Fresh-water Fauna of New Zealand.

Nos. 2–6.

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(Communicated by E. W. BENNETT).

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CONTENTS:—

SINCE the former paper was written, some more of the collections kindly forwarded by Mr. E. W. Bennett have been examined, and the further information which has been obtained on the fresh-water fauna of New Zealand is recorded in this paper, independently of strict systematic sequence.

2. THE PLANKTON OF LAKE LYNDON.

The plankton collections from Lake Lyndon, which is 2,743 feet above sea-level, are remarkable in several respects. The absence of Rotifers (with one exception) and of plankton Diatoms and Peridinians may perhaps be attributed to the use of a net with too wide a mesh to retain the smaller organisms†; but on the other hand the absence of the genera *Daphnia* and *Cyclops* may be safely regarded as a genuine peculiarity of the lake, which is remarkable for the fewness of its planktonic species.

The components of the plankton were as follows:—

1. A species of the family Boeckellidae, which will be dealt with elsewhere;
2. *Ceriodaphnia* spec.;
3. *Bosmina hagmanni.;*
4. *Asplanchnopus myrmeleo.*

Some accompanying explanation of the use of the names in this list will be necessary.

Ceriodaphnia spec. was present in incredible numbers, and was distinctly the dominant form in the plankton. Yet no ephippium-

*For No. 1, see Trans. N.Z. Institute, vol. 59, p. 779, 1928.

†The net was a seven-foot surface-net of sign-writers' muslin, operated from a row-boat. The paucity of species may in part be due to the violent storm and heavy rain at the time of collecting; but on the other hand I found no recognisable plankton at all in a similar locality (the Intake, Lake Coleridge), where I operated the same net during fine weather on the following day.—E.W.B.

bearing females and no males were found, and this makes it necessary to leave the identity of the species an open question at present. The following are the records, as far as I have determined, of *Ceriodaphnia* from Australia and New Zealand: Miss Henry has reported *C. cornuta, C. spinata,* and *C. honorata* from the continent, Gurney has added *C. dubia* from Queensland, and Smith has described *C. hakea* and *C. planifrons* from Tasmania. Moreover, Sars has recorded *C. dubia* from Lake Wakatipu in New Zealand.

The Tasmanian forms and *C. honorata* can scarcely be included in a survey, for the accounts of these species are scarcely sufficient for their clear recognition. The accounts of *C. dubia* do not quite agree with one another. Gurney refers, in the course of his description of the Queensland specimens, to Stingelin's proposal to unite *C. dubia* and *C. reticulata,* and rejects the proposal because the Queensland specimens have no such pronounced lateral crest on the terminal claw. And moreover there is a striking difference between the two species in the form of the male antennule; but since no males are present in my collection, an essential point of comparison is lacking. However, Gurney definitely states that a lateral crest is present in his specimens; and there can be no doubt on this point in the case of my specimens, for the terminal claws show no more than a fine fringe along their whole length. Our species, therefore, is at all events not identical with the Queensland *C. dubia.*

Now as already mentioned, Sars recorded *C. dubia* from New Zealand, and this record would bring the species into especial prominence as an instance of zoo-geographical relationships; but here again the essential point remains obscure, for Sars likewise had no male specimens. But the figure which he gives does not hint at any secondary crest, so that it may very well be possible for the Lake Lyndon form to be identical with that from Lake Wakatipu. It is interesting to note, in connection with the relationships of the Australian-New Zealand faunas with that of South America, that Sars drew a comparison between his form and the var. *acuminata* of *C. dubia,* described by Ekman from Patagonia; but once again, Ekman saw no males of his form. And moreover, generally speaking, the attempts hitherto to characterize the species of Cladocera are to a considerable extent of doubtful systematic value. I might instance, as a characteristic of the form from Lake Lyndon, the size of the eyes, which are considerably larger than those of Sars's form from Lake Wakatipu, or of Ekman's from Patagonia. But in view of what is known of the variability of the size of the eyes according to environmental circumstances, I would prefer to consider this character as a minor difference only. Certainly the circumstance that my specimens came from a considerable altitude, and were therefore exposed to more intense ultra-violet light, permits us to conjecture that the eyes are influenced by the light-relationships in Lake Lyndon; and this suspicion gains strength from the fact that it was observed, in the neighbourhood of the Biological Station at Lunz, that *Daphnias* from mountain-pools at an elevation of more than 1,600 metres had larger eyes than those from the bottoms of the valleys.

Another character might perhaps serve better as a distinguishing feature between this and the other forms, viz., the strong development of the process from which arises the lateral seta of the antennule.

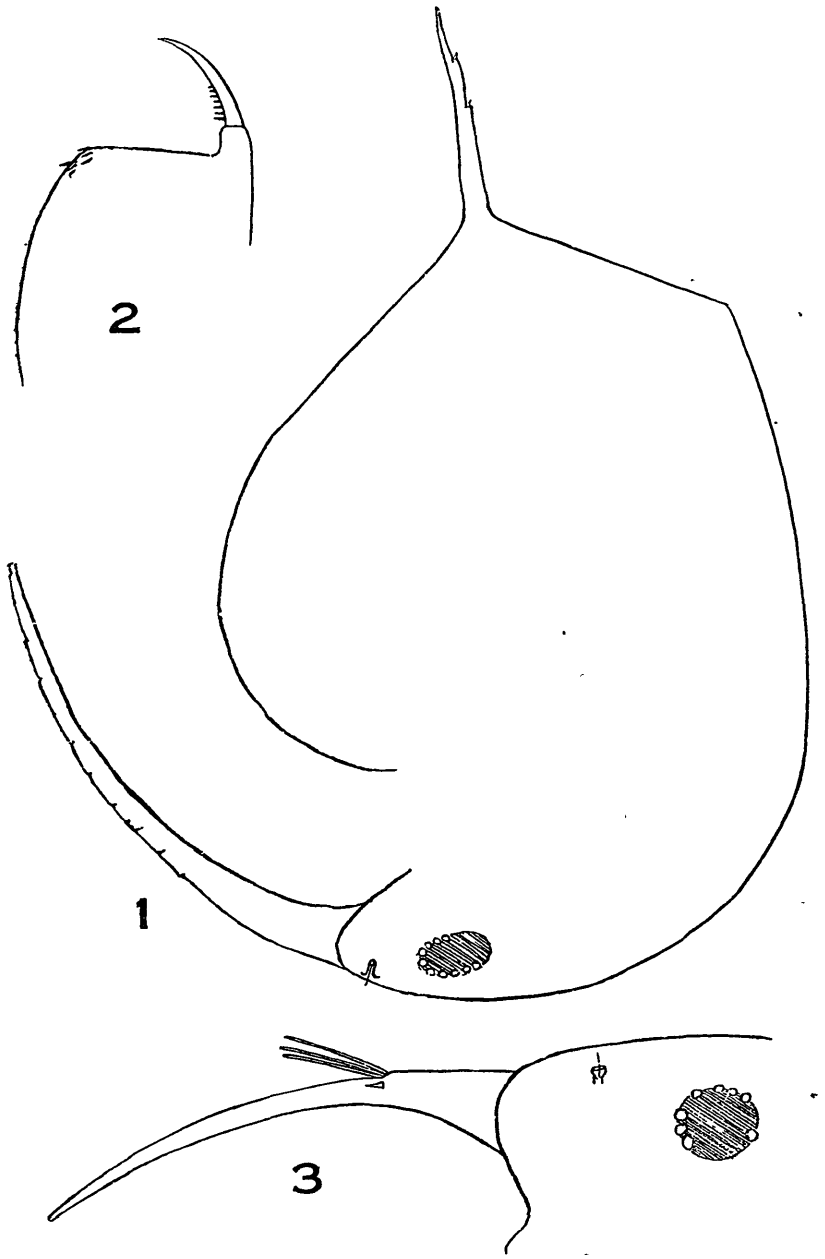
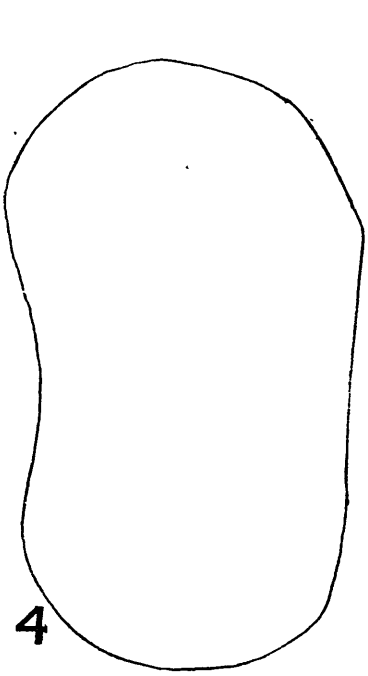


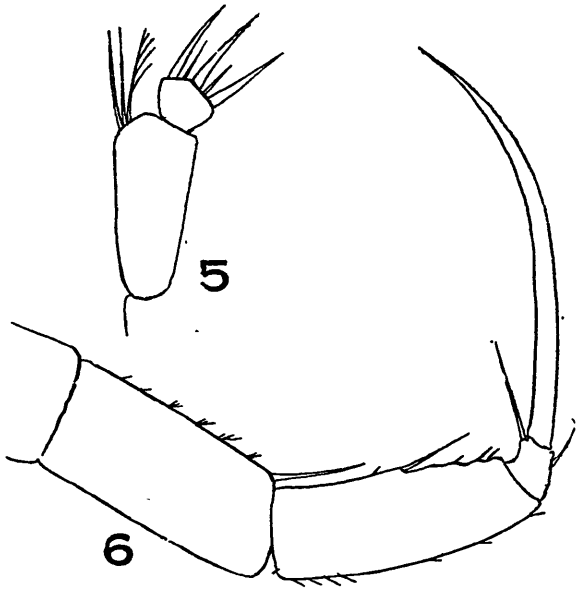
FIG. 1.—*Bosmina hagmanni* Stingelin, young female with incisures on the antennule and mucro.
FIG. 2.—*Bosmina hagmanni* Stingelin, post-abdomen of mature female.
FIG. 3.—*Bosmina hagmanni* Stingelin, head of a female with two embryos, antennule without incisures.

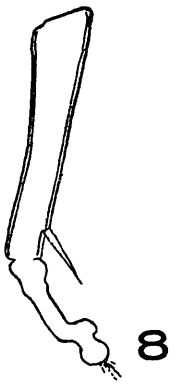
Under these circumstances there is no alternative but to consider the *Ceriodaphnia* of Lake Lyndon as perhaps belonging to *C. dubia,* and to leave the question undecided until the males of the species can be investigated.

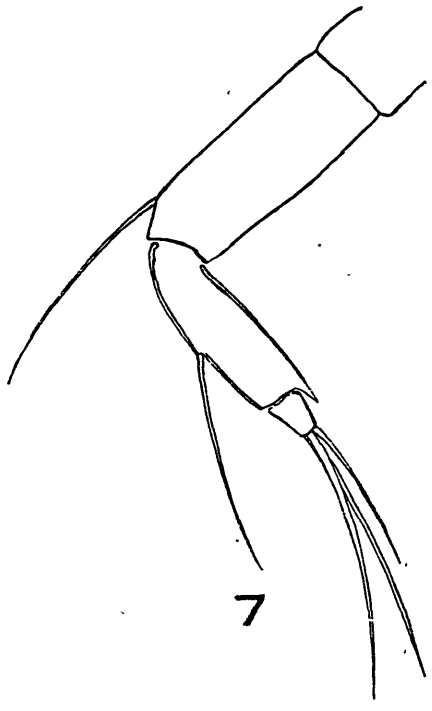
Bosmina hagmanni Stingelin.—Before explaining the reasons for the assigning of this form to the South American species *B. hagmanni,* it will be necessary to refer briefly to previous references to Australian Bosminidae. While *Bosmina* appears to be very sparingly represented on the Australian continent—there are only two records of the occurrence of *B. longirostris,* and none was noticed by Henry in her work on the Cladocera of New South Wales—yet in 1909 G. W. Smith made known three new species from Tasmania, which, after a minor nomenclatural alteration, have gone down in the literature as *B. Goffreyi, B. Sorelli,* and *B. tasmanica.* However, Ruehe has since expressed strong doubts, in his valuable monograph of the genus *Bosmina* (*Zoologica,* Heft 63, 1921) upon the specific distinctness of these forms. Sars, again, in his "Pacifische Plankton-Crustacean" (*Zool Jahrb.,* Bd. 19, 1903), has described B. *meridionalis* from Lake Wakatipu in New Zealand; but here also, Ruehe, in the above-mentioned monograph, has raised serious doubts as to the validity of this species; for he points out that, as may be seen both from the author's description and from his figures, Sars's species falls into the "*longispina* series" of *B. coregoni,* and that Sars (to translate Ruehe's remark) "perhaps came to his conclusion through the incorrect assumption that *B. meridionalis* was the only *Bosmina* from the southern hemisphere." We shall shortly see how justified Ruehe was in assuming this critical attitude, and on the other hand how unsafe it is to base a definite conclusion merely upon the description and figures of a species.

As the accompanying figures show (Figs. 1—3), the present species has a certain resemblance to *B. obtusirostris.* The frontal seta is generally inserted nearer to the end of the rostrum than to the eyes; but I also found specimens in which the frontal seta was inserted very nearly in the middle. The terminal claw of the hinder abdomen has no pronounced notch, and bears only seven thick spines, *which become smaller distally.* In well-grown and embryo-bearing females, averaging 0.5 mm. in length, the antennule showed no incisures, and the mucro was quite free from incisures. Of the "seta Kurzi" nothing was to be seen, so that this must be regarded as quite absent. There were no males or ephippigerous females; but numerous young specimens were present, which make it possible to identify the species with *B. hagmanni;* for they had not only 11 incisures on the antennule, but also *two* sharp incisures, each armed with a spine, on the mucro, on its dorsal side. To make use of this discovery for our present purposes, it may be recalled that in a later comment upon Ruehe's discussion (on p. 18 of the above-mentioned monograph), I have shown that in *B. hagmanni,* described by Stingelin from the Amazon, we have a typically South American form, whose distribution extends somewhat into North America, but, as far as we know, does not reach the older world (cf. Brehm, Ergebnisse einer von Prof. Klute nach Patagonien unternommenen Forschungsreise, *Archiv. f. Hydrobiologie,* 1925). In this paper I have









Ilyocypris fallax n. sp.

FIG. 4.—Male outline of shell.
FIG. 5.—Terminal joint of maxillary palp.
FIG. 6.—Male, first leg.
FIG. 7.—Male, second leg.
FIG. 8.—Grasping organ of male.

also pointed out that the dorsal position of the incisure of the mucro, and consequently the identity of the species, are often obscured by the fact that this character is shown in young specimens, and is lost in the sexually-mature stage; so that the specific identity can be definitely determined only if, as in the present collection from New Zealand, young specimens also occur with the adult ones. This is perhaps an exceptional case, but it is not without parallel; for in many Chironomidae we can detect specific differences in the larva or pupa where none are to be recognized in the imago.

There is no doubt, then, of the identity of the *Bosmina* from Lake Lyndon with the South American species; and I am convinced that in an adequate revision, all the other supposed species mentioned above from the Australian and New Zealand regions will be found to belong to the one form *B. hagmanni.*

In that case the opinion expressed by Smith as to the origin of the Australian *Bosminas* may be allowed to pass, if it is understood in a different sense from that in which the author intended it. In a footnote on page 14 of his monograph, Ruehe expresses his opinion of the new species proposed by Smith:—" Infolgedessen stehen auch die weitgehenden tiergeographischen Speculationen, soweit sie Smith auf das Vorkommen von Bosminen in Tasmanien gründet, auf sehr schwachen Füssen. Smith glaubt annehmen zu müssen dass Bosmina (!) von der nördlichen Hemisphäre uber die Andenkette und eine antarktische Landbrücke nach Tasmanien gelangt sei." (Hence the sweeping speculations concerning zoogeography, in so far as Smith bases them on the presence of *Bosmina* in Tasmania, are very insecurely founded. Smith thinks it necessary to assume that *Bosmina* has spread from the northern hemisphere into Tasmania by way of the Andes and an Antarctic land-bridge.)

From Ruehe's parenthetical exclamation mark, it may be seen how improbably he considered the whole hypothesis. And yet it seems to me quite reasonable, so long as we restrict it to the route by which *B. hagmanni* reached Australia; but the species may very well have originated in South America, and the representatives found north of Panama seem to me to be quite as much emigrants as the Australian. But it seems also reasonably safe to suppose that originally the genus *Bosmina,* as such, was derived from the northern hemisphere, in accordance with Smith's map of the geographical distribution of the genus.

3. Ostracoda from Banks Peninsula.

The specimens referred to here were collected near Motukurara, on the flat below Gebbies Pass; they were in a shallow muddy pool under a culvert on the main road.

In this collection (tube 34), which is characterized by the great abundance of *Newnhamia fenestrata* and *Cypridopsis* cf. *aculeata,* a member of the genus *Ilyocypris* was found; unfortunately there was no more than the one specimen, a male. It is recorded below as *Ilyocypris fallax* n. sp. (Figs. 4—11.)

Hitherto no species of *Ilyocypris* has been known from New Zealand. In 1899 Sars recorded a species of the genus from Queens-

land, under the name *I. australiensis*; but unfortunately the description of the species is so imperfect that Mueller, in his monograph in the "Tierreich," considered it to be only a *nomen nudum*. Until further material from the same locality can be examined in order to revise the description, one can hardly arrive at a working-idea of the nature of the species. Henry has mentioned *I. australiensis* in her paper, but as she had no specimens of the species she could give

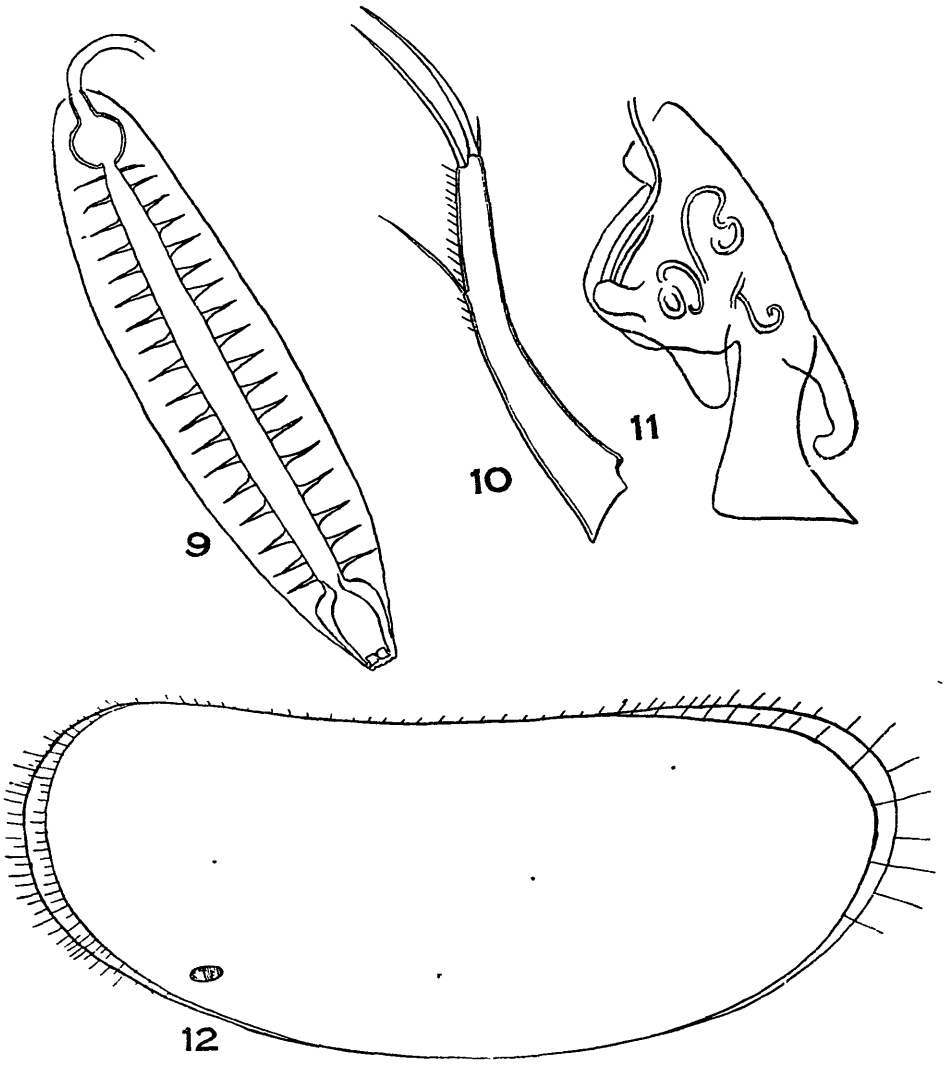


FIG. 9.—*Ilyocypris fallax* n. sp., Zenker's organ.
FIG. 10.—*Ilyocypris fallax* n. sp., furca of male.
FIG. 11.—*Ilyocypris fallax* n. sp., copulatory organ of male.
FIG. 12.—*Herpetocypris Pascheri* n. sp., outline of shell.

no further information, so that it would have been better if she had followed Mueller in ignoring the specific name and retaining only the record of the genus from Australia.

My New Zealand specimen of this genus is a male, 0.96 mm. in length, whose valves are covered with numerous colonies of a jet-black *Siderocapsa*. In general appearance the animal has such a a resemblance to a *Limnicythere*, especially in the outline and colour of the shell, that at first glance I thought that I had a representative of that genus before me; and for this reason the specific name *fallax* was chosen. The granulations frequently found on the valves of *Ilyocypris* do not occur in the present form. The swimming-setae reach beyond the claws. In comparison with figure of *I. gibba* given by Vavra, the small lateral tufts of setae, which occur especially on the middle joints of the second antennae and on the cleaning-foot, are much less developed, and are more noticeable on the first pair of feet, of which unfortunately Vavra gives no figure. As for the modified antenna of the male, I have before me a figure of *I. decipiens* by Alm, and from this the New Zealand species differs considerably. The end-joint in our species is not pointed, but ends in two semi-circular swellings. Instead of the plumed seta on the fingered process, there is here a different structure, which however was difficult to see clearly, as it was obscured in the preparation. Five small and slender hyaline setae could be made out, or else a hyaline lamella, frayed out along the edge. In the Zenker's organ, the entrant and exit apertures have the spherical form characteristic of the genus, and the organ is provided with 18 rings of spines. The furca is strongly bent. The proximal edge of the furcal branch is quite bare, which is to be noted, because Vavra shows three tufts of hairs near the base of *I. gibba*. The hinder edge bears long thin hairs between the terminal claw and the seta of the hinder edge, while in front of the seta of the hinder edge there are only a few hairs, and these are immediately in front of it. The copulatory organ shows the typical characters in the genus.

4. Notice of the Occurrence of *Saycia* in New Zealand.

In a tube bearing the label, "stagnant grassy pond, just north of Waimate," two female specimens of the Cladoceran *Saycia orbicularis* G. O. Sars were found; this species has hitherto been known only from Victoria, and is evidently rare on the continent. It was not found by Henry in New South Wales, and in view of the size and conspicuousness of the species, this can hardly be put down to an oversight.

5. **Herpetocypris Pascheri** n. sp. (Figs. 12—19.)

In a tube whose label unfortunately was destroyed, there occurred, together with numerous examples of a blue-green *Cypretta*, some specimens of a large Ostracod, which is described below as *Herpetocypris Pascheri* n. sp.

Before we enter upon this description, however, an interesting point may be noted in connection with the *Cypretta* just mentioned.

In his paper, "Contributions to the Knowledge of the Fresh-water Crustacea of New Zealand" (*Videnskabs Selskabets Skrifter,* Kristiana, 1894), G. O. Sars includes three plates of coloured figures of the Ostracoda described by him, and it is very noticeable that with the exception of *Cypris sydneia,* all the species are coloured more or less green. At first I regarded this as a coincidence, but after seeing Mr. Bennett's material I must state that the New Zealand Ostracod fauna is in fact distinguished by an extraordinarily high percentage of green species. In the present state of ignorance of the nature of this green pigment, one must perforce refrain from any attempt to explain this phenomenon. *Herpetocypris Pascheri* is likewise green in colour, though the pigment is not equally intense in all specimens. Examples from another tube, which bore the locality-label, "shallow muddy pool, probably temporary, under a culvert, Cheviot," were distinguished by an intensely green colour.

The present form is placed in the genus *Herpetocypris* because the left valve of the shell is larger than the right, by which it is distinguished from *Candonocypris,* and because the seta of the hinder edge of the furca is not definitely clawed, as in *Iliodromus*; yet it has not the character of a simple seta, but it somewhat intermediate, so that in considering the position of the species, one might well be in doubt whether to regard it as an *Iliodromus* or a *Herpetocypris.*

As may be seen from the accompanying figures, *Herpetocypris Pascheri* is characterized by the following features:—At the end of the second antenna, there is a structure at the end of the last joint, which may be best described as a group of flatly arranged setae. In the literature which I have consulted, I find a similar structure figured by G. W. Mueller in his species *Cypris bicornis* which he described from South Africa (*Zool. Jahrb.* Bd. 13, 1900). The penultimate joint of the second antenna bears a comb of spines immediately in front of the point of insertion of the seta which is placed in the middle of the lateral margin. The swimming setae reach nearly to the end of the claws. The respiratory plate of the mandible bears five setae. The second joint of the mandibular appendage bears a transversely oblique row of short setae on the surface. Both of the strong claws of the masticatory lobe of the maxilla are toothed. The basal joints of the first pair of legs bear short tufts of setae at the edge; the brush-foot shows the typical form for *Herpetocypris,* that is, in particular, a terminal claw which is at least three times as long as the end joint. The foremost seta of the furca bears five fringes of teeth; the distal fringes are always more strongly developed than the preceding. These fringes remind one somewhat of the arrangement in *Stenocypris,* but the asymmetry of the branches of the furcae, characteristic of that genus, is lacking; this is at least indicated in some Asiatic species of *Herpetocypris.* The seta of the hinder edge, which, as mentioned above, is intermediate between a simple seta and a claw, is situated immediately alongside the shorter terminal claw. The anterior seta of the furca is about as long as the shorter claw. The accompanying figures indicate the outline of the valves and the structure of their edges. The available specimens represent only the female sex, and this gives rise to the suspicion that the species may be obligatorily parthenogenetic, especially as no

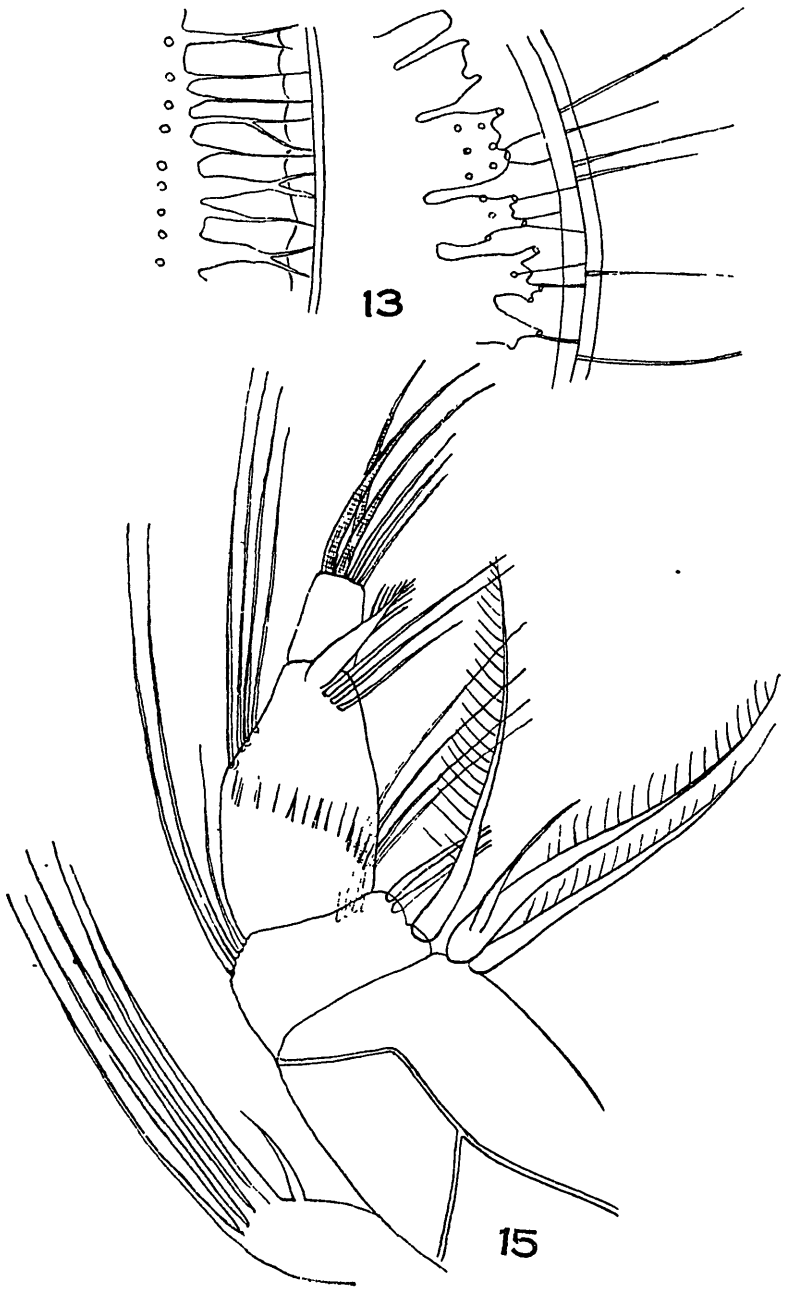


FIG. 13.—*Herpetocypris Pascheri* n. sp., structure of edge of shell.
FIG. 15.—*Herpetocypris Pascheri* n. sp., palp of mandible.

sperms were to be found in the receptacula of the females. The length of the animal averaged 2.5 mm.

I dedicate this new species to my honoured friend Professor A. Pascher, to whom authors of the *Suesswasserflora Deutschlands, Oesterreichs, und der Schweiz* are indebted for his investigations into the phylogeny of the Algae and Rhizopoda.

6. **Camptocercus** sp. (Figs. 20, 21.)

In a tube which unfortunately bore no locality-label, I found an example of a *Camptocercus,* whose specific identity however may remain an open question because of the debatable details involved. This discovery provides at least the first record of the genus from New Zealand. The genus was already known from the Australian continent, for Sars has described a species *C. australis* from there; but the present species is not the same as that of Sars.

In the third volume of the *Wissenschaftliche Ergebnisse der Deutschen Zentral Africa Expedition* (Leipzig, Verlag Klinkhardt), I have described *C. adhaerens* from Lake Luhondo, and in this the presence of a grasping-organ in the neck region was recorded as an especially characteristic feature. In 1918, in his paper "Cladoceres des Andes Peruviennes," in the *Bullet. Soc. Neuchateloise des Sci. naturelles,* tom. 43, Delachaux again described a new species *C. naticochensis* which was characterized also by the possession of a similar grasping-organ. And since the present specimen from New Zealand likewise possesses this organ, I supposed at first that it would be necessary to assume that a primitive group of the genus *Camptocercus* was thereby indicated, the group being characterized by the possession of a grasping organ, and restricted in its distribution to the southern hemisphere.

A remark by Wagler, however, in his account of the Cladocera in Kuekenthal's *Handbuch der Zoologie,* suggested that this organ might be present in all species of *Camptocercus.* Unfortunately when I described *C. adhaerens* I had no material for comparison, by which I might have been able to answer the question whether the grasping organ is present in all or only in some of the species of *Camptocercus*; nor have I any such material at the present time, and the available literature contains nothing which might solve the problem. I therefore referred to Dr. E. Wagler, who was kind enough to inform me that the European species also possess this organ. It is therefore very probable that the organ is a generic character, and that the attempt by Delachaux and myself to separate a group of phylogenetically older species, restricted to the southern hemisphere, from a phylogenetically younger group of species, limited to the northern, is left without foundation.

It therefore remains an open question whether the two species founded by Delachaux and by myself should be withdrawn, or whether in spite of the lack of phylogenetic and zoo-geographical distinctiveness they may be retained. The fate of the present species from New Zealand is linked up with that of the other two. Before the question can be settled, however, light must be thrown on the problem whether the characters used in the description of these

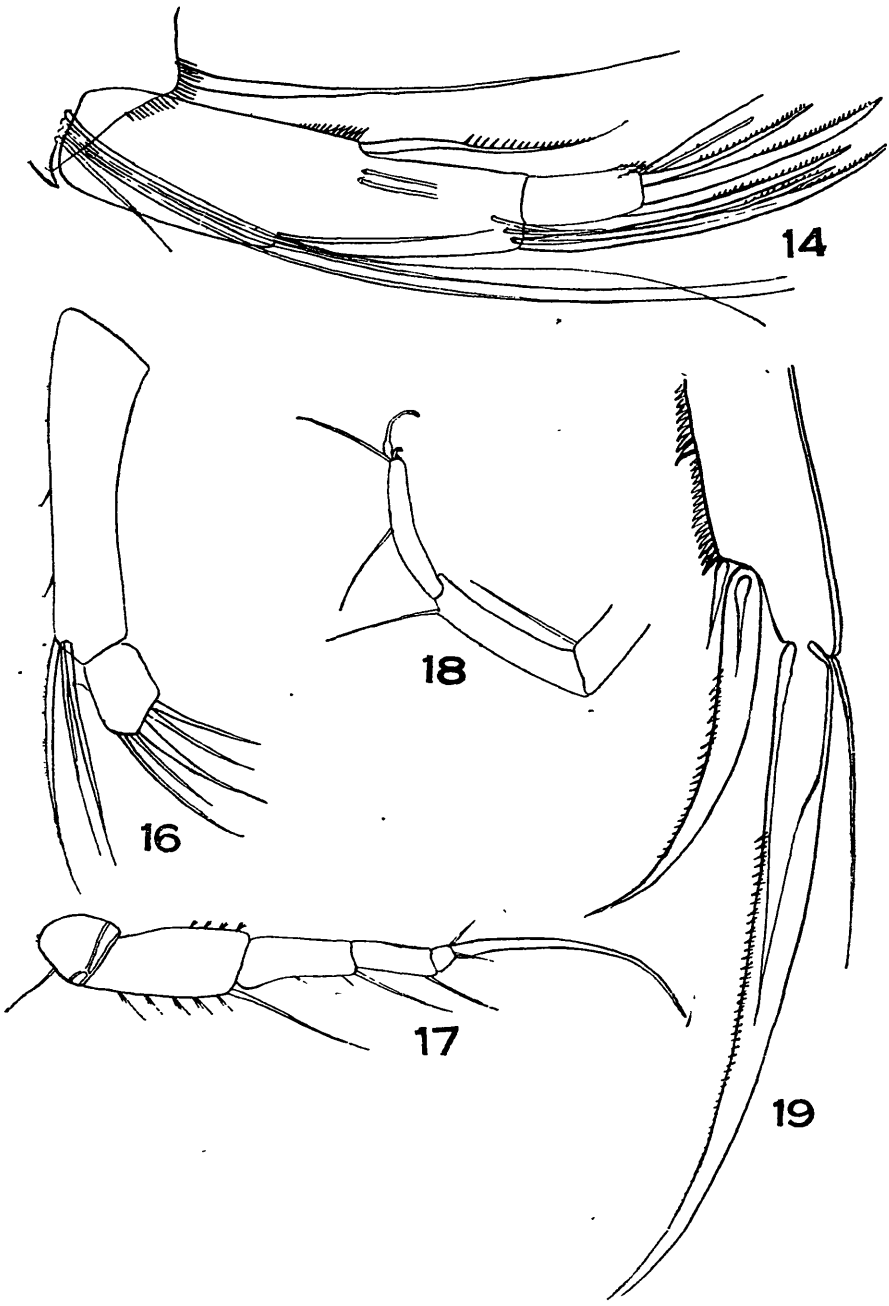


FIG. 14.—*Herpetocypris Pascheri* n. sp., second antenna.
FIG. 16.—*Herpetocypris Pascheri* n. sp., terminal joint of maxillary palp.
FIG. 17.—*Herpetocypris Pascheri* n. sp., first foot.
FIG. 18.—*Herpetocypris Pascheri* n. sp., second foot.
FIG. 19.—*Herpetocypris Pascheri* n. sp., end of furca.

species do in reality possess the distinctiveness attributed to them as structures of genuine systematic worth. It is known to all students of the Cladocera that there reigns a regrettable obscurity on this point, and that the use of such features involves a highly subjective factor. I believe that those who write on the Cladocera arrive, either conscious of the fact or not, at conclusions which differ according as the authors in question consider the Cladocera to be cosmopolitan or otherwise. Those who are of the opinion that different regions must be inhabited by different Cladocera will naturally find characters sufficient for the distinction of species in such features as the number of teeth or lateral tufts of hairs on the hinder abdomen, in the sculpture of the valves, in the form of the carina, or in the size of the eyes. But one who, like the author of the present paper, finds in the Cladocera a group which, generally speaking, is cosmopolitan in its distribution, will remain somewhat sceptical of the value of these features; and all the more so, because with many of these characters (such as the form of the carina in *Acroperus,* and the size of the eyes in *Simocephalus* and *Daphnia*), it has been found that environmental circumstances, both in nature and in experiments, have a profound influence.

If after these precautionary remarks we review the three problematical species, we find the following characters, apart from the grasping-organ:—

In *C. adhaerens,* the eye is twice as large as the pigmented area; on the post-abdominal edge there are 18 teeth (up to 17 in *C. longirostris,* and at least 20 in *C. macrurus*). There is also the longitudinal striping of the valves and the granulation of the carina.

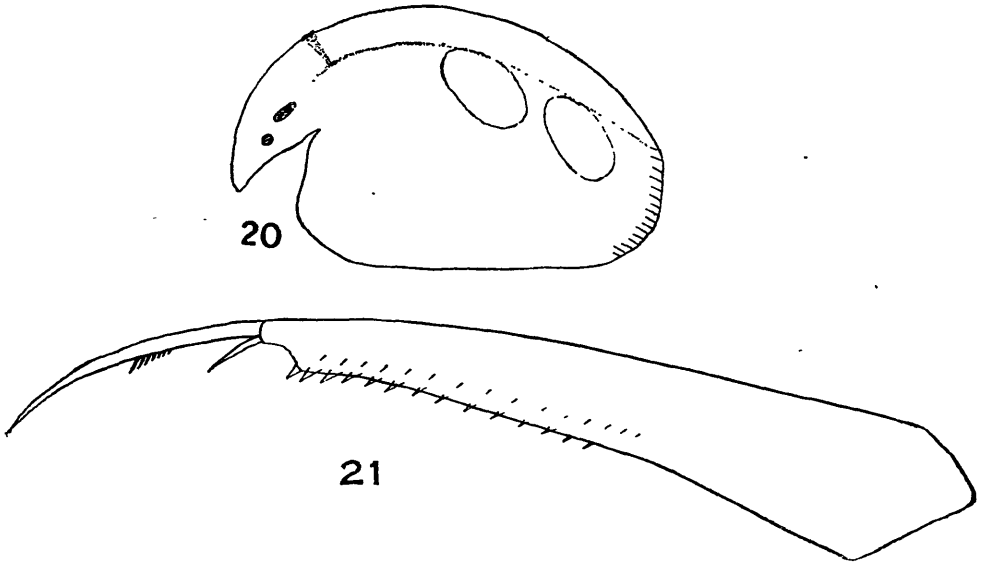


FIG. 20.—*Camptocercus* sp. (*atavus* in litteris).
FIG. 21.—*Camptocercus* sp. (*atavus* in litteris).

In *C. naticochensis,* the reduction of the keel of the head and of the dorsal surface was quoted as typical; but this feature is not surprising, for on acocunt of the altitude of the locality (Lake Naticocha lies at a height of more than 5,000 metres), such a reduction in the carina is equally to be expected as in the case of the *Acroperus* of the Alpine lakes of Europe, or of *G. aloniceps,* which was described by Ekman from Patagonia, and which forms a remarkable parallel to the *Acroperus* of Europe. In *C. naticochensis* the number of post-abdominal teeth is 18-19, that of the lateral tufts of setae is 15. The eyes and the pigmented area are large (this largeness of the eyes can also be associated with the altitude of the home of the species, as found also in the case of the eyes of *Daphnia pulex* from the lakes in the vicinity of Lunz).

Finally, in the New Zealand form, which, in accordance with the earlier speculations discussed above, I had intended to name *C. atavus,* the following features suggest themselves as distinctive:—16 post-abdominal teeth, reduction of the lateral tufts of setae on the post-abdomen to single setae, the strong developement of the carina, the elongated form of the eyes (which are twice as long as broad), and finally the fact that the post-abdomen, in front of the long terminal claw, is suddenly narrowed, with a distinct marginal angulation, whereas in *C. adhaerens* and *C. naticochensis* it gradually diminishes right to the whole breadth of the terminal claw. The length of the two perfectly hyaline egg-bearing females from New Zealand was 1 mm.

To summarize our investigations—with the exclusion of the question of the grasping-organ—we find that *Camptocercus* is represented both in Australia and in New Zealand; the Australian species, *C. australis* Sars, differs from the New Zealand form by its smaller size (0.7 mm. as against 1 mm.) by the steady diminution of the post-abdomen, by the greater number of post-abdominal teeth (22 as against 16), and finally by the non-elongated form of the eyes.

On the assumption, which has yet to be proved, that these characters will suffice to distinguish the species, *C. australis* would stand as the Australian representative of the genus, and *C. atavus* as the New Zealand representative. Yet I still entertain doubts as to the validity of the latter species, and believe that in this genus—just as shown by the younger Spandl in the case of *Alona*—many species from beyond Europe will prove to be identical with the European species, since most of them were founded under the impression that different regions must be inhabited by different species. In this connection it has to be stated that the Cladocera are for the most part cosmopolitan, and also that the unique character of the Australian region in zoo-geographical respects, which is also clearly recognizable in other groups, finds expression here in the presence of three endemic genera, *Saycia, Neothrix,* and *Pseudomoina.*