O. M. Dahlgren

On some

Freshwater Ostracoda and Copepoda,

raised from Dried Australian Mud.

By

G. O. Sars.

With 8 Autographic Plates, partly coloured from Living Specimens.

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Introductory.

The present memoir forms a supplement to a series of papers published by the author in this Journal and giving the results obtained in artificially hatching and domesticating Australian freshwater Entomotraca. In the former papers only of the order *Branchiopoda* (Phyllopoda and Cladocera) was treated; in the present I propose to describe the several forms of *Ostracoda* and *Copepoda*, appearing in my aquaries together with the Branchiopoda. Of Copepoda only 2 species of the genus *Diaptomus* were observed, whereas of Ostracoda no less than 7 different forms, belonging to several distinct genera, have been successfully hatched and in most cases observed during numerous succeeding generations. The domesticating of freshwater Ostracoda would seem on the whole to be attended with far less difficulties than is the case with Branchiopoda and Copepoda, probably owing to the more hardy nature of the former animals. In fact, the experiments in hatching exotic freshwater Entomostraca formerly instituted by the late Dr. Baird have almost exclusively yielded species of this order.

Some of the Australian species described below I have succeeded in domesticating in my aquaries during no less than

4 succeeding years, and by this proceeding I have been enabled to state a very peculiar and remarkable fact, viz., that there are certain genera of Cyprididæ, in which the propagation may be said to be exclusively parthenogenetical, no male intervention being needed either for the development of the summer- or winter-eggs. A similar mode of propagating would also seem to distinguish the European Phyllopode *Limnadia lenticularis* (Lin); but in all other known Branchiopoda and Copepoda the intervention of males is found to be absolutely necessary, at least for the development of the winter-eggs.

The Ostrocoda have been made the object of special study by several naturalists of the day, especially by Prof. G. S. Brady, who has described, besides the indigenous forms, also numerous exotic species, both freshwater and marine. But in most cases only the shell of the latter has been more closely examined, probably owing to the less perfect state of preservation of the specimens. As regards the forms described in the present paper, I have carefully examined, besides the shell, also the enclosed animal with its several limbs and soft parts, and by this examination have succeeded in pointing out certain anatomical characters which will be of great value in the unavoidable subdivision of the very extensive old genus *Cypris*.

Of the 7 species of Ostracoda described below, I have been enabled to identify 5 with species formerly recorded, partly from India by the late Dr. Baird, partly from Ceylon and Australia by Prof. Brady. The 2 remaining species I regard as new. As to the two species of *Diaptomus* described at the close of this paper, the one is, I believe, identical with a form recently recorded from Ceylon by Prof. Brady: the other I cannot identify with any species as yet described.

The plates have been executed with the greatest care in autography, the habitus figures being copied from coloured pencil drawings made from living specimens. The anatomical analyses were in most cases made by dissection of specimens carefully preserved in alcohol.

Descriptions of the Species, with Biological Observations.

Order Ostracoda.

Tribe Podocopa.

Family Cyprididæ.

Gen 1. **Cyprinotus**, Brady, 1885.

Generic Characters. — Shell rather thin, compressed, oval or subtriangular, height considerably exceeding the half length, dorsal margin greatly vaulted, ventral almost straight. Valves rather unequal, the right being overlapped by the left both anteriorly and posteriorly, but sometimes dorsally produced far beyond the level of the latter. Free edges of the left valve smooth, and having at either extremity a rather broad hyaline border, those of the right armed with a regular series of small tuberculiform teeth. Inner duplicatures of both valves rather narrow. Natatory setæ of lower antennæ very elongate, reaching far beyond the terminal claws. Palpus of 1st pair of maxillæ rather narrow, last joint linear; masticatory lobes of middle length. Caudal rami narrow, claws smooth, seta of dorsal edge close to the claws. Propagation sexual. Prehensile palps of 2nd pair of maxillæ in male rather powerful, unequal. Copulative organs comparatively small, with outer plate obtuse, linguiform. Ejaculatory tubes narrow, with numerous wreaths of spines, crown simple, not produced.

Remarks. — This genus has been established by Mr. Brady upon a Ceylon species, having the dorsal part of the right valve produced in an unusual manner to a strongly projecting

gibbous protuberance. In fact, Mr. Brady would seem to have based his genus more especially on this anomalous character of the shell, having not examined minutely the animal itself. I have succeeded in raising a single specimen of the same species from Australian mud, and on closer examination of this specimen, I find that in the anatomical details as well as in some of the shell characters this species agrees very closely with another Australian species, in which the above mentioned gibbous protuberance does not at all occur, and hence this character cannot be regarded of generic value. We find however some other characters, common to both species, partly in the structure of the shell, partly in that of the soft parts, which make it most advisable to retain the genus as a natural subdivision of the old genus Cypris, the more so as there are also 2 northern species, viz., *Cypris salina* Brady and *Cypris fretensis* Brady, which evidently belong to the same division, and agree in all essential points with the two Australian species. As to the shell, the high, compressed form is characteristic of all 4 species, as also the peculiar crenulation of the right valve. Although the soft parts agree on the whole pretty closely with those of the typical genus *Cypris*, there are still to be found some minor differences distinguishing the present genus from the other genera. Moreover there is a feature that would seem to separate this genus very markedly from the genus Cypris (sens. strict.) and to bring it in closer relationship to the genus *Cyprois* of Zencker. As with the latter genus the propagation is sexual and not, as in the true genus Cypris, exclusively parthenogenetical, the males being almost as frequent as the females.

I. Cyprinotus dentato-marginatus, (Baird).

(Pl. I, figs 1—4, Pl. III, figs 1—11, Pl. IV).

Cypris dentato-marginata, Baird, Description of some new recent Entomostraca from Nagpur collected by the Rev. S. Hislope. Proceed. Zool. Soc. London 1859, p. 233, Pl. LXIII, fig. 5, a—f.

Specific Characters. — Shell seen laterally, irregular oval, greatest height about in the middle and nearly equalling $^3/_5$ of the length, anterior extremity obliquely rounded, posterior obtuse, dorsal margin greatly arcuate, almost angular in the middle, ventral nearly straight: seen from above narrow oblong, anterior extremity more pointed than posterior, greatest width in the middle and about equalling $^2/_5$ of the length. Surface of shell smooth, shining, only sparingly beset with hairs; right valve not surpassing the left dorsally. Colour yellowish, with two dark brown oblique patches on either side and a narrow band of the same colour close to the anterior edge; coecal appendages of intestine bright green. Claws of inferior antennæ and those of 1st pair of legs rather elongate and finely denticulate. Caudal rami slightly tapering, almost straight, exterior claw exceeding the half length of the ramus, apical seta much shorter than the dorsal. Length of female 1,30 mm; of male 1,15 mm.

Remarks. — There cannot, I think, be any doubt as to the identity of this form with that described by Baird under the above name from India. It is very nearly related to the European species *C. salinus* (Brady), though differing by a somewhat less elevated shell and by the colour of the latter.

Description. — The shell of adult female specimens attains a length of 1.30 mm; that of the male is somewhat smaller, scarcely exceeding a length of 1,15 mm.

In a lateral aspect the shell of the female (Pl. I, fig. 1) exhibits a somewhat irregular oval form, with the anterior extremity a litle lower than the posterior. The greatest height is situated about in the middle and considerably exceeds the half length, or, more precisely, equals $^3/_5$ of the total length. The dorsal margin is greatly vaulted and almost angular in the middle, sloping rather abruptly to either extremity, though somewhat more steeply to the anterior. The ventral margin, on the other hand, is nearly quite straight, or very indistinctly sinuated in front of the middle. The anterior extremity is obliquely rounded, whereas the posterior appears more obtusely truncate, with the lower part a little projecting. Seen from

above (fig. 2) the shell exhibits a very narrow oblong, or nearly fusiform shape, tapering somewhat more rapidly anteriorly than posteriorly. The greatest width, situated a little behind the middle, is considerably less than the height and scarcely exceeds $^2/_5$ of the length. The anterior extremity is much narrower and more pointed than the posterior, and along the median line there is behind the middle a rather deep groove. The shell of the adult male (fig. 3) differs very little from that of the female, being perhaps a little shorter in proportion to its height and somewhat more expanded in its posterior part.

The valves are in both sexes rather thin and pellucid, with a smooth, shining surface and sparingly beset with very fine hairs, more distinct at either extremity. The inner duplicatures of the shell, extending inside the free edges of the valves (see Pl. IV, figs 1 and 2), are very narrow, though a little broader on either extremity than ventrally. In the ventral part, anterior to the middle, the edges are, as usual, to a short extent inflexed, dorsally they are connected by an elastic band, but without any distinct hinge-teeth. The two valves are rather unequal, the left being much the larger and distinctly overlapping the right at both extremities as also along the ventral margin. Moreover the right valve (fig. 2) is prominently distinguished by its free edge being in the greater part of its extent armed with a regular series of small, knobshaped teeth, giving it a peculiar crenulated appearance (see fig. 3). On the left valve (fig. 1) there is no trace of such teeth, whereas it exhibits at both extremities a rather broad and extremely thin and hyaline border, also observed on the right one, but here considerably narrower. The muscular impressions of the great adductor of the shell are distinctly seen in the middle part of either valve, both outside and inside, as an assemblage of lucid spots, two of which are situated at some distance in front of the others and forming together an oblique line (see Pl. IV, fig. 2).

In quite young specimens (Pl. I, fig. 4) the shell, as usual, exhibits a form rather differing from that in adults, the anterior part being much higher than the posterior, which is almost

wedge-shaped. There is moreover no trace of the crenulate armature to be found on the right valve, which is exactely like the left.

The colour of the shell is yellowish, when the animal is in a living state, with two irregular, somewhat oblique, dark brownish patches on either side, limiting an irregular oblong area of a lighter colour, which extends obliquely upwards from the central region of the shell. The anterior patch is continued down the sides to the region within which the oral parts of the animal are situated, whereas the posterior terminates about in the middle of the valve, and from this point a narrow diagonal stripe runs posteriorly immediately above the coecal appendage of the intestine. Moreover, a narrow bandlike patch of the same dark colour is seen extending along the anterior extremity at a short distance from the edge. Through the shell also some of the inner parts of the animal are more or less distinctly seen. Thus in the anterior part, above, the eye is readily observed, and in the posterior part the coecal appendages of the intestine appear very distinctly as a narrow diagonal band extending from the central part of either valve to its posterior extremity and generally exhibiting a very conspicuous bright greenish colour. Just above this band a faint orange shade is more frequently observed in adult females, indicating the place, where the ova lie accumulated within the body. In the males, moreover, the testicular coeca, or spermatic tubes, lying between the lamellæ of the valves, are at once distinguished, forming in the posterior part of the shell, on either side, 4 concentric arcs (see Pl. 1, fig. 3).

In order to examine the animal with its several appendages in their natural situs, it is proper to kill the specimens in hot water, when the valves open widely so as easily to be separated. On removing only one of the valves and leaving the animal within the other, it is found (see Pl. IV, fig. 1) that the body does not by far fill up the cavity of the shell, a considerable space being left anteriorly for the reception of the antennæ, when not in action, and also inferiorly and posteriorly there is some room between the inner face of the valves and

the body. Those limbs, which admit of being partly extended from the shell, are only the two pairs of antennæ and the 1st pair of legs, occasionally also the caudal rami. Besides, in the male the prehensile palpi of the 2nd pair of maxillæ and the copulative organs may at times — during copulation — be found exserted beyond the edges of the shell. All these parts are, on the other hand, readily withdrawn within the shell, in which case the valves close hermetically over the animal.

The eye (see Pl. IV, fig. 1), located at the frontal part of the animal, just above the base of the upper antennæ, exhibits the structure characteristic of the greater part of Cyprididæ, consisting of a single mass of dark pigment, from either side of which a clear refracting body of very delicate consistency is seen to project. It would seem to be to some extent movable by the aid of several muscular bundles originating from the inner face of the valves and converging to the organ.

The upper antennæ (Pl. III, fig. 1, Pl. IV, fig. 1) are composed of a thickish, muscular basal part, and a narrow cylindric, flexible terminal flagellum. The basal part consists of 2 less distinctly defined segments, the first of which is very massive, of an irregular oval form and supported by several chitinous stripes partly anastomosing with each other; anteriorly it bears a single unciliated seta and posteriorly two similar but considerably longer setæ originating close together and diverging posteriorly. The outer segment of the basal part is rather small and at the end anteriorly provided with a short bristle. The terminal portion of the antennæ, which is very movably articulated to the basal part, nearly equals the latter in length and is composed of 5 articulations, the first of which is much the largest, the others successively diminishing both in length and breadth. They bear both anteriorly and posteriorly slender natatory setæ, disposed in pairs, and considerably increasing in length towards the extremity. These setæ form together a dense fascicle, which during the swimming motion of the animal admits of being spread to a certain extent.

The lower antennæ (Pl. III, fig. 2, Pl. IV, fig. 1), originating

at a considerable distance from the upper, to either side of the labrum, are pediform and much more powerful than the latter, exhibiting a double geniculate bend. At the base there is a rather complicate system of chitinous stripes, partly anastomosing with each other and marking off a short basal joint, to which the free part of the antennæ is very movably articulated, forming with the same a more or less distinct elbowlike flexure; inferiorly this joint bears 2 short bristles. The free part of the antenna is composed of 4 well defined articulations, the first of which is rather large and muscular, pointing generally forwards; it is provided at the end with 2 very long and slender setæ, one of which originates form the inner side of the joint and projects in front, whereas the other is attached to the lower edge and points inferiorly. The succeeding joint, forming with the latter an almost right angle, is nearly of the same length, but much narrower, and exhibits posteriorly, somewhat above the middle, a well marked ledge, to which a peculiar short, baculiform, biarticulate appendage is attached, evidently representing a sort of sensory apparatus, nearest corresponding in structure with the so-called olfactory setæ in other Crustacea. From the infero-posterior corner of this joint, moreover, a rather strong posteriorly curved seta originates, and inside the terminal edge a transverse series of 6 extremely long and slender natatory setæ occurs, forming a dense, inferiorly pointing fascicle, generally projecting in front of the succeeding joints. Of these setæ the foremost is the shortest, whereas the 4 others are subequal and more than twice as long, considerably surpassing the terminal claws of the antenna. The 3rd joint, forming with the 2nd a similar, though less strong geniculate bend, is both shorter and narrower than the latter, and exhibits about in the middle of either edge 2 short bristles placed close together. The extremity of the joint is somewhat obliquely truncated, forming anteriorly an obtuse projection, to which are attached 3 strong claws of unequal length. The last joint, finally, is very small and immovably connected with the 3rd, of narrow cylindric form and at the tip armed with 3 similar claws, pro-

jecting immediately behind the ones originating from the preceding joint; all the claws are finely denticulate at the posterior edge and slightly exceed the length of the two outer joints taken together.

The anterior lip, or labrum (see Pl. III, fig. 3 and Pl. IV. fig. 1), forms a rather thick, fleshy prominence of a rounded oval form projecting between the bases of the lower antennæ and anteriorly covering over the oral orifice. It is finely ciliated along the inferior and posterior edges and supported by several chitinous stripes, the largest of which runs on either side at a short distance from and parallel to the posterior edge.

The posterior lip (ibid. and fig. 4) forms a thin, transversely striated membrane supported by a pair of very strong chitinous rods, each expanding at the end to a transverse plate armed at the outer edge with a series of 7 strong horncoloured teeth diminishing successively in size interiorly. Posteriorly the lip joins a sternum-like vaulted plate, carinated along the middle and placed between the bases of the 1st pair of mixillæ.

The mandibles (Pl. III, fig. 5, Pl. IV, fig. 1) are each composed of a highly chitinised elongate corpus and a well developed pediform palp. The corpus is located on either side of the body, immediately behind the base of the lower antennæ, its upper acuminate extremity being articulated to the inner surface of the corresponding valve in front of the muscular impressions of the great adductor, whereas the lower incurved extremity is wedged in between the anterior and posterior lip. The greater part of the corpus is hollowed to receive the powerful adductor muscles, and only the most inferior part, lying to either side of the oral orifice, exhibits a more compact consistency. The cutting edge is divided into several (about 6) strong, bifurcate teeth, diminishing in size interiorly, and between them stiff bristles are seen to project. Besides, a short seta is found attached to the outer side at some distance from the cutting edge. The palp, originating from the outer side of the corpus and extending anteriorly, forms a thick, fleshy, somewhat pediform stem, curving downwards to either side of the labrum

and reaching to the lower edges of the valves. It is about half as long as the corpus and composed of 4 joints, the two first of which, however, are less distinctly defined. Of the joints the basal one is much the largest and bears on the outer side a narrow plate, the so-called branchial appendage, pointing obliquely upwards and provided at the tip with about 5 very strong and densely plumous setæ; along the posterior edge this joint has 3 thick setæ provided with unusually long cilia at the edges. The 2nd joint is quite short and bears at either edge a bunch of long slender bristles, 3 anteriorly and 4 posteriorly. The 3rd joint is almost twice as long, but considerably narrower and somewhat tapering to the extremity; it is likewise provided at the end on either side with a fascicle of setæ, but rather smaller than those on the preceding joint. The last joint, finally, is very small and terminates with several, partly unguiform bristles.

The 1st pair of maxillæ (Pl. III, fig. 6, Pl. 4, fig. 1) exhibit a thick muscular basal part, from the extremity of which 4 digitiform processes are seen to originate, pointing obliquely forwards to the oral orifice. The foremost of these processes is movably articulated to the basal part and consists of two well defined articulations, the first narrow cylindrical and at the end anteriorly provided with about 4 curved bristles, the last rather small, almost quadrangular and terminating with several strong curved bristles, shorter than those on the preceding joint. This process must evidently be regarded as a palp, whereas the 3 posterior processes, forming the immediate continuation of the basal part, are the true masticatory lobes. The latter are much shorter than the palp and successively diminish in size posteriorly; they are at the tip provided with a dense bunch of strong, partly spiniform bristles, and the foremost lobe has besides a few ciliated setæ affixed to the anterior edge. To the outer side of the basal part a large, semilunar lamella is attached, generally termed the branchial plate. This plate, which in the living animal is seen moving in a rhythmical manner in order to renew the water within the shell-cavity for the purpose of

respiration, is directed obliquely upwards and exhibits along the posterior edge a dense and regular series of very strong, finely plumose setæ, about 18 in number, the upmost being however very short; besides from the inferior corner of the plate, at some distance from the others, 3 or 4 much more slender setæ, pointing straight downwards, originate.

The 2nd pair of maxillæ (Pl. III, fig. 7, Pl. IV, fig. 1) consist of the same principal parts as the 1st, though rather different in appearance. The basal part is considerably smaller and not divided at the end, terminating with a single, somewhat compressed masticatory lobe, that points obliquely forwards. To the obliquely truncated tip of this lobe a considerable number of delicate curved bristles, successively diminishing in length interiorly, are attached, and besides a single slender ciliated seta is found at some distance from the tip, originating from a distinct ledge of the inner edge. The branchial lamella, attached to the posterior edge of the basal part, is very small, semicircular, and provided with 6 finely plumose and diverging setæ. The palp, finally, originating immediately below the branchial lamella, is represented by a simple conical lappet, pointing obliquely backwards and terminating with 3 setæ, the middle one much longer than the other two. In the male these maxillæ are modified in a peculiar manner to serve for grasping the female during copulation (see Pl. IV, fig. 1), the palp being converted into a powerful prehensile organ, which admits of being extended from the shell inferiorly. On closer examination the form of the palp somewhat differs on the right and left maxilla (fig. 4 and 5). In both it is composed of a strong muscular basal part, armed at the antero-inferior corner with a pair of small projections, more pointed of the right maxilla (fig. 4), and a highly chitinised, clawshaped terminal part, movably articulated to the former, and admitting of being impinged against the above mentioned projections. This terminal part is on the right maxilla (fig. 4) lamelliform dilated in the middle and nearly curved at a right angle, whereas on the left (fig. 5) it is quite narrow and more evenly curved at the base; on both

maxillæ this part terminates with a delicate pellucid, and somewhat deflexed point.

The 1st pair of legs (Pl. III, fig. 8, Pl. IV. fig 2), originating immediately behind the 2nd pair of maxillæ, are rather powerful and admit of being extended from the shell inferiorly. They are composed of a short and thickish basal part and a slender terminal portion, forming together a geniculate bend. The basal part exhibits 2 indistinctly defined joints, the outer of which is quite short and rounded. The terminal part forms a 4-articulated stem, tapering successively to the end and having at the tip an elongated, anteriorly curving claw. Of the joints the 1st is by far the largest, equalling in length the 2 succeeding ones taken together, and bears at the end anteriorly a small seta. The 2 succeeding joints are nearly of uniform size and both provided with a similar short seta. The last joint is very small, quadrangular in form, and exhibits, on either side of the base of the terminal claw, a very small bristle. The claw is very slender, a little longer than the 3 outer joints taken together and regularly curved in the outer part, which is finely denticulate along the anterior edge.

The 2nd pair of legs (Pl. III, fig. 9, Pl. IV, fig. 1), originating immediately behind and somewhat outside the 1st, are never exserted from the shell, being constantly kept inflexed, with the outer part generally curving upwards along the sides of the body. They are composed of 4 joints, the 1st and 2nd forming together an abrupt geniculate bend, the others almost straight. The basal joint bears at the end both anteriorly and posteriorly a very slender seta, and a similar but somewhat shorter one is also found attached to the anterior edge. The 2nd joint is rather narrow, slightly inspissated at the extremity and provided with a single slender seta originating from the end posteriorly. The 3rd joint is a little shorter than the 2nd, somewhat instricted at the base and provided with a delicate seta about in the middle of the posterior edge; the extremity of this joint juts out posteriorly as a short thumb-like projection. The last joint finally, is very small and not very distinctly defined from the

preceding; it terminates with a small incurved point and bears at the extremity a short curved claw and a slender recurved seta.

The caudal rami (Pl. III, fig. 10u, Pl. IV, fig. 1), very movably articulated to the posterior extremity of the body and generally, when not in action, closely applied against the ventral face of the body, form two narrow chitinous plates lying in close juxtaposition. They are almost linear in form, though somewhat tapering from the base to the extremity, and bear 2 slender claws and 2 delicate setæ. Of the claws the longer one originates from the tip and slightly exceeds the half length of the corresponding ramus; the other attached to the posterior, or dorsal, edge at a short distance from the apex, is considerably smaller, but of a similar form and as the apical one quite smooth and but very slightly curved. Of the setæ the smaller one originates from the apex immediately in front of the terminal claw, whereas the longer one is attached to the dorsal edge at a short distance from the upper claw, the half length of which it slightly exceeds.

Between the caudal rami and the insertion of the 2nd pair of legs there is in the female on either side a broad rounded lobe (Pl. III, fig. 10c), projecting inferiorly — the genital lobes. In the interior of these lobes a narrow, very tortuous canal occurs, originating at the posterior, somewhat projecting corner, and more anteriorly forming a rather large, almost globular convolut; it is highly probable, that the spermatozoa are introduced in the body through this canal during copulation. In the male these lobes are converted into a pair of very complicated copulative organs (see Pl. IV, fig. 1), which admit of being fully extended beyond the shell and during copulation become introduced within the shell-cavity of the female and applied against the genital lobes of the same. They are connected with the body by a narrow neck (see figs 6, 7) and, when not in action, are turned posteriorly in a horizontal direction, their extremities projecting to either side of the insertion of the caudal rami (see fig. 1). The organs are quite symetrical and consist each

of 2 superposed plates, the inner exhibiting a rounded triangular form, whereas the outer projects beyond the latter as a narrow, slightly incurved, linguiform lobe, obtuse at the extremity. Along the anterior half of the ventral edge the inner plates are firmly connected with each other, but for the rest slightly diverge upwards and backwards. They exhibit a very complicated system of highly chitinised stripes curved in different manners and anastomosing with each other, some of them forming very compact and dark horn-coloured projections of the upper face and apparently serving for a closer affixion of the organs to the genital parts of the female. Through the neck-shaped part connecting the organs with the body two narrow canals are seen penetrating the organs, forming within the same several circumvolutions; these canals represent the outer part of the „vasa deferentia" or spermatic ducts

Inner organs. — The alimentary canal consists of 3 principal parts: a narrow, muscular oesophagus ascending almost perpendicularly from the mouth, the intestine proper, and a very short rectum opening just in front of the caudal rami. The intestine proper exhibits two considerable dilatations, the anterior, lying in the foremost part of the body, almost globular in form, the posterior somewhat larger and more oval, both defined by a well-marked median instriction, just above the great adductor of the shell. From the anterior division of the intestine 2 slender coecal appendages are given off, each being received between the lamellæ of the corresponding valve (see Pl. III, fig. 11) and running diagonally backwards to the infero-posteal corner. They generally exhibit a bright green colour, and their walls are invested by large cellular bodies, probably secreting a fluid for dissolving the aliments.

Of a heart there is no trace to be detected, neither of any distinct blood-vessels.

The nervous system I have not been able to examine in details, on account of the concealed situation of its central parts.

The inner genital organs considerably differ in structure in

the two sexes. The ovaries of the female (see Pl. III, fig. 11) are found between the two lamellæ of either valve as an elongate sac-like body, running from the central part of the shell diagonally to the posterior extremity, immediately above the coecal appendage of the intestine. On reaching the extremity of the valve the ovarian sac curves upwards and forwards forming a nearly semicircular bend. In this outmost part of the ovary the true germinal layer is found, constituting an assemblage of numerous very small and pellucid cellules, each provided with a very distinct and highly refracting nucleus. These cellules become sucesssively larger and more distinctly defined inwards, and soon form only a single layer containing at first 4, then 3, and at last only 2 juxtaposed cells of a polygonal form, each with a very distinct nucleus, or germinal vesicle, in the interior of which an equally distinct central body — the germinal spot — is observed. In the inner part of the ovary, finally, lying at the middle of the valve, there is only found a single series of very large ovicells, the germinal vesicle of which successively becomes quite hidden by an opaque, granular matter — the vitelline mass —, accumulating in the interior. The innermost of these ovicells is constantly the largest and is ready to be poured off from the ovary. It soon becomes introduced within the body-cavity, and successively other ovicells follow. They are however not yet ready to be deposited, but still remain some time within the body of the parent, generally accumulating in its posterior part to either side of the dilated part of the intestine (see fig. 10). After having attained their full development and having been fertilized, they are successively deposited by the animal on foreign objects, and by the aid of some secreting fluid glued together in rows or greater masses. The openings, through which the ova are poured off, would seem to lie on the inner side of the genital lobes, but their exact place I have not been enabled to ascertain. As belonging to the genital apparatus of the female may, moreover, be mentioned a pair of rather large, elongate pyriform sacs (fig. 10 r) extending anteriorly beneath the intestine and generally filled up

by an opaque filamentous mass, which on closer examination is found to consist entirely of innumerable intertwined spermatozoa. These sacs — representing of course the seminal receptacles — form posteriorly, above the insertion of the caudal rami, a sharp bend, and their narrow, neck-shaped outer part would seem to join the above mentioned canal curled up within each of the genital lobes.

The inner genital organs of the male exhibit a very complicated aud remarkable structure (see Pl. IV, figs 1 & 2). The testes, as the ovaries, are wholly received between the lamellæ of the valves, but instead of forming a single pair of saccular organs, they consist on either side of no less than 5 elongate and narrow band-like appendages, 4 of which form a dense bundle curled up in the posterior part of the valve, with their narrow tapered extremities reflexed along the dorsal margin, whereas the fifth pair, somewhat differing in structure from the others, take a forward direction, running along the anterior and inferior edge. All the 5 appendages converge at the base on either side to a point just above the great adductor of the shell and the 4 posterior appendages are here found to coalesce to a single stem penetrating the walls of the body. The appendages are generally found filled up with numerous extremely fine thread-like bodies, more frequently curled up pretly regularly in loose spiral bends or skrew-like turns. Besides there are present a more or less considerable number of large nuclear cells, more especially accumulated in their terminal part, and in younger specimens even wholly occupying its lumen (see fig. 10). These cells (fig. 11) are the germinal cells, or spermatocysts, from which the spermatozoa develop. The latter, highly distinguished by their comparatively enormous size and highly complicated structure, are successively poured off into the body-cavity, which at last becomes filled up with great masses of these filiform bodies, apparently disposed without any perceptible ordre and curled up in different manners (see fig. 1). The Finnish naturalist, Mr. Nordqvist, which recently has published a most elaborate memoir

on the male sexual organs of the Cypridida[1]), believes that the spermatozoa, poured off from the testicular appendages and thus received in the interior of the body itself, are contained on either side within a distinct very elongate duct („upper part of the vas deferens"), forming numerous convoluts and finally debouching in the upper extremity of the ejaculatory apparatus to be described below. On carefully dissecting several specimens, I have failed to detect any trace of such a duct and cannot but doubt its real existence. In my opinion the fully developed spermatozoa are simply received within the cavity of the body, as is also the case with the ova, and remain here until copulation is effected. The true efferent apparatus consists on either side of two very sharply defined parts, a very peculiar cylindrical body extending along the side of the posterior part of the body obliquely from above backwards (fig. 6 x), and a narrow duct (v) originating from the inferior extremity of this body and representing the true vas deferens. This duct immediately makes a sharp curve forwards and penetrates the neck-shaped part joining the copulative organs to the body, its mode of termination having not yet been exactly ascertained. As to the remarkakle tube-shaped part representing the upper division of the efferent apparatus, it exhibits a very peculiar and highly complicated structure. At first sight (fig. 6 x) it has the appearance of being composed of two tubes, the one lying within the other and forming a more compact axis, from which at regular intervals lateral projections are given of crossing the lumen of the outer, more pellucid tube or sheath. On closer inspection with a strong magnifier (fig. 9) the inner tube is found to be supported by a complicate chitinous skeleton, divided into short regular segments, about 34 in number, each bearing a whorl of radiating spines reaching the outer cuticle of the enveloping sheath. The latter would seem to be for the most part built up by numerous radiating muscles acting upon the inner cylindre. At each extremity

[1] Beitrag zur Kenntniss der inneren männlichen Geschlechtsorgane der Cypriden. Acta Societatis Scientiarum Fennicæ, Tom. XV.

there is a circular chitinous plate, the proximal being continued in the vas deferens, the distal (fig. 8) exhibiting a somewhat depressed area, in the centre of which a fine opening occurs, limited by a network of delicate chitinous stripes, which form together a regular rosette. This rosette — termed the coronula — is again surrounded by a thickened chitinous ring, giving off radiating stripes to the periphery. — Regarding the nature of this peculiar organ, it has long been misunderstood by the naturalists, the erroneous view maintained by Zencker as to its being a glandular auxiliary organ — „mucous gland" — having generally been accepted. Prof. Weissman has however suggested a very different explanation of the organ in question, and his view has also been fully adopted by Mr. Nordqvist. According to these distinguished naturalists, the organ has the signification of an ejaculatory apparatus, by the action of which the spermatozoa are forced through the vas deferens during copulation, and this view I have also myself found wholly confirmed by direct observations on living specimens. If my opinion is correct, that the spermatozoa after having left the testicular tubes are not contained within any distinct canals, but simply accumulated in the body-cavity, the organs, besides, would seem to act upon the body-cavity as a sort of pumping-work, whereby the spermatozoa lying nearest to the upper end of the apparatus, are, as it were, one by one sucked up into the organ through the so-called coronula, and by the same action expelled through the other end within the vas deferens. This peculiar movement of the organs I have in fact once directly observed on examining under the microscope a very pellucid male specimen of *Candona fabæformis* Fischer.

The spermatozoa of the Cyprididæ are highly remarkable by their comparatively colossal size, as also by their apparently very complicate structure. They have been minutely examined by Zencker, both in their perfect state and in their several developing faces. I have myself studied closer the spermatozoa of the present species and give below some few notes on their structure. Each fully developed spermatozoon has the form of a very elongated and fine thread-

like body of a rather firm, but elastic consistency. On inspection by the aid of a high magnifying power, the thread has the appearance of being built up by 2 threads twined together and exhibiting „en miniature" a quite similar aspect as a common cable (see figs 12, 13), the twining being now at the right, now at the left; sometimes even the appearance of a double plaiting may be conveyed to us, and in fact Zencker has given a figure indicating such an arrangement. By the application of the strongest and most improved immersion-lenses, in connection with a sufficiently complete illuminating apparatus, we may, however, find that this apparent plaited structure of the spermatozoon merely depends on an optical illusion. It will, on the other hand, not be very difficult to detect a central axis running through the whole spermatozoon, and upon this axis but a single band-like body is twined in more or less close circumvolutions. At the one extremity (see fig. 12) these circumvolutions become rapidly looser and more distant, and at the same time the spermatozoon considerably diminishes in thickness, forming at last a very narrow rod, along which a thin lamella is seen to wind in loose spiral turns; the edges of this plate, alternately projecting on either side, may under less powerful magnifying powers easily convey upon us the impression of as many fine recurved spines, and have also been represented in this manner by some naturalists. The cable-like appearance of the chief part of the spermatozoon is thus evidently effected by the circumvolutions of the above mentioned spiral plate lying in close contact with each other (see fig. 14). The opposite extremity of the spermatozoon, which may be named the upper or anterior, since the spermatozoon would seem constantly to be expelled with this extremity forwards, terminates (fig. 13) quite abruptly in a pelucid, somewhat flexuous point, sharply marked off from the body of the spermatozoon, which until its base exhibits the densely coiled appearance described above.

Biological Observations. — Two specimens of this species, both adult females, were observed as early as 1884 in one of my aquaries, prepared with mud sent by Mr. Lumholtz from the

Gracemere Lagoon. They were both immediately caught by the aid of a dipping tube and submitted to a closer examination under the microscope. No other specimens appeared either this or the following year. But in 1886 having received through the kindness of Mr. Archer a new material of dried mud, I succeeded in raising in several of my aquaries a considerable number of specimens, both males and females. They seemed to thrive very well and soon after having arrived at maturity, the females began to deposit their ova at the bottom of the aquaries, partly to pieces of mud partly to the walls of the vessels. Male and female specimens were at that time often seen in copulation, but I did not succeed in observing the act closer under the microscope. At the close of the summer I allowed the water of the aquaries to evaporate and kept the residue in a dried state till the following summer, when fresh water was again poured on the mud. Towards the end of May in the same year there appeared in most of these aquaries numerous young, evidently hatched from the ova deposited in the mud the preceding summer. They rapidly increased in size, and in the course of the succeeding month most of them were full-grown, the number of male and female specimens being nearly equal. Soon copulation was seen to go on, and the depositing of the eggs continued during the rest of the summer, some of them developing immediately to young, some — probably those deposited in the latter part of the summer — being left undeveloped in the mud. The same mode of proceeding as in the last year was now repeated, the mud being dried up and preserved in this state until the following summer, 1888, when the hatching operations were taken up again. The result was very successful, and in some of the aquaries the number of specimens even very considerably increased. I still purpose to continue the experiments, in order to know, how far the domesticating of the species may be extended. Until now I have in fact succeeded in domesticating this form during no less than 3 succeeding years.

In habits this form is very active, swimming about in the water with great rapidity by the aid of the 2 pairs of antennæ,

the upper ones being struck upwards and backwards with their swimming setæ exposed, the lower moving at the same time in the opposite direction downwards and backwards. By these movements of the two pairs of antennæ the animal is propelled through the water at a quite even speed and constantly turns the back upwards, an inverse attitude, as in the genus *Notodromas*, being never assumed. Now and then the animal clings to the walls of the aquary or any aquatic plants; at other times it dwells at the bottom, creeping about, especially by the aid of the lower antennæ and the 1st pair of legs. From time to time the caudal rami are seen to be stretched out beyond the shell inferiorly and to be forcibly thrown backwards, the purpose for this movement being either to remove some foreign particles introduced between the valves, or to push the shell away from some obstacle. Very often the males are seen in ardent pursuit of the females, and as they are rather more active, they soon get up with the latter. The shell of the female gets then firmly grasped by the male posteriorly by the aid of his prehensil palps of the 2nd pair of maxillæ, whereon both individuals immediately sink to the bottom effecting here the copulation.

Occurrence. — The present species was raised from mud derived from 3 different localities in the neighbourhood of Rockhampton, Queensland; viz., from the Gracemere Lagoon, 7 miles west of that town, from another Lagoon near Racecower — 4 miles from Rockhampton, and from the Crescent Lagoon — 2 miles from the same town.

Distribution. — Besides from Australia the species is also recorded from Nagpur, India, where it was collected by the Rev. S. Hislop and submitted to the late Dr. Baird for closer examination and description.

2. Cyprinotus cingalensis, Brady.

(Pl. I, figs 5, 6; Pl. III, fig. 12).

Cyprinotus cingalensis, Brady, Notes on Entomostraca collected by Mr. A. Haly in Ceylon. Linn. Soc. Journ. Zool. Vol. XIX, p. 302, Pl. XXXVIII, fig. 28—30.

Specific Characters. — Shell seen laterally subtriangular, greatest height about in the middle and equalling nearly $^2/_3$ of the length, anterior extremity obliquely rounded, posterior obtuse, dorsal margin greatly elevated, forming in the middle a rounded gibbous projection, ventral almost straight: seen from above oblong ovate, anterior extremity more pointed than posterior, greatest width behind the middle and not quite equalling half the length. Surface of shell smooth, beset with scattered fine hairs. Valves very unequal, left overlapping the right at both extremities, but dorsally at a considerable extent surpassed by the gibbous projection of the right. Colour rather similar to that in the preceding species. Length of adult female 1,20 mm.

Remarks. — This species, though very nearly related to the preceding, is readily distinguished by the peculiar gibbous dorsal projection of the right valve, a character upon which Mr. Brady would seem to have especially based his genus Cyprinotus. As to the identity of this form with that described by the latter author under the above name, there cannot, I think, be any doubt.

Description. — The shell of the adult female measures 1,20 mm. in length, being thus a little smaller than that of the preceding species.

Seen laterally (Pl. I, fig. 5) the shell exhibits a somewhat triangular form, the height being relatively considerably greater than n C. *dentato-marginatus* and nearly attaining $^2/_3$ of the length. As in the latter species the anterior extremity is obliquely rounded and somewhat lower than the posterior, which is more obtusely truncated. The dorsal margin is greatly elevated and exhibits a little behind the middle a peculiar rounded gibbous projection, rather sharply defined from the other part of

the margin, which gradually slopes down to either extremity. The ventral margin, as in the preceding species, is almost straight, or with a rather indistinct sinus in front of the middle. Seen from above (fig. 6) the shell exhibits an oblong oval form, though comparatively a little broader than in C. dentato-marginatus. The anterior extremity is considerably narrower and more pointed than the posterior, which is obtusely rounded. The greatest width lies somewhat behind the middle and nearly attains half the length.

The valves are very unequal, the left being rather longer than the right and overlapping it both anteriorly and posteriorly, as also along the ventral margin. On the other hand, this valve does not by far attain the height of the right one, which dorsally projects at a considerable distance beyond it, forming the above mentioned gibbous prominence. The free edges of the left valve are quite smooth and exhibit anteriorly and posteriorly a rather broad pellucid border surpassed by fine hairs. The right valve, on the other hand (see Pl. III, fig. 12) is distinguished by a quite similar regular crenulation of the free edges as in the preceding species. The surface of the shell is smooth and shining, without any perceptible sculpture, and beset with fine hairs, more crowded at both extremities. The impressions of the adductor muscle exhibit a quite similar form and disposition as in the other species.

The colour of the shell, in living specimens, rather agrees with that in C. dentato-marginatus, being light yellowish, clouded with dark brownish shades. The latter form also in this species 2 irregular, partly confluent transverse patches, limiting a lighter oval area just above the impressions of the adductor muscle, the anterior of the patches being continued obliquely downwards to the oral region. Moreover, as in the preceding species, a narrow band of the same colour is found running at a short distance from the anterior edges of the valves. Through the shell the eye is more or less distinctly seen, as also the coecal appendages of the intestine running diagonally from the

centre of the shell to the posterior extremity and distinguished by their bright green colour.

The structure of the several limbs and the soft parts, as observed in their natural situation, when one of the valves has been removed (see Pl. III, fig. 12), would seem in all essential points perfectly to agree with those in the preceding species, only very slight differences being perceptible in the relative length of the several joints.

Biological Observations. — I have only been enabled to examine a single specimen of this species, an adult female, which was found on the 13th July 1886 in one of my aquaries, prepared on the 7th June same year. The specimen was immediately fished up with the dipping tube and submitted to a closer examination under the microscope, a coloured drawing being made after life. No other specimens appeared either in this or in any of the other aquaries prepared with mud from the same locality.

In its movements it was somewhat less active than the preceding species, otherwise however agreeing in habits with that form.

Occurrence. — The mud that yielded this form was collected the preceding year from a Water Hole at Cattle Station — salt at high tides — 20 miles from Rockhampton. From the same mud several other interesting Entomostraca were raised, partly described in my previous papers.

Distribution. — The range of the species would seem nearly to agree with that of the preceding, including both Australia and the Indian province, Ceylon, where it was first detected by the Rev. A. Haly.

Gen. 2. **Stenocypris,** n.

Generic Characters. — Shell very narrow and elongate, height by far not attaining half the length, ventral margin distinctly sinuated in front of the middle. Valves subequal, free

edges smooth, inner duplicatures very large, especially at the anterior part. Natatory setæ of lower antennæ not reaching beyond the terminal claws. Palpus of 1st pair of maxillæ very narrow, cylindrical, last joint small, masticatory lobes long and narrow. Caudal rami rather large, more or less lamelliform, dorsal edges sometimes pectinate, claws very unequal both coarsely denticulate, seta of dorsal edge absent or very small, the apical one rather elongate. Propagation exclusively parthenogenetical.

Remarks. — I have felt justified in establishing this new genus for reception of a few species of the old genus *Cypris,* which differ in some points rather markedly from the more typical forms, both as to the shell and the animal. The very narrow and elongate shape of the shell may be named as an easily perceptible outer character, which has also given rise to the generic appellation. Besides, the unusually large inner duplicatures of the valves at their anterior extremity are rather characteristic. As distinctive anatomical characters may be mentioned the comparatively feebler development of the natatory setæ on the antennæ, the narrow elongate form of the palpus and masticatory lobes of the 1st pair of maxillæ, finally the form and armature of the caudal rami. In addition to the species described below, the northern form, *Cypris fasciata* Müller, undoubtedly belongs to the same generic type, and a rather nearly related species I have succeeded in raising from dried Chinese mud. It may also be, that some others of the exotic forms, described by Baird and Brady, may belong to the same genus.

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3. Stenocypris malcolmsonii, (Brady).

(Pl. I, figs 7, 8; Pl. V, figs 1–4).

Cypris cylindrica, Baird, l. c. Proceedings Zool. Soc. London 1859, p. 233. Pl. 63, figs 3, 4 (not Sowerby).

Cypris malcolmsonii, Brady, l. c. Linn. Soc. Journ. Zool. Vol. XIX, p. 297, Pl. XXXVIII, figs 5—7.

Specific Characters. — Shell seen laterally elongated reniform, height about equalling $^2/_5$ of the length, both extremities rounded, dorsal margin flattened, nearly straight in the middle, ventral deeply sinuated: seen from above very narrow oblong, greatest width not attaining $^1/_3$ of the length, sides flattened, both extremities subacuminate. Surface of shell smooth beset with scattered hairs. Valves nearly equal, the left only very slightly overlapping the left, free edges strongly chitinised, without any pellucid border, but transversally ridged, the ridges being of greatest length at the upper part of the anterior extremity. Colour light greenish with indistinct yellowish shades, coecal appendages of intestine yellowish green, ova contained in the body bright reddish. Eye very large and conspicuous. Caudal rami very unequal, the right rather broad, slightly curved, scarcely tapering, outer part of dorsal edge elegantly pectinated, left considerably narrower, without distinct teeth of the dorsal edge; terminal claw about twice as long as the other, both coarsely denticulate; apical seta almost as long as the claw, seta of dorsal edge absent. Length of adult female 1,70 mm.

Remarks. — This beautiful species is undoubtedly identical with the form described by Baird from Nagpur, India, under the name of *Cypris cylindrica* Sowb., and more especially agrees with the figures given of his variety „*major*“. Mr. Brady, who had for examination specimens of the same species from Ceylon, does not however agree with Baird in identifying this species with the fossil form described by Sowerby, and hence has proposed a new specific denomination, that of *malcolmsonii*. Whether the two varieties named by Baird belong to the same species, I am unable to say. Baird has found both to be exactly similar, except in size, the variety „major“ being ascertained to be about twice as large as the other variety, in spite of the latter being full-grown.

Description. — The shell of adult specimens attains a length of about 1,70 mm, which would seem nearly to correspond with

the size of the larger variety, described by Baird, according to the small line subjoined to the figure. Brady, on the other hand, gives the length of his Ceylon specimens as $^1/_{12}$ of an inch, or about 2,10 mm.

The shell is very elongated and narrow, approaching the cylindric form, though rather compressed. Seen laterally (Pl. I, fig. 7) it exhibits a somewhat reniform shape, the height being nearly the same throughout the greater part and considerably less than half the length, or more precisely equalling about $^2/_5$ of the same. Both extremities are rounded and almost of the same appearance, or the posterior a little lower. The dorsal margin is much flattened and nearly quite straight in the middle, sloping in front and behind rather abruptly to the corresponding extremity. The ventral margin is distinctly sinuated a little in front of the middle and joins the anterior and posterior edges by a quite even curve. Seen from above or below (fig. 8) the shell exhibits a very narrow oblong form, the greatest width not even attaining $^1/_3$ of the length. The lateral contours are very little if at all curved in the middle, nearly parallel, and both extremities subacuminate, the anterior, however, somewhat narrower than the posterior. The surface of the shell is smooth and polished, beset with scattered fine hairs, as usually, more distinct at both extremities.

The valves are of rather firm consistency, though very pellucid, and are nearly equal, or the left very little longer than the right. The free marginal part (see Pl. V, fig. 1) is highly chitinised and without any such pellucid border, as in the preceding genus. On the other hand, it exhibits throughout a very marked transverse striation, the stripes having the appearance of somewhat irregular grooves, terminating at a short distance from the edge and generally each giving origine to a marginal hair. These stripes become on the upper part of the anterior extremity very elongate and somewhat converging inwards. In not yet fully developed, though still rather large specimens the edges of the valves are much less chitinised and without any trace of the above described peculiar transverse

striation, which of course is an infallible criterion of the adult state. A little in front of the middle the ventral edge of either valve forms a small rounded lobe, projecting inwards, that of the left side overlapping the other, when the valves are closed (see Pl. I, fig. 8). On the inner side each valve exhibits (see Pl. V, fig. 1) a well-marked duplicature, the anterior part of which is very broad and shelf-like, being bounded by a curved line crossing the extremity at a considerable distance from the edge. The duplicature is continued along the ventral edge, being however here rather narrow, but at the posterior extremity it becomes again somewhat broader, though by far not reaching the large size as anteriorly.

The colour of the shell in the living state of the animal is light greenish, variegated with indistinct yellowish shades, this colour being chiefly due to the enclosed body. The coecal appendages of the intestine appear very distinctly as a narrow diagonal band of a bright yellowish green colour, running from the centre of each valve to the posterior extremity. Moreover the eye is seen with great distinctness through the shell, as also the bright reddish coloured eggs contained in the posterior part of the body. Those limbs, which admit of being extended beyond the shell exhibit a light brownish hue.

The eye (see Pl. V, fig. 1) is very large, and its outer faces exhibit a most brillant irridescent lustre; each of them would seem to be divided into 3 facets, but their limitation is by no means sharply defined.

As to the several limbs, their structure agrees in all essential points with that minutely described above in *Cyprinotus dentato-marginatus,* and hence I do not regard it necessary to give separate descriptions of each pair — though closely examined by dissection —, but only to point out the more marked differences occurring in some of them and indicating the generic distinction between these two forms. On Pl. V, fig. 1 I have however given an accurate drawing of the animal — lateral view — exhibiting all its limbs in their natural situation, as it appears

when the right valve has been removed, and in figs 2—4 some few detail-figures are reproduced on a somewhat larger scale.

The two pairs of antennæ (see fig. 1), as compared with the same organs in Cyprinotus, appear a little more robust, and the swimming setæ are appreciably shorter. This is more especially the case with those of the lower antennæ, which do not at all exceed the tip of the terminal claws, whereas in Cyprinotus they reach at a considerable distance beyond the latter. The claws themselves are, moreover, comparatively shorter and thicker and not so coarsely denticulate as in that form.

The 1st pair of maxillæ, though being constructed upon the very same type as in Cyprinotus, slightly differ by the form of the palp and the masticatory lobes (fig. 2). All these parts are on the whole rather more slender, and especially are the masticatory lobes distinguished by their unusually narrow and elongate form.

Also the two pairs of legs (see fig. 1) would seem to be more slender in form, and the terminal claw of the 1st pair does not show any distinct denticulation.

The caudal rami (see fig. 1) are rather large and powerful as also distinguished by their peculiar armature. On closer examination the two rami are found to be very unequal in form, the right (fig. 3) being constantly much broader than the left (fig. 4) and nearly of uniform width throughout. This ramus, moreower, exhibits along the outer part of the dorsal edge a dense row of denticles arranged in a pretty regular pectinate manner and successively diminishing somewhat in size upwards. The left ramus (fig. 4) is much narrower, slightly tapering, and has only a few very small denticles of usual appearance close to the upper claws. In both rami the claws are rather unequal in size, the apical being about twice as long as the other, though not attaining half the length of the ramus; both claws are coarsely denticulate along the concave edge, the denticles being sharply defined from the edge, which is not the case with the teeth of the dorsal edge of the right ramus. In f ont of the apical claws a very slender seta, nearly attaining the length

of the claw, is affixed. On the other hand, there is no trace of the seta generally found originating from the dorsal edge above the claws.

Biological Observations. — I first observed this elegant and distinct species on the 6th July 1886 in one of my aquaries, prepared on the 1st June same year. A single adult specimen was caught by mere chance with the dipping tube, and on closer examination several young ones were also found in the aquary. In the course of the summer the number of specimens considerably increased, and numerous individuals were at different times fished up for examination and preservation, all of which were females. Also in another aquary prepared with mud from a different locality, some few specimens of this form appeared late in the summer. At the approach of the winter I allowed the water in one of the two aquaries to evaporate, whereas the other was from time to time supplied with fresh water so as to keep the mud constantly submerged during the winter. Only in the first of these aquaries this form reappeared the following summer 1887 together with numerous specimens of two other Cyprididæ to be described below, and also this year but the one sex was represented. The species was not observed subsequently.

As mentioned above, all the specimens examined were females, not a single male specimen appeared in any of the two aquaries, though several succeeding generations were observed. Having also examined numerous specimens of the northern species, *S. fasciata* (Müller), at different seasons, without ever having met with any male, I am led to the conclusion, that the species of this genus are exclusively parthenogenetical. As will be shown further below, I have been enabled to ascertain in a still more evident manner the absolute absence of males in the case of two other Australian Cyprididæ, belonging to the genus *Herpetocypris*.

As to the habits of the present species, it is far less active than the species of the genus *Cyprinotus*, a fact that is easily accounted for by the less development of the natatory setæ of the

antennæ. The animal is therefore generally found dwelling at the bottom of the aquary, or slowly creeping up the sides of the same. It is however not quite devoid of swimming power, and at times we see it making a short trip through the water, but this swimming motion is far from being rapid and does not admit of any comparison with the quick and continuous movements of the species belonging to the preceding genus.

Occurrence. — The mud from which this form was raised came from two different localities, viz., from the Gracemere Lagoon and from the Crescent Lagoon, both being also stated to contain the species *Cyprinotus dento-marginatus,* described above.

Distribution. — The species was first detected at Nagpur, India, and has subsequently also been met with in Ceylon. It would thus seem to exhibit a rather similar range as the 2 preceding forms.

Gen. 3. **Herpetocypris**, Norman & Brady, 1889.

Generic Characters. — Shell more or less elongate, height generally not attaining the half length, ventral edge sinuated in front of the middle. Valves rather unequal, sometimes the right, sometimes the left being the larger, free edges smooth, inner duplicatures generally very broad in front. Setæ of lower antennæ very small and rudimentary, not adapted for swimming. Palpus of 1st pair of maxillæ rather large, 1st joint dilated at the extremity, terminal joint broader than it is long, obliquely truncate at the tip; masticatory lobes very short and thick. Caudal rami narrow, sublinear, claws smooth, or very minutely denticulate. Propagation exclusively parthenogenetical.

Remarks. — This genus has been proposed by Messrs Norman & Brady in a work on the European Ostracoda recently published, for the reception of the well-known northern species, *Cypris reptans* Baird, and some few other forms. As indicated

by the generic appellation, the chief character, upon which the genus has been based, is the absolute want in the animal of swimming power, in which respect the species agree with those of the genus *Candona*, to which latter group the type was in fact referred by Baird. Besides, there are a few other characters, mentioned in the above diagnosis, partly derived from the shell, partly from the limbs, which may be regarded as of generic value. Two of the species, which I have succeeded in raising from dried Australian mud, undoubtedly belong to this genus, and also several of the exotic species, described by Baird and Brady, may probably be found on closer examination of the soft parts to be congeneric.

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4. Herpetocypris stanleyana, (King).

(Pl. II, figs 1—2; Pl. V, figs 5—7).

Condona stanleyana, King, Papers & Proceedings of the Royal Society of Van Diemens Land, Vol. III, P. I, p. 66, Pl. X. H (according to Brady).

Cypris stanleyana, Brady, Notes on Freshwater Entomostraca from South Australia. Proceed. Zool. Soc. London 1886, p. 89, Pl. VIII, figs 3, 4.

Specific Characters. — Shell seen laterally subreniform, tapered anteriorly, greatest height rather behind the middle and not quite attaining the half length, anterior extremity obliquely rounded, posterior obtuse, dorsal margin evenly curved, ventral distinctly sinuated in front of the middle, its posterior part being convex: seen from above oblong, greatest width about equalling $^2/_5$ of the length, sides convex, anterior extremity more pointed than posterior. Surface of shell smooth, but finely dotted all over and beset at each extremity with fine hairs. Valves in adult specimens very unequal, the right being by far the larger and considerably overlapping the left both posteriorly and anteriorly, exhibiting moreover a double setiferous lip, the inner lying at a considerable distance inside the outer. Colour yellow-

ish, clouded with green and exhibiting 2 light diagonal bands, running on either side from the centre of the shell to the posterior extremity; ova contained in the body bright orange-coloured. Setæ of lower antennæ very small, not reaching to the end of the penultimate joint. Caudal rami narrow and elongate, almost straight, claws slender, very finely denticulate, seta of dorsal edge small, scarcely longer than the apical. Length of adult female 1,50 mm.

Remarks. — I am by no means sure that my identification of this species is correct. The memoir of King I have unfortunately not been able to consult, and the specimen described and figured by Brady under the above name, is evidently not yet full-grown. Besides, this author says that the setæ of the lower antennæ reach to the extremity of the terminal claws, which is not the case in our species. In the remarkable unequality of the valves it shows some resemblance to *Cypris luxata*, described by the same author from Ceylon, but the form of the shell in this species would seem, to judge from the figure given, to be rather different.

Description. — The shell of the adult female attains a length of 1,50 mm. The measure given by Brady is much less, viz., $^1/_{20}$ of an inch; but, as noted above, the specimens examined by him were undoubtedly far from being full-grown.

Seen laterally (Pl. II, fig. 1) the shell exhibits a rather elongate, somewhat reniform shape, being however rather narrower anteriorly than posteriorly. The greatest height lies considerably behind the middle and does not fully attain the half length. The anterior extremity is obliquely rounded, whereas the posterior is more evenly obtuse. The dorsal margin forms a rather uniform curve declining somewhat more abruptly to the posterior than to the anterior extremity. The ventral margin is distinctly sinuated in front of the middle, but becomes convex in its posterior part. Seen from above (fig. 2) the shell appears somewhat inflated in its posterior half, though exhibiting a rather elongate oblong form. The greatest width lies somewhat behind the middle and equals about $^2/_5$ of the length. The lateral contours of the

shell appear rather convex, and the anterior extremity is much narrower and more pointed than the posterior. The surface of the shell is smooth, though everywhere finely dotted with small dark spots of an irregular form, and is only sparingly beset with hairs, more distinct at both extremities.

The valves are in full-grown specimens remarkably unequal, the right being by far the larger and to a considerable extent overlapping the left at both extremities, especially at the anterior. Moreover, this valve exhibits a double lip, the inner fitting to the edge of the left valve, when the shell is closed, whereas the outer projects freely beyond it at a distance more or less great. Both lips (see Pl. V, fig. 5) are highly chitinised and without any distinct pellucid border, whereas they exhibit numerous transverse grooves, generally dividing at the edge into 2 or more branches, each of which gives origine to a fine marginal hair. The distance between the two lips is especially in the anterior part very considerable, and the valve here looks as if it were composed of two superposed valves. In younger, not yet sexually mature, specimens, the inner lip is, however, quite wanting and the valves nearly of equal size. The inner duplicatures of the valves are rather large, especially the part lying in front, which, as in *Stenocypris*, forms a broad, semilunar, shelf-like plate, bounded interiorly by a strongly curved sharp edge.

The colour of the shell in a living state of the animal is light yellowish, more or less clouded with grass-green, especially in the dorsal and posterior part. From the centre of the shell on either side two diagonal lighter bands run to the posterior extremity, the lower representing the place, where the coecal appendages of the intestine lie imbedded between the lamellæ of the valves, the upper indicating the ovaries.

The eye (see Pl. V, fig. 5) is rather large and conspicuous and of a similar structure as in Stenocypris malcolmsonii.

The antennæ (ibid.) also rather agree in shape with those organs in the latter form. The setæ of the upper antennæ are, however, somewhat shorter, and those of the lower antennæ are

quite rudimentary, not reaching even to the extremity of the penultimate joint.

The 1st pair of maxillæ exhibit in their terminal part (fig. 6) well-marked differences from those organs in the genus Stenocypris. The palp is much coarser, its first joint being considerably dilated towards the extremity, which anteriorly juts out as a rounded prominence beset with a fascicle of rather strong ciliated setæ. The terminal joint of the palp is very short, broader than it is long and somewhat obliquely truncate at the tip, which is armed with about 6 partly spiniform setæ. The masticatory lobes are unusually short and thick, and the outmost has, besides the apical tuft of bristles, a very thick and densely ciliated seta affixed to the anterior edge.

The 2 pairs of legs do not seem to differ materially from those in Stenocypris, except that the latter are somewhat less elongate.

The caudal rami (fig. 5 and 7) are quite symmetrical and very narrow, almost linear, though a little broader at the base. The claws are rather slender and at first sight appear quite smooth. On closer examination, however, by the aid of a very strong magnifier, their concave edge is found to be beset with extremely small denticles, which also occur along the dorsal edge of the ramus. Of the claws the apical is a little (about $^1/_4$) longer than the other, but does not attain the half length of the ramus. The seta of the dorsal edge, placed at a short distance from the upper claw, is rather small, scarcely longer than the apical, which does not quite reach the half length of the terminal claw.

Biological Observations. — Of this form I have been enabled to examine great quantities of specimens and during a rather long period. The species at first appeared at the beginning of September 1886 in two of my aquaries, the same in which *Stenocypris malcolmsonii* was found. The specimens were at that time not very numerous, and in one of the aquaries they were only observed that year. In the other, however, the water of which I had allowed to evaporate at the close of the autumn, the spe

cies reappeared the following summer 1887 in considerable number and continued to live and propagate during the whole remaining part of the year. In order to see, how far into the winter they would endure, I did not allow the water te evaporate in this aquary, but poured on it from time to time fresh water. In fact the specimens continued to live also in the new year 1888, though their activity was considerably diminished in the same proportion as the temperature became lower. Still in the beginning of March there were numerous specimens present in the aquary, both adult and young, but in the course of that month a great mortality began to affect the species, numerous specimens being found at the bottom dead or in a very morbid state, with the valves wide open. This was, I believe, for a great part caused by the water having assumed too much condensity by evaporation. In fact after having supplied to the aquary a new quantity of fresh spring water, I found that the remaining specimens became rather more active, as also that the hatching of the young was going on, in spite of the comparatively low temperature. In May the water of the aquary had assumed a rather impure appearance, being very turbid and af a greenish colour, owing to great quantities of microscopical algæ having developed. As this condition of the water seemed highly to affect the specimens, a great number of which were found dead at the bottom, I thought it right to empty the aquary at once and pour fresh spring water on the bottom residue. This done, the aquary was placed so as to be as much as possible exposed to the direct rays of the sun. The result was very satisfactory. During the following month, besides numerous young recently hatched, also several full-grown specimens, which had evidently survived the operation, were observed and proved to be in very good health, depositing their ova on the bottom and to the walls of the aquary. The number of specimens increased in the course of the summer in a manner quite astonishing, and at last the aquary literally swarmed with enormous multitudes of this form. The species has continued to live in the aquary until the moment, I write these lines

(February 1889), and I do not doubt, that most of them will survive the winter and next summer again produce a new series of generations[1].

As seen from the above given dates, I have been enabled to watch this form in the same aquary during no less than 4 successive years, each year exhibiting several successive generations; but I have not yet met with a single male individual, though great quantities of specimens were at different times extracted from the aquary and submitted one by one to a close examination. I thus believe to be fully justified in concluding, that male specimens do not exist at all, and that this form of course propagates in an exclusively parthenogenetical manner. To the same conclusion I am led as regards the following species, and also for a considerable number of the indigenous Cyprididæ, of which never any male specimen has been met with, this peculiar fact may be substantiated.

In habits this species is a true bottom form, being, as stated above, quite devoid of swimming power. Of course it will generally be found at the bottom of the aquary, partly creeping along the surface of the mud, partly burrowing more or less deeply into the loose bottom deposit. Very often, however, the animal is seen, especially in warm weather, slowly creeping up the walls of the aquary, or along the stems of water-plants growing in the same; but when losing its hold, it invariably sinks back to the bottom without being able to support its body freely in the water. As is also the case with several other Cyprididæ, the shell, when touching the surface of the water, continues to float with the one valve quite out of the water, and it is then rather difficult to get it again submerged. In taking up from the aquary a small quantity of mud by the aid of a dipping tube and placing it in a shallow vessel, as a watchglass, the specimens contained in the mud will soon come to sight at

[1] Whilst this sheet is going through the press (beginning of June), the aquary swarms with numerous specimens, both adult and young, the latter having been developed in the course of the preceding month.

the surface on stirring up the contents with a small brush or feather.

Occurrence. — The species being raised from the very same mud as *Stenocypris malcolmsonii,* the same localities for both species may be recorded, viz., the Gracemere Lagoon and the Crescent Lagoon. Its occurrence in the first of these Lagoons I have, moreover, been enabled to ascertain in a still more direct manner, having extracted 2 rather complete specimens from the stomachal contents of a little freshwater fish caught in this Lagoon and brought home by Mr. Lumholtz.

Distribution. — The species has not yet been recorded out of Australia. Mr. King observed it in the neighbourhood of Sydney, and the specimens examined by Brady came from the same region.

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5. Herpetocypris viridula, (Brady).

(Pl. II, figs 3, 4: Pl. V. figs 8—11).

Cypris viridula, Brady, l. c. Proceed. Zool. Soc. London 1886, p. 88, Pl. VIII, figs 1, 2.

Specific Characters. — Shell seen laterally subreniform, greatest height rather behind the middle and nearly attaining the half length, anterior extremity obliquely rounded, posterior obtusely truncate, dorsal margin nearly straight in the middle, ventral distinctly sinuated: seen from above narrow oblong, greatest width somewhat exceeding $^1/_3$ of the length, sides evenly curved, anterior extremity more pointed than posterior. Surface of shell smooth, finely hairy at both extremities. Valves of rather firm consistency, somewhat unequal, left valve the larger, inner duplicatures of anterior extremity very broad, shelf-like. Colour bright greenish with lighter shades. Upper antennæ provided at the inferior edge of 2nd joint with a peculiar sensory appendage. Setæ of lower antennæ reaching to the end of the penultimate joint. Caudal rami broader than in the preceding species, scarcely tapering, claws rather strong, smooth, seta of dorsal edge claw-shaped. Length of adult female 1,20 mm.

Remarks. — This species, though easily distinguishable from the preceding, both as to the shell and the soft parts, undoubtedly belongs to the same genus. I think my identification of the species will be found correct, though the figures and description given by Brady show a few apparent differences.

Description. — The length of the shell in full-grown specimens does not exceed 1,20 mm., and hence this species is considerably smaller than the preceding.

Seen laterally (Pl. II, fig. 3) the shell exhibits a somewhat reniform shape, though the contours appear a little more angulated than in the preceding species. The greatest height lies rather behind the middle, in the posterior part of the shell, and does not quite attain the half length. The anterior extremity is considerably lower than the posterior and obliquely rounded, whereas the latter is broadly and obtusely truncate. The dorsal margin is in the greater part of its length nearly straight and somewhat ascending posteriorly, sloping with a rather abrupt, nearly angulated, bend to either extremity. The ventral margin is distinctly sinuated in the middle and joins the anterior and posterior edges by an even curve. Seen from above (fig. 4) the shell appears much compressed, exhibiting a very narrow oblong form. The greatest width lies a little behind the middle and does not much exceed $^1/_3$ of the length. The lateral contours are evenly convex, and the anterior extremity much narrower and more pointed than the posterior. The surface of the shell in adult specimens is quite smooth, whereas in younger individuals a slight reticulation may be observed; it is sparingly beset with fine hairs, as usual more distinct at either extremity.

The valves are of rather firm consistency and somewhat unequal, the left being in this form the larger and slightly overlapping the right at the extremities as also along the ventral margin. The marginal part is highly chitinised and, as in the preceding species, in adult specimens distinctly grooved transversally (see Pl. V, fig. 8). The inner duplicatures are very large, especially their anterior part, which forms a broad, shelf-like plate, bounded inwards by an obliquely curved line crossing

this extremity at a considerable distance from the edge. Also the posterior part of the duplicature is of considerable breadth though by far not so broad as the former.

The colour of the shell in a living state of the animal is dark greenish, especially on the upper and hind part, as also on the outer half of the anterior extremity exhibiting inside the shelf-like duplicature. Some areas of the shell are, however, more pellucid, allowing some of the inner parts to be faintly traced. As in most other Cyprididæ, there are 2 diagonal bands of a lighter hue, running on either side from the centre of the shell towards the posterior extremity and indicating the place where the coecal appendages of the intestine and the ovaries lie imbedded between the lamellæ of the valves.

The eye (see Pl. V, fig. 8), as in the two preceding species is very large and conspicuous by the brillant iridescent lustre of its outer faces. Its structure agrees exactly with that in the preceding species.

The upper antennæ (ibid.) do not differ much from those organs in *H. stanleyana*. The setæ are, however, comparatively shorter, almost spiniform, and at the inferior edge of the 2nd joint of the basal part a peculiar little apppendage occurs, not found in the latter species. This appendage (fig. 9), which undoubtedly represents a sort of sensory organ, consists of a very delicate cylindrical stem, movably articulated to the antenna and exhibiting two indistinctly defined segments, the outer a little narrower and terminating in an exceedingly delicate and pointed flap.

The setæ of the lower antennæ (see fig. 8) are, as in the preceding species, very small, though a little longer than in that form, reaching about to the end of the penultimate joint.

The terminal part of the 1st pair of maxillæ (fig. 10) exactly agrees in structure with that part in *H. stanleyana*. This is also the case with the mandibles, the 2nd pair of maxillæ and the two pairs of legs.

The caudal rami (fig. 11), on the other hand, exhibit well-marked differences. They are on the whole rather coarser in

structure, the outer part being not tapered but about of equal breadth, or even slightly dilated towards the end. The claws are moreover 3 in number, instead of 2, owing to the seta of the dorsal edge having assumed quite an unguiform character; this 3rd claw is however considerably smaller than the other two, which exhibit a similar mutual relation as in the preceding species. All the claws are smooth, whereas the dorsal edge of the rami, on closer examination by the aid of a strong magnifier is found to be very finely denticulate. Immediately in front of the terminal claw the usual apical seta occurs, which however is very small, not attaining $^1/_3$ of the length of that claw.

Biological Observations. — Also of this very distinct species I have been enabled to examine numerous specimens domesticated in my aquaries. It was first observed as early as 1884 in an aquary, prepared with mud from the Gracemere Lagoon sent by Mr. Lumholtz, but only two adult female specimens were at that time secured. In 1886, having received a new supply of dried Australian mud, I raised the same species in 3 of my aquaries, and in 2 of them the number af specimens considerably increased in the course of that summer. In one of the latter aquaries, the water of which I did not allow to evaporate, this form continued to live during the whole winter, but at the end of May 1887 successively disappeared without subsequently giving rise to another series of generations. In the other aquary, however, the bottom residue of which was kept in a dried state during the winter, the species reappeared in June 1887, and at the close of that summer the aquary swarmed with great multitudes of this form, in company with *Cyprinotus dentato-marginatus* and *Herpetocypris stanleyana*, described above. The specimens continued to live during the succeeding winter, diminishing however considerably in number and at last, in the commencement of the summer 1888, wholly disapppeared.

As seen from the above given notes, also this species has been observed during numerous succeeding generations, but no male specimens could ever be detected, and hence it would seem

that I am justified in believing for this species a similar exclusively parthenogenetical propagation as stated for the preceding.

In habits the present species agrees with *H. stanleyana*, being a true bottom-form and quite devoid of swimming power. In its movements it is even still less active than that species, probably owing to the more compact consistency of its shell. Generally it is found more or less deeply immerged in the loose bottom deposit, more rarely creeping up the walls of the aquary.

Occurrence. — The mud from which this species was raised, came from the same two localities that yielded the preceding species, viz., the Gracemere Lagoon and the Crescent Lagoon.

Distribution. — The specimens examined by Brady were collected by Mr. Thomas Steel at Candong, on the river Tweed near Sydney, New South Wales. Hence the range of the species as yet known does not extend beyond the limits of Australia.

Gen. 2. **Ilyocypris,** Brady & Norman, 1889.

Generic Characters. — Shell compressed, subreniform, upper part distinctly impressed on either side in front of the middle, anterior extremity higher than posterior, dorsal margin nearly straight, ventral deeply sinuated. Valves subequal, of rather firm consistency, surface everywhere closely set with deep rounded pits, and sometimes bulging out to large lateral protuberances, edges finely hairy and more or less distinctly spinulose, inner duplicatures not very large. Natatory setæ of both pairs of antennæ sometimes greatly elongated, sometimes very short. 1st pair of maxillæ about as in Herpetocypris; 2nd pair rather deviating, masticatory lobe very broad and compressed, branchial lamella well developed, palp very small, cylindric and composed of two well-defined joints, the outer terminating with 3 setæ. 1st pair of legs only 5-articulate, the penultimate and antepenultimate joints being fused together, terminal claw very slender. 2nd pair of legs comparatively short, last joint without

any hook, but terminating with 3 long and slender setæ. Caudal rami small, sublinear, claws slender, subequal, seta of dorsal edge attached nearly in the middle. Propagation sexual. Prehensil palps of 2nd pair of maxillæ in male rather slender and exactly alike on both maxillæ. Copulative organs not very large, outer lobe securiform, terminating in a sharp incurved corner. Ejaculatory tubes with numerous whorls of spines, coronula produced, cupuliform.

Remarks. — This is another new genus recently established by Messrs. Brady & Norman to receive the rather anomalous European form, *Cypris gibba*, Ramdohr, with which the Australian species described below is undoubtedly congeneric. Another northern species, which I have identified with *C. biplicata*, Koch, also belongs to this genus. Moreover, I have succeeded last year in raising from dried Chinese mud 2 other species of the same genus, both distinguished by the peculiar spiny armature of their shells, somewhat reminding us of certain species of the marine genus *Cythereis*. As seen from the above given diagnosis, the generic characters are very well marked, both as to the shell and the soft parts, and even before knowing the work of Messrs. Brady & Norman I had set up the genus, naming it, curiously enough, in the very same manner.

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6. Ilyocypris australiensis, n. sp.

(Pl. II, figs 5—8; Pl. VI).

Specific Characters. — Shell of female, seen laterally, oblongo-quadrangular or subreniform, the greatest height considerably in front of the middle and rather exceeding the half length, anterior extremity broadly rounded, posterior subtruncate, dorsal margin nearly straight, ventral deeply sinuated: seen from above oblong, greatest width behind the middle and about equalling $^2/_5$ of the length, anterior extremity tapered and acuminate, posterior obtuse. Shell of male somewhat narrower with the anterior ex-

tremity shorter and more abruptly rounded, marginal part swollen in front. Surface of shell without any visible lateral protuberances but exhibiting on either side, near the dorsal face, two well-marked transverse impressions; anterior and posterior edges finely hairy and, in female, armed with a dense series of extremely small and delicate spinules. Colour of shell in female pale greyish with a greenish shade dorsally, in male more or less dotted with purplish brown. Natatory setæ of the upper antennæ very long and slender, those of the lower antennæ considerably exceeding the terminal claws. Caudal rami slightly curved, claws very slender, almost setiform, seta of dorsal edge attached somewhat below the middle. Length of adult female 0,90 mm., of male 0,84 mm.

Remarks. — This species is very nearly related to the northern form. *I. gibba* (Ramdohr), though easily distinguished by the absolute want of the peculiar lateral protuberances, characterising that species. In some specimens of the northern form these protuberances are certainly very small, but I have never found them completely wanting as in the Australian species. The 2nd northern species, which I believe to be identical with *Cypris biplicata* Koch, is very distinct from both these species, having the natatory setæ of both pairs of antennæ quite short, whence the animal, unlike what is the case with the other species, is wholly devoid of swimming power.

Description. — The length of the shell in adult female specimens does not exceed 0,90 mm; that of the male is still smaller, the length being only 0,84 mm.

Seen laterally (Pl. II, fig. 5) the shell of the adult female exhibits a somewhat oblong quadrangular, or rather angular subreniform shape. The greatest height, unlike what is generally the case in Cyprididæ, lies in the anterior part, about where the eye has its place, and considerably exceeds the half length. The anterior extremity is broadly rounded, whereas the posterior is obtusely truncate. The dorsal margin is nearly straight and somewhat declining posteriorly, joining the anterior edges by a rather prominent, almost angular bend just above the eye; also

posteriorly there is a distinct nearly right-angled corner, marking off the dorsal from the posterior edge. The ventral margin is deeply sinuated in the middle and joins the anterior and posterior edges by an even curve. Seen from above (fig. 6) the shell exhibits a rather narrow oblong form, the greatest width lying behind the middle and about equalling $\frac{2}{3}$ of the length. The lateral contours are but very slightly curved in the middle, nearly parallel, but from the region of the eye they rapidly converge anteriorly to a sharp point, whereas posteriorly they are more evenly curved and meet in an obtuse point.

The shell of the adult male (fig. 7) exhibits a somewhat more narrow shape, the height exceeding but little the half length. The anterior extremity too is shorter and more abruptly rounded than in the female, and the ventral margin less deeply sinuated. Seen from above (fig. 8) it appears somewhat more compressed and the anterior extremity exhibits a peculiar swelling of its marginal part giving it the appearance of being narrowly truncate at the tip.

The shell is, especially in the female, of a very firm consistency and its surface of a rather dull appearance, being everywhere closely set with numerous deep, rounded pits. Dorsally it exhibits on either side, a little in front of the middle, two irregular transverse impressions; but of any lateral protuberances there is no trace to be found either in the female or male.

The valves are nearly equal, fitting exactly together at either extremity; but dorsally, just above the eye, the right valve overlaps to a short extent the left, forming the above mentioned angular projection. The anterior edges of the valves, and in the female also the posterior, exhibit, besides a dense fringe of very fine hairs, a closely set series of extremely small spinules only visible by the aid of a high magnifying power. Moreover, in the female, some few coarser spines or spiniform processes are found along the posterior edges (see Pl. VI, fig. 1). In the male (see fig. 11) this peculiarity occurs, that the anterior series of spinules are inflexed and surpassed by a very thin and pellucid border not occurring in the female. The inner duplicatures

of the valves (see fig. 1, 11) are not very large, that of the anterior extremity being somewhat broader, especially in the female. The shell-structure, as appearing by transmitted light (fig. 2), shows numerous irregular, angulated facets of an opaque appearance, lying close together.

As to colour, the shell of adult females is rather opaque, of a dull white or greyish hue, with a slight greenish shade in the dorsal part. That of the adult male is far more pellucid and more or less mottled with small purplish brown dots.

The eye (see Pl. VI, figs 1 & 11) is not very large and has its place at a considerable distance below the upper margin of the shell. Its structure would also seem to be somewhat more simple than in the forms described above.

The upper antennæ (fig. 3) are rather powerful, with the basal part very thick and muscular. The joints of the terminal part successively diminish in thickness but less so in length than in most other Cyprididæ. The last joint is rather narrow, sublinear and bears at the tip 3 not very long, spiniform bristles, somewhat pointing upwards. The preceding joints are each provided with 2 natatory setæ on either side, those of the anterior edge being excessively long and slender and forming together a dense fascicle, almost equalling the whole antenna in length.

The lower antennæ (fig. 4) are likewise rather powerful, and of the usual structure. The apical claws are not very elongate and quite smooth. The natatory setæ, on the other hand, are very long and slender, reaching considerably beyond the tips of the claws.

The mandibles (fig. 5) have a rather strong and somewhat curved corpus, the lower part of which is highly chitinised and exhibits the usual armature of masticatory teeth. The palp is very thick, especially the basal joint, which bears a well developed branchial appendage.

The 1st pair of maxillæ (fig. 6) somewhat resemble those organs in the genus *Herpetocypris*, the palp being rather large, with the 1st joint considerably dilated towards the end and an-

teriorly armed with a bundle of ciliated setæ, whereas the last joint is very short, broader than it is long, and at the tip provided with several strong, partly unguiform bristles. The masticatory lobes are short and thick, rounded at the tip and densely bristle-beset. The branchial plate is very large, semilunar and provided with a dense row of about 25 finely plumose setæ, the 6 lower of which are, however, much more slender than the rest and pointing straight inferiorly.

The 2nd pair of maxillæ (fig. 7) rather differ in shape from those organs in the typical Cypridida. The basal part is rather strongly curved and terminates with a very broad and compressed masticatory lobe, obliquely truncate at the tip and provided with numerous delicate curved setæ, one of which is attached to a separate ledge on the inner edge. The branchial lamella is well developed, of a rounded form, and provided with 6 thickish plumose setæ. The palp is very unlike that in most other Cypridida, being very small, cylindric, and composed of 2 sharply defined joints, the last bearing at the tip 3 setæ, the middle one the longest. In the male the palp of these maxillæ (see figs 11, 12) has been converted into a highly chitinised prehensile organ, consisting of two segments, the last claw-like and movable so as to be impinged against the 1st. Both palps are exactly alike and rather slender, the 1st joint exhibiting quite a linear form and bearing but a single seta at the end anteriorly, the last very narrow, only slightly curved and terminating with a very delicate and pellucid pointed flap.

The 1st pair of legs (fig. 8), though exhibiting at first sight quite a normal appearance, differ on closer examination materially by the complete fusion of the penultimate and antepenultimate joints, and this is also the case in all the other species of the genus. The apical claw is very elongate and slender, slightly curved and without any trace of lateral denticles.

The 2nd pair of legs (fig. 9) are likewise well distinguished from those organs in the typical Cypridida and somewhat resemble the corresponding legs in the genus *Candona*. They are rather short and generally less strongly upturned than usual (see figs

1 & 11). The 3rd joint is somewhat shorter than the 2nd and considerably dilated towards the end, which is obliquely truncated, with the outer corner produced and finely denticulate. At the inner edge this joint bears 2 slender setæ, one of which is attached about the middle, the other at a short distance from the end. The last joint is very small, of conical shape and forms with the preceding a distinct angle; there is no trace of the usual hook, but it bears on the tip 3 very elongate and slender setæ, the middle of which is the longest.

The caudal rami (fig. 10) are very small, sublinear or only slightly curved. The claws are rather slender, nearly of uniform length and quite smooth, terminating in a fine, setiform point. A very small bristle is attached just in front of the apical claw, and another more elongate seta originates from a distinct ledge of the dorsal edge, a little below the middle.

The copulative organs of the male (fig. 13) are comparatively small and on the whole constructed upon the same type as in the male of Cyprinotus. In their details, however, they exhibit well marked differences. Thus the inner plates are comparatively shorter and more rounded, having moreover their distal parts sharply defined from the rest as two juxtaposed narrow linguiform processes. The outer plates are likewise somewhat different in shape, being almost securiform, with the inner corner much produced and acuminate.

The ejaculatory tubes (fig. 14) are rather large and, as in Cyprinotus, exhibit numerous (about 20) whorls of radiating spines. Their distal extremity, or coronula, is however not as in that genus truncate, but brought to a rather large cupuliform projection.

Biological Observations. — Of the present species numerous specimens were found, at the close of the summer 1884, in a small aquary prepared the same year with mud from the Gracemere Lagoon, sent by Mr. Lumholtz. The specimens continued to live during the whole winter, but disappeared before the beginning of the next summer. All the specimens then observed were females; but in 1886 I succeeded in securing 2 male

specimens of the same species raised from another lot of mud from the same locality. One of the specimens was still quite young, whereas the other, from which the figures here given were made, had attained its full development. I may add, that of the 2 Chinese species, raised last summer, male specimens seemed to be nearly as numerous as females, whence the propagation in this genus must on the whole be named a sexual one, though at times also a partenogenesis might take place.

As to the habits of this species, it is a true bottom form and, as is also the case with the other species of the genus, may generally be found more or less deeply immerged in the loose bottom deposit, so as to be rather difficult to detect. Very often, moreover, the shell is covered with a thick crust of dirt that causes it easily to be overlooked. It is however by no means devoid of swimming power, as may be *a priori* inferred from the greatly developed natatory setæ on the antennæ. In fact the animal is at times seen to leave the bottom, swimming rapidly through the water; but this movement, being apparently rather laborious, never continues for any length of time and is soon stopped, when the shell, by its relative great weight, rapidly sinks back to the bottom.

Occurrence. — The only locality as yet ascertained for this species is the Gracemere Lagoon, all the specimens being raised from mud collected at that place.

Gen. 5. **Cypridopsis**, Brady.

Generic Characters. — Shell very tumid, more or less globular in form, dorsal margin boldly arched, ventral nearly straight. Valves subequal, rather thin, hairy, inner duplicatures narrow. Eye unusually broad, transverse. Upper antennæ comparatively short but having very long natatory setæ; lower antennæ rather powerful, with greatly elongated apical claws, and the natatory setæ reaching beyond their tips. Labrum

very large and vaulted. 1st pair of maxillæ with palps and masticatory lobes narrow and elongate; 2nd pair without any branchial lamella. Legs about as in Cypris. Caudal rami extremely small and narrow, but of quite normal structure, claws slender and setiform, 3 on either ramus, besides a very small apical bristle. Propagation exclusively partenogenetical.

Remarks. — This genus has been established by Mr. Brady to comprise the 3 northern species *Cypris vidua* Müller, *C. aculeata* Lilljeborg, and *C. villosa* Jurine. The 2 latter species I have, however, found to differ materially from the first one, in certain well-marked characteristics, and more especielly in the structure of the caudal rami, and, as another genus, *Potamocypris*, has been proposed for a form very nearly related to the last named species (C. villosa), it will, I believe, be appropriate to restrict the genus *Cypridopsis* to those forms, which more closely agree with the northern species *Cypris vidua* Müller. The genus would seem to embrace numerous species, both northern and foreign. In the following pages a well-marked Australian species will be described, and another very distinct species I have succeeded last year in raising from dried Chinese mud. Mr. Brady has, moreover, described, though rather insufficiently, 4 other exotic forms, 2 from Australia and 2 from Ceylon. Finally several northern species have recently been established, though not yet published, by Prof. Lilljeborg, two of which I have myself been enabled to examine in the neighbourhood of Christiania.

The species are easily recognised by the very tumid, almost globular shell, the colour of which is generally, but not always, whitish banded with dark green.

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7. Cypridopsis globulus, n. sp.

(Pl. II, figs 9, 10; Pl. VII, figs 1—11).

Specific Characters. — Shell seen laterally rounded triangular, greatest height in the middle exceeding $^2/_3$ of the length, anterior extremity obliquely rounded, posterior somewhat lower

and obtuse, dorsal margin greatly arcuate, almost angular in the middle, ventral nearly straight: seen from above very tumid, almost globular, greatest width behind the middle and about equalling $^4/_5$ of the length, anterior extremity narrowed, posterior broadly rounded. Surface of shell rather hairy and everywhere closely set with small depressed pits, marginal part of anterior extremity with distant transverse grooves, posterior edge of left valve armed with a series of very small tuberculiform denticles. Colour light yellowish green, with 3 irregular flexuous dark green transverse bands, the two anterior confluent above; marginal part of anterior extremity very dark, almost black, with a light-coloured border. Length of adult female 0,70 mm.

Remarks. — The present species is easily distinguished from the northern form, *C. vidua* Müller, with which it rather agrees in colour, by the much higher and more globular shell, as also by its distinctly granular surface. The Australian species, *C. minna* (King), has, according to the description and figure given by Brady a still higher shell and moreover differs in colour from the present form. The 2nd Australian species described by Brady, *C. funebris*, has been based only upon quite young specimens which had not yet assumed any definitive form, and hence it is impossible to recognise the species. The two Ceylon species, described by the same author, are both, I believe, different from the one here described.

Description. — The length of the shell in adult specimens does not exceed 0,70 mm, and hence this species is somewhat smaller than the northern form, C. vidua.

Seen laterally (Pl. II, fig. 9) the shell exhibits a very short and high, rounded triangular form, with the greatest height exactly in the middle and somewhat exceeding $^2/_3$ of the length. The anterior extremity is rather broad and obliquely rounded, the posterior somewhat lower and obtuse. The dorsal margin is exceedingly arched, almost angular in the middle, and slopes rather steeply both anteriorly and posteriorly. The ventral margin is very short, nearly straight and well defined from the anterior edges. Seen from above (fig. 10) the shell appears

exceedingly tumid and well-nigh of globular form. The greatest width lies rather behind the middle and is considerably greater than the height, or about equalling $^4/_5$ of the length. The anterior extremity is obtusely pointed, whereas the posterior is evenly rounded, its contours forming with the lateral ones quite an uninterrupted curve. The dorsal part of the shell is in the posterior half distinctly depressed along the median line, forming here a rather deep groove. The surface of the shell exhibits a dull granular aspect, on account of numerous small depressed pits, and is rather densely beset with hair, more especially at both extremities.

The valves are subequal and rather thin, except the marginal part of the anterior extremity, which is highly chitinised and provided with very conspicuous distant transverse grooves (see Pl. VII, fig. 1). This marginal part is surmounted by a very thin and pellucid border, and a similar, though less developed border also occurs at the posterior extremity. The edges of the right valve are quite smooth, whereas those of the left exhibit posteriorly a series of very small, tuberculiform denticles (see fig. 1).

The colour of the shell is light yellowish green, with 3 rather conspicuous, irregularly flexuous transverse bands of a very dark greenish hue. Of these bands the posterior is rather narrow and well defined from the other two, which on the other hand, coalesce above the impressions of the adductor muscle to a larger, irregular patch. The foremost of the two gives anteriorly origine to a short lateral branch, which however does not reach to the anterior edge. The marginal part of the anterior extremity is very dark-coloured, almost black, but is surmounted by a narrow, light-coloured border. The shell on the whole is not very pellucid, and the only inner organ, which is distinctly traced through the same, is the eye.

The latter organ (see Pl. VII, figs 1 and 2) is located rather close to the dorsal margin and, when viewed from above (see also Pl. II, fig. 10) appears very broad, the ocular pigment having the form of a short cylinder placed transversally to the

axis of the body. The lenticular bodies occupying the extremity of the cylinder are highly refracting, but do not seem to be, as in the preceding forms, divided into facets.

The upper antennæ (Pl. VII, fig. 3) are comparatively short, but powerful, with the basal part very thick and muscular. The terminal part does not attain the length of the basal and rapidly tapers towards the end. Of its joints the 1st is by far the largest, equalling in length the two succeeding joints taken together, whereas the two outer joints are very small. The natatory setæ are very slender and elongate, exceeding the antennæ in length.

The lower antennæ (fig. 4) are considerably longer than the upper and of the usual pediform aspect. The penultimate joint is, however, unusually short, scarcely exceeding half the length of the preceding joint. The apical claws of this and the last joint are greatly elongated and slender, very slightly curved in their outer part and finely denticulate. The natatory setæ are very slender and reach somewhat beyond the tips of the apical claws.

The labrum (see fig. 1) is large and prominent, rounded in front and supported by several strong chitinous stripes.

The mandibles (fig. 5) exhibit the usual structure. Their body is very elongate, about twice the length of the palp, which is provided with a well-developed branchial appendage.

The 1st pair of maxillæ (fig 6) somewhat resemble those organs in the genus *Stenocypris*. Thus the palp is very narrow and cylindrical in form, with the 1st joint not at all dilated at the end, and the last joint nearly twice as long as it is broad. The masticatory lobes are likewise rather elongate and slender. The branchial plate (see fig. 1) is very large and of the usual structure.

The 2nd pair of maxillæ (fig. 7) do not exhibit the slightest trace of any branchial lamella. The masticatory lobe forms with the basal part a well pronounced angle and is rather narrow, with numerous very delicate and curved apical bristles.

The palp has the form of a quite simple conical lappet, terminating with 3 setæ.

The 1st pair of legs (fig. 8) are distinctly 6-articulate and have the 3rd joint comparatively short, not attaining the length of the 2 succeeding joints taken together. The setæ attached to the 4 joints anteriorly are unusually long and slender, reaching far beyond the last joint. The apical claw is likewise very slender and in its outer part finely denticulate.

The 2nd pair of legs (fig. 9) do not materially differ from those organs in the more typical Cypridididæ. As in the latter, the terminal joint is indistinctly defined from the preceding and provided with a small hook and a slender recurved seta.

The caudal rami (figs 10, 11) are exceedingly small and mostly quite hidden between the large genital lobes (see fig. 1). On closer examination by dissection, they are, however, found to be of quite normal structure, and are thus very unlike the same organs in the genus *Potamocypris*. As to form they are (figs 10, 11) very narrow, linear, and almost quite straight, terminating with 3 slender, almost setiform claws, somewhat diverging and attached rather close together. Of these claws the outmost or apical is the largest and nearly as long as the corresponding ramus, the other two about equal in length; immediately in front of the apical claw a very small bristle is attached. Both rami lie in close juxtaposition throughout their whole length (fig. 11).

Biological Observations. — Of this beautiful little form, a single specimen was observed on the 2nd July 1886 in one of my aquaries prepared on the 23rd May same year. No more specimens appeared that summer but the following year, 1887, in another aquary the same form was raised at first only in a few specimens, which, however, soon began to multiply in such a manner that before the close of the summer the number of specimens was considerably increased. Also last summer, 1888, this species reappeared rather plentiful in the same aquary and continued to live and propagate even through the first part of the winter. Thus I have been enabled to observe

also this form during numerous succeeding generations and at different seasons, but only female specimens have as yet appeared. The same is also the case with the Chinese species, of which numerous specimens were domesticated last summer, and likewise of the very common northern species *C. vidua* no male has ever been observed. Hence I think, it must be assumed, that also the species of the present genus propagate in an exclusively partenogenetical manner.

In habits this form nearly agrees with the northern species *C. vidua* (Müller). The animal is rather active in its movements, being able to swim with rather considerable speed through the water, as may *a priori* be concluded from the great development of the natatory setæ on both pairs of antennæ. Very often, however, it is seen quite slowly creeping up the walls of the aquary, at times resting nearly immobile for a long while in the same place.

Occurrence. — The mud from which this species was raised, came from two different localities, viz., from a Lagoon near Racecower — 4 miles from Rockhampton, and from a Water Hole at Cattle Station — 20 miles from that town.

Order Copepoda.

Tribe Calanoidea.

Family **Diaptomidæ.**

Gen. **Diaptomus,** Westwood.

1. Diaptomus orientalis, (Brady).

(Pl. VII, figs 12—16; Pl. VIII, figs 1—4)

Diaptomus orientalis, Brady l. c., Linn. Soc. Journal. Zool. Vol. XIX, p. 296, Pl. XXXVII, figs. 21—26.

Specific Characters. — Form of body rather robust, anterior division in female oblong, tapered anteriorly, greatest width exceeding $^1/_3$ of the length, terminal lobes broad, with outer corner acute, inner obtuse. First caudal segment in female about as long as the remaining part of the tail, nearly cylindric, or but very little expanded at the base and without distinct lateral spines; the 3 succeeding segments coalesced. Furcal lobes rather broad in female, narrower in male. Anterior antennæ in female, when reflexed, reaching slightly beyond the 1st caudal segment; right antenna of male very much swollen in the middle, antepenultimate joint produced anteriorly to a strong, slightly upturned spiniform process. Last pair of legs in female with the inner ramus narrow cylindric, nearly as long as 1st joint of outer ramus and terminating with 2 slender spines; terminal joint of latter ramus rather small and provided with 2 unequal spines. Right leg of last pair in male robust, inner ramus very small, 2nd joint of outer ramus broadly ovate, spine of outer edge remote from the tip, apical claw sigmoid; left leg with outer ramus rather complicate in structure, having 2 digitiform processes and a rounded ciliate lamella. Colour of female more or less distinctly bluish green, anterior antennæ

with a conspicuous blue transverse band beyond the middle; that of male lighter, right anterior antenna and furcal lobes partly tinged with red. Length of adult female 1,80 mm, of male 1,55 mm.

Remarks. — This form, I believe, is identical with the Ceylon species described, though very insufficiently, by Brady under the above name. It is rather well defined from all the northern species with which I am acquainted. Whether any of the forms mentioned by King from Australia should be regarded as synonymous or not, I am unable to say, having unfortunately not had an opportunity to confer with that Volume of the Papers and Proceedings of the Roy. Soc. of Van Diemens Land.

Description of the female. — The length of the body in adult ovigerous specimens scarcely exceeds 1,80 mm, and hence this species is somewhat smaller than the wellknown European form, *D. castor* (Jurine), or about of the size of *D. denticornis*, Wierzejski (D. hamatus Lilljeb).

The general habitus (see Pl. VII, figs 12, 13) on the whole rather reminds of that of the last named species, The anterior division of the body (cephalothorax) is comparatively broad, the greatest width rather exceeding the third part of the length, and, as usual, is composed of 7 segments, the anterior and posterior of which, however, are less distinctly defined. Seen from above (fig. 12) this division exhibits a narrow oblong form and tapers rather more anteriorly than posteriorly, the front being narrowly rounded, whereas the posterior extremity is broadly subtruncate, with a deep median emargination. To either side of the latter, the posterior segment forms a broad, lamellar lobe, somewhat projecting laterally and exhibiting two corners, the outer of which juts out as a pointed process, whereas the inner is obtuse. Seen laterally (fig. 13) the dorsal part of this division appears rather vaulted, whereas the ventral is more flattened. The greatest height, being about in the middle, exactly equals the width as seen from above, and the anterior extremity appears narrower than the posterior. The front somewhat curves down-

wards between the insertion of the anterior antennæ and bears at the tip 2 exceedingly small tentacular appendages.

The posterior division of the body, or tail (see figs. 12, 13 and 16) does not attain the third part of the length of the anterior, and is also much narrower. It apparently consists only of 2 segments, besides the furcal lobes. The anterior of these segments is by far the larger and about equals the whole remaining part of the tail. It is nearly cylindrical in form, or but very little dilated in its basal part and does not exhibit any trace of the usual lateral projections; in their place only an extremely small and delicate bristle may be detected springing off from a shallow pit. Ventrally this segment exhibits near the base the usual obtuse protuberance containing the genital orifice (see fig. 13). The posterior segment comprises properly speaking no less than 3 originally distinct segments, which however in the adult female become completely fused together and are only indicated by a very slight folding of the lateral edges (see fig. 16). In the posterior part this terminal segment is a little dilated and somewhat flattened, with a slight median incision. Somewhat in front of the latter on the dorsal side a semilunar transverse fold occurs, covering over the anal orifice, and from either extremity of this fold a slightly curved line extends posteriorly, limiting the anal area. The furcal lobes are rather broad, subquadrangular, or slightly dilated towards the tip; their inner edge is finely ciliated, whereas the outer edge has a well-marked ledge in the middle. The caudal setæ are 6 in number on each furcal lobe. The innermost of these setæ is however rather small and extremely thin, originating somewhat dorsally. The 5 other setæ, on the other hand, are very large and densely plumose, diverging to each side and forming together with those on the other furcal lobe a broad fan, which constitutes a most powerful propelling organ. Of the setæ the 4 originate close together from the truncated extremity of the lobe, whereas the 5th is attached at some distance from the others to the ledge of the outer edge. All

these true natatory setæ are about of uniform length and exhibit a very short and indistinctly defined basal joint.

As to the structure of the several limbs, it agrees on the whole so closely with that found in other species of the genus, that I do not find it necessary to give any complete description, but only to speak of those parts, in which the specific differences generally are more obvious, viz., the anterior antennæ and the last pair of legs.

The anterior antennæ (see figs 12 and 13), as usual, form each a very elongate and slender stem, tapering to the extremity and consisting of 25 distinctly defined joints bearing short setæ especially along the anterior edge. During the movements of the animal, these antennæ are borne expanded to either side, nearly at right angles with the axis of the body. In the present species they exhibit however near the base a rather sharp curve, whence their outer straight part points somewhat obliquely posteriorly (see fig. 12). When reflexed along the sides of the body (see fig. 13), their tips reach a little beyond the 1st caudal segment. Thus their length somewhat exceeds that of the same organs in the European form, *D. castor* (Jurine), whereas they are shorter than in the other species mentioned above, *D. denticornis* Wierzejski, in which they reach the length of the whole body.

The last pair of legs (fig. 14) exhibit, as in the other species of the genus, an aspect very different from that of the 4 preceding pairs, which constitute the chief natatory organs of the animal. Notwithstanding this dissimilarity, it is not difficult to see, that they are composed of the same principal parts, though very much modified in structure. The basal part consists of 2 very distinctly defined and movably connected segments, generally forming with each other a more or less pronounced angle. The 1st of these segments is the larger and nearly globular in form; the 2nd is somewhat compressed and slightly dilated at the end, bearing at the outer corner a small bristle. To the extremity of the latter segment the 2 rami are attached, the outer of which is by far the larger and, at

first sight, appears as the immediate continuation of the basal part. This ramus is composed of 3 joints, the 1st rather large and of oblong oval form, without any setæ or spines, the 2nd rather smaller and inside prolonged to a strong, slightly curved and compressed, unguiform process, finely denticulate along the inner edge. The last joint (see fig. 15) is so very small as easily to escape attention, and is not distinctly defined from the preceding, on the outer side of which it appears to be located. It is nearly quadrangular in shape and provided at the tip with 2 unequal spines, the inner of which is rather elongate; at the base of this joint, moreover, a very small denticle occurs on the outer side. The inner ramus has the form of a very narrow, cylindric appendage issuing from the inner somewhat produced corner of the last segment of the basal part. It is uniarticulate and reaches nearly to the end of the 1st joint of the outer ramus: at the tip it is provided with 2 unequal spines, and along the inner edge, to some distance from the apex, a few cilia occur.

The body is in a living state of the animal rather pellucid, with a more or less distinct bluish green tinge, the anterior division being more deeply coloured than the posterior. On each of the anterior antennæ, moreover, a very conspicuous bright bluish transverse band is constantly found somewhat beyond the middle, or comprising the 16th to the 19th joint. The outer 6 joints contain in their interior an opaque whitish pigment.

Inner organs. — The body being rather transparent, several of the inner organs may be more or less distinctly traced through its walls. Thus the eye is easily distinguished lying within the frontal part of the body nearer the ventral face. It is rather small and of comparatively simple structure, exhibiting a dark red pigment, from either side of which a clair refracting body protrudes. Immediately behind the eye the cephalic ganglion is faintly traced. — The intestine may best be examined in a lateral position of the animal (fig. 13). Especially the anterior dilated division is very distinct by its generally bright yellowish green colour, whereas the posterior

narrowed part only becomes visible at times, when filled with faeces. — The heart is easily observable in the living animal, on account of its very rapid pulsations. It has the form of a rather small hyaline vesicle, located immediately beneath the dorsal skin at the junction between the 3rd and 4th segment. — The ovaries are at times very conspicuous, extending as they do through most part of the anterior division of the body. They constitute two rather large tubes, filled up by a dark green content, and being somewhat irregular flexuose, the anterior part lying in a higher level than the rest and close together, whereas the remaining part extends on either side nearer the ventral face, forming in each segment a slight lateral dilatation. The content of these tubes is on closer examination found to consist of rather large ova filled by an opaque granular yolk and generally arranged in a single series, whereas developing egg-cells do not occur. The true germinative layer is much more difficult to examine, on account of its great pellucidity. This part forms a single median body lying near the dorsal face, immediately in front of the heart, and best observed in a lateral aspect of the animal (fig. 13). It is found to be built up of numerous clair cellules of different size, all provided with a very conspicuous nucleus, in the inner of which a more opaque body, the nucleolus, is generally traced. The ova, after having attained maturity, are successively forced through the oviducts, which open on the ventral side of the first caudal segment at the tip of the rounded protuberance occurring there. By some secret the ova poured out from the body are held together and enclosed within a pellucid envelop, forming a large flattened sac adhering to the base of the tail (see figs 12, 13). They are arranged here with rather great regularity and generally pass their development in a very short time, the young escaping as small nauplii of the well-known imperfect appearance.

Description of the male. — The adult male (Pl. VIII, fig. 1) exhibits an aspect very unlike that of the female. It is also of somewhat smaller size, very little exceeding $1^1/_2$ mm. in length,

and has the body on the whole rather more slender. The anterior division of the body is nearly fusiform, considerably tapering both posteriorly and anteriorly. The lateral lobes of the last segment are much smaller than in the female, forming simple acute lappets not sharply defined at the base (see fig. 4). The tail (ibid.) is very slender, about half as long as the anterior division, narrow cylindric in form and almost of uniform breadth throughout. It is moreover composed of no less than 5 distinctly defined segments, besides the furcal lobes. Of these segments the 1st is very short, but a little broader than the others. The 4 succeeding segments gradually diminish in length in such manner, that the last is only half as long as the 2nd. The furcal lobes are relatively narrower than in the female and their setæ less divergent.

The anterior antennæ (see fig. 1) are relatively shorter than in the female and are also borne in a somewhat different manner, pointing a little obliquely forwards. Moreover they are very assymetrical, the right being modified in a peculiar manner to a prehensile organ, by the aid of which the female is grasped during copulation. This antenna (fig. 2) exhibits 3 well-defined sections. The proximal section successively tapers to the end and consists of about 13 or 14 joints, the outer of which are densely crowded together and connected by very oblique articulations so as to be very difficult to count exactly; some of the outer joints are armed anteriorly with spines instead of the usual setæ. The middle section is about of same length as the proximal but greatly dilated and of somewhat fusiform shape. It consists of 6 well defined joints, the 1st of which is the smallest and produced anteriorly to a strong spiniform process. A similar, though somewhat smaller spine is also found on the 3rd joint, and on each of the 2 outer joints an appressed acuminate process occurs, that of the last joint being connected with a highly chitinised and somewhat flexuous stripe. The inner cavity of this section is traversed by an exceedingly powerful muscle joining the terminal part. The latter, which is very movably articulated to the former section and admits by

the aid of the above mentioned muscle of being doubled upon the anterior face of this part, is somewhat shorter and much narrower, consisting of only 4 joints. The 2 first of these joints are by far the largest and about of equal length, whereas the 2 outer joints are rather small and of the same structure as in the female. The 2nd, or antepenultimate joint is produced at the end anteriorly to a strong, somewhat upturned spiniform process, and bears posteriorly 2 slender setæ.

The last pair of legs (fig. 3) considerably differ from those organs in the female and are also highly assymetrical, the right leg being much the larger. On both legs, however, the same principal parts as in the female may be easily distinguished, though rather much modified in structure. The 2nd segment of the basal part is in both legs considerably larger than the 1st, of oblong form and provided at the outer edge with a very delicate bristle. Of the two rami the inner is in both legs very small, forming a simple conical process without any armature. The outer ramus is very different in the two legs, that of the right being very large and powerful and consisting of 3 well-marked joints, the last of which has the form of a very slender claw. The 1st joint of this ramus is rather short, broader than it is long, and projects at the end exteriorly in a spiniform corner. The 2nd joint is rather compressed, of a broad oval form and armed with a strong spine attached to a well-marked ledge of the outer edge at some distance from the apex. The apical claw is very movably articulated to the extremity of the preceding joint and nearly as long as the whole leg. It is quite smooth, terminating in a sharp point, and exhibits a peculiar, almost sigmoid curvature. The outer ramus of the left leg is very small, scarcely as long as the outer segment of the basal part and does not exhibit any distinct segmentation. It is however rather complicate in structure, jutting out at the end into 2 digitiform and finely ciliated processes, besides, on the inner side, a thin rounded lamella, likewise finely ciliated at the edge. In connexion with the inner ramus, the terminal part of this leg constitutes a sort of complex chela, by the aid of

which the animal gets hold of the spermatophore to be attached to the genital opening of the female. The right leg, on the other hand, would seem to act as a prehensile organ assisting the right antennæ in seizing the female during copulation.

The body of the male is considerably paler than that of the female, with only a very faint bluish tinge and generally a light yellowish shade over the anterior division of the body, a little in front of the middle. The characteristic blue transverse bands on the anterior antennæ, observed in the female, are also in the male easily perceptible. Besides the right prehensile antenna is tinged with reddish or orange, especially at the edge of the dilated middle section, and a similar colour is often found also to occur on the furcal lobes. The caudal setæ, which in the female are quite pellucid, exhibit in the male more generally a bright bluish hue in their basal half.

Biological Observations. — I first observed this form on the 13th June 1886 in one of my aquaries prepared on the 23rd May same year. Only two specimens were at that time present, and, when becoming full-grown, they proved to be of different sexes. The male was seen in ardent pursuit of the female, and copulation soon took place, whereby a spermatophore had been attached to the genital orifice of the latter. After some days the female was found, besides, provided with a large egg-bag filled with numerous greenish eggs. The latter developed immediately to young, and before the close of the summer the aquary swarmed with numerous specimens, both males and females. Also in another aquary, prepared with mud from the same locality, this form was raised that summer, but here it did not multiply, disappearing after a short time completely. In none of these aquaries the present species reappeared the following summer.

In habits this form agrees with the other species of the genus. It is a very active animal, moving about in the water with quite an extraordinary speed, so that it is only with great difficulty caught by the dipping tube. At times however, it is found to keep its body suspended in the water for a long

while in nearly the same place, probably by the action of the 2nd pair of antennæ; but at the slightest disturbation it suddenly starts away so rapidly as hardly to be got sight of. The latter movement is effected by a powerful stroke of the 4 natatory legs, combined with a sudden bend of the tail, whereby the broad caudal fan acts with great force upon the water. Often is the said abrupt movement repeated at short intervals, and thereby the body thrown about through the water in long and rapid jerks. The attitude of the body during the movements is more generally an erect, the front extremity turning upwards, and the anterior antennæ extended to either side, the latter organs acting apparently as a sort of balancing poles. As usual, the males are more active than the females, especially when the latter are encumbered by their large egg-bags.

Occurrence. — The mud that yielded this species was collected on the 14th March 1885 from a Lagoon near Racecower — 4 miles from Rockhampton.

Distribution. — If my identification is correct, the range of the species is rather wide, extending to Ceylon, and in all probability also to the Indian continent.

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2. Diaptomus Lumholtzi, n. sp.

(Pl. VIII, figs 5—12)

Specific Characters. — Form of body much more slender than in the last species, anterior division in female narrow fusiform, greatest width not exceeding $^1/_3$ of the length, terminal lobes not very projecting, rounded, with two acute projections, both pointing outwards. First caudal segment in female very large, longer than the remaining part of the tail, and rather dilated at the base, with a distinct lateral spine on either side; 2nd segment well-defined from the 2 succeeding which are coalesced; furcal lobes short and broad. Anterior antennæ of female very slender and elongate, reaching far beyond the caudal fan;

right antenna of male less dilated in the middle, antepenultimate joint produced to a spiniform process, as in the preceding species. Last pair of legs in female with inner ramus very short, not reaching beyond the middle of the 1st joint of outer ramus, apex acuminate without spines; claw-like expansion of 2nd joint of outer ramus short and broad, not attaining the length of the preceding joint, terminal joint extremely small and rudimentary, knob-shaped with but a single apical spine. Right leg of last pair in male rather slender, inner ramus broad, lamelliform, reaching beyond 1st joint of outer ramus, and having the inner edge serrulate, 2nd joint of outer ramus narrow oblong, spine of outer edge close to the apex, terminal claw evenly curved. Left leg with inner ramus simple conic, outer ramus without any terminal lamella. Body very pellucid and almost colourless. Length of adult female 1,50 mm.

Remarks. — This species, which I regard as new, would seem to be nearest related to the northern form, *D. gracilis*, G. O. Sars. It is however well distinguished by the form of the terminal lobes of the last pedigerous segment in the female, as also by the structure in both sexes of the last pair of legs, finally by the structure of the right anterior antennæ of the male.

Description of the female. — The length of the adult ovigerous female is 1 1/2 mm, and hence the present species is rather smaller than the preceding.

The form of the body (see Pl. VIII, figs 5, 6,) is much more slender and rather resembles that of the northern species, *D. gracilis* G. O. Sars. Seen from above (fig. 6) the anterior division of the body exhibits a rather narrow oblong, or almost fusiform shape, the greatest width not exceeding the third part of the length. As with the preceding species the foremost part of this division is much more tapered than the posterior and terminates with a narrowly rounded front. The lateral lobes of the last segment (see fig. 10) are relatively smaller and less expanded than in that species and of a rounded form, exhibiting two acute projections, both pointing outwards. Seen

laterally (fig. 5) the dorsal face of this division appears far less vaulted than in *D. orientalis* and more evenly tapering anteriorly. The tail (fig. 10) is rather short, scarcely exceeding 1/3 of the length of the anterior division. Its 1st segment is comparatively very large, considerably exceeding the remaining part in length, and has the distal part nearly cylindric, whereas the proximal part is rather expanded and provided on either side with a small but distinct spine pointing straight outwards. The 2nd segment, though very short, is rather well defined from the two succeeding, which are fused together and only indicated by a slight indentation of the lateral edges. The furcal lobes are still somewhat shorter than in the preceding species and very little longer than they are broad, for the rest nearly agreeing in structure with those in *D. orientalis*.

The anterior antennæ (see figs 5, 6) are exceedingly slender and elongate, even considerably longer than the whole body, and taper successively to the end. They are composed of the same number of joints as in the preceding species, but towards the end the joints become relatively much more slender (see fig. 7), and also the setæ attached to them are considerably longer than in that species. During the movements of the animal these organs are borne in a similar manner as in *D. orientalis*, being rather abruptly curved at the base, whereby the remaining part points somewhat obliquely posteriorly. When reflexed along the sides of the body (see fig. 5) they considerably extend even beyond the tips of the caudal setæ.

The last pair of legs (fig. 8), though of a similar structure as in the preceding species, are comparatively smaller, and both rami exhibit moreover well-marked differences. Thus the inner ramus is very short, not reaching beyond the middle of the 1st joint of the outer ramus, and exhibits a simple conical form, without any distinct apical spines. The unguiform expansion of the 2nd joint of the outer ramus is relatively shorter and broader than in *D. orientalis*, and does not attain the length of the preceding joint. Finally the terminal joint (see fig. 9) is

extremely small and rudimentary, knob-shaped, and only provided with a single apical spine.

The body is in a living state of the animal highly pellucid and almost colourless, with only a very faint bluish or greenish tinge. The ova contained in the rather large egg-bag are also of a much paler greenish hue than in the preceding species. Within the anterior division of the body several rather large and highly refracting oil-globules are seen rather regularly arranged. Similar oil-glubules disposed in the same manner are also found in the preceding species, but by far not so large and conspicuous. Their destination would seem to be that of diminishing the specific weight of the body and thus of facilitating the swimming motions of the animal.

Description of the male. — In its outer habitus the male would seem to exhibit quite analogous differences from the female, as described in the preceding species.

The right anterior antenna (fig. 11.) exhibits the same 3 divisions, but the middle one is far less swollen, and both this and the terminal section are much more elongate than in the male of *D. orientalis*. As in this species the antepenultimate joint is produced at the end anteriorly to a spiniform, slightly upturned process.

The last pair of legs (fig. 12), though of a type quite similar to those in the male of the preceding species, yet exhibit well-marked differences in their details. Thus the right leg is much more slender and has both rami rather deviating in shape from those in the said species. The inner ramus of this leg is relatively much larger, reaching considerably beyond the 1st joint of the other ramus, and has the form of an oblong lamella, somewhat expanded towards the end and finely serrulate at the inner edge. The 1st joint of the outer ramus is rather narrow, nearly twice as long as it is broad and wants the spiniform outer corner found in the preceding species. The 2nd joint likewise is much more slender, narrow oblong in form and nearly of uniform breadth throughout. It is moreover somewhat incurved and has the

spine of the outer edge located close to the apex. The terminal claw, finally, is quite regularly curved, not as in the preceding species sigmoid. The left leg, as usual, is much shorter than the right and has the inner ramus rather small and of simple conical form. The outer ramus is less complicate in structure than that of the male of *D. orientalis*, exhibiting at the end two slightly projecting angles, between which a small seta is attached; but of the peculiar ciliated lamella found in the preceding species, no trace can be detected.

Biological Observations. — Of this elegant species 2 specimens, male and female, were observed in the first days of July 1884 in one of my aquaries, a rather small glass-vessel, prepared with mud from the Gracemere Lagoon sent by Mr. Lumholtz. On the 9th July the female specimen was fished up by the aid of a dipping tube and submitted to a closer examination, a coloured drawing being made from life. It was then provided with a large egg-bag containing numerous pale greenish ova, and on removing the bag two spermatophores were besides found adhering to the genital orifice (see fig. 5). The male specimen I then failed to catch on account of its exceedingly rapid movements, and some days later it was no more to be found. As no other specimens of this form appeared subsequently, it seemed that my anatomical investigations of this species, restricted as they were only to the female sex, should remain incomplete. On examining, however, some time later, the stomachal contents of some small fresh water fishes caught in the same Lagoon and sent to our Museum, I fortunately detected numerous remains of this form, comprising both females and males. A few of the male specimens were even in a comparatively well preserved condition, so as to allow a rather complete dissection and examination of the several limbs, whereby the specific differences could be ascertained also as regards the male sex. The figures 11 and 12 here given have been made from such dissections.

In habits the species perfectly agrees with the preceding, though the animal is perhaps still more active in its movements.

Occurrence. — The only locality as yet ascertained for the present species is the Gracemere Lagoon, where, to judge from the numerous remains found in the stomach of fishes from that locality, it would seem at times to occur in great profusion.

Explanation of the Plates.

Plate I.

Figs. 1—4 **Cyprinotus dentato-marginatus,** (Baird).

Fig. 1. Adult female, from right side, magnified 46 diameters.
„ 2. Same, from above.
„ 3. Adult male, from left side.
„ 4. A very young specimen, from left side, magnified 100 diameters.

Figs 5—6, **Cyprinotus cingalensis,** Brady.

Fig. 5. Adult female, from right side, magnified 46 diameters.
„ 6. Same, from above.

Figs 7—8, **Stenocypris malcolmsonii,** (Brady).

Fig. 7. Adult female, from right side, magnified 46 diameters.
„ 8. Same, from below.

Plate II.

Figs 1—2, **Herpetocypris stanleyana,** (King).

Fig. 1. Adult female, from left side, magnified 46 diameters.
„ 2. Same, from above.

Figs 3—4, **Herpetocypris viridula,** (Brady).

Fig. 3. Adult female, from right side, magnified 46 diameters.
„ 4. Same, from above.

Figs 5—8, **Ilyocypris australiensis**, n. sp.

Fig. 5. Adult female, from left side, magnified 61 diameters.
„ 6. Same, from above.
„ 7. Adult male, from left side.
„ 8. Same, from above.

Figs 9—10, **Cypridopsis globulus**, n. sp.

Fig. 9. Adult female, from left side, magnified 61 diameters.
„ 10. Same, from above.

Plate III.

Figs 1—11, **Cyprinotus dentato-marginatus**, (Baird); female.

Fig. 1. Antenna of 1st pair, magnified 105 diameters.
„ 2. Antenna of 2nd pair.
„ 3. Anterior and posterior lips together with the adjoining part of the sternal shield, from left side.
„ 4. Posterior lip, from the anterior face.
„ 5. Mandible with palp.
„ 6. Maxilla of 1st pair.
„ 7. Maxilla of 2nd pair.
„ 8. Leg of 1st pair.
„ 9. Leg of 2nd pair.
„ 10. Posterior part of body, from left side, magnified 89 diameters; *u* caudal rami, *r* seminal receptacles.
„ 11. Posterior half of right valve, from inner side, magnified 63 diameters, and exhibiting the coecal appendage of the intestine and the ovary.

Fig. 12 **Cyprinotus cingalensis**, Brady.

Right valve of adult female with enclosed animal, viewed from the inner face; magnified 63 diameters.

Plate IV.

Cyprinotus dentato-marginatus, (Baird).

Fig. 1. Left valve of adult male, with enclosed animal, viewed from inner face; magnified 89 diameters.

Fig. 2. Right valve of same specimen, viewed from the inner face, exhibiting the testicular tubes in situ.
„ 3. Marginal part from anterior extremity of same valve, magnified 120 diameters.
„ 4. Right maxilla of 2nd pair, magnified 120 diameters.
„ 5. Left maxilla of 2nd pair.
„ 6. Right copulative organ (c) together with the corresponding vas deferens (v) and ejaculatory tube (x), viewed laterally.
„ 7. Both copulative organs, expanded and viewed from the upper face, magnified 160 diameters.
„ 8. Upper extremity of an ejaculatory tube, showing the coronula, end view; magnified 390 diameters.
„ 9. Portion of the ejaculatory tube, containing 5 segments, lateral view; same enlargement.
„ 10. Extremity of a testicular tube from a specimen quite young, showing the regularly disposed spermatocysts; magnified 160 diameters.
„ 11. Spermatocysts from the testicular tubes of an adult male; same enlargement.
„ 12. Posterior extremity of a fully developed spermatozoon, magnified 740 diameters.
„ 13. Anterior extremity of same spermatozoon.
„ 14. Portion from the middle part of a spermatozoon, magnified 2000 diameters.

Plate V.

Figs 1—4, **Stenocypris malcolmsonii**, (Brady).

Fig. 1. Left valve of adult female with enclosed animal, viewed from inner face; magnified 61 diameters.
„ 2. Masticatory part of a maxilla of 1st pair, magnified 110 diameters.
„ 3. Right caudal ramus, lateral view; same enlargement.
„ 4. Left caudal ramus from same individual.

Figs 5—7, **Herpetocypris stanleyana**, (King).

Fig. 5. Right valve of adult female with enclosed animal, viewed from inner face; magnified 61 diameters.

„ 6. Masticatory part of a maxilla of 1st pair, magnified 110 diameters.

„ 7. Caudal ramus; same enlargement.

Figs 8—11, **Herpetocypris viridula**, (Brady).

Fig. 8. Left valve of adult female with enclosed animal, viewed from inner face; magnified 63 diameters.

„ 9. Sensory appendage from an upper antenna; magnified 300 diameters.

„ 10. Masticatory part of a maxilla of 1st pair; magnified 110 diameters.

„ 11. Caudal ramus; same enlargement.

Plate VI.

Ilyocypris australiensis, n. sp.

Fig. 1. Right valve of adult female with enclosed animal, viewed from inner face; magnified 89 diameters.

„ 2. Portion of the valve, viewed from inner face, showing the shell-structure.

„ 3. Outer part of an antenna of 1st pair, magnified 120 diameters.

„ 4. Antenna of 2nd pair.

„ 5. Mandible with palp.

„ 6. Maxilla of 1st pair.

„ 7. Maxilla of 2nd pair.

„ 8. Leg af 1st pair.

„ 9. Leg of 2nd pair.

„ 10. Caudal ramus.

„ 11. Left valve of adult male with enclosed animal, viewed from inner face; magnified 89 diameters.

„ 12. Maxilla of 2nd pair from same specimen; magnified 120 diameters.

Fig. 13. Copulative organs expanded and viewed from upper face; same enlargement.

„ 14. Ejaculatory tube with part of vas deferens, lateral view.

Plate VII.

Figs 1—11, **Cypridopsis globulus**, n. sp.

Fig. 1. Left valve of adult female with enclosed animal, viewed from inner face; magnified 110 diameters.

„ 2. Eye from above, magnified 160 diameters.

„ 3. Antenna of 1st pair.

„ 4. Antenna of 2nd pair.

„ 5. Mandible with palp.

„ 6. Masticatory part of a maxilla of 1st pair.

„ 7. Maxilla of 2nd pair.

„ 8. Leg of 1st pair.

„ 9. Leg of 2nd pair.

„ 10. Right caudal ramus, lateral view.

„ 11. Both caudal rami, from below.

Figs 12—16, **Diaptomus orientalis**, Brady; female.

Fig. 12. Adult ovigerous female, from above; magnified 46 diameters.

„ 13. Same from left side, with the anterior antennnæ reflexed.

„ 14. Leg of last pair; magnified 120 diameters.

„ 15. Extremity of outer ramus of same leg; magnified 300 diameters.

„ 16. Tail together with adjoining part of anterior division of body, from above, magnified 89 diameters.

Plate VIII.

Figs 1—4, **Diaptomus orientalis**, Brady; male.

Fig. 1. Adult male, from above; magnified 46 diameters.

„ 2. Right prehensile anterior antenna; magnified 89 diameters.

„ 3. Last pair of legs, from the posterior face; magnified 120 diameters.

„ 4. Tail with adjoining part of anterior division of body, from above; magnified 89 diameters.

Figs 5—12, **Diaptomus Lumholtzi**, n. sp.

Fig. 5. Adult female, from right side, with the anterior antennæ reflexed and 2 spermatophores adhering to the genital orifice; magnified 46 diameters.

„ 6. Same, from above, with egg-bag and the anterior antennæ expanded.

„ 7. Terminal part of an antenna of 1st pair, magnified 80 diameters.

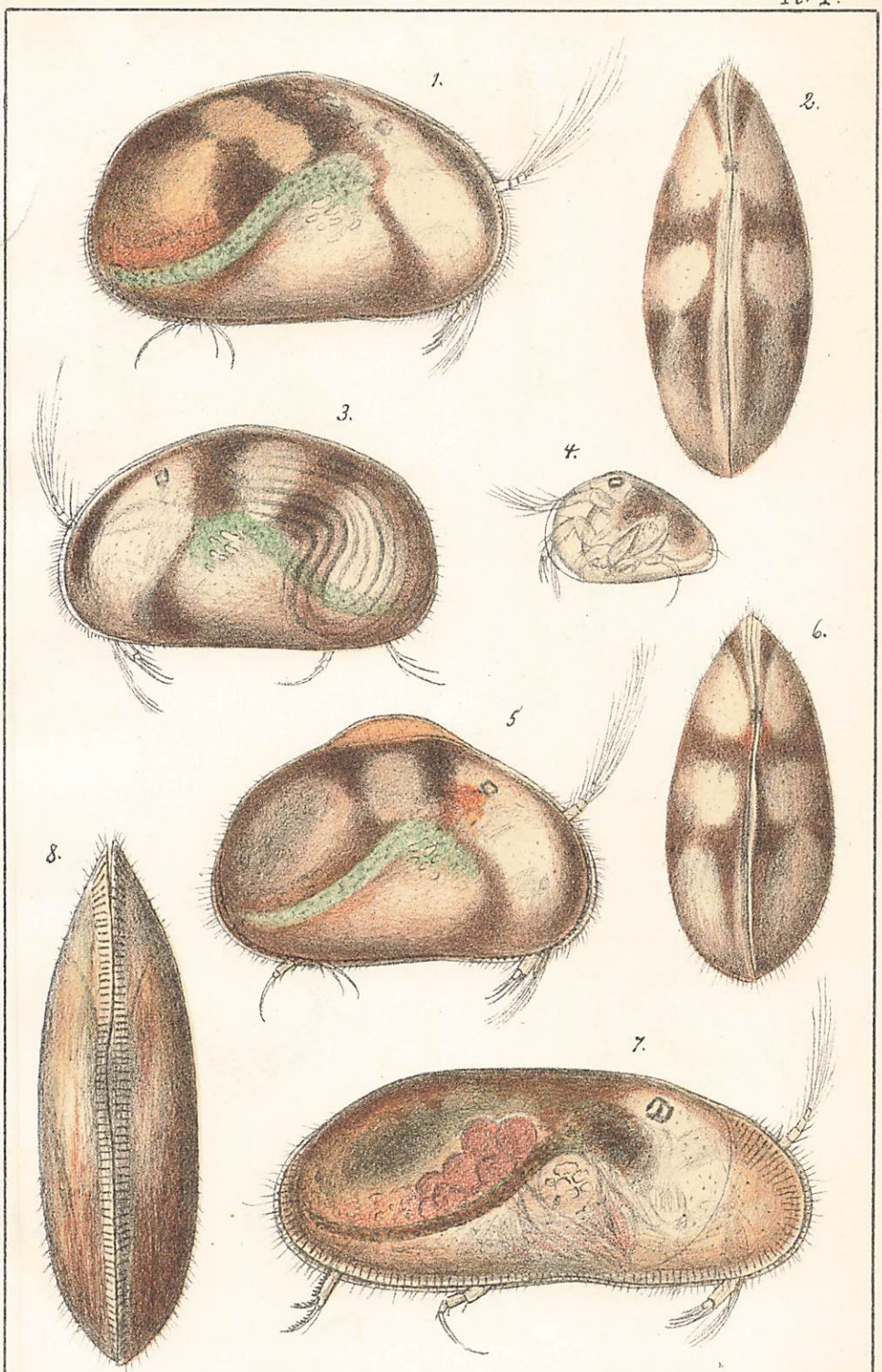
„ 8. Leg of last pair, magnified 160 diameters.

„ 9. Extremity of same leg, magnified 300 diameters.

„ 10. Tail with adjoining part of anterior division of body, from above; magnified 110 diameters.

„ 11. Right prehensile anterior antenna of male (the basal part is omitted); magnified 120 diameters.

„ 12. Last pair of legs of same, from posterior face; magnified 160 diameters.



G. O. Sars autogr.

M. Lynge lith. Anst. Christiania.

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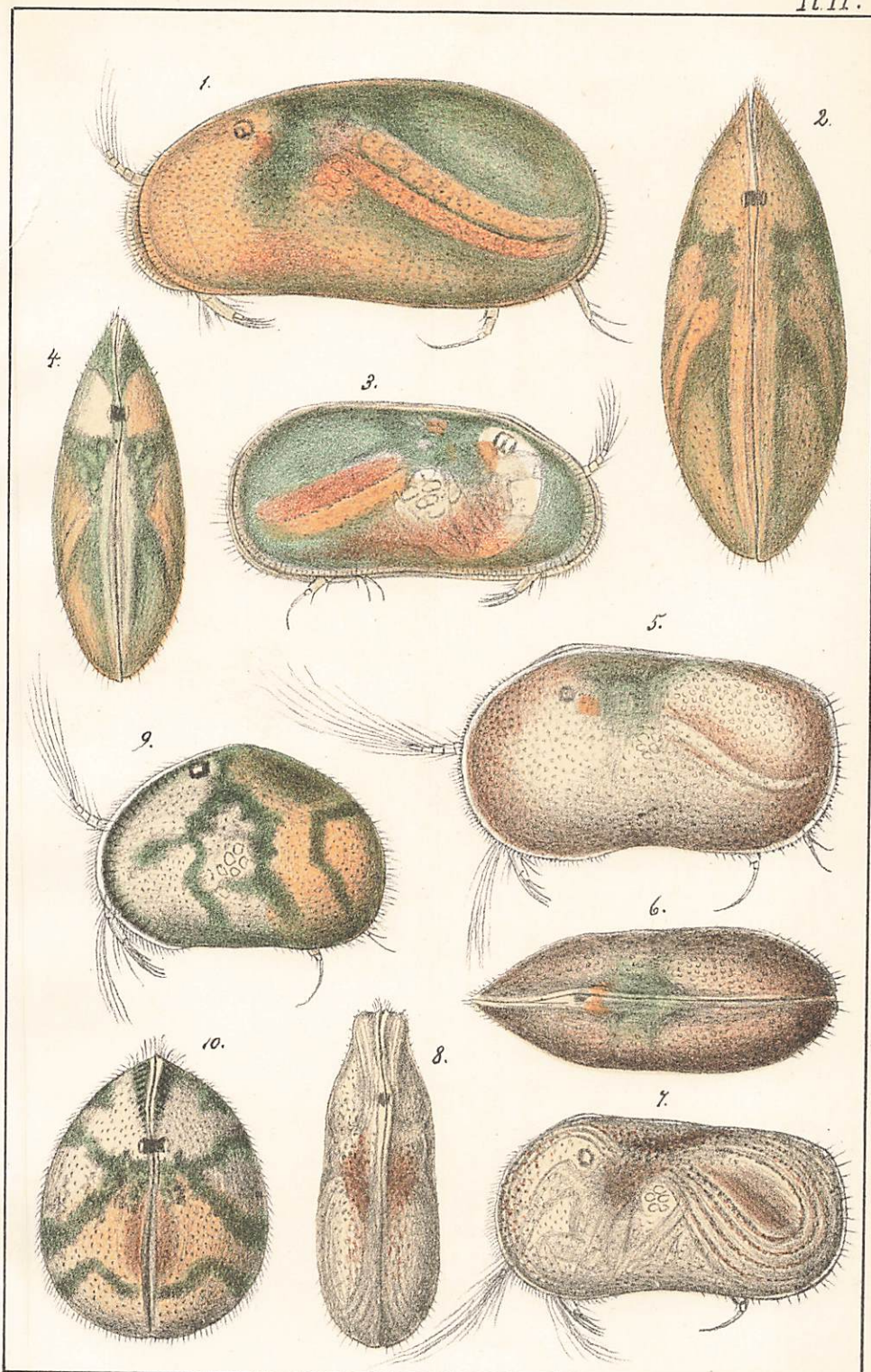
Figs 5–6, " cingalensis, Brady.
Figs 7–8, Stenocypris malcolmsoni, (Brady).



G. O. Sars autogr.

Figs 1-2, Herpetocypris stanleyana, (King).
Figs 3-4, " viridula, (Brady).
Figs 5-8, Ilyocypris australiensis, n. sp.
Figs 9-10, Cypridopsis globulus, n. sp.

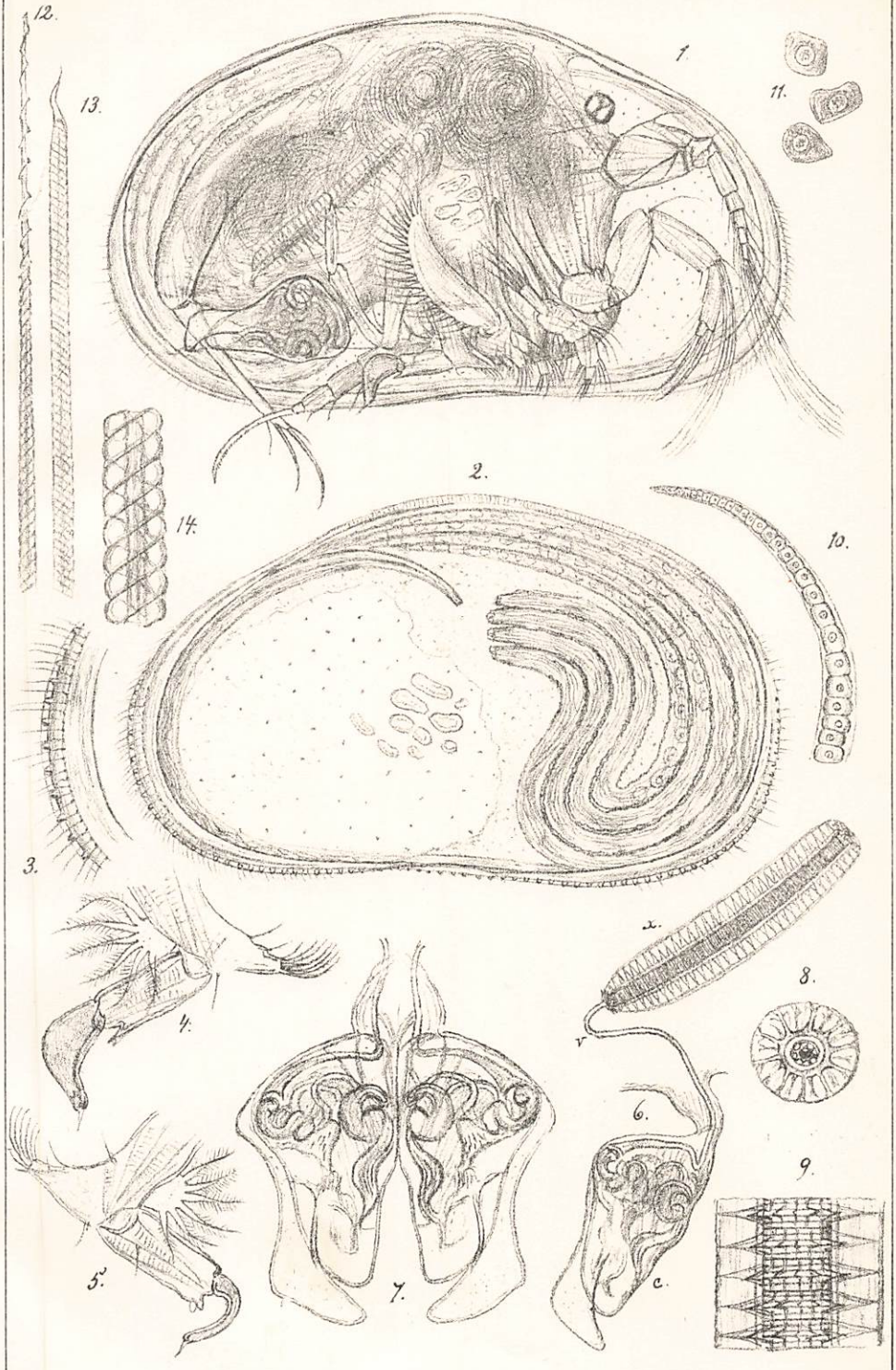
M. Lynge lith. Anst. Christiania.

G. O. Sars autogr.

M. Iyng. lith. Anst. Christiania.

Figs 1–11, Cyprinotus dentato-marginatus, (Baird) ♀.

Fig. 12, " cingalensis, Brady ♀.



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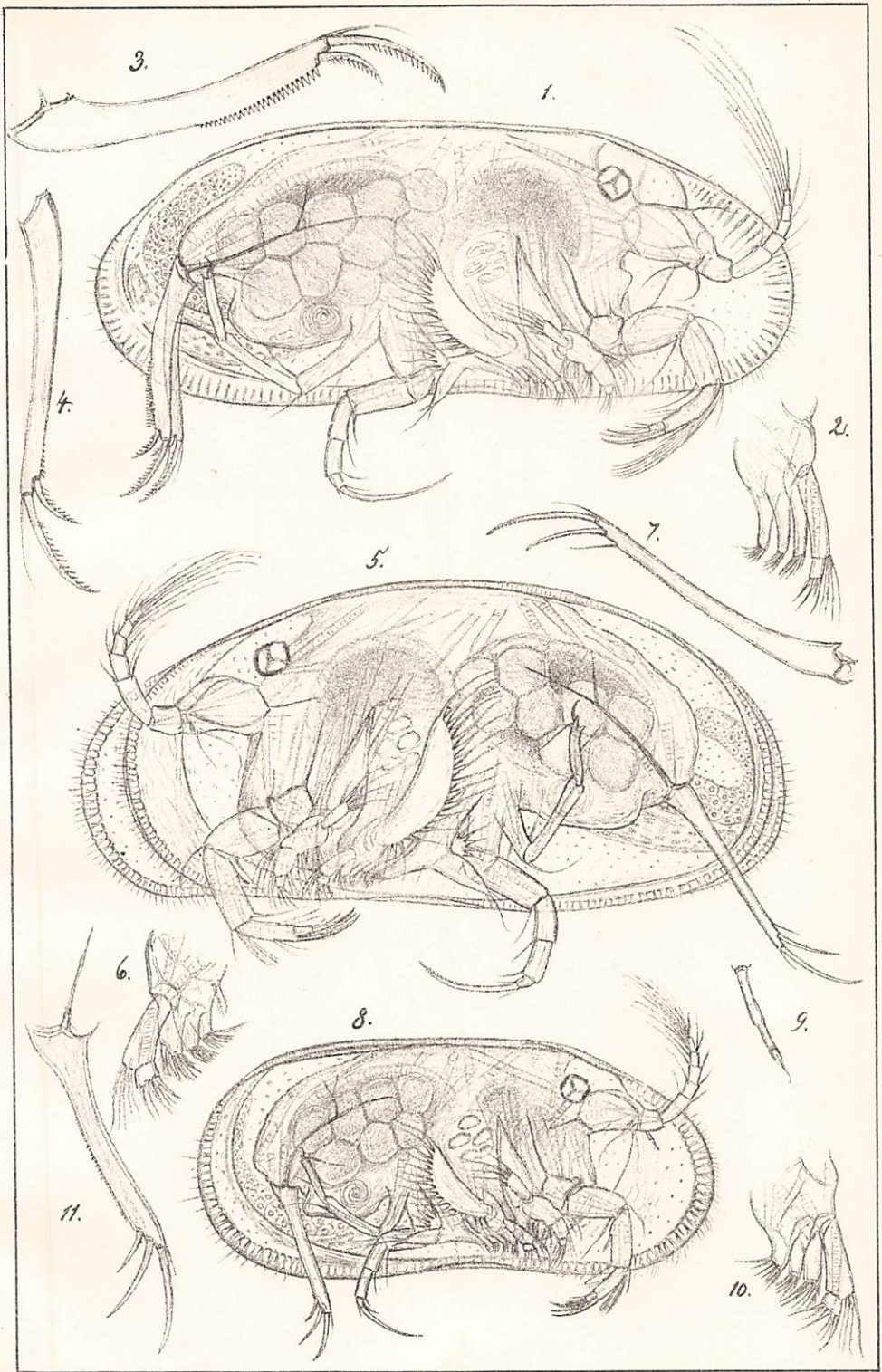
M. Lyngs lith. Anst. Christiania.

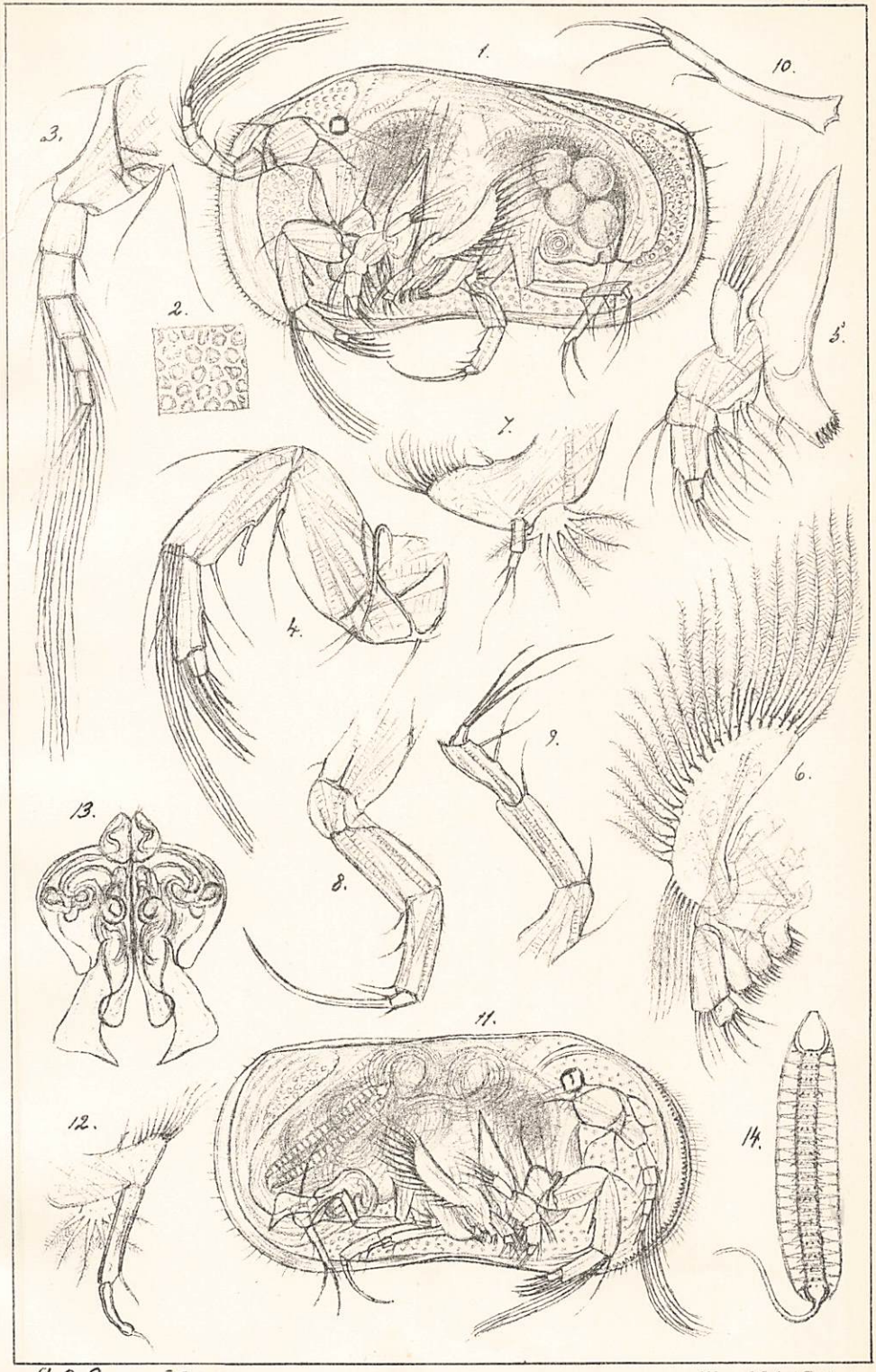
Cyprinotus dentato-marginatus, (Baird). ♀.



G. O. Sars autogr.

M. Lyng: lith. Anst. Christiania

Figs 1–4, Stenocypris malcolmsoni, (Brady).
Figs 5–7, Herpetocypris stanleyana, (King).
Figs 8–11, " " viridula, (Brady).



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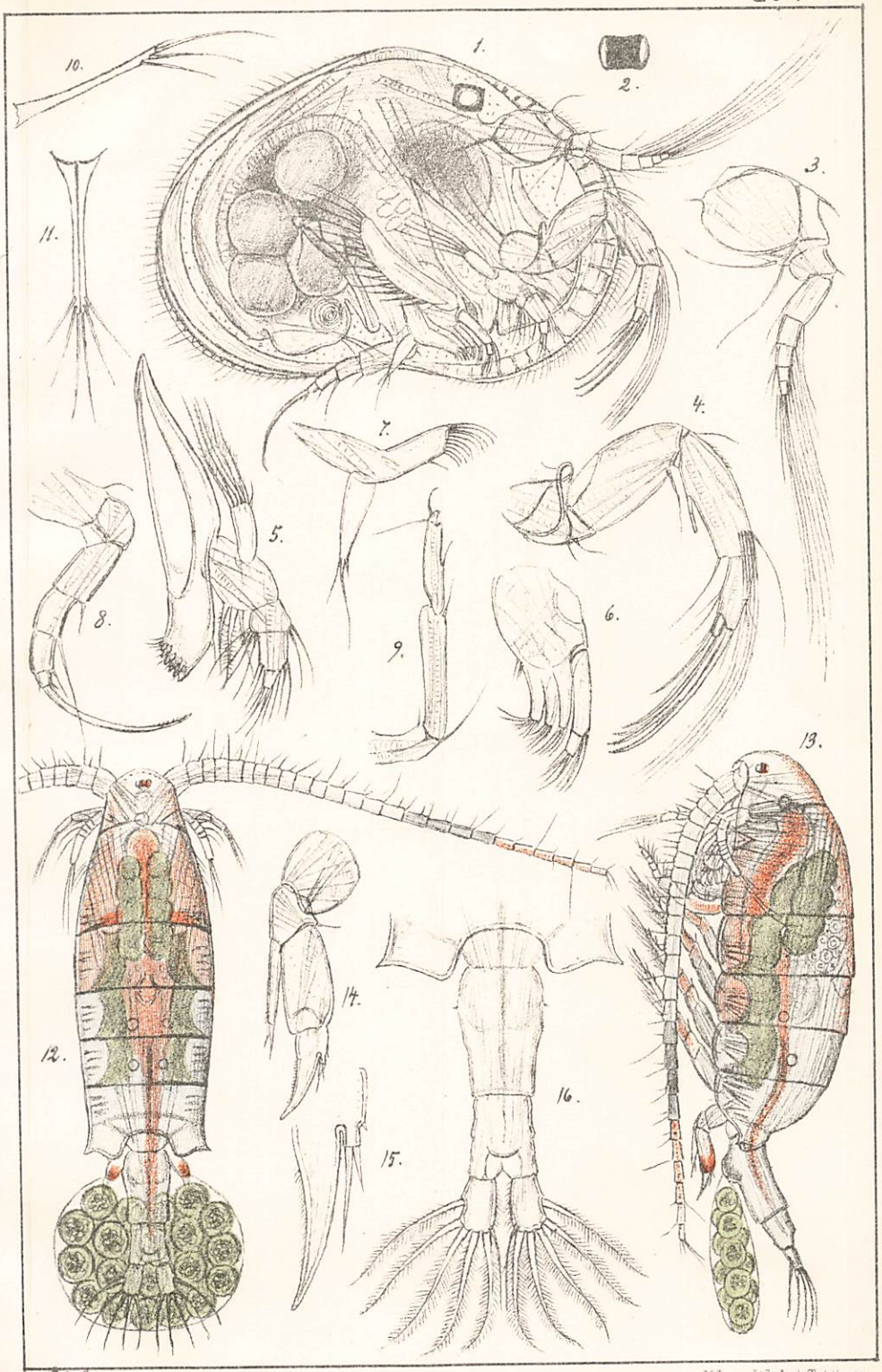
M. Iyngt lith. Anst. Christiania.

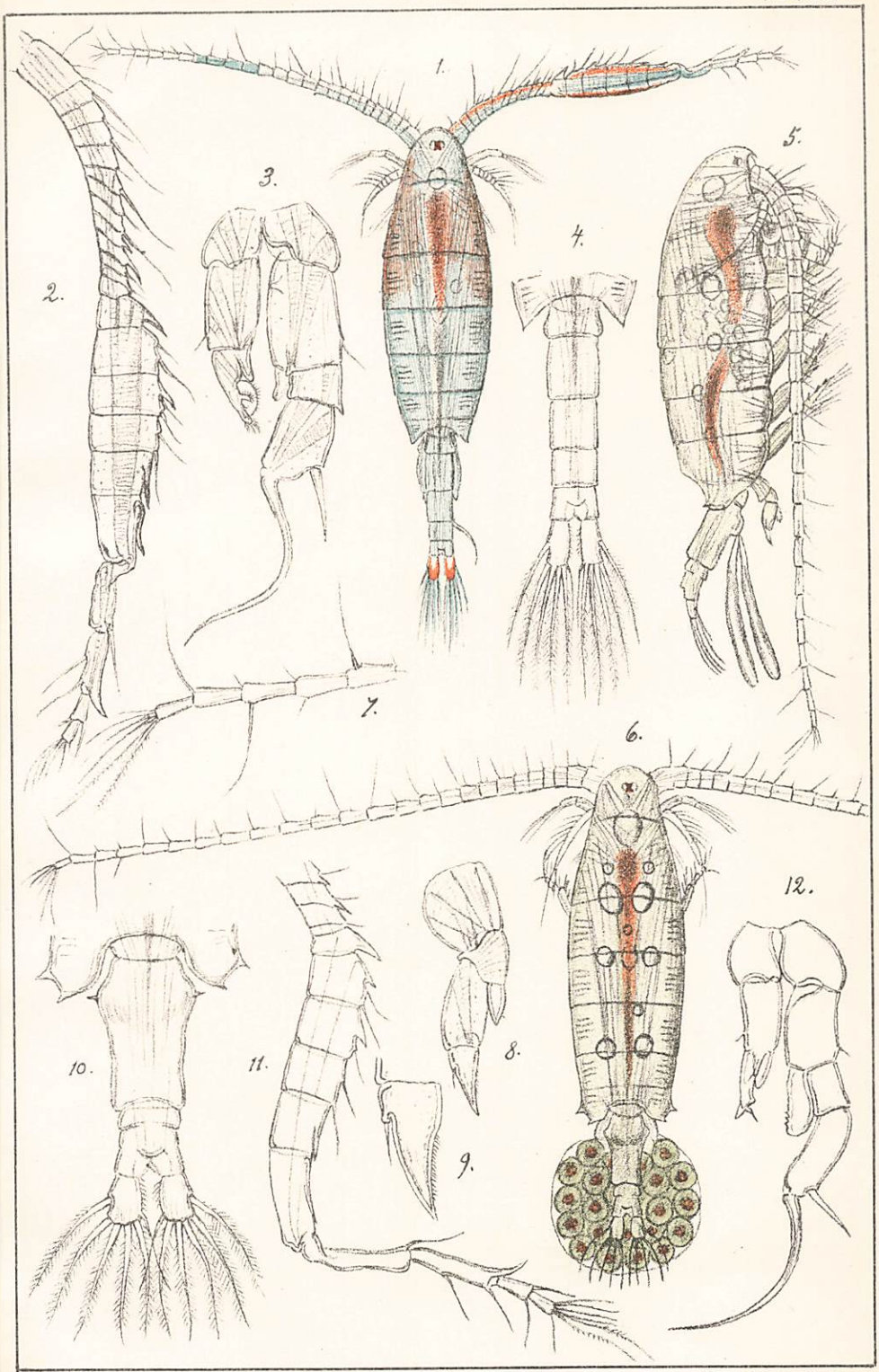
Ilyocypris australiensis, n. sp.



G.O. Sars autogr.

M. Lynge lith. Anst. Christiania.

Figs 1–11, Cypridopsis globulus, n. sp.
Figs 12–16, Diaptomus orientalis, Brady. ♀.



G. O. Sars autogr.

M. Lynge Ith. Anst. Christiania.

Figs 1–4, Diaptomus orientalis, Brady ♂.
Figs 5–12, Diaptomus Lumholtzi, n. sp. ♀ & ♂.