INDIAN SPECIES OF THE GENUS *APUS* (CRUSTACEA BRANCHIOPODA) WITH DESCRIPTION OF TWO NEW SPECIES.

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INTRODUCTION.

Sometime ago Mr. P. I. Chacko, Assistant Director of Fisheries, Madras State, sent one specimen of *Apus*, collected during April 1949, from the Nagasunni Temple Tank, Tirunelveli District (Madras State), for identification to the Zoological Survey of India. This specimen appears to be closely allied to *Apus sudanicus* Brauer, and may perhaps be identical with it. The discovery of the genus *Apus* in South India is interesting and a note, recording this occurrence, has been published by Mr. Chacko elsewhere.[1] Another lot of sixteen specimens of *Apus* collected by Mr. K. S. Pradhan at Mavli in Rajputana in October 1948, proved to belong to a new species and it is described below as *Apus mavliensis*, sp. nov. Recently Dr. S. L. Hora, Director, Zoological Survey of India, handed over to me two tubes containing reddish and greenish specimens of *Apus* collected at Panchgani. These specimens are identical with those described as *Apus asiaticus* by Gurney from this locality, earlier on two occasions. A detailed study of these specimens, along with other material of *Apus* from Panchgani preserved in the Zoological Survey, has convinced me that the Panchagani examples do not seem to be conspecific with *Apus asiaticus* Gurney (=*Apus granarius* Sars, *nec* Lucas) from Central Asia. I, therefore, propose a new specific name *Apus orientalis*, sp. nov., for the Panchagani examples.

The relative value of the characters, on which species of *Apus* are based, is very doubtful in many cases, since these characters depend to a great extent on the state of preservation of the specimens. Barnard (*vide infra.* pp. 229-234), while assessing the diagnostic value of various characters in the genus *Apus*, suggested that the most reliable characters for specific diagnosis are the shape of carapace, shape of nuchal organ and the number of apodal segments. To these I may add the total number of movable somites, as this character is independent of the state of contraction or expansion of the animal.

The species of *Apus* dealt with in this paper, can be distinguished as follows :—

1. Nuchal organ triangular—
   i. Number of movable somites 41-42 .. .. .. *A. asiaticus* Gurney.
   ii. Number of movable somites 36-39—
      a. Apodal segments 11-13 in females, 12-14 in males. .. .. .. *A. orientalis*, sp. nov.
      b. Apodal segments 8-10 in females .. .. *A. mavliensis*, sp. nov.
2. Nuchal organ oval—
   i. Apodal segments 6-8 in males, 5-8 in females *A. cancriformis* Sch.
   ii. Apodal segments 10 in male .. .. *Apus* sp. prox. *sudanicus* Brauer.

[1]Chacko, P. I., *Journ. Bombay Nat. Hist. Soc.* XLIX, p. 571 (1950).

Systematic Account.

Apus asiaticus Gurney.

1901. *Apus granarius*, Sars, *Ann. Mus. Petersb.*, VI, pp. 131-142, pl. i, figs. 1-7 & pl. ii, figs. 1-12. (*nec. Apus granarius*, Lucas, *Bull. Entom. Paris*, 1864.)

1921. *Apus asiaticus*, Gurney, *Jour. Bombay Nat. Hist. Soc.* XXVII, pp. 836-838.

Gurney proposed a new name, *Apus asiaticus*, for the specimens from the Chinghan Mountains in Central Asia, referred by Sars to *A. granarius* Lucas, and included a collection of *Apus* from Baghdad under the former species. In 1924 and 1925 (*vide infra*) he extended the range of this species to India, by referring to it some examples collected at Panchagani, near Poona (Bombay State).

I have carefully examined a large number of specimens collected at Panchagani on different occasions, and I am of the opinion that these specimens are not identical with the Central Asian forms. I, therefore propose a new name, *A. orientalis*, sp. nov., for the Indian examples.

The Central Asian examples, belonging to *A. asiaticus* Gurney (*s.s.*), differ from the Indian examples in the following features :—

(i) The angles of the nuchal organ are rounded.

(ii) Total number of movable somites are 41-42.

(iii) The abdomen is relatively much longer than carapace and 32-33 abdominal somites are exposed in dorsal view.

(iv) The fifth endite of the first thoracic legs is much shorter than the carapace.

(v) The posterior sinus of carapace is broader and shallower than in *A. orientalis*.

The examples from Baghdad are probably more related to Central Asian forms, referable to *A. asiaticus*.

Apus orientalis, sp. nov.

1924. *Apus asiaticus*, Gurney (pp.), *Ann. Mag. Nat. Hist.* (9) XIV, pp. 566-568.

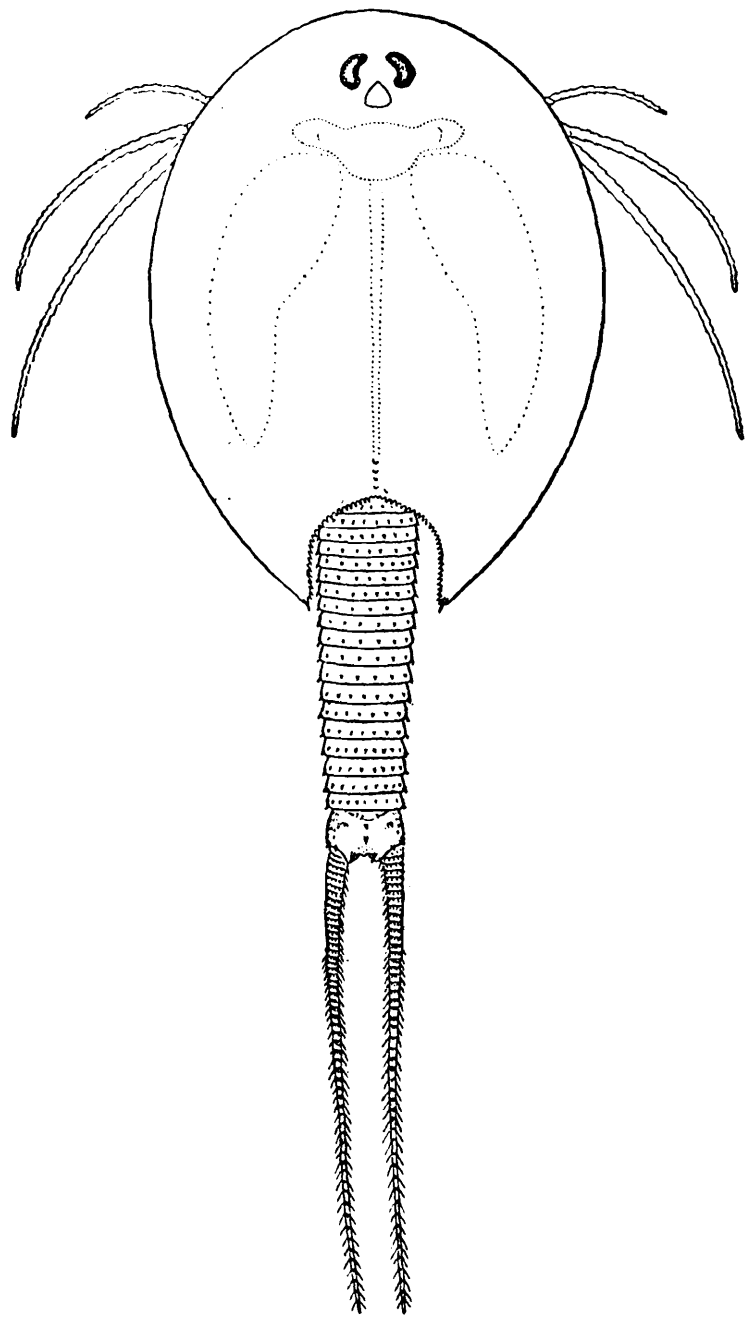
1925. *Apus asiaticus*, Gurney, *Rec. Ind. Mus.* XXVII, p. 440.

This species includes Indian examples from Panchagani, earlier identified by Gurney as *A. asiaticus*.

This species is characterised by the following features :—

Carapace is orbicular and broadly rounded in front (text-fig. 1). The nuchal organ is rounded, with apex somewhat pointed. Posterior sinus is slightly notched in the middle and its outer angles are somewhat produced. It bears 42 to 56 spines on its free edge. The fifth endite of first pair of thoracic legs usually reaches the posterior end of carapace in males.

The exposed part of abdomen in most of the well preserved specimens is longer than carapace in large examples but distinctly sub-equal to, or shorter than the latter in smaller individuals. The caudal furca, when unbroken, are about as long or somewhat longer than the exposed part of abdomen.



TEXT-FIG. 1.—*Apus orientalis*, sp. nov., ♀, dorsal view : ×3.

The number of abdominal somites, exposed behind the posterior limit of carapace is variable to a great extent and depends on the size of the individual as well as the state of its preservation. Although the total number of movable somites of the animal or the number of apodal somites do not vary much with age, the length of abdomen does appear to increase

with growth in this species. There also does not appear to be any sexual dimorphism in the length of abdomen. In 31 individuals (18♂♂,13,♀♀) the following figures express the number of exposed dorsal somites :—

No. of exposed somites (including telson).	No. of specimens.
18	1
19	3
20	3
21	2
22	5
23	7
24	2
25	6
26	..
27	1
28	1
	31

The apodal somites are less variable in number and seem to be correlated with sex. In 45 specimens of both sexes the number of apodal somites (including the telson) is as under.—

No. of apodal somites.	No. of specimens. ♂♂	♀♀
11	—	1
12	5	13
13	21	1
14	4	—
	30	15

Thus, generally speaking, males have 13 and females have 12 apodal somites, although the ranges are 11-13 for females and 12-14 for males. The total number of movable somites varies from 37-39 (generally 38-39). The telson (text-fig. 3*b*) resembles that of *A. asiaticus*.

Gurney (1925) states that " females are deep green in colour while males are paler and tend towards a brownish tinge " To me, however, the coloration appears to be independent of sex. I have examined two freshly collected samples of this species from Panchagani. One of the samples was labelled as " greenish variety " while the other was " reddish variety " In both these samples males outnumbered the females, there being two females and eleven males in the " greenish " sample while only one female and ten males in the " reddish " one. These two

samples were almost similar, except that the reddish specimens had the exposed part of abdomen somewhat shorter and with lesser number of segments.

Distribution.—Panchagani, Satara District (Bombay).

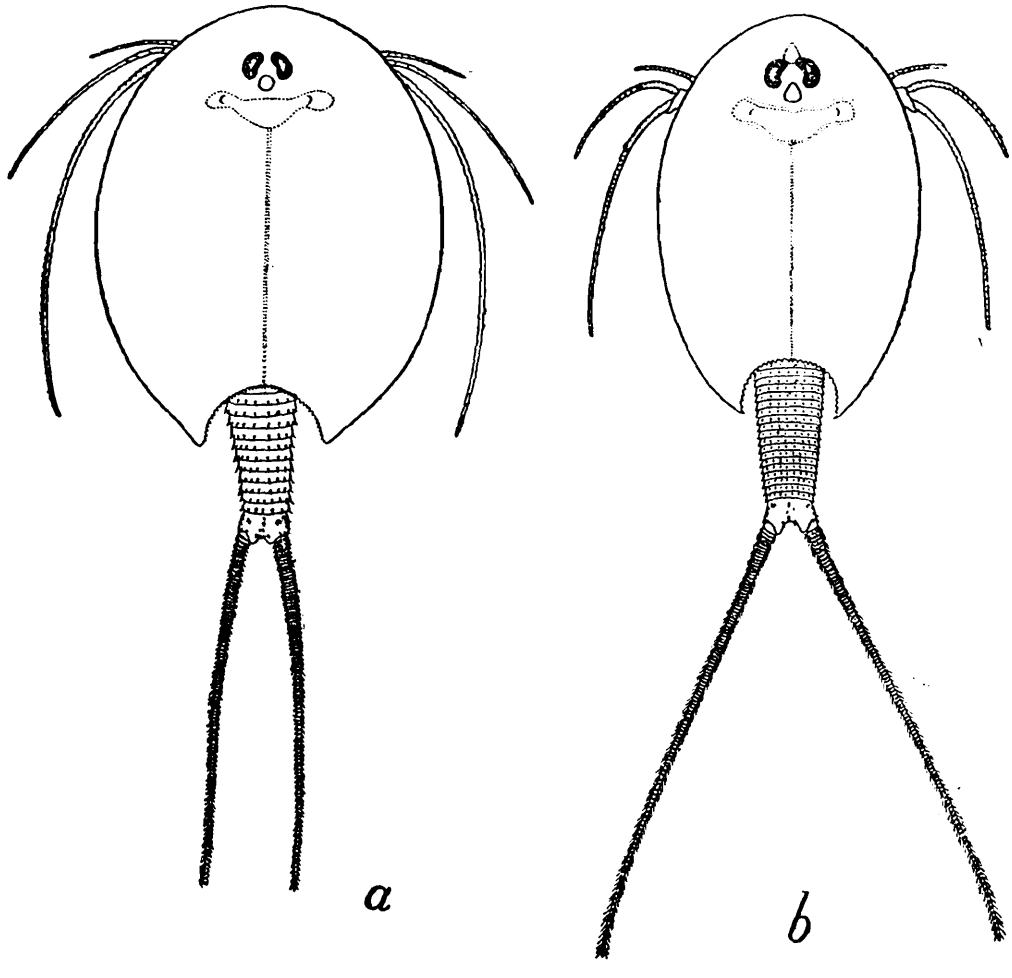
Apus mavliensis, sp. nov.

Diagnosis.—Carapace oval, somewhat longer than broad. Nuchal organ triangular. Apodal segments 8-10 in females. Fifth endite of first thoracic leg shorter than the median length of carapace. Caudal furca somewhat longer than or sub-equal to the body. Females 8·8 mm. to 15·8 mm. in body length (excluding caudal furca).

Holotype.—♀, Regd. No. C3066/1, Zoological Survey of India.

Paratypes.—16♀♀, Regd. No. C3067/1 Zoological Survey of India.

Locality.—Mavli (Jodhpur State), Rajasthan.

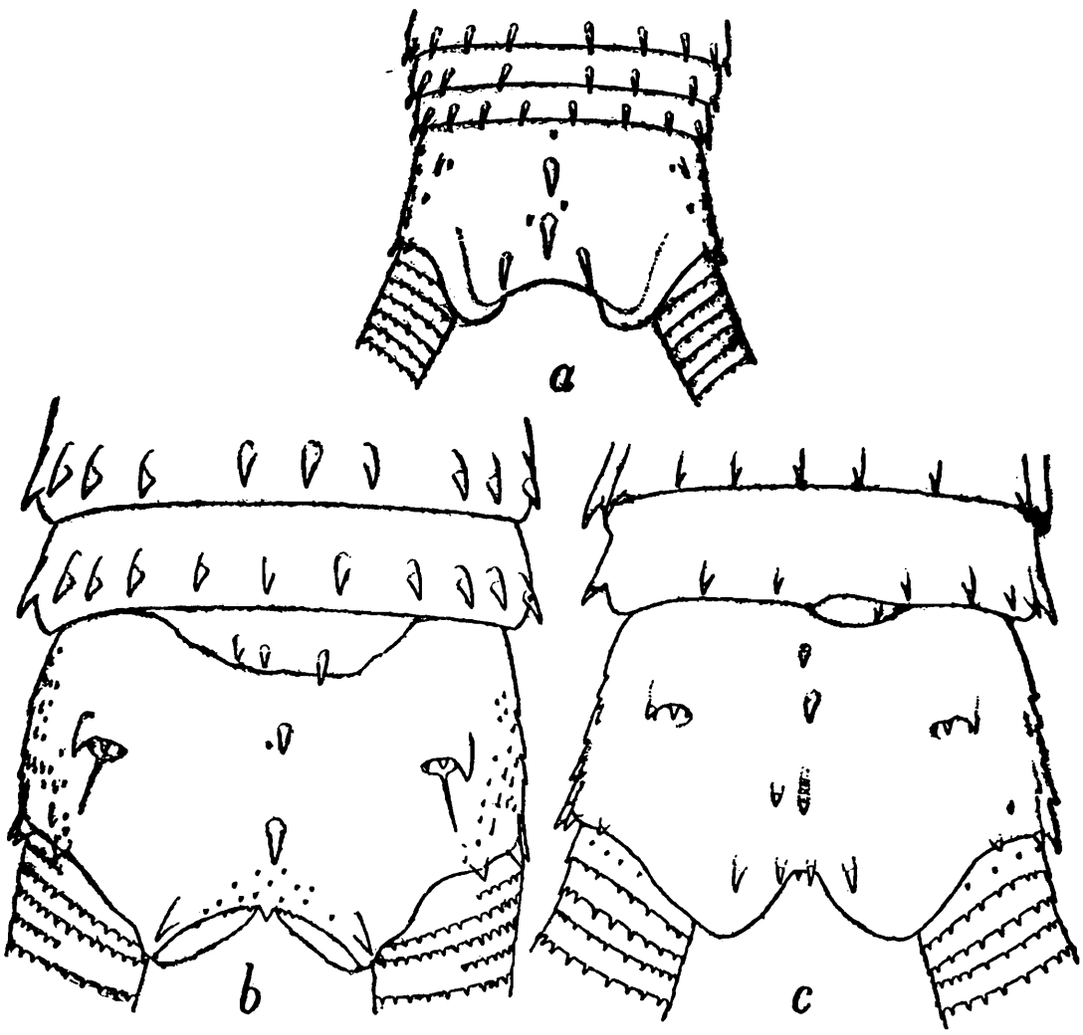


TEXT-FIG. 2.—*a. Apus* sp. prox *sudanicus*, ♂ dorsal view : ×3 ; *b. Apus mavliensis*, sp. nov., ♀ dorsal view : ×4½.

Description.—There are sixteen females of this new species present in the collection, varying in length from 8·8 mm. to 15·8 mm. The carapace is oval (text fig. 2*b*). The median carina is quite prominent, being about two-third as long as the total length of carapace. The nuchal organ is triangular in shape. The posterior sinus is rounded,

and bears from 36 to 44 small denticles. The posterior edge of carina is minutely serrate and the postero-dorsal surface of the carapace bears very fine spinules. The fifth endite of the first pair of thoracic appendages is shorter than the carapace. The fourth endite is about half as long as the fifth.

In the specimens before me the exposed part of the abdomen is shorter than the median length of carapace. The table on page 205 gives measurements of some female examples in this species. In the larger specimens the exposed part of abdomen is appreciably more than one-third of the total length of the body, but in shorter specimens it is only about one-third of the body length. The number of abdominal somites exposed behind the sinus varies from 20 to 24.* There are nine or ten, rarely eight, apodal somites. The number of post-genital somites varies from 25 to 27. Each abdominal ring bears a transverse row of six to nine dark, stout, backwardly directed dorsal spines, and somewhat more numerous and weaker ventral spines.



Text-fig. 3.—Dorsal surface of telson in *Apus*.

a. *Apus mavliensis*, sp. nov. : ×27 ; *b*. *Apus orientalis*, sp. nov. : ×27 ; *c*. *Apus* sp. prox *sudanicus* : ×27.

Telson (text-fig. 3*a*) is broader than the last abdominal ring, and conspicuously emarginate in the middle. The number of spines on its dorsal surface is variable. There is a median row of two or three moderately large spines, but in some cases there are shorter spinules between

* The number of somites includes the telson.

these. There are one or two spines on the posterior edge, on each side of the median row, which do not project beyond the telsonic edge. The lateral edges, above the insertion of the caudal appendages, bear some spines. The ventral surface is rough, and beset with minute spinules.

The caudal furca, when unbroken, are somewhat longer than the body, or sub-equal to it. In the basal region, each ring of the furca, bears one transverse scaly row on the margin, and another row of spines along the middle of the ring. Towards the distal region the scaly rows are replaced by circlets of bristles.

Eggs are spherical, measuring 0·44 mm. in diameter.

Affinities.—This species very closely resembles *Apus orientalis*, Tiwari from Panchagani (Bombay State, India). The following table gives the differences between *A. mavliensis*, sp. nov. and *A. orientalis*, Tiwari :—

A. mavliensis, sp. nov.	*A. orientalis*, Tiwari.
i. Carapace oval, being longer than broad.	i. Carapace proportionately broader than in *A. mavliensis*.
ii. Posterior sinus rounded with the angles not produced.	ii. Posterior sinus slightly notched in the middle. External angles somewhat produced.
iii. Exposed part of abdomen shorter than the median length of carina.	iii. Exposed part of abdomen longer than the median length of carina.
iv. No. of apodal segments generally 9-10.	iv. No. of apodal segments 11-13 in females, 12-14 in males.
v. Caudal furca sub-equal to body.	v. Caudal furca much shorter than body.

Apus orientalis attains a larger size than *A. mavliensis*. The pattern of telsonic armature does not differ much in the two species.

Apus cancriformis Sch.

1911. *Apus cancriformis*, Kemp, *Rec. Ind. Mus.* VI, pp. 353-357.
1925. *Apus cancriformis*, Gurney, *ibid.* XXVII, pp. 439-440.
1931. *Apus cancriformis*, Barnard, *Ann. S. Afr. Mus.*, XXIX, p. 241.
1934. *Apus cancriformis*, Bond, *Mem. Connecti. Acad. Sci.* X, p. 55. fig. 16.

The nuchal organ in this species is oval. Carapace is vaulted, and the median carina projects into the posterior sulcus, as a short spine. The abdomen is relatively very short. Number of apodal segments is five to seven according to most authors but in the examples seen by me the apodal segments were 6-7 in number. The total number of movable somites is 34-35; generally the examples with six apodal segments had 34 somites while those with seven had 35 movable somites. Caudal furca are longer than the body. Dorsal surface of the telson is beset with few stout spines, and its ventral surface is smooth.

This species has been recorded from Kashmir, Buland Shahar (Kemp; Major Walton[1]) Nuriwalla, Sargodha District, Punjab (Bond) and Gujrat (Mahabate[2]).

Apus sp. prox.. **sudanicus** Brauer.

1877. *Apus sudanicus*, Brauer, *Sitz. Ber. Ak. Wiss. Wien.* LXXV, p. 590.
1931. *Apus sudanicus*, Barnard, *Ann. S. Afr. Mus.* XXIX, pp. 240-241, text-fig. 25, c.

[1]Walton, H. J., *Rec. Ind. Mus.* VI, pp. 351-352 (1911).
[2]Mahabate, T. S., *Curr. Sci.* VIII, p. 471, (1939).

A single male specimen (text-fig. 2*a*) from Nagasunni Temple Tank, Tirunelveli District (Madras), appears to be closely related to *A. sudanicus* Brauer. It agrees with *A. cancriformis* in having an oval nuchal organ and a short tail, but, however, differs from it in the structure of telson, number of apodal segments and the number of exposed abdominal segments.

The following are the important measurements of this specimen :—

Length of body (excluding caudal furca)	17·4 mm.
Median length of carapace	12·8 mm.
Length of carina	8·0 mm.
Breadth of carapace	11·6 mm.
Breadth of posterior sinus (measured between external angles) ..	4·3 mm.
Depth of posterior sinus	2·0 mm.
Length of fifth endite of first thoracic appendage	14·2 mm.
Length of caudal furca ..	12·0 mm.
Total number of somites	36
No. of somites exposed beyond the carapace (telson included) ..	11
No. of apodal segments ..	10
Spines on posterior sinus	45
Dorsal spines on abdominal somites ..	7-9

Carapace in this specimen is oval, being slightly longer than its maximum breadth. The carina is about two-thirds as long as the carapace (in the middle). Posterior sinus is about one-third of the carapace breadth and about half as deep as broad, its edge carrying about 45 spines. The angles of sinus are not drawn out.

Fifth endite of first thoracic leg is slightly longer than carapace.

The abdomen is short being less than 1/3 of the total length of body. Total number of somites are 36, out of which only eleven (including telson) are exposed behind the carapace. Total number of apodal segments is 10. Each abdominal ring bears dorsally a transverse row of 7-9 spines.

Telson (text-fig. 3*c*) is emarginate in the middle. Dorsally it carries a median row of two spines, and the telsonic edge has a transverse row of four spines.

Caudal furca are about as long as the median length of carapace. The spines towards the base of furca are scaly. Each ring carries a proximal row of scaly spines and a distal row of acute spines. In the distal half the spines are replaced by bristles.

This specimen resembles *A. cancriformis* in the structure of its nuchal organ, and short ' tail ' It agrees with *A. mavliensis* in having 10 apdoal segments, as also in the dorsal spinulation of telson.

The nearest ally of this specimen is *Apus sudanicus* Brauer. I have not seen the original description, but Barnard's diagnosis of this species applies fairly closely to the Madras example, except that the number of apodal segments in this specimen is one less than that for the male of *A. sudanicus*.

Apus sudanicus is recorded from Khartoum, Ailar, North of Cairo and Cape Province, Namaqualand and Ovamboland in South Africa (sec. Barnard).

TABLE I.—*Measurements of females of* Apus mavliensis *sp. nov. from Rajputana.*

Specimen No.	1	2	3	4	5	6	7	8	9
Total length of body	15·8	15·0	14·6	12·4	12·1	11·3	10·9	9·9	8·8
Median length of carapace	8·7	8·7	8·9	8·3	7·9	7·0	7·3	6·5	5·3
Length of carina	..	..	5·7	5·2	5·4	4·6	4·8	3·8	3·8
Length of exposed part of abdomen	7·1	6·3	5·7	4·1	4·2	4·3	3·6	3·4	2·9
Length of fifth endite of first thoracic appendage.	6·7	6·3	6·8	6·5	5·9	5·7	..	4·5	4·2
Length of caudal appendage	14·5	..	12·8	10·3	11·4	..	..	11·4	9·9
No. of exposed abdominal somites	23	23	22	20	20	21	20	24	20
Number of legless segments	10	9	10	10	10	10	10	8	10
Number of post-genital abdominal somites	27	27	..	25	27	26	..	26	..
No. of spines on post-sulcus	37	36	40	38	..	42	..	38	38