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TRANSACTIONS OF THE SOCIETY.

X.—*On the Fresh-water Crustacea of Algeria and Tunisia.*

By Robert Gurney.

(*Read February* 17, 1909.)

Plates VII. to XIV.

In the following paper I propose to give the results of the examination of collections made during a visit to Algeria and Tunisia in February and March 1906. Thirty-one days in all were spent in the country, and collections were made in Algiers, Constantine, Biskra, and Hammam Meskhoutine in Algeria, and in the neighbourhood of Tunis, as opportunity offered.

The weather of early February was bitterly cold and wet, snow falling heavily on our arrival in Algiers, and so heavily on the high plateaux as to block the line to Constantine for some days. It is probable that the coldness of the spring retarded the appearance of the Entomostraca to some extent, so that my earlier collections were poorer in species than they should have been. It was probably for this reason that I found no specimens of *Apus* or *Estheria* at Biskra, though nauplii of the latter were met with. On the other hand the abundance of rain provided pools of water which, in a drier season, would not have existed. The conditions are so different in the dry and wet seasons of the year that it is difficult for a stranger visiting the country to form a true idea of the usual state of affairs.

The fresh-water Crustacea of Algeria are better known than those of any other part of Africa, but, even here, a great deal of work remains to be done. The Ostracoda contained in my collections have not yet been worked out, and will not therefore be referred to on this occasion.

June 16th, 1909

The following is a description of the localities in which collections were made :—

I. ALGERIA.

Algiers.

The neighbourhood of Algiers proved singularly barren. The only pools in which anything living was found were some artificial ponds in the Jardin d'Essai. These ponds are supplied with water brought from the hills above the town, and are used for the cultivation of aquatic plants such as *Papyrus*. The following is a list of the species found :—

Asellus aquaticus Linn.
Simosa vetula O.F.M.
Ceriodaphnia reticulata Jur.
Pleuroxus aduncus Jur.
Chydorus sphæricus O.F.M.
Cyclops albidus Jur.
C. prasinus Fisch.
C. bicuspidatus Claus. var. *lubbocki* Brady.
C. strenuus Fisch.

Biskra.

The oasis of Biskra is the capital of the Central Zab district of the Lower Sahara. It is situated on the very edge of the desert, 124 m. above sea-level. The water supply of the oasis is derived from two sources, the River or Oued Biskra, and from springs. The supply from the river is one of very fluctuating quantity, and entirely ceases during the summer. In winter and spring the whole river channel, which is some 400 yards wide, may at times be filled by a turbid torrent, making it difficult to realise that its waters at this point can fail entirely. The essential source of water is therefore the springs, which rise in and by the bed of the river itself, in several groups, $2\frac{1}{2}$ kilometres to the north of the town. Those of the left bank supply the oasis of Filiach, while those of the right bank supply Biskra itself. The water of these springs rises evidently from the cretaceous rocks of the Atlas Mountains, and reaches the surface at a temperature of 29·33° C. (84·8° F.) and with about 2·16 grm. of dissolved salts per litre; it flows along the river bed, which would otherwise be quite dry during the summer, and is directed by means of a low masonry barrage into the main supply canal of Biskra. A large part of the water is doubtless lost by percolation through the gravel of the river bed, but the total volume available amounts to about 10,000 litres a minute. One-tenth of the whole is taken by a special canal for the needs of the town and garrison, the rest

being available for the oasis itself. An additional canal, the "Canal des Crues," was dug in 1878 to catch and utilise the flood-water of the river, but its supply is necessarily uncertain and intermittent. The main canal sends branches all over the oasis, and these branches, or seguias, subdivide till every parcel of land is supplied with water, the surplus finding its way into ponds and finally into the desert at the south of the oasis. The watering of the palms is effected by means of pools dug at the foot of each tree, or group of two or three. These pools are filled at varying intervals according to the season, in summer (June to September) about every seven days, in winter about every sixty-one days, and in spring (February to May) every twenty-five days. The amount of water allowed per palm for each watering is about 3 cubic metres, the annual supply working out at about 72 cubic metres per palm. These pools are usually quite small, about 4 metres square in extent, but vary in size according as they supply one palm or more than one; they always have a muddy bottom and rarely contain any vegetation, one or two being seen with a little *Nitella*. The typical association of species found in them consists of *Branchipus pisciformis*, *Macrothrix hirsuticornis*, *Cyclops bicuspidatus* var. *lubbocki*, *C. diaphanus*, *Cypris virens* and *Herpetocypris reptans*, but other species are also found occasionally. In seventeen pools examined in Biskra sixteen species were found, of which the following is a list, with their frequency expressed as occurrences per 100 collections. The fauna of these pools appears to be the same as in the neighbouring oases of Oumach and Sidi Okbar.

TABLE SHOWING THE CRUSTACEAN FAUNA OF SEVENTEEN PALM IRRIGATION POOLS IN BISKRA, AND THE RELATIVE FREQUENCY OF THE OCCURRENCE OF THE DIFFERENT SPECIES.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Frequency per cent.
Daphnia magna		+	+				+									+		24
Ceriodaphnia dubia ..															+	+		12
Macrothrix hirsuticornis	+	+	+		+			+	+									35
Alona elegans											+							6
Chydorus letourneuxi			+												+	+		18
Cyclops bicuspidatus ..	+			+	+	+			+				+			+		41
C. diaphanus		+					+			+		+					+	30
C. planus																+		6
C. viridis															+			6
Diaptomus wierzejskii											+	+						12
Cyprinotus incongruens											+							6
Cyprinotus sp.												+						6
Cypris virens		+	+	+	+	+	+	+	+	+			+					59
Herpetocypris reptans		+	+					+	+					+				30
Branchipus pisciformis			+	+	+	+	+	+	+	+	+	+	+	+		+	+	83

The periodical drying up of the pools might be expected to make them suitable only for species with a very short life-cycle, or capable of surviving dry periods, and it is probably for that reason that Cladocera, with exception of *Macrothrix hirsuticornis*, are not usually found. The occurrence of the latter is difficult to explain, inasmuch as it was only once found reproducing sexually; it is possible that the species maintains itself in some parts of the irrigation channels and is introduced afresh into the pools when they are filled.

Besides these palm-pools, I investigated three large ponds which probably owed their existence to the superabundance of water at that time, and are probably dry in summer. These were:—

1. *Kasbah pond.*—The old Turkish fort, or kasbah, at the south of the oasis, is surrounded by a deep depression filled with water forming a large pond divided into three parts by causeways. This pond contained little vegetation, but a rich fauna, particularly of Ostracods.

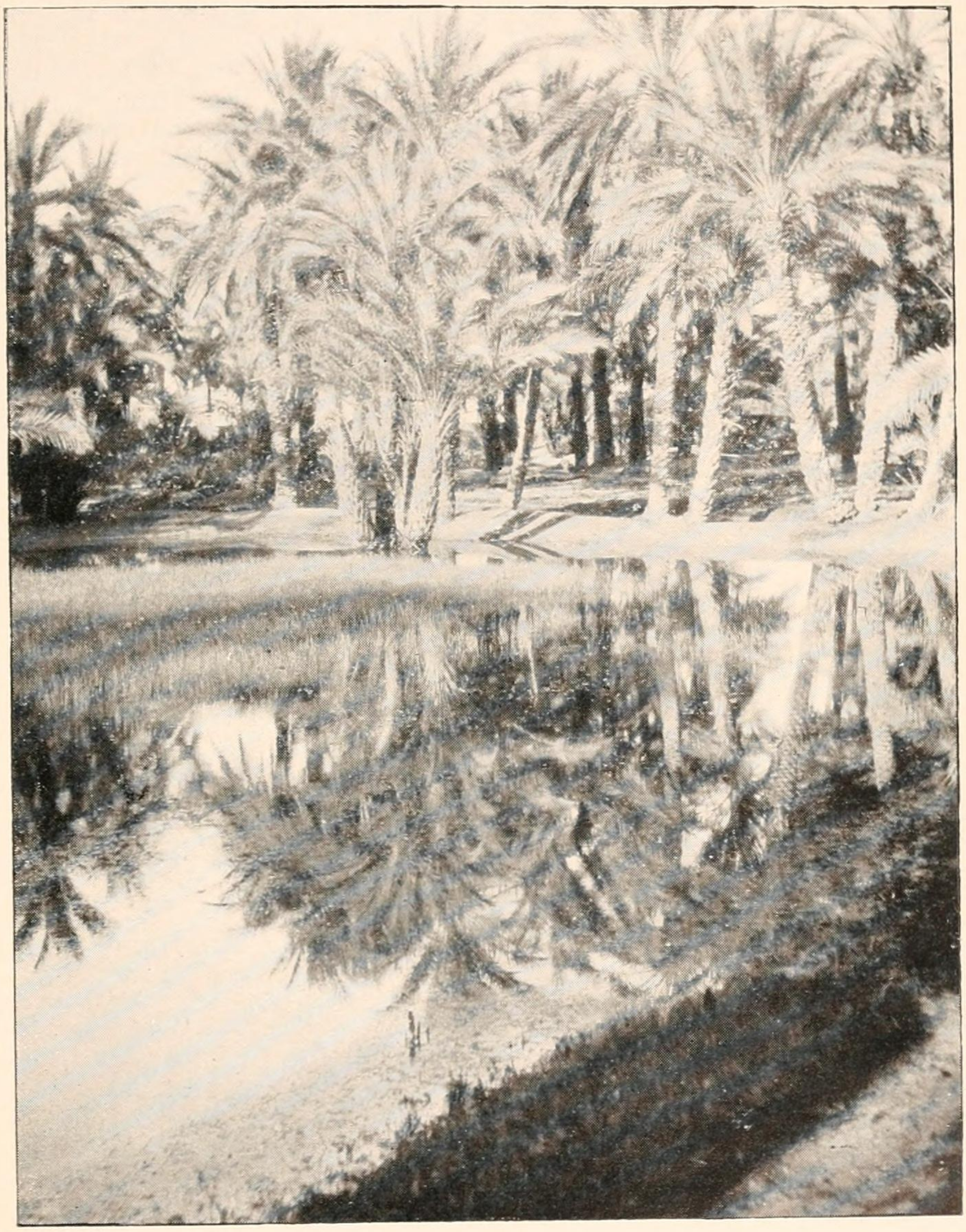
List of species:—

Daphnia magna Strauss.
Ceriodaphnia dubia Rich.
Macrothrix hirsuticornis Norm. and Brady.
Alona elegans Kurz.
Cyclops diaphanus Fisch.
C. bisetosus Rehb.
C. planus sp. n.
Diaptomus chevreuxi De Guerne and Rich.
Branchipus pisciformis Schaeff.
Estheria sp. (larvæ).

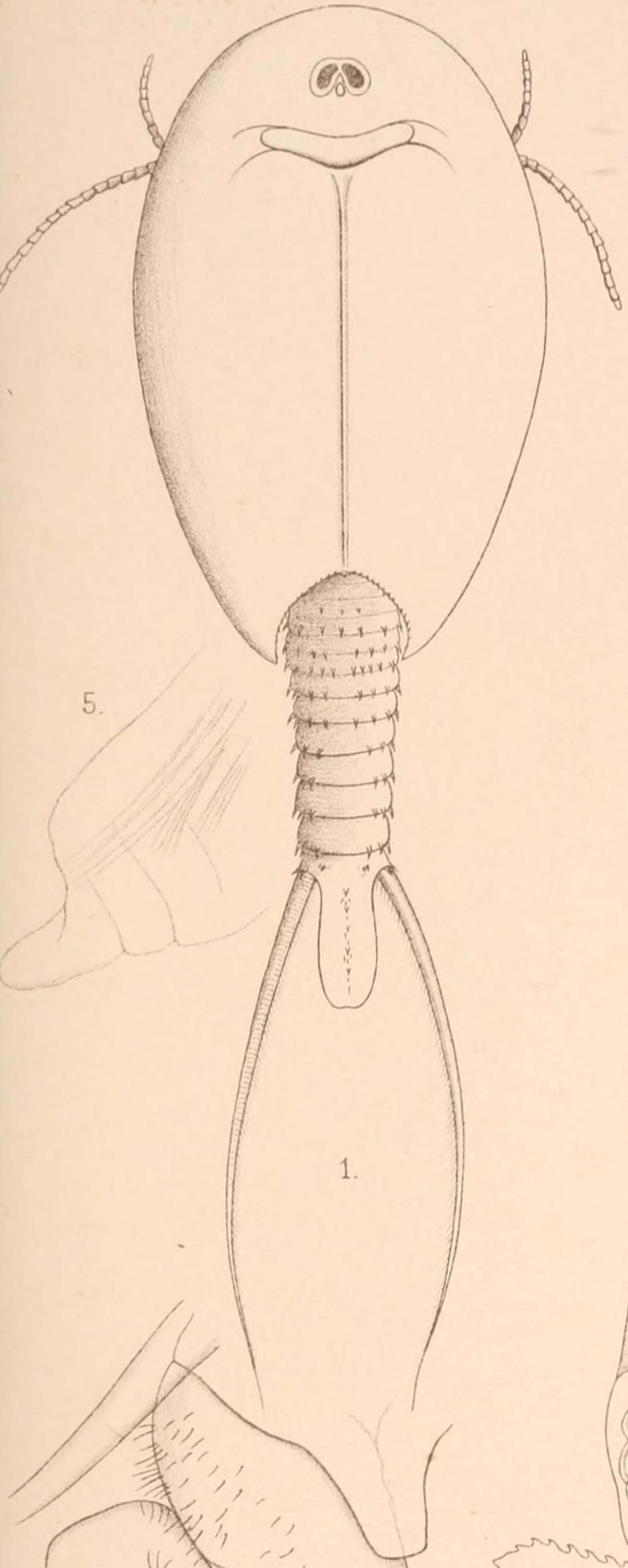
2. *Frog pond* (plate VII.).—This name seems appropriate from the immense number of frogs inhabiting the pond, which is situated among the palms in the western part of the oasis. Here there was a rich vegetation.

EXPLANATION OF PLATE VIII.

Fig. 1.—*Lepidurus lubbocki.* Female. × 3.
,, 2.—Ditto. Tail-plate. × 15.
,, 3.—*Streptocephalus bimaris* sp. n. Male. Second antenna. × 37.
,, 4.—Ditto. Female, 6th leg. × 26.
,, 5.—Ditto. Female, tip of egg-sac. × 30.



Frog-pond, Biskra.



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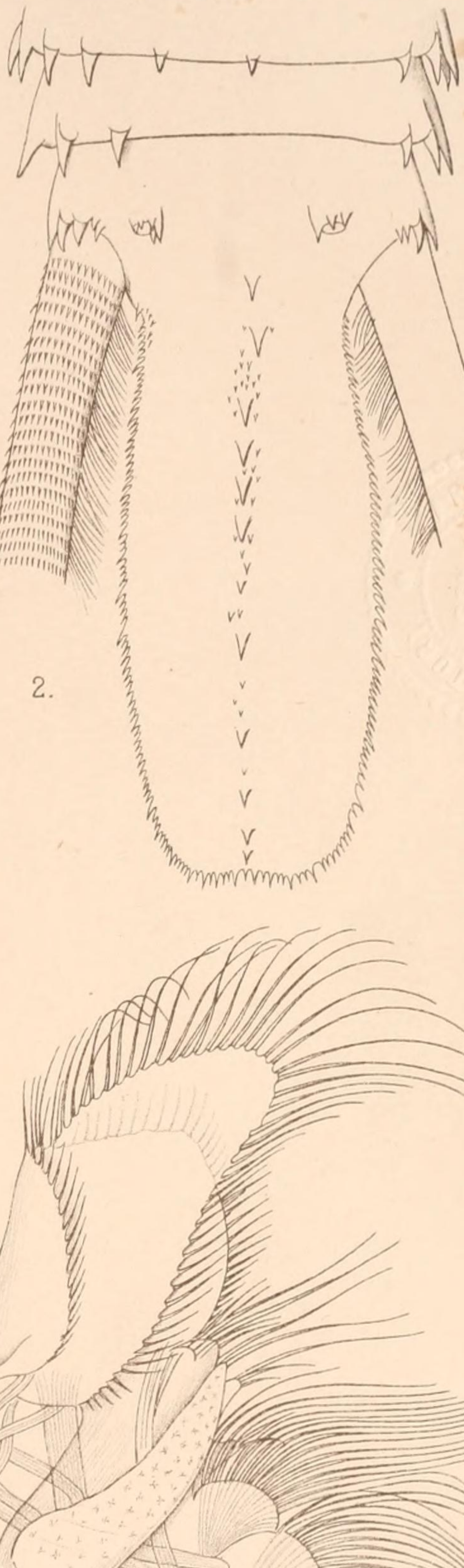

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R. Gurney del. ad nat.

West, Newman lith.

List of species:—

Daphnia magna Strauss.
Ceriodaphnia dubia Rich.
Alona elegans Kurz.
Dunhevedia crassa King.
Chydorus letourneuxi Rich.
Cyclops prasinus Fisch.
C. diaphanus Fisch.
C. bicuspidatus var. *lubbocki* Brady.
Branchipus pisciformis Schaeff.

3. *Beni Mora pond.*—This is a large shallow pond with little vegetation close to the racecourse at Beni Mora, on the north-west of Biskra.

List of species:—

Daphnia magna Strauss.
Macrothrix hirsuticornis Norm. and Brady.
Alona elegans Kurz.
Cyclops diaphanus Fisch.
C. bicuspidatus var. *lubbocki* Brady.
Diaptomus wierzejskii Rich.
Branchipus pisciformis Schaeff.

About six kilometres west of Biskra is the hot spring of Hammam Salahin, and in its neighbourhood are two crater-like depressions full of highly saline water. The water is said to be of the same nature as that of the springs supplying Biskra, but concentrated by evaporation, and might have been expected to contain Entomostraca. However, neither here, nor in any other saline water in the neighbourhood, did I find any trace of Entomostraca of any kind. In one of these "crater lakes" a few Coleoptera, Mollusca, and the fish *Cyprinodon fasciatus* Val., which also lives in the hot water flowing from the baths, were found. The water was rich in Diatoms, the following species having been identified by Mr. Morland, to whom I wish to express my thanks:—

Surirella striatula Turpin.
Pleurosigma elongatum Smith.
Synedra tabulata Kutz.

The Rotifer *Notholca striata* (kindly identified for me by Mr. Rousselet) also occurred in some numbers. This Rotifer and all the Diatoms are species characteristic of brackish water.

Sources d'Oumach.—The springs which supply the oasis of Oumach rise about 10 kilometres south-west of Biskra and about

the same distance from Oumach, which lies to the south of Biskra. There are three springs, differing somewhat from each other in nature. The first, which is called Aïn-el-Hadjar, springs from a hole in the base of a mass of limestone rock, and has an output of about 1800 litres a minute at a temperature of 26° C. according to my own observation. The water is very clear, rather sulphurous to the taste, but of normal density. The bed of the outflowing stream is covered with small stones, under which were found swarms of *Gammarus simoni*, and, at the mouth of the spring, a few specimens of a *Cirolana* which I have described as *Cirolana fontis*. Another spring, or group of springs, known as Aïn-el-Faouar, are apparently of similar origin to the Aïn-el-Hadjar. The third group, named Aïn Mogloub, lies a little to the east. Here there are two large springs having the form of more or less round pools, the one about 4 metres across, the other smaller, and both very deep and clear. The bottom is all shifting sand, and there is a sort of film of white which ever and again spreads over the bottom of the pool and draws back again. The spring is intermittent, now bubbling furiously and now sinking quiescent, but with no regular periodicity comparable to that of geysers or the so-called tidal wells of Australia and other places. An Arab assured me that the water comes from the sea; but, however that may be, it is here quite fresh and drinkable, with a temperature of 26·33° C. In the outflow from this group several specimens of *Palæmonetes varians* were found. The water from all the springs is collected into an artificially embanked channel which leads straight over the desert to Oumach. In this channel *Potamon fluviatilis* and *Barbus callensis* abound, while *Tilapia zillei* was found in the Aïn Mogloub and in the outflow of Aïn-el-Hadjar. *Palæmonetes varians* probably occurs sparingly throughout the length of the channel, as it was found, in the first instance, by Lord Walsingham about five kilometres from the springs.

II. TUNISIA.

Oued Tindja.

Oued Tindja station is about thirty miles north-west of Tunis, betwen the lakes of Garaa Achkel and Bizerta. Garaa Achkel is a great lake surrounded by hills on three sides and with a barren sandy shore. At the time of my visit the water was fresh to the taste and to the salinometer, and was at an unusually high level. It was said to have been 3 metres above its usual level a short time before, but was then falling. We were told that during winter and spring this lake contains fresh water and has an outflow into Lake Bizerta, but that, during summer, owing to evaporation,

the level sinks and there is an inflow of salt water from Lake Bizerta. No Entomostraca were found in the lake, the only Crustacea seen being a species of *Sphæroma* and *Gammarus locusta*. Shells of *Cardium* were picked up on the shore, so that it is probable that the fauna is a brackish- rather than a fresh-water one. A thorough investigation of the lake would prove of great interest. A very strong stream was flowing out at the north-west end of the lake into the Oued Tindja, and at this point, in a backwater, *Gobius rhodopterus* and *Anguilla vulgaris* were found abundant, and a large species of *Balanus* was found upon some wooden posts. Close to the outflow there is a large, weedy marsh, swarming with frogs, and with a rich Entomostracan fauna.

List of species :—

Macrothrix hirsuticornis Norm. and Brady.
Alona elegans Kurz.
Chydorus sphæricus.
Cyclops strenuus Fisch.
C. planus sp. n.
C. serrulatus Fisch.
Canthocamptus trispinosus Brady.
Diaptomus numidicus sp. n.
Poppella guernei Rich.

The following species were found in a large pond not far from this point :—

Daphnia chevreuxi Rich.
Ceriodaphnia dubia Rich.
Simosa vetula Müll.
Moina rectirostris Jur.
Macrothrix hirsuticornis Norm. and Brady.
Chydorus sphæricus.
Cyclops macrurus Sars.
C. viridis Jur.
C. diaphanus Fisch.
C. planus sp. n.
C. bicuspidatus var. *lubbocki* Brady.
Canthocamptus staphylinus Jur.
Diaptomus incrassatus Sars.
D. weirzejskii Rich.
D. ingens sp. n.
D. cyaneus sp. n.
Estheria cycladoides Joly.
Streptocephalus sp.

Near the station, on the east of the line, the soil is sandy and dune-like, and among the dunes there were some small rain-pools,

which were remarkable for containing four species of Phyllopods, besides several other species of Entomostraca.

List of species:—

Daphnia chrevreuxi Rich.
D. atkinsoni Baird.
Simosa vetula Müll.
Ceriodaphnia dubia Rich.
Moina rectirostris Jur.
Alona elegans Kurz.
Cyclops viridis Jur.
C. bicuspidatus var. *lubbocki* Brady.
Diaptomus incrassatus Sars.
D. cyaneus sp. n.
D. wierzejskii Rich.
Lepidurus lubbocki Brauer.
Estheria cycladoides Joly.
Chirocephalus diaphanus Prev.
Streptocephalus bimaris sp. n.

Sidi Athman.

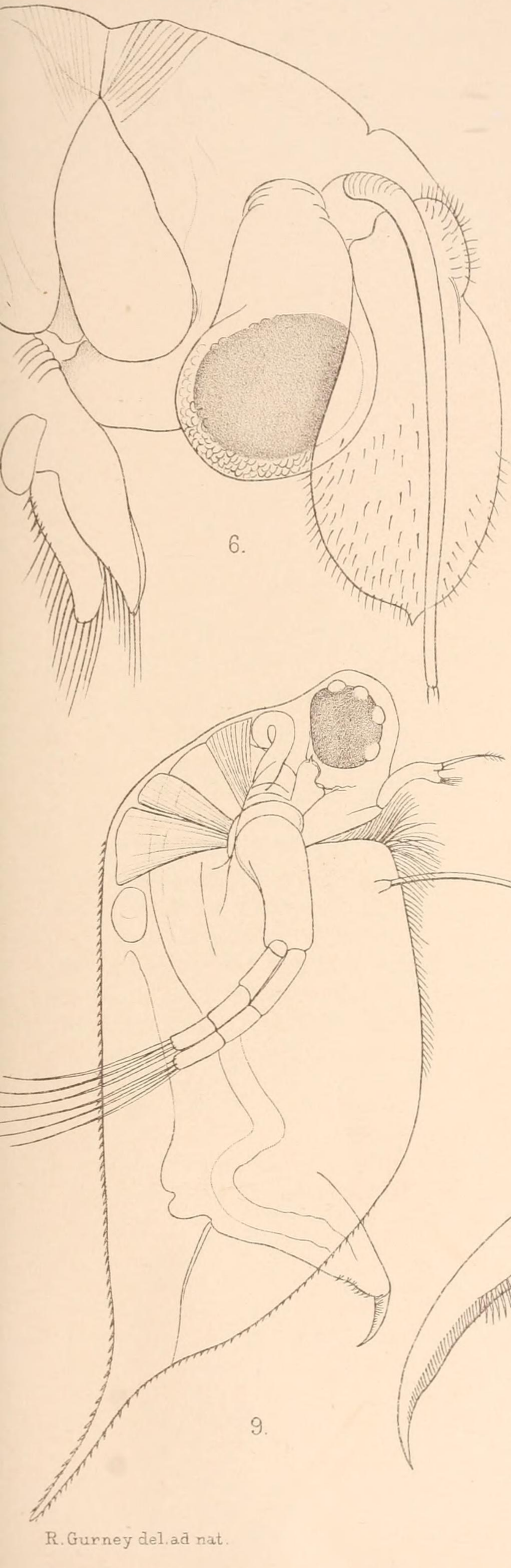
Sidi Athman is a station on the line to Bizerta about fourteen miles north-west of Tunis. On the east there stretches a large marshy plain called Garaet-el-Mebtouh, which is part of a great depression following the course of the Oued Medjerdah to the sea at Lake Porto Farina, and extending between Djebel Amar on the south and Djebel Kechabta on the north. The level at Sidi Athman is given on the map as 8 metres. At the time of my visit there was an unusual amount of water on the marsh, while in places the road itself was inundated. Away to the north a large sheet of water was seen, which could not be reached owing to the boggy character of the ground. Close to the road there are drainage ditches and small ponds with abundance of vegetation, notably *Ranunculus aquatilis*, and harbouring a rich fauna. The following are the species found here:—

1. In roadside ditch:

Daphnia atkinsoni. ♂ and eph. ♀. Abundant, many of the young showing the characters of *D. bolivari* Rich.
Daphnia magna Strauss. Rare.

EXPLANATION OF PLATE IX.

Fig. 6.—*Streptocephalus* sp. Head of female. × 37.
„ 7.—Ditto. Base of the setæ on the exopodite of the 6th leg. × 260.
„ 8.—*Branchinecta* sp. Head of female. × 37.
„ 9.—*Daphnia chevreuxi* Rich. Male. × 57.
„ 10.—Ditto. Post-abdomen of male. × 260.



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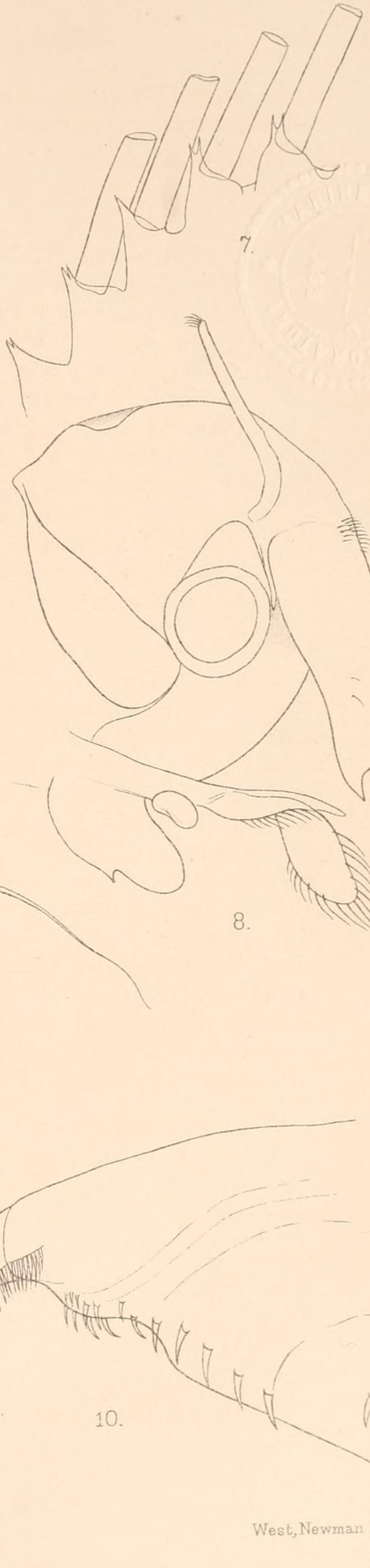

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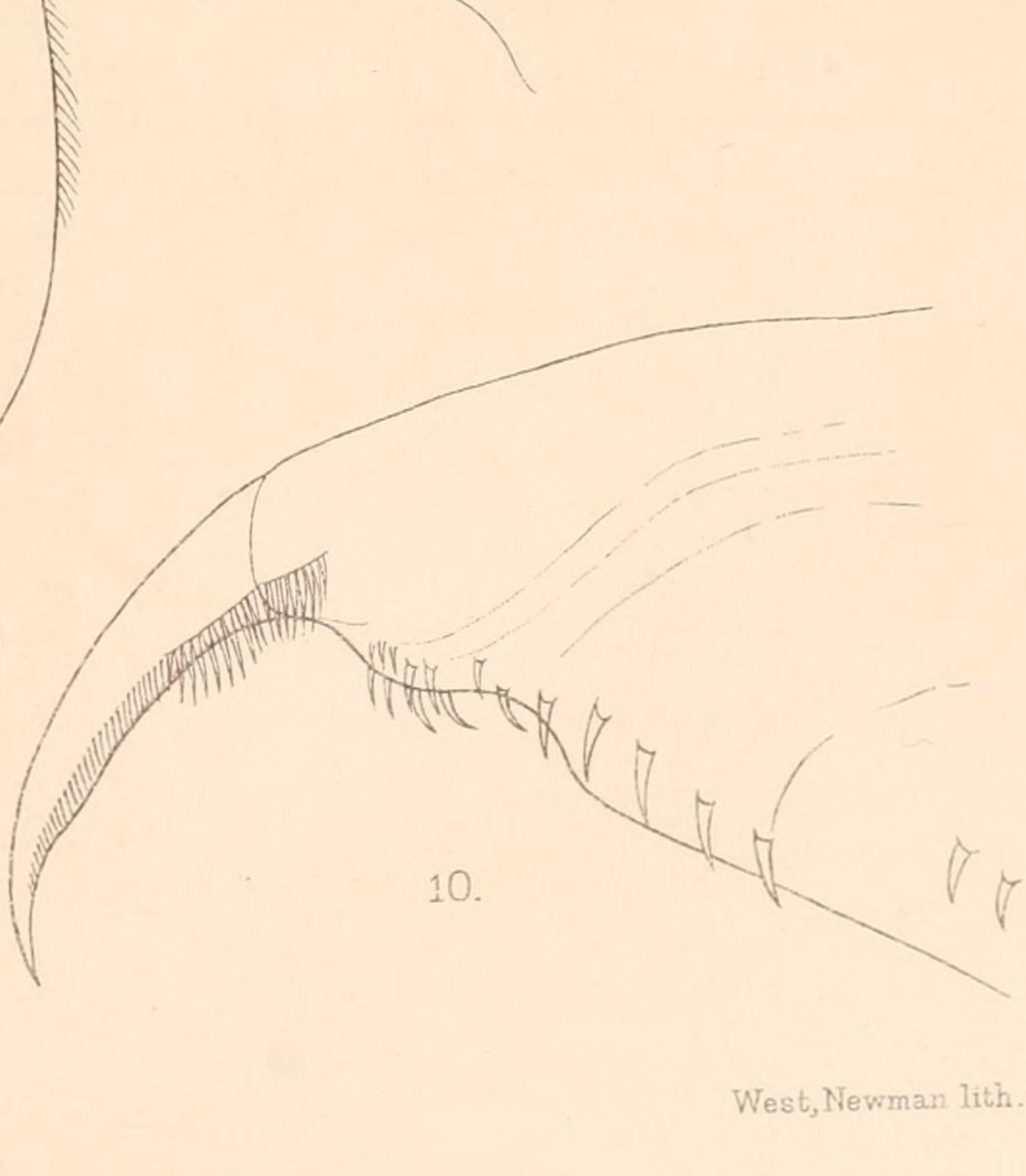

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R.Gurney del.ad nat.

West, Newman lith.

Ceriodaphnia dubia Rich.
Moina rectirostris Jur.
Macrothrix hirsuticornis Norm. and Brady.
Alona elegans Kurz. Rare.
Cyclops diaphanus Fisch. Few.
Diaptomus wierzejskii Rich. Common.
D. incrassatus Sars.
Chirocephalus diaphanus Prev. Common.
Estheria cycladoides Joly. Common.

2. Flooded road:

Daphnia atkinsoni Baird.
Moina rectirostris Jur.
Macrothrix hirsuticornis Norm. and Brady. Abundant. Many males and ephippial females.
Alona elegans Kurz.
Chydorus letourneuxi Rich. Abundant. Ephippial female present.
Cyclops diaphanus Fisch.
Diaptomus wierzejskii Rich.

Sebkhet-er-Riana.

This great salt like lies somewhat to the north of Carthage. Though full of water at the time of my visit, the Sebkha is dry in summer and salt is taken from it by an English company, which, unfortunately, absolutely forbids all approach to its shores, so that I was unable to collect as freely as I should have desired. Judging from pools by the edge of the lake, the fauna is the same as that of most "Chotts," as described by MM. Blanchard and Richard. The salinity of these pools was excessively high—above 1·046, which was the highest reading of my salinometer.

Species found:—

Moina sp. Ephippium.
Marshia blanchardi Rich. Common.
Artemia salina Linn. 7 females and 2 males.

Tunis.

The town of Tunis stands on a ridge which separates the Lake of Tunis from the Salt Lake or Sebkha Sedjouma. The latter, like all salt lakes, is dry in summer, but at the time of my visit was full of water. The lake was then surrounded by a strip of soft and tenacious mud in which the retreating water had left a number of small pools containing water of varying salinity and

with a varying fauna. The following table shows the fauna of four such pools:—

Density	1·007	1·013	1·017	1·035
Daphnia atkinsoni	Abundant	Abundant	Abundant	Rare
Moina salinarum	..	..	Common	Rare
Cyclops diaphanus	Common	..	..	..
Diaptomus salinus	..	Numerous	Rare	..
Marshia blanchardi	..	..	Common	..
Branchinecta sp.	..	Larvæ	..	Larvæ

LIST OF SPECIES.

Malacostraca.

Potamon edule Latr.—The fresh-water crab is apparently widely distributed in Algeria and Tunisia, but it was only seen by me in Biskra and its neighbourhood. It seems to hide itself in cold weather, and it was only in spring water which was somewhat warmer than the air that it was noticed. Miss Rathbun has recently (1904) separated the circum-Mediterranean form of *Potamon* (*P. fluviatile* Belon) into three species, *P. edule* Latr., *P. potamoios* Oliv., and *P. setiger* Rathb. The first of these, to which my specimens belong, inhabits Italy, Greece, and Numidia, while the second is found in Egypt, Palestine, Syria, Mesopotamia, and Cyprus, the former being, therefore, the Western and the latter the Eastern form. The separation of an Eastern from a Western Mediterranean form recalls the separation of *Saxicola albicollis* Viell. by Whitaker into an Eastern form, *S. amphileuca* Ehr., and a Western form, *S. albicollis*. The distribution of these two species agrees almost exactly with that of *Potamon potamoios* and *P. edule* respectively.

Palæmonetes varians Leach.—The first specimens of this species found in Algeria were taken by Lord Walsingham, just before my visit, in the conduit supplying the oasis of Oumach. I myself found several more specimens in the outflow of one of the Sources d'Oumach, but it seems to be far from common. It has been recorded from several localities in Tunisia.

Asellus aquaticus Linn.—A few specimens were found in pools in the Jardin d'Essai at Algiers.

Cirolana fontis Gurney.—A description of this interesting species has already been given elsewhere.* Three specimens

* Zool. Anzeig., xxxii. (1908) p. 682.

only were found under stones at the mouth of the spring Aïn-el-Hadjar (Sources d'Oumach) near Biskra.

Sphæroma sp.—A species of *Sphæroma* occurs in Lake Garaa Achkel at Oued Tindja, but my specimens are not sufficiently mature to be identified with certainty. They resemble *S. serratum*, which occurs abundantly along the shore of the Lake of Tunis (in salt water).

Gammarus simoni Chevreux.—This species was found to be common at the mouth of the spring Aïn-el-Hadjar (Sources d'Oumach) about 10 kilometres west of Biskra. My specimens differ in some respects from the description given by M. Chevreux, but the differences are not of great importance. In my specimens the accessory flagellum of the first antenna consists of two or three joints; the fourth segment of the abdomen bears a group of setæ but no spines, the fifth and sixth being as described by M. Chevreux with the addition of a few setæ. The telson differs in that there is no lateral seta. In the form of the head and of the gnathopods in both sexes there is complete agreement. It appears to be a species widely distributed throughout Algeria and Tunisia, and has already been recorded from the neighbourhood of Biskra.

Gammarus pungens M. Edw.*—Found in a small rock-hewn tank in the Gorge of the Roummel at Constantine.

Gammarus locusta Linn.—A few specimens were found living in fresh-water in Lake Garaa Achkel at Oued Tindja.

Corophium volutator Pall.—A few specimens of this species were found in the Oued Tindja at its outflow from the lake in water practically fresh. The species seems to be very adaptable with regard to salinity, since it is found also in Norfolk in places where, for the greater part of the year, the water is perfectly fresh.

Entomostraca.

Lepidurus lubbocki Brauer.—A small number of specimens of a species of *Lepidurus* were found on March 7 in some small pools near Oued Tindja. Through the kindness of Canon Norman I have been able to compare them with a specimen of *L. lubbocki* from Sicily, and have no hesitation in identifying my specimens with that species in spite of certain differences which I think it advisable to mention.

There appears to be a great variability with regard to several of the characters of the species. The differences are as follows:—

1. The nuchal organ is described by Brauer as "fast kreisrund," whereas in Canon Norman's specimen and in my own the outline

* My specimens of this and the preceding species have been submitted to the Rev. T. R. R. Stebbing, who has been kind enough to examine them, and to confirm my identification.

is somewhat elliptic, the proportion of width to length being about 1 : 1·4 (plate VIII. fig. 1).

2. The number of teeth on either side of the posterior emargination of the shell is in the Sicilian specimen 14 to 15, and in mine varies from 17 to 22. Brauer gives the number as about 17.

3. In the Sicilian specimen the proportion of width to length of the tail-plate (plate VIII. fig. 2) is 1 : 1·87, and is given by Brauer as 1 : 2. In my specimens this plate is considerably longer, varying from 1 : 2·2 to 1 : 2·8, with an average of 1 : 2·4. The tip of the plate is emarginate in the Sicilian specimen, and in my own may be evenly rounded, truncate, or emarginate. The number of dorsal median teeth is generally about 7, but may be as many as 11 in addition to many minute denticles. In the Sicilian specimen there are 6.

The form of the tail-plate in young individuals resembles very closely that of the adult *L. glacialis*, as has been pointed out by Brehm with reference to *L. productus*.

L. lubbocki has been found at Bône in Algeria (Simon).

Artemia salina Linn.—*Artemia salina* seems to occur in all the chotts, or salt lakes, of Algeria and Tunisia, but I was somewhat surprised to find that it did not occur in any waters in the immediate neighbourhood of Biskra, whatever their salinity might be. I myself found it only in Chott Tinecilt (Haut Plateau, 2800 ft.), and in Chott El Ariana, near Tunis. Eight adult specimens were collected in a pool by the shore of the latter, of which two were males. The furcal rami of the six females show an extraordinary variety in the number and arrangement of the setæ, the number being generally different in the two rami. The number of setæ on each ramus (including minute teeth) ranges from three to eleven.

Branchinecta sp.—In the salt pools at the edge of Lake Sedjouma, a species of Branchipod was found which I am unfortunately unable to identify. Several larvæ were taken, and one nearly adult female, besides a single male just beginning to show its sexual characters. The following is a description of these two specimens:—

Female: Head and thorax considerably shorter than the abdomen, which consists of nine segments. Segments of the abdomen longer than broad. Furca longer than the last segment

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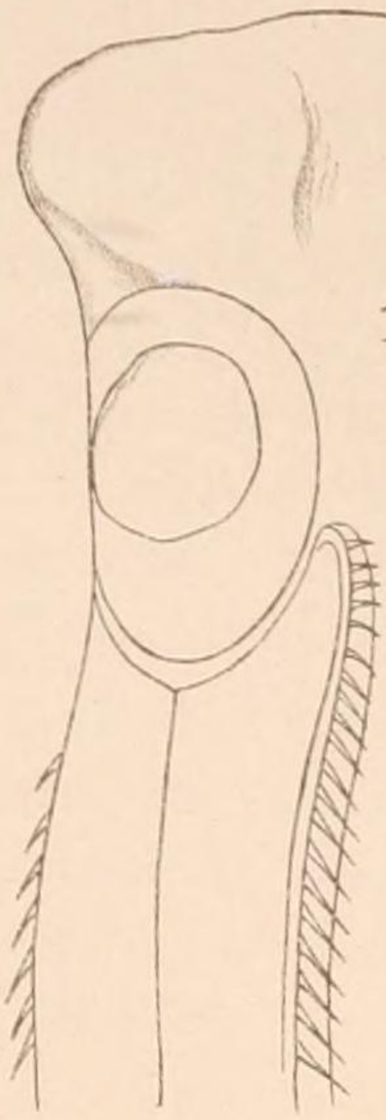
EXPLANATION OF PLATE X.

Fig. 11.—*Daphni chevreuxi* Rich. Head of young male, from dorsal side. × 260.
,, 12.—*Streptocephalus bimaris* sp. n. Male. × 8.
,, 13.—*Moina salinarum* sp. n. Female. × 65.
,, 14.—Ditto. First antenna of female. × 260.
,, 15.—Ditto. Part of the post-abdomen. × 440.
,, 16.—*Macrothrix hirsuticornis* Norm. & Br. Male. × 120.

13.



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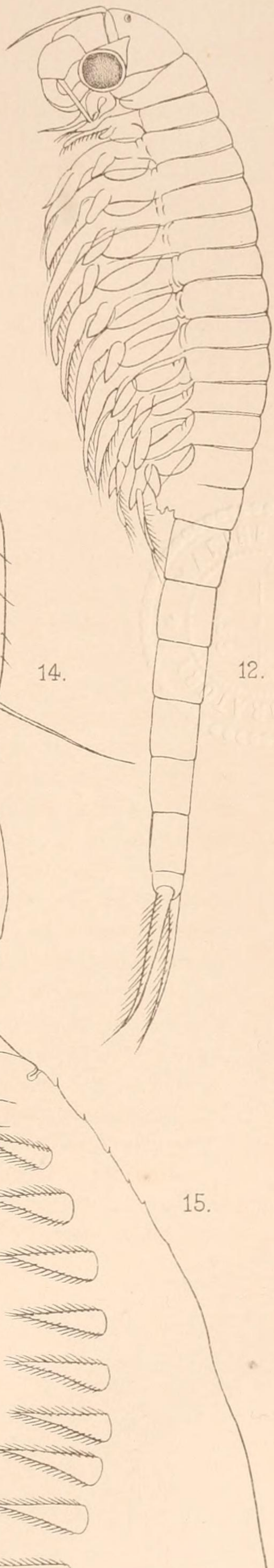

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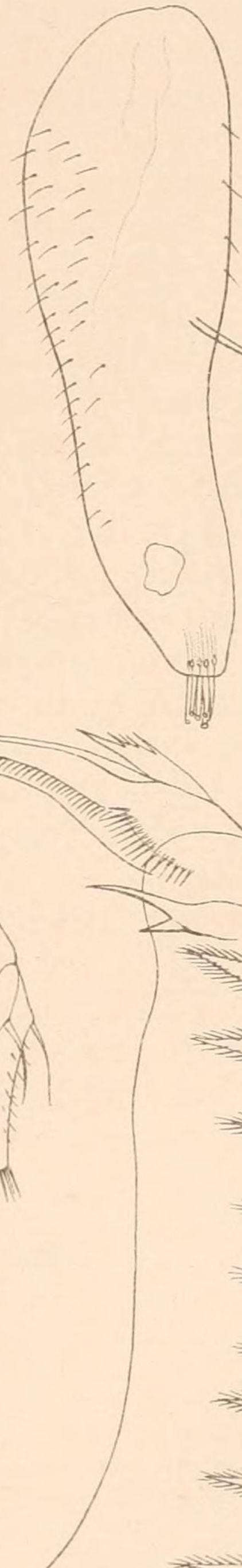

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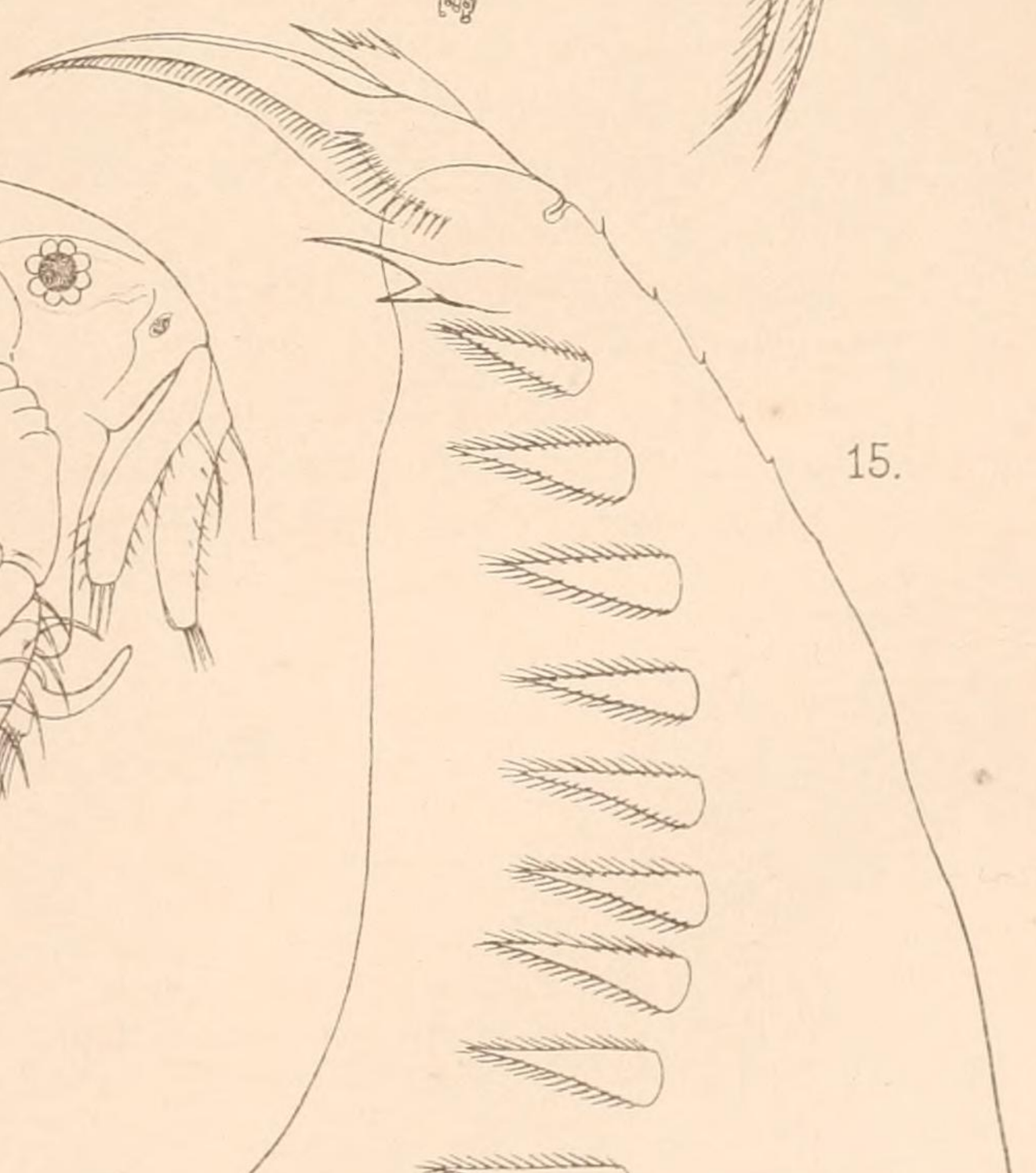

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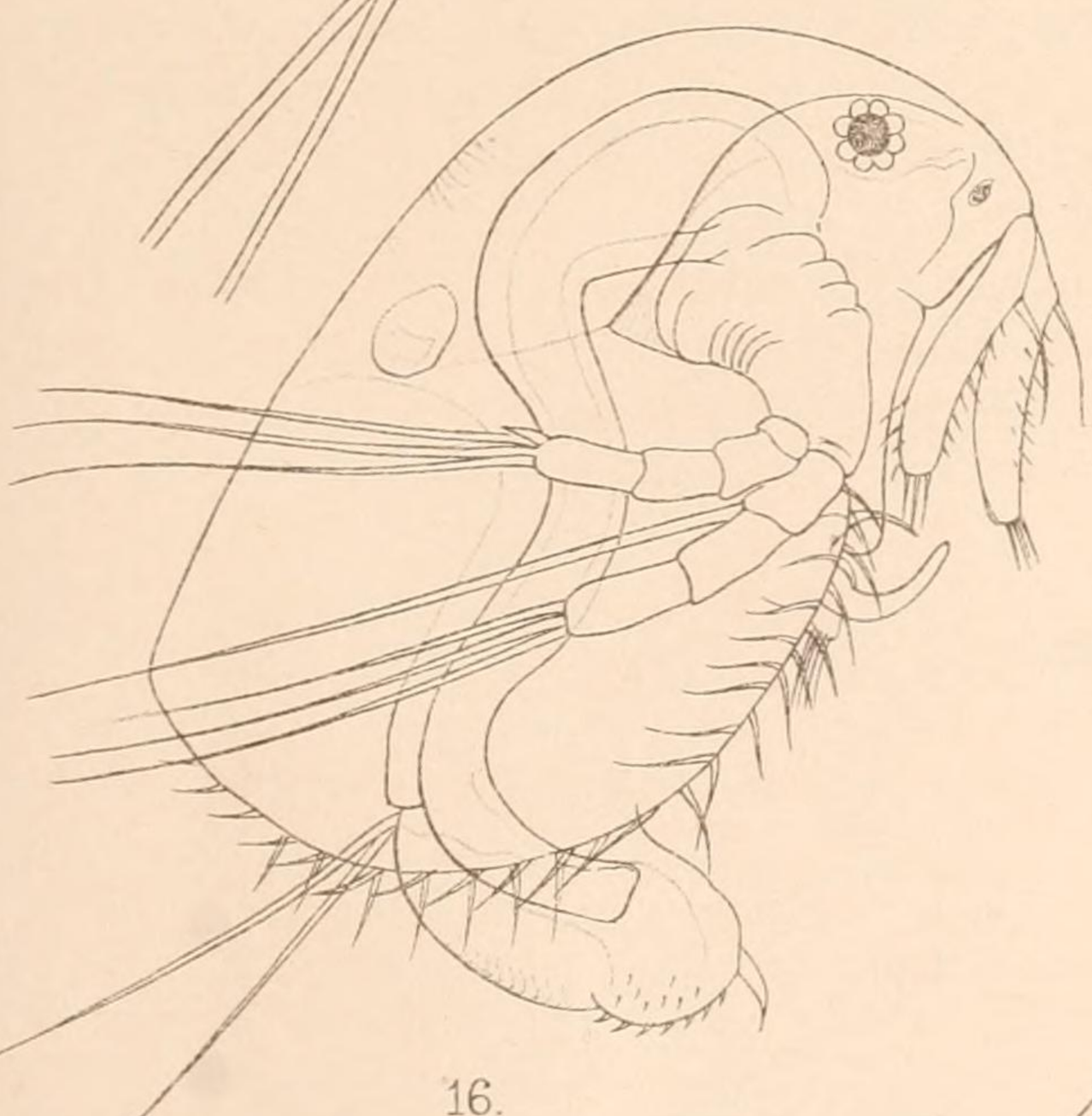

16.

R. Gurney del. ad nat.

West, Newman lith.

of the abdomen and closely ciliated. Egg-sac not fully developed, shorter than the 3rd abdominal segment, and probably cylindrical when fully formed. Second antenna narrow, flattened, with the external margin prolonged to a point (plate IX. fig. 8). Branchial legs, having the 6th endite somewhat triangular in shape, with a rather pointed apex. Coxal exite single, with a single large notch on its external margin. Base of the setæ of the exopodite and 6th endite surrounded by a ring of minute denticles.

Male: Head and thorax slightly longer than the abdomen. Segments of the latter scarcely longer than broad, the 3rd and 8th having each a pair of small ventral knobs. Furca mutilated, but apparently similar to that of the female. Second antenna not fully developed, but consisting of a stout basal part and a slender distal joint not longer than the basal joint. No frontal appendages. Legs as in the female.

Measurements:—

	Head and Thorax.	Abdomen.	Furca.	Total.
Male ..	4·5 mm.	4·25 mm.	..	8·75 mm.
Female ..	5·25 „	6·3 „	0·85 mm.	12·4 „

It is much to be regretted that adult specimens of this species were not obtained, as the habitat was such that only *Artemia* might have been expected to be found, the density of the water reaching as high as 1·035. It is quite clear that the specimens do not belong to that genus, but I refer them to *Branchinecta* with some doubt. It is possible that they may be immature specimens of *Branchinecta spinosa* M. Edw., which has been found in salt water near Odessa.

Branchipus pisciformis Schaeff.—Nearly all the irrigation pools in Biskra contained *B. pisciformis* in abundance, but it was not met with anywhere except in Biskra, where it was also found by M. Blanchard. M. Simon has recorded its occurrence in Tunisia (1885).

Chirocephalus diaphanus Prevost.—This species was found at Oued Tindja, Sidi Athman, and Rades, in Tunisia. All the individuals belonged to the large race. M. Simon records its occurrence in three places in Algeria. In two of these places the large race was found, and in one (Kef-el-Akdar) the small race.

Streptocephalus bimaris * sp. n.—Female: Body compact and thickset, the head and thorax together exceeding the length of the abdomen without the rami, but about equal to it if the rami are included. Egg-sac large, rather longer than the first five segments of the abdomen, and ending in a short, finger-like process (plate VIII. fig. 5). First pair of antennæ simple, linear appendages; 2nd pair thick and fleshy, somewhat triangular in shape,

* "Between two seas," i.e. between Lake Bizerta and Garaa Achkel.

and ending in a sharp incurved point. In the branchial legs the terminal plate of the endopodite (6th endite) is short and very broad, with a rather well defined inner angle (plate VIII, fig. 4). The fringing setæ are short and spiniform on the inner margin. The exopodite is large, oblong, and considerably longer than the endopodite. Branchial appendix (flabellum) long and pointed, coxal exite (bract) represented by two large lobes so deeply divided from one another as to be nearly separate.

Male: Body as in the female, but the abdomen is about equal in length to the head and thorax together (plate X. fig. 12). The head is produced into a short, blunt rostral process. Furcal rami as in the female. Second pair of antennæ small; the basal part is thick and hairy, and about equal in length to the succeeding flexible part (plate VIII. fig. 3). The terminal part consists of two subequal dactyli, each with a small rounded process on its inner face at its base. Legs as in the female, but with the coxal exite undivided.

Measurements (average):—

	Head and Thorax.	Abdomen.	Furca.	Egg-sac.	Total Length.
Male	7·7 mm.	7·5 mm.	1·8 mm.	..	17 mm.
Female ..	8·1 ,,	6·5 ,,	2·1 ,,	4·2 mm.	16·8 ,,

A few specimens of the species here described were found at Oued Tindja in a pool in company with *Lepidurus lubbocki* and *Estheria cycladoides*. Five females and one male only were preserved. The species is characterised by the simple form of the antennæ and egg-sac of the female, and especially by the form of the branchial legs of the latter. In the Polyartemiidæ and in most species of *Chirocephalus*, the coxal joint of the leg bears two foliaceous exites. In *Chirocephalus stagnalis* the female may have two exites, while the male has one, as in the species here described. On the other hand, no species of *Streptocephalus* has yet been described, so far as I am aware, which has the coxal exite at all divided.

Streptocephalus sp.—A single, not quite mature, female specimen of a species of *Streptocephalus* quite distinct from the preceding one was taken in a weedy pool a few yards away from that in which the latter was found. As I assumed at the time that it belonged to the same species, I made no effort to obtain more specimens. As the specimen seems to belong to some undescribed species, I give here a short account of it.

The body is slender, the head and thorax somewhat exceeding the length of the abdomen. The egg-sac has evidently not attained its full development; its extremity is bifid. The last segment of the abdomen is somewhat wider than the preceding segment and quadrangular in outline. The second pair of antennæ are folia-

ceous, hairy, and with a small pointed process in the middle of its rounded end (plate IX. fig. 6). The branchial legs are of the usual form, the terminal plate more or less rectangular, and the exopodite very much longer than the endopodite in the legs of the middle of the series. At the base of the setæ of the distal margin of the exopodite is a small bifurcated spine (plate IX. fig. 7).

Measurements :—

Head and Thorax.	Abdomen.	Furca.	Total.
7·0 mm.	6·5 mm.	1·6 mm.	15·1 mm.

Estheria cycladoides Joly.—Abundant at Oued Tindja and at Sidi Athman. Numbers of larvæ, probably belonging to this species of *Estheria*, were found in an irrigation pool in Biskra. According to M. Simon it is widely distributed in North Africa and occurs also in Southern France, Spain and Sicily.

Daphnia atkinsoni Baird.—This species was not found in Algeria, though its ephippium was noticed in a collection taken in Chott Tinecilt while the train stood in Les Lacs station. In the neighbourhood of Tunis it was a common occurrence. In small pools surrounding Lake Sedjouma by Tunis it was found in water having a very high salinity, the density of which varied from 1·007 to 1·035. It was also found in various small pools at Sidi Athman, Oued Tindja, and St. Germains.

While none of the specimens seen are referable to the variety *bolivari* Richard, many, and particularly young individuals, show a distinct transition towards it, having a pronounced dorsal cephalic ring which, in some young individuals, is provided with very minute spines. Some specimens taken at Sidi Athman have the dorsal cephalic ring very distinct but not spinous, while the anterior part of the fornix of the valves is provided with spines as in *D. bolivari*. Males and ephippial females were found on five occasions out of a total of twelve occurrences.

Daphnia chevreuxi Richard.—Found in some numbers at Oued Tindja and also at St. Germains. Males and ephippial females were found on the first occasion.

Whereas in the adult female the head is more or less square in outline, in the young of both sexes the anterior margin of the head slopes upward, meeting the dorsal margin in a sharp, backwardly projecting peak. On the dorsal side just behind this peak there is a small oval disk resembling the nuchal adhesive organs of certain other Cladocera (plate X. fig. 11). The two dorsal rows of spines are continued up to this point, enclosing the posterior half of the disk between them. In the adult both disk and dorsal peak generally disappear, but an ephippial female from Oued Tindja still showed a slight protuberance in the position of the peak. The arrangement of the dorsal spinules in a curve

round the disk recalls the dorsal cephalic ring of *D. atkinsoni* var. *bolivari*; in fact young individuals very closely resemble the young of *D. atkinsoni*. M. Richard does not figure the post-abdomen of the male separately, and his figure of the whole animal (plate IX. fig. 9) is misleading. The post-abdomen of the male does not, in fact, differ materially in shape from that of the female (plate IX. fig. 10), but there are fewer and more irregular denticles along the dorsal border and a group of spinules on the small papilla on which the vas deferens opens.

Daphnia magna Strauss.—This species was common in Biskra in irrigation pools and in some of the larger ponds. It was also found in highly saline water by Lake Sedjouma and at Sidi Athman and Radés. The specimens from water of high density showed no differences from the type resembling the varieties found by Schmankewitsch in similar situations.

Simosa vetula (O.F.M.).—Apparently rather a rare species in Algeria and Tunisia. A few individuals were found in ponds in the Jardin d'Essai in Algiers and at Oued Tindja near Tunis.

Ceriodaphnia reticulata Jur.—Found only in an irrigation tank in the Jardin d'Essai in Algiers, and in a pond near Tunis.

Ceriodaphnia dubia Richard.—A species of *Ceriodaphnia* was found rather commonly both at Biskra and in Tunisia, which I rather doubtfully identify with *C. dubia* Richard. With regard to general form, shape of the head, fornix, antennæ, and reticulation of the shell and head, the agreement is complete. The shape of the post-abdomen varies somewhat according to the degree of contraction of the specimen, but in its extended condition it has a tapering form as shown in M. Richard's figure. The claws are long and very distinctly ciliated, the cilia arranged in a proximal and a distal series. The teeth of the dorsal surface are ten or eleven in number and are short, those in the middle of the series being slightly the longest. The only conspicuous point of difference is the presence in some specimens of a very long dorsal process closing the brood-chamber. M. Richard says that in most specimens there is a "prolongement conique court faisant saillie dans la cavité incubatrice," and in many of my adult specimens the same condition is found; there appears to be great variability in the length of this process. There is, however, a great difference between the ephippium in my specimens and that of *C. dubia* as

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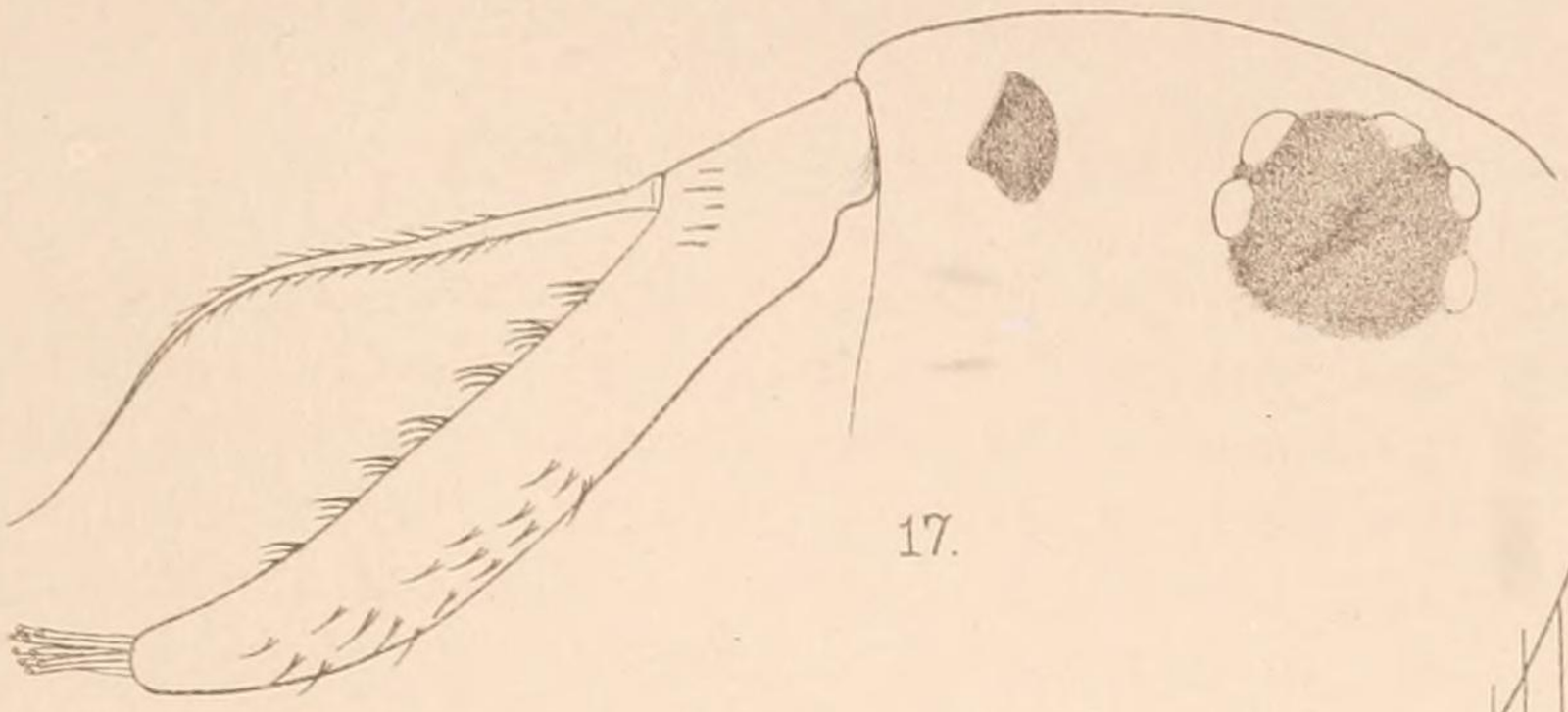
EXPLANATION OF PLATE XI.

Fig. 17.—*Macrothrix hirsuticornis* Norm. & Br. First antenna of male. × 260.
„ 18.—Ditto. Post-abdomen of male. × 260.
„ 19.—*Alona elegans* Kurz. Part of shell of ephippial female, showing line of fracture. × 440.
„ 20.—*Chydorus letourneuxi* Rich. Male. × 260.
„ 21.—Ditto. First antenna of male. × 440.
„ 22.—Ditto. Female, portion of shell margin. × 1050.
„ 23.—Ditto. Ephippial female. × 120.



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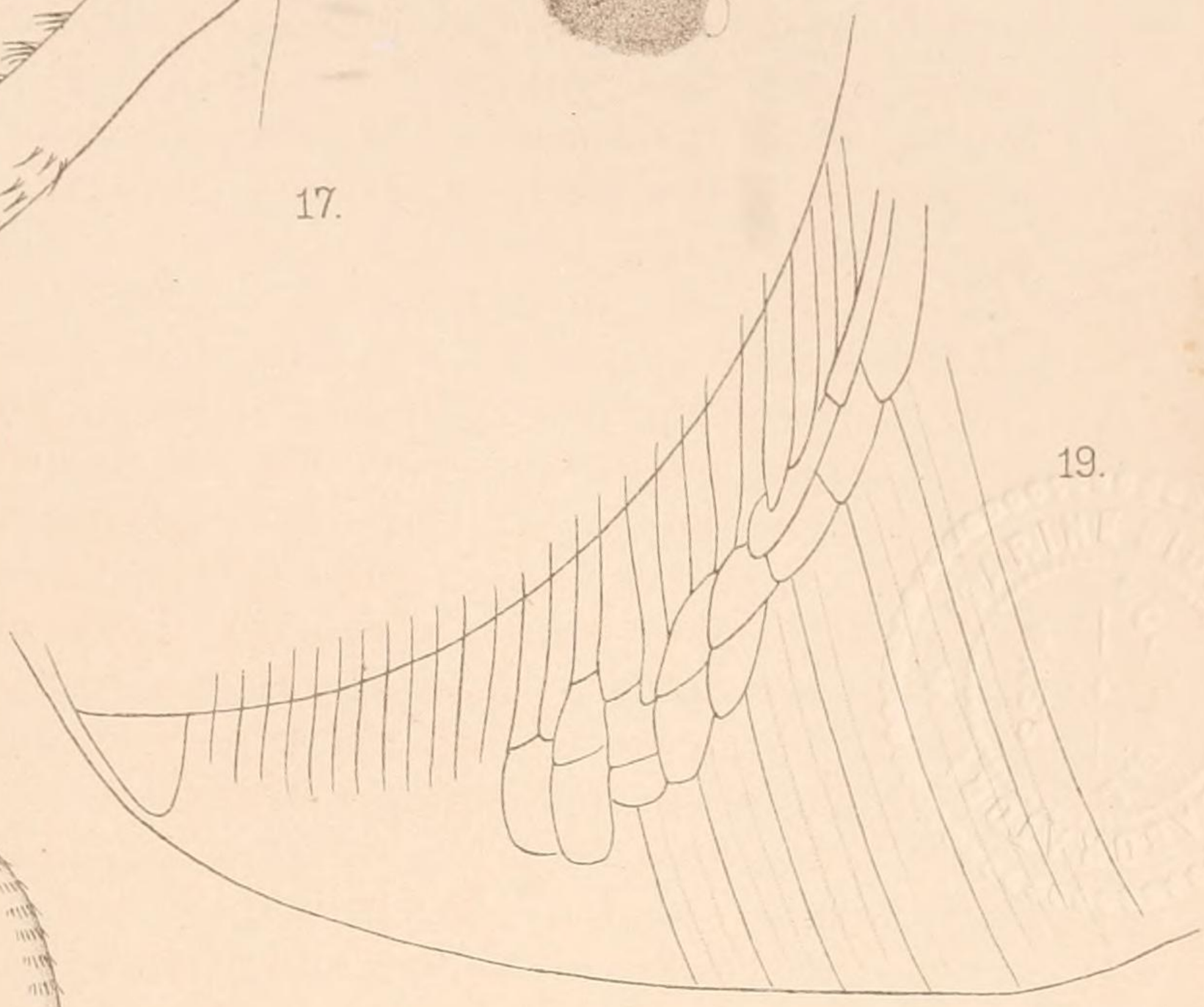

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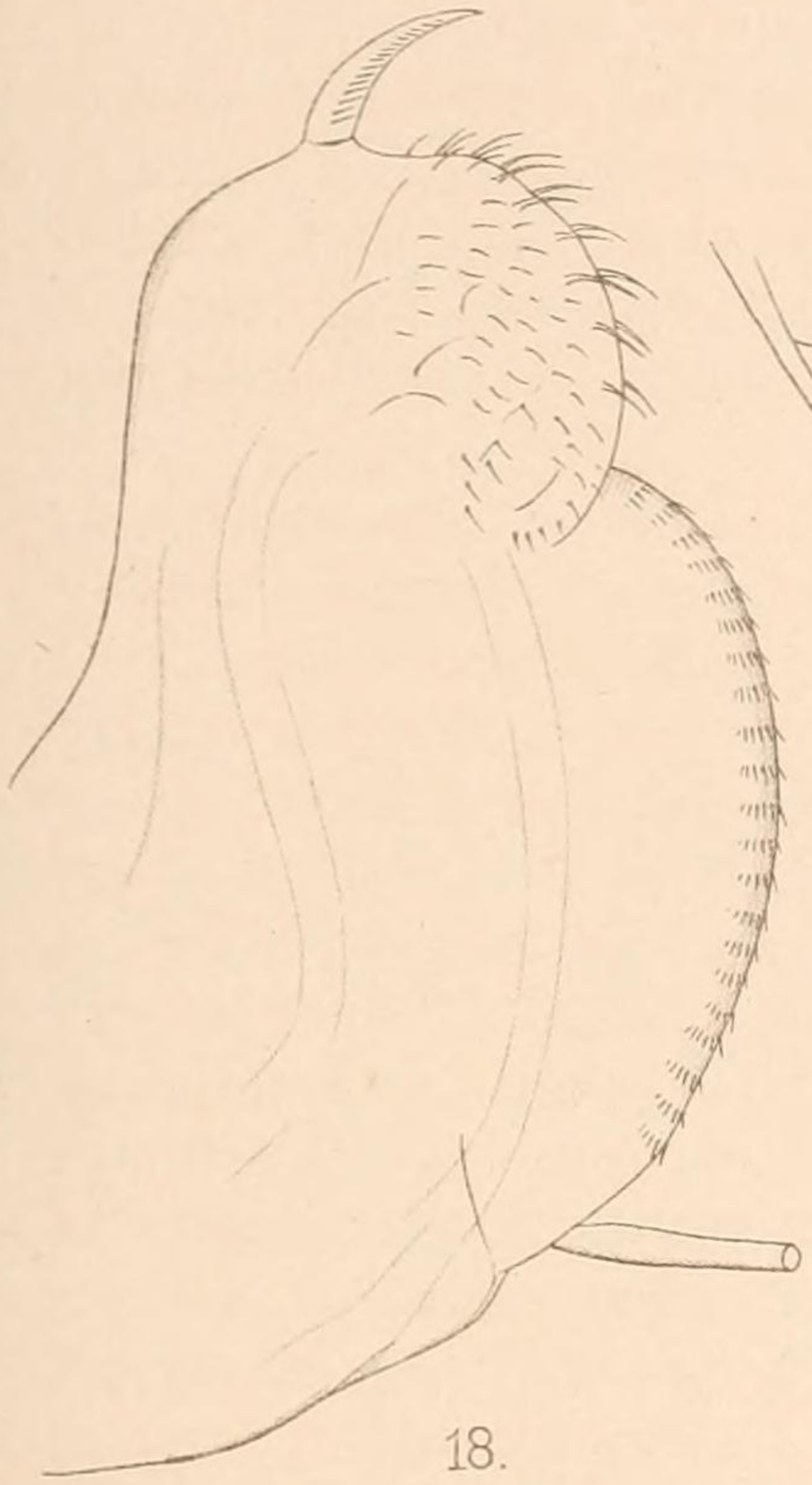

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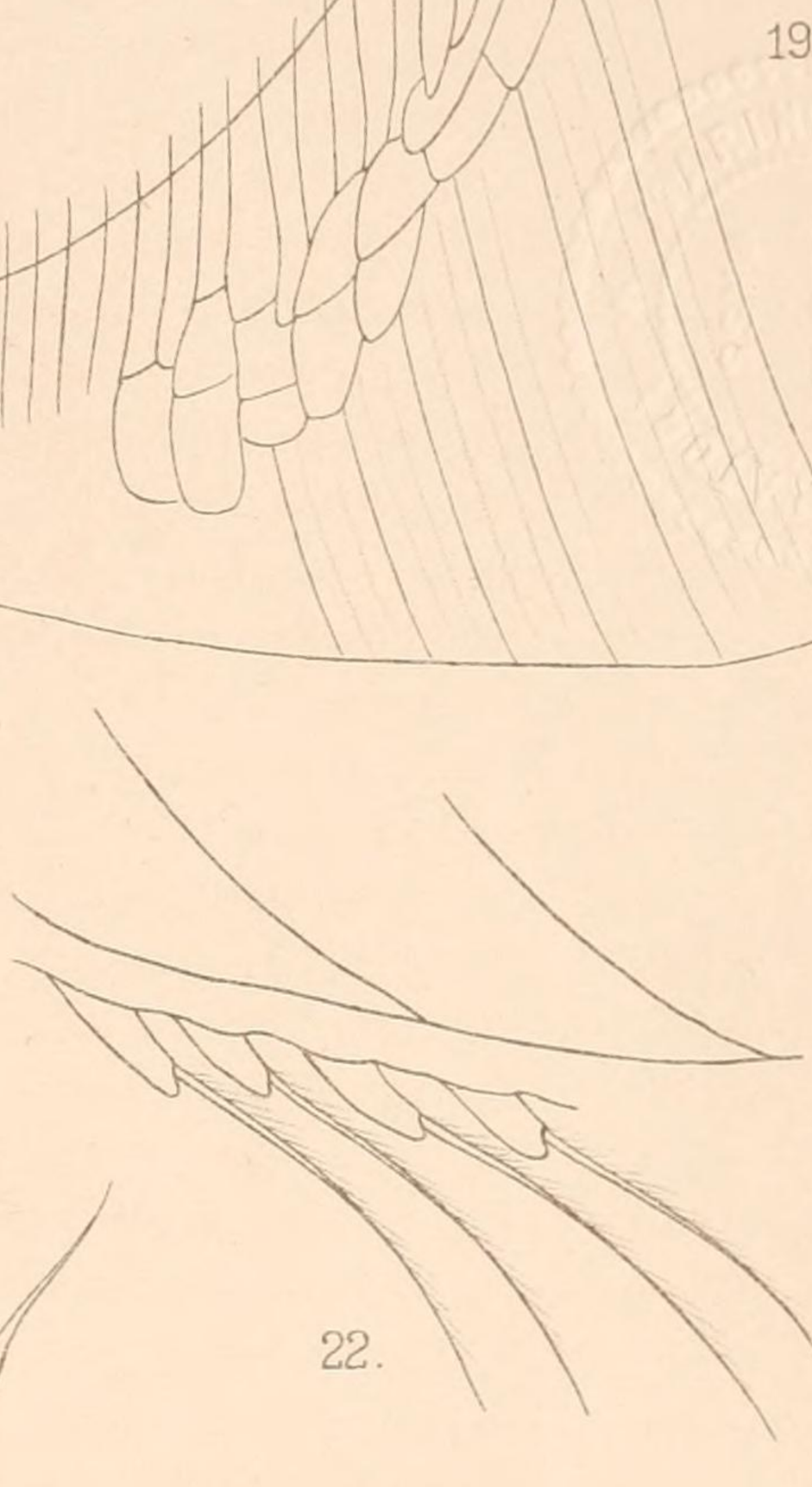

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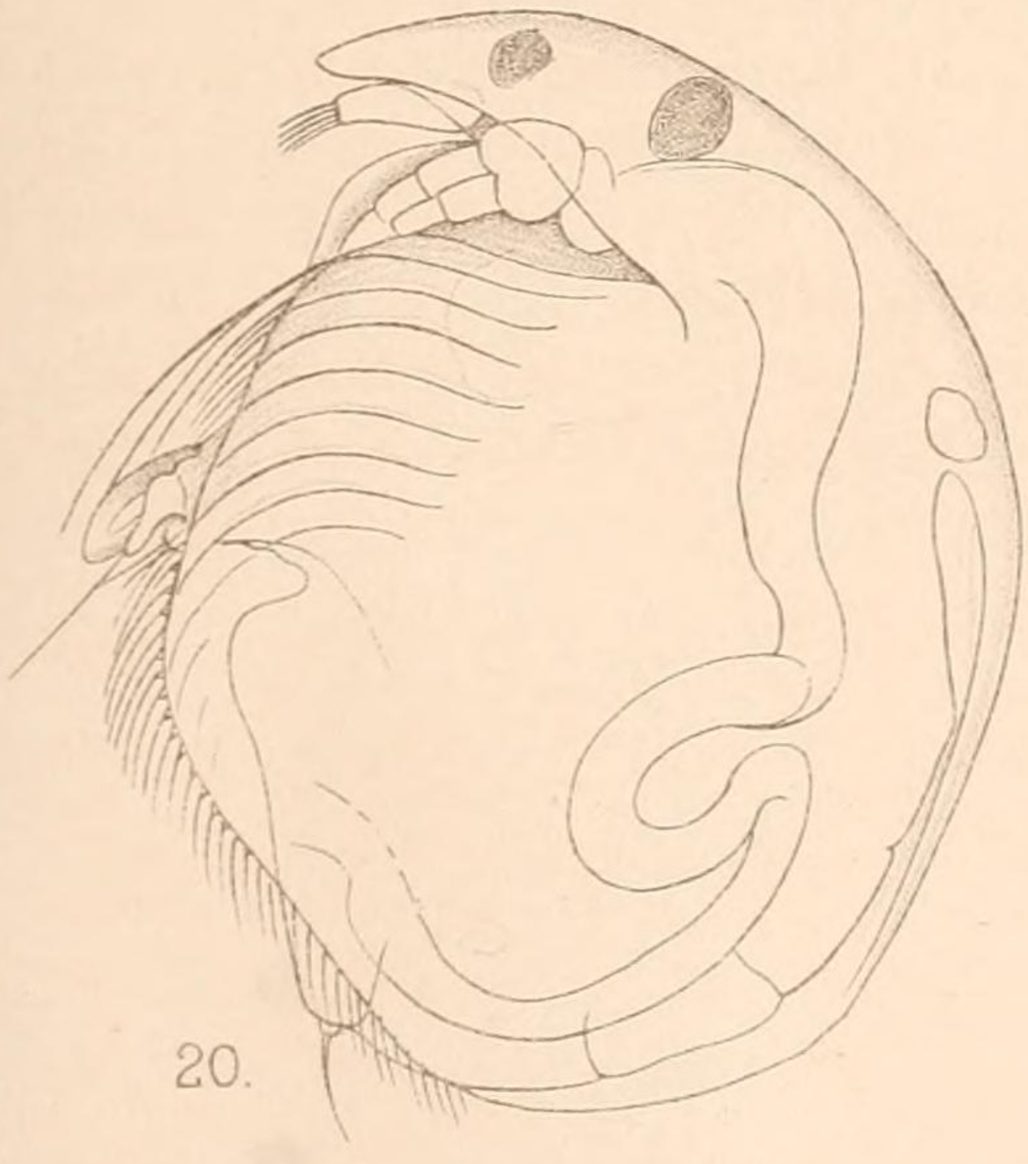

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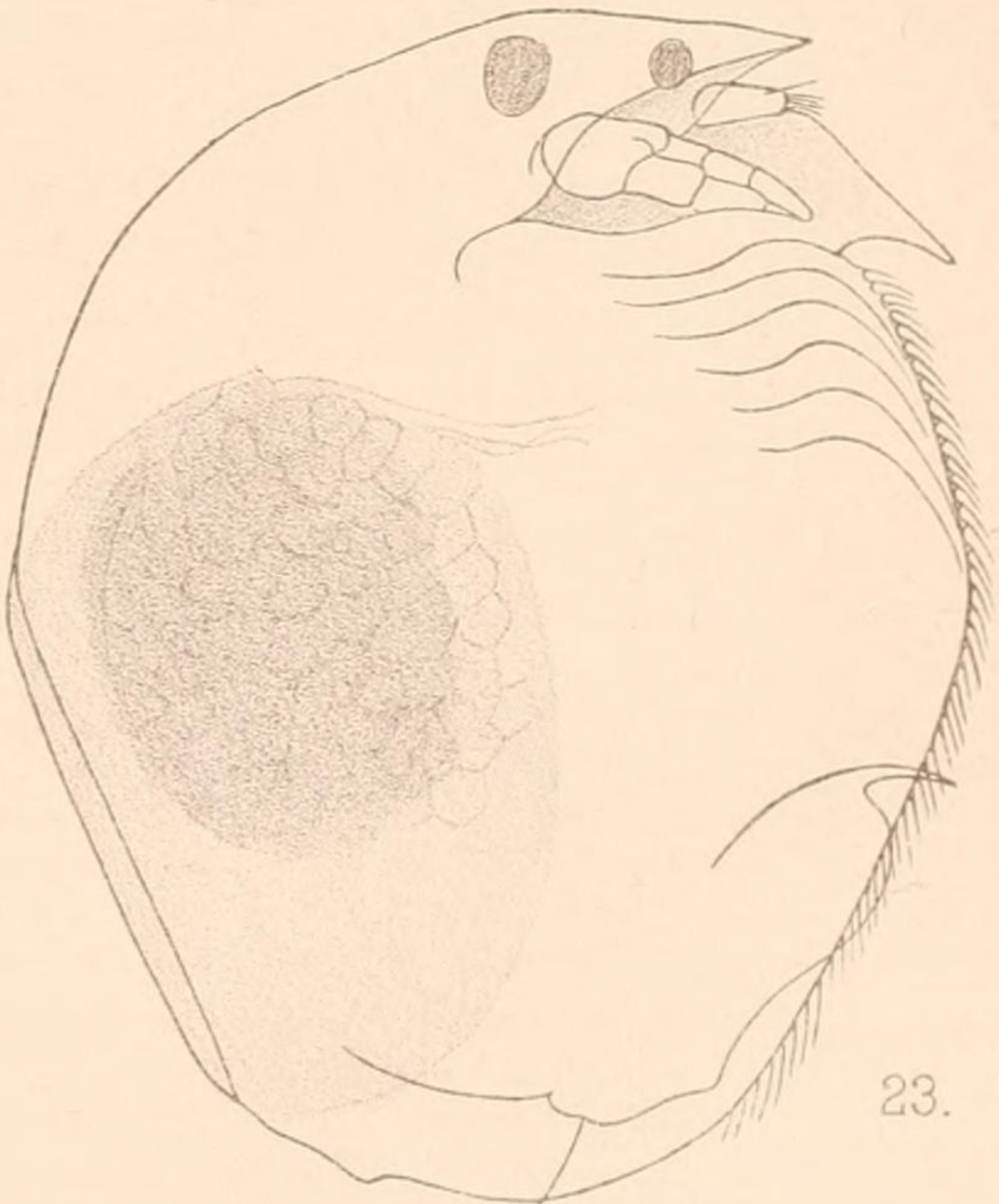


23.

R. Gurney del. ad nat.

West, Newman lith.

described by others. In my specimens the ephippium resembles exactly that of some forms of *C. quadrangula*. The ampullary area is covered with small, rather protuberant reticulations, each with a minute chitinous knob in the centre. The remainder of the ephippium dorsal to the ring of air cells is strongly reticulate, with a small rod of chitin projecting from the centre of each mesh. These rods are very conspicuous along the dorsal margin. Gradations can be traced from the condition in the ampullary area, where there is but a minute knob to the condition with well-developed rods. The male does not differ from that of *C. dubia*.

The importance to be attached to the structure of the ephippium as a specific character is uncertain. In *C. quadrangula*, while it is generally spiny, it may also have the normal form. Also Stingelin (1895) has met with one example of a spiny ephippium in *C. pulchella* Sars, so that it appears that this form of shell ornament is not constant, and therefore not of specific importance.

There are two other points of difference between my specimens and *C. dubia*. Firstly, my specimens are very large, some measuring as much as 1·5 mm. in length; and secondly, the adult female carries eggs varying in number from five to eighteen. Both these differences are, however, quite unimportant in comparison with the identity of structure, and are due to the occurrence of the animal in small pools rich in food, instead of in large open waters. The length of the dorsal abdominal process is probably also connected with the larger number of eggs in the brood-pouch.

Moina salinarum sp. n.—Head depressed, the dorsal margin with a slight depression behind the eye (plate X. fig. 13). Frontal angle rather sharp; ventral margin of the head nearly straight. Valves of the shell without any sculpture, fringed with setæ along their ventral margin, and with the posterior margin somewhat sinuate. Eye small, its diameter about one-fourth of the length of the head. First antennæ short and comparatively thick, one-seventh of the whole length of the body (plate X. fig. 14). Anterior seta inserted nearly in the middle of the antenna, and rather more than one-third of the length of the latter. Posterior margin of the antenna fringed with exceedingly delicate cilia, which are not easy to see. Sensory rods very short. Second pair of antennæ stout, the rami shorter than the stem.

Post-abdomen less than half the length of the body, and rather slender. The post-anal part very short, less than one-fourth of the length of the whole post-abdomen. Terminal claws short and stout, the cilia along their edge somewhat stronger at the base, but not forming a comb (plate X. fig. 15). Lateral teeth 10 to 12 in number. Dorsal edge of the pre-anal part covered with delicate cilia, which here and there take an arrangement in transverse rows.

Length 1·35 to 1·8 mm.

Male and ephippial female unknown.

The species here described appears to be very closely related to *Moina micrura* Kurz. The general form of the body and of the post-abdomen are the same, but *M. salinarum* differs from it in being considerably larger, in having more teeth on the post-abdomen, and in having the claws of the post-abdomen armed with denticles, whereas they are smooth in *M. micrura*. These differences are not such as might be caused by adaptation to life in water of high salinity, since such adaptations usually take the form of reduction and simplification of parts. I believe, therefore, that the species is distinct, though it is much to be regretted that the male and ephippial female are not available to put the matter beyond doubt.

Moina rectirostris Jur.—Apparently rather a common species in the neighbourhood of Tunis, being found at Sidi Athman, Oued Tindja and Rades. There is no doubt that my specimens belong to this species, though they differ in some minute points from specimens taken in England. In all essentials the agreement is exact. The only striking point of difference is the presence of seven hooks on the first antenna of the male instead of the normal number of five. The difference is remarkable since the number of sensory setæ and other outgrowths of the first antenna of Cladocera is not as a rule subject to variation.*

Macrothrix hirsuticornis Norman and Brady.—This is the commonest of all the Cladocera found in Algeria and Tunisia, being met with in nearly every pool in Biskra and its neighbourhood, and also in various places near Tunis. As is frequently the case among the *Macrothricidæ*, this species seems very rarely to reproduce by means of resting-eggs, although it inhabits, in Biskra, at all events, pools of water which become dry periodically at short intervals. If resting-eggs are not produced in these circumstances it seems almost incredible that the species should be able to persist. And yet I met with ephippial females in only one of the irrigation pools examined. Males and ephippial females were found in shallow flood-water covering a road at Sidi Athman near Tunis and in a roadside ditch at Rades. Lilljeborg (1900) states that the male and ephippial female are unknown.

The male is much smaller than the female, measuring 0·35 to 0·5 mm. The head is very large, rather more than one-third the length of the whole body (plate X. fig. 16). In general shape it is more or less rectangular, the dorsal and ventral margins of the shell-valves nearly straight, the posterior margin forming a rounded angle with the dorsal margin. The eye is not larger than that of the female. The first pair of antennæ are nearly as long as the head, curved, and not dilated at their extremities (plate XI.

* See Scourfield, The Olfactory Setæ of the Cladocera, Journ. Quekett Micr. Club, ii. vi. 1896. Die sogenannten Riechstäbchen der Cladoceren, Plöner Forschungsberichte, xii. 1905.

fig. 17). They are fringed with cilia, and bear, near the head, two lateral setæ. Of these the longest reaches beyond the extremity of the antenna. There are nine terminal sensory rods. The hook of the first pair of legs projects beyond the shell-valves and has three minute tubercles at its extremity. A strong spiniform seta springing from the stem opposes itself to the claw so as to form a sort of chela. The post-abdomen does not differ much from that of the female except that the ventral edge of it in front of the claws projects as a rounded prominence upon which the vas deferens opens (plate XI. fig. 18).

Ephippial females vary much in size, measuring from 0·6 mm. to 1·3 mm. in length. The ephippial area occupies the greater part of the shell-valve, and differs from the remainder only in its slightly darker colour and in showing no visible reticulation. The surface simply appears to be very dirty. In moulting, the whole of the valve separates from the head. A faint line can be traced, dividing the ephippial area from the ventral reticulated part of the shell, and the shell probably splits eventually along this line. The ephippium contains two or three small oblong resting-eggs. They lie together enveloped in a delicate membrane, which represents the inner layer of the shell, and imbedded in what appears to be cellular tissue. Unfortunately my specimens are not sufficiently well preserved to determine the nature or origin of this tissue.

Alona elegans Kurz.—Commonly found in Biskra in all the larger ponds which do not rapidly dry up. It was once found also in one of the small pools at the foot of the palms. In Tunisia it occurred at Sidi Athman, Oued Tindja, and Rades, so that it may be considered as a common North African species. Males and ephippial females were found on four occasions, three times in Biskra and once at Sidi Athman.

The ephippium presents certain features which are of some interest. The ephippium becomes, as is usual, of a deep brown colour, but the surface markings of the shell are not changed, though they are rather more prominent. The outline of the ephippium is marked by an unusually conspicuous "line of weakness," composed of large reticulations following the line of the ephippial margin (plate XI. fig. 19). The striations of the ventral part of the shell end abruptly against this line, bending round in the anterior half to meet it more or less at right angles. The ephippium differs from that of most Lynceidæ in shape since it includes scarcely any part of the posterior margin of the shell, resembling, in this respect, that of *Alonopsis ambigua*. In the majority of species only a greater or lesser portion of the ventral margin is thrown off, so that the ephippium includes the greater part of the shell.*

* Scourfield, 1902.

Pleuroxus aduncus Jurine.—A few specimens found in the fountain basin, and in a tank in the Jardin d'Essai in Algiers.

Chydorus sphæricus O.F.M.—A rare species, found only at Algiers and Oued Tindja. Its place seems to be taken by the next species.

Chydorus letourneuxi Richard.—This species was found in several of the irrigation pools in Biskra, and in pools at Sidi Athman in Tunisia. Males and one ephippial female were among the specimens taken at the latter place.

The ephippium resembles that of *Chydorus barroisi* * in that the dorsal chitinous thickening extends up nearly the whole length of the back. The ephippial area is dark and strongly reticulated, with the surface finely punctate, but I am unable to detect a definite line of fracture, and have no knowledge of the shape of the ephippium when shed. There appears to be a crumpled inner membrane enclosing the egg (plate XI. fig. 23).

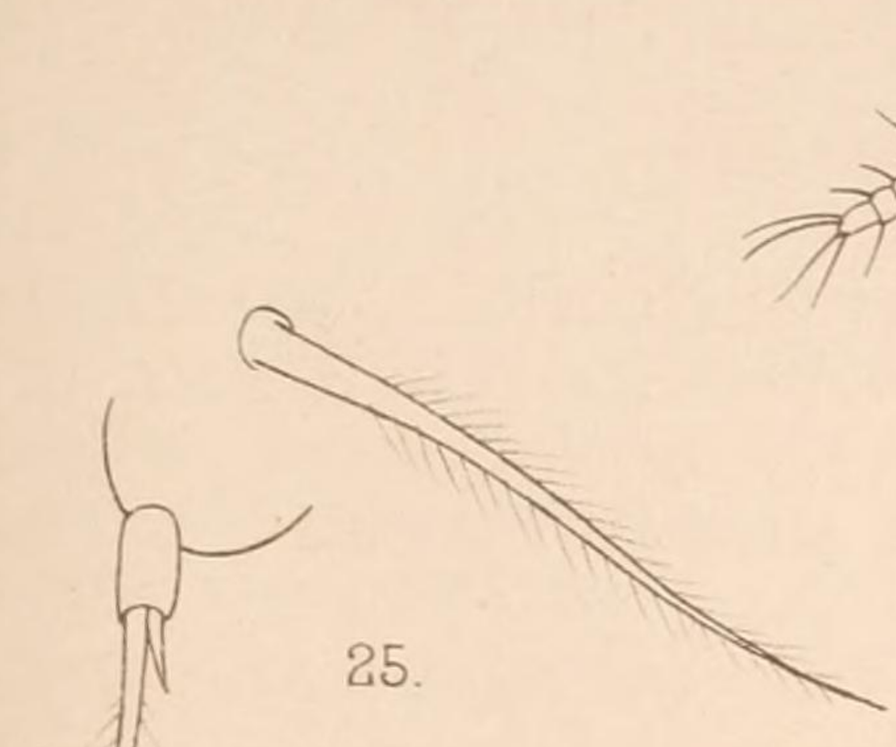
The male is much smaller than the female, measuring about 0·35 mm. in length and 0·26 mm. in greatest width (plate XI. fig. 20). The shape of the shell does not differ much from that of the female, but the ventral margin is rather more prominent. The first antenna is short and thick, with two lateral sensory setæ and nine terminal sensory rods (plate XI. fig. 21). The prehensile appendage bears a strong, sharply bent claw, which has two minute recurved teeth at its extremity. The anterior edge of the appendage is thickly fringed with cilia arranged in transverse rows. The post-abdomen is similar to that of the female both in shape and in arrangement of the delicate cilia. The ventral edge of the valves is spinous, as in the female, but the spines are not, in either sex, outgrowths of the shell itself. They are really the thickened bases of the setæ which fringe the valves (plate XI. fig. 22).

Dunhevedia crassa King.—There can be no doubt that *D. setigera* Birge is identical with *D. crassa* King, as Stingelin has shown. The sole important difference between the two species appears to lie in the greater or lesser sculpturing of the shell, the form of the

* Scourfield, 1902, fig. 35.

EXPLANATION OF PLATE XII.

Fig. 24.—*Cyclops planus* sp. n. Female. × 98.
„ 25.—Ditto. 5th foot of female. × 540.
„ 26.—Ditto. 3rd foot. × 260.
„ 27.—Ditto. 1st antenna. × 260.
„ 28.—*Diaptomus numidicus* sp. n. Abdomen of female. × 98.
„ 29.—Ditto. Rostral processes of female.
„ 30.—Ditto. Joints 23 and 24 of right antenna of male. × 260.
„ 31.—Ditto. Female. × 57.
„ 32.—Ditto. 5th legs of male. × 150.



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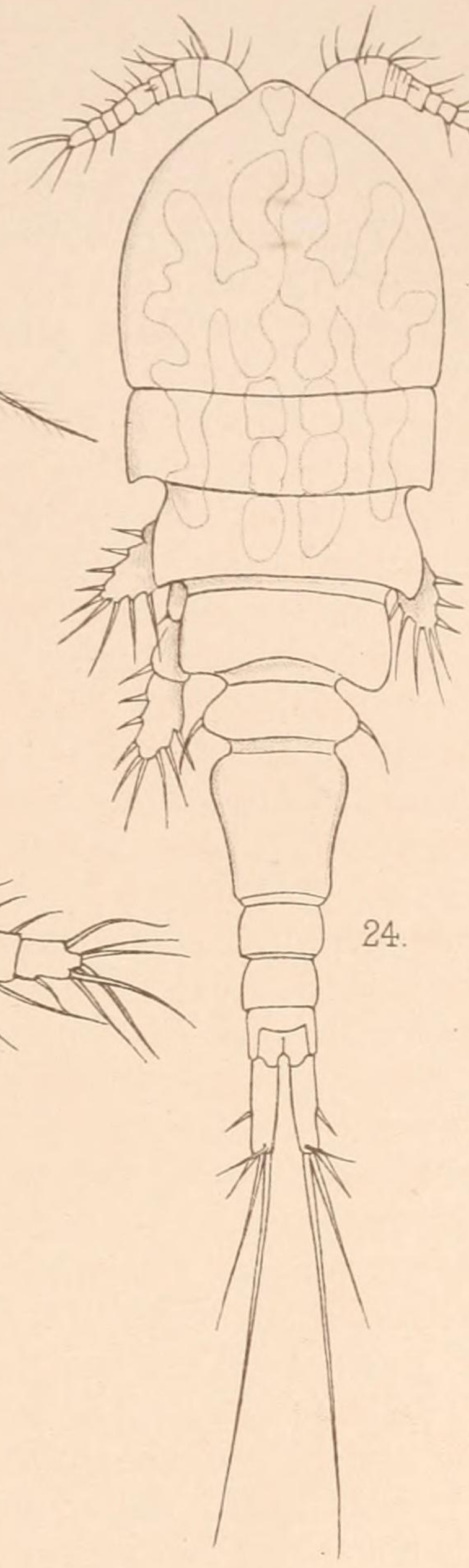

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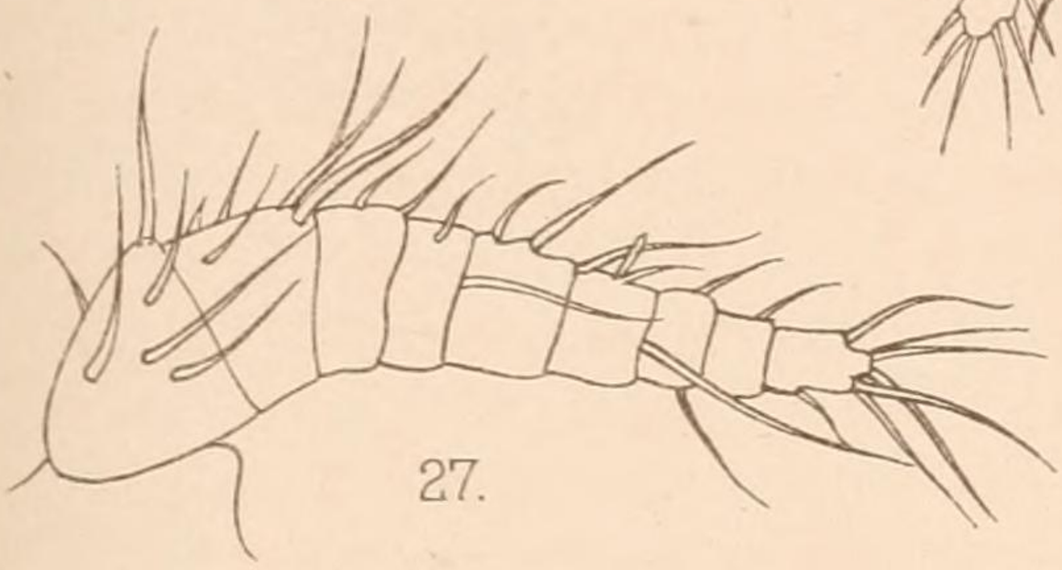

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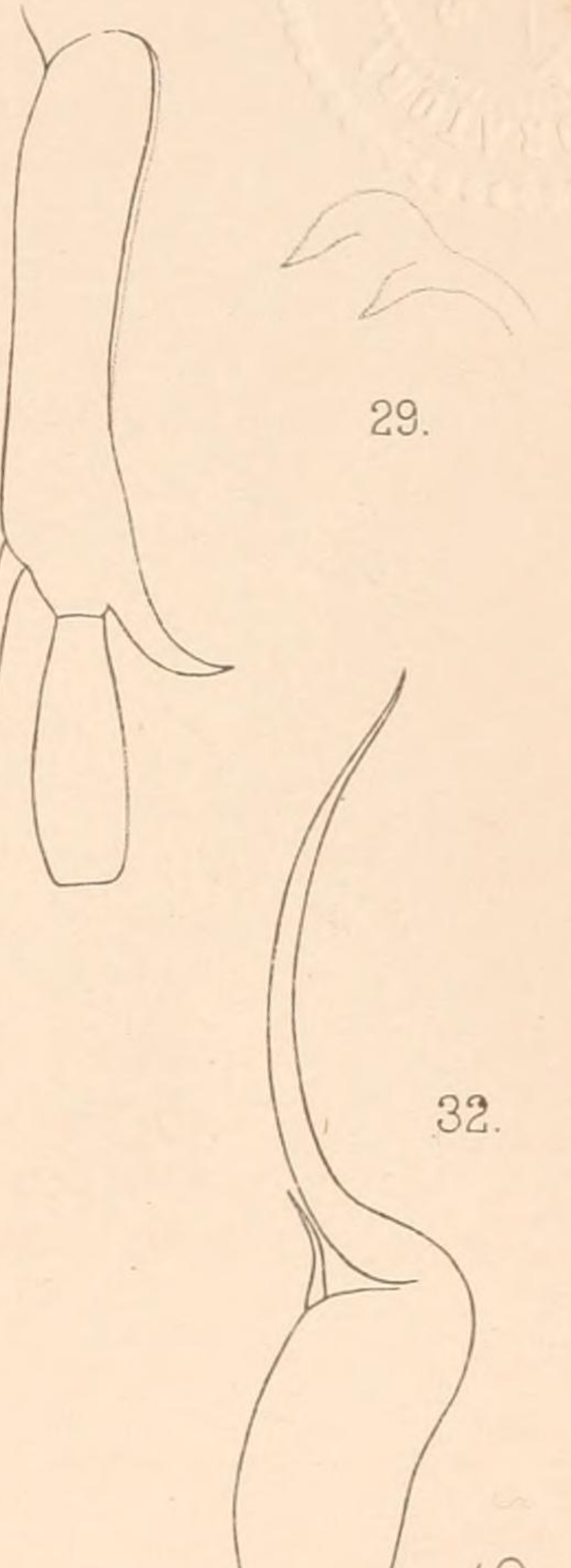

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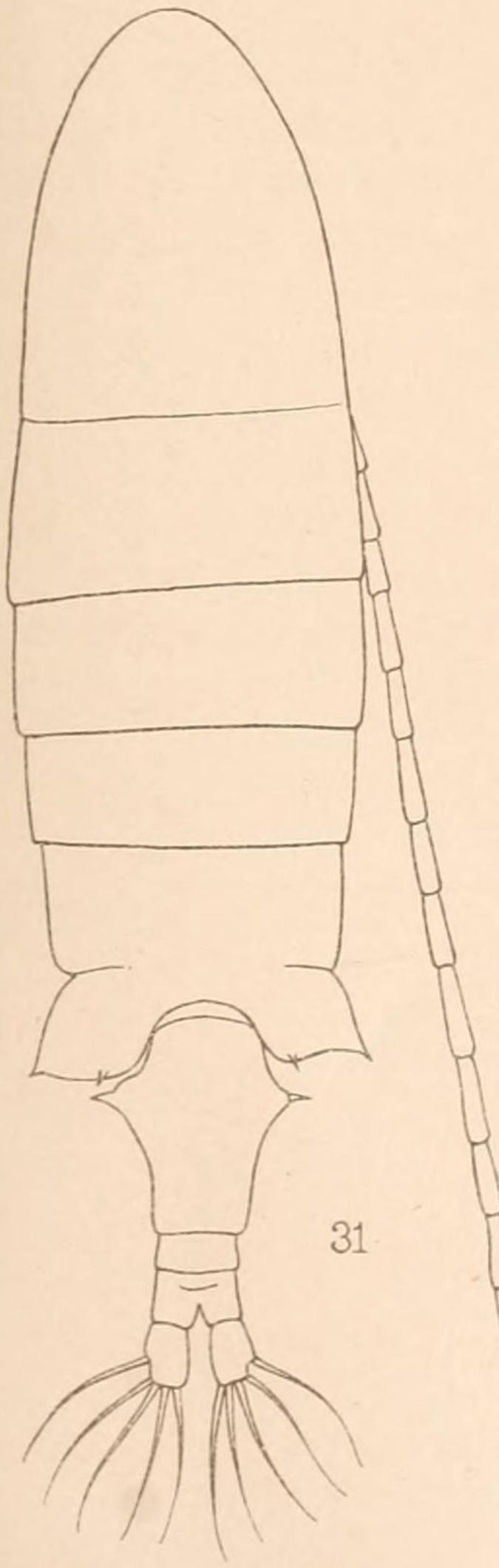

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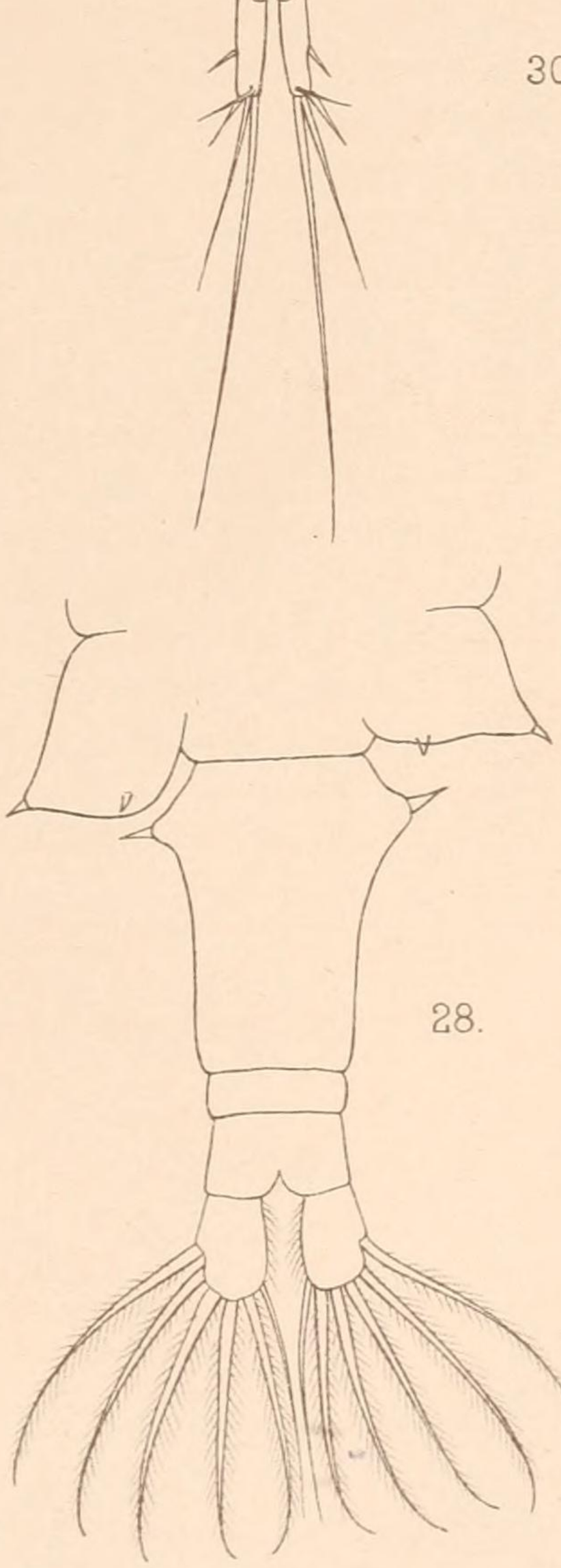

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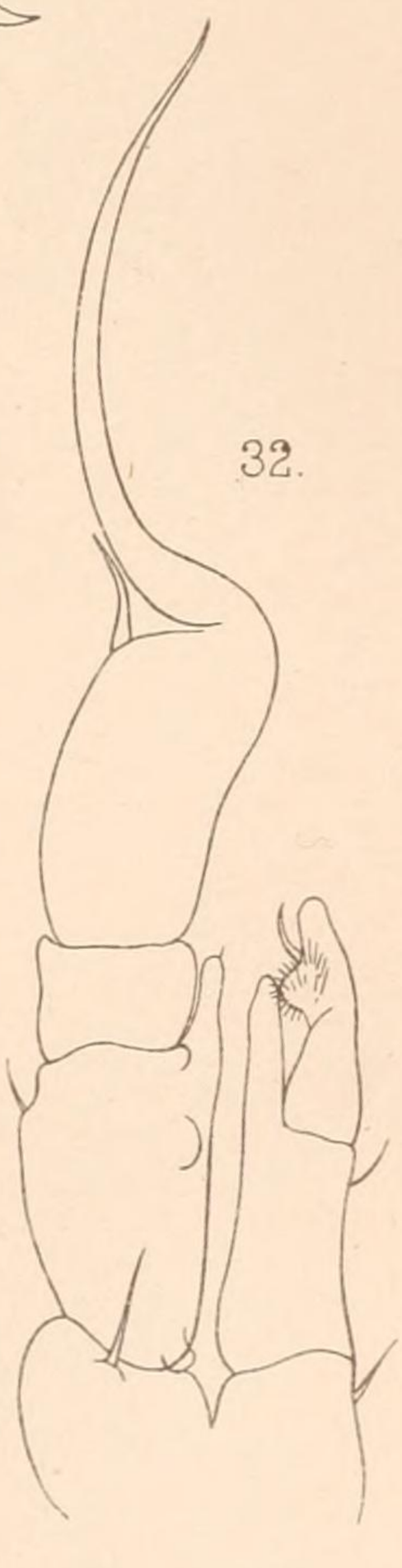

32.

R.Gurney del.ad nat.

West, Newman lith.

upper lip and of the post-abdomen being identical. The sculpture is certainly variable, and may be present in Asiatic individuals. Specimens from Calcutta which I have examined show a reticulation which, though faint, is as distinct as that of many of my specimens from Algeria. *D. neglecta* Daday is only distinguishable from this species by a slight prominence in the anterior margin of the upper lip, and in this respect forms a transition to *D. odontoplax* Sars, in which the anterior margin is provided with a tooth-like projection.

D. crassa was found to be abundant in a pond in Biskra, which I call the "frog pond," by reason of the multitude of frogs living in it.

Cyclops planus sp. n.—Female: Body flattened and tapering gradually without any abrupt transition between thorax and abdomen. Segments of the thorax separated by rather deep indentations (plate XII. fig. 24). The first abdominal segment broad, as long as the remaining segments together; the furcal rami about as long as the last two segments of the abdomen together. The proportional lengths of the furca and its setæ may be expressed thus—

Furca	20
Setæ:—Outermost	11
„ 2nd	33
„ 3rd	104
„ 4th	8

The lateral setæ are inserted about the middle of the furca.

The first pair of antennæ (plate XII. fig. 27) short, reaching about half-way along the first segment of the thorax, and consisting of nine segments only. The proportional lengths of the joints are as follows:—

Length ..	11	6	4	3	5	4	3	4	5
Joints ..	1	2	3	4	5	6	7	8	9

The third joint is partially divided into two: the sixth joint, corresponding to the 12th–14th of the 17-jointed antenna, bears a sensory club.

All the swimming legs have both branches 2-jointed; the last joint of the exopodite of the third leg bears three lateral spines and one terminal spine, while the last joint of the endopodite has a single terminal spine (plate XII. fig. 26). The last joint of the exopodite of the fourth leg has two lateral and one terminal spine. The fifth leg (plate XII. fig. 25) consists of a single cylindrical joint armed with a minute spine and a long terminal seta. The egg-sacs are closely pressed to the abdomen and contain few eggs. The form of the receptaculum seminis is not clearly distinguishable, but appears to consist of an elongated oval sac with two

narrow lateral arms at the anterior end. The spermatophores are so attached that they diverge obliquely from each other like the two arms of a V.

Length: to base of furca 0·7 mm.; to end of furca 0·755 mm.

This species resembles *C. diaphanus* in some respects, but appears to be quite distinct from it in the form of the body, antenna, and receptaculum seminis.

It occurred rather frequently in Biskra and at Oued Tindja in Tunisia.

Cyclops strenuus Fischer.—Found only in the Jardin d'Essai in Algiers and in a large pond at Oued Tindja.

Cyclops bicuspidatus Claus.—Common in small pools at Algiers, Biskra, and near Tunis, in water both fresh and salt. But, whatever the salinity might be, the specimens found always belonged to the variety *C. lubbocki* Brady, with fourteen joints in the antennæ.

Cyclops bisetosus Rehberg.—Found in four irrigation pools in Biskra. One female was noticed with eighteen joints in the antenna.

Cyclops viridis Jurine.—Palm irrigation pools in Biskra, in pools by the conduit of Oumach, and at Oued Tindja.

Cyclops albidus Jurine.—This seems to be a rare species, and was only found in the Jardin d'Essai in Algiers and in Chott Tinecilt in the high plateau.

Cyclops serrulatus Fischer.—A few immature females of this species were found at Oued Tindja in a marsh by the river. They appear to belong to the form *C. varius* Lillj., but cannot be identified with it with certainty.

Cyclops prasinus Fischer.—Taken in the Jardin d'Essai in Algiers and in pools in Biskra and Sidi Okbar.

Cyclops diaphanus Fischer.—This is by far the commonest species of *Cyclops* found. It occurred in palm irrigation pools at Biskra and Sidi Okbar, in large ponds at Biskra, in the River Seybouse at Hammam Meskhoutine, at Carthage, Sidi Athman, Oued Tindja, and in brackish water at Tunis (Lake Sedjouma).

Canthocamptus pygmæus Sars.—A number of individuals of this species were collected in a tiny trickle of water at Hammam Meskhoutine.

Canthocamptus minutus O. F. Muller.—A single female and a male were found in a pond at Oued Tindja. While obviously belonging to this species, these specimens differ from the type in the possession of an exceedingly large spine on either side of the last segment of the abdomen.

Canthocamptus trispinosus Brady.—A few individuals were collected in a marsh at Oued Tindja.

Marshia blanchardi Richard.—This species occurred in very

salt water only by Lake Sedjouma, at Oumach, Radés, and El Ariana. M. Richard suggests that the presence of this and other species of Harpacticids in the Algerian Sahara may be adduced as evidence of the existence of a quaternary inland sea. On the other hand these minute Crustacea are so easily dispersed that it is more reasonable to suppose that these species have recently colonised the inland waters which they have found suitable by reason of their high salinity. There appears to be overwhelming evidence that the Algerian Sahara has not recently been covered by the sea, but rather that there was, in late Pliocene and Quaternary times, a Lacustrine period in which rivers and great fresh-water lakes existed in the Sahara. The chotts are the sunken relics of these lakes, the water of which has become progressively salter. With the increase of salinity of the Saharan lakes they became suitable for the colonisation of brackish species, such as *Cardium edule* and certain Harpacticids. *Cardium* has now disappeared, since the water of the chotts is too salt for it. Had the Harpacticids been relics of an ancient sea it is probable that they would now be represented by species peculiar to the district, whereas the only species not yet found elsewhere is *Mesochra lybica* Blanch. and Rich.

Diaptomus incrassatus Sars.—This species was found in some numbers in pools and ditches at Sidi Athman and Oued Tindja near Tunis. Through the kindness of Canon Norman I have been able to compare my specimens with co-types sent to him by Prof. Sars, so that I feel no doubt as to their identity. The only difference of any importance that can be detected lies in the form of the rostral filaments. In specimens from Mongolia these are long and tapering, whereas in mine they are short, broad at the base, and abruptly contracted distally into fine points. In my specimens the genital segment is slightly broader and has a minute spine on either side.

The species has not been found hitherto elsewhere than in Central Asia, where it appears to be widely distributed and tolerant of a rather high salinity. Its occurrence in Tunisia is comparable to the occurrence in North Africa of *Hemilepistus reaumuri*, which belongs to a genus of Isopods confined, with one other exception, to Central Asia.

Diaptomus numidicus sp. n.—Body rather slender, the greatest width near the middle of the thorax (plate XII. fig. 31). Last segment of the thorax in the female expanded into sharply pointed lobes. Abdomen of the female composed of three segments; the genital segment more than twice as long as the last two combined, not greatly expanded, and with a small spine on either side (plate XII. fig. 28). In the male the fourth segment is slightly asymmetrical, overlapping the fifth segment on the right side.

Furcal rami symmetrical in both sexes. Rostral processes distinct but small. First pair of antennæ in the female reaching considerably beyond the furca. In the male the penultimate joint of the prehensile antenna bears a short hook and a very narrow hyaline membrane (plate XII. fig. 30). The 14th, 15th, and 16th joints each have a short, strong spine (plate XIII. fig. 34).

The fifth foot of the female has the endopodite one-jointed and half as long as the first joint of the exopodite (plate XIII. fig. 33); the third joint of the latter is distinct and well developed, bearing a short spine and a seta which reaches nearly the end of the spinous process.

In the right foot of the male (plate XII. fig. 32) the second basal joint bears two minute cuticular processes; the endopodite is equal to the first joint of the exopodite; the second joint of the latter has no cuticular processes; and the lateral spine is very short and near the end of the joint. In the left leg the basal joint has no cuticular processes; the endopodite is longer than the first joint of the exopodite; the second joint of the latter is prolonged into a short, blunt process. The third joint is represented by a short seta.

Measurements:—

	Female. Length, mm.	Male. Length, mm.
Sagittal	1·47	1·34
,, with furca	1·54	1·41
Thorax	1·14	0·92
Abdomen	0·33	0·42
,, 1st segment	0·23	0·08
,, 2nd ,, ...	0·04	0·09
,, 3rd ,, ...	0·06	0·105
,, 4th ,, ...	..	0·09
,, 5th ,, ...	..	0·055
Furca	0·07	0·07
Left antenna	1·69	1·26

A few specimens of the species here described were found in a pool at Oued Tindja in company with *Poppella guerni*. The resemblance between them and *D. drieschi* Poppe and Mrazek on the one hand and *D. steindachneri* Richard on the other is so close that I have been in much doubt as to whether the species should

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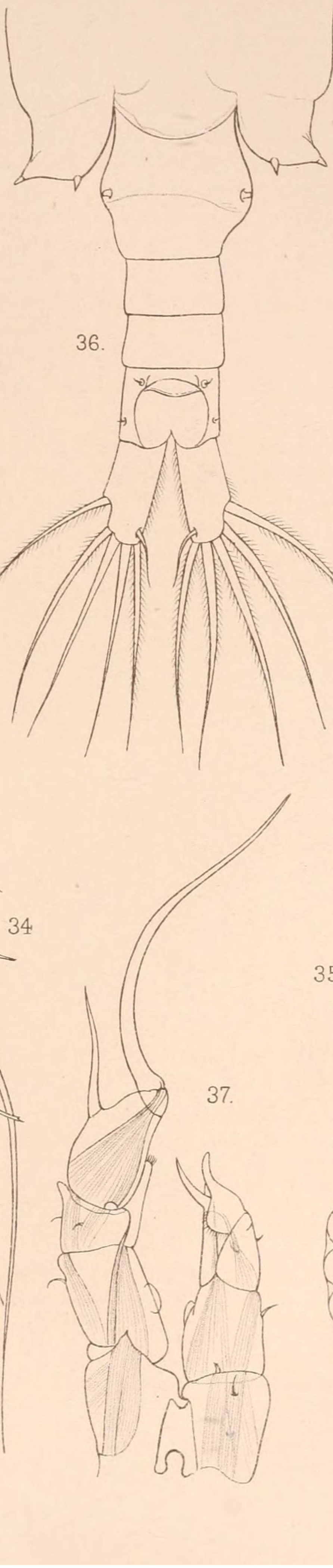
EXPLANATION OF PLATE XIII.

Fig. 33.—*Diaptomus numidicus*. 5th leg of female. × 260.
,, 34.—Ditto. Part of right antenna of male. × 260.
,, 35.—*Diaptomus cyaneus* sp. n. Female. × 37.
,, 36.—Ditto. Abdomen of female. × 65.
,, 37.—Ditto. 5th legs of male. × 98.
,, 38.—Ditto. 5th leg of female. × 150.

33.



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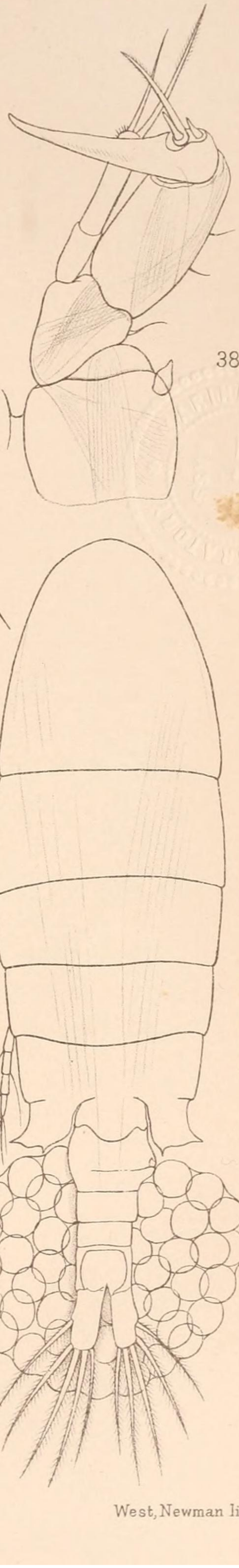

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R.Gurney del. ad nat.

West, Newman lith.

be considered as distinct. While the form of the body and of the fifth feet in the female seem to agree exactly with those of *D. steindachneri*, the prehensile antenna and the fifth feet of the male present differences which are very striking. The description given of *D. drieschi* is somewhat imperfect, but a comparison of the fifth feet, in both sexes of the two species, seems to make specific identity impossible. The relationship between *D. numidicus* and *D. steindachneri* is very close, and they seem, together with *D. drieschi* and *D. vulgaris*, to form a group of nearly connected species.

Diaptomus cyaneus sp. n.—Female: Body stout, the greatest width being in the first free thoracic segment (plate XIII. fig. 35). Last segment of the thorax with small lateral lobes pointed at their outwardly directed apices and with a small posterior spine (plate XIII. fig. 36). Rostral processes rudimentary. Abdomen short, its length, including the furcal rami, equal to the greatest width of the thorax. Genital segment scarcely dilated, with a minute blunt spine on either side. A distinct line of division runs across the dorsal face of it, making the abdomen to consist of five segments. Furcal rami about twice as long as broad, ciliated on their inner edge and sometimes on the outer edge also.

The antennæ reach, when reflexed, as far as the last segment of the thorax.

Fifth pair of legs with the basal joint bearing a short broad tooth (plate XIII. fig. 38). Endopodite two-jointed, the proximal joint the shorter, equalling the first joint of the exopodite in length. At its apex are two long slender spines of unequal length. Third joint of the exopodite distinct though very small, bearing two unequal spines. The egg-sacs contain very numerous small eggs, as many as 60 or 70 being counted.

Male:—Body tapering little anteriorly. Last segment of the thorax symmetrical; abdomen and furcal rami symmetrical. Last segment of the prehensile antenna without a hook. Penultimate joint with a small process one-third the length of the succeeding joint (plate XIV. fig. 39). Hyaline membrane present, but very narrow. The 14th, 15th, and 16th joints bear setæ and sensory rods only.

Fifth pair of legs (plate XIII. fig. 37).—In the right leg the basal joint bears a small hyaline membrane; the endopodite is slender, much longer than the first joint of the exopodite. Second joint of the exopodite short and broad, the long lateral spine inserted beyond the middle. In the left leg the second basal joint has a small hyaline process. The endopodite is longer than the first joint of the exopodite. Second joint of the latter forms a rounded hairy pad on its inner surface, and is produced into a finger-like process having a striated hyaline membrane on its

inner edge. Third joint (inner spine) long and stout, with a similar membrane.

Measurements (averages) :—

	Male. Length, mm.	Female. Length, mm.
Sagittal	2·28	2·47
,, with furca	2·5	2 66
Thorax	1·64	1·96
Abdomen, total	0·63	0·51
,, 1st segment	0·12	0·20
,. 2nd ,, ...	0·15	0·112
,, 3rd ,, ...	0·135	0·102
,, 4th ,, ...	0·135	0·097
,, 5th ,, ...	0·09	..
Furca	0·235	0·18
Left antenna	1·89	1·95

This species was found in considerable numbers in pools at Oued Tindja near Tunis. It is of a bright blue colour, the colour persisting in some preserved specimens but fading in others.

Diaptomus chevreuxi Guerne and Richard.—The specimens described under this name by Guerne and Richard were found in the high plateau region on the road from Algiers to Laghouat. I found it to be common in ponds at Biskra, but it did not occur in any of my collections in the coastal, or Tell region.

Diaptomus wierzejskii Richard.—This species appears to be common and widely distributed in Algeria and Tunisia. It was common at Biskra, and also at Sidi Athman and Oued Tindja, near Tunis.

Diaptomus salinus Daday.—This species was found only in Lake Sedjouma, by Tunis, and in salt pools by the shore of the lake. These pools had a density of 1·013–1·017.

In one male specimen a slight, but rather curious, abnormality was noticed. The first joint of the exopodite of the left fifth foot bears a peculiar stout spine with a basal branch and a terminal cluster of teeth. This joint does not, as a rule, bear either a spine or a seta (plate XIV. fig. 40).

Diaptomus ingens sp. n.—Female: Body robust, the greatest width falling in the first segment of the thorax. Last segment

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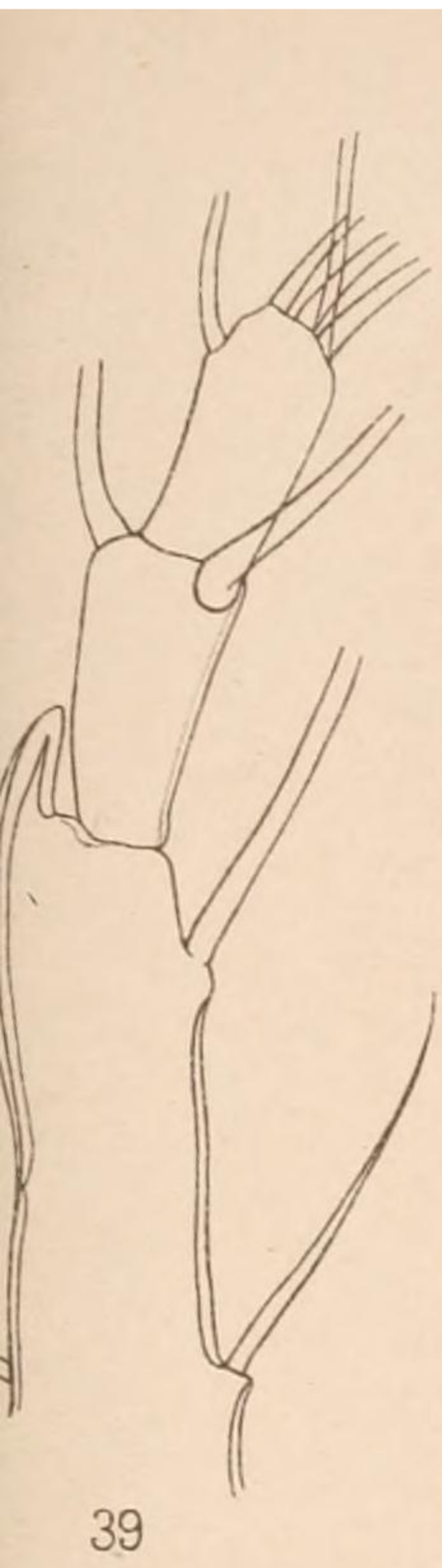
EXPLANATION OF PLATE XIV.

Fig. 39.—*Diaptomus cyaneus*. Terminal joints of right antenna of male. × 260.
,, 40.—*Diaptomus salinus* Dad. Abnormal left 5th foot of male. × 260.
,, 41.—*Diaptomus ingens* sp. n. Terminal joints of right antenna of male. × 98.
,, 42.—Ditto. Abdomen of male. × 37.
,, 43.—Ditto. 5th leg of female. × 70.
,, 44.—Ditto. 5th leg of male. × 98.
,, 45.—Ditto. Abdomen of male. × 57.
,, 46.—*Poppella guernei* Rich. Margin of the 24th joint of the antenna of the female. × 1050.



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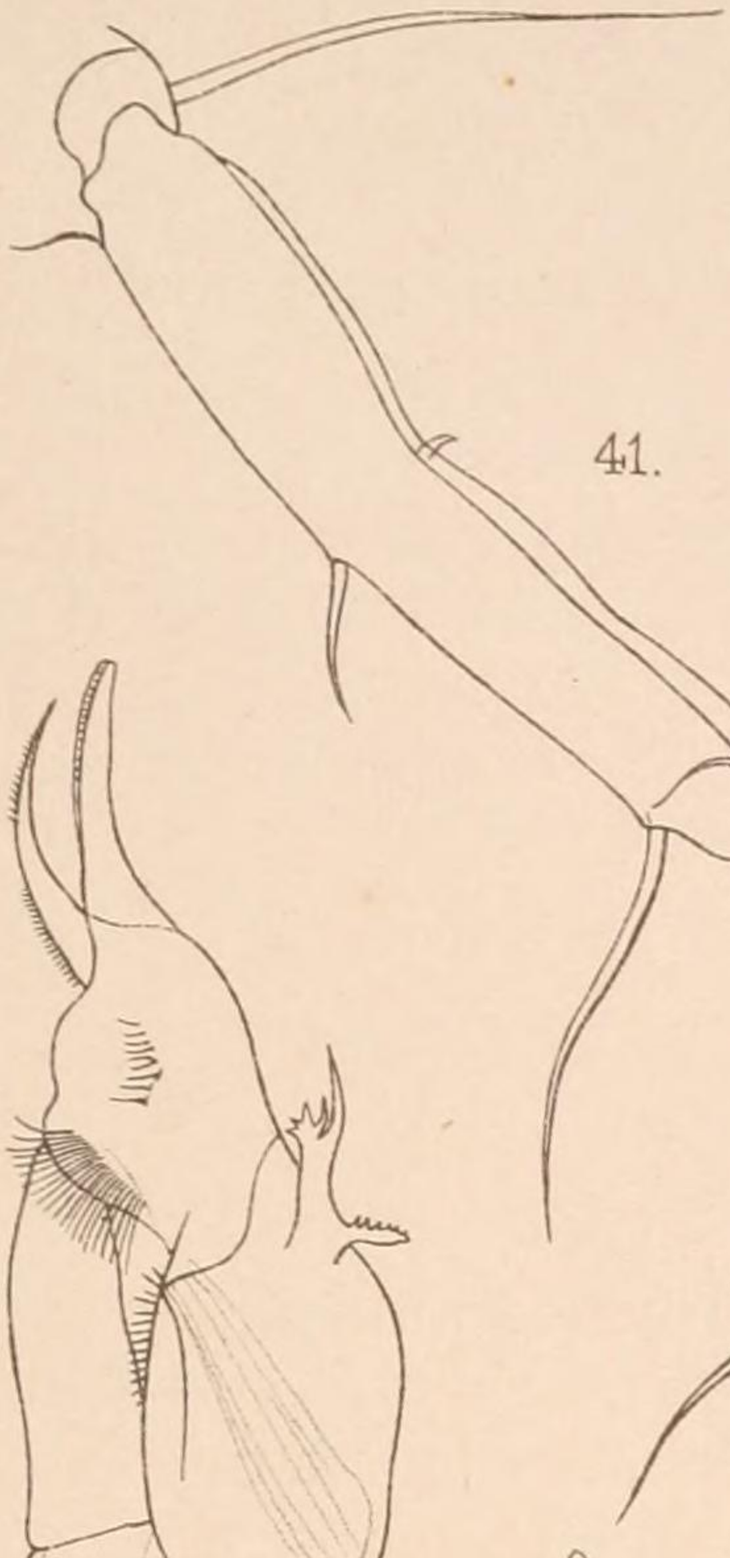

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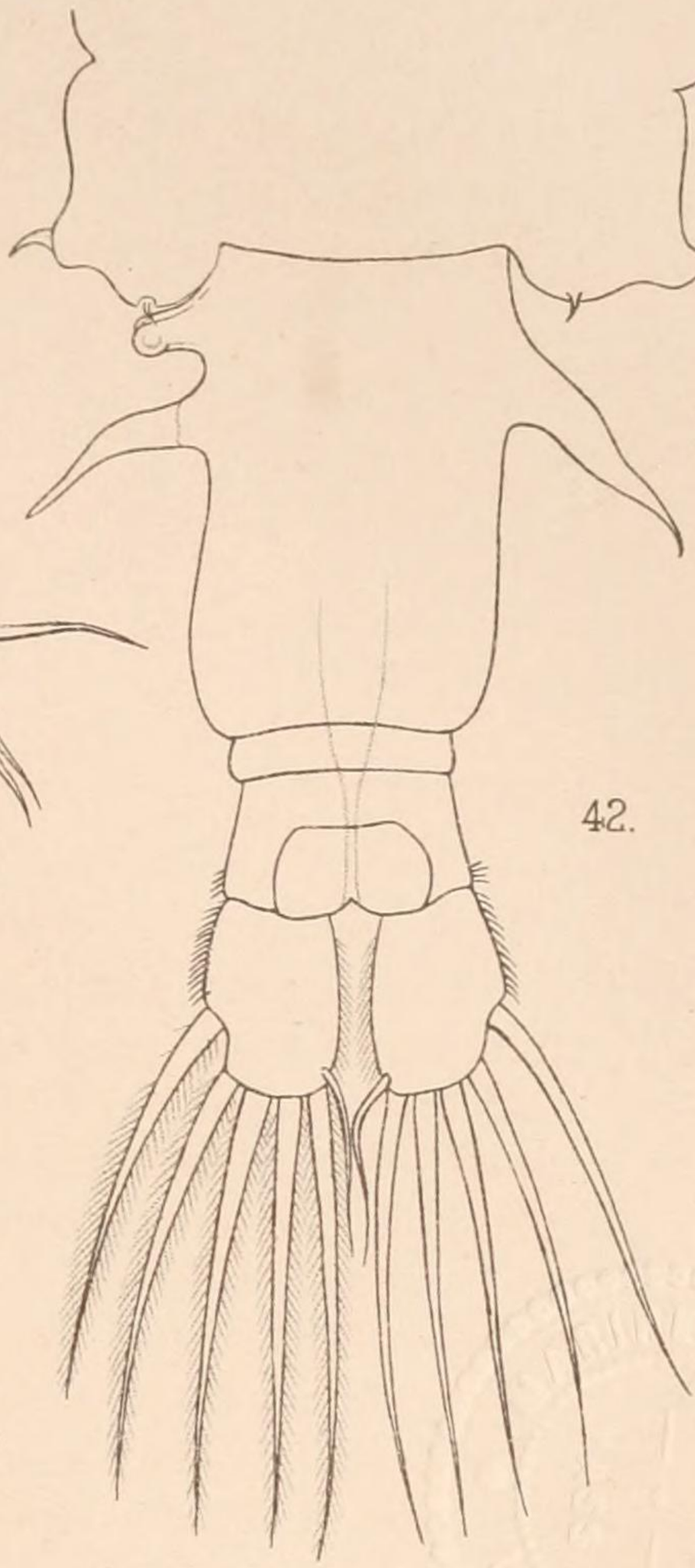

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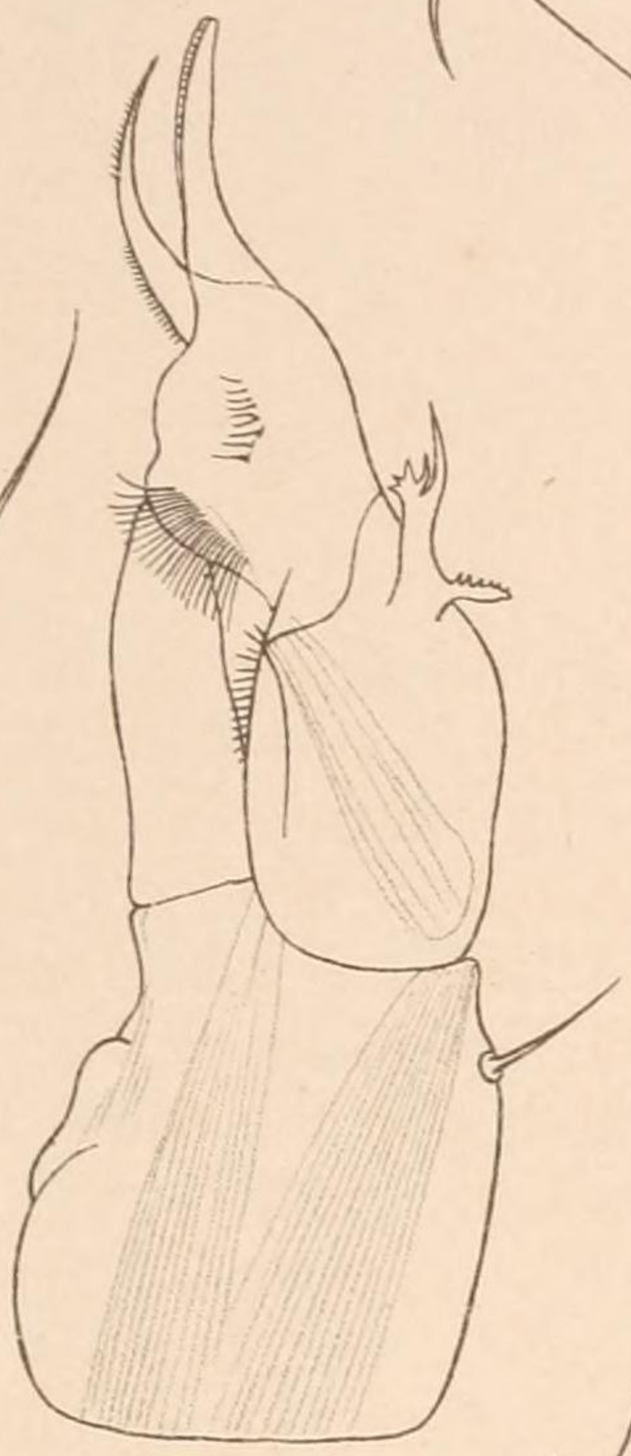

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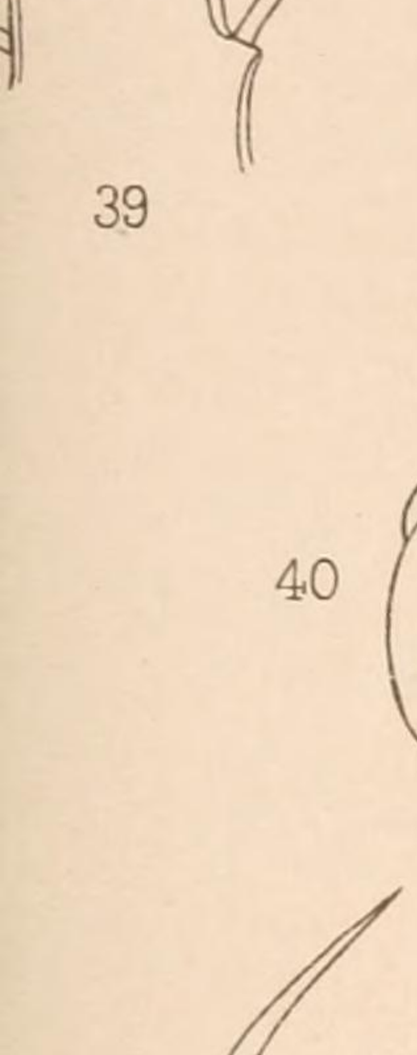

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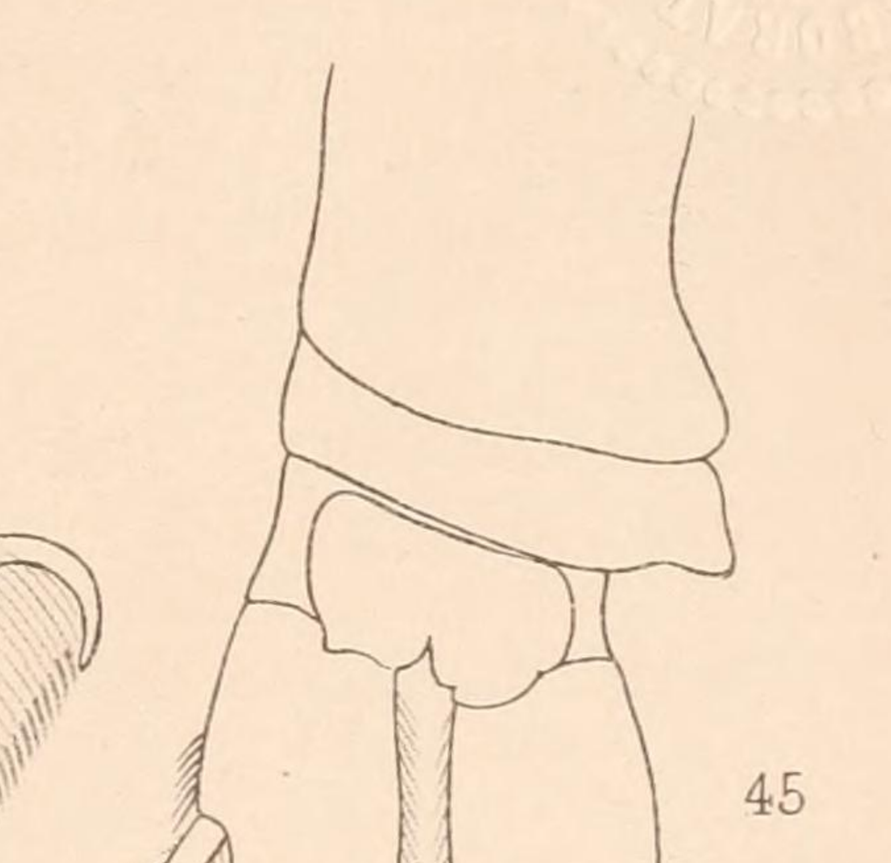

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Gurney del. ad nat.

West, Newman lith.

of the thorax not completely fused with the preceding segment, not greatly expanded laterally, but with its outer angles acute. Abdomen of three segments only; the genital segment more than twice as long as the two succeeding segments together, bearing on the left side anteriorly a short rounded knob and on either side a long stout spine (plate XIV. fig. 42). These two spines are not exactly symmetrical either in size or position. Second segment of the abdomen very short, scarcely one-third of the length of the third segment. Furcal rami broad, the breadth greater than half the length, ciliated on both sides. Frontal filaments absent. First pair of antennæ reach, when reflexed, to the end of the thorax. The fifth pair of legs (plate XIV. fig. 43) have the endopodite slender, indistinctly two-jointed, nearly equalling in length the first joint of the exopodite. The apex of it bears two long setæ and a few small spines. Third joint of the exopodite distinct, bearing two short, subequal spines.

Male: Shape as in the female, but somewhat more slender and tapering posteriorly. Third and fourth segments of the abdomen produced asymmetrically on the right side (plate XIV. fig. 45). Prehensile antennæ bears a stout spine on the fifteenth and sixteenth joints, but no spine on the fourteenth. Penultimate joint with a narrow hyaline lamella not produced at the distal end into a hook (plate XIV. fig. 41). Terminal joint without a hook. Fifth pair of legs (plate XIV. fig. 44). Right leg has a large bilobed hyaline lamella on the second basal joint. Endopodite short and club-shaped; second joint of the expodite with the lateral spine inserted nearly in the middle, with a hyaline process at its base. Terminal claw comparatively short and finely serrated. Left leg with endopodite cylindrical, 1-jointed, as long as the first joint of the exopodite and bearing at the end two long setæ. Second joint of the exopodite rather elongated, and with a hairy pad and short distal spine; inner spine, corresponding to the third joint, short and stout.

Length, female 5 to 5·5 mm.; male, 4 to 4·5 mm.

This very large species resembles in many respects *Diaptomus roubaui* Richard, but differs strikingly from it in some points. It differs from it in the form of the genital segment, which in *D. roubaui* is produced on the right side into a rounded process. In the fifth foot of the female the spines of the third joint of the exopodite are much shorter than in *D. roubaui*. and the endopodite is a little longer. There is a considerable agreement in form between the fifth feet of the male in the two species, but *D. roubaui* lacks the hyaline membrane of the second basal joint of the right foot and the long setæ of the endopodite of the left foot. The abdomen of the male is exactly the same in both.

My specimens were found in a pool at Oued Tindja.

Poppella guernei Richard.—A few specimens of this peculiar species were found in a marshy lake by the outflow of the Lake Garaa Achkel at Oued Tindja. The water was perfectly fresh.

The species was found by M. Richard in a fresh-water canal in southern France, but has also been recorded by Sars from the Caspian Sea, and by Van Douwe from Transcaspia and Turkestan. Its distribution is therefore peculiar both geographically and biologically, since it occurs both in fresh-water and also in water of very high salinity (Bay of Karabugas).

Professor Sars has stated his opinion that the large double-toothed plate on the posterior face of the second joint of the fifth foot in the female figured by Richard is nothing more than the terminal part of the newly-formed leg as seen just before the moult. Van Douwe has, however, fully confirmed Richard's description by the examination of Transcaspian specimens, and my own show the existence of the toothed plate as clearly as possible. Viewing the anterior face of the leg, this plate, as seen through the leg, has a remarkably close resemblance to the third joint of the latter, and might easily give rise to error. It is, of course, possible that the Caspian form is a distinct species.

A small anatomical point has not been mentioned by either Sars or Van Douwe. On the inner face of the twenty-third and twenty-fourth joints of the antenna in the female, there is a very delicate hyaline lamella, or rather "stiftchensaum," since its delicate striation indicates that it is composed of excessively fine cilia. This lamella is supported distally by a peculiar, highly refringent, curved rod of chitin (plate XIV. fig. 46).

Conclusion.

Much work has already been done on the fresh-water Crustacea of North Africa, particularly by M. Richard and Professor Sars, who have worked largely on material supplied by M. Chevreux. Compared with those of Algeria, the Crustacea of Tunisia have been somewhat neglected, but my own collections, though I spent but a few days in that country, are sufficient to show that the fauna of the coast region, or Tell, is very rich and will repay closer investigation. I think it worth while to give here what I believe to be a complete list of the species hitherto recorded from Algeria and Tunisia. I have included in it all the species found by me, and have indicated roughly the distribution of each one.

List of Species found in Algeria and Tunisia.

	Numidia only.	Palæarctic Region (remainder of).	Nearctic Region.	Neotropical Region.	Ethiopian Region.	Oriental Region.	Australian Region.
Potamon edule Latr.		+					
Palæmonetes varians Leach		+					
Atyaephyra desmaresti Millet		+					
Caridina nilotica Roux		+			+		
Asellus aquaticus Linn.		+	+				
Cirolana fontis Gurney	+						
Gammarus pulex L.		+					
G. simoni Chevr.	+						
G. pungens M. Edw.		+					
G. tunetanus Sim.	+						
G. locusta Linn.		+	+				
Orchestia gammarellus Pall.		+					?
Talitrus saltator Mont.		+					
Niphargus rhipidiophorus Catta		+					
Pseudoniphargus africanus Chev.	+						
Corophium volutator Pall.		+					
Artemia salina Linn.		+	+			+	
Branchinecta salina Daday	+						
Branchinecta sp.	+						
Branchipus pisciformis Schaeff.		+					
Chirocephalus diaphanus Prév.		+					
C. recticornis Brauer	+						
Streptocephalus rubrocaudatus Klunz.					+		
S. bimaris Gurney	+						
S. sp.	?						
Apus cancriformis Schaeff.		+					
A. numidicus Grube					+		
Lepidurus lubbocki Brauer		+					
Estheria cycladoides Joly		+					
E. angulosa Simon	+						
E. mayeti Simon	+						
Diaphanosoma brachyurum Liev.		+	+	+			
Daphnia magna Strauss		+	+		+		
D. atkinsoni Baird		+	+				
D. chevreuxi Rich.	+						
D. acuminirostris Lucas	+						
D. obtusa Kurz		+	+	+			
Simosa vetula O.F.M.		+	+	+			
S. exspinosa Koch		+	+				
Scapholeberis mucronata O.F.M.		+	+	+		+	
Ceriodaphnia megalops Sars		+	+				
C. reticulata Jur.		+	+	+			
C. dubia Rich.				+			+
Moina macrocopa Strauss		+	+				
M. rectirostris Jur.		+	+				
M. salinarum Gurney	+						
Macrothrix hirsuticornis Norm. & Br.		+		+			
Lathonura rectirostris O.F.M.		+	+				
Alonopsis ambigua Lillj.		+					
Alona tenuicaudis Sars		+	+	+		+	
A. elegans Kurz		+					

LIST OF SPECIES FOUND IN ALGERIA AND TUNISIA—*continued.*

	Numidia only.	Palæarctic Region (remainder of).	Nearctic Region.	Neotropical Region.	Ethiopian Region.	Oriental Region.	Australian Region.
A. rectangula Sars		+	+	?			
A. guttata Sars		+	+	+	+	+	
Leydigia acanthocercoides Fisch.		+	+	+		+	
Pleuroxus aduncus Jur.		+		+		?	
Dunhevedia crassa King		+	+	+	+	+	+
Chydorus sphæricus O.F.M.		+	+	+	+	+	+
C. letourneuxi Rich.		+					
Cypris ungulata Moniez	+						
C. virens Jur.		+	+				
C. incongruens Ramd.		+	+				
C. blanchardi Moniez	+						
C. fischeri Lillj.		+					
C. mareotica Fisch.		+					
C. bispinosa Luc.		+					
C. phaseolus Luc.	+						
C. balnearia Moniez	+						
Herpetocypris reptans Baird		+	+				
Cyprinotus fragilis Brady	+						
C. prasinus Fisch.		+					
Stenocypris chevreuxi Sars	+						
Ilyocypris gibba Ramd.		+	+				
I. australiensis Sars						+	+
Cypridopsis villosa Jur.		+		+			
Candonopsis complanata Brady	+						
Diaptomus lilljeborgii G. & R.		+					
D. chevreuxi G. & R.	+						
D. salinus Dad.		+					
D. wierzejskii Rich.		+					
D. incrassatus Sars		+					
D. cyaneus Gurney	+						
D. ingens Gurney	+						
D. numidicus Gurney	+						
Poppella guernei Rich.		+					
Cyclops bicuspidatus Claus		+	+				
C. albidus Jur.		+	+	+		+	+
C. strenuus Fisch.		+		+			
C. prasinus Fisch.		+		+	+	+	
C. diaphanus Fisch.		+					
C. viridis Fisch.		+	+				
C. macrurus Sars		+		+			
C. serrulatus Fisch.		+	+	+	+	+	+
C. planus Gurney	+						
C. aequoreus Fisch.		+					
Canthocamptus pygmaeus Sars		+					
C. yahiai Bl. & Rich.	+						
C. minutus O.F.M.		+					
C. trispinosus Brady		+		+			
Marshia blanchardi Rich.		+					
Mesochra lybica Bl. & Rich.	+						
Laophonte mohammed Bl. & Rich.		+				+	
Dactylopusia jugurtha Bl. & Rich.						+	
Belisarius viguieri Maupas		+					

This list of species recorded from Algeria and Tunisia is an extensive one compared to any list that could be compiled for any other part of Africa. The great majority of these species were taken in the Tell or coast region, mainly in the neighbourhood of Bône, but scattered observations have been made all over the country from Oran to Tunis and as far south as Ouargla.

The close connection existing between both the fauna and flora of North Africa and those of the southern parts of Europe has been abundantly demonstrated by many authors, and the conclusions of the botanists and zoologists are borne out by those of geologists. It is not, therefore, to be expected that the Crustacea should do otherwise than confirm the generally accepted opinion. Furthermore, the Entomostraca, with their generally wide, and yet often perplexing distribution, are not by any means a good group from which to draw zoogeographical evidence. It is, however, remarkable, in view of their immense powers of dispersal, that they do in fact point in the clearest possible way to the independence of North Africa from the rest of the continent, and its zoological affinity with Europe. The only species which, outside Numidia, are found only in Southern Africa, are *Apus numidicus* Grube and *Streptocephalus rubricaudatus* Klunz. The latter really hardly affects the question, as it has only been found in Algeria between Ouargla and Temassinim, near the boundary of the Palæarctic and Ethiopian regions. A peculiar feature of the Entomostracan fauna is the presence of certain species hitherto found only in Asia or Australia. These are *Diaptomus incrassatus* Sars, which is recorded only from Central Asia, *Dactylopusia jugurtha* Blanch. and Rich. from Siam, and *Ilyocypris australiensis* Sars from Queensland and Ceylon. *Ceriodaphnia dubia* Rich. is found in Sumatra, New Zealand, Chili, Patagonia, and Tierra del Fuego, but not in South Africa as yet.

The countries bordering the Western Mediterranean have faunistic relations which have led Dr. Forsyth Major to unite them in a province called by him "Tyrrhenis,"* and it is a characteristic of this province that many of its representative species, either existing or extinct, have Oriental or South American affinities.† The species just mentioned provide further evidence of such affinity. Further, the species of *Diaptomus* which I have called *D. numidicus*, seems to be most nearly related to *D. steindachneri* from Albania, and *D. drieschi* from Ceylon. *D. ingens* is related to the Spanish *D. roubaui* and to *D. amblyodon*, which extends from Austria to Siberia.

The Entomostraca of Numidia indicate, therefore, an intimate connection between North Africa and Western Europe, and suggest

* See R. F. Scharff, European Animals, London, 1907, pp. 212–30.
† Loc. cit.

that there has been an immigration of Eastern forms following the Northern coast of the Mediterranean, as stated by Professor Engler.*

Literature referring to the Fresh-water Crustacea of Algeria and Tunisia.

Blanchard, R.—Résultats d'une excursion zoologique en Algéria. Mém. Soc. Zool. France, iv. (1891) pp. 208-45.

Blanchard, R., & J. Richard—Sur les Crustacés des Sebkhas et les Chotts d'Algérie. Bull. Soc. Zool. France, xv. (1890) p. 136.

„ „ „ Faune des lacs salés d'Algérie. Cladocères et Copépodes. Mém. Soc. Zool. France, iv. (1892) p. 512.

Brady, G. S.—On New and imperfectly known Ostracoda, chiefly from a collection in the Zoological Museum, Copenhagen. Trans. Zool. Soc. Lond. xvi. (1902).

Brauer, F.—Beiträge zur Kenntniss der Phyllopoden. SB. k. Akad. Wiss. Math. Nat. Cl., lxxv. (1877).

Chaignon, H de—Contributions à l'Histoire naturelle de la Tunisie. Bull. Soc. Hist. Nat. Autun, xvii. (1904).

Chevreux, E.—Sur quelques Crustacés amphipodes recueillis aux environs de Cherchel. C.R. Ass. Français, Oran, 1888.

„ *Gammarus simoni* sp.n., Amphipode des eaux douces d'Algérie et de Tunisie. Bull. Soc. Zool. France, xix. (1894) pp. 171-6.

„ „ Amphipodes des eaux souterraines de France et d'Algérie. Bull. Soc. Zool. France, xvi. (1901).

Cotty, E.—Particularités curieuses sur différents Reptiles, Insectes et Crustacés d'Algérie. Amiens, 1869.

Daday, E. von—Diagnoses præcursoriæ specierum aliquot novarum e familia Branchipodidæ. Ann. Sci. Nat., ser. 9, vii. (1908) pp. 137-50.

Deyrolle—Note sur l'habitat de quelques Crustacés décapodes et phyllopodes fluviatiles de Tunisie. C.R Soc. Biol. Paris, lviii. (1905) p. 379.

Giard, A.—A propos du *Barbus callensis* Guichenot (= *Mullus barbatus* Blanch. nec L.). C.R. Soc. Biol. Paris, lv. (1903) p. 1144. Réponse par R. Blanchard, p. 1185.

Guerne, J. de—Distribution géographique du *Cypris bispinosa*. Bull. Soc. Zool. France, xviii. (1893).

Guerne, J. de, & J. Richard—Diagnose de deux *Diaptomus* nouveaux d'Algérie. Bull. Soc. Zool. France, xiii. (1888) p. 160.

„ „ „ *Diaptomus chevreuxi*, Copépode nouveau d'Algérie. Bull. Soc. Zool. France, xix. (1894) p. 176.

Gurney, R.—A New Species of *Cirolana* from a fresh-water spring in the Algerian Sahara. Zool. Anzeig., xxxii. (1908) p. 682.

Kobelt, W.—Reiseerinnerungen aus Algerien und Tunis. Frankfurt A.M. 1885.

Lucas, H.—Histoire naturelle des Animaux articulés. Explor. Scient. de l'Algérie, 1849.

* See R. F. Scharff, European Animals. London, 1907, pp. 212–30.

MAUPAS, M.—Sur le *Belisarius viguieri*, nouveau Copépode d'eau douce. C.R. Acad. Sci. Paris, CXV. (1892).

MONIEZ, R.—Description d'une nouvelle espèce de Cypris, vivant dans les eaux thermales du Hammam Meskhoutine. Bull. Soc. Zool. France, xviii. 1893.

„ Faune des lacs salés d'Algérie. Ostracodes. Mem. Soc. Zool. France, iv. (1891).

RICHARD, J.—Entomostracés nouveaux ou peu connus. Bull. Soc. Zool. France, xiii. (1888) p. 43.

„ Sur la Distribution géographique des Cladocères. Congr. Int. de Zool. II. Moscou, 1892, part I.

„ Revision des Cladocères. Ann. des Sci. Nat., ser. 7, xviii. (1895), and ser. 8, xx. (1896).

SARS, G. O.—On a New Fresh-water Ostracod, *Stenocypris chevreuxi* G. O. Sars, with notes on some other Entomostraca raised from dried mud from Algieria. Arch. Math. Nat. Krist, xviii. (1896).

„ On the Crustacean Fauna of Central Asia. Part II. Cladocera. Ann. Mus. St. Petersburg, viii. (1903).

SIMON, E.—Étude sur les Crustacés terrestres et fluviatiles recueillis en Tunisie en 1883 and 1885. Explor. Sci. de la Tunisie, 1885.

„ Étude sur les Crustacés du Sous-Ordre des Phyllopodes. Ann. Soc. Entom. France, ser. 6, vi. (1886).

Other Literature referred to.

RATHBUN, M. J.—Les Crabes d'eau douce (Potamonidæ). Arch. Mus. Paris, vi. 2 (1904).

ROLLAND, G.—Hydrologie du Sahara Algerien. Paris, 1894.

SCOURFIELD, D. J.—The Ephippia of the Lynceid Entomostraca. Journ. Quekett Micr. Club, ser. 2, viii. (1902).

STINGELIN, TH.—Die Cladoceren der Umgebung von Basel. Rev. Suisse Zool., iii. (1895).

Note.—For an excellent Bibliography of Algeria see—

PLAYFAIR, R. L.—A Bibliography of Algeria, from the Expedition of Charles V. in 1541, to 1887. Supplementary Papers of the Royal Geographical Society, ii. (1888) part II.

„ „ Supplement to the Bibliography of Algeria, from the earliest times to 1895. London, 1898.