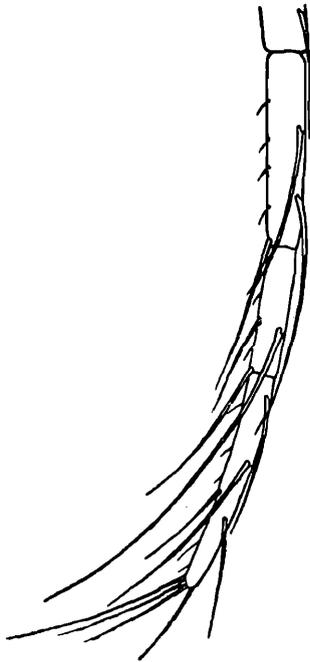


FIG. 6.—*Acetes japonicus*.  
Terminal segment of outer  
maxillipede.

The outer antennular flagellum of the female resembles that of *A. insularis* in the possession of two clasping spines, but does not bear the additional apparatus found in that species. One of the two clasping spines is very much longer than the other and is feebly serrate on its inner margin near the apex. The segments opposite the tips of the clasping spines each bear a small blunt process at the proximal end and one or two short spinules distally (text-fig. 2*d*).

The external maxillipedes do not reach quite so far forwards as the third peraeopods and extend to, or a little beyond the apex of the antennal scale. The terminal segment of the external maxillipede differs from that of all the other species in being divided into three sub-segments; of these the middle one is the shortest and the last the longest (text-fig. 6). There is no tooth on the inner margin of the basis of the third peraeopods.

The third thoracic sternite of the female is altogether peculiar; it projects backwards from the base of the third legs in the form of a large plate, posteriorly overlying the fourth sternite. It is slightly depressed in the middle line, its lateral edges are posteriorly convergent and its distal margin, which is free, and in consequence easily visible in lateral view, is conspicuously emarginate (text-fig. 3*d*).

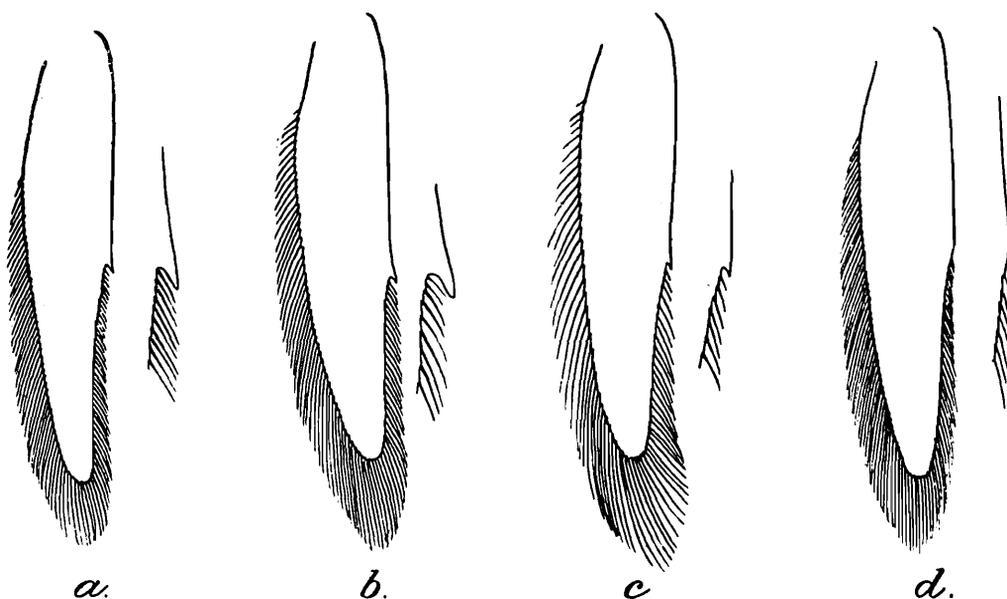


FIG. 7.—Outer uropod, with portion of external margin more highly magnified.

a. *Acetes indicus*.

b. *Acetes erythraeus*.

c. *Acetes insularis*.

d. *Acetes japonicus*.

The large-hooked tooth found in *A. indicus* and *A. erythraeus* between the bases of the first pleopods is replaced, as in *A. insularis*, by a small pointed process.

The internal lobe of the petasma is truncate at its proximal end and scarcely at all expanded. The distal portion is bulbous at the tip and set with numerous minute hooklets; on its outer side it bears a large process usually terminating in a long and very fine point (text-fig. 4*d*). The length of this pointed process is variable; sometimes it reaches to the end of the lobe to which it is attached, while occasionally it terminates abruptly with a blunted apex.

The sixth abdominal somite, in lateral view, is a little more slender than in the other species, its length being usually twice its greatest depth.

The telson resembles that of *A. erythraeus* and *A. indicus*, but the tip is rounded rather than pointed (text-fig. 5f). I have not been able to detect the pair of small teeth mentioned by Kishinouye, but the outer corners of the apex are sometimes a little angular.

The external border of the outer uropod differs from that of all the other three species in the complete absence of the tooth between the ciliated and non-ciliated portions. In adults, moreover, the latter part is a little longer than the former, the reverse being the case in the other forms (text-fig. 7d). In very young specimens the proportions are rather different, the non-ciliated part being equal to, or even a trifle longer than the ciliated part.

Large specimens reach a length of about 26 mm.

*Acetes japonicus* was described by Kishinouye from the Inland Sea of Japan and from Korea. Specimens in the Indian Museum are from the following localities:—

$\frac{9684.5}{10}$	Mormugao Bay, Portuguese India	...	S. Kemp.	Many.
$\frac{9686}{10}$	Kilakarai, Ramnad dist., S. India	...	„	Three.
$\frac{9694}{10}$	Ennur backwater, near Madras	...	N. Annandale.	Three.
$\frac{9687.9}{10}$	Mergui Archipelago, 11°17'—11°28'N., 98°29'—98°36' E	... ..	Investigator.'	Several.
$\frac{9690}{10}$	Patani R., below town of Patani, Siamese Malay States ...	... ..	N. Annandale.	Six.
$\frac{9691}{10}$	Tale Sap, near Singgora, G. of Siam	...	„	Many.
$\frac{9692}{10}$	From market, Osaka, Japan	...	„	Many.
$\frac{9693}{10}$	Niigata, Japan ...	... ..	?	Several.

In the Patani river the species was found in fresh water, but in a situation subject to tidal influence; in Mormugao Bay it was taken in water of specific gravity 1.0165 (corrected), while at Kilakarai it was obtained in pure sea water in the vicinity of a coral reef.

The species was found in the Mergui Archipelago and in the Tale Sap in company with *A. indicus*, and in the Patani river with *A. erythraeus*.

The known distribution may be summarised as,—W. and S. coasts of India, lower parts of Bay of Bengal, Gulf of Siam, Korea, Japan.

