

[From the PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
1913.]

[Published June 1913.]

Zoological Results of the Third Tanganyika Expedition,
conducted by Dr. W. A. Cunnington, 1904–1905.
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1. Introduction.

Through the collections made by Stuhlmann in Lakes Victoria Nyanza and Albert Edward Nyanza, and by Fülleborn in Lake Nyasa, we have for some time known of the existence of Argulidae in the waters of those lakes. The material collected during the Third Tanganyika Expedition proves that these parasitic copepods also occur commonly in Tanganyika, from which lake, indeed, far more species are now known than from any of the other great African lakes. As many as 363 specimens were obtained by this Expedition, the great majority of them from Tanganyika, with a few from Victoria Nyanza. There are nine species represented in all, and it is interesting to remark that, while two species—both previously described—were found in Victoria Nyanza, the same two forms were associated with no fewer than seven new species in Tanganyika.

Since the return of the Expedition there have come into my hands specimens of Argulids from Nyasa and from Albert Nyanza; and as these constitute new records and add to our knowledge of distribution, it seems desirable to refer to them also in the present paper. Including the two types collected by Fülleborn in Nyasa, the following is thus a complete list

* For explanation of Plates, see pp. 282–283.

of the species at present known to occur in the lakes in question :—

TANGANYIKA.

Dolops ranarum Stuhlmann.

Argulus incisus, sp. n.

„ *rubropunctatus*, sp. n.

„ *personatus*, sp. n.

„ *exiguus*, sp. n.

„ *angusticeps*, sp. n.

„ *striatus*, sp. n.

„ *rubescens*, sp. n.

„ *africanus* Thiele.

VICTORIA NYANZA.

Dolops ranarum Stuhlmann.

Argulus africanus Thiele.

NYASA.

Dolops ranarum Stuhlmann.

Argulus africanus Thiele.

Chonopeltis inermis Thiele.

ALBERT NYANZA.

Argulus africanus Thiele.

By the kindness of Dr. Calman I have been permitted to examine the African specimens belonging to the British Museum. They are of species already known to science, but as, in one instance, they afford a record of a new locality, and as no notice of them has been published, they will be referred to in their place in the systematic part of this paper.

To illustrate the general appearance of the new species, I have made use of photographs taken with a low-power lens from the actual specimens themselves. The difficulties in the way of obtaining reasonably good results from objects which are by no means flat are very considerable, but I think that the photographs in question are really more satisfactory for the purpose than drawings would be. They were made with a special photomicrographic lens in the Zoological Laboratory of King's College, London, and I have to express my indebtedness to Prof. Dendy for allowing me to work in the laboratory, and also to him and to Mr. R. W. H. Row for affording me the benefit of their experience with the apparatus.

2. *Systematic Notes and Description of New Species.*

Family ARGULIDÆ.

DOLOPS RANARUM Stuhlmann.

Gyropeltis ranarum Stuhlmann, Zool. Jahrb., Syst. Bd. vi. 1891, p. 154.

Dolops ranarum Bouvier, Bull. Soc. Philom. sér. 9, tome i. 1899, p. 13.

Dolops ranarum Wilson, Proc. U.S. Nat. Mus. vol. xxv. 1903, p. 737.

Dolops ranarum Thiele, Mitt. Zool. Mus. Berlin, Bd. ii. Heft 4, 1904, p. 17.

This species was originally obtained by Stuhlmann at Bukoba, on the western shores of Victoria Nyanza, and described by him under the name *Gyropeltis ranarum*. The specimens were found attached to the surface, and occasionally at the entrance of the branchial chamber, of a number of tadpoles, and on that account received their specific name. It does not appear a very fortunate title, however, since specimens were obtained by the present Expedition from the bodies of four different kinds of fish, and most of the specimens, as a curious coincidence, actually from Bukoba itself. It is, indeed, no new fact that certain species of Argulidæ may be found on a variety of hosts, the well-known European type, *Argulus foliaceus*, being an excellent example, as its host-list also includes frog-tadpoles as well as a number of fish. The literature of the subject contains other cases of similarly inappropriate specific names derived from those of the hosts, and as long ago as 1875 Claus* deprecated this obvious but unsatisfactory manner of naming species.

It may be no more than coincidence, but it is remarkable how often this form was found associated with *Argulus africanus* on a common host.

TANGANYIKA.—*Dolops ranarum* does not appear to be common in Tanganyika, since it was obtained on only one occasion, and then from a single large fish. The coloration of these specimens differs somewhat from that stated hitherto, and, in fact, to some extent from the Victoria Nyanza specimens in the present collection. The upper surface of both carapace and abdomen is irregularly covered by arborescent pigment-spots of a grey colour, which are most numerous on the carapace lobes. In addition, there is an irregular series of small white spots, scattered without any apparent relation to the grey pigment-spots already mentioned.

Occurrence.—Kala, 18/11/04. From mouth-cavity and gill-bars of large *Lates microlepis* (length 910 mm.). Three male and three female specimens. Associated with them were specimens of *Argulus africanus*.

VICTORIA NYANZA.—This is the only species of Argulid hitherto known from the lake, and still seems to be the commonest, although specimens of another widely distributed form (*Argulus africanus*) were obtained during this Expedition. The specimens of *D. ranarum* taken in this lake differ slightly in colour from those collected in Tanganyika. They are of a more uniform brown colour, and show little of the arborescent grey spots above

* Zeitschr. f. wiss. Zool. Bd. xxv. 1875, p. 278.

mentioned, though these are faintly indicated in some cases. The white spots are clearly visible.

Occurrence.—Bukoba, 24/4/05. From surface of body, mouth, and gill-chambers of a large Siluroid (? *Bagrus degeni*)—native name, *Njui*. Ten male and eleven female specimens. A specimen of *Argulus africanus* was associated with these.

Bukoba, 24/4/05. Associated with specimens of *Argulus africanus* from surface of body and inside mouth of large *Protopterus ethiopicus* (length 1040 mm.). Three males and one female.

Bukoba, 24/4/05. From surface of body, mouth, and gill-chamber of large Siluroid (? *Clarias anguillaris*)—native name, *Nshonzi*. Two male and three female specimens. An individual of *Argulus africanus* occurred with these.

A single female specimen in the collection of the British Museum has been more recently obtained from the lake. The particulars recorded are:—"On skin of fish ('*Mälē*') ? catfish. Lake Victoria. Collected by G. D. H. Carpenter, 6. xi. 11." This was associated with specimens of *Argulus africanus*.

NYASA.—I am indebted to my friend Capt. E. L. Rhoades, of the British Naval Service on Lake Nyasa, for a small collection of Argulidæ from this lake. The specimens all proved to belong to this species, and not to either of those obtained by Fülleborn in the lake. They are thus an addition to the number of forms known in Nyasa, and at the same time a record of still wider distribution of the species. There are two male and four female specimens, the only particulars given on the label being:—"Fish-lice, ex. '*Sungwa*': Lake Nyasa, 1908."

RIVER NILE.—In the British Museum collection are six male and ten female specimens from yet another new locality. With them was associated a single female specimen which I place, with some hesitation, under *Argulus africanus*. They were obtained by Mr. L. Loat, who gives the following details:—"Parasites out of the mouth of a large '*Hala*' (*Heterobranchus bidorsalis*), caught at the mouth of Lake No, White Nile, Jan. 30, 1901."

Genus ARGULUS.

All the remaining Argulids in the collection belong to the genus *Argulus* itself. The number of species included in this genus is fairly considerable, yet they are, on the whole, reasonably distinct, and there seems to be no grounds for subdividing the genus. As the number grows, it becomes at the same time a matter of increasing difficulty to diagnose a species accurately, save at some length, since the differences are often of a minor nature, concerning numerous parts of the external anatomy. These facts render it more than ever difficult to offer to other workers in this field a satisfactory key to the species.

Wilson *, in 1903, made a serious attempt to provide a key to

* Proc. U.S. Nat. Mus. vol. xxv. 1903, p. 701.

the whole of the then known species of *Argulus*, but without achieving a great success. He was unfortunate in choosing for the purpose certain characters which clearly depend upon the state of contraction of the specimen and, in addition, are difficult to distinguish with exactness. It is not easy, for example, to determine how far the swimming-legs are covered by the carapace, as this is influenced by the relative states of contraction, as well as by any chance displacement. Again, while it is easy in extreme cases to point out forms in which the carapace lobes overlap, or do not reach the abdomen, it is virtually impossible to distinguish accurately those with "Carapace lobes just reaching the base of the abdomen." Most keys are open to the objection that they are purely artificial, and Wilson, it is true, fully admits the artificiality in this case. Nevertheless, a key in which in so many cases male and female specimens of the same species are separated under merely arbitrary standards, falls very short of what is to be desired.

It is certainly a matter of great difficulty in this genus to discover characters which satisfactorily lend themselves to the purpose of key-making. Where male and female differ markedly in external shape, as is sometimes the case, it seems perhaps inevitable that the sexes should be artificially separated; but this might be avoided to a greater degree than has been done by Wilson. While objecting to the form of the key above mentioned, we feel that Wilson is to be commended for attempting to tabulate the species; and since he included all the then-known forms, it at first seemed wise to incorporate in his key the seven new species described in this paper. It was on going into the matter with this end in view that the unsatisfactory features already mentioned revealed themselves, and, in addition, certain regrettable inaccuracies* which only added to the difficulties of incorporation. Under these circumstances it was finally decided to prepare a key to include only the African species; and this is the more desirable, since the one species of this genus hitherto known from the continent is now increased to eight.

Before proceeding to give the key and the descriptions of new species, a few words of caution may be offered. The characters employed in diagnosing the forms belonging to this group, while perhaps the most obvious, are in some cases profoundly influenced by artificial contractions and contortions, and in addition by the age of the individual. Proportions of length to breadth are seldom quite constant, size of suckers may vary with degree of expansion, and certain spines and processes may be more

* *Op. cit.* p. 702. On this page, for example, under the heading 6., *A. niger* is said to have an "abdomen narrow, ovate." Under the heading 7., *A. pugettensis* is contrasted with this as having "abdomen wide, elliptical." Actual measurements of both these species are given in the body of the work, and may be written breadth over length as follows:—*niger* $\frac{3.25}{4}$, *pugettensis* $\frac{4}{5.3}$. Expressing these in the form of percentage of breadth to length, they become:—*niger* 81.2, *pugettensis* 75.4. Thus it is evident that the abdomen of *niger*, described as "narrow," is in reality broader than that of *pugettensis*, described as "wide."

prominent in some individuals than others. An extensive series of measurements undertaken by the writer has shown that, while sizes and proportions may be stated in general terms, a considerable degree of variation is commonly met with, and that young specimens as a rule deviate somewhat from the normal specific characteristics.

Concerning the actual figures given in the specific descriptions, it is to be noted that the proportions are not always precisely those adopted by Wilson. The latter gives the relative length of the abdomen as a fraction of the entire length of the animal *exclusive of the abdomen*. This has seemed to me less satisfactory than to express it as a fraction of the *total* length of the animal. What is wanted is to indicate briefly what proportion of the total length is constituted by the abdomen, and this mode of expression has therefore been chosen in the following descriptions.

Again, in the matter of the suckers it seems likely that Wilson's fractions are not strictly comparable with those given in this paper, although the same plan has been adopted of expressing the size as a proportion of the breadth of the carapace. My earlier sucker measurements were all made on a basis of the over-all diameter contrasted with the carapace breadth. They gave decimal fractions which seemed to vary somewhat erratically, and it was, moreover, most difficult to decide what might be legitimately considered as the edge of the sucker in an average state of expansion. The well-marked chitinous ring to which the membranous border of the sucker is attached seemed to offer a much more definite structure for investigation, the dimensions of which could be clearly observed. A further series of measurements, in which the size of this chitin ring was taken as a standard of comparison, gave results, when expressed in fractions, which were distinctly more uniform; and this method has consequently been adopted for arriving at the figures given in the specific descriptions. The diameter of the suckers and the corresponding decimal fractions are both smaller, of course, than if the over-all dimensions had been taken; and as the figures obtained are smaller, on the whole, than those given by Wilson, it appears highly probable that his are based on the maximum diameter of the suckers.

Key to the African Species of Argulus.

- a. Carapace orbicular, about as long as broad.
- b. Antero-lateral depressions very pronounced; no accessory spines or processes behind the antennules and maxillipeds *incisus*.
- b'. Antero-lateral depressions slight; accessory spines present behind the antennules and maxillipeds *rubropunctatus* ♂.
- a'. Carapace elliptical, distinctly longer than broad.
- b. Basal segment of maxilliped bearing spines.
- c. Second segment of antennule with anterior hook.
- d. Abdomen long elliptical, lobes bluntly pointed and separated by moderately broad sinus *personatus*.
- d'. Abdomen broadly elliptical, lobes obtusely pointed and separated by broad sinus; carapace with characteristic reddish spots *rubropunctatus* ♀.

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- c'. Second segment of antennule with anterior spine.
 d. Abdomen slightly longer than broad, sinus less than one-quarter of its length; eyes very large ... *exiguus* ♂.
 d'. Abdomen distinctly longer than broad, sinus one-half of its length; eyes and suckers situated close together and far forward *angusticeps* ♀.
 V. Basal segment of maxilliped bearing broad processes.
 c. Abdomen long elliptical, at least one and a quarter times as long as broad.
 d. Abdominal lobes pointed, sinus one-third or more of length of abdomen; carapace lobes characteristically striated *striatus*.
 d'. Abdominal lobes rounded, sinus one-sixteenth of length of abdomen *rubescens* ♂.
 c'. Abdomen broadly elliptical, less than one and a quarter times as long as broad.
 d. Basal segment of antennule bearing broadly rounded process, second segment with small posterior spiniform process *rubescens* ♀.
 d'. Basal segment of antennule bearing somewhat rounded spine, second segment with stout posterior spine; carapace with characteristic black pigment-spots *africanus*.

ARGULUS INCISUS, sp. n. (Pl. XLI. figs. 1, 2; Pl. XLIII. figs. 17, 18.)

Description.—Carapace orbicular, about as long as broad, with antero-lateral depressions very pronounced, so that portions of the antennæ may be visible from above. Posterior lobes broad and rounded, only covering bases of first and second swimming-legs, and separated by a broad sinus about one-fifth the length of the carapace. The edge of the carapace below is only moderately armed with small spines, which extend to the region of the swimming-legs. There are no such spines in the anterior region in front of the eyes. Abdomen in the male twice as long as broad, about two-fifths * entire length of body; posterior lobes pointed, and separated by broad sinus two-fifths length of abdomen. Abdomen in the female more than one and a half times as long as broad, about one-third entire length of body; posterior lobes bluntly pointed and separated by broad sinus one-half length of abdomen. The furcal appendages in both sexes lie at the bottom of the anal sinus. Antennules and antennæ small and ill-armed, approaching closely to one another in the mid line. The second segment of the antennule only is armed with an inconspicuous anterior spine and slender lateral hook. No accessory spines or processes close behind these appendages. Eyes rather large, in the males less than one-quarter, in the females less than one-fifth breadth of carapace apart, and situated somewhat far forward. Suckers rather large, in the males $\cdot 14$ – $\cdot 15$, in the females $\cdot 15$ † of breadth of carapace. Maxillipeds of moderate size, rather poorly armed; basal segment produced into three flattened processes; "area"

* Proportions not to be confused with those given by Wilson and differently expressed, *vide supra*.

† Diameter of sucker measured at chitinous supporting ring and not at extreme edge.

rather large, roughly pear-shaped and armed with small spines. No accessory processes are present between the bases of the maxillipeds. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth. In the female, basal segment of fourth leg produced postero-laterally into pointed lobe. Colour (in spirit) light brown, the testes covered above by large irregular blotches of dark brown.

Dimensions as follows:—

Adult male (largest specimen). Adult female (largest specimen).

Total length	mm.	Total length	mm.
Length of carapace ...	7·3	Length of carapace ...	11·6
Breadth of carapace...	4·1	Breadth of carapace...	6·2
	4·3		6·7

Remarks.—The most striking characteristic of this species is the unusually deep antero-lateral depression or sinus, which gives occasion for the specific name. This feature does not occur in any other of the African species—a fact which naturally suggests that excessive shrinkage might be the sole cause. Such an explanation is obviously impossible in this case. The specimens were all of them taken from a single fish, in association with *A. striatus*, but the species were not distinguished on the spot, and all the specimens were treated alike and were brought home in the same bottle. On examination, the deep antero-lateral incision first afforded a palpable distinction between the forms, which proved to be specifically different to a marked degree. Another important feature in which this type differs from the other African species, and indeed from the great majority of the known species, is the complete absence of accessory spines or processes behind both the antennules and maxillipeds.

Occurrence.—Rumonge, 16/2/05. From mouth and surface of body of large specimen of *Auchenoglanis occidentalis*, var. *tanganicanus*. Ten males and thirteen females, some ovigerous. These were associated with a large number of specimens of *Argulus striatus*.

ARGULUS RUBROPUNCTATUS, sp. n. (Pl. XLI. figs. 3-5; Pl. XLIII. figs. 19, 20.)

Description.—Carapace in the male orbicular, slightly broader than long; in the female elliptical, slightly longer than broad. Antero-lateral depressions slight. Posterior lobes broad and rounded, covering bases of all but fourth swimming-legs, and separated by a broad sinus about one-fifth the length of the carapace. The edge of the carapace below is well armed with small spines, which extend into the region of the swimming-legs. Abdomen in the male nearly two and a half times as long as broad, about ~~three-sevenths~~ ^{eighths} entire length of body; posterior

lobes pointed and separated by fairly broad sinus one-half length of abdomen. Abdomen in the female as long as or slightly longer than broad, less than one-fourth entire length of body; posterior lobes obtusely pointed and separated by broad sinus almost one-half length of abdomen. The furcal appendages in both sexes lie at the bottom of the anal sinus. Antennules of moderate size, basal segment with stout posterior spine; second segment with stout anterior hook and rather slender lateral hook. Antennae with stout spine on basal segment. Immediately behind the insertion of the antennule is situated a stout accessory spine. Eyes somewhat small, about one-quarter breadth of carapace apart. Suckers in the males rather small, .12-.14 of breadth of carapace; in the females rather large, .15-.16 of breadth of carapace. Maxillipeds fairly strong and moderately armed; basal segment produced into three stout spines; "area" of moderate size, oval shape, distinguished by red-brown pigment, but only sparsely armed with spines. A pair of stout accessory spines is situated between the bases of the maxillipeds, and a second pair a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth. In the female, basal segment of fourth leg produced postero-laterally into sharply pointed lobe. Colour (in spirit) light brownish grey, covered by an irregular series of red-brown spots, which in part are aggregated together to form definite blotches. Testes covered by irregular blotches of the same pigment.

Dimensions as follows:—

Adult male (largest specimen). Adult female (largest specimen).

	mm.		mm.
Total length	12.2	Total length	10.6
Length of carapace ...	7.1	Length of carapace ...	8.1
Breadth of carapace...	7.7	Breadth of carapace...	7.4

Remarks.—This species affords a good example of the striking differences in form of male and female specimens which are not uncommon, although extremely inconvenient for incorporation in any key. Both the shape and dimensions of the carapace, as well as the nature of the abdomen, are markedly dissimilar in the two sexes. While the red spots and blotches are certainly characteristic of the species, it must be admitted that they are not equally obvious on all specimens. They show little on certain specimens in the collection, which are uniformly of a darker brown colour, and they are less conspicuous on young individuals. The posterior lobes of the carapace, especially in the female, may sometimes nearly meet in the middle line, thus, of course, altering the shape of the sinus and also covering the bases of the fourth swimming-legs.

Occurrence.—Kibwesi, 19/12/04. From surface of head (one

specimen on eyeball) of very large *Lates microlepis* (length 1340 mm.). Thirteen male and five female specimens.

Maswa, 15/1/05. Mostly from the surface of the body of a number of *Lates microlepis*. Fifteen males, seven females.

Ndanvie, 8/2/05. From surface of head and body of large specimen of *Lates microlepis*. Seventeen males, three females.

As will be seen from the above, this form has always been found infesting specimens of *Lates*, and never in association with any other species of Argulid.

ARGULUS PERSONATUS, sp. n. (Pl. XLI, figs. 6-8; Pl. XLIV, figs. 23-25.)

Description.—Carapace elliptical, longer than broad, with rather pronounced antero-lateral depressions. Posterior lobes broad and rounded, covering bases of all but fourth swimming-legs: in a female distended with eggs the third swimming-legs are only partially covered. The lobes are separated by a moderately broad sinus, about one-fifth the length of the carapace or sometimes more. The edge of the carapace below is well armed with very small spines, which extend to the region of the swimming-legs. Abdomen in the male two and a half times as long as broad, about two-fifths entire length of body; posterior lobes bluntly pointed and separated by moderately broad sinus two-fifths length of abdomen. Abdomen in the female about one and a quarter times as long as broad, more than one-quarter entire length of body; posterior lobes bluntly pointed, and separated by moderately broad sinus more than one-half length of abdomen. The furcal appendages are small and inconspicuous and lie at the bottom of the anal sinus. Antennules of moderate size, basal segment with stout posterior spine; second segment with small anterior hook, posterior spiniform process, and lateral hook of medium size. Antennæ with small spine on basal segment. Immediately behind the insertion of the antennule is situated a stout accessory spine. Eyes rather large, about one-quarter breadth of carapace apart. Suckers of moderate size, in the males 13-15, in the females 10-18 of breadth of carapace. Maxillipeds strong and well armed; basal segment produced into three stout spines; "area" large, pear-shaped, and armed with small spines. A pair of stout accessory spines is situated between the bases of the maxillipeds, and a second pair, rather slighter, a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth. In addition, a small backwardly directed process is present near the base of the second leg, and a considerable conical projection on the anterior face of the third leg. In the female, basal segment of fourth leg produced postero-laterally into pointed lobe. Colour (in spirit) light yellowish brown, the testes covered by irregular blotches of darker brown.

Dimensions as follows :—

Adult male (largest specimen).		Adult female (largest specimen).	
	mm.		mm.
Total length	6·6	Total length	11·4
Length of carapace ...	3·8	Length of carapace ...	7·0
Breadth of carapace...	3·4	Breadth of carapace...	6·0

Remarks.—While exhibiting no very outstanding characteristics, this species is sufficiently well defined by a number of minor differences affecting several parts of its external anatomy. There are only a few specimens in the collection, and, as is usual, the small ones differ to a certain degree from the large. In the smaller specimens the antero-lateral depressions are less pronounced, and the anterior hook on the antennules is less marked or even absent.

In default of a name more obviously suggested by its anatomy, the mask-like appearance of the carapace is alluded to in its specific name.

Occurrence.—Ndanvie, 7/2/05. From mouth-cavity of several specimens of *Bathybates ferox*. Three males, two females.

ARGULUS EXIGUUS, sp. n. (Pl. XLII. fig. 9; Pl. XLIII. figs. 21, 22.)

Description.—Carapace (in the male) elliptical, considerably longer than broad, with slight antero-lateral depressions. Posterior lobes moderately broad, rounded, covering bases of all swimming-legs, and separated by moderately broad sinus one-third the length of the carapace. The edge of the carapace below is armed with small spines which extend to the region of the swimming-legs. Abdomen in the male slightly longer than broad, about one-quarter entire length of body; posterior lobes bluntly pointed and separated by moderately broad sinus almost one-quarter length of abdomen. The furcal appendages lie at the bottom of the anal sinus. Antennules and antennæ rather small, but moderately armed, approaching somewhat to one another in the mid line. Basal segment of the antennule with posterior spine; second segment with blunt anterior spine, posterior spiniform process, and slender lateral hook. Antennæ with slight spiniform projection on basal segment. Immediately behind the insertion of the antennule is situated a stout accessory spine. Eyes very large, a little more than one-quarter breadth of carapace apart and somewhat far forward. Suckers of moderate size, .13-.15 of breadth of carapace. Maxillipeds strong and well armed; basal segment produced into three stout spines; "area" of fair size, roughly oval, and armed with small spines. A pair of stout accessory spines is situated between the bases of the maxillipeds, and a second pair, rather slighter, a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth.

Colour (in spirit) a reddish brown; in one specimen, the testes are covered by irregular blotches of a darker colour.

Dimensions as follows:—

Adult male (largest specimen).

	mm.
Total length	2·7
Length of carapace	2·1
Breadth of carapace	1·6

Remarks.—This species is unfortunately only represented by two specimens, both of the male sex. They appear to be adult, however, although they are small, and there seems no reasonable doubt but that they represent a distinct species. The compound eyes are unusually large, and are actually larger in proportion than in the species which has been named *A. megalops*. The swimming-legs in these specimens are so backwardly directed, that the bases of at least the last pair are, strictly speaking, covered by the abdomen and not by the carapace lobes.

Occurrence.—Mpala, 31/12/04. From surface of body of small *Simochromis diagramma*. One male specimen.

Mpala, 31/12/04. From outside body of medium-sized *Haplochilus tanganicanus*. One male.

ARGULUS ANGUSTICEPS, sp. n. (Pl. XLII. figs. 10, 11; Pl. XLIV. figs. 26, 27.)

Description.—Carapace (in the female) elliptical, considerably longer than broad, with antero-lateral depressions well marked. Posterior lobes moderately broad, rounded, covering bases of all but fourth swimming-legs, and separated by a somewhat narrow sinus, more than one-third the length of the carapace. The edge of the carapace below is well armed with very small spines which barely extend to the region of the swimming-legs. Abdomen in the female slightly longer than broad, about one-quarter entire length of body; posterior lobes somewhat pointed but with rounded tips, and separated by moderately broad sinus one-half length of abdomen. The furcal appendages, which are very small and inconspicuous, lie at the bottom of the anal sinus. Antennules and antennæ small, but moderately armed, approaching closely to one another in the mid line. Basal segment of the antennule with posterior spine; second segment with stout anterior spine, posterior blunt spiniform process, and slender lateral hook. Antennæ with slight spiniform projection on basal segment. Immediately behind the insertion of the antennule is situated a stout accessory spine. Eyes large, one-sixth breadth of carapace apart, and far forward. Suckers small, $\cdot 11$ of breadth of carapace. Maxillipeds strong and well armed; basal segment produced into three stout and sharp spines; "area" of fair size, roughly oval, and armed with small spines. Both suckers and maxillipeds are situated unusually far forward. A pair of stout accessory spines is situated between the bases of the maxillipeds, and a

second pair a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the female, basal segment of fourth leg produced posteriorly into pointed lobe. Colour (in spirit) a uniform brown, but somewhat darker in the region of the egg-masses.

Dimensions as follows:—

Adult female (only specimen).	
Total length	10·7 ^{mm.}
Length of carapace	7·8
Breadth of carapace	5·6

Remarks.—It is unfortunate that this species has to be described from a single specimen. The latter is, however, an ovigerous female which exhibits a number of distinctive features and cannot be classed with any of the known forms. Prominent characteristics are the narrow head region, rather well marked off, and the large eyes placed close together. The eyes, suckers, and maxillipeds are also situated remarkably far forward. The carapace lobes appear curiously thick and fleshy—an appearance which might possibly be due to shrinkage. The specimen was obtained from an uncommon source, namely, from a basket of small fish, but was attached to none of the latter. Thus, although the specimen may well have been dead, there is no reason for supposing that it was dried up to any extent, and indeed, its general condition seems to preclude such a suggestion.

Occurrence.—Uvira, 5/3/05. Found among a number of small fish of different kinds—at the moment adhering to none. A single female, distended with eggs.

ARGULUS STRIATUS, sp. n. (Pl. XLII. figs. 12-14; Pl. XLV. figs. 28-30.)

Description.—Carapace elliptical, longer than broad, with slight antero-lateral depressions. Posterior lobes fairly broad and rounded, covering bases of all but fourth swimming-legs; in a female distended with eggs, the third swimming-legs are only partially covered. The lobes are separated by a broad sinus one-fifth the length of the carapace. The edge of the carapace below is armed with small spines, which extend to the region of the swimming-legs. Abdomen in the male nearly twice as long as broad, about two-fifths entire length of body; posterior lobes pointed, and separated by broad sinus one-third length of abdomen. Abdomen in the female about one and a quarter times as long as broad, about one-quarter entire length of body; posterior lobes pointed and separated by broad sinus one-half length of abdomen. The furcal appendages in both sexes lie at the bottom of the anal sinus. Antennules of moderate size, basal segment with blunt posterior process; second segment with stout anterior spine, posterior small spiniform process, and lateral hook of medium size. Antennæ with short blunt process on basal segment.

Immediately behind the insertion of the antennule is situated a stout and moderately sharp accessory spine. Eyes rather large, a little more than one-quarter breadth of carapace apart. Suckers, in the males, rather small, $\cdot 12$ - $\cdot 14$ of breadth of carapace; in the females, rather large, $\cdot 14$ - $\cdot 18$ of breadth of carapace. Maxillipeds strong and moderately well armed; basal segment produced into three broad rounded processes; "area" of fair size, pear-shaped, and armed with small spines. A pair of accessory processes, also broad and rounded, is situated between the bases of the maxillipeds, and a second pair, rather slighter, a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth. In the female, basal segment of fourth leg produced postero-laterally into pointed lobe. Colour (in formol) light brownish grey, sometimes with a pronounced reddish tinge, the lateral and posterior regions of the carapace lobes showing a distinct radial striation, most clearly seen by transmitted light. Testes covered above by irregular blotches of brown pigment.

Dimensions as follows:—

Adult male (largest specimen).		Adult female (largest specimen).	
	mm.		mm.
Total length	10·2	Total length	11·1
Length of carapace ...	6·7	Length of carapace ...	7·5
Breadth of carapace...	6·1	Breadth of carapace...	6·5

Remarks.—It is not unusual among the Argulidæ for the posterior carapace lobes to exhibit some striation, which is due, no doubt, to the branching of what Wilson calls the side-pouches of the stomach. This appearance is, however, so outstanding a feature of these specimens, that *striatus* at once suggested itself as a suitable specific name. From the large number of specimens contained in the collection, this would seem to be the commonest, and perhaps the most widely distributed of the Tanganyika species. There are a few small individuals the sexual characters of which are less obvious, and yet others which must be classed as larval forms and do not show the secondary genital modifications typical of the adult.

Occurrence.—Mbeté, 25/9/04. From gill-arches and roof of mouth of large male specimen of *Dinopterus cunningtoni* (length 1020 mm.). Twenty-two males and twenty-five females.

Sumbu, 13/10/04. From gill-arches and roof of mouth of large *Clarias robecchii*. One female, associated with specimens of *A. africanus*.

Vua, 29/10/04. From surface of head and mouth of very large female specimen (length 1550 mm., weight 30·6 kilogr.) of a Siluroïd (? *Clarias lazera*)—native name *Muomi*. A single male, associated with specimens of *A. africanus*.

Kasawa, 1/11/04. From mouth and gill-bars of large *Dinopterus cunningtoni*. Three male and two female specimens.

Kibwesi, 19/12/04. From head, mouth, and gill-bars of several large specimens of *Chrysiichthys brachynema*. One male and one female, associated with specimens of *A. rubescens*.

Rumonge, 16/2/05. From mouth and surface of body of large *Auchenoglanis occidentalis*, var. *tanganicanus*. Sixty-four males and fifty-six females (some larval) associated with specimens of *A. incisus*.

ARGULUS RUBESCENS, sp. n. (Pl. XLII. figs. 15, 16; Pl. XLV. figs. 31, 32.)

Description.—Carapace elliptical, longer than broad, with moderate antero-lateral depressions. Posterior lobes broad and rounded, covering bases of all but fourth swimming-legs, and separated by a broad sinus, more than one-fifth the length of the carapace. The edge of the carapace below is armed with small spines, which extend to the region of the swimming-legs. Abdomen, in the male, nearly one and a half times as long as broad, about two-fifths entire length of body; posterior lobes rounded and only separated by an insignificant sinus one-sixteenth length of abdomen. Abdomen, in the female, slightly longer than broad, about one-quarter entire length of body; posterior lobes rounded and separated by somewhat narrow sinus almost one-quarter length of abdomen. The furcal appendages in both sexes lie at the bottom of the anal sinus. Antennules of moderate size, basal segment with rounded posterior process; second segment with blunt anterior spine, posterior small spiniform process, and lateral hook of medium size. Antennæ with rounded process on basal segment. Immediately behind the insertion of the antennule is situated an accessory rounded process. Eyes of moderate size, a little more than one-quarter breadth of carapace apart. Suckers, in the males, rather large, .15 of breadth of carapace; in the females, of moderate size, .13–.14 of breadth of carapace. Maxillipeds fairly strong and moderately armed; basal segment produced into three broad flattened processes; “area” of fair size, oval shape, and armed with small spines. A pair of accessory flattened processes is situated between the bases of the maxillipeds, and a second pair, rather slighter, a short distance behind them. Flagella present on the first two pairs of swimming-legs. In the male, vesicula seminalis present on the third leg, copulatory peg and accessory cushion on the fourth. In the female, basal segment of fourth leg produced postero-laterally into pointed lobe. Colour (in spirit) reddish, but with lighter areas anteriorly and round the eyes. Testes covered above by irregular blotches of reddish brown.

Dimensions as follows:—

Adult male (largest specimen).		Adult female (largest specimen).	
	mm.		mm.
Total length	3.5	Total length	5.4
Length of carapace ...	2.3	Length of carapace ...	4.1
Breadth of carapace...	1.9	Breadth of carapace...	3.7

Remarks.—This species, which in some features comes near to the preceding one, may be readily distinguished from it by the rounded nature of the abdominal lobes. The reddish coloration, which is striking in the larger specimens, is less evident or almost entirely absent in smaller ones. All the male specimens in the collection, which are rather small, show little colour, except, of course, the characteristic blotching of the testes. It will be noticed that this form has only been obtained from the Siluroid *Chrysichthys brachynema*, which is itself an endemic species.

Occurrence.—Moliro, 24/10/04. From roof of mouth of fair-sized *Chrysichthys brachynema*. One female.

Kibwesi, 19/12/04. From head, mouth, and gill-bars of several large *Chrysichthys brachynema*. Three males and nine females, associated with specimens of *A. striatus*.

Mrumbi, 27/12/04. From inside mouth and outside body of large *Chrysichthys brachynema*. One male and one female specimen.

ARGULUS AFRICANUS Thiele.

Argulus africanus Thiele, Zool. Anz. vol. xxiii. 1901, p. 47.

Argulus africanus Wilson, Proc. U.S. Nat. Mus. vol. xxv. 1903, p. 727.

Argulus africanus Thiele, Mitt. Zool. Mus. Berlin, Bd. 2, Heft 4, 1904, p. 37.

A preliminary description of this form was given by Thiele in 1901, and was followed by a more complete account with figures in 1904. It is the only species of the genus *Argulus* which had been previously obtained from the continent of Africa, and it still remains the only species known outside the confines of Lake Tanganyika. Thiele speaks of it as a form widely distributed in eastern Africa, and it is now possible to add other localities to those hitherto known.

As I have examined more than 60 specimens from different parts of Africa, perhaps I may add a few remarks in modification of Thiele's detailed description. Between the average male and female specimens there is by no means so clear a contrast as he indicates in the relative proportions of the carapace (cephalothorax). It is a fact, as I have determined by actual measurements, that the carapace of a large female is broader in proportion, and so less closely resembles the male condition, but except in extreme cases of large females contrasted with small males, there is but little difference in this respect between the two sexes.

Again, the carapace lobes in the female are stated to cover the whole of the swimming-legs, leaving but the tips of the last two pairs visible from above. This may, perhaps, be the condition of things in an individual greatly distended with eggs, but is neither normal nor typical. In the great majority of the females in this collection, the tips of all four pairs of swimming-legs project from beneath the carapace, and in a few cases the

bases of the fourth pair of legs are also visible much as in the male.

The proportions of the abdomen are likewise indicated as affording a distinction between the species, yet it appears that, as a rule, the female abdomen is really longer than broad, the measurements agreeing closely with those of the male, though of course the shape is distinctly different in the two cases. While these additional observations slightly modify the account given by Thiele, there can be no reasonable hesitation in identifying the species, which is readily distinguished by the conspicuous pigment spots and the nature of the antennæ and maxillipeds.

TANGANYIKA.—The species is apparently quite common in this lake, as the collection contains more than thirty specimens obtained from various localities. It does not appear to be confined to one host, and it was in some instances found in association with the endemic species of *Argulus*.

Occurrence.—Sumbu, 13/10/04. From gill-arches and roof of mouth of large specimen of *Clarias robecchii*. Four males and four females. A female of *A. striatus* was associated with these.

Sumbu, 20/10/04. From branchial arches and roof of mouth of two smallish specimens of *Clarias robecchii*. Six males and six females.

Vua, 29/10/04. From surface of head and mouth of very large female specimen (length 1550 mm., weight 30.6 kilogr.) of a Siluroid (? *Clarias lazera*)—native name *Muomi*. Five males and five females, with which a single *A. striatus* was associated.

Kala, 18/11/04. From mouth-cavity and gill-bars of large *Lates microlepis* (length 910 mm.). Two females, associated with specimens of *Dolops ranarum*.

Ndanvie, 8/2/05. From surface of head and body of large *Lates microlepis*. One male. Specimens of *A. rubropunctatus* were associated with this.

VICTORIA NYANZA.—From this lake, too, specimens of *A. africanus* were obtained by the Expedition for the first time. All of them, as it happens, were collected at Bukoba, on the western shore, the place at which Stuhlmann first discovered *Dolops* [*Gyropeltis*] *ranarum*. Curious to relate they were also associated in every case with specimens of the latter, living with them on a common host.

Occurrence.—Bukoba, 24/4/05. From surface of body, mouth and gill-chambers of a large Siluroid (? *Bagrus degeni*)—native name *Nfui*. One female specimen, associated with a number of *Dolops ranarum*.

Bukoba, 24/4/05. From surface of body and inside mouth of large *Protopterus aethiopicus* (length 1040 mm.). Four males, five females, associated with *Dolops ranarum*.

Bukoba, 24/4/05. From surface of body, mouth, and gill-chamber of large Siluroid (? *Clarias anguillaris*)—native name

Nshonzi. A single female, associated with specimens of *Dolops ranarum*.

In the collection of the British Museum are other specimens which have been subsequently obtained. They were also associated with a *Dolops ranarum*. The label reads:—"On skin of fish ('*Mälē*') ?catfish. Lake Victoria. Collected by G. D. H. Carpenter, 6. xi. 11." Five male and fourteen female specimens.

ALBERT NYANZA.—As the result of a rather unusual occurrence, we now know of the existence of Argulidæ in this lake. In a tow-netting from the lake which was placed in my hands for examination by my friend Dr. R. T. Leiper, Helminthologist to the London School of Tropical Medicine, I found very unexpectedly, a young Argulid. The material was collected by Dr. Leiper in July 1907, when he accompanied the expedition despatched to Uganda by the Egyptian Survey Department, and is of special interest at the present time, being the only collection of plankton as yet made in the lake. The tow-netting was taken at the north end of the lake opposite Magungo. While we know of the free-swimming habit of young Argulids, which would render them liable to be taken in the tow-net, it is certainly very exceptional to capture them in this manner, as is evidenced by their complete absence from the extensive series of tow-nettings made during the Third Tanganyika Expedition. It is thus a very happy accident which gives us this additional record.

I believe the specimen to be a male larval form of *A. africanus*. The blunt rounded spines or processes on antennæ and maxillipeds which are characteristic of the adult, are represented by sharper structures in this individual, but I think there is evidence that this is usual in young specimens.

RIVER NILE.—In the British Museum collection, associated with the specimens of *Dolops* obtained by Mr. Loat, and referred to above, there is a single female which I regard as belonging to this species. There are, it is true, points of difference from a typical specimen, yet in view of its general similarity, and since this form is known to occur in the Nile and is commonly found in association with *Dolops*, it seems desirable to place it here. It was taken from the buccal cavity of a large *Heterobranchus bidorsalis*, caught at the mouth of Lake No, White Nile.

3. General Remarks.

With singular uniformity, all the collections made in Tanganyika prove, to a greater or less degree, the unique character of the organisms inhabiting the lake. The Branchiura are no exception to the rule, for, as a result of this Expedition, we now know that while two species are widely distributed in Africa, they are associated in Nyasa with a single endemic form, but in Tanganyika with no less than seven. Thus in this case again, Tanganyika

is shown to possess not only a considerable number of characteristic species, but a much richer fauna than the other great African lakes, with which we may reasonably compare it. In the adjoining table of distribution, these facts are expressed in graphic form.

Table of Distribution.

Name of Species.	Tanganyika.	Victoria Nyanza.	Nyasa.	Albert Nyanza.	Other parts of Africa.
<i>Dolops ranarum</i>	+	+	+	...	+
<i>Argulus incisus</i>	+				
" <i>rubropunctatus</i>	+				
" <i>personatus</i>	+				
" <i>eriguus</i>	+				
" <i>angusticeps</i>	+				
" <i>striatus</i>	+				
" <i>rubescens</i>	+				
" <i>africanus</i>	+	+	+	+	+
<i>Chonopeltis inermis</i>	+		
10 species.	9	2	3	1	2

Taking a general survey of the specimens which have been examined, there are a few points which call for mention. Speaking broadly, there is no great disparity in the numbers of the two sexes in the collection. Only in the case of *Argulus rubropunctatus* was there a marked preponderance of one sex, a total of 45 males accompanying 15 females. There were occasional isolated individuals, but both sexes were usually associated on one host. As a rule, females were larger than males, which seems to be commonly the case.

It is difficult to understand why, in certain species, the relative size of the suckers is different in the sexes. The most striking example is that of *A. striatus*, where a series of measurements gave the following results:—Sucker diameter in males .12-.14 of breadth of carapace: in females, .14-.18 of breadth of carapace. Such a degree of variation cannot, in this case, be merely an index of carapace diversity in the sexes—short and broad, for instance, contrasted with long and narrow—since these males and females are very similar in this respect. As a rule, where we have sufficient evidence to go upon, the male appears to have a smaller sucker in proportion than the female.

Concerning the relations of these forms to their hosts, some further observations may be offered. Both in Victoria Nyanza and Tanganyika, the smaller fish appear to be relatively little infested by the parasites. These were most frequently observed upon large fish, and particularly on Siluroids, the scaleless nature of which must render them especially liable to attack. Large

specimens of the Tanganyika Serranid *Lates microlepis* also usually bore some examples attached to the surface of the head or within the mouth-cavity.

It is commonly considered that these parasites do not constitute a menace to the fish on which they prey. This was equally the impression made in the present instance. Cases have been recorded, however, in which it seems clear that an excessive number of Argulids infesting a fish may actually cause the death of their host. What appeared to be a striking instance of this came to my notice during this Expedition, and certainly merits a few words of description. Nearing the north-eastern shore of Tanganyika one afternoon, after a long voyage, a large fish was noticed floating on the surface of the water. My men fetched it on board, and it proved to be a specimen of the "kavungwe" (*Auchenoglanis occidentalis*, var. *tanganicanus*), absolutely covered with Argulidæ. There was literally hardly a spot on the body not infested with the parasites, and in the head region and within the mouth they were positively overlapping and lying on top of one another. Instead of detaching isolated specimens, as had usually to be done, a layer of writhing Argulids could be scraped from most parts of the body. The fish was not only perfectly fresh, but was still feebly making convulsive movements, and one could not resist the conviction that it was succumbing to the fierce attack of such a swarm of parasites. The latter, in this instance, did not all belong to one species. There were specimens of both *Argulus striatus* and *A. incisus*, the last-named species, strange to say, being obtained on this occasion only.

It was no very unusual thing on Tanganyika to discover the bodies of large fish floating far from shore. The crew of my dhow kept a sharp lookout, and made a point of picking them up when possible, as it meant a little addition to their fare, unless the fish were too putrid for even their taste. I never saw Argulidæ under these circumstances, except in the case detailed above, but in no other instance was the fish still living. The suggestion nevertheless occurs, that these also may have been victims of such parasites as appear to have caused the death of the *Auchenoglanis*.

No doubt, as is usually the case, the different types of Argulid are not rigidly confined to one host, though they may have a preference for a particular fish. Thus *Argulus rubropunctatus*, taken on different occasions and in different localities, was obtained only from *Lates microlepis*; similarly, *A. rubescens* was found only on *Chrysichthys brachynema*. On the other hand, *A. striatus*, perhaps the commonest and most widely distributed Tanganyikan form, was obtained from a number of hosts, whilst *A. africanus* and *Dolops ranarum*, owing to their extended distribution, clearly have still larger host-lists.

The question suggests itself—do the Tanganyika endemic species infest endemic fish? Since the number of endemic types

of fish in Tanganyika is so great (some 101 out of 115) it is not surprising that they constitute a majority of the actual hosts. Still there is no reason to suppose that there is any significance in such a connection from what we know of the habits of these parasites, and we find, in fact, an endemic *Argulus* living on a widely distributed host, and widely distributed Argulids (*Dolops ranarum* and *Argulus africanus*) living in Tanganyika on endemic fish.

Not infrequently two species were found living together on a common host. It is remarkable that *Dolops ranarum* was almost invariably found associated with *Argulus africanus*. On the only occasion on which the former was obtained in Tanganyika, it was, as usual, accompanied by individuals of the latter. While one is hardly prepared to say that there is a real significance in this association, it is certainly strange that these two widely distributed forms should appear to range together in the localities from which they come. There is no such constancy in the occurring together of other types. *A. rubropunctatus*, though taken on several different occasions, was always found alone.

The question of distribution within the limits of each lake was hardly likely to prove interesting. Apart from forms obtained on a single occasion, there is no evidence that any of the species are confined to a particular region.

EXPLANATION OF THE PLATES.

PLATE XLI.

- Fig. 1. *Argulus incisus* (p. 268). Male, dorsal view. $\times 5\frac{1}{2}$.
 2. " " Female, dorsal view. $\times 5\frac{1}{2}$.
 3. *Argulus rubropunctatus* (p. 269). Female, dorsal view. $\times 5\frac{1}{2}$.
 4. " " Male, dorsal view. $\times 5$.
 5. " " Male, ventral view. $\times 5$.
 6. *Argulus personatus* (p. 271). Male, dorsal view. $\times 6$.
 7. " " Female, dorsal view. $\times 4\frac{1}{2}$.
 8. " " Female, ventral view. $\times 4\frac{1}{2}$.

PLATE XLII.

- Fig. 9. *Argulus exiguus* (p. 272). Male, dorsal view. $\times 6$.
 10. *Argulus angusticeps* (p. 273). Female, dorsal view. $\times 5\frac{1}{2}$.
 11. " " Female, ventral view. $\times 5\frac{1}{2}$.
 12. *Argulus striatus* (p. 274). Female, dorsal view. $\times 6$.
 13. " " Male, dorsal view. $\times 6$.
 14. " " Male, ventral view. $\times 6\frac{1}{2}$.
 15. *Argulus rubescens* (p. 276). Female, dorsal view. $\times 6\frac{1}{2}$.
 16. " " Male, dorsal view. $\times 6\frac{1}{2}$.

PLATE XLIII.

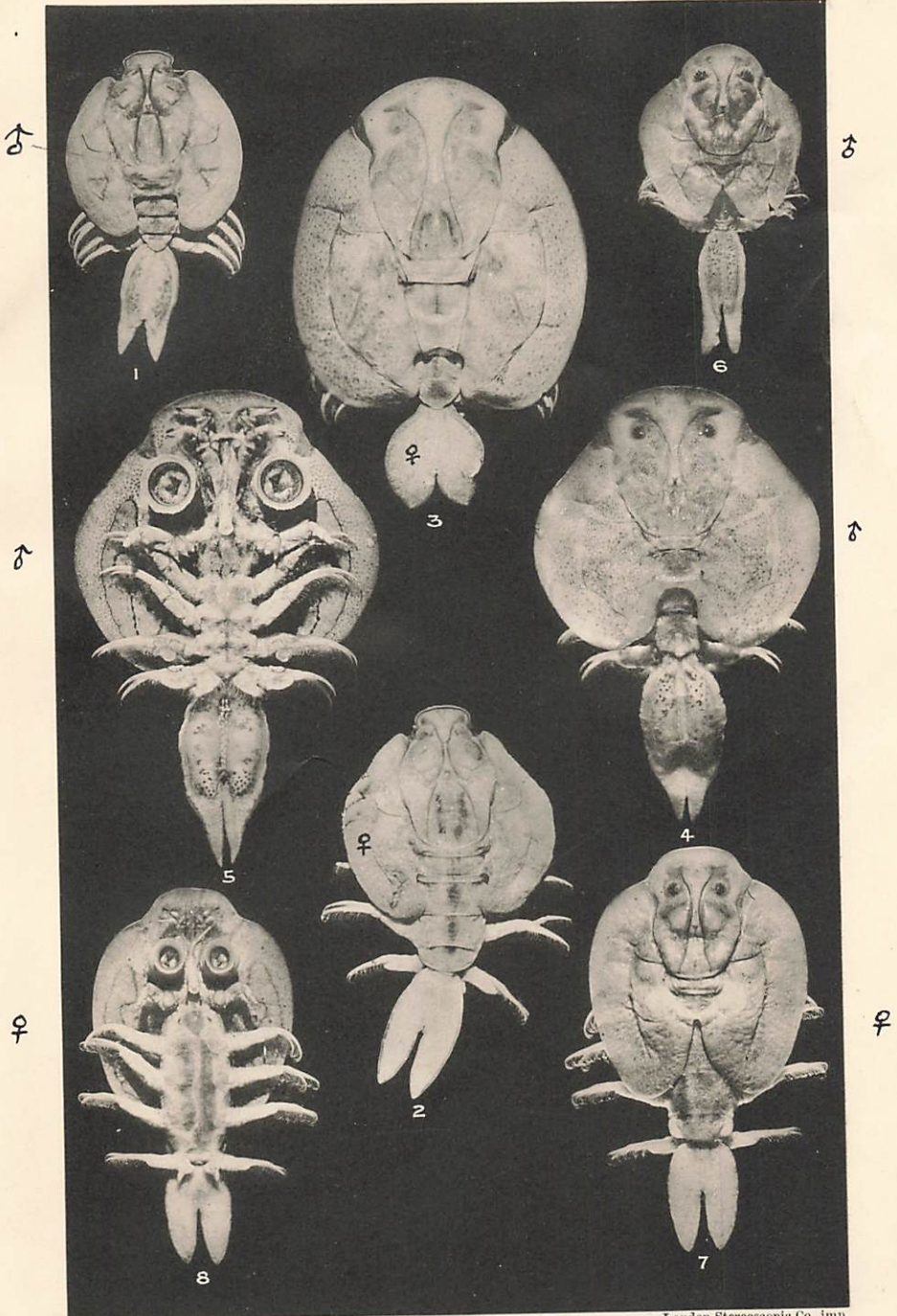
- Fig. 17. *Argulus incisus* (p. 268). Antennule and antenna. $\times 60$.
 18. " " Maxilliped. $\times 50$.
 19. *Argulus rubropunctatus* (p. 269). Antennule and antenna. $\times 40$.
 20. " " Maxilliped. $\times 30$.
 21. *Argulus exiguus* (p. 272). Antennule and antenna. $\times 100$.
 22. " " Maxilliped. $\times 100$.

PLATE XLIV.

- Fig. 23. *Argulus personatus* (p. 271). Posterior three swimming-legs to show accessory copulatory apparatus. $\times 60$.
 24. " " Antennule and antenna. $\times 60$.
 25. " " Maxilliped. $\times 60$.
 26. *Argulus angusticeps* (p. 273). Antennule and antenna. $\times 60$.
 27. " " Maxilliped. $\times 60$.

PLATE XLV.

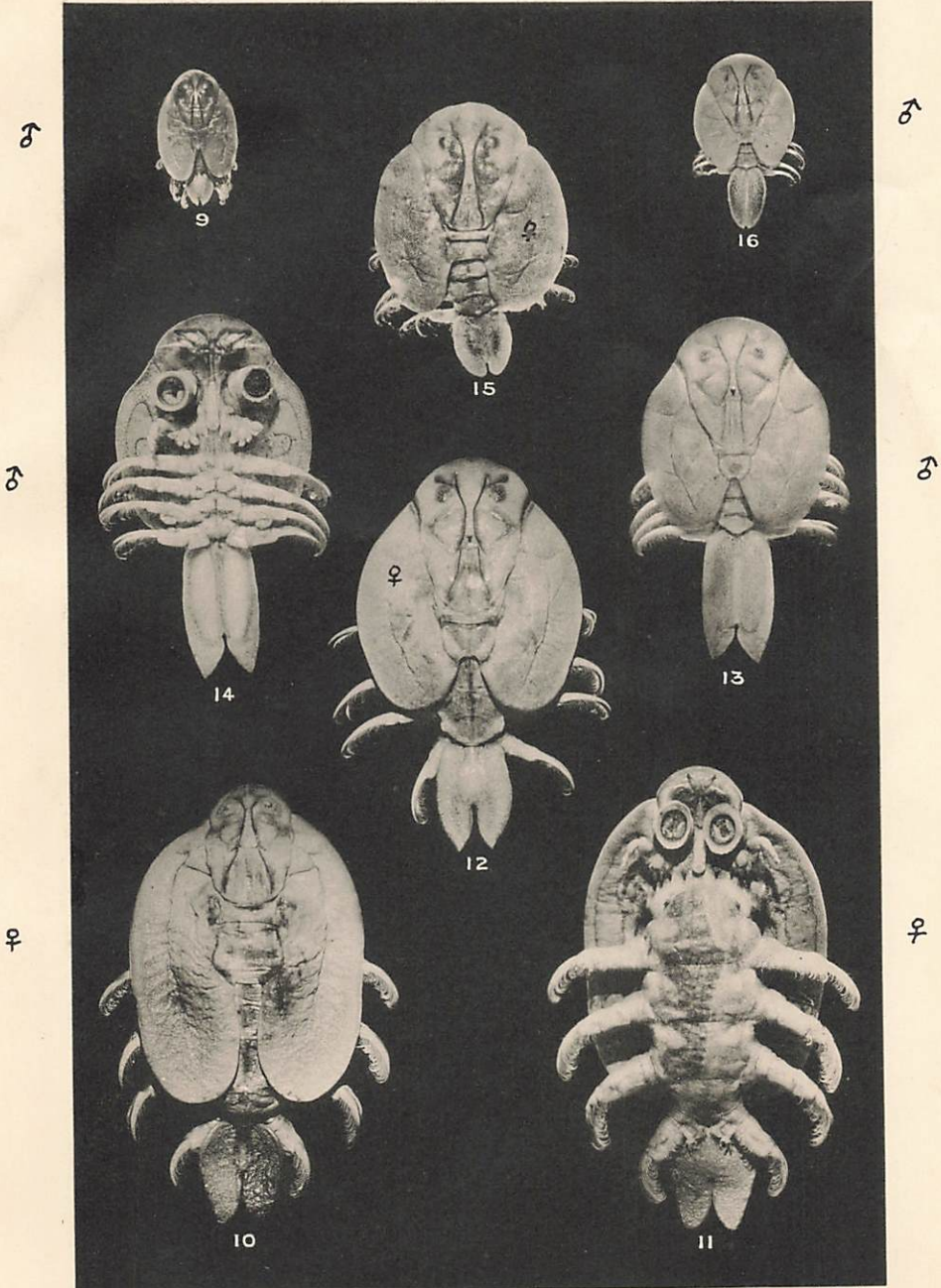
- Fig. 28. *Argulus striatus* (p. 274). Posterior two swimming-legs to show accessory copulatory apparatus. $\times 40$.
 29. " " Antennule and antenna. $\times 60$.
 30. " " Maxilliped. $\times 60$.
 31. *Argulus rubescens* (p. 276). Antennule and antenna. $\times 60$.
 32. " " Maxilliped. $\times 60$.



W.A.C. Photo.

London Stereoscopic Co. Imp.

1, 2. ARGULUS INCISUS. 3-5. A. RUBROPUNCTATUS.
6-8. A. PERSONATUS.

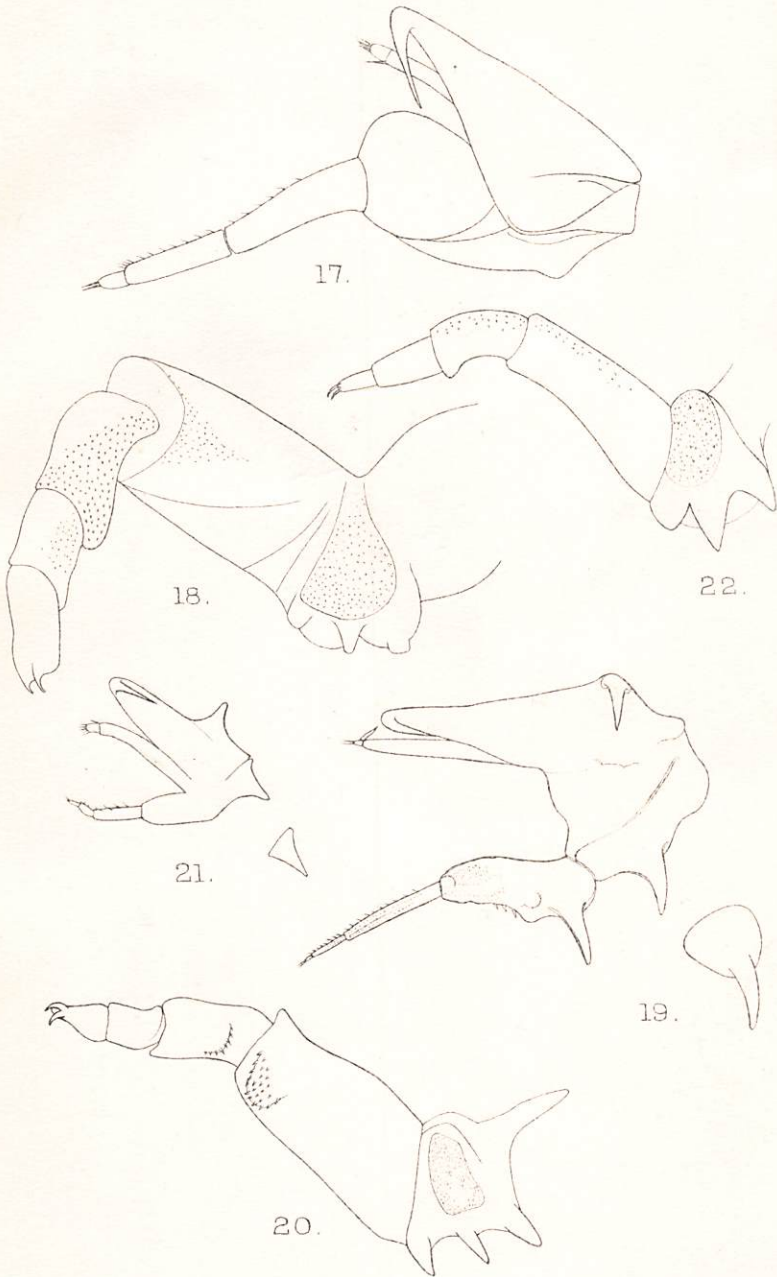


W.A.C. Photo.

London Stereoscopic Co. Imp.

9. ARGULUS EXIGUUS.
12-14. A. STRIATUS.

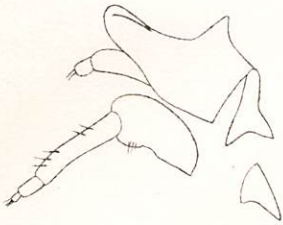
10, 11. A. ANGUSTICEPS.
15, 16. A. RUBESCENS.



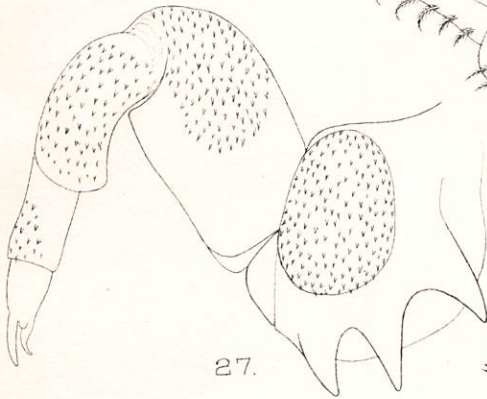
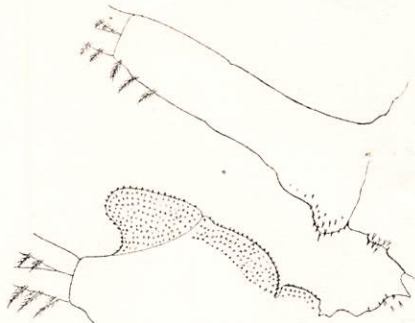
W.A.C. del.

Huth sc. et imp.

17,18. ARGULUS INCISUS. 19,20. A. RUBROPUNCTATUS.
21,22. A. EXIGUUS.



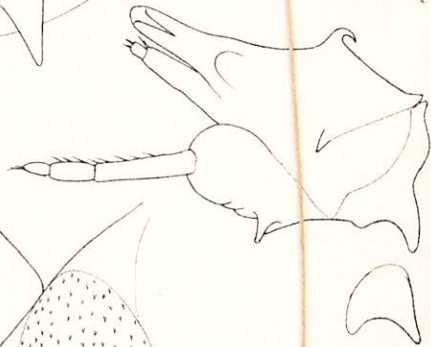
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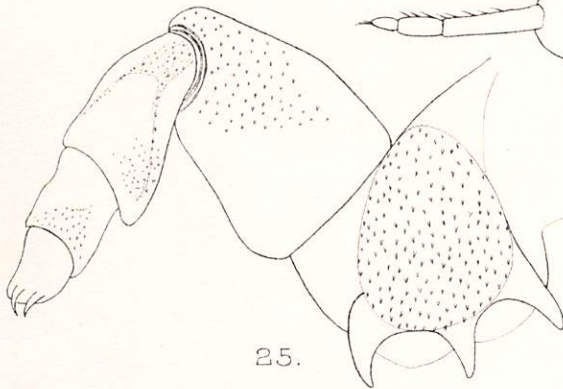
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23.



24.

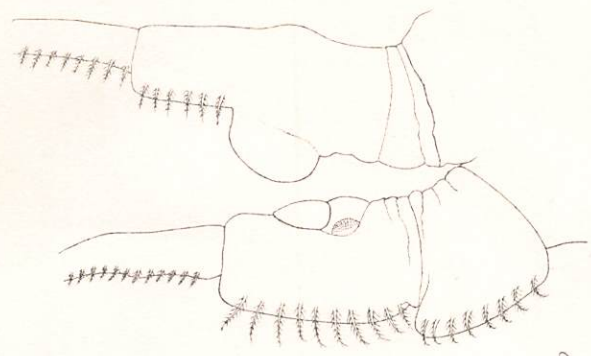


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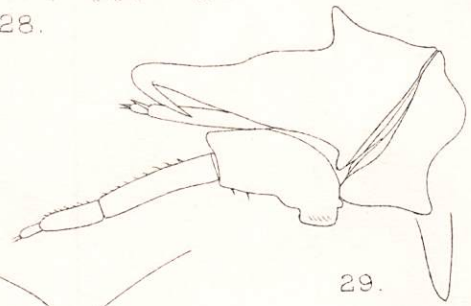
W.A.C. del.

Huth sc. et imp.

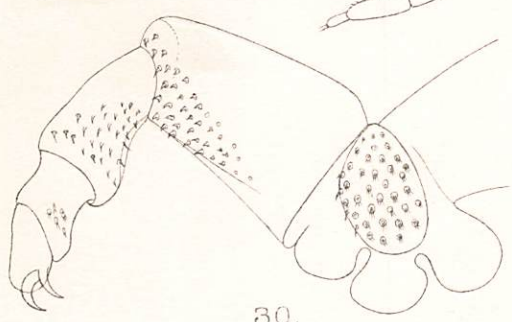
23-25. ARGULUS PERSONATUS. 26, 27. A. ANGUSTICEPS.



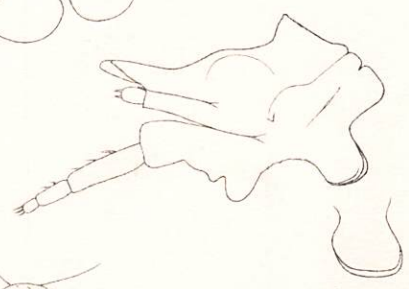
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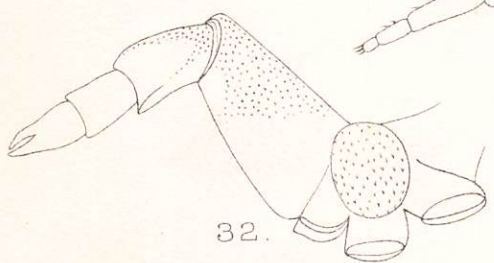
29.



30.



31.



32.

W.A.C. del.

Huth sc. et imp.

28-30. ARGULUS STRIATUS. 31, 32. A. RUBESCENS.