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THE FRESHWATER OSTRACODS (CRUSTACEA: OSTRACODA) OF INDIA

BY

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Introduction

The systematics of freshwater Ostracoda has been studied in detail in relatively few areas of the world. These are mainly in the temperate zone and tropical freshwater ostracods are poorly known. The present study is therefore largely devoted to the systematics of the freshwater ostracoda of the Indian subcontinent. It is based on a larger number of collections than has hitherto been made for the region by any previous worker except Hartmann (1964). The taxonomy of all taxa of Ostracoda known from India is brought up to date and their status critically evaluated. A provisional key is given to the species. Short notes are given on their distribution.

Freshwater ostracods are common in India. Most species are benthonic. Some occur among aquatic vegetation and algal mats, and a few are planktonic. The role of freshwater ostracods in an aquatic ecosystem is well established (Hoff, 1942). They can form an important component in the food of aquatic macroorganisms (Forbes, 1888, Kornicker and Sohn, 1971), serve as ecological indicators (Puri, 1964), act as secondary hosts for a number of fish parasites (Hoff, 1942; Hoffman, 1967), and are found to be epizoic or parasitic in the gills of various species of freshwater crayfishes (Rioja, 1942, 1943, 1949, 1951, 1955; Hoff, 1943; Hobbs, 1967; Hobbs and Walton, 1967; Hobbs and Hobbs, 1970). Moreover, in the geologic past these tiny crustaceans produced an impressive record (Kesling, 1965) and are used as stratigraphic markers (Moore, 1961a; Howe, 1969). The importance of freshwater ostracods in palaeoecological determinations has been proved beyond doubt, (Benson and MacDonald, 1963; Delorme, 1969, 1971a, 1971b; Swain *et al.* 1971; Szczechura, 1971; Stout, 1974). Despite many limnological investigations in India, the freshwater ostracods have remained, to quote Kesling (1956), 'neglected little crustaceans.'

Howe (1969) aptly pointed out that "ecology is only as good as taxonomy permits." This is remarkably true in the case of freshwater ostracods of India. A review of earlier work on the ostracod fauna of India shows a paucity of taxonomic information, and hence their ecology in India remains practically unknown. Baird (1859) described three species of freshwater ostracods, *Cypris subglobosa*, *Cypris cylindrica* var. *major* and *Cypris marginatodentata* from Nagpur, and Gurney (1907) recorded *Stenocypris malcolmsoni* from Lower Bengal. Klie (1927) reported two new species, *Stenocypris sewelli* and *Cypridopsis horai* from Punjab, Darjeeling and Cheerapunji, and recorded *Cypria javana* from Kerala. Arora (1931), as part of a study on the entomostracan fauna of Lahore (now in Pakistan), described ten species of freshwater ostracods of which four were new to Science. Hartmann (1964) in his extensive work on 'Asiatische Ostracoden' dealt with 25 species, inclusive of two new genera, 13 new species and one new subspecies. Deb (1972) described *Stenocypris biswasi* and *Stenocypris krishnakantai*, from Rajasthan and Maharashtra, respectively. Victor and Michael (1975) described nine new species and Michael and Victor (1975) redescribed two little known ostracods from Southern India (Fig. 1).

Apart from this taxonomic literature, there are also passing references to ostracods in some ecological papers where identification was carried to the generic level (Ganapathi, 1950; Victor, 1973). However, most of the ecological literature tends to refer to these organisms under the blanket term 'ostracods'.

It is worthwhile to mention some of the difficulties encountered in working with this group in India. The meagre and scattered literature appears to be the primary problem. The earlier descriptions are inadequate and often misleading. Hartmann's (1964) reliable German monograph is not readily available, and a key to the species is still lacking.

The present study was undertaken with a view of clarifying this situation. A large number of collections from Southern India and a few from Northern India are analysed and the descriptions of all the species obtained are presented. It is realised that in a country as large and as ecologically diverse as India, a large area is yet to be covered. However, a compilation of all the earlier work is attempted. Though several previously described species were not obtained, their taxonomic validity is carefully scrutinised and a provisional key is constructed for 56 valid species. All the localities of previous work are taken into account to provide an initial understanding of freshwater ostracod distribution in India. In toto the present study hopes to provide a basic guide to the systematics of freshwater ostracods, which may be of use to those who carry out Indian freshwater research and may eventually encounter these tiny little 'seed shrimps'

Materials and Methods

Description of the study area

The mainland of India is almost 3800 km from west to east from Long. 61° E to nearly 100° E, and about 3000 km from north to south. The southernmost point of India is 8° north of the Equator and the Tropic of Cancer cuts the country approximately in half. The northern extremity reaches nearly to Lat. 37° N.

For the purpose of presenting the current status of freshwater ostracod systematics and distribution, records made by previous workers were included. The location of both previous and present records are given in Fig. 1.

Materials

We made 125 collections from Southern India during the period 1973–1975. Apart from these the ostracod material used in the present study was obtained from 211 samples collected by Mrs. Anne John, Fisheries College, Mangalore, India; Dr. D. G. Frey, Indiana University, Bloomington, U.S.A.; Dr. Y Radhakrishna, A.U.P. Centre, Guntur, India; and Dr. M. Rajendran, Government Arts College, Coimbatore, India.

Methods

Collections made by others, which were for small invertebrates in general, were made using bolting silk plankton nets No. 10 or No. 25 (154 μ and 67 μ). Samples were immediately fixed and preserved in 10% formalin. The ostracods were separated and transferred to vials containing 70% methanol.

Our own collections were for ostracods alone. A cone-shaped plankton net was used and the methods of collection and preservation varied from the general collections. Several sweeps were made just above the substratum of the habitat and also among weeds. The bottom of the habitat was also disturbed to ensure the collection of ostracods living in the upper-most layer of the substratum. The samples were then transferred to large glass or polythene containers with a small quantity of water.

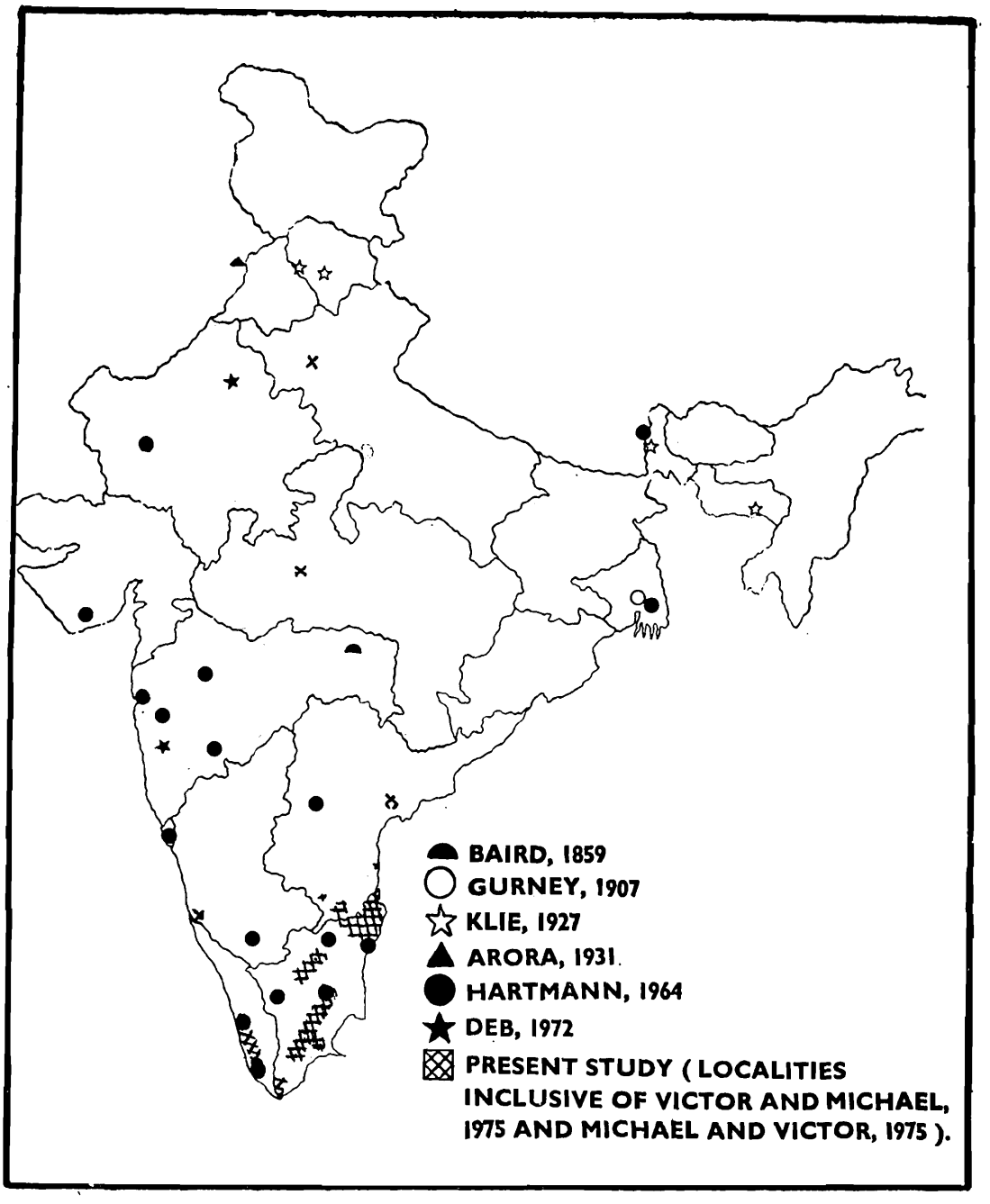


Fig. 1. Map showing the localities of previous and present collections.

Small quantities of absolute alcohol were slowly added to these samples at intervals, over a period of 20 to 30 minutes. The ostracods subjected to this procedure died with their valves open. Another suitable method was adding a few drops of concentrated Chloretone solution to a fresh collection. This chemical relaxed all the muscles, and the valves of ostracods opened, exposing the soft parts. This made dissection easier and the valves could be separated without damage.

These collections were later filtered through Tyler sieves of different mesh sizes. This procedure separated both large and small ostracods along with coarse debris and the sieves were carefully washed into Petri dishes and the ostracods were separated under a stereoscopic dissecting microscope, using a pair of dissection needles and micropipettes. 70% methanol was used as the preservative.

For dissections, the ostracods were removed to a glass cavity dish containing 70% alcohol and the valves were separated under a dissecting microscope using a pair of fine tungsten needles set in metal holders. The valves were mounted on micropalaeontological slides. However, this procedure was not

feasible for specimens which had been preserved for a long time, since the valves tended to curl up as soon as they were removed from the alcohol. In these cases the valves were permanently stored in 70% methanol.

The soft parts were transferred to a clean glass slide, and the appendages were teased out in a drop of polyvinyl lactophenol, stained with lignin pink (Edward Gurr Lond.). The appendages were arranged in the desired positions and the preparation was allowed to dry for 10 to 12 hours. Whenever a quick preparation was needed, the slides were placed on a hot plate to minimise the drying period. Then a coverslip was placed over the dissection using a fresh drop of mountant. This was necessary, since otherwise the appendages rotated to unsuitable positions, making study difficult, when a coverslip was placed over a fresh dissection.

Identification was carried out under higher magnifications (10×25 or 10×40) and the figures were drawn using Camera lucida.

Taxonomy

I. The Generalised Structure of Recent Ostracods

Detailed accounts of the morphology, anatomy and behaviour of various ostracod species were given by Claus (1896); Bernecker (1909); Bergold (1910); Hanström (1924); Klie (1926); Hoff (1942); Kesling (1951b; 1965); Howe *et al.* (1961); Van Morkhoven (1962) and Pokorny (1965).

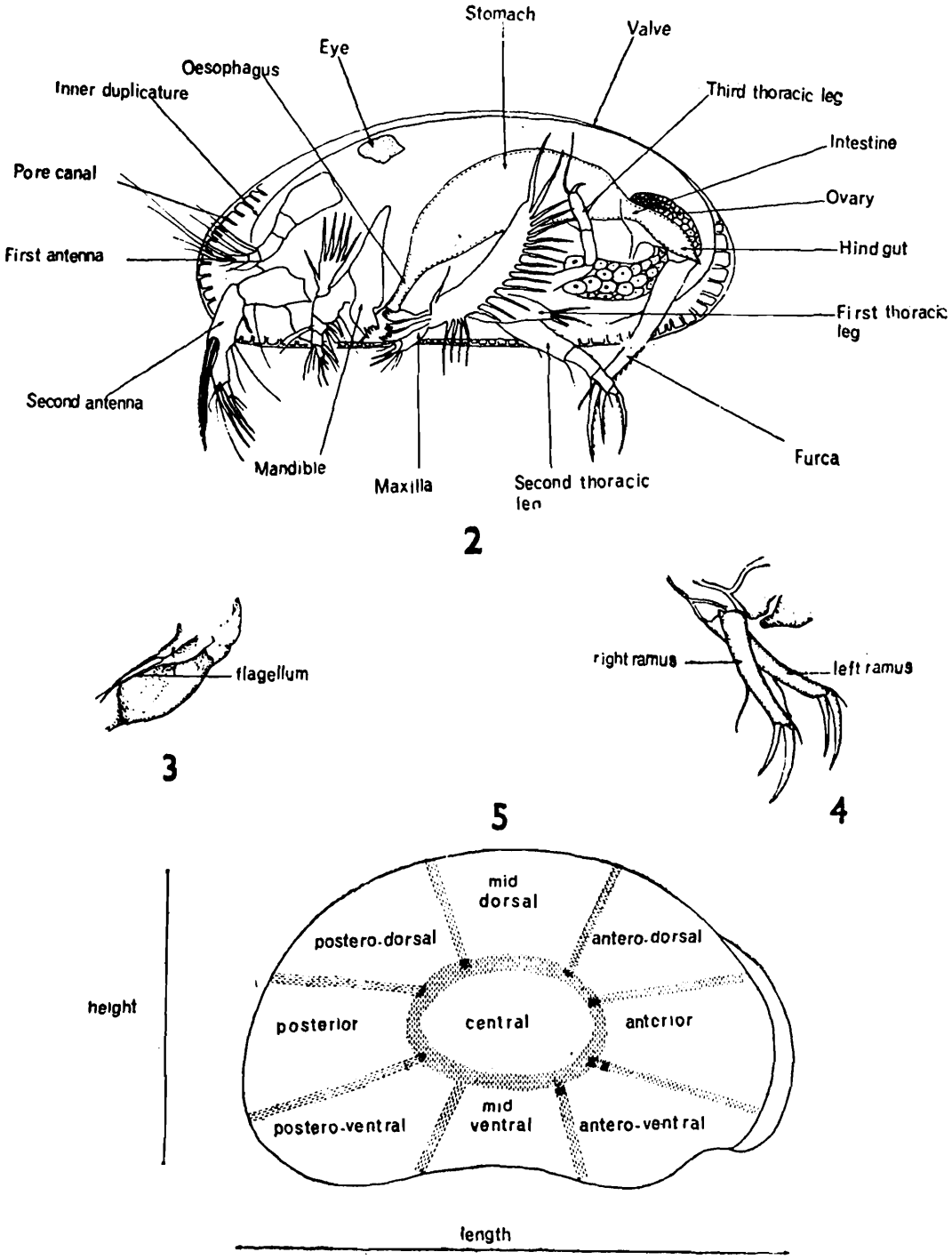
The ostracods are compactly built Crustaceans with a bivalved carapace into which the soft body may be wholly withdrawn. They represent an efficient aerodynamic (Van Den Bold, 1946) or, rather, hydrodynamic (Van Morkhoven, 1962) (Fig. 2) shape, which helps to overcome the resistance of the surrounding water. Each valve consists of an inner layer called the inner lamella, made of epidermal and chitinous layers and an outer lamella with an additional calcareous layer. The valves are attached on the dorsal margin by a hinge and the rest of the valve margin is free. The valves are closed and opened by the contraction and relaxation of adductor muscles originating in the centre of the ostracod body (Van Morkhoven, 1962).

The organization of the ostracod body can be seen after the removal of one valve (Fig. 2). There is no true segmentation of the body; sometimes a faint constriction in the middle divides the body into cephalic and thoracic regions. The rudimentary abdomen is fused with the thorax.

There are seven pairs of modified biramous appendages. The first four pairs are cephalic appendages. They are the 1st antennae, 2nd antennae, mandibles and the maxillae (Fig. 2). Three pairs of thoracic legs form the thoracic appendages (Fig. 2). Apart from these there is a pair of furcal rami attached to the posterior end of the body (Figs. 2, 3, 4). These are not normally regarded as true appendages. The second antennae, first thoracic legs and the furcal rami exhibit sexual dimorphism (Kesling, 1965).

The digestive tract is well differentiated with an atrium, mouth, oesophagus, stomach, intestine, hind gut and anus (Fig. 2). The mandibles are masticatory and the food is pushed into the mouth by the movement of mandibular, maxillary and first thoracic appendages. Digestion is facilitated by mandibular glands, present in the atrium, and the hepatic secretion from the "liver" The nervous system consists of a cerebrum, a circumoesophagial ganglion and a ventral chain of paired, fused ganglia. A network of motor

nerves supplying the muscles is also present (Kesling, 1951b; Van Morkhoven, 1962). It was suggested that respiration takes place through the body wall and exchange of gases is enhanced by the so-called respiratory or branchial plates (Pokorny, 1965). However, studies to date have provided no confirmation of this hypothesis (Van Markhoven, 1962).



Figs. 2–5. Generalised structure of freshwater ostracod. 2. Structure of the ostracod with one valve removed. 3. Reduced furcal rami. 4. Well developed furcal rami. 5. Valve terminology of freshwater ostracod.

The female reproductive system consists of a pair of ovaries (Fig. 2) and a pair of receptacula semines. The male reproductive system has highly-coiled paired testes. The sperms are usually 2–8 times longer than the valves (Pokorny, 1965). Hemipenes are complicated, usually triangular, organs. Some genera have ejaculatory ducts or Zenkers organs to pump sperm out through the penes (Howe *et.al.* 1961). Sexes are separate. Parthenogenesis is common.

II. The Taxonomic Characters

Ostracods are taxonomically characterised on the basis of both hard and soft parts. Hard parts are the calcareous valves and the soft parts comprise the appendages and internal organs. Micropalaeontologists use only the hard parts for descriptions. Taxonomic studies on living material, however, includes both hard and soft parts. The following characters (Figs. 3–15) are used in ostracod taxonomy.

(1) *The carapace*

The carapace consists of right and left valves. The shape and size of the valves in lateral view may be identical, or there may be some form of structural asymmetry. When the carapace is examined as a whole, the valve overlap must be given due consideration (Fig. 6). Usually the larger valve determines the valve overlap. The terminology describing the orientation and different areas of palaeozoic ostracods was given by Kesling (1951a) and this can be easily modified for recent freshwater ostracods (Fig. 5). Moore (1961b) also gives a glossary of morphological terms applicable to ostracod hard parts.

Ornamentation is usually defined as the total of all local ornamentation of the valves at their lateral surface and can be divided into primary and secondary ornamentation (Van Morkhoven, 1962). Primary ornamentation includes presence or absence of all prominent ridges, lobes, punctations, tuberculations, and spines whereas secondary ornamentation includes reticulations, presence and absence of posteroventral spines, hairs and the nature of their distribution. Living freshwater ostracods usually exhibit less intense patterns of ornamentation than marine and fossil genera. The nature of primary and secondary ornamentation may vary depending upon environmental influences like turbulence (Van Morkhoven, 1962) and also food (Fassbinder, 1912), so taxonomic interpretations must be made with caution.

The structure of the valve margin includes marginal denticulations or tuberculations, pore canal pattern, septa and pubescence. Marginal denticulations can be present on one valve (e.g., *Cyprinotus* and *Physocypria*, Fig. 119, 321) or on both valves (e.g., *Centrocypris*, Figs. 337, 338). Ostracod valves generally have pore canals in the margins which bear bristles used for pressure perception (Nuttall, 1969) and these may be concentrated or sparse on the anterior and posterior margins. The pore canals may be insignificant or well developed and showing a definite pattern (e.g., *Stenocypris*, Fig. 196, 205, 219).

The adductor muscle scars are present in the center of the valves. The number, shape and relative positions of the individual scars vary considerably in different groups (Van Morkhoven, 1962). Kesling (1951b) reported the central muscle scars to be consistent in *Cypridopsis vidua*. Benson and MacDonald (1963) used these muscle scars for identification of *Candona* species. Although this is accepted as a reliable feature, it is used for Indian ostracods in only a few cases. Preservation can affect the pattern of scars, and the muscle scars may be indistinct in specimens preserved for a long time.

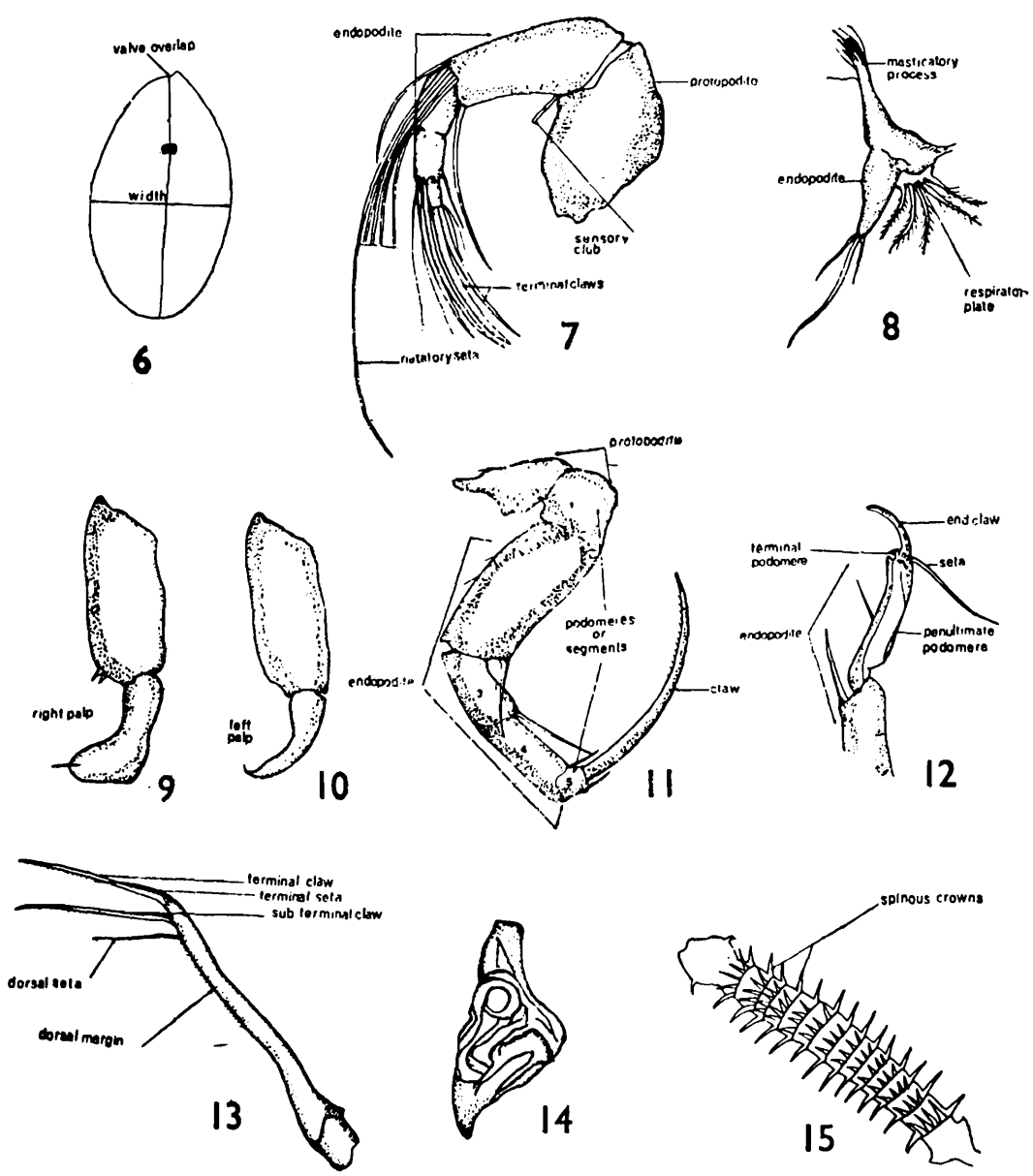
Measurements of length, height and width (Figs. 5, 6) of a specimen are useful. Kesling (1951b) questioned the validity of using length to height ratios in species determination. This view is reasonable only when the dimensions are used as the primary criterion to determine a species. But these measurements may prove useful to supplement other characters. The length, height and width of valves may vary within different populations of a single species (Farkas, 1974a, b). Remane (1933,1940) and Elofson (1941) reported size differences in a single species of marine ostracods due to variable environmental factors and Nuttall (1969) noticed size differences in the same

species of freshwater ostracods collected from two different provinces of Canada. Certain Indian species also showed such differences. This is discussed later.

Though pigment patterns on the carapace are used, the present study did not rely on this feature except for one species, *Pseudocypretta maculata* Klie, 1932 (Figs. 311, 312). This is mainly due to the fact that ostracods preserved in alcohol soon lose their colouration. Formalin preserves the colouration but the valves become very brittle and may break on separation.

(2) *Appendages*

The presence, absence or rudimentary nature of natatory setae on the second antenna are useful in distinguishing different families of freshwater ostracods (Figs. 85, 328, 360). The structure and length of natatory setae, the terminal claws, the sensory club, the arrangement of setae and spines on various segments of the second antenna (Fig. 7), the structure of maxillary spines, the first thoracic leg of the female (Fig. 8) and the asymmetrical, first thoracic legs of males modified as prehensile palps (Figs. 9, 10) are used for species diagnosis.



Figs. 6-15. 6. Carapace showing width and valve overlap. 7–15. Taxonomically important characters of freshwater ostracods. 7. Second antenna. 8. First thoracic leg. 9. Right prehensile palp, first thoracic leg, Male. 10. Left prehensile palp, first thoracic leg, Male. 11. Second thoracic leg. 12. Third thoracic leg. 13. Furcal ramus. 14. Hemipenis. 15. Ejaculatory duct or Zenkers organ.

The structure and length of the second thoracic leg, its end claw, the number of setae on the second segment, the nature of the penultimate segment, the structure and arrangement of other setae (Fig. 11), and the claws, setae and spines on the terminal segment of third thoracic leg (Fig. 12)vary considerably in different freshwater ostracod taxa.

The furcal rami are either well developed (Fig. 4) or reduced (Fig. 3). When well developed; their symmetry, the presence or absence of dorsal setae, the length, position and structure of the dorsal seta; the length and structure of terminal and subterminal claws and the spines and denticulation of the dorsal margin are characteristic in different groups.

(3) *Internal organs*

The subtriangular hemipenis (Fig. 14) with variable lobe arrangement and the ejaculatory duct or Zenkers organ (Fig. 15) and its shape, structure and arrangement of spinous crowns are characteristic. These structures can be used only when males are available and males are not known for many species of ostracods.

The gonads, the gonadial *imprints* on the valves, and eggs are not taxonomically important, but they are used as markers to eliminate immature stages which would otherwise create confusion. Ability to discriminate larval stages is necessary. Van Morkhoven (1962) has mentioned various cases in which larval stages have been described as new species or even new genera and Ghetti (1970) stresses the taxonomic significance of ostracod larval stages.

III. Classified Species List of Indian Freshwater Ostracods

Presently Known—Previous and present records given separately under their respective authors

	PRESENT RECORDS	Victor and Michael, 1975	Deb, 1972	Hartmann, 1964	Arora, 1931	Klie, 1927	Gurney, 1907	Baird, 1859
Subclass Ostracoda Latrielle, 1806								
Order Popocopida Müller, 1894								
Suborder Podocopa Sars, 1866								
Superfamily Cypridacea Baird, 1845								
Family Cyprididae Baird, 1845								
Subfamily Cypridinae Baird, 1845								
Tribe Cypridini Baird, 1845								
Genus *Cypris* O.F. Müller, 1776								
Cypris 'subglobosa' Sowerby, 1840	+			+				+
**Cypris decaryi* Gauthier, 1933	+							
Cypris dravidensis Victor and Michael, 1975	+	+		+				
Cypris protubera Victor and Fernando	+							
Cypris reticulata Zaddach, 1844	?				+			
Eurycypris kumari Arora, 1931	?				+			
Tribe Eucypridini Bronstein, 1947								
Genus *Eucypris* Vavra, 1891								
Eucypris bispinosa Victor and Michael, 1975	+	+						
Genus *Strandesia* Stuhlmann, 1888								
Strandesia elongata Hartmann, 1964	+			+				
Strandesia indica Hartmann, 1964	+			+				
**Strandesia purpurascens* (Brady) 1886	+							
**Strandesia flavescens* Klie, 1932	+							
Strandesia bicornuta Hartmann, 1964	N			+				
Strandesia labiata Hartmann, 1964	N			+				

	PRESENT RECORDS	Victor and Michael, 1975	Deb, 1972	Hartmann, 1964	Arora, 1931	Klie, 1927	Gurney, 1907	Baird, 1859
Strandesia parva Hartmann, 1964	N			+				
Strandesia saetosa Hartmann, 1964	N			+				
Strandesia rotunda Hartmann, 1964	N			+				
Strandesia tuberculata Hartmann, 1964	N			+				
Tribe Cyprinotini Bronstein, 1947								
Genus *Cyprinotus* Brady, 1886								
Cyprinotus nudus Victor and Michael, 1975	+	+						
Cyprinotus cingalensis Brady, 1886	N			+				
Cyprinotus chandrai Arora, 1931	N				+			
Cyprinotus incongruens (Ramdohr) 1808	N			+	+			
Cyprinotus crenatus Turner, 1893	?				+			
Genus *Heterocypris* Claus, 1892								
Heterocypris dentatomarginatus (Baird) 1859	N							+
Genus *Hemicypris* Sars, 1903								
**Hemicypris pyxidata* (Moniez) 1892	+							
Hemicypris anomala (Klie) 1938	+			+				
Hemicypris falcatus Victor and Fernando, 1976	+							
Hemicypris dissonus Victor and Fernando, 1976	+							
Tribe Dolerocypridini Kaufmann, 1900								
Genus *Candonocypris* Sars, 1895								
Candonocypris dentatus Victor and Michael, 1975	+	+						
Subfamily CYPRETTINAE Hartmann, 1964								
Genus *Cypretta* Vavra, 1895								
Cypretta alagarkoilensis Victor and Michael, 1975	+	+						
Cypretta fontinalis Hartmann, 1964	N			+				
Cypretta foveata Hartmann, 1964	N			+				
Cypretta globulus (Sars) 1889	N				+			
Subfamily STENOCYPRINAE Ferguson, 1964								
Genus *Stenocypris* Sars, 1889								
Stenocypris major(Baird) 1859	+			+			+	+
Stenocypris derupta Vavra, 1906	+			+				
Stenocypris hislopi Ferguson, 1969	+							×
Stenocypris distincta Victor and Fernando	+							
Stenocypris sewelli Klie, 1927	N					+		
Stenocypris biswasi Deb, 1972	N		+					
Genus *Chrissia* Hartmann, 1957								
Chrissia halyi (Ferguson) 1969	+				×			
Chrissia humilis (Klie) 1932 *indica*	N			+				
Chrissia krishnakantai (Dev) 1972	N		+					
Genus *Parastenocypris* Hartmann, 1964								
Parastenocypris canaliculata Hartmann, 1964	N			+				
Subfamily CYPRIDOPSINAE Kaufmann, 1900								
Genus *Cypridopsis* Brady, 1868								
Cypridopsis dispar Hartmann, 1964	+			+				
**Cypridopsis dubia* Sars, 1903	+							
Cypridopsis angularis (Victor and Michael) 1975	+	+		•				
Cypridopsis maduraiensis Victor and Michael, 1975	+	+						
Cypridopsis horai Klie, 1927	N					+		

	PRESENT RECORDS	Victor and Michael, 1975	Deb, 1972	Hartmann, 1964	Arora, 1931	Klie, 1927	Gurney, 1907	Baird, 1859
Genus *Oncocypris* G.W. Müller, 1898								
Oncocypris voeltzkowi Müller, 1898	N			+				
Oncocypris pustulosa Gurney, 1916	+	+						
Genus *Pseudocypretta* Klie, 1932								
**Pseudocypretta maculata* Klie, 1932	+							
Family CYCLOCYPRIDIDAE Kaufmann, 1900								
Genus *Physocypria* Vavra, 1897								
Physocypria furfuracea (Brady) 1886	+			+				
Physocypria minutus Victor and Michael, 1975	+	+						
Physocypria devai Arora, 1931	?				+			
Physocypria javana Müller, 1906	?					+		
Family NOTODROMADIDAE Kaufmann, 1900								
Genus *Centrocypris* Vavra, 1895								
Centrocypris matthaii (Arora) 1931	+	+			×			
Centrocypris horrida Vavra, 1895	N			+				
Genus *Indiacypris* Hartmann, 1964								
Indiacypris dispar Hartmann, 1964	N			+				
Family EUCANDONIDAE Swain, 1961								
Genus *Candonopsis* Vavra, 1891								
**Candonopsis putealis* Klie, 1932	+							
Family ILYOCYPRIDIDAE Kaufmann, 1900								
Genus *Ilyocypris* Brady and Norman, 1889								
Ilyocypris nagamalaiensis Victor and Michael, 1975	+	+						
Ilyocypris australiensis Sars, 1889	N			+				
Ilyocypris bradyi Sars, 1890	N				+			
Total	61	11	2	25	10	3	1	4

\+ — species examined
N — species not examined, description and figures from previous authors are provided
? — doubtful taxonomic status
* — New records
× — species subsequently designated

IV. PROVISIONAL KEY TO THE FRESHWATER OSTRACODS OF INDIA

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22b. Terminal seta of the furca present— 23
23a. Subterminal claw of the furca as long as the terminal claw (Fig. 189)— *Cypretta alagarkoilensis*
23b. Subterminal claw of the furca shorter than the terminal claw— 24
24a. Dorsal seta of the furca more than 1/2 the length of the subterminal claw (Fig. 195)— *Cypretta globulus*
24b. Dorsal seta on the furca less than 1/2 the length of the subterminal claw (Fig. 191)— *Cypretta fontinalis*
25a. Denticles on the valve margins distinctly larger than the surface tubercles (Figs. 349, 350)— *Centrocypris horrida*
25b. Denticles on the valve margin as large as the surface tubercles (Figs. 377, 338)— *Centrocypris matthaii*
26a. Valve surface with thimble-shaped depressions (Figs. 16, 18)— *Cypris subglobosa*
26b. Valve surface without any such depressions— 27
27a. Valves with a prominent antero-ventral protuberance (Fig.54, 55)— *Cypris protubera*
27b. Prominent antero-ventral protuberance absent— 28

28a. Length of the valves 1·3–1·5 mm, extremely globose in dorsal view, valve surface punctate (Figs. 40, 41, 53)— *Cypris globulosa*

28b. Length of the valves 1·8–2·0 mm, not globose in dorsal view, valve surface hairy (Figs. 31, 32)— *Cypris decaryi*

29a. One valve with tuberculation or denticulation or dentate projections on the margin in external view, the other valve smooth margined— 30

29b. Both valves with smooth or serrate margins or with blunt projections in external view— 40

29c. Both valves with prominent, pointed denticulations on the margins in external view— ..... *Candonocypris*
The only species described for this genus from India is *Candonocypris dentatus* Victor and Michael, 1975 (Figs. 173–183).

30a. Reflexed seta on the terminal segment of the third thoracic leg longer than the penultimate segment— *Physocypria* 31

30b. Reflexed seta short— 32

31a. Right valve with tubercles on the anterior and posterior margin (Fig. 321)— ..... *Physocypria furfuracea* (=P. tuberata)

31b. Right valve with dentate projections (Fig. 327)— *Physocypria minutus*

32a. Tuberculations or denticulations only on the right valve— *Cyprinotus* 33

32b. Tuberculations only on the left valve— 36

33a. Dorsum of the right valve with a prominent hump in the mid dorsal region (Figs. 125, 126)— *Cyprinotus cingalensis*

33b. Dorsum smooth without any such hump— 34

34a. Dorsal seta of the furca less than 1/2 the length of the subterminal claw (Fig. 128)— *Cyprinotus chandrai*

34b. Dorsal seta of the furca more than 1/2 the length of the subterminal claw— 35

35a. Furca relatively short 11 × least width (Fig. 131)— *Cyprinotus incongruens*

35b. Furca slender 20X least width (Fig. 124)— *Cyprinotus nudus*

36a. Left valve always overlaps the right— *Heterocypris*
The only Indian species assigned to this genus at present is *Heterocypris dentatomarginatus* (Baird) 1859 and not of Sars, 1889 (Fig. 136). Soft part morphology not known.

36b. Right valve always overlaps the left— *Hemicypris* 37

37a. Dorsal seta of the furca longer than the subterminal claw (Fig. 156) *Hemicypris pyxidata*

37b. Dorsal seta shorter than the subterminal claw— 38

38a. Dorsum of the valve angular in the middle (Fig. 137, 138)— *Hemicypris anomala*

38b. Dorsum of the valve smoothly convex— 39

39a. Furcal ramus straight (Fig. 164)— *Hemicypris falcatus*

39b. Furcal ramus curved (Fig. 172)— *Hemicypris dissonus*

40a. Natatory setae of the second antenna absent (Fig. 360)— *Candonopsis*
The only species reported from India is *Candonopsis putealis* Klie, 1932

40b. Natatory setae of the second antenna always present— 41

41a. Terminal segment of the third leg with no claw, but with three setae of which one may be reflexed— 42

41b. Terminal segment of the third leg with a claw and an usually reflexed seta— 45

42a. Left valve with septa in the anterior margin, completely overlapping the right valve (Fig. 353, 355)— *Indiacypris*
Indiacypris dispar Hartmann, 1964 is the only species described from India.

42b. No septa in the anterior margin of the valves, valve overlap insignificant— *Ilyocypris* 43

43a. Third and fourth segment of the second thoracic leg distinctly separated (Fig. 380)— *Ilyocypris bradyi*

43b. Third and fourth segment of the second thoracic leg fused— 44

44a. Posterior margin of the valve without any protuberances (Fig. 375)— *Ilyocypris australiensis*

44b. Posterior margin of the valves with prominent protuberances (Fig. 366)— *Ilyocypris nagamalaiensis*

45a. Furcal rami slender and long— *Strandesia* 46

45b. Furcal rami short and stumpy— *Eucypris*
Eucypris bispinosa (Victor and Michael) 1975 is the only species known to this genus (Figs. 63–69).

46a. Left valve extended as a spinous projection in the anterior and posterior regions (Fig. 98)— *Strandesia bicornuta*

46b. Left valve without any such spinous extensions— 47

47a. Right valve with a prominent lip-like canaliculate projection in the antero-ventral region (Fig. 104)— *Strandesia labiata*

47b. Right valve without any such projection— 48

48a. Both valves with a blunt projection in the anterior region (Figs. 115, 116, 117)— *Strandesia tuberculata*

48b. Anterior region of valves without any such projection—.....49
49a. Terminal seta of the furca longer than the terminal claw (Fig. 88)— *Strandesia purpurascens*
49b. Terminal seta shorter than the terminal claw—.....50
50a. Furcal ramus with four groups of strong spines on the dorsal margin (Figs. 96, 97)— *Strandesia flavescens*
50b. Furcal ramus with weak spines— 51
51a. Anterior margin of the valve broadly rounded than the posterior margin—.....53.
51b. Both anterior and posterior margins broadly rounded—.....52
52a. Dorsum of the valve angular in the middle (Figs. 106, 107)— *Strandesia parva*
52b. Valve dorsum evenly convex (Fig. 112)— *Strandesia rotunda*
53a. Furcal ramus characteristically curved (Fig. 111)— *Strandesia saetosa*
53b. Furcal ramus straight— 54
54a. Valve dorso-ventrally compressed (Figs. 70, 71)— *Strandesia elongata*
54b. Valve dorso-ventrally inflated (Figs. 77, 78)— *Strandesia indica*

V TAXONOMIC DESCRIPTIONS

Genus **Cypris** O.F. Müller, 1776

Generic diagnosis:

Carapace tumid, width greater than height. Natatory setae of second antenna well developed and reaching to or beyond the tips of the terminal claws. Ultimate podomere of the maxillary palp with a width about one third its length. Furcal rami well developed. Its length more than 20 X least width, dorsal setae present.

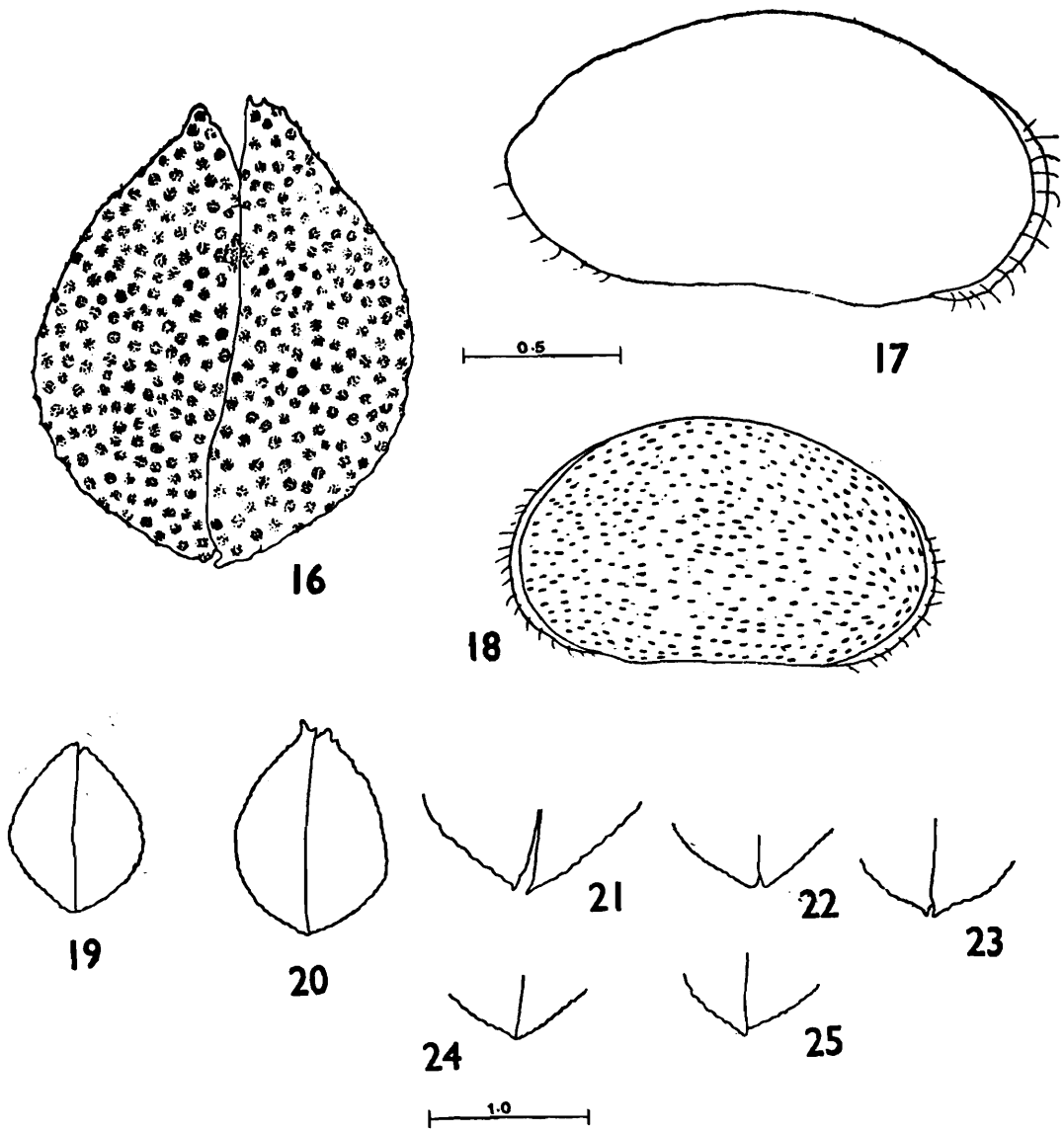
Indian species:

The following species have been assigned to this genus:—*Cypris 'subglobosa'* Sowerby, 1840; *Cypris decaryi* Gauthier, 1933; *Cypris dravidensis* Victor and Michael, 1975 and *Cypris protubera* Victor and Fernando (in press).

Cypris subglobosa Sowerby, 1840

Cypris subglobosa Sowerby, 1840: Baird, 1859., p. 232, Pl. 63, Fig. 2.
Chlamydotheca subglobosa (Sowerby) Brady, 1886., p. 300, Pl. 38, Fig. 24-27a.
Cypris granulata Daday, 1898 ,p. 73, Abb. 36.
Eurycypris subglobosa Sowerby: Vavra, 1906., p. 420, Taf. 24, Fig. 9-13.
Chlamydotheca subglobosa Sowerby: Apstein, 1907., p. 229, Fig. 7.
Cypris subglobosa Sowerby, 1840: Klie, 1932., p. 458; 1938., p. 22.
Cypris subglobosa Sowerby: Bronstein, 1947., p. 103, Fig. 26.
Cypris subglobosa Sowerby: Brehm, 1953., p. 166.
Cypris subglobosa Sowerby, 1840: Triebel, 1961., p. 59, Taf. 9, Fig. 21-24; Taf. 10, Fig. 25.
Cypris subglobosa Sowerby, 1840: Hartmann, 1964., p. 92, Abb. 34 a,b.

Female: Colour greenish when alive. Valves subglobular, tumid, right valve with a flange at the rounded anterior margin, posterior margin narrowly produced; left valve without a flange, both anterior and posterior margins broadly rounded; dorsum convex; ventral margin almost straight and slightly sinuate in the right valve; both anterior and posterior margins hairy; valve overlap variable; surface with thickly set thimble-shaped depressions and minute hairs (Figs. 16, 17, 18). Length 1.43– 1.45 mm; height 0.92–0.94 mm and width about 1.18 mm. Natatory setae of the second antenna setulate, barely reaching the tips of the pectinate terminal claws (Fig. 26). First thoracic leg with a respiratory plate bearing five setulate setae (Fig. 27). Second thoracic leg with an end claw pectinate; segments three and four fused (Fig. 28). Third thoracic leg with a clow and a reflexed seta (Fig. 29). Furcal rami symmetrical, slender; subterminal claw slightly more than 1/2 the length



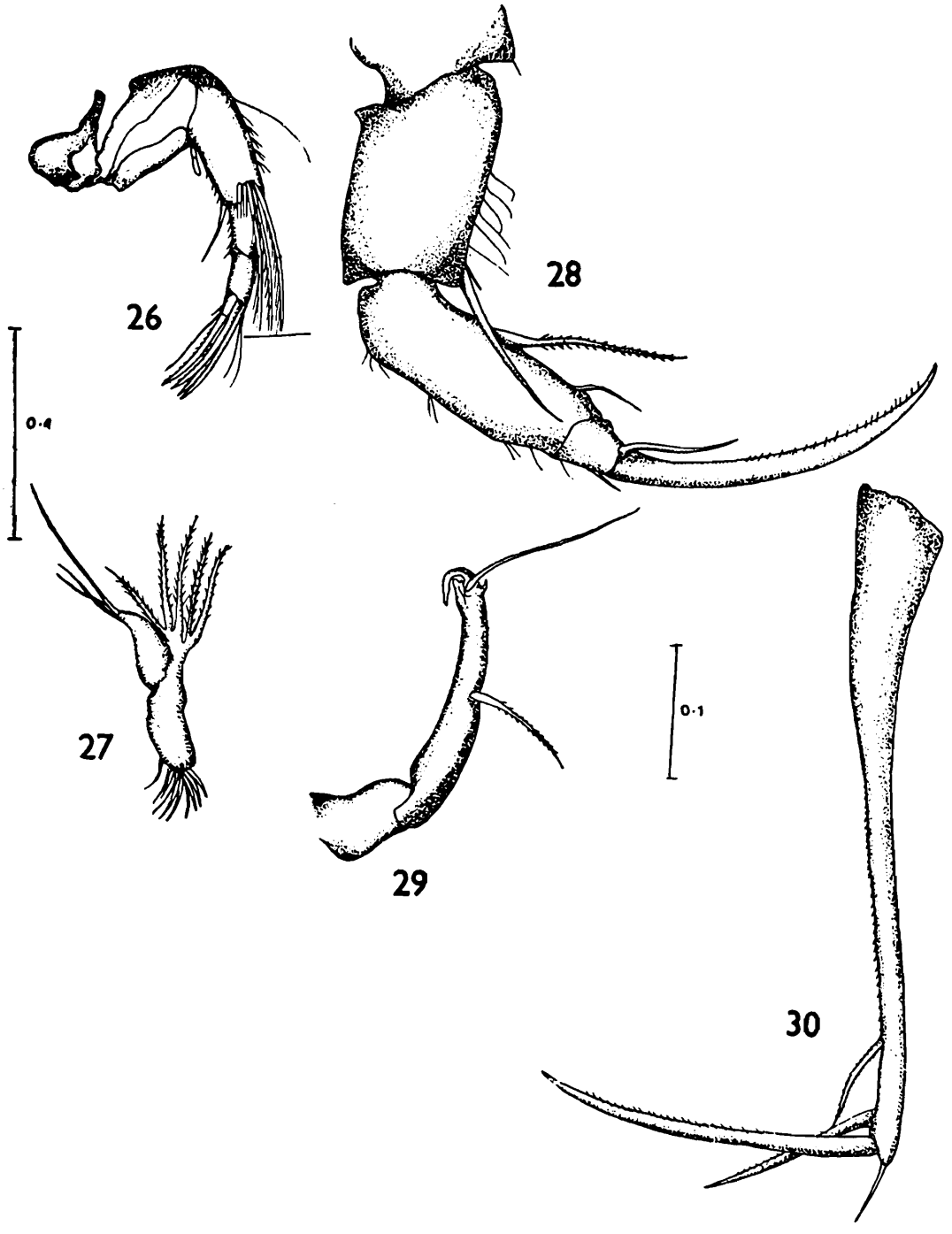
Figs. 16–25. *Cypris subglobosa* Sowerby, 1840. 16. Carapace, dorsal view. 17. Right valve, lateral view. 18. Left valve, lateral view showing surface ornamentation. 19–20. Juvenile carapaces. 21–25. Posterior extremities of adult carapaces showing variable valve overlap.

of the terminal claw, both claws pectinate; dorsal seta setulate, more than 1/2 the length of the subterminal claw; terminal seta short; dorsal margin lined with small spines for more than 1/2 the length of the ramus (Fig. 30).

Male: Not known.

Remarks: The tumid valves with the characteristic thimble-shaped depressions on the valve surface, make *Cypris subglobosa* readily distinguishable from other species of *Cypris*. The living forms of *C. subglobosa* were first described by Baird (1859) from Nagpur, India. He believed that this species was conspecific with a fossil ostracod collected by J.G. Malcolmson from Sichel Hills, India and described by Sowerby (1840) as *Cypris subglobosa*.

Examination of large numbers of individuals revealed certain variations in this species. Figures 21–25 show the different types of valve over-lap observed at the posterior extremity of the carapace. Moreover in adults, the right valve overlaps the left in the anterior extremity (Fig. 16) whereas the reverse situation is observed in juveniles (Figs. 19, 20).



Figs. 26–30. *Cypris subglobosa* Sowerby, 1840. 26. Second antenna. 27. First thoracic leg. 28. Second thoracic leg. 29. Third thoracic leg. 30. Furcal ramus. All measurements in mm.

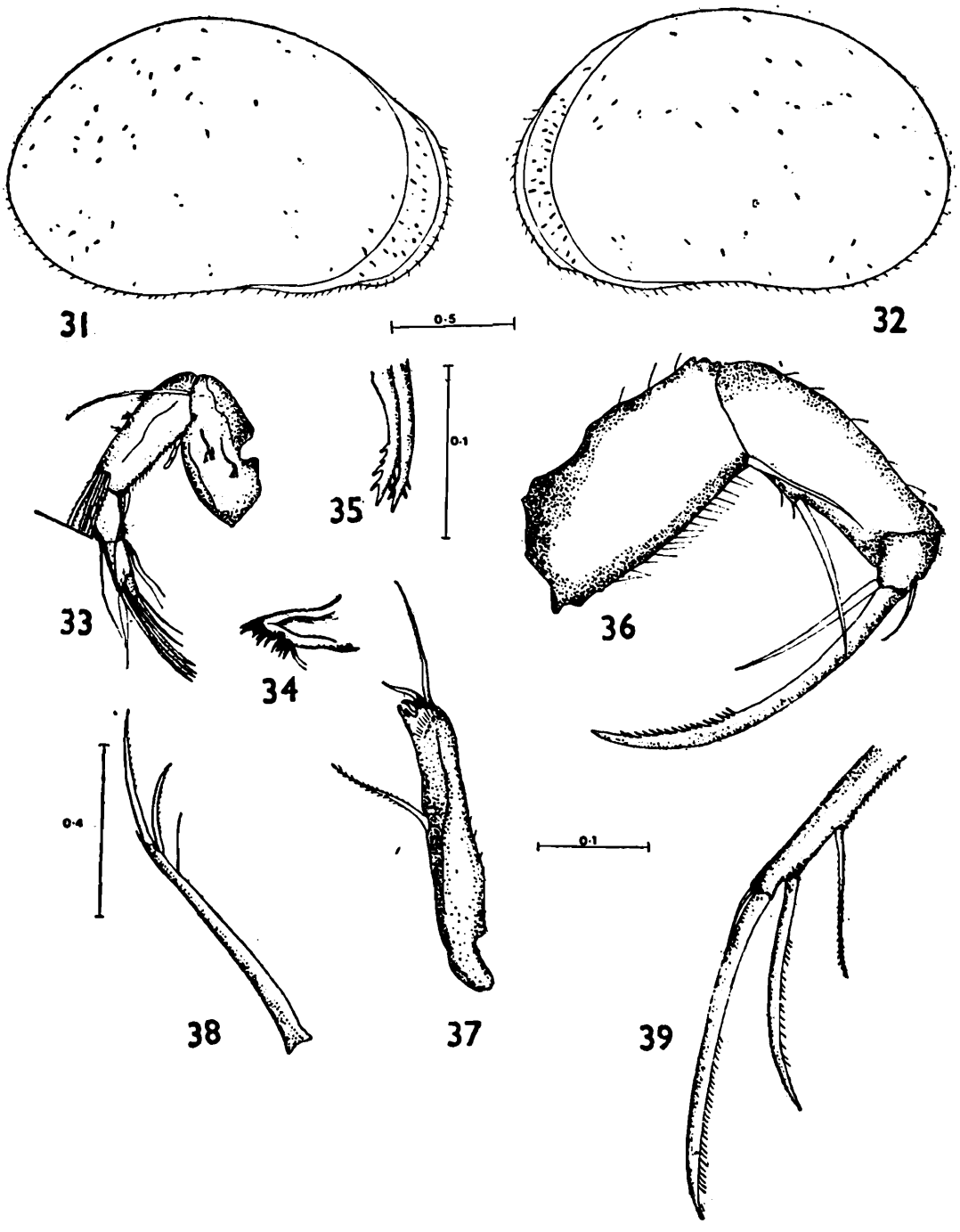
Indian Localities: Nagpur, Bomaby *Dt., and Pandharpur in Maharashtra; Bhopal in Madhya Pradesh; Chitoor, Guntur area, and Yanam-Godavari delta in Andhra Pradesh; Madurai Dt., Trichy Dt., and Kanyakumari in Tamilnadu; Trivandrum in Kerala.

* Dt.=District—an accepted geographical division in India.

Cypris decaryi Gauthier, 1933

Cypris decaryi Gauthier, 1933., p. 209, Abb. 1–4.
Cypris ravenula Brehm, 1934., p. 74, Abb. 1–7.
Cypris decaryi Gauthier, 1933: Triebel, 1961., p. 56, Taf, 6, Fig. 1–8, Taf. 7, Fig. 9–12, Taf. 8, Fig. 13–18.

Female: Valves tumid; dorsum smoothly arched; anterior margin of both the valves with a flange; left valve slightly larger than the right; valve overlap not conspicuous; ventral margin of the valve hairy with a slight convex sinuation in the anteroventral region; granulated surface with a distribution of minute hairs. Inner duplicature wide anteriorly (Figs. 31, 32). Length 1.88–1.90 mm and height 1.15–1.18 mm. Natatory setae of the second antenna setulate, not reaching the tips of the terminal claws; claws pectinate; sensory club three segmented (Fig. 33). Pars incisiva of the



Figs. 31–39. *Cypris decaryi* Gauthier, 1933. 31. Right valve, lateral view. 32. Left valve, lateral view. 33. Second antenna. 34. Mandibular teeth. 35. Maxillary spines. 36. Second thoracic leg. 37. Third thoracic leg. 38. Furcal ramus, entire. 39. Furcal ramus, distal end. Measurements in mm.

mandible with pointed teeth (Fig. 34). Both maxillary spines armed with prominent, blunt teeth (Fig. 35). Second thoracic leg with a long terminal claw, toothed in the distal end; second segment with a hairy ventral margin, a single seta and with few spines on the dorsal margin; third and fourth segment fused, with two spines and a smooth seta on the ventral aspect, dorsal margin with six spines (Fig. 36). Terminal podomere of the third leg with a narrow pointed claw, a blunt projection with a row of obliquely placed spines at the base and a reflexed seta; seta in the middle of the penultimate podomere setulate (Fig. 37). Furcal rami symmetrical; length about 23 X least width; dorsal seta more than 1/2 the length of subterminal claw, setulate; terminal seta short, about 1/5th the length of terminal claw; dorsal margin covered with a row of minute spines (Figs. 38, 39).

Male: Unknown

Remarks: Cypris decaryi, originally described from Malagasy (Gauthier 1933), was later reported from the Caribbean and the Aldabra islands (Triebel, 1961; McKenzie, 1971a). This species differs from other Indian species of *Cypris* in its valve characteristics, soft part morphology and the larger size. The Indian specimens with the length range of 1.88–1.90 mm are closer to the original length range of 1.90–2 mm reported by Gauthier (1933). However the specimens examined by Triebel (loc. cit.) were smaller ranging from 1.58 -1.70 mm. This species is a new record for India.

Indian Locality: New Delhi–Agra Road, Uttar Pradesh.

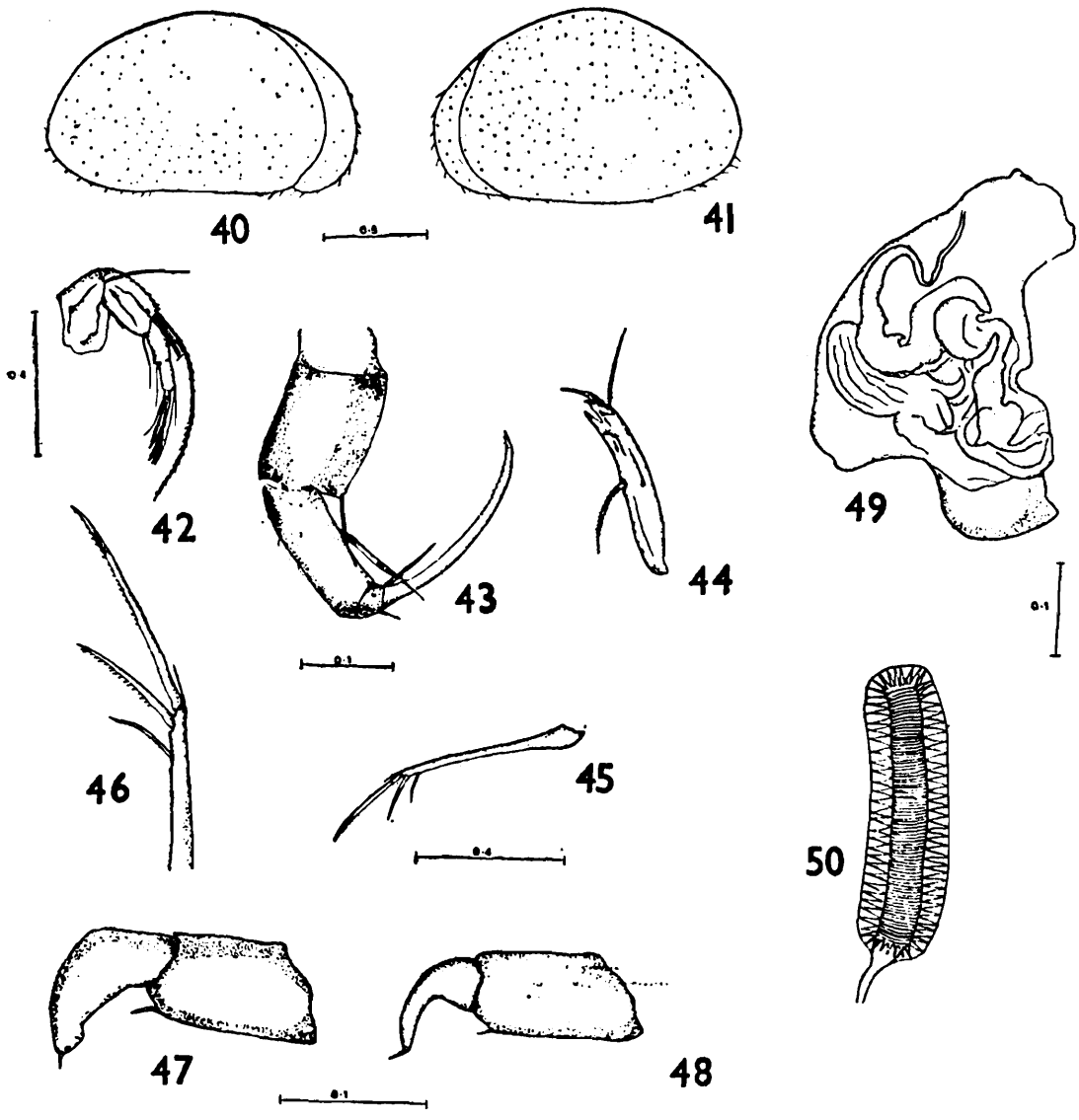
Cypris dravidensis (Victor and Michael) 1975

Cypris globulosa Victor and Michael, 1975, p. 366, Fig. 4, A–E.
Cypris latissima (Müller) 1898: Hartmann, 1964, p. 93, Abb. 33.

Female: Valve very tumid, globular; dorsum markedly arched; right valve with a distinct flange; equivalved; ventral margin straight; marginal hairs prominent on anterior and posterior extremities; valve surface punctate (Figs. 40, 41, 53). Length 1.38–1.50 mm; height 0.88–1.10 mm and width 1.20–1.35 mm. Natatory setae of the second antenna well developed, setulate, usually reaching the tips of the terminal claws; claws toothed (Fig. 42). Maxillary spines toothed. First thoracic leg with five setae on the respiratory plate. Second leg with a long end claw, distal half pectinate; second segment with a single seta; third and fourth segment fused, its dorsal margin with a few spines (Fig. 43). Terminal segment of the third leg with claw, a small projection at its base and a reflexed seta; seta in the middle of the penultimate segment setulate (Fig. 44). Furcal rami symmetrical; length 25 X least width; dorsal seta more than 1/2 the length of the subterminal claw, setulate; terminal seta short; both terminal and subterminal claws pectinate; dorsal margin armed with short spines (Figs. 45, 46).

Male: Smaller than females; first leg modified as prehensile palps (Figs. 47, 48). Hemipenis subtriangular, lobe blunt (Fig. 49). Zenkers organ with 28 crowns (Fig. 50).

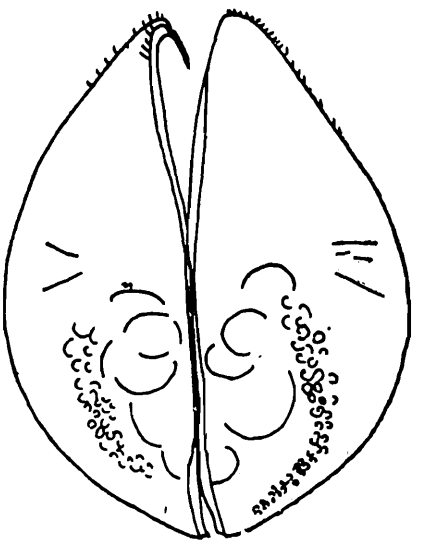
Remarks: Cypris dravidensis was described from Southern India (Victor and Michael, 1975) as *C. globulosa*. This species differs from earlier described species in its extreme globose shape of the valves. Hartmann (1964) reported a species from India which he considered *Cypris latissima* (Müller) 1898,



Figs. 40– 50. *Cypris dravidensis* (Victor and Michael) 1975. 40. Right valve, lateral view. 41. Left valve, lateral view. 42. Second antenna. 43. Second thoracic leg. 44. Third thoracic leg. 45. Furcal ramus, entire. 46. Furcal ramus, distal end. 47. Left prehensile palp, Male. 49. Hemipenis. 50. Ejaculatory duct or Zenkers organ. Measurements in mm.

however the illustration given closely resembles *C. dravidensis* (Figs. 52, 53). In this situation one may raise the question whether *C. dravidensis* Victor and Michael, 1975 is synonymous with *Cypris latissima* (Müller) 1898. G.W. Müller (1898, 1912) described *Cypris latissima* from Madagascar and the type material was re-examined by Swain and Gilby (1969). The dorsal views of *C. dravidensis* and *C. latissima* show a major difference in the overall shape (Figs. 51, 53). Although *C. latissima* is tumid, it is definitely different from an almost circular outline of *C. dravidensis* and *C. latissima* of Hartmann (1964) (Fig. 52). Moreover the valve surface is smooth in *C. latissima* whereas *C. dravidensis* is punctate. *C. dravidensis* also differs from *C. latissima* in the spination of the second thoracic leg, the setulate dorsal seta of the furca and the dorsal margin of the ramus lined with spines along the entire length.(see G.W. Müller, 1898). The valve length of *C. dravidensis* is in conformity with Hartmann's (loc. cit.) Indian specimens. In my opinion, what Hartmann (1964) determined as *C. latissima* from Lindberg's Indian material was probably, a different species, which was later described (Victor and Michael, 1975) as *Cypris globulosa.* The name *Cypris globulosa* has been replaced with a new name *Cypris dravidensis* in the present work because *C. globulosa* Victor

and Michael, 1975 was discovered to be a junior homonym of *C. globulosa* Sharpe, 1910 and hence should be rejected. The male characteristics are illustrated in detail in the present study.



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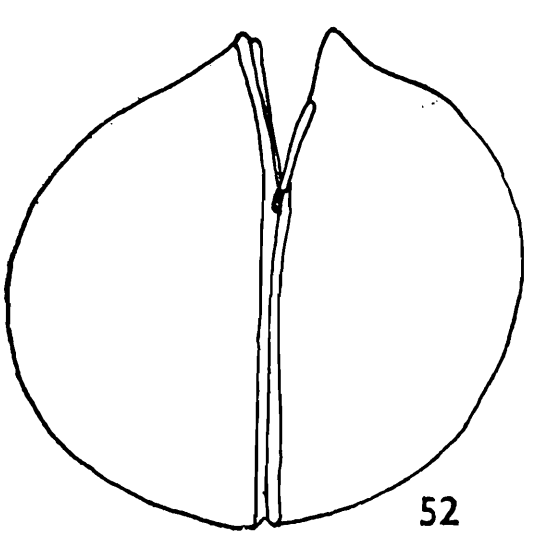

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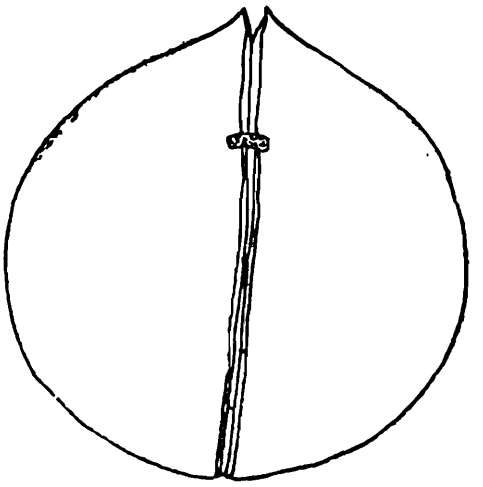

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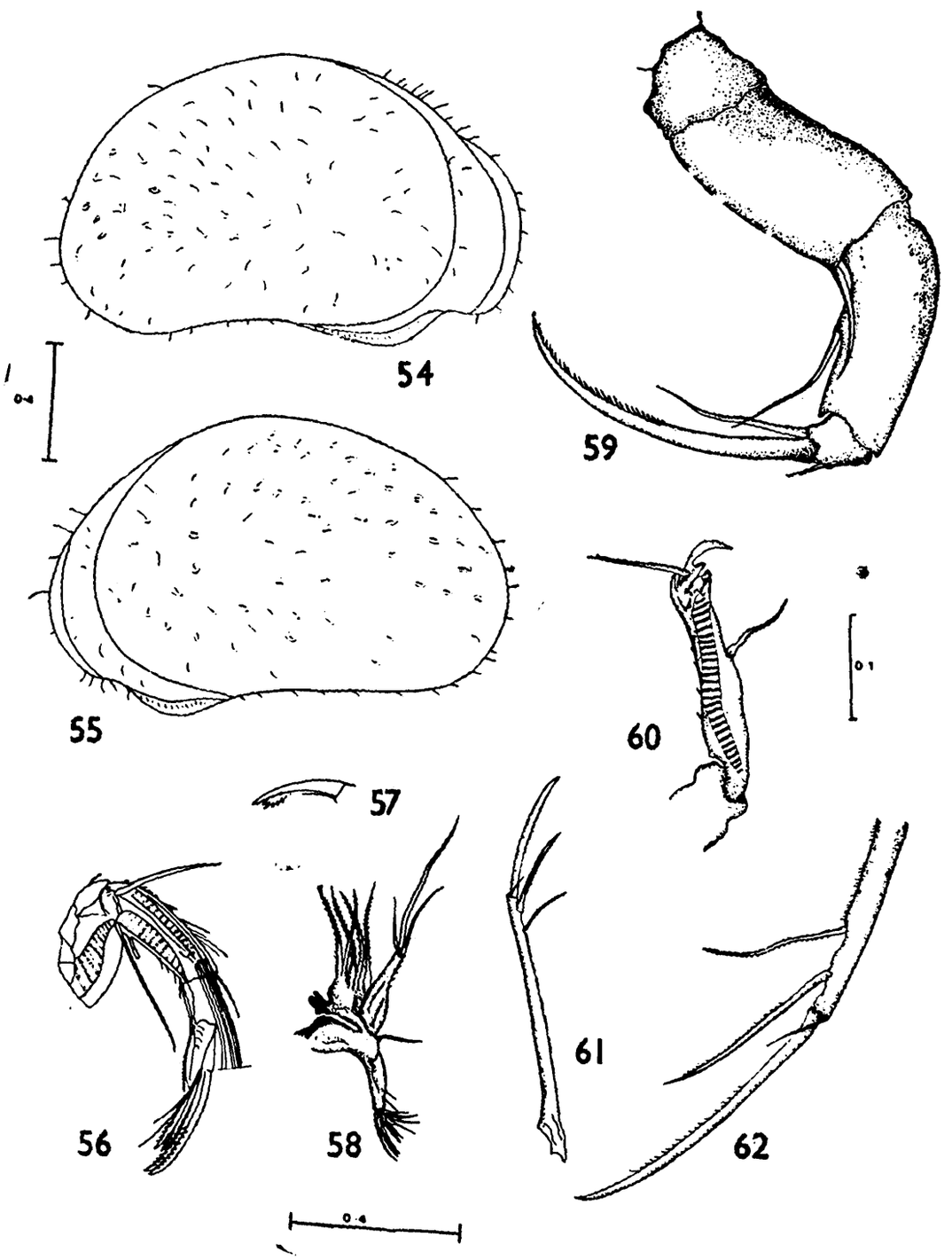
Figs. 51–53. 51. *Cypris latissima* (Muller) after Swain and Gilby, 1969. 52. *Cypris latissima* (Muller) after Hartmann, 1964. 53. *Cypris dravidensis* Victor and Michael, 1975. All figures present the dorsal view of the carapace.

Indian Localities: Madurai Dt., Trichy Dt., Tirupattur (N.A.) in Tamilnadu; Pandharpur area in Maharashtra.

Cypris protubera Victor and Fernando (in press)

Female: Valves tumid; dorsum boldly arched, sloping smoothly posteriorly; anterior margin of both valves with a narrow flange; anteroventral margin with prominent protuberance; valve margin hairy except dorsally; surface covered with hairs; left valve slightly larger than right (Figs. 54, 55). Length 1.50–1.54 mm; height 0.94–0.97 mm and width 0.96–0.98 mm. Natatory setae of the second antenna smooth, not reaching the tips of the terminal claws (Fig. 56). Maxillary spines toothed (Fig. 57). First thoracic leg with respiratory plate bearing five setae (Fig. 58). Second thoracic leg with a terminal

claw pectinate in its distal half (Fig. 59). Terminal segment of the third leg with a prominent claw, a small sinuate claw-like projection and a reflexed seta; dorsal surface of the penultimate segment with four short spines and the seta in the middle setulate (Fig. 60). Furcal rami symmetrical; length about 20.5 X least width; dorsal seta more than 3/4th the length of subterminal claw, setulate; terminal seta short; both the claws pectinate; dorsal margin covered with ten groups of spines along the entire length (Figs. 61, 62).



Figs. 54–62. *Cypris protubera* Victor and Fernando. 54. Right valve, lateral view. 55. Left valve, lateral view. 56. Second antenna. 57. Maxillary spines. 58. First thoracic leg. 59. Second thoracic leg. 60. Third thoracic leg. 61. Furcal ramus, entire. 62. Furcal ramus, distal end. Measurements in mm.

Male: Unknown

Remarks: This species was common in ponds along with *Cypris subglobosa.* The hairy valve surface of *C. protubera* devoid of thimble-shaped depressions

differentiates it from *C. 'subglobosa'* Comparison with other Indian species of the genus shows it to be distinct. The prominent anteroventral protuberance of the valve separates this species from most other species of the genus *Cypris*. (Müller, 1880; Tressler, 1959; Triebel, 1961; Delorme, 1970). It resembles only one other species *C. puertoricoensis*. Although an anteroventral protuberance of the valve is mentioned as a significant character for this Puerto Rican species (Ferguson, 1967), the present species differs from *C. puertoricoensis* in having toothed maxillary spines, smooth natatory setae on the second antennae, a long and slender furca without convexity of the dorsal margin, and a relatively long, setulate dorsal seta.

Indian Localities: Trichy Dt., Madurai Dt., in Tamilnadu.

Cypris (?) **reticulata** Zaddach, 1844

This species was reported by Arora (1931) from Lahore. Though the description is inadequate to recognise the current generic status, it positively indicates that this species does not belong to the genus *Cypris* Müller, 1776.

No Indian material available for study.

Eurycypris kumari Arora, 1931

This species was described as a new species from Lahore (Arora, 1931). The structure of the valve, the second leg and furca closely resemble those of *Cypris subglobosa* Sowerby, 1840. Synonymy is uncertain. Location of type material not known.

Genus **Eucypris** Vavra, 1891

Generic diagnosis:

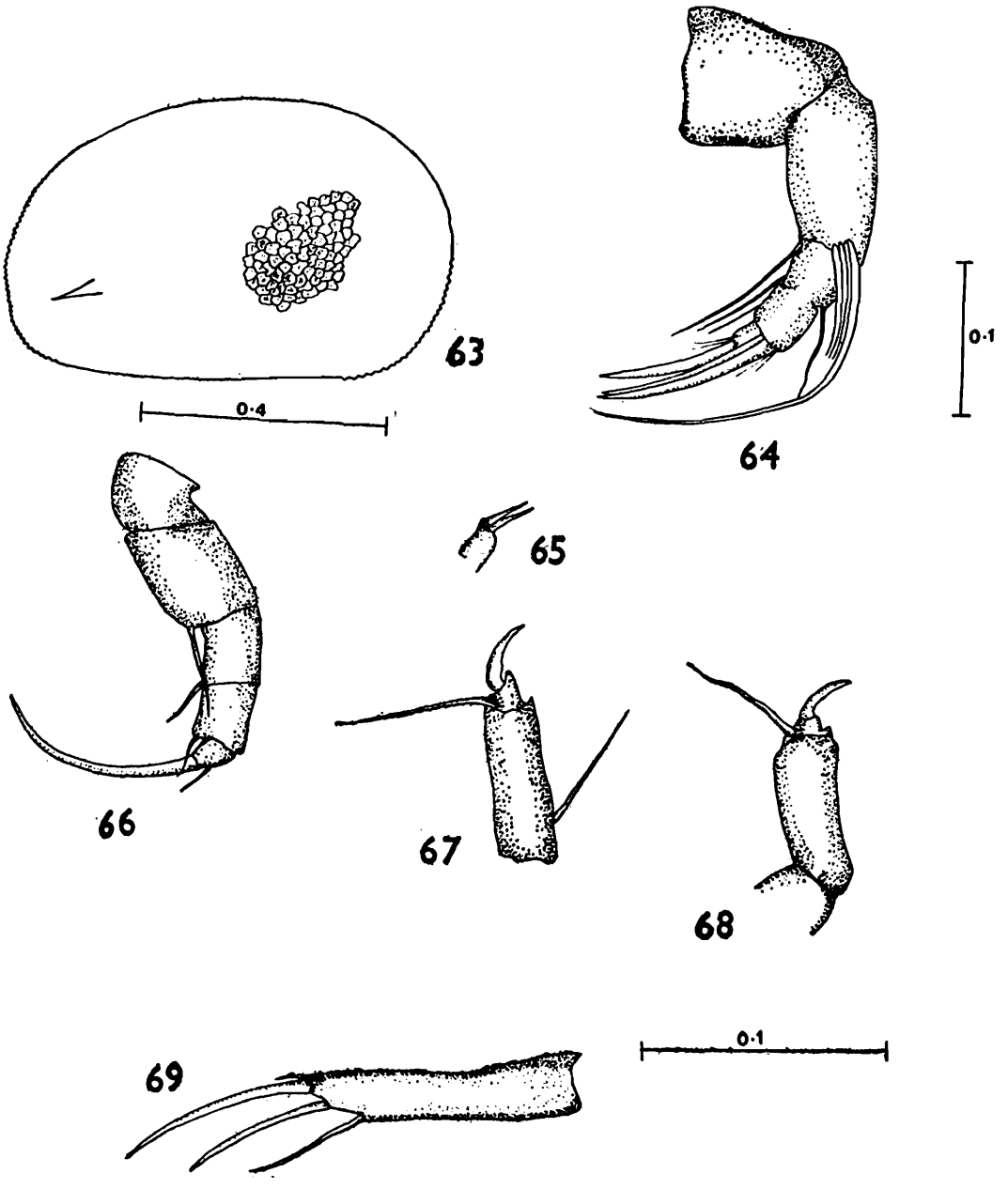
Valve shape, variable greatest height in the middle or slightly behind the middle, valves moderately compressed and subequal. Penultimate segment of the second thoracic leg divided. Symmetrical furca, usually short, less than 1/2 the length of the valves.

Indian species: The only species assigned to this genus in India is *Eucypris bispinosa.*

Eucypris bispinosa (Victor and Michael) 1975

Cyprinotus bispinosa Victor and Michael, 1975 p. 364, Fig. 2, A–G.

Female: Laterally compressed valves; reniform; left little larger than right; both valves with a posteriorly placed, posteriorly directed spine; dorsum convex; venter straight; anterior and posterior margins serrate; surface reticulate with a granular appearance (Fig. 63). Length 0.60–0.64 mm and 0.40–0.43 mm. Natatory setae of the second antenna smooth, reaching beyond the tips of the terminal claws (Fig. 64). Maxillary spines smooth (Fig. 65). Second thoracic leg with a scythe-like claw (Fig. 66). Third thoracic leg with a claw and a reflexed seta (Figs. 67, 68). Furca well developed, short and symmetrical; dorsal seta as long as the subterminal claw and terminal seta short (Fig. 69).



Figs. 63–69. *Eucypris bispinosa* (Victor and Michael) 1975. 63. Right valve, lateral view, a portion showing surface pattern. 64. Second antenna. 65. Maxillary spines. 66. Second thoracic leg. 67–68. Third thoracic leg. 69. Furca. Measurements in mm.

Male: Unknown

Remarks: This species, originally described as *Cyprinotus bispinosa* is redescribed as *Eucypris bispinosa* because the serrate projections of both valves are structurally different from Cyprinotine tuberculations, present only on one valve. This species differs from *Cypris bispinosa* Lucas (Bronstein, 1947; Hartmann, 1964) in the absence of the valve tumidity and the shape of the valves. This species is also different from other species described in the genus *Eucypris* (Brady, 1886; Tressler, 1959; Chapman, 1966).

Indian Locality: Nagamalai, Madurai Dt. in Tamilnadu.

Genus **Strandesia** Vavra, 1895

Generic characters:

Valves moderately elongate, subelliptical, dorsum convex, hinge margin variable, usually left valve overlaps the right. Sensory club of the second antenna long, natatory setae well developed. Furcal rami symmetrical, lender and long.

Indian species:

The following species have been assigned to this genus: *Strandesia elongata* Hartmann, 1964; *Strandesia indica* Hartmann, 1964; *Strandesia purpurascens* (Brady) 1886; *Strandesia Flavescens* Klie, 1932; *Strandesia bicornuta* Hartmann, 1964; *Strandesia labiata* Hartmann, 1964; *Strandesia parva* Hartmann, 1964; *Strandesia saetosa* Hartmann, 1964; *Strandesia rotunda* Hartmann, 1964 and *Strandesia tuberculata* Hartmann, 1964. Only material of the first four species were available for study. The rest of the species have been described and figured from earlier studies.

Strandesia elongata Hartmann, 1964

Strandesia elongata Hartmann, 1964, p. 98, Abb. 37, a–c; 38, a–b.

Female: Eyes prominent. Valves subelliptical; elongate; anterior margin broadly rounded and posterior margin narrowly produced, left valve larger than the right, overlapping both anteriorly and posteriorly; entire margin of the valve lined with densely packed hairs except dorsally; dorsum moderately convex; ventral margin straight; valve surface hairy and punctate. Inner duplicature narrow. In mesial view, the inner margin appears sinuate, representing diffuse pore canals (Figs. 70, 71, 72). Length of the valves 0.72 –0.81 mm; height 0.30–0.39 mm and width 0.35–0.38 mm. Natatory setae of the second antenna smooth, barely reaching the tips of the terminal claws; claws pectinate (Fig. 73). Maxillary spines smooth. Second thoracic leg with a elongate scythe-shaped terminal claw, armed with teeth at the distal end; second segment with a single seta; ventral margin of the second segment with few hair (Fig. 74). Terminal podomere of the third leg with a prominent claw and a reflexed seta (Fig. 75). Furcal rami symmetrical; terminal and subterminal claws slender, terminal seta nearly the length of the subterminal claw, setulate; dorsal seta stout, short, 1/4 the length of subterminal claw, armed with spines on dorsal aspect; dorsal margin of the entire ramus lined with delicate spines (Fig. 76). Furca 20 X least width.

Male: Not known

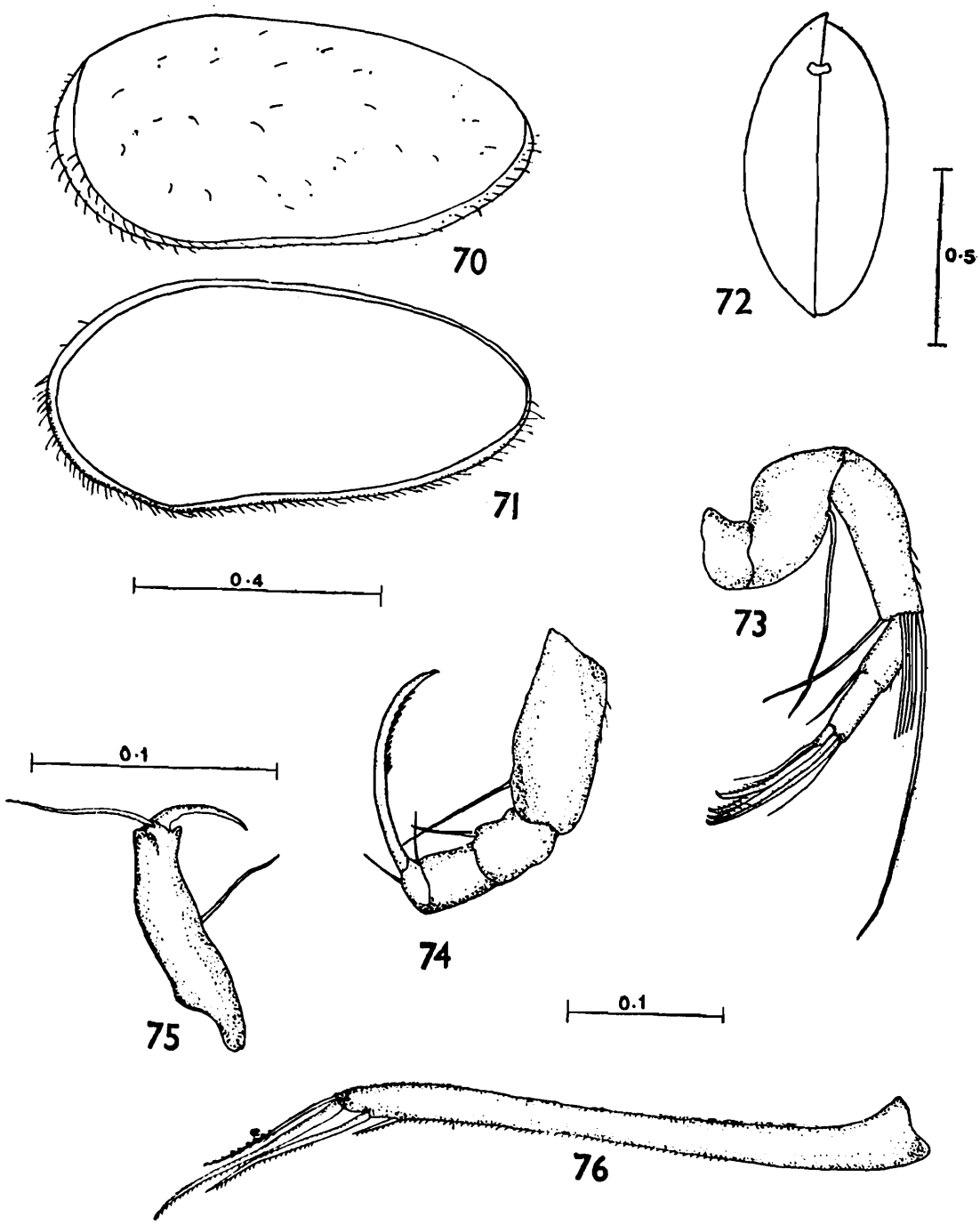
Remarks: This species was found to be very common. The present Indian specimens were in complete agreement with the original description of *Strandesia elongata* (Hartmann, 1964). The distribution of hairs on the valve surface was found to be variable. This species closely resembles *Strandesia ueoni* described by Klie (1938a) from Formosa, but Hartmann (1964) considers them to be different. We agree with Hartmann's (*loc. cit.*) view.

Indian Localities: Trichy Dt., Madurai Dt., Madras, Arkonam, Karaikal and Pondicherri in Tamilnadu; Douladabad and Kovur in Andhra Pradesh; Trivandrum in Kerala and Goa.

Strandesia indica Hartmann, 1964

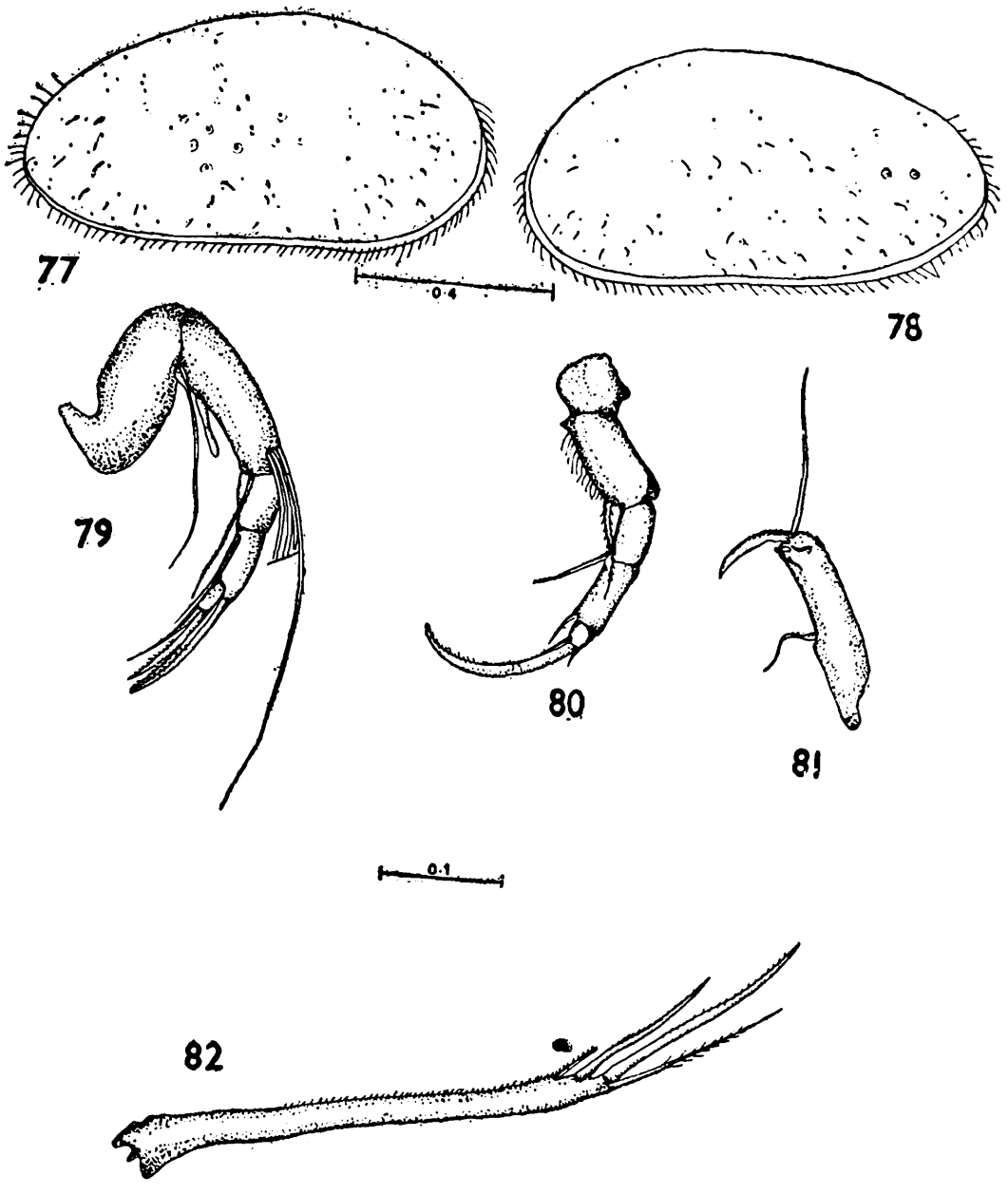
Strandesia indica Hartmann, 1964, p. 101, Abb. 39, a–c; 40, a–c; 41.

Female: Valves subelliptical; seen laterally elongate; anterior margin more broadly rounded than the posterior; left valve overlaps right valve; entire margin of the valve hairy except dorsally; dorsum convex,



Figs. 70– 76. *Strandesia elongata* Hartmann, 1964. 70. Left valve, lateral view. 71. Left valve, internal view. 72. Carapace, dorsal view. 73. Second antenna. 74. Second thoracic leg. 75. Third thoracic leg. 76. Furca. Measurements in mm.

highly arched in the anterior region; ventral margin almost straight; valve surface sparsely hairy and punctate (Figs. 77, 78). Length of valves 0.88–0.96 mm; height 0.45–0.48 mm and width 0.35–0.39 mm. Natatory setae of the second antenna smooth, slightly reaching beyond the tips of the terminal claws; claws pectinate (Fig. 79). Maxillary spines smooth. Second thoracic leg with a long terminal scythe-like claw, weakly pectinate; second segment with a single setulate seta; ventral margin of the second segment hairy (Fig. 80). Third leg with a prominent claw, slighlty serrate, a small claw and a reflexed seta (Fig. 81). Furcal rami symmetrical, long and slender; terminal and subterminal claws slender, lined with spines on the dorsal edge; terminal seta hairy, little shorter than terminal claw, dorsal seta less than 1/3 the length of subterminal claw, lined with setules on the dorsal edge; dorsal margin of both the rami have minute spines along 3/4 the entire length (Fig. 82).



Figs. 77–82. *Strandesia indica* Hartmann, 1964. 77. Right valve, lateral view. 78. Left valve, lateral view. 79. Second antenna. 80. Second thoracic leg. 81. Third thoracic leg. 82. Furca. Measurements in mm.

Male: Not obtained during the present study though Hartmann (1964) reported males.

Remarks: Insignificant size differences were noticed between the populations of *Strandesia indica* from the East and West coasts of India. The structure of valves and soft parts were however consistant.

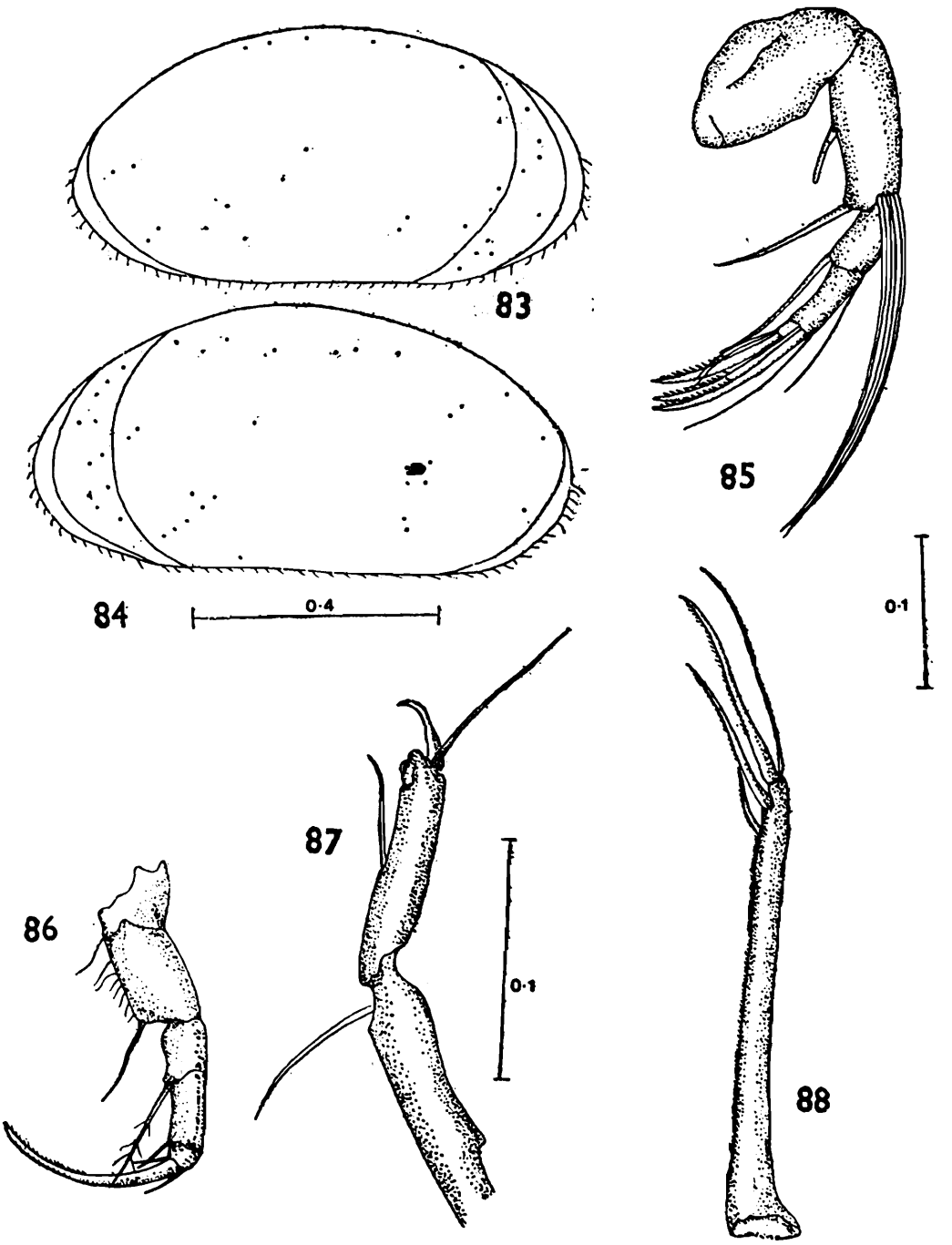
Indian Localities: Ginar Hill reservoir in Kathiawar, Gujarat; Madras and vicinity, Pondichery in Tamilnadu; Trivandrum and vicinity in Kerala and Calcutta in West Bengal.

Strandesia purpurascens (Brady) 1886

Cypris purpurascens Brady, 1886: Brady, G.S., p. 298, Pl. XXVIII, Fig. 12–14 and not of Apstein, 1907, p. 227, Fig. R.

Female: Subelliptical valves; laterally elongate; both anterior and posterior margins rounded; left valve slightly larger, overlapping the right;

anterior, posterior and ventral margin hairy; dorsum convex, evenly arched, reaching the maximum height in the middle; ventral margin straight; valve surface vesicular. Inner duplicature wide anteriorly and narrow posteriorly (Figs. 83, 84). Length of valves 0.81–0.85 mm and height 0.42–0.44 mm. Natatory setae of the second antenna smooth, reaching the tips of the toothed terminal claws; sensory club three segmented (Fig. 85). Maxillary spines smooth. Second thoracic leg with a faintly toothed, long scythe-like claw; second segment lined with unequal hairs on the ventral margin and a single seta; seta in the third segment hairy (Fig. 86). Terminal podomere of the third leg with a single beak-shaped claw and a reflexed seta (Fig. 87). Furcal rami symmetrical; terminal and sub-terminal claws slender with spines; terminal seta little longer than the terminal claw and smooth; dorsal seta setulate on the dorsal aspect, little shorter than 1/2 the length of subterminal claw (Fig. 88). Furca 16 X least width.



Figs. 83–88. *Strandesia purpurascens* (Brady) 1886. 83. Right valve, lateral vew. 84. Left. valve, lateral view. 85. Second antenna. 86. Second thoracic leg 87. Third thoracic leg. 88. Furca. Measurements in mm.

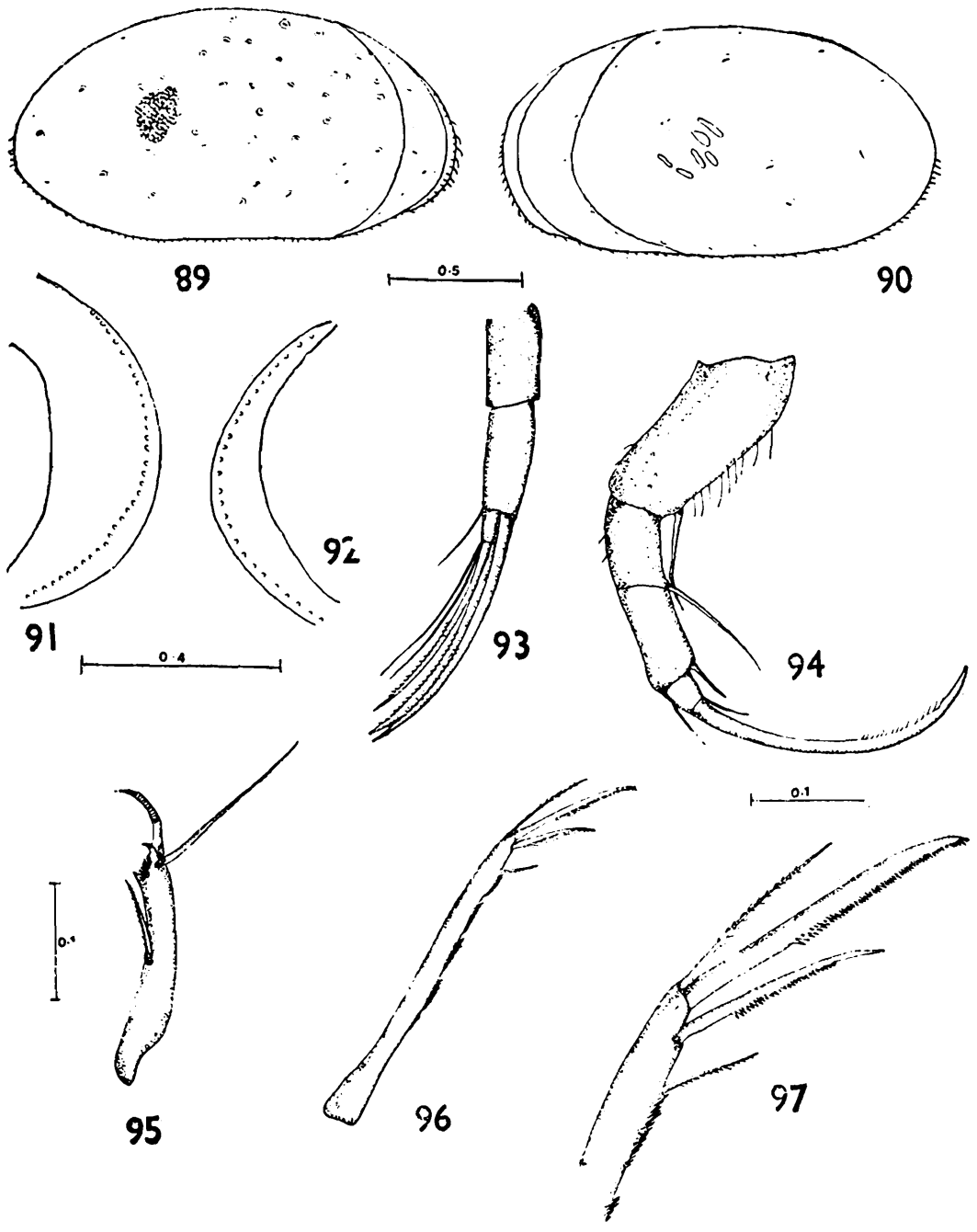
Male: Unknown

Remarks: Brady (1886) described *Cypris purpurascens* from Ceylon and this species is being reassigned as *Strondesia purpurascens* (Brady) 1886. The Indian specimens examined were identical with *S. purpurascens* type material. Neale (personal communication) reports purple patches of colouration on the valves and this character was not observed in the present specimens. The loss of colouration may be due to the preservation in alcohol.

Indian Localities: Ramnad Dt., Madurai and surrounding areas in Tamilnadu.

Strandesia flavescens Klie, 1932

Female: Valves ovate; right valve slightly larger than the left; left valves with nodules along the anterior and posterior margins restricted to the inner face; dorsum convex, evenly arched; ventral margin almost straight; bristles along the entire valve margin except dorsally; valve surface hairy and reti-

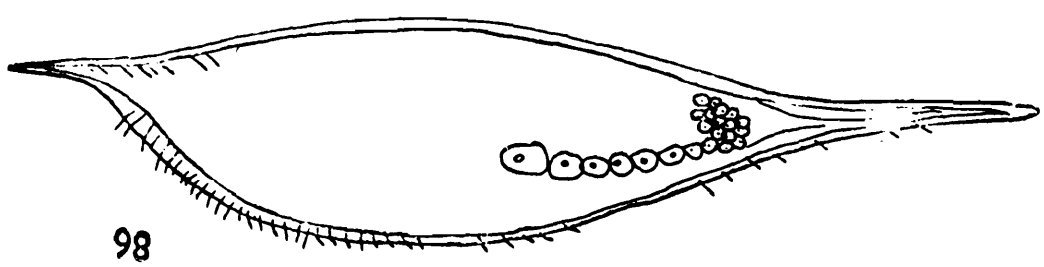


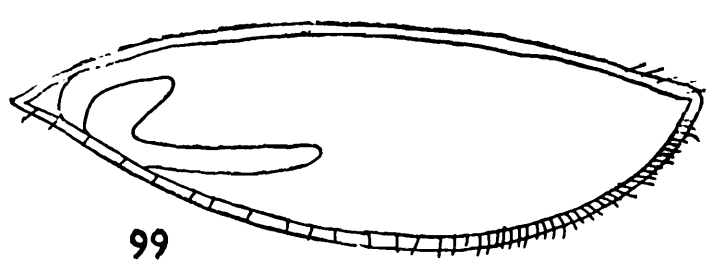
Figs. 89–97. *Strandesia flavescens* Klie, 1932. 89. Right valve, a part showing reticulation. 90. Left valve and central muscle scars. 91. Inner margin of left valve, anterior. 92. Inner margin of left valve, posterior. 93. Distal segments of second antenna. 94. Second thoracic leg. 95. Third thoracic leg. 96. Furcal ramus, entire. 97. Furcal ramus, distal end. Measurements in mm.

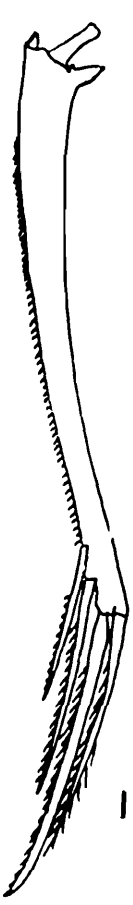
culate; six prominent muscle scars. Inner duplicature wide anteriorly (Figs. 89–92). Length of valves 1.50–1.58 mm; height 0.83–0.86 mm and width about 0.70 mm. Natatory setae of the second antenna not reaching the tips of the terminal claws; claws pectinate (Fig. 93); sensory club three segmented. Maxillary spines smooth. Second thoracic leg with a long end claw, pectinate; second segment with a single seta; ventral margin of second and third segments with a few spines; setae on all segments smooth (Fig. 94). Third leg with a sickle-shaped striated claw, a knob-like projection with a small claw and a row of spines; seta in the middle of the penultimate podomere setulate (Fig. 95). Furcal rami symmetrical; terminal claw broader than the subterminal claw, both the claws heavily toothed; terminal seta setulate, little shorter than the subterminal claw; dorsal seta setulate on dorsal aspect, approximately half the length of subterminal claw; dorsal margin of the ramus with four groups of characteristically arranged spines and a faint fifth group with a few spines (Fig. 96, 97). Furca 17.5 X least width.

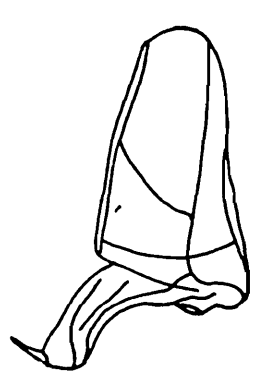
Male: Not known

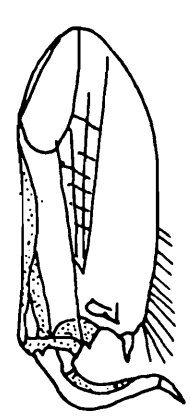
Remarks: Strandesia flavescens resembles a West African species, *Strandesia prava* Klie, 1935 in the presence of nodules in the inner margin of the left valve, the presence of grouped spines on the dorsal margin of the furca, the setulate dorsal and terminal setae (Klie, 1935). But it differs markedly in the valve overlap, shape of the valves, the central muscle scar pattern and also in the











Figs. 98–102. *Strandesia bicornuta* Hartmann, 1964 (After Hartmann, 1964). 98. Left valve. 99. Right valve. 100. Furca. 101. Left prehensile palp, Male. 102. Right prehensile palp, Male.

number of spinous groups on the dorsal margin of the furca. *Strandesia flavescens* was originally described from Pangururan and Singarak (Central Sumatra) (Klie, 1932). The present Indian specimens were smaller in size but the other features were similar.

Indian Localities: Ramnad Dt. and Madurai Dt. in Tamilnadu.

Strandesia bicornuta Hartmann, 1964

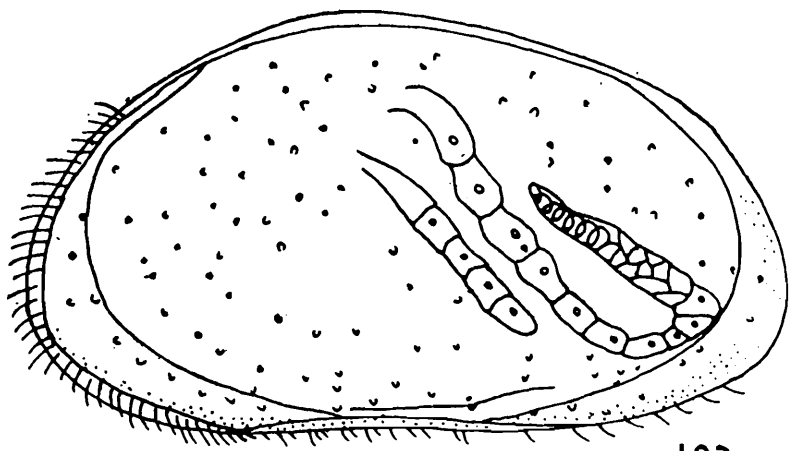
Female: Valves unequal, left valve overlaps the right; anterior and posterior extremities of the left valve extend into a spinous projection (Figs. 98, 99). Furcal rami symmetrical with a thick, setulate terminal seta (Fig. 100). Prehensile palps of the male first thoracic legs are asymmetrical (Figs. 101, 102). Length of the left valve 2.2 mm, right valve 1.5 mm; height 0.50 mm and width 0.20–0.21 mm.

Male: known

Indian Localities: Goa and Travancore, mountainous terrains.

Strandesia labiata Hartmann, 1964

Female: Valves tuberculate, right valve with an anteroventral lip-like projection (Figs. 103, 104). Furcal ramus with a terminal seta little less than



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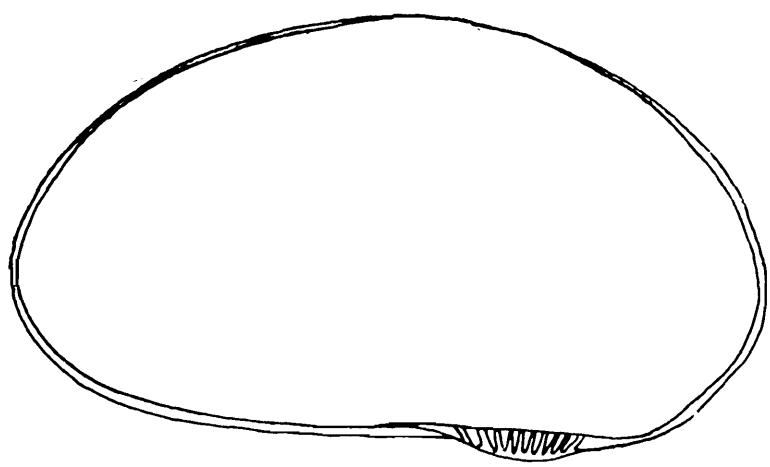

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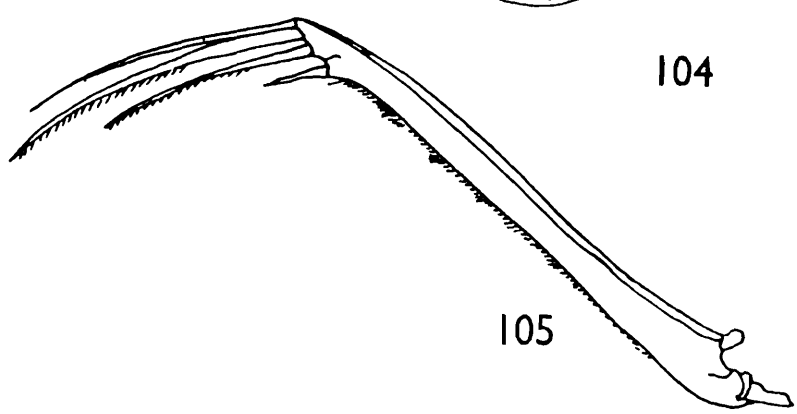

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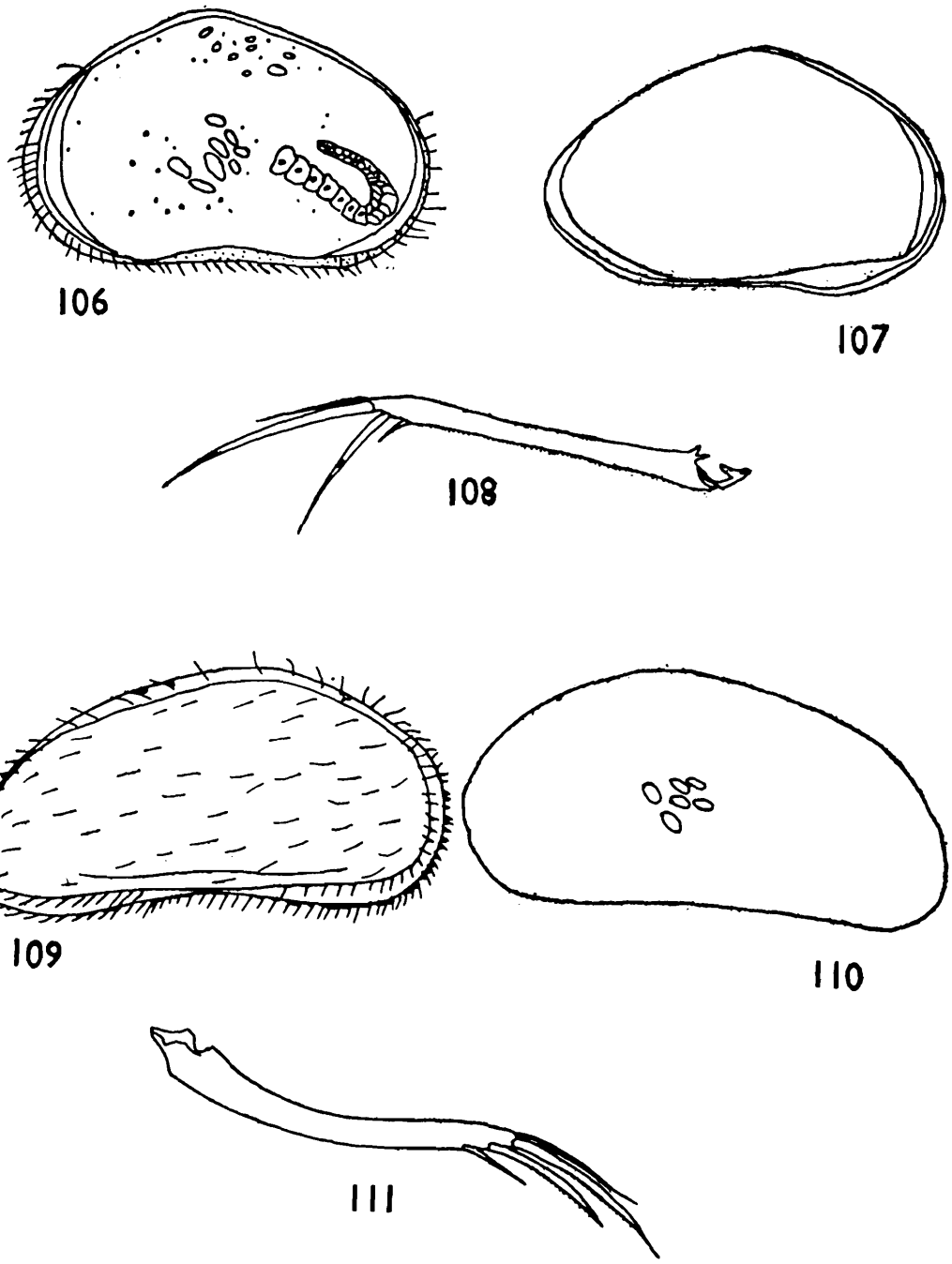
the length of the terminal claw, smooth; dorsal margin of the ramus with groups of spines, continuous along the entire length (Fig. 105). Length 1.17–1.30 mm; height 0.61–0.62 mm.

Male: Known, smaller than females.

Indian Localities: Bombay in Maharashtra; Travancore, Kerala; Palni Hills, Kodikanal Hills, Nilgiri Hills and South Madras in Tamilnadu; Hyderabad, Andhra Pradesh and Sikkim.

Strandesia parva Hartmann, 1964

Female: Left valve overlaps the right; punctate surface; angular dorsum (Figs. 106, 107). Terminal seta of the furca approximately half the length of the terminal claw, smooth; both the claws smooth; dorsal margin armed with inconspicuous spines along the entire length (Fig. 108). Length 0.62–0.64 mm and height 0.36–0.37 mm.



Figs. 106–111. 106–108. *Strandesia parva* Hartmann, 1964 (After Hartmann, 1964). 106. Left valve. 107. Right valve. 108. Furca. 109–111. *Strandesia saetosa* Hartmann, 1964 (After Hartmann, 1964). 109. Right valve. 110. Left valve. 111. Furca.

Male: Not known

Indian Localities: Bombay, Maharashtra; Jodhpur, Rajsathan; Malabar coast, Keralà and Palni Hills in Tamilnadu.

Strandesia saetosa Hartmann, 1964

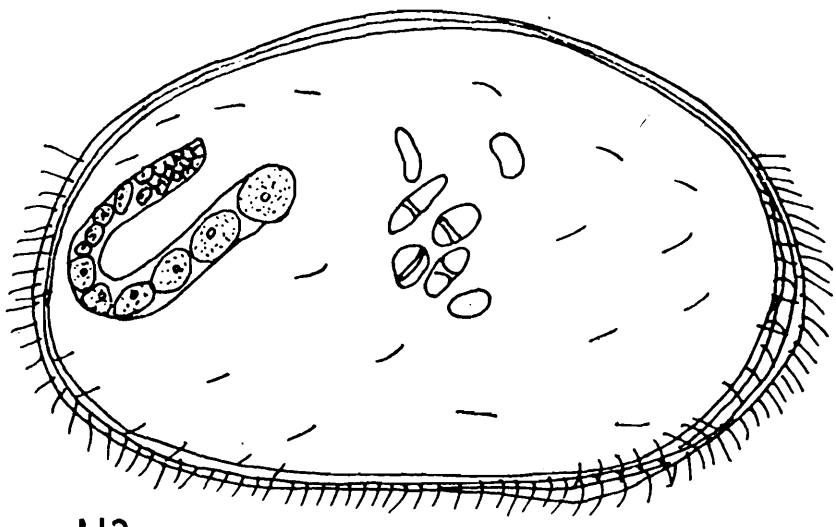
Female: Elongate valves; left overlapping the right; anterior margin broadly rounded than the posterior; valve surface with dense distribution of hairs (Figs. 109, 110). Furcal rami characteristically curved (Fig. 111). Length 0.69 mm; height 0.32 mm and width 0.26-0.27 mm.

Male: Known

Indian Localities: Malabar coast, Kerala and Barsi, Maharashtra.

Strandesia rotunda Hartmann, 1964

Female: Valves ovate; valve surface sparsely hairy (Figs. 112, 113).



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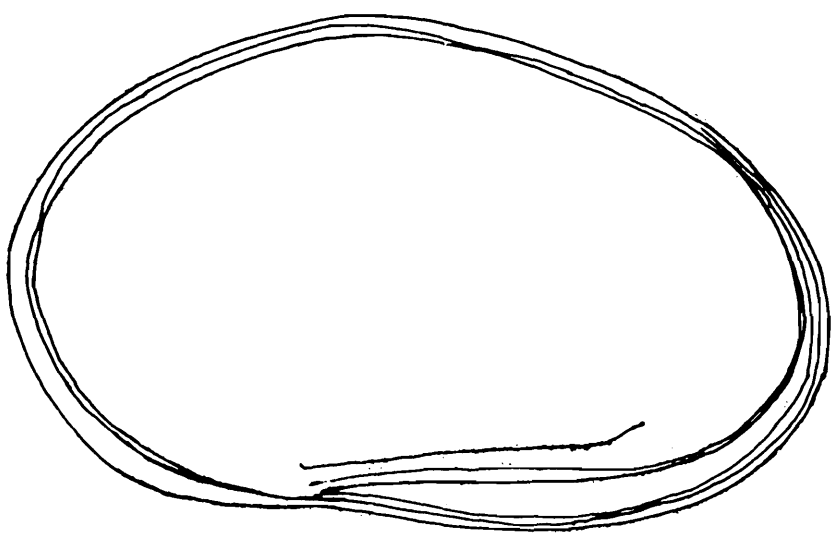

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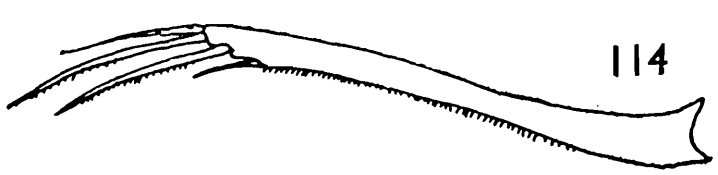

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Figs. 112–114. *Strandesia rotunda* Hartmann, 1964 (After Hartmann, 1964). 112. Right valve. 113. Left valve 114 Furca

Terminal seta of the furca 3/4 the length of the terminal claw, smooth (Fig. 114). Length 0.83–0.86 mm; height 0.51–0.52 mm and width 0.26–0.27 mm.

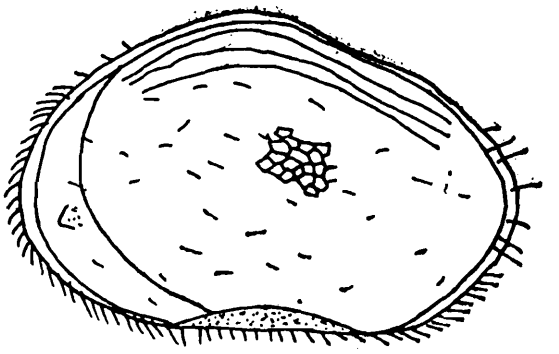
Male: Not known

Indian Localities: Ginar, Kathiawar in Gujarat; Bombay, Maharashtra; Cochin, Kerala and Pondichery, Tamilnadu.

Strandesia tuberculata Hartmann, 1964

Female: Valves subtriangular; left slightly overlapping the right; each valve with a protuberance in the anterior region; surface reticulate and sparsely hairy (Figs. 115, 116, 117). Furcal rami straight, terminal seta smooth, more than 1/2 the length of the terminal claw (Fig. 118). Length 0.71–0.74 mm; height 0.43–0.45 and width 0.54–0.55 mm.

115



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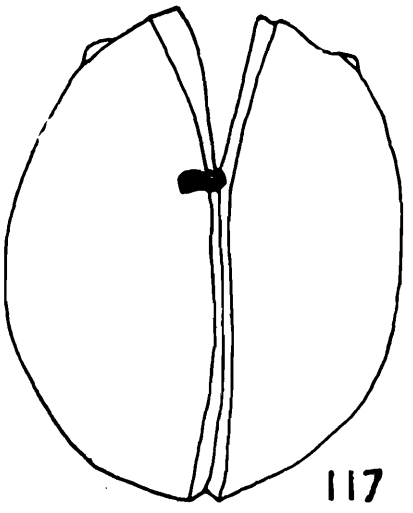

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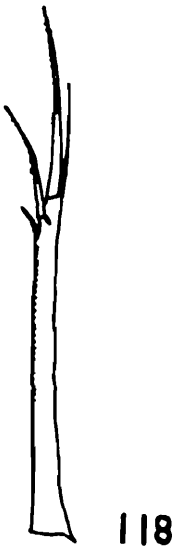

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Figs. 115–118. *Strandesia tuberculata* Hartmann, 1964 (After Hartmann, 1964). 115. Right valve. 116. Left valve. 117. Carapace, dorsal view. 118. Furca.

Male: Not known

Indian Locality: Sikkim at an altitude of 3000 m.

Genus **Cyprinotus** Brady, 1886

Generic diagnosis:

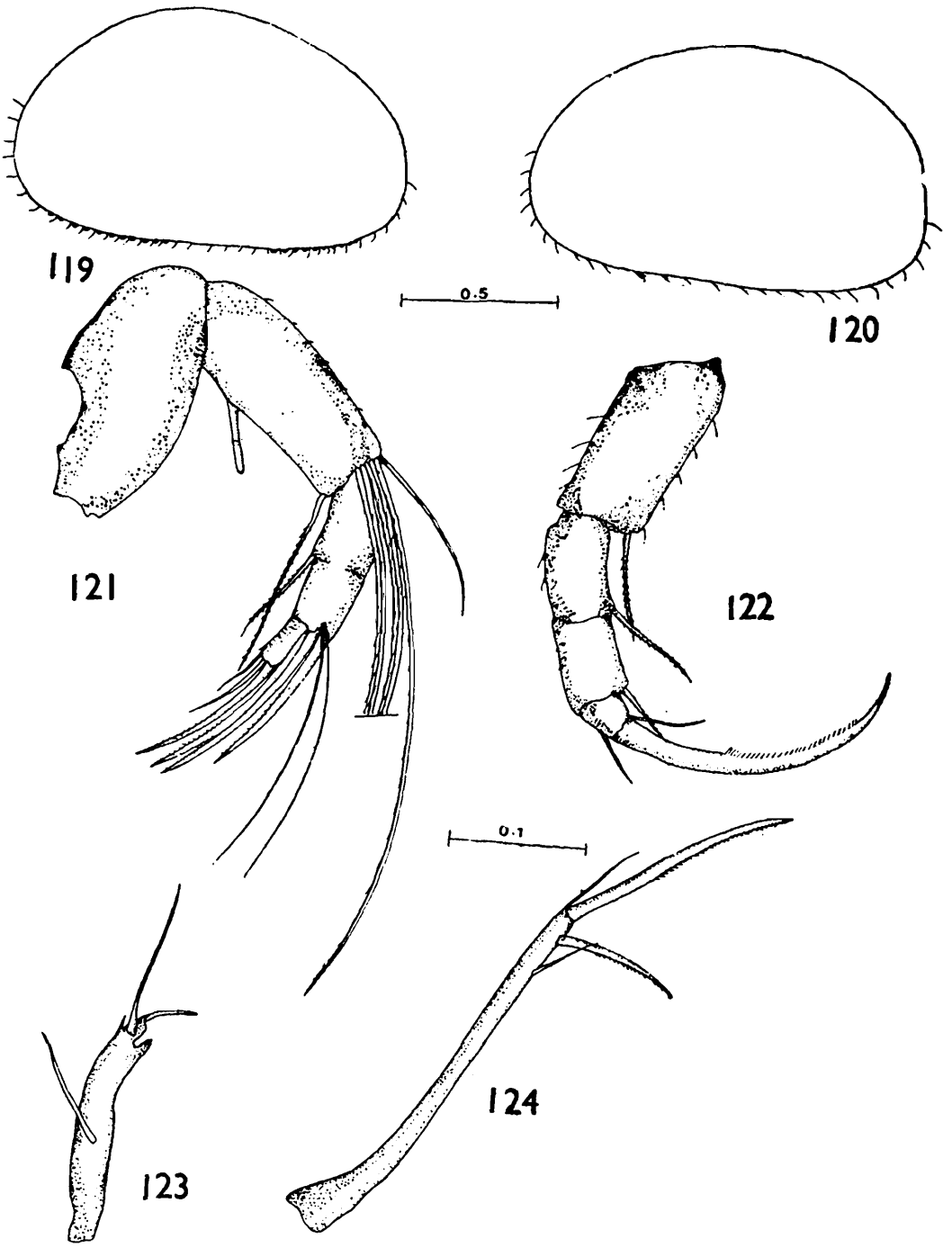
Valves subovate to subtriangular; not tumid; both anterior and posterior margins rounded; left valve larger than the right; overlap variable; right valve with tubercles. Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Furcal rami well developed and symmetrical;

Indian species:

The following species are reported for this genus in India:— *Cyprinotus nudus* Victor and Michael, 1975; *Cyprinotus cingalensis* Brady, 1886; *Cyprinotus chandrai* Arora, 1931; *Cyprinotus incongruens* (Ramdohr) 1908; *Cyprinotus crenatus* Turner, 1893 (?). Only *C. nudus* was available for study and the other species have been described and figured from earlier studies.

Cyprinotus nudus Victor and Michael, 1975

Female: Valves subovate, unequal; left valve larger than the right; right valve tuberculate; dorsum convex, greatest height in the middle; ventral margin straight; anterior and posterior margins rounded; valve surface smooth (figs. 119, 120). Length varies from 1.2–1.3 mm, height from 0.7–0.8 mm and width from 0.6–0.65 mm. Natatory setae of the second antenna well developed, hairy, reaching beyond the tips of the terminal claws; sensory club two seg-



Figs. 119-124. *Cyprinotus nudus* Victor and Michael, 1975. 119. Right valve, lateral view. 120. Left valve, lateral view. 121. Second antenna. 122. Second leg. 123. Third thoracic leg. 124. Furcal ramus. Measurements in mm.

mented (Fig.121). Maxillary spines toothed. Second thoracic leg with a long, scythe-shaped, pectinate claw (Fig. 122). Third leg, terminal segment with a claw, a short claw-like projection and a reflexed seta (Fig. 123). Furcal rami symmetrical, nearly straight; dorsal seta nearly 1/2 the length of the subterminal claw; terminal seta less than 1/2 the length of terminal claw; dorsal margin of the ramus hairy (Fig. 124). Furca 20 X least width approximately.

Male: Not known

Remarks: This species has been compared with several species of the genus *Cyprinotus* Brady, 1886 and was found to be different (Victor and Michael, 1975). This species also differs from Brady's type species, *Cyprinotus cingalensis* in the absence of a 'hump' on the right valve and in the curvature of the dorsum which is more angular than *C. nudus* (Figs. 125, 126). Unfortunately, lack of illustrations for the soft parts of *C. cingalensis* (Brady, 1886; Sars, 1889,) limits a detailed comparison, though the above mentioned characters are emphatic enough to establish their distinctions.

Indian Localities: Trichy Dt., Ramnad Dt., Madurai Dt., Salem in Tamilnadu.

Cyprinotus cingalensis Brady, 1886

Cyprinotus cingalensis Brady 1886, p. 302, Pl. 38, Figs. 28–30.

Cyprinotus cingalensis Brady, 1886: Sars, 1889, p. 25, Pl. I, Figs. 5, 6; Pl. III.

Female: Valves subtriangular, greates height in the middle; unequal, anterior and posterior margin rounded; dorsal margin of the right valve elevated forming a hump; right valve tuberculated (Figs. 125, 126), margins of the left valve smooth; valve surface smooth with scattered hairs. Length about 1.20 mm. Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Furca symmetrical.

Male: Not known

Indian Locality: Poona, Maharashtra.

Cyprinotus chandrai Arora, 1931

Cyprinotus chandrai Arora, 1931, p. 83, Pl. VII. Figs. 36–41.

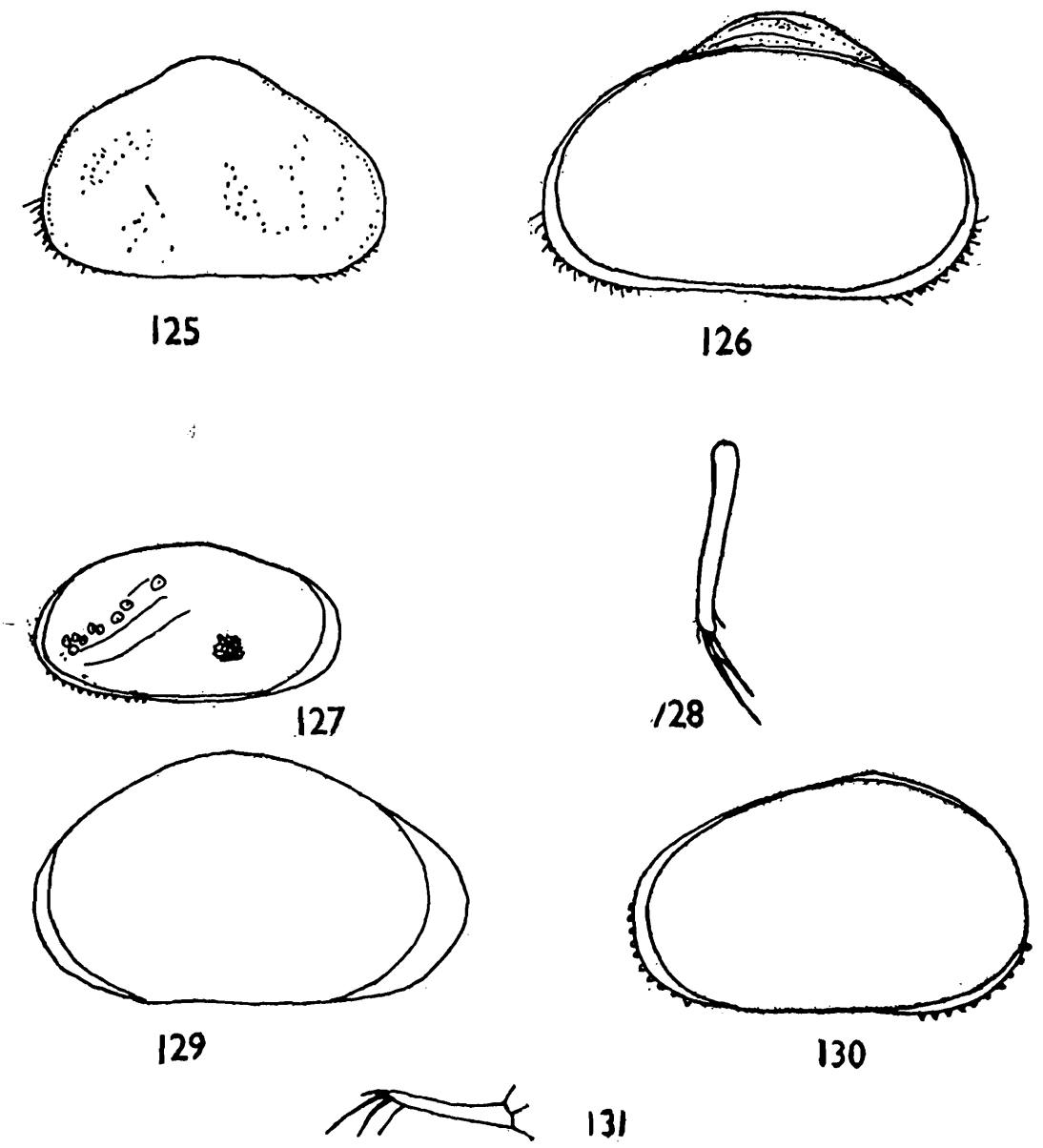
Female: Valves oblong, unequal, left overlaps the right; right valve tuberculated; dorsum smoothly convex, venter straight, valve surface reticulated (Fig. 127). Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Third leg with a short beak-like claw and a reflexed seta. Furca symmetrical, nearly straight; dorsal seta less than 1/2 the length of sub terminal claw (Fig. 128).

Male: Not known

Reported from Lahore.

Cyprinotus incongruens (Ramdohr) 1808

Female: Valve irregularly ovate, unequal; left overlapping the right; right valve with tubercles, left valve smooth; dorsum boldly arched; ventral margin nearly straight (Figs. 129, 130). Length ranging from 1.40–1.75 mm. Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Maxillary spines toothed. Furcal rami symmetrical, short and straight, dorsal seta more than 1/2 the length of subterminal claw; length of the ramus about 11 X least width (Fig. 131).



Figs. 125–131. 125–126. *Cyprinotus cingalensis* Brady, 1886 (After Sars, 1896). 125. Right valve, external view. 126. Right valve, internal view. 127–128. *Cyprinotus chandrai* Arora, 1931 (After Arora, 1931). 127. Right valve, lateral view. 128. Furca. 129–131. *Cyprinotus incongruens* (Ramdohr) 1808 (After Szczechura, 1971). 129. Left valve, internal view. 130. Right valve, internal view, (After Hoff, 1942). 131. Furca.

Male: Reported to be smaller (Klie, 1938).

Remarks: This species is cosmopolitan in occurrence. Arora (1931) reported this species from Lahore but his description (Figs. 132, 133) seems to differ considerably. Hartmann (1964) reported *Heterocypris* aff. *incongruens* from Aurangabad, India and the description was not given. Specimens corresponding to this species were not encountered in the present study. Since this species is reported from India, the above description is compiled from Hoff (1942) and Szczechura (1971). There are contradictory opinions regarding the placement of this species in the genus *Cyprinotus*. Swain (1961) considers the tuberculated right valve as a differentiating character from the tuberculated left valve of *Heterocypris*, whereas Hartmann (personal communication) considering the nature of valve asymmetry feels that this species belongs to the genus *Heterocypris*.

Indian Locality: Aurangabad, Maharashtra.

Cyprinotus crenatus Turner, 1893 (?)

This species which was originally described by Turner (1893) from Ohio, U.S.A. (Tressler 1959) was reported by Arora (1931) from Lahore (Figs. 134, 135). His description is not in agreement with the North American material (Sharpe, 1918; Tressler, 1959). The identity of these Lahore specimens as *C. crenatus* is doubtful.

Genus **Heterocypris** Claus, 1892

Generic diagnosis:

Valves usually subvate; not tumid; unequal; left valve overlaps the right; left valve tuberculate. Furcal rami well developed, symmetrical and short.

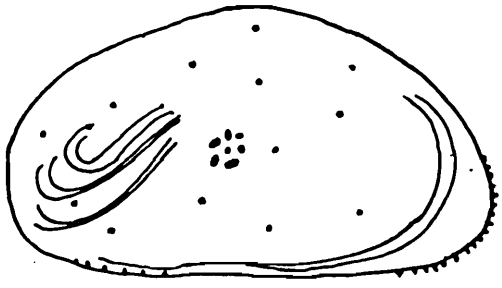
Indian species:

The only species assigned to this genus is *Heterocypris dentatomarginatus* (Baird) 1859.

Heterocypris dentatomarginatus (Baird) 1859

Cypris dentatomarginatus Baird, 1859: Baird, 1859, p. 233, Pl. LXIII, Fig. 5. and not of Sars, 1889.

Female: Valve subovate, greatest height slightly posterior to the middle, tuberculated left valve (Fig. 136) overlapping the right. Measurements and soft part morphology are not known.



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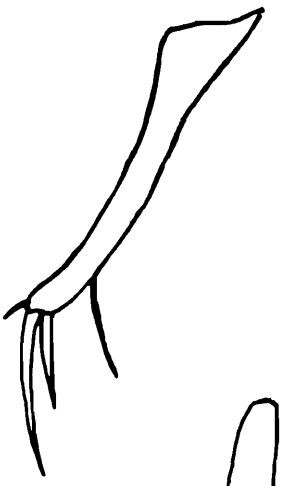

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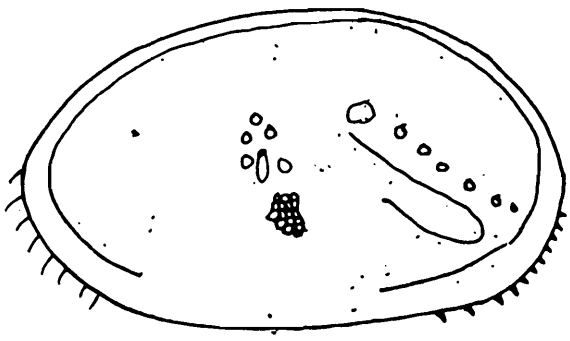

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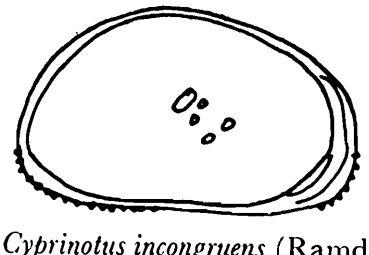

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Figs. 132–136. 132–133. *Cyprinotus incongruens* (Ramdohr) (After Arora, 1931). 132. Right valve. 133. Furca. 134–135. *Cyprinotus crenatus* (Turner) (After Arora, 1931). 134. Right valve. 135. Furca. 136. *Heterocypris dentatomarginata*

Remarks: Sars (1889) redescribed this species as *Cyprinotus dentatomarginatus* from Australia and the detailed description of this species reports tuberculations on the margin of the right valve in contrast to the illustrations and description given by Baird (1895) indicating tuberculations on the left valve. Sars' Australian specimens also seem to differ in the shape of the valves. This is the prevailing opinion (Neale, personal communication) and the identity of Australian material (Sars, 1889) must be reinvestigated.

Male: Not known

Indan Locality: Nagpur, Maharashtra.

No material available during the present study.

Genus **Hemicypris** Sars, 1903

Generic diagnosis:

Subtriangular or subovate valves; moderately compressed; dorsum convex, smoothly arched or subangulate medially; venter straight or slightly concave; right valve always overlaps the left; left valve with tubercles along the margin at least posteriorly. Natatory setae of the second antenna reaching beyond the tips of the terminal claw; Furca well developed, symmetrical with both dorsal and terminal setae.

Indian species:

The following species are assigned to this genus in India:—
Hemicypris anomala (Klie) 1938; *Hemicypris pyxidata* (Moniez) 1892; *Hemicypris falcatus*, Victor and Fernando 1976; *Hemicypris dissonus*, Victor and Fernando 1976.

Hemicypris anomala (Klie) 1938

Heterocypris anomala Klie, 1938, p. 23, Abb. 1–7.

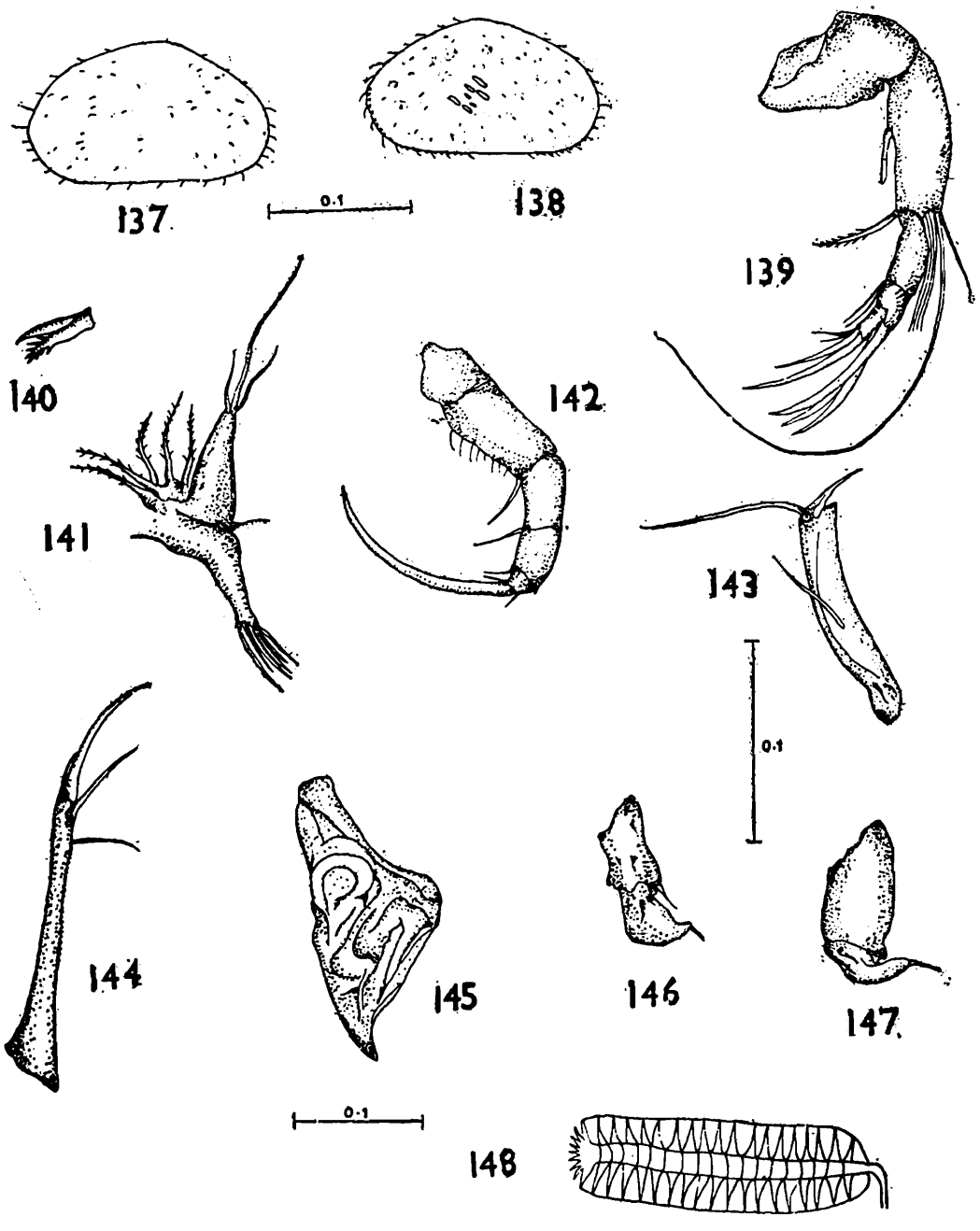
Heterocypris anomala Klie, 1938: Hartmann, 1964, p. 92.

Female: Valves subtriangular, unequal; right valve larger, completely overlapping the left; left valve tuberculated; convex dorsum, somewhat angular with greatest height in the middle; valve margins hairy; valve surface with short hairs, not very dense (Figs. 137, 138). Length of the valves 0.70–0.75 mm and height 0.42–0.45 mm. Natatory setae of the second antenna reaching beyond the tips of the terminal claws; sensory club two segmented (Fig. 139). Two maxillary spines, one toothed and one smooth (Fig. 140). Endopodite of first leg with three setae (Fig. 141). Second thoracic leg with a long end claw; second segment with a single seta (Fig. 142). Third leg with a beak-shaped claw and a reflexed seta (Fig. 143). Furca symmetrical, straight; dorsal seta more than 3/4 the length of subterminal claw; terminal seta less than 1/2 the length of terminal claw; dorsal margin of the ramus finely spinose (Figs. 144).

Male: Hemipenis with a blunt angular lobe (Fig. 145). Prehensile palps of first thoracic legs asymmetrical (Figs. 146, 147). Zenkers organ well developed with 19 crowns (Fig. 148).

Remarks: This species, originally described by Klie (1938) from Formosa, has been redescribed as *Hemicypris anomala* since the right valve overlaps the tuberculated left valve.

Indian Localities: Tirupattur, Pondicherri, Madurai Dt. and Vridachalam in Tamilnadu; Travancore, Kerala and South Bombay in Maharashtra.



Figs. 137–148. *Hemicypris anomala* (Klie) 1938. 137. Right valve, external view. 138. Left valve, external view. 139. Second antenna. 140. Maxillary spines. 141. First thoracic leg, Female. 142. Second thoracic leg. 143. Third thoracic leg. 144. Furca. 145. Hemipenis. 146. Right prehensile palp, Male. 147. Left prehensile palp, Male. 148. Zenkers organ. Measurements in mm.

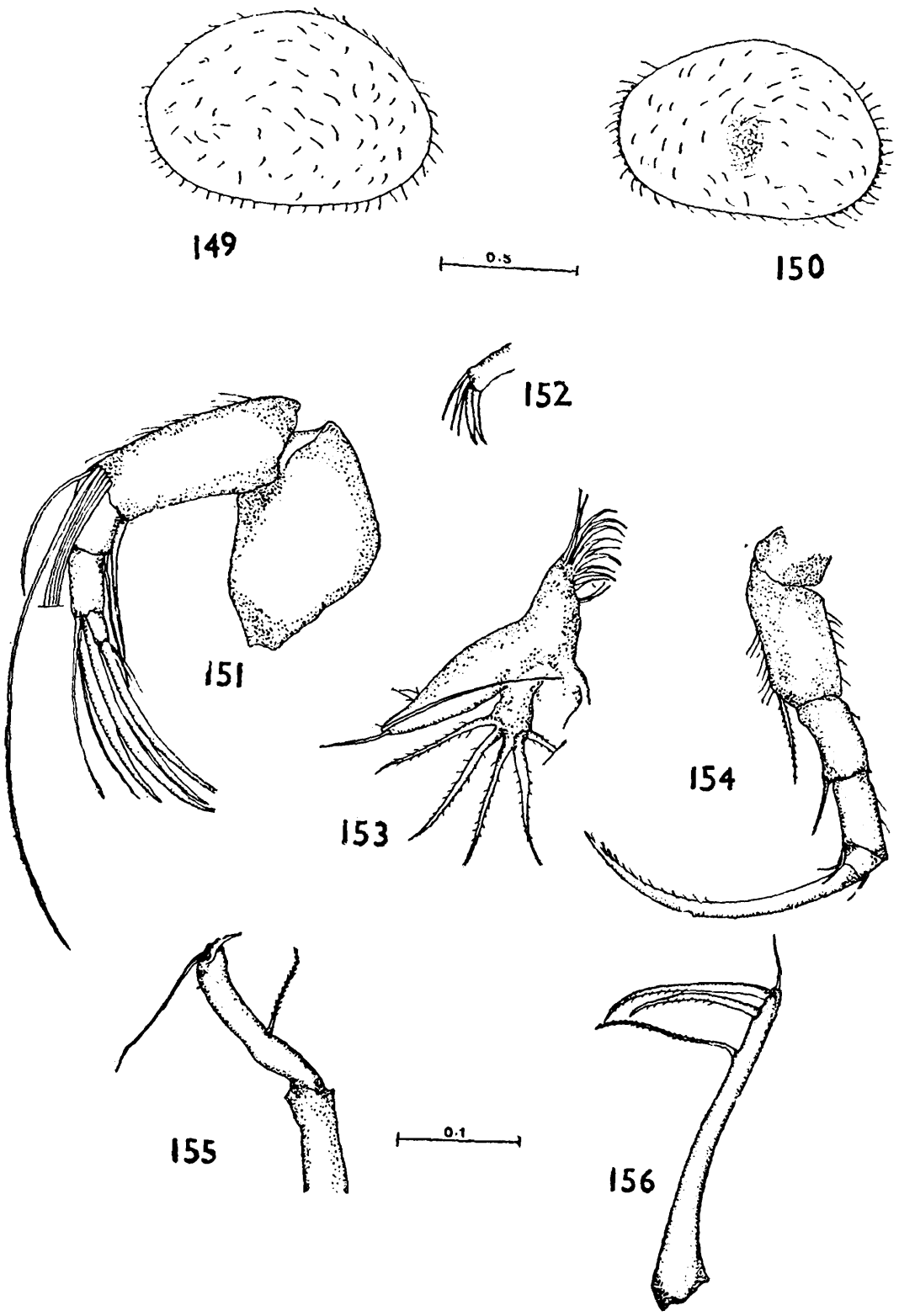
Hemicypris pyxidata (Moniez) 1892

Cyprinotus pyxidatus Moniez, 1892, p. 134, Pl. 10, Fig. 23–37.

Hemicypris pyxidata (Moniez): Sars, 1903, p. 25, Pl. III, Figs. 1 a–f.

Female: Valves subovate, unequal; right valve overlaps the left, left valve tuberculate; dorsum convex, smoothly arched, greatest height in the middle; venter almost straight; anterior and posterior margins rounded and hairy; valve surface densely hairy and conspicuously dotted giving a reticulate appearance (Figs. 149, 150). Length of the valves 0.93–0.98 mm; height 0.66–0.68 mm. Natatory setae of the second antenna well developed, smooth reaching beyond the tips of the terminal claws (Fig. 151). Maxillary spines smooth (Fig. 152). Masticatory process of the first thoracic leg with curved

spines; respiratory plate with Five setulate setae (Fig. 153). Third thoracic leg with a short beak-like claw and a reflxed seta (Fig. 155). Furcal rami symmetrical, slightly curved; subterminal and terminal claws pectinate; dorsal seta longer than the subterminal claw, setulate; terminal seta short. Furca 19 X least width (Fig. 156).



Figs. 149-156. *Hemicypris pyxidata* (Moniez) 1892. 149. Right valve, external view. 150. Left valve, external view. 151. Second antenna. 152. Maxillary spines. 153. First thoracic leg. 154. Second thoracic leg. 155. Third thoracic leg. 156. Furca. Measurements in mm.

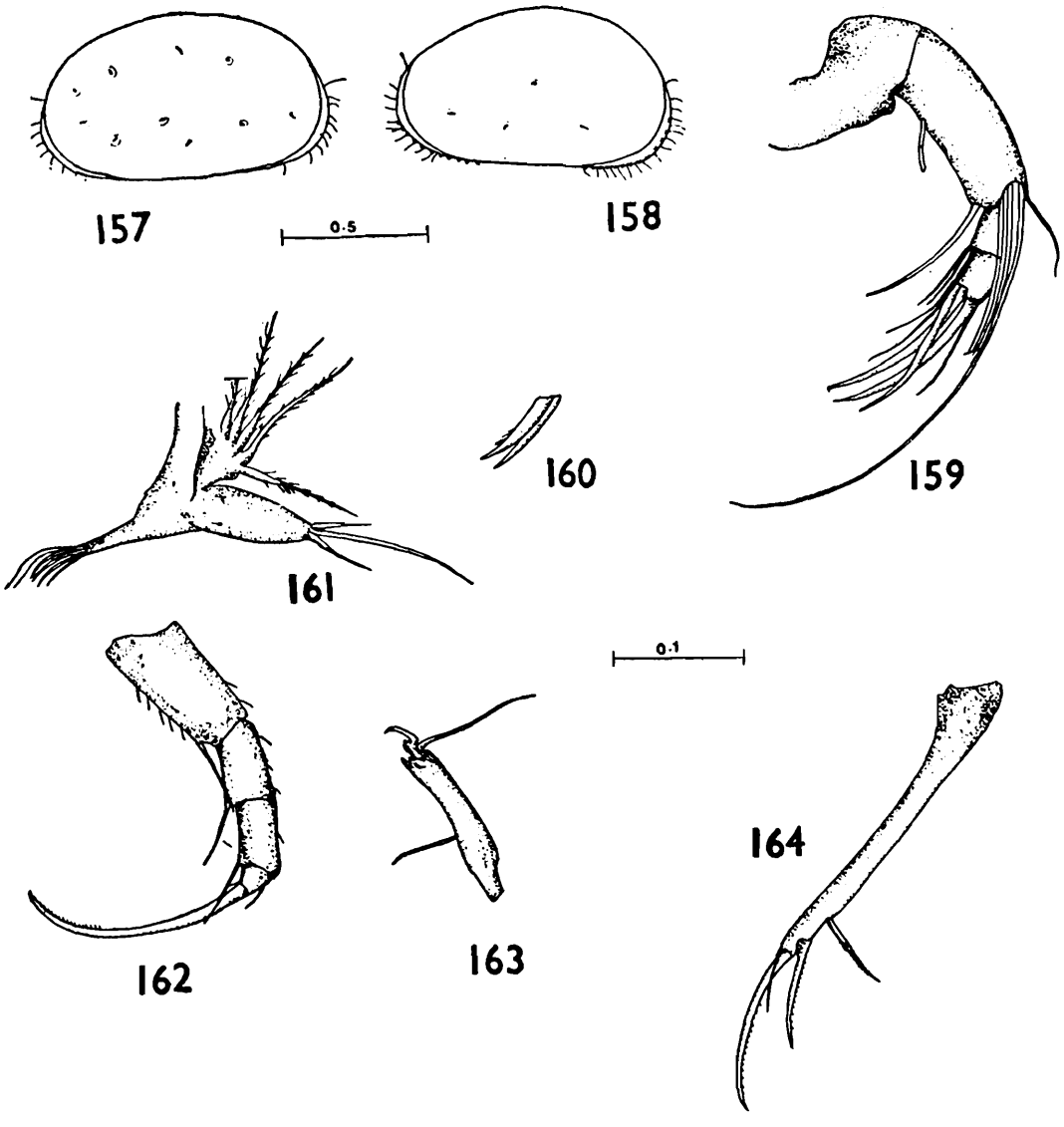
Male: Not known

Remarks: This species was originally described from Celebes (Moniez, 1892) and redescribed by Sars (1903) from Sumatra. The Indian specimens are smaller but the size difference is insignificant.

Indian Locality: A rock pool in Tirupparankundram Hill, Madurai area, Tamilnadu.

Hemicypris falcatus Victor and Fernando, 1976

Female: Valves subovate, unequal; right valve larger overlapping the left; left valve tuberculate; dorsum smoothly convex; anterior and posterior margins broadly rounded with long hairs; surface smooth and shiny except for a few hairs (Figs. 157, 158). Length of the valves 0.86–0.90 mm; height about 0.50 mm. Natatory setae of the second antenna well developed reaching beyond the tips of the terminal claws; sensory club two segmented (Fig. 159). Maxillary spines, one weakly spinose, the other smooth (Fig. 160). First leg endopodite with three setae (Fig. 161). Terminal claw of the second leg pectinate; dorsal margin spinose (Fig. 162). Third leg with a sickle-shaped claw, a small projection and a reflexed seta (Fig. 163). Furca symmetrical straight; dorsal seta setulate, about 3/4 the length of subterminal claw; terminal seta more than 1/2 the length of the sub-terminal claw (Fig. 164).



Figs. 157–164. *Hemicypris falcatus* Victor and Fernando. 157. Right valve, external view 158. Left valve, external view. 159. Second antenna. 160. Maxillary spines. 161. First thoracic leg. 162. Second thoracic leg. 163. Third thoracic leg. 164. Furca. Measurements in mm.

Male: Unknown

Remarks: *Hemicypris falcatus* was compared with five species of the genus described from the Oriental region, namely *Hemicypris anomala* Klie; *Hemicypris*

pyxidata (Moniez); *Hemicypris megalops* Sars; *Hemicypris ovata* Sars and *Hemicypris kaufmanni* (Vavra). It differs from *H. pyxidata* in the shape of the valves, the absence of surface areolations, dense distribution of hairs, the structure of the first leg and the furcal ramus. Though it resembles *H. anomala* in the structure of the first thoracic leg, the valve characteristics, the structure of maxillary spines, the structure of third leg terminal segment and the furcal rami are different. *H. kaufmanni* is a much larger species with length of 1.60 mm (Vavra, 1906). *H. megalops* and *H. ovata* differ in the shape of the valves. This species has also been compared with other Cyprinotines and was found to be different. In addition to the above mentioned differences, the terminal podomere of the third thoracic leg with a sickle-shaped claw is unique for *Hemicypris falcatus*.

Indian Localities: This species was described from Salem, Tamilnadu and also recorded in Chokkikulam, Madurai area, Tamilnadu, along with *Cypris subglobosa*; *Stenocypris major* and *Cyprinotus nudus*.

Hemicypris dissonus Victor and Fernando, 1976.

Female: Valves ovate, unequal; right valve larger overlapping the left; left valve tuberculate; dorsum smoothly arched; anterior and posterior margins equally rounded; hairs along anterior, posterior and ventral margins; surface smooth (Figs. 165, 166). Length of the valves 0.72–0.80 mm; height 0.48–0.52 mm. Natatory setae of the second antenna slightly reaching beyond the tips of the terminal claws; two segmented sensory club, distal segement narrowly produced (Fig. 167). Maxillary spines smooth (Fig. 168). Masticatory process of the first leg with two strong spines apart from other setae; endopodite with three unequal setae (Fig. 169). Second leg terminal claw pectinate; second segment with a single setulate seta, ventral margin hairy; dorsal margin of the leg lined with spines (Fig. 170). Third leg with a pointed claw and a reflexed seta (Fig. 171). Furcal rami symmetrical; curved; dorsal seta setulate, little shorter than the length of the subterminal claw (Fig. 172).

Male: Unknown

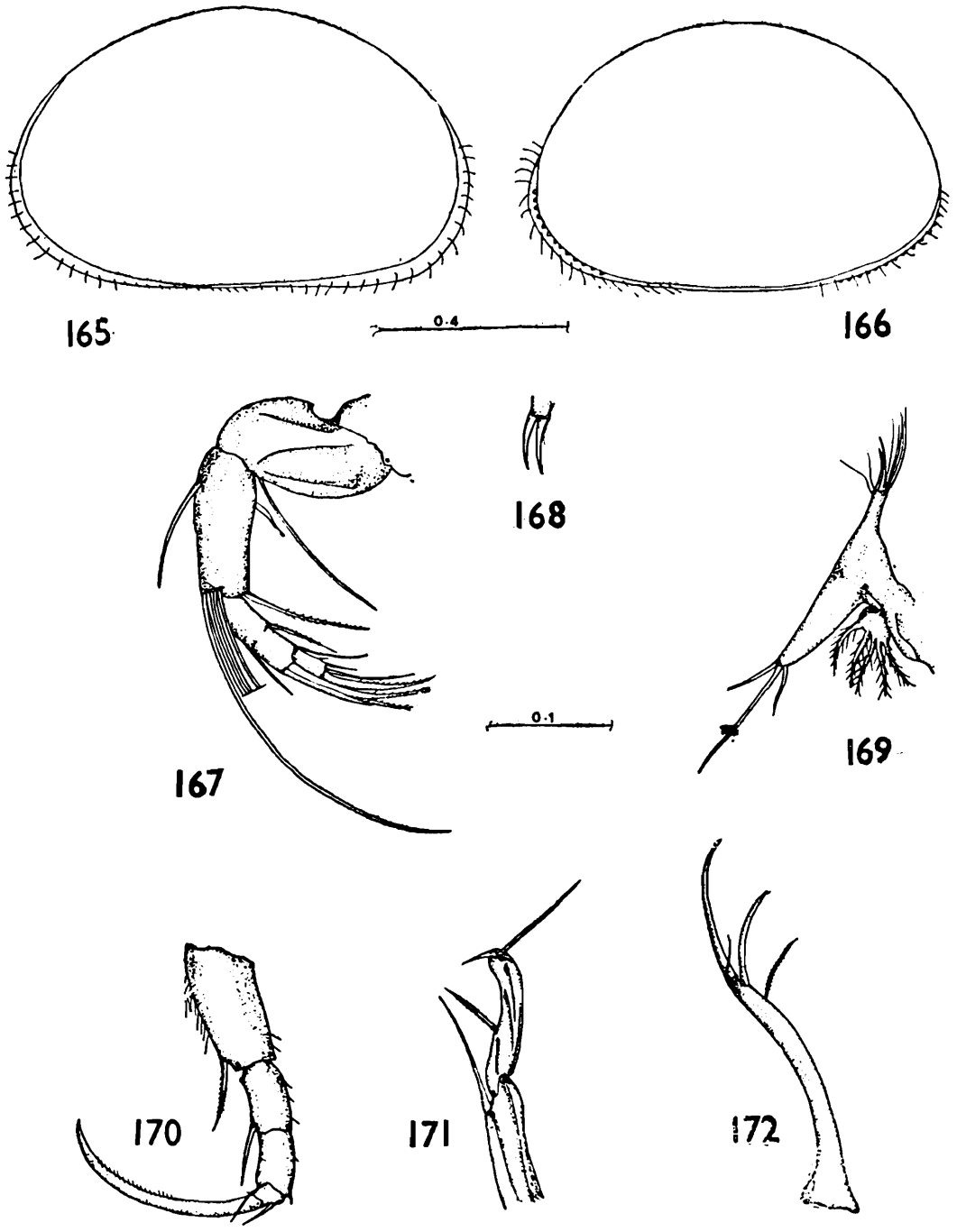
Remarks: Hemicypris dissonus resembled *Hemicypris pyxidata* in the overall shape of the valves, the structure of second and third thoracic legs, but the valve surface devoid of reticulations and hairs, the masticatory process and endopodite of the first leg and the structure of the furcal ramus were significantly different. The angular dorsum of *H. anomala*, the much larger size range of *H. kaufmanni*, the valve shape and furcal rami of *H. megalops* and *H. ovata* were different from this species. *Hemicypris dissonus* was also compared with other Cyprinotines to establish its distinction. The characteristically curved furca with a setulate dorsal seta, not longer than the subterminal claw is a unique character of this small species.

Indian Localities: A few specimens were found in a sample collected by Dr. Y Radhakrishna from Lake Kolleru, Andhra Pradesh along with *Cypridopsis dispar* Hartmann, 1964.

Genus **Candonocypris** Sars, 1894

Generic diagnosis:

Elongate, suboblong valves; dorsum variable, venter straight or concave. Natatory setae of the second antenna not exceeding the tips of the terminal claws. Distal segment of the maxillary palp broadened, spines smooth Furcal rami symmetrical.



Figs. 165–172. *Hemicypris dissonus* Victor and Fernando. 165. Right valve, external view. 166. Left valve, external view. 167. Second antenna. 168. Maxillary spines. 169. First thoracic leg. 170. Second thoracic leg. 171. Third thoracic leg. 172. Furca. Measurements in mm.

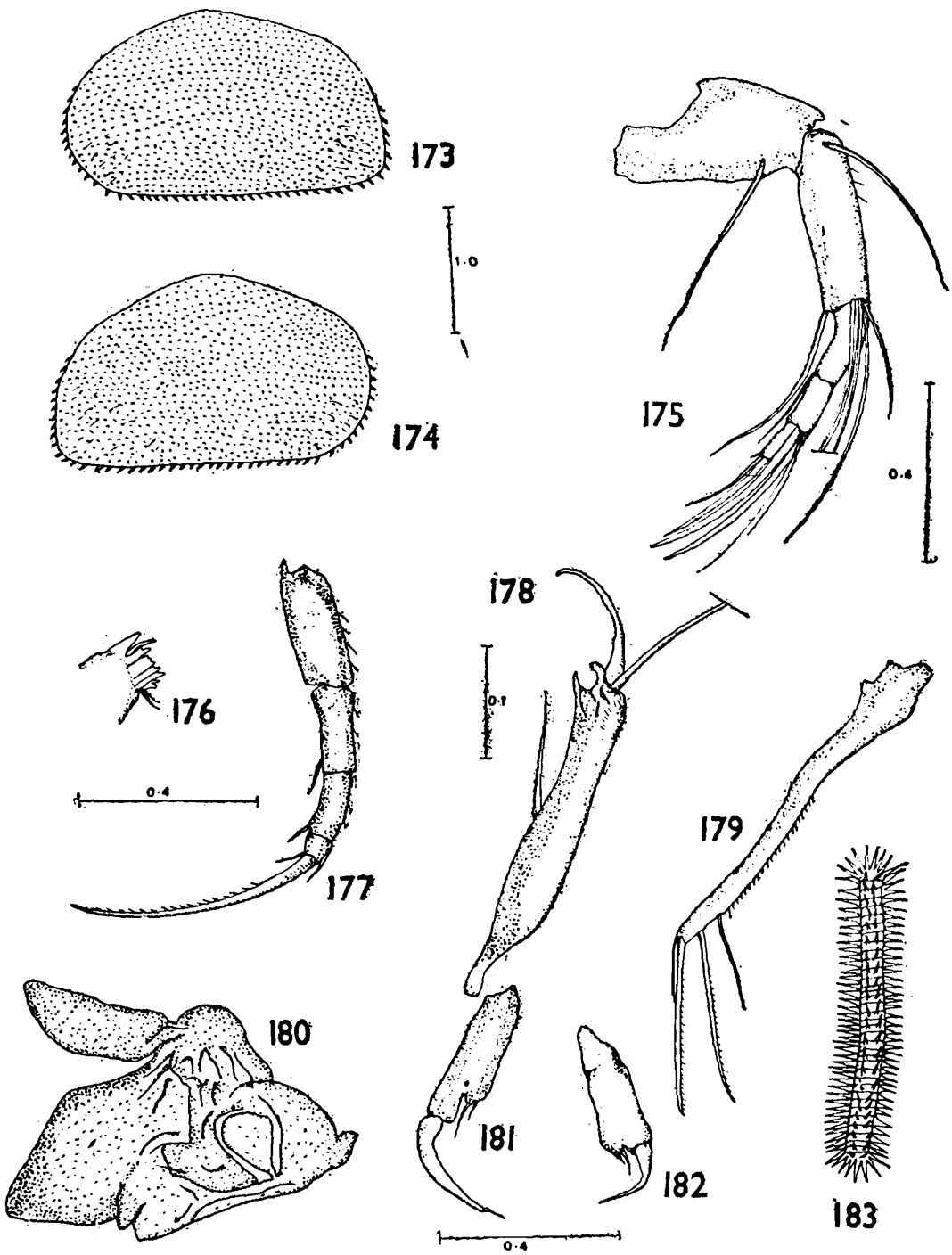
Indian species:

Candonocypris dentatus is the only species assigned to this genus in India

Candonocypris dentatus Victor and Michael, 1975

Female: Colour transparently whitish. Equivalve; not tumid; dorsum angular; ventral margin straight with thick posteriorly directed spines; anterior margin broadly rounded than the posterior; valve surface tuberculate giving a pitted appearance; sparse distribution of hairs on the anterior and posterior extremities (Figs. 173, 174). Length of the valves 2.5–3 mm; height 1.3–1.88 mm and width about 1.2 mm. Natatory setae of the second antenna not reaching the tips of the terminal claws (Fig. 175). Pars incisiva with large molar-shaped teeth (Fig. 176). Maxillary spines smooth. Second thoracic leg slender with a long terminal claw, pectinate (Fig. 177). Terminal segment of

the third leg with beak-like claw, a small sinuate claw and a reflexed seta, with a row of spines at its base (Fig. 178). Furcal rami symmetrical, bent at the proximal end; dorsal seta more than 1/2 the length of subterminal claw; terminal seta less than 1/2 the length of terminal claw; both claws pectinate; dorsal margin lined with a row of spines (Fig. 179).



Figs. 173–183. *Candonocypris dentatus* Victor and Michael, 1975. 173. Left valve, external view. 174. Right valve, external view. 175. Second antenna. 176. Mandibular teeth. 177. Second thoracic leg. 178. Third thoracic leg. 179. Furca. 180. Hemipenis. 181. Right prehensile palp, Male. 182. Left prehensile palp, Male. 183. Zenkers organ. Measurements in mm.

Male: Characteristic hemipenis finely granulated (Fig. 180). First thoracic legs modified as prehensile palps, asymmetrical (Figs. 181, 182). Ejaculatory duct with 40-41 crowns (Fig. 183).

Remarks: Although the shell shape of this species is different from the more elongated valves of the type species *Candonocypris candonoides* King, 1885 (Chapman, 1963, 1967), it is not peculiar to the genus *Candonocypris*. Two such

examples are *C. pugionis* and *C. serratomarginata* (Tressler, 1959). However, *C. dentatus* was found to be different from all the other species of *Candonocypris* (Victor and Michael, 1975). Males were reported earlier but the present description provides detailed illustrations of the male characteristics.

(Note:—*C. dentatus* was successfully cultured from dried mud obtained from temporary ponds of Madurai Dt. Southern India. Males always appeared earlier in the culture and were short lived. This observation was also supported by field studies.)

Indian Localities: Madurai Dt., in Tamilnadu and Guntur area in Andhra Pradesh.

Genus **Cypretta** Vavra, 1895

Generic diagnosis:

Small, valves less than 1 mm in greatest length, tumid carapace, surface smooth, punctate or reticulate, left and right valves equal or unequal; anterior margin of the adults always with well defined septa. Furcal rami well developed, symmetrical, slender and flexible, terminal seta present or absent, dorsal seta present.

Indian species:

The following Indian species have been assigned to this genus:– *Cypretta alagarkoilensis* Victor and Michael, 1975; *Cypretta fontinalis* Hartmann, 1964; *Cypretta foveata* Hartmann, 1964 and *Cypretta globulus* (Sars) 1889. Only *C. alagarkoilensis* was available for study. The others are described and figured from earlier works.

Cypretta alagarkoilensis Victor and Michael, 1975

Female: Equivalve, tumid; anterior and posterior margins rounded, hairy; dorsum convex; ventral margin slightly concave; anterior margin with prominent septa; surface hairy (Fig. 184). Length of the valves 0.65-0.66 mm; height 0.45-0.48 mm and width about 0.48 mm. Natatory setae of the second antenna barely reaching the tips of the terminal claws (Fig. 185). Maxillary spines smooth (Fig. 186). Second leg with a scythe-like terminal claw, pectinate at the distal tip (Fig. 187). Terminal podomere of the third leg with a long claw, a small claw and a reflexed seta (Fig. 188). Furcal rami symmetrical; straight; terminal and subterminal claws equal in length, long and slender; dorsal and terminal setae very short; dorsal margin smooth (Fig. 189).

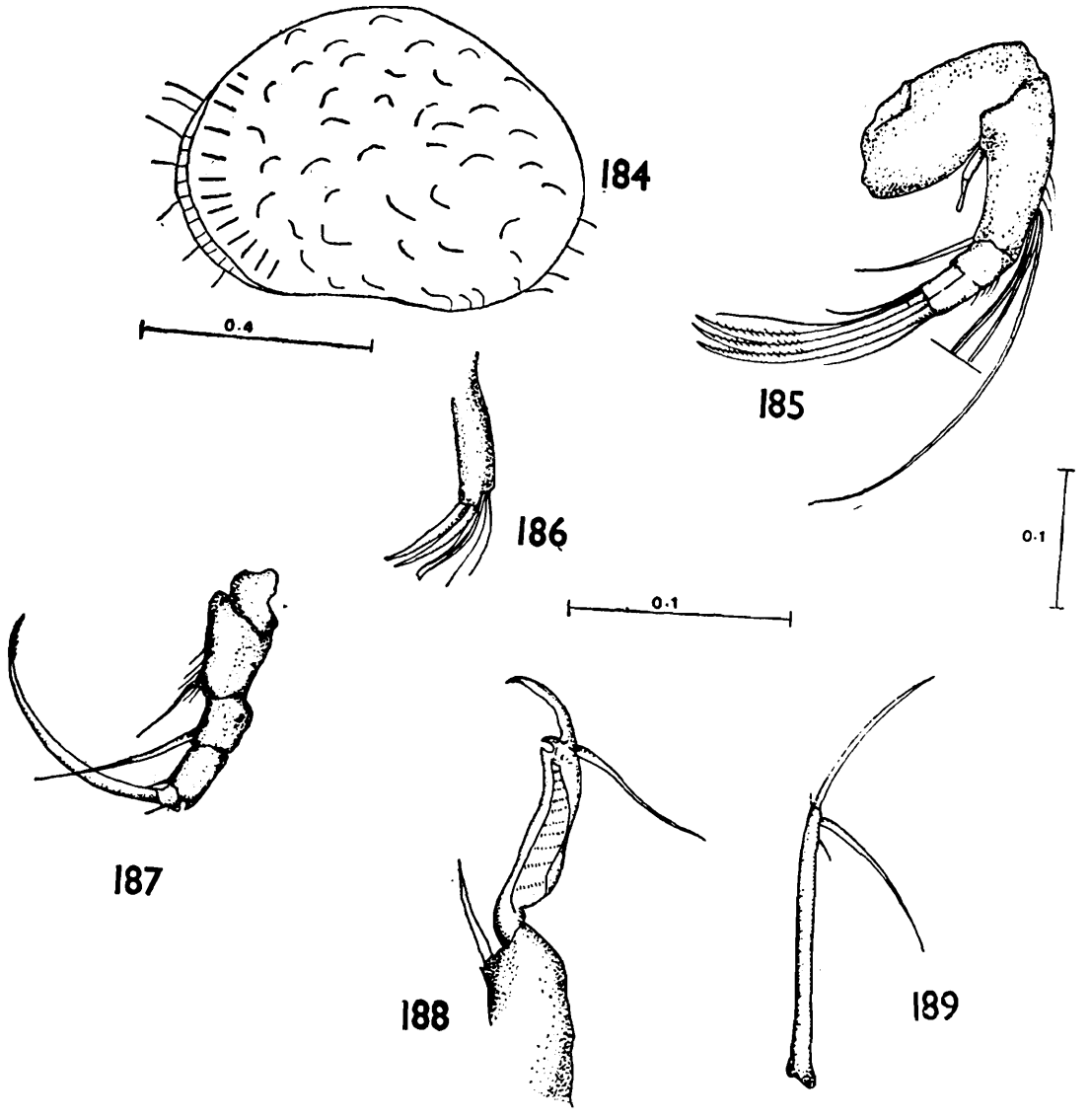
Male: Not known.

Remarks: Cypretta alagarkoilensis is completely different from *C. foveata* Hartmann, 1964; *Cypretta fontinalis* Hartmann, 1964 and *Cypretta globulus* (Sars) 1889, in its furcal characteristics, especially with equally long terminal and subterminal claws. *C. fontinalis*, also differs from *C. alagarkoilensis* in the more angular dorsum, the greatest height of the valve being more central and in the pilose posterior margin which is more evenly rounded.

Indian Locality: A subterranean pool in Alagarkoil Hills, Madurai Dt., Tamilnadu.

Cypretta fontinalis Hartmann, 1965

Female: Tumid valves, right overlapping the left, surface hairy, anterior margin with a well defined septa (Fig. 190). Length 0.83-0.86 mm; height 0.52-0.54 mm and width 0.60-0.62 mm. Furcal rami symmetrical; terminal



Figs. 184–189. *Cypretta algarkoilensis* Victor and Michael, 1975. 184. Left valve, external view. 185. Second antenna. 186. Maxillary spines. 187. Second thoracic leg. 188. Third thoracic leg. 189. Furca. Measurements in mm.

and subterminal claws slender; dorsal seta less than 1/4 the length of subterminal claw and terminal seta rudimentary (Fig. 191).

Male: Not known.

Indian Localities: Palni hills, Tamilnadu, Travancore and Maharashtra, mountainous terrains.

Cypretta foveata Hartmann, 1964

Female: Tumid, valves, appears equivalve, hairy surface; anterior septal pattern characteristic and different from *C. alagarkoilensis* and *C. fontinalis* (Fig. 192). Length 0.59-0.64 mm; height 0.39-0.42 mm and width 0.46-0.47 mm. Symmetrical furca with very short dorsal seta and terminal seta absent (Fig. 193).

Male: Known, larger than females

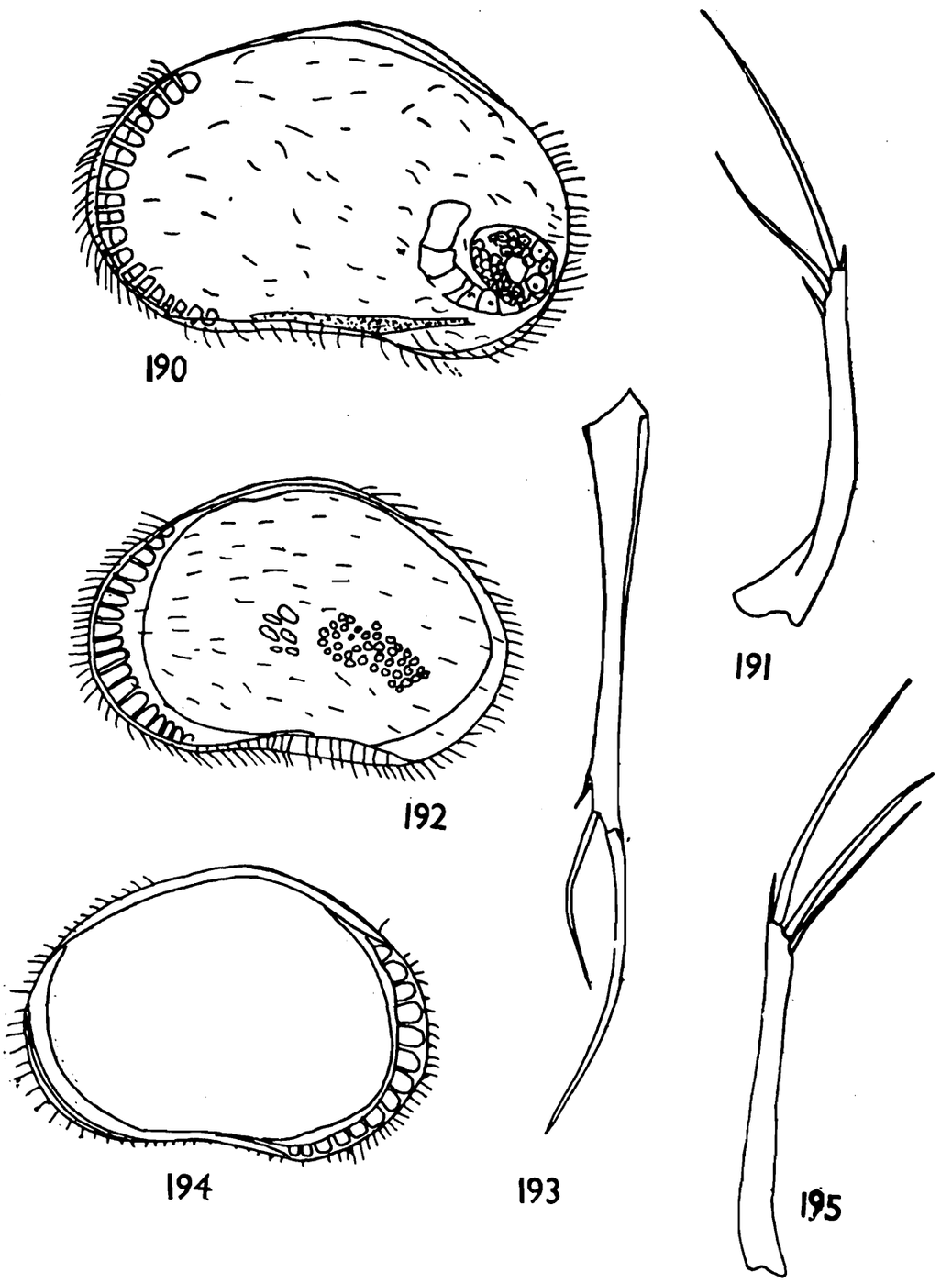
Indian Localities: Kathiawar in Gujarat.

Cypretta globulus (Sars) 1889

Cypridopsis globulus Sars, 1889, p. 53, Pl. II, Fig. 9, 10; Pl. VII, Figs. 1–11.

Cypretta globulus Sars, 1889: Arora, 1931, p. 88, Pl. VII, Figs. 49–53,

Female: Valves tumid; laterally somewhat triangular with greatest height in the middle; dorsum boldly arched; venter concave; anterior margin with a well developed septa (Fig. 194); surface with closely set hairs and pits. Length about 0.70 mm. Natatory setae of the second antenna reaching slightly beyond the tips of the terminal claw; claws slender and long. Third leg terminal podomere with a hook-like claw and a reflexed seta. Furca symmetrical, small and straight; dorsal seta little shorter than the subterminal claw and terminal seta very small (Fig. 195).



Figs. 190–195. *Cypretta fontinalis* Hartmann, 1964. 190. Left valve, external view. 191. Furca. *Cypretta foveata* Hartmann, 1964. 192. Left valve, external view. 193. Furca. *Cypretta globulus* (Sars) 1896. 194. Right valve. 195. Furca.

Male: Not known

Reported from Lahore (Arora, 1931).

Genus **Stenocypris** Sars, 1889

Generic diagnosis:

Valves from above elliptical; equal or unequal; very elongate; the septa prominent, compact, forming a radial band atleast anteriorly; inner duplicature wide anteriorly and valve surface varibale. Furcal rami asymmetrical; dorsal setae absent.

Indian species:

The following species are assigned to this genus:–

Stenocypris major (Baird) 1859; *Stenocypris derupta* Vavra, 1906; *Stenocypris hislopi* Ferguson, 1969; *Stenocypris distincta* Victor and Fernando. *Stenocypris sewelli* Klie, 1927; *Stenocypris biswasi* Deb, 1972. Material of the following species was not available for study namely *S. sewelli* ans *S. biswasi.* They are described and figured from earlier work.

Stenocypris major (Baird) 1859

Cypris cylindrica major Baird, 1859, p. 233, Fig. 1, 4a–f.

Cypris malcolmsonii Brady, 1886, p. 297, Pl. 38, Figs. 5–7.

Stenocypris malcolmsonii (Brady) 1886: Sars, 1889, p. 28–34, Pl. 1, Figs. 1–4; Moniez, 1892, p. 33; Vavra, 1906, p. 426; Gurney, 1916, p. 339; Lowndes, 1930, p. 975, Pl. 1, Figs. 1–6; Pl. 2, Figs. 1–6; Bronstein, 1947, p. 148, Pl. 9, Fig. 2.

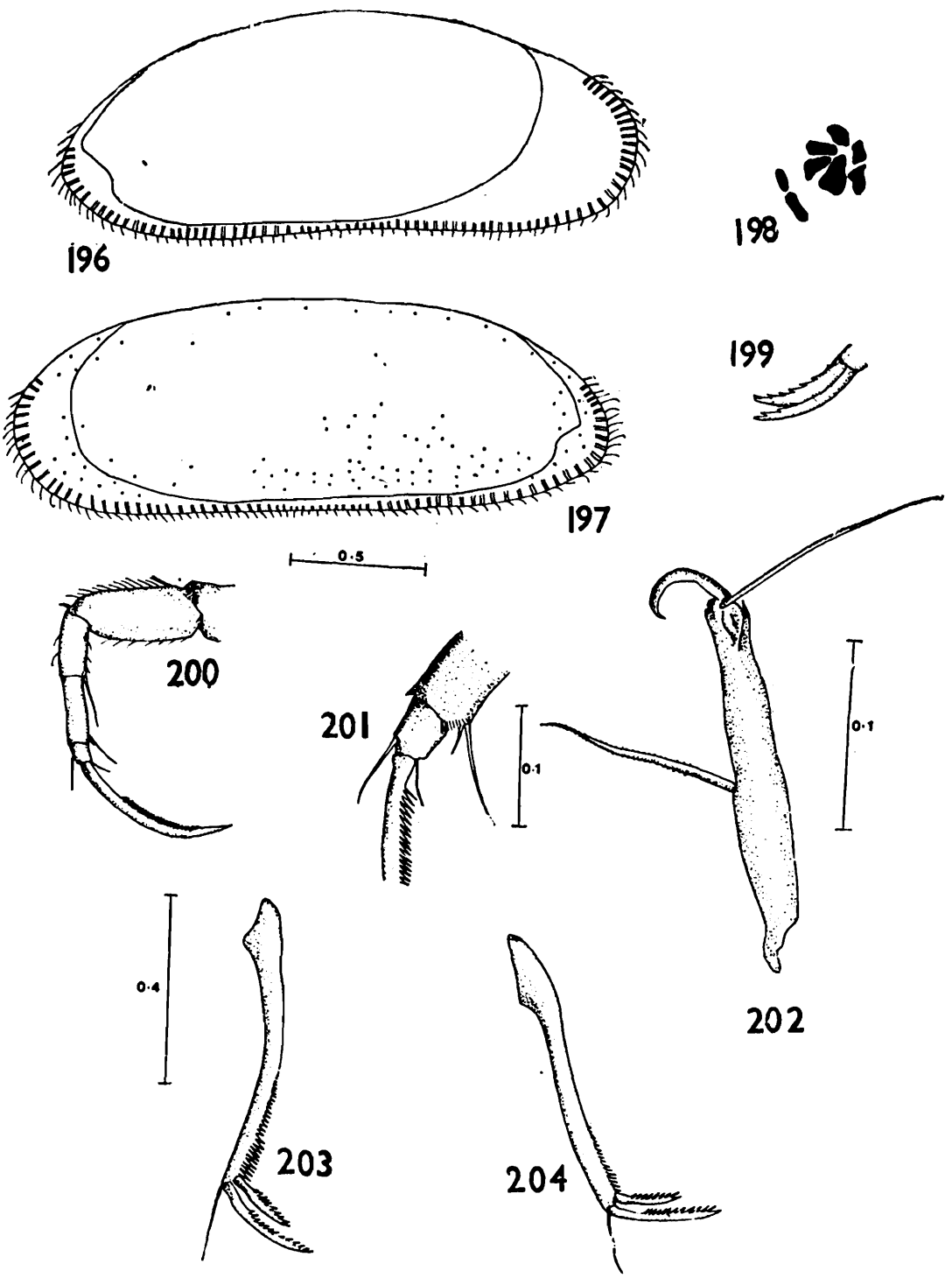
Stenocypris major (Baird) 1859: Daday, 1898, p. 69, Fig. 34a–d; Apstein, 1907, p. 228, Fig. 5; Hartmann, 1964, p. 121, Abb. 52.

Stenocypris cylindrica major (Baird) 1859: Ferguson, 1969, p. 67, Fig. 3, 1–3.

Female: Valves from above elliptical; reniform as seen laterally; anterior and posterior margins rounded; left and right valves almost of the same size; radial band of septa prominent, of uniform width anteriorly and posteriorly; valve margins hairy, except dorsally; surface with puncta as the ornamentation, rarely with a sparse distribution of hairs; ventral margin straight Inner duplicature wide anteriorly and narrow posteriorly; eight prominent central muscle scars present (Figs. 196, 197, 198). Length of valves 1.88-2.13 mm; height 0.73-0.87 mm. Natatory setae of the second antenna barely reaching the tips of the terminal claws, claws pectinate; sensory club two segmented. Maxillary spines toothed (Fig. 199). Second thoracic leg with a beak-shaped end claw, toothed; dorsal and ventral surface sparsely hairy without any definite pattern, variable (Figs. 200, 201). Third leg with a prominent claw and a seta; seta in the middle of the penultimate podomere setulate (Fig. 202). Furcal rami asymmetrical; terminal and subterminal claws of both the rami heavily toothed; dorsal setae absent; right ramus curved, the dorsal margin heavily toothed, terminal seta more than 1/2 the length of the terminal claw; left ramus relatively straight, very few teeth on the distal end, terminal seta 1/2 the length of the terminal claw (Figs. 203, 204).

Male: Unknown.

Remarks: This species widely known as *Stenocypris cylindrica major* was originally described by Baird (1859) as *Cypris cylindrica major.* It is now known that *Cypris cylinderica major* Baird and *Cypris cylindrica* Sowerby are not conspecific, whereas the former and *Cypris malcolmsonii* Brady are conspecific and hence *Cypris cylindrica major* Baird becomes the valid type species of the genus *Stenocypris* Sars, 1889 (Ferguson, 1964). Since the variety *major* is not conspecific with fossil *C. cylindrica*, it becomes *Stenocypris major* (Baird) 1859 and the type species of *Stenocypris* Sars, 1889.



Figs. 196-204. *Stenocypris major* (Baird) 1859. 196. Right valve, lateral view. 197. Left valve, lateral view showing surface pattern. 198. Central muscle scars. 199. Maxillary spines. 200. Second thoracic leg. 201. Second thoracic leg, distal segments. 202. Third thoracic leg. 203. Right furcal ramus. 204. Left furcal ramus. Measurements in mm.

Examination of several collections from Southern India showed that the ornamentation of valve surface is variable in this species, either with punctations alone or also with a sparse distribution of hairs. This species is reported to be cosmopolitan (Triebel, 1953, Tressler, 1959; Ferguson, 1962, 1964).

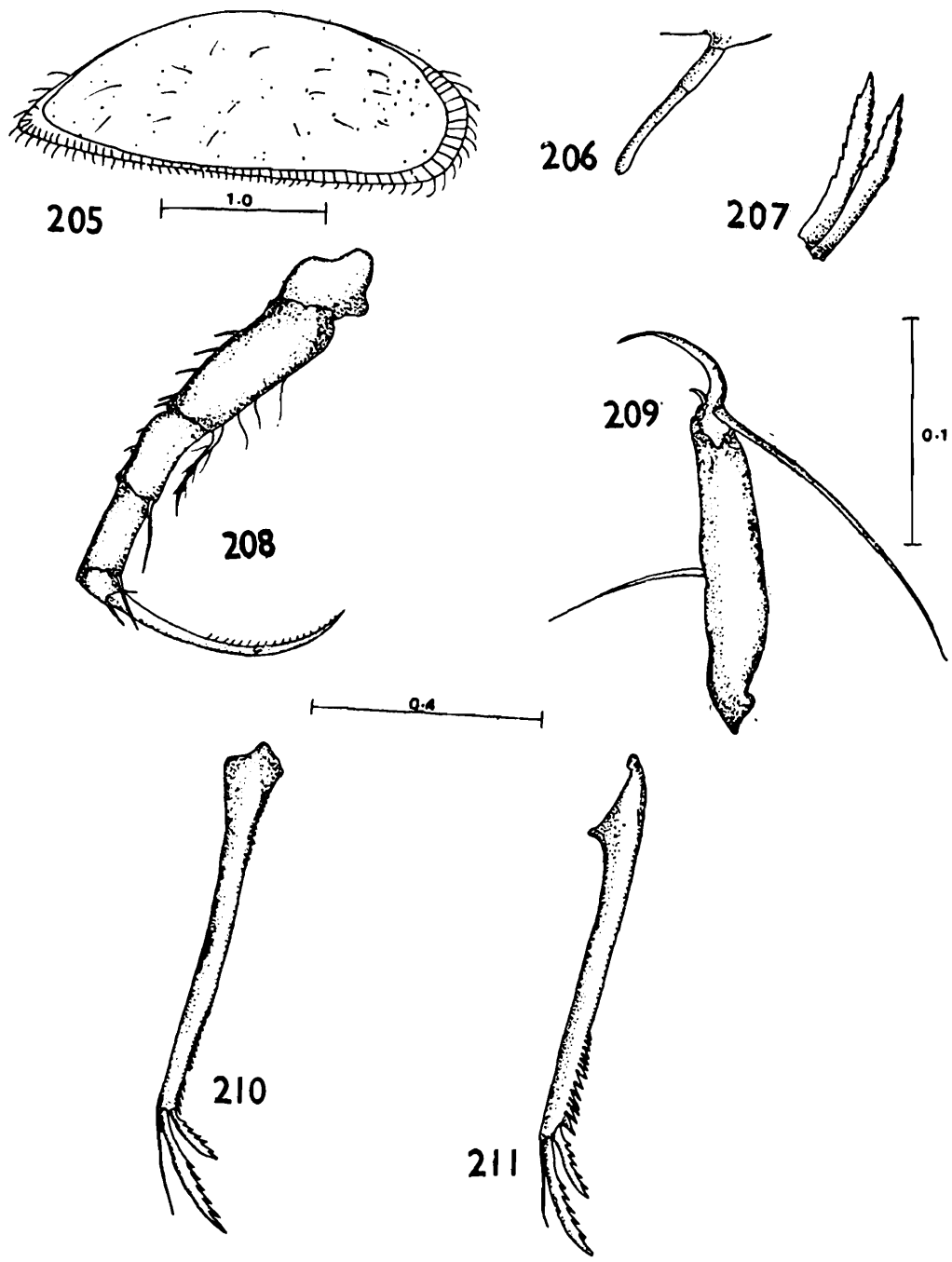
Indian Localities: Palni Hills, Madurai Dt., Trichy Dt., Ramnad Dt., Madras and vicinities in Tamilnadu; Mysore in Karnataka; Guntur and Hyderabad in Andhra Pradesh; Trivandrum in Kerala; Ginar reservoir in Gujarat; Bombay area in Maharashtra; Bhopal in Madhya Pradesh and West Bengal.

Stenocypris derupta Vavra, 1906

Stenocypris derupta Vavra, 1906, p. 426, Taf. 24, Fig. 21–24.

Stenocypris derupta Vavra, 1906: Hartmann, 1964, p. 122, Abb. 53, a–g.

Female: Valves elliptical; laterally elongate; anterior margin rounded, posterior margin pointed; prominent radial band of septa; valve margins hairy; surface with puncta and sparse distribution of hairs; ventral margin straight, dorsum convex, sloping posteriorwards rather steeply (Fig. 205). Length 2.50-2.57 mm; height 0.93-0.99 mm. Natatory setae of the second antenna setulate, not reaching the tips of the terminal claws; claws pectinate; sensory club two segmented (Fig. 206). Maxillary spines prominently toothed (Fig. 207). Second leg with a slender, pectinate end claw; second segment with a hairy seta, dorsal margin spinose and ventral margin hairy (Fig. 208).



Figs. 205–211. *Stenocypris derupta* Vavra, 1906. 205. Right valve, external view. 206. Sensory club of the second antenna. 207. Maxillary spines. 208. Second thoracic leg. 209. Third thoracic leg. 210. Left furcal ramus. 211. Right furcal ramus. Measurements in mm.

Third leg with a prominent sickle-shaped claw, a small claw and a seta Fig. 209). Furcal rami asymmetrical; terminal and subterminal claws of both the rami heavily toothed; dorsal setae absent; dorsal margin of the right ramus with heavy denticulation, terminal seta more than 1/2 the length of the terminal clw; left ramus with faint spines on the dorsal margin (Figs. 210, 211).

Male: Not known.

Remarks: The valve and soft part morphology of the present specimens are similar to the original description (Vavra, 1906).

Indian Lcoalities: Pandharpur in Maharashtra; Guntur area in Andhra Pradesh; Vaigai Nursery, Andipatti (Madurai Dt.) in Tamilnadu.

Stenocypris hislopi Ferguson, 1969

Stenocypris hislopi Ferguson, 1969, p. 69, Fig. 1, 1–6.

Female: Valves elliptical; laterally reniform, elongate; anterior and posterior margins rounded; left valve overlaps the right; septa forming a prominent band along the margins except dorsally; surface with punctation as the only ornamentation; dorsum smoothly convex, ventral margin straight; anterior, posterior and ventral margins hairy. Inner duplicature wide anteriorly (Figs. 212, 213, 214). Length of the valves 1.38-1.63 mm; height 0.55-0.70 mm. Natatory setae of the second antenna not reaching the tips of the terminal claws; claws pectinate. Second thoracic leg with a long end claw, toothed; second segment with a single seta (Fig. 215). Third leg with a terminal claw and an unreflexed seta, seta approximately half the length of the penultimate podomere; claw with few teeth at the distal tip; seta in the middle of the penultimate podomere smooth (Fig. 216). Furcal rami asymmetrical; dorsal setae absent; terminal and subterminal claws toothed; right ramus slightly curved, dorsal margin toothed, terminal seta almost the length of the terminal claw; left ramus straight, dorsal margin smooth, terminal seta as long or little more than the length of the terminal claw (Figs. 217, 218).

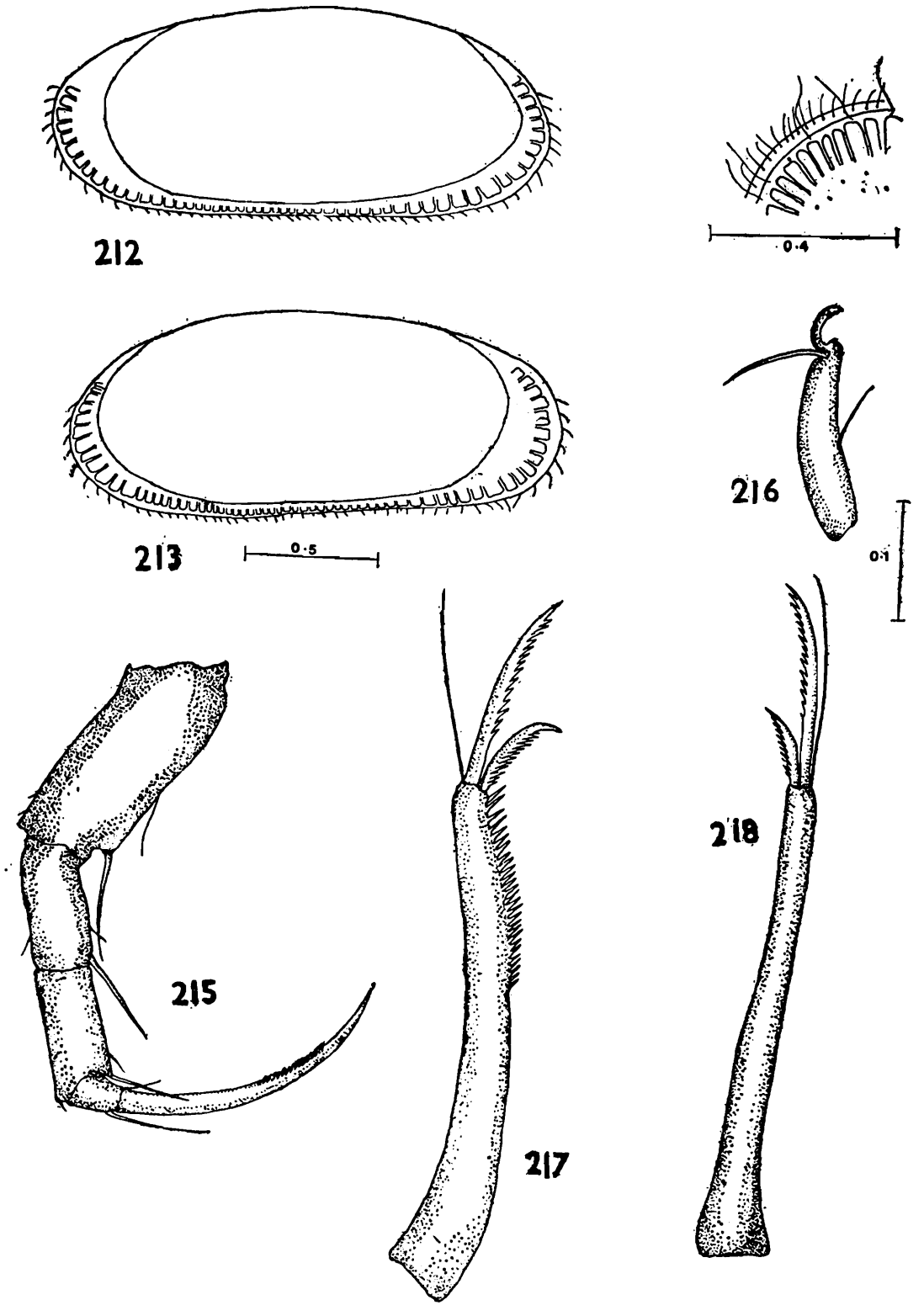
Male: Unknown.

Remarks: This species can be easily mistaken for *S. major* (Baird) because of their overall resemblance. However *Stenocypris hislopi* is smaller, and there is no overlap in the size range of this species and *S. major* (Ferguson, 1969). The toothed end claw of the third thoracic leg is a unique character for this species. The left furcal ramus of *S. hislopi* has a smooth dorsal margin, whereas *S. major* always has few denticulations.

Indian Localities: Nagpur in Maharashtra; Kovur in Andhra Pradesh; Salem in Tamilnadu.

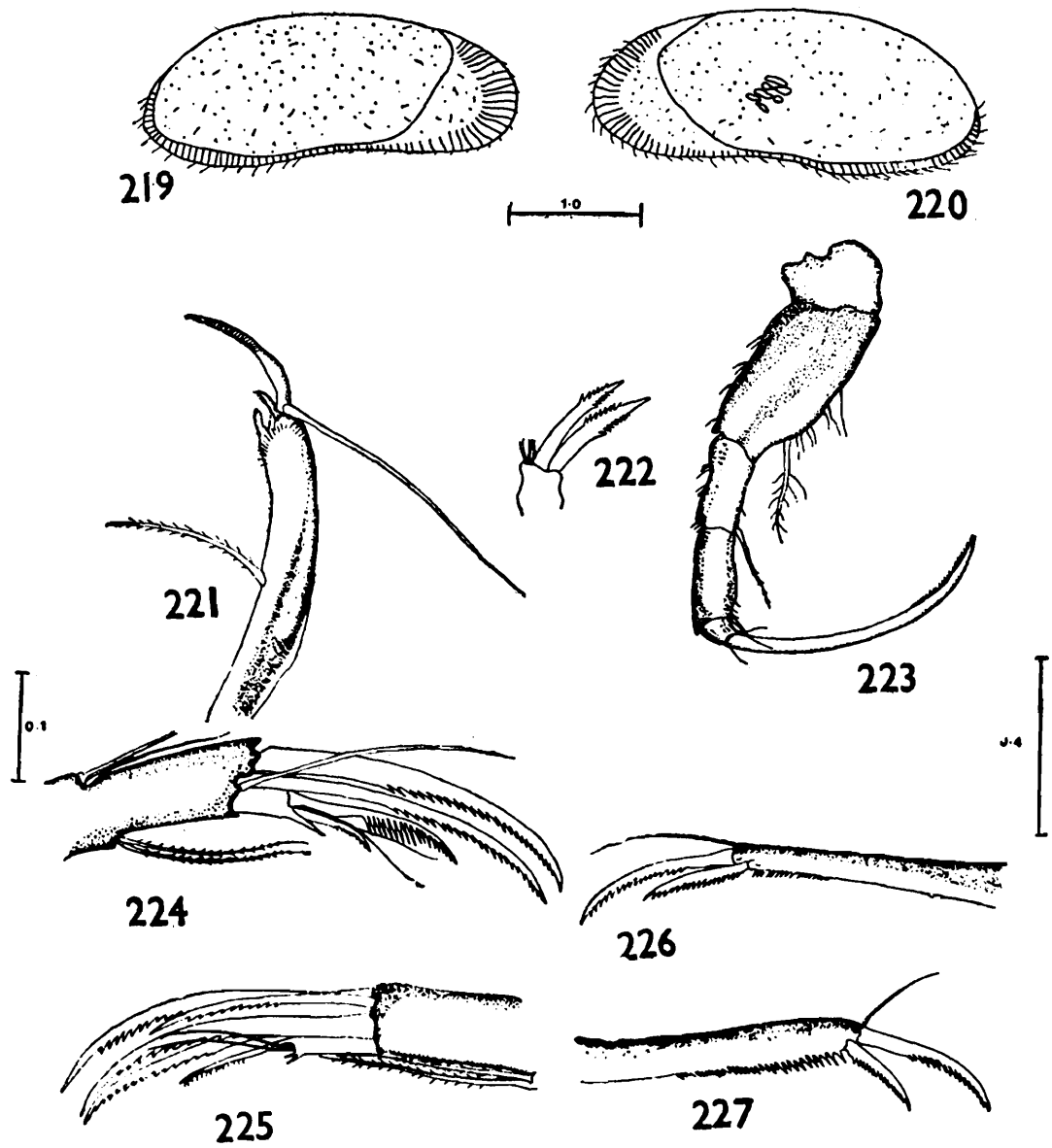
Stenocypris distincta Victor and Fernando (in press)

Female: Valves from above elliptical; seen laterally valves elongate; anterior and posterior margins rounded; left valve slightly larger than the right; radial band of septa prominent, wider anteriorly and narrow posteriorly; valve margins hairy except dorsally; valve surface with puncta and hairs; ventral margin slightly concave in the middle, dorsum with a low arch sloping posteriorly (Figs. 219, 220, 228, 229). Inner duplicature wide anteriorly and narrow posteriorly. Length of valves



Figs. 212–218. *Stenocypris hislopi* Ferguson, 1969. 212. Left valve, lateral view. 213. Right valve, lateral view. 214. A portion of anterior valve margin showing pore canals and surface punctation. 215. Second thoracic leg. 216. Third thoracic leg. 217. Right furcal ramus. 218. Left furcal ramus. Measurements in mm.

2.84-3.20 mm; height 1.02-1.18 mm; width 0.76-0.86 mm. Natatory setae of the second antenna well developed, not reaching the tips of the terminal claws and smooth; sensory club three segmented, claws toothed. Maxillary spines toothed (Fig. 223). Second thoracic leg with a long terminal scythe-like claw, second segment with a single seta, hairy; dorsal surface and margin having groups of spines and ventral margin hairy (Fig. 223). Third leg with a prominent claw, a shorter denticulated claw, and a seta; the distal end lined with a row of short spines, the seta in the middle of the penultimate podomere setulate (Fig. 221). Furcal rami asymmetrical, terminal and subterminal claws

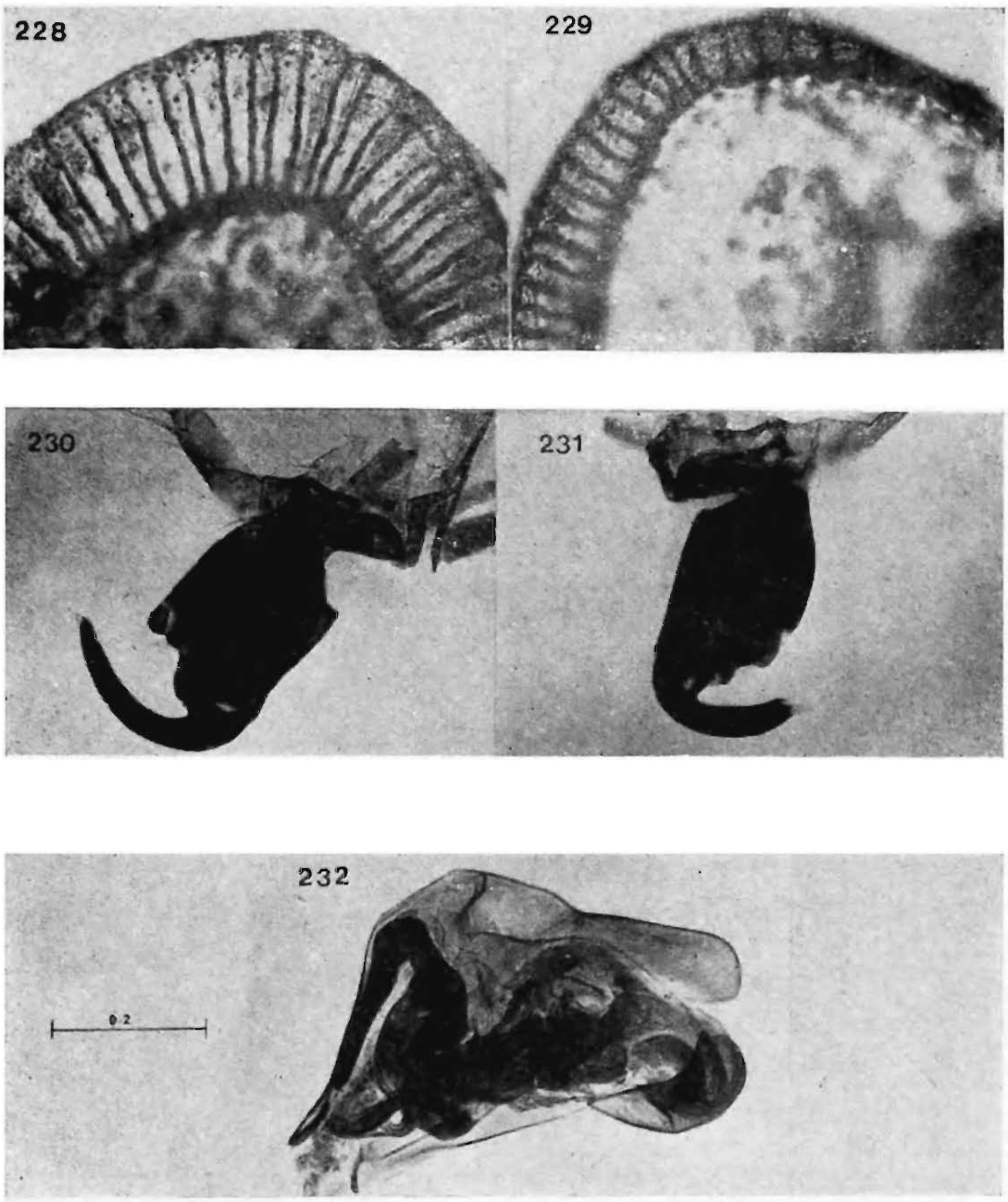


Figs. 219–227. *Stenocypris distincta* Victor and Fernando. 219. Right valve, external view. 220. Left valve, external view. 221. Third thoracic leg. 222. Maxillary spines. 223. Second thoracic leg. 224. Distal segments of second antenna, Male. 225. Distal segments of second antenna. Female. 226. Left furcal ramus. 227. Right furcal ramus. Measurements in mm.

of both rami toothed, dorsal setae absent; right ramus curved, broader with dorsal margin heavily toothed, terminal seta more than 1/2 the length of the terminal claw; left ramus straight, dorsal margin with groups of teeth covering 1/4 the length of the ramus, terminal seta more than two-thirds the length of the terminal claw (Figs. 226, 227, 233, 234).

Male: One terminal claw of the second antenna having prominent teeth while the other claws are similar to those of the female (Fig. 224, 225). First thoracic legs modified as prehensile palps (Figs. 230, 231). Hemipenis triangular with two lobes (Figs. 232). Zenkers organ with densely packed crowns (Fig. 237). Ventral margin of the furcal rami with four prominent spines and a faint one at the distal end (Figs. 235, 236).

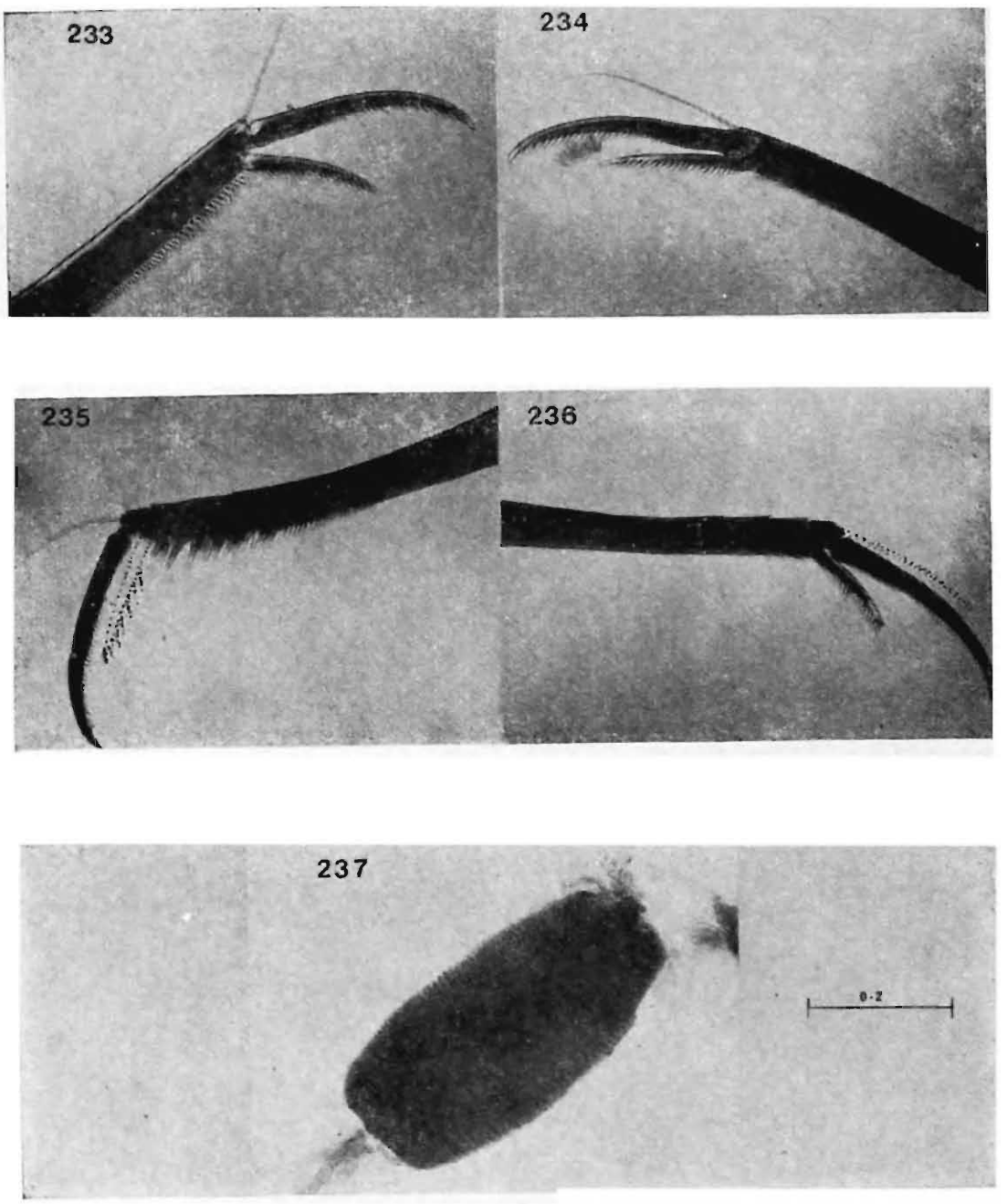
Remarks: This species has been compared with the description of the 31 species belonging to the genus *Stenocypris* Sars, 1889. *Stenocypris distincta* is completely different in valve structure and in the morphology of the soft parts from 23 species described by Müller (1898; 1900) Daday (1898) Delachaux (1919) Sars (1924), Lowndes (1932), Klie (1935; 1939) and Hartmann (1964).



Figs. 228–232. *Stenocypris distincta* Victor and Fernando. 228. Anterior margin of the right valve. 229. Posterior margin of the right valve. 230. Left prehensile palp, Male. 231. Right prehensile palp, Male. 232. Hemipenis. Measurements in mm.

S. distincta differs markedly from *S. sewelli* Klie, 1927, *S. derupta* Vavra, 1906 and *S. biswasi* Deb, 1972 in the shape of the valve, the structure of the third leg, and the structure of the furca. Though this species resembles *S. major* and *S. hislopi* in the valve shape and the presence of radial band of septa it differs from *S. major* in the ornamented terminal podomere of the third leg, the distinctly wide band of septa in the anterior margin; and from *S. hislopi* in the much larger size, the structure of the third leg and the furcal characteristics. The common occurrence of males, the structure of the male furca, the form of the prehensile palps of the first thoracic legs, and the hemipenis are unique to this species. The size range of the adults is also sufficiently distinct to form an useful guide in distinguishing it from other Indian species (Table. 1).

Indian Locality: Nidubrolu, Andhra Pradesh.



Figs. 233–237. *Stenocypris distincta* Victor and Fernando. 233. Right furcal ramus, Female. 234. Left furcal ramus, Female. 235. Right furcal ramus, Male. 236. Left furcal ramus, Male. 237. Zenkers organ. Measurements in mm.

Stenocypris sewelli Klie, 1927

Female: Valves elongate, unequal, left overlaps the right; dorsum convex; greatest height in the middle; radial band of septa only in the anterior region (Fig. 238). Length 1.2-1.5 mm height 0.53-0.65 mm. and width 0.37-0.43 mm. Third leg with a long curved claw, a small clawlike projection and a seta. Asymmetrical furca, straight; right ramus heavily denticulated and left ramus with weak denticles on the distal end; terminal setae longer than the terminal claws (Figs. 239, 240).

Male: Not known.

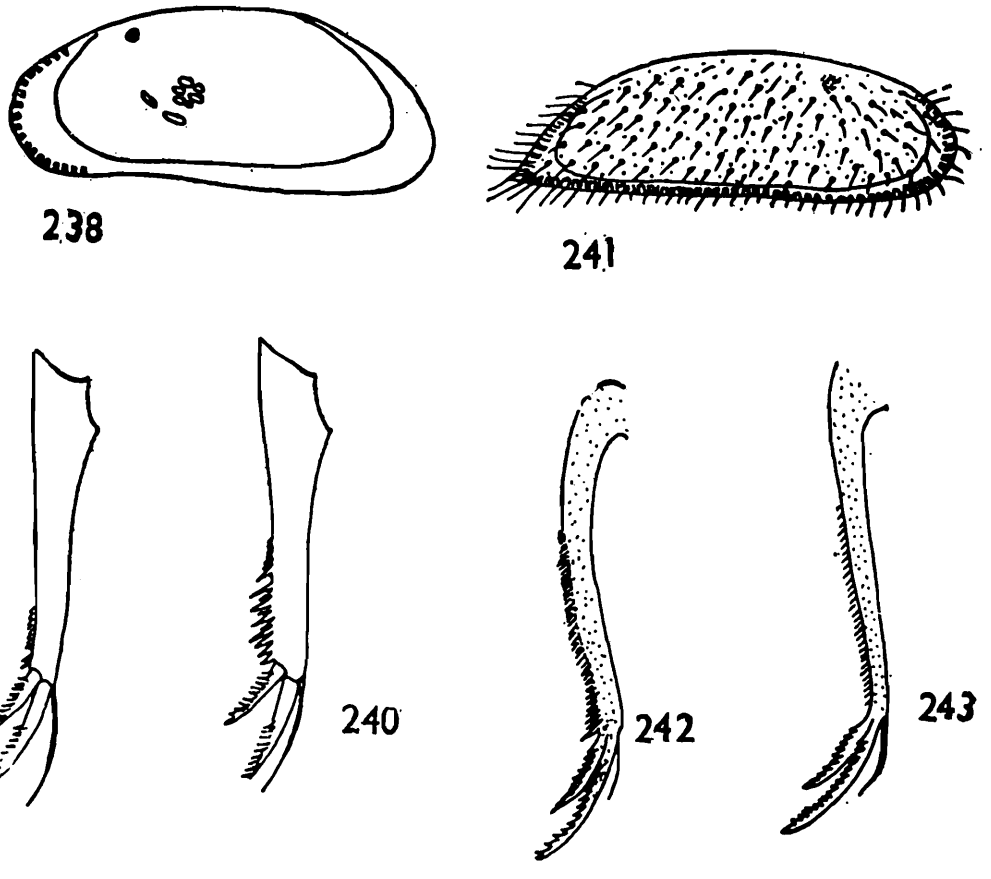
Indian Localities: Simla, Bhagsunath, Cheerapunji and Darjeeling.

TABLE 1.—Size Ranges of Indian Stenocyprines

	SPECIES	LENGTH mm.	HEIGHT mm.	WIDTH mm.
1.	Stenocypris biswasi	4·30	1·30	—
2.	S. cylindrica major	2·0–2·13	0·80–0·87	—
3	S. derupta	2·5	0·91	—
4.	S. distincta n.sp.	2·84–3·20	1·02–1·18	0·76–0·86
5.	S. sewelli	1·2–1·5	0·53–0·65	0·37–0·43
6.	S. hislopi	1·38–1·50	0·55–0·65	—
7.	Chrissia krishnakantai	5·37	1·87	1·25
8.	C. halyi	1·40–1·50	0·44–0·50	—
9.	Parastenocypris canaliculata ...	2·08	·0·91	—

Stenocypris biswasi Deb, 1972.

Female: Length of valves 4.30 mm; height 1.30 mm. Anterior margin of the valve rounded and posterior margin pointed; valve surface hairy (Fig. 241). Asymmetrical furca, straight; right ramus with a prominent denticulation on the dorsal margin than the left (Figs. 242, 243).



Figs. 238–243. 238–240. *Stenocypris sewelli* Klie, 1927 (After Klie, 1927). 238. Right valve, external view. 239. Left Furcal ramus. 240. Right furcal ramus. 241–243. *Stenocypris biswasi* Deb, 1972 (After Deb, 1972). 241. Right valve lateral view. 242. Right furcal ramus. 243. Left furcal ramus.

Male: Not known.

Remarks: This species was described on the basis of one undissected specimen (Deb, 1972), and hence the soft part morphology is not known.

Indian Locality: Jaipur Dt., Rajasthan.

Genus **Chrissia** Hartmann, 1957

Generic diagnosis:

Valves very elongate laterally; equal or unequal; pore canals present, inconspicuous, never as a radial band along the margins. Asymmetrical furca; dorsal setae of the rami absent.

Indian species:

Chrissia halyi (Ferguson) 1969; *Chrissia humilis* (Klie) 1932 ssp *indica* and *Chrissia krishnakantai* (Depb) 1972 are assigned to this genus. Only *C. halyi* was available for study. The other species have been described and fiedgur from earlier work.

Chrissia halyi (Ferguson) 1969

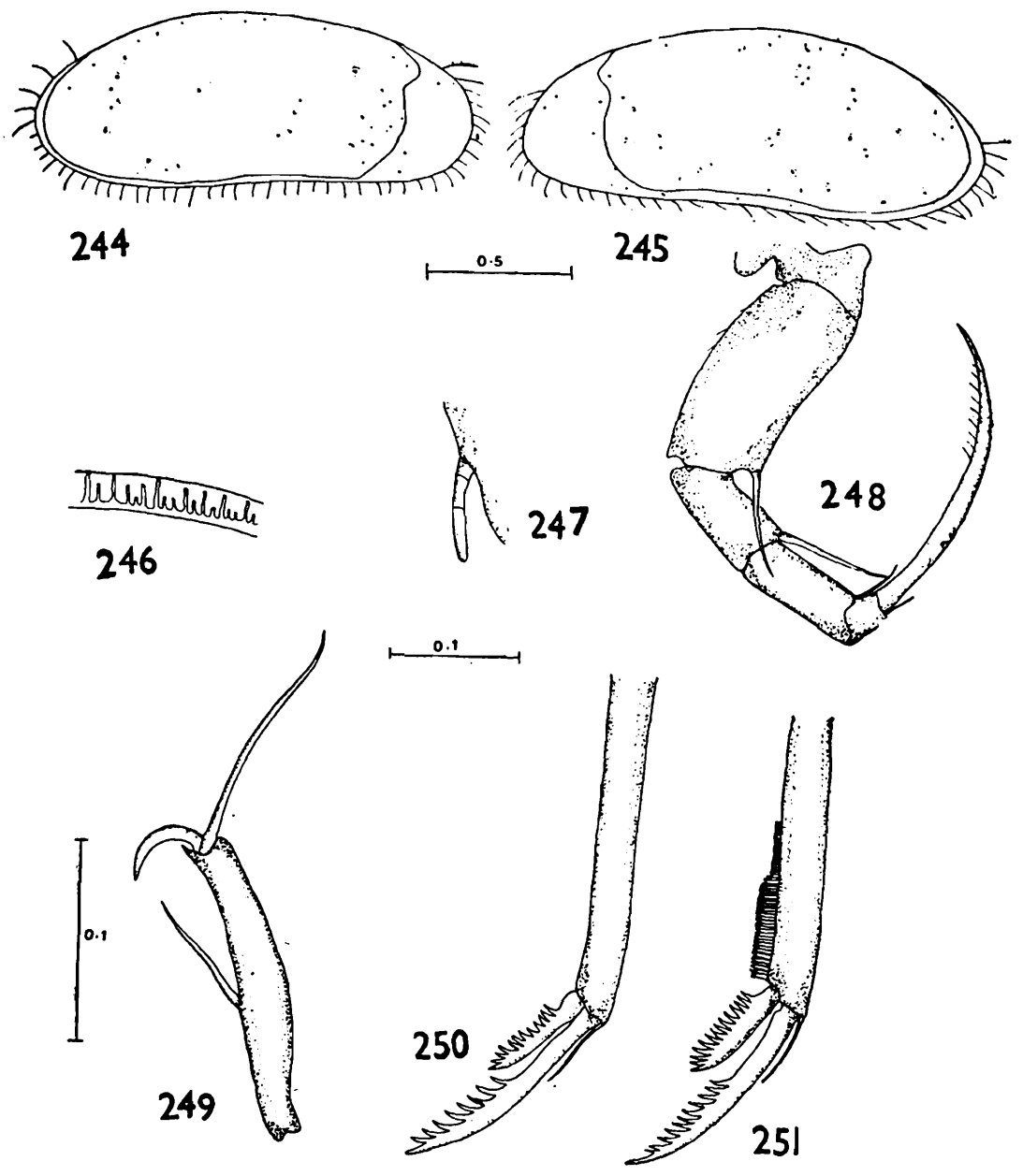
Stenocypris malcolmsoni (Brady): Arora, 1931, p. 87, Pl. VIII, Figs. 68–73.
Stenocypris halyi Ferguson, 1969, p. 71, Fig. 2, 1–4.

Female: Valves elliptical; reniform and elongate laterally; anterior and posterior margins rounded; left valve slightly larger than the right; pore canals inconspicuous, radial band of septa absent; valve margins hairy; dorsum smoothly convex, ventral margin almost straight; surface with sparsely distributed puncta. Inner duplicature wide anteriorly and narrow posteriorly (Figs. 244, 245, 246). Length 1.40–1.60 mm; height 0.40–0.56 mm. Natatory setae of the second antenna almost reaching the tips of the terminal claws; claws pectinate; sensory club three segmented (Fig. 247). Second thoracic leg with a weakly pectinate end claw, long; dorsal margin smooth except for a few spines on the second segment; second segment with a single seta, smooth (Fig. 248). Third leg with a claw and a seta, nearly as long as the penultimate segment (Fig. 249). Furcal rami asymmetrical, terminal and subterminal claws toothed, dorsal setae absent; curvature of the right ramus insignificat, dorsal margin lined with closely packed fine denticulations, covering the distal half of the ramus with shorter denticles proximally and longer ones distally giving a step like arrangement, terminal seta less than 1/2 the length of the terminal claw; left ramus straight, dorsal margin smooth, terminal seta less than 1/2 the length of the terminal claw (Figs. 250, 251).

Male: Unknown.

Remarks: This species was described as *Stenocypris halyi* by Ferguson (1969) from the collections of Mr. Haly (1886) from Geylon. The absence of a radial band of septa is a unique character for the genus *Chrissia* Hartmann, 1957 when compared to its very closely related genus *Stenocypris*, and hence thls species is redescribed as *C. halyi*. Okubo (1974) considered that this species is closely related to a Japanese species, *Chrissia vittata* Okubo, 1974. 25 collections examined during the present study contained this species, and *C. halyi* is completely different from *C. vittata*, except for an overlapping size range.

Indian Localities: Vridachalam, Trichy Dt., Madurai Dt., Salem in Tamilnadu; Chitoor in Andhra Pradesh; Trivandrum in Kerala and Lahore (now in Pakistan).



Figs. 244–251. *Chrissia halyi* (Ferguson) 1969. 244. Right valve, external view. 245. Left valve, external view. 246. Margin of the valve, magnified. 247. Sensory club of the second antenna. 248. Second thoracic leg. 249. Third thoracic leg. 250. Left furcal ramus. 251. Right furcal ramus. Measurements in mm.

Chrissia humilis (Klie) 1932 ssp. **indica**

Chrissia humilis (Klie) 1932 ssp *indica* Hartmann, 1964, p. 122, Abb. 54.

Female: Left valve slightly larger than the right; valve margins devoid of radial band of septa; surface hairy (Fig. 252). Furcal rami asymmetrical; dorsal margin of the right ramus with spines for 1/2 the length; dorsal margin of the left ramus smooth (Figs. 253, 254).

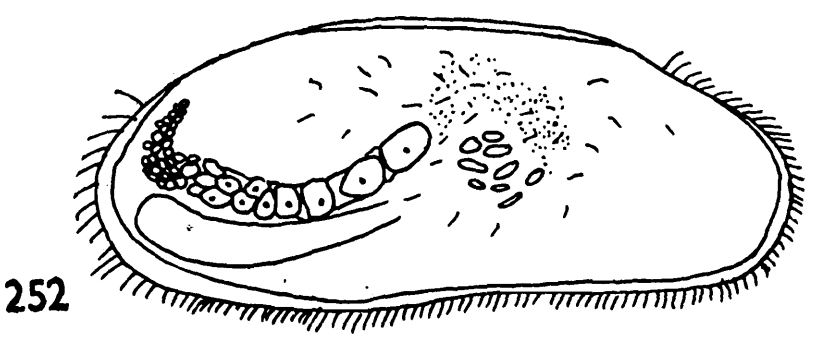
Male: Not known.

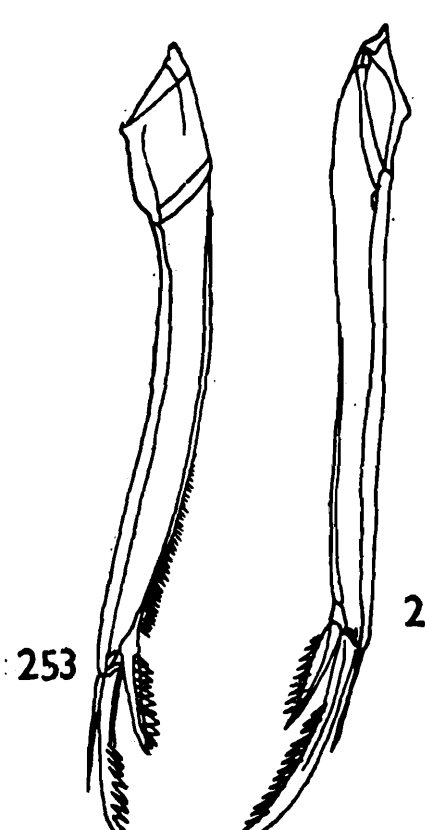
Indian Localities: Bombay (Maharashtra); Travancore (Kerala); Pondicherry, Kanyakumari (Tamilnadu) and Calcutta (West Bengal).

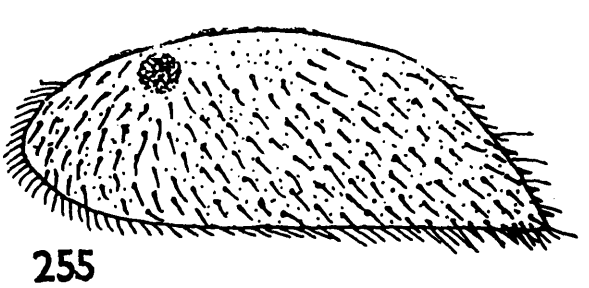
Chrissia krishnakantai (Deb) 1972

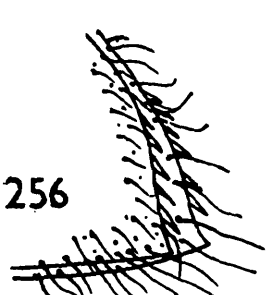
Stenocypris krishnakantai Deb, 1972, p. 93, Fig. 2, A–G.

Female: Large species. Length of valves 5.37 mm; height 1.87 mm and width 1.25 mm. Anterior margin broadly rounded, posterior margin pointed; radial band of septa absent; surface hairy (Figs. 255, 256). Furcal ram asymmetrical; straight; right ramus more strongly spinose than the left on the dorsal margin (Figs. 257, 258).









Figs. 252–258. 252–254. *Chrissia humilis* (Klie) 1932 *indica* (After Hartmann, 1964). 252. Right valve. 253. Right furcal ramus. 254. Left furcal ramus. 255–258. *Chrissia krishnakantai* (Deb) 1972 (After Deb, 1972). 255. Left valve. 256. Left valve, posterior margin. 257. Right furcal ramus. 258. Left furcal ramus.

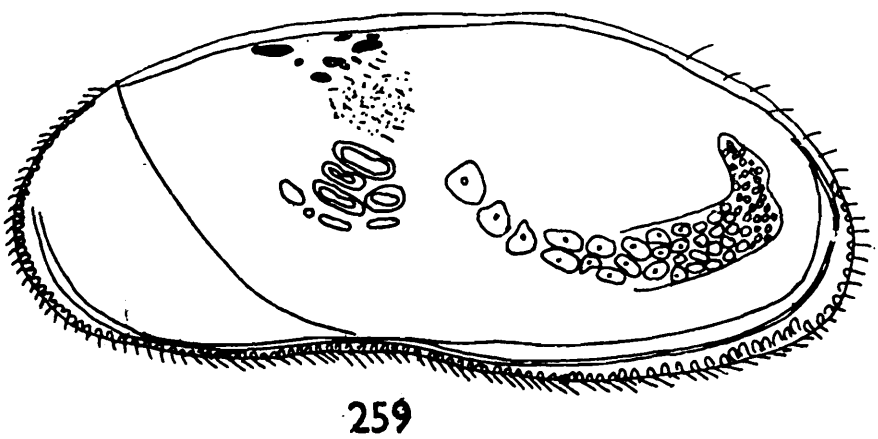
Male: Not known.

Indian Locality: Satara, Maharashtra.

Parastenocypris Hartmann, 1964

Generic diagnosis:

Very elongate valves laterally; pore canals prominent, the arrangement diffuse, branched and continuous along the anterior, posterior, and ventral margins. Furcal rami asymmetrical and dorsal setae absent.



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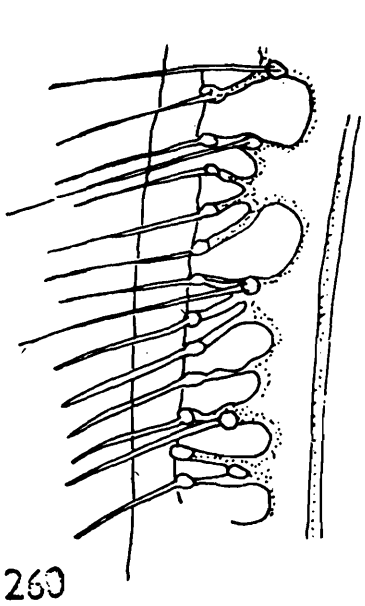

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Figs. 259–262. *Parastenocypris canaliculata* Hartmann, 1964 (After Hartmann, 1964). 259. Left valve. 260. Valve margin showing porecanal pattern. 261. Right furcal ramus. 262. Left furcal ramus.

Indian species:

The only species known of this genus in India is *Parastenocypris canaliculata* Hartmann, 1964.

Female: Valves with irregular, continuous pore canals along the margins; surface with minute hairs (Figs. 259, 260). Asymmetrical furca, bent at the proximal end; right ramus with groups of stronger spines for 2/3 the length of the ramus, on the dorsal margin; left ramus is also armed with spines but they are relatively weak (Figs. 261, 262). Length 2.08 mm and height 0.91 mm.

Male: Not known.

Indian Locality: Nagpur, Maharashtra.

Genus **Cypridopsis** Brady, 1867

Generic diagnosis:

Valves reniform, subtriangular to subovate, strongly arched dorsum, venter concave or straight, right valve usually larger than the left, surface pitted, hairy or spinose. Furca reduced to a flagellum.

Indian species:

The following species of this genus are reported: *Cypridopsis dispar*, Hartmann, 1964; *Cypridopsis dubia* Sars, 1903; *Cypridopsis angularis* (Victor and Michael) 1975; *Cypridopsis maduraiensis* Victor and Michael, 1975 and *Cypridopsis horai* Klie, 1927. All except *C. horai* were available for study. *C. horai* is described and figured from earlier work.

Cypridopsis dispar Hartmann, 1964

Cypridopsis dispar Hartmann, 1964, p. 136, Abb. 61, a–f; Abb. 62, a–f.

Female: Valves reniform; anterior and posterior margins rounded, hairy; right valve overlaps the left; dorsum boldly arched, greatest height in the middle; venter concave; valve surface covered with minute hairs; four muscle scars prominent. Inner duplicature narrow throughout (Figs.263–265). Length 0.56–0.60 mm and height 0.29–0.36 mm. Natatory setae of the second antenna smooth, reaching to the tips of the terminal claws; sensory club two-segmented (Fig. 266). Maxillary spines smooth (Fig. 267). Second thoracic leg with a short, pectinate scythe-like claw; seta on the third segment exceeds the length of fourth and fifth segments; joints of fourth, ultimate segment, and terminal claw have two small spines on the dorsal aspect (Fig. 268). Third thoracic leg with a beak-like claw and a reflexed seta (Fig. 269). Furcal ramus reduced to a flagellum (Fig. 270).

Male: Not seen during the present study, although Hartmann (1964) reported males.

Remarks: This species was found to be of common occurrence. The distribution of hairs on the valve surface is variable. Most of the specimens examined during the present study had a sparse distribution of hairs only in the

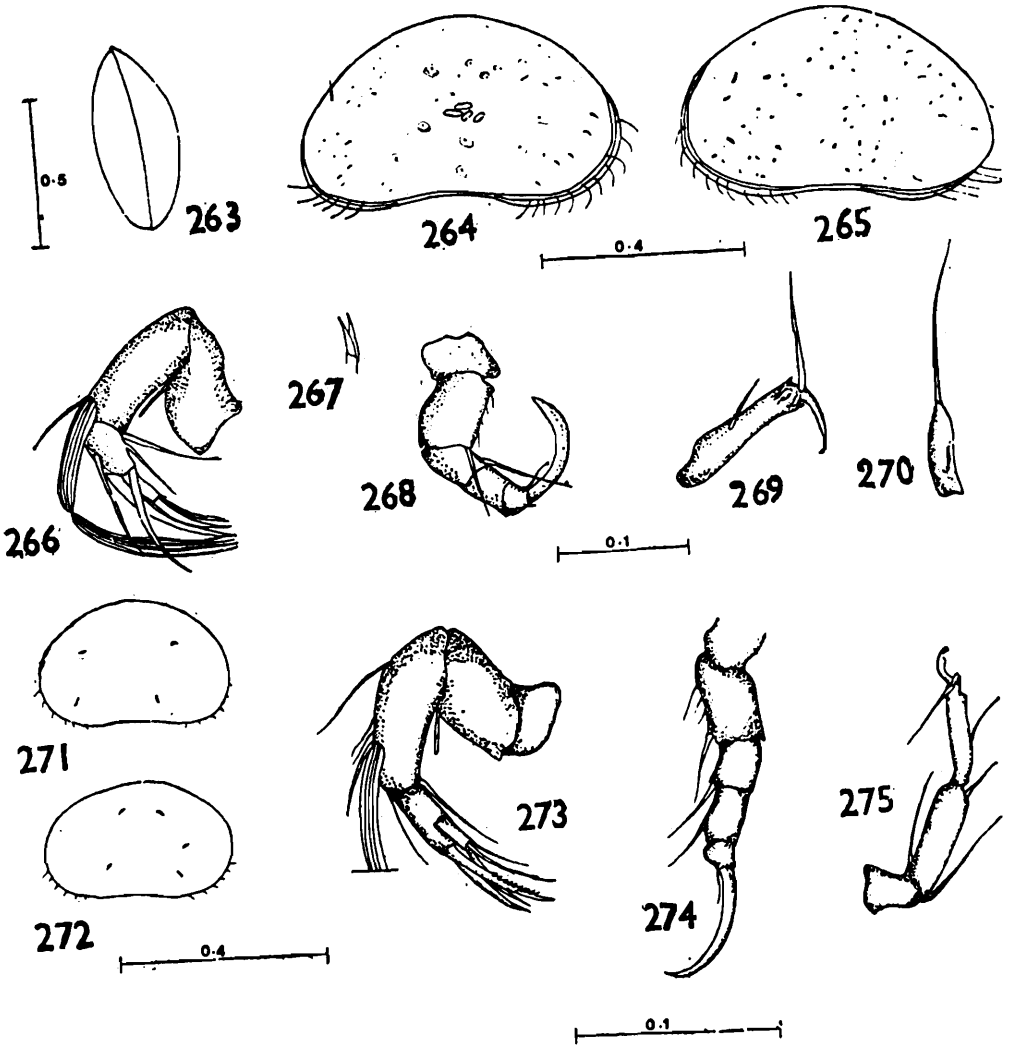
anterior and posterior extremities in contrast to Hartmann's (1964) illustrations showing densely set hairs on the valve surface. However, the decalcified valves, examined under higher magnification had minute hairs over the entire surface.

Indian Localities: Trichy Dt., Madurai Dt., Madras, and vicinities in Tamilnadu; Mysore in Karnataka; Hyderabad, Guntur and Kovur in Andhra Pradesh; Pandharpur and Tulsi Dam in Maharashtra.

Cypridopsis dubia Sars, 1903

Cypridopsis dubia Sars, 1903, p. 35, Pl. IV, Figs. 5, a–b.

Female: Valves subovate; anterior and posterior margins rounded; having right valve slightly larger than the left; dorsum evenly arched, venter almost straight; valve surface with scattered hairs. Inner duplicature narrow (Figs. 271, 272). Length 0.35–0.38 mm and height 0.23–0.25 mm. Natatory setae of the second antenna reaching beyond the tips of the terminal claws, one claw strongly denticulate (Fig. 273). Maxillary spines smooth. Second thoracic leg with a curved scythe-like terminal claw; second segment with a single seta longer than the third segment (Fig. 274). Third leg with a claw and a reflexed seta (Fig. 275). Furca reduced to a flagellum.



Figs. 263–275. 263–270. *Cypridopsis dispar* Hartmann, 1964. 263. Carapace, dorsal view. 264. Right valve, external view. 265. Left valve, external view. 266. Second antenna. 267. Maxillary spines. 268. Second thoracic leg. 269. Third thoracic leg. 270. Furca. 271–275. *Cypridopsis dubia* Sars, 1903. 271. Left valve. 272. Right valve. 273. Second antenna. 274. Second thoracic leg. 275. Third thoracic leg. Measurements in mm.

Male: Not known.

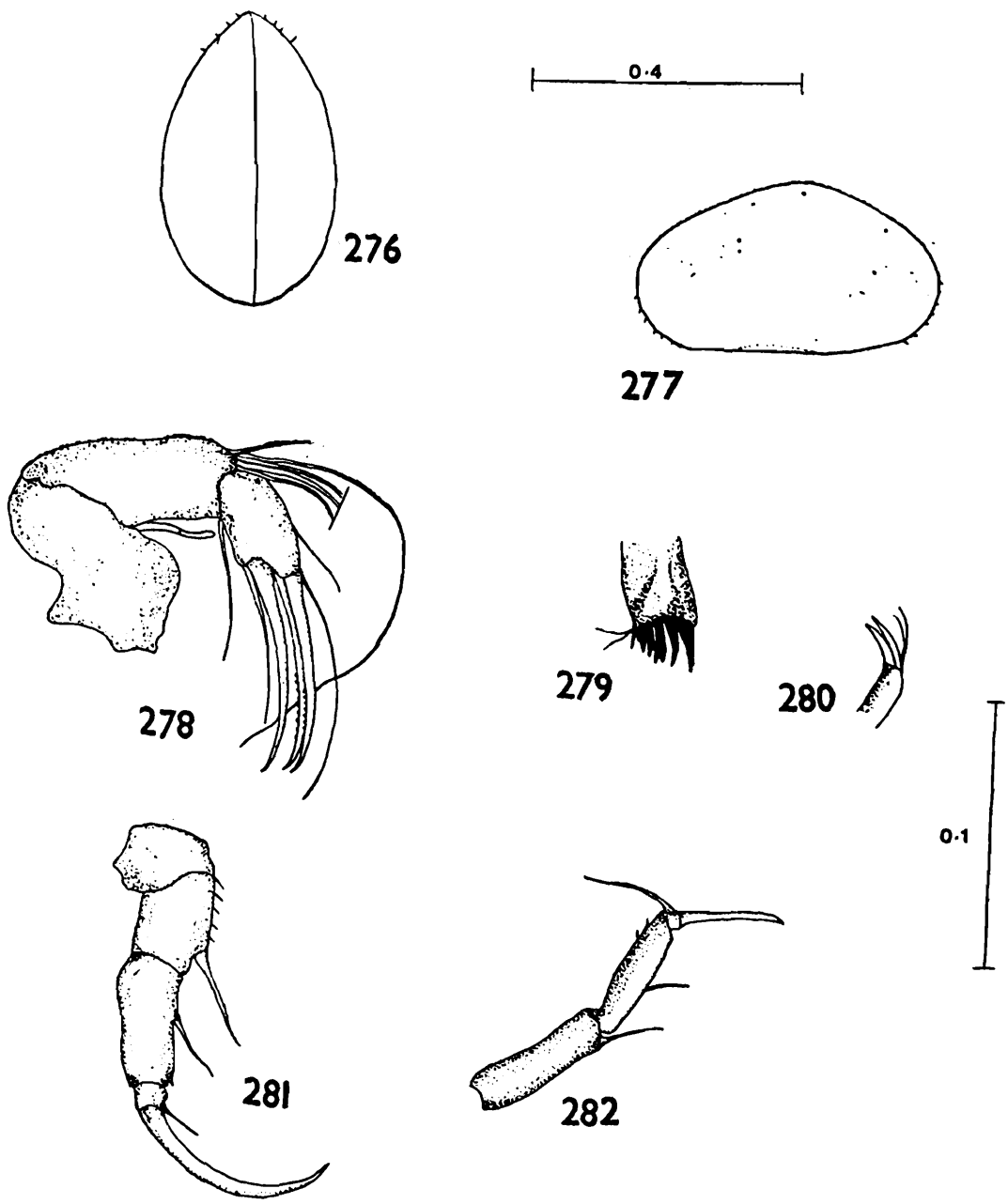
Remarks: *Cypridopsis dubia* is the smallest Indian species reported so far. Sars (1903) described this species from aquaria lined with mud from Sumatra. The specimens examined in the present study were little smaller but otherwise similar. *Cypridopsis dubia* is a new record for India.

Indian Locality: Vivekananda Island in Indian Ocean, Kanyakumari (Tamilnadu).

Cypridopsis angularis (Victor and Michael) 1975

Potomocypris angularis Victor and Michael, 1975, p. 369, Fig. 6, A–E.

Female: Valves moderately compressed, equivalve; laterally subtriangular; dorsum angular in the middle; venter straight, concave in internal view; valve surface sparsely hairy, with very few puncta (Figs. 276, 277). Length



Figs. 276–282. *Cypridopsis angularis* (Victor and Michael) 1975. 276. Carapace, dorsal view. 277. Right valve, external view. 278. Second antenna. 279. Mandibular teeth. 280. Maxillary spines. 281. Second thoracic leg. 282. Third thoracic leg. Measurements in mm.

0.38–0.41 mm; height about 0.20 mm. Natatory setae of the second antenna smooth, reaching beyond the tips of the terminal claws; claws long and toothed; sensory club two segmented (Fig. 278). Mandible with two molar shaped teeth, the rest pointed (Fig. 279). Maxillary spines smooth (Fig. 280). Second leg with a long end claw; second segment with a single seta (Fig. 281). Terminal podomere of the third leg with an elongate claw and a reflexed seta; short spines on the distal end of the penultimate podomere (Fig. 282). Furca reduced.

Male: Unknown.

Remarks: This species was originally described as *Potomocypris angularis* on the basis of laterally compressed valves in addition to other Cypridopsine characters (Victor and Michael, 1975). The degree of valve inflation and the nature of valve overlap appear to be the major differences between the genera *Cypridopsis* and *Potomocypris* (Tressler, 1959; Van Morkhoven, 1963). But the exact line of demarcation between a moderately inflated valve and a laterally compressed valve is not clear. Moreover, other characters follow a generalised pattern. After examining four different species from India, in comparison with other Asian species described in the genus *Cypridopsis* (Daday, 1898; Sars, 1903; Klie, 1927; Hartmann, 1964), we decided to reassign this species as *Cypridopsis angularis*.

Indian Lacalities: Madurai Dt; in Tamilnadu; Trivandrum in Kerala.

Cypridopsis maduraiensis Victor and Michael, 1975

Female: Valves reniform; dorsum convex; venter straight: anterior and posterior margins equally rounded, ventral margin hairy; equivalve; surface with pits and hairs (Fig. 283). Length from 0.55–0.62 mm; height from 0.35–0.37 mm. Natatory setae of the second antenna well-developed, reaching the tips of the terminal claws (Fig. 284). Second thoracic leg with a terminal claw, smooth; seta on the third segment less than the total length of fourth and fifth segments (Fig. 286). Terminal podomere of the third thoracic leg with a beak-shaped claw, broader at the distal end and a usually reflexed seta (Fig. 285). Furca reduced to a flagellum (Fig. 287).

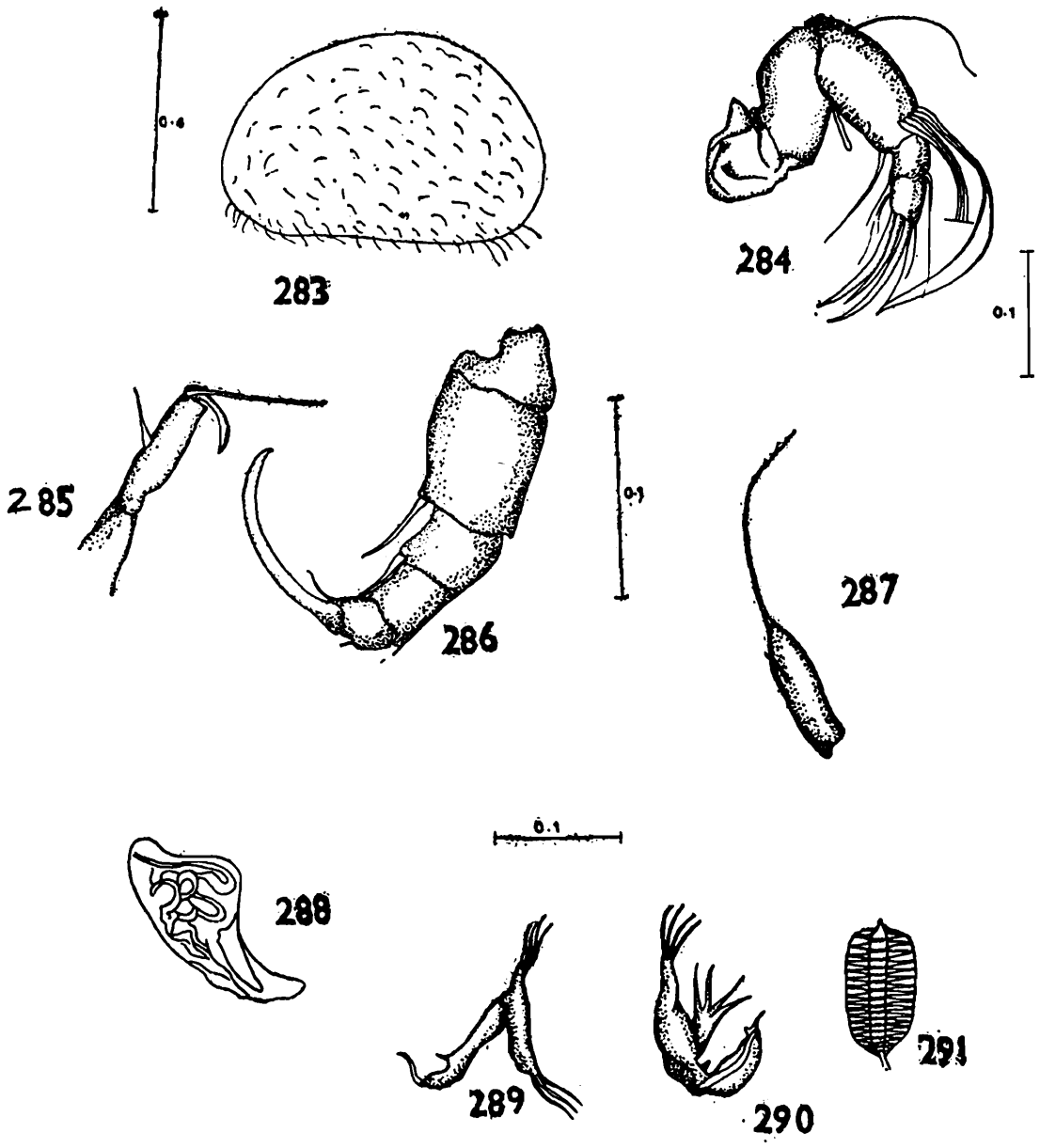
Male: First thoracic legs modified as prehensile palps, asymmetrical (Figs. 289, 290). Hemipenis triangular (Fig. 288) and Zenkers organ with 17 whorls (Fig. 291).

Remarks: Cypridopsis maduraiensis differs from *C. dispar*, which it otherwise resembles, in the shape of the valves, arrangement of claws on the terminal podomere of the second antenna, length of the seta on the third segment of second thoracic leg, and in the structure of male appendages. This species often co-occurs with *C. dispar* Hartmann, 1964. For recent comments on the generic status of this species see Addenda.

Indian Localities: Trichy Dt., Madurai Dt. in Tamilnadu, Guntur area in Andhra Pradesh.

Cypridopsis horai Klie, 1927

Female: Length of the valves 0.44 mm, height 0.23 mm and width 0.21 mm. Carapace moderately inflated; right valve larger overlapping the left (Fig. 292). Second antenna with four end claws, one claw weakly pectinate (Fig. 293). Furca reduced to a flagellum; dorsal seta present (Fig. 294).



Figs. 283–291. *Cypridopsis maduraiensis* Victor and Michael, 1975. 283. Left valve, external view. 284. Second antenna. 285. Third thoracic leg. 286. Second thoracic leg. 287. Furca. 288. Hemipenis. 289. Left prehensile palp, Male. 290. Right prehensile palp, Male. 291. Zenkers organ. Measurements in mm.

Male: Not known.

Indian Localities: Tiloknath; Darjeeling.

Genus **Oncocypris** Müller, 1898

Generic diagnosis:

Small, subovate to subquadrate valves; tumid or strongly inflated post medially; surface with complex ornamentation, inclusive of protuberances and pits; characteristic inner arches in the mesial view; left valve usually larger than the right; inner lamellae narrow. Furca reduced to a flagellum.

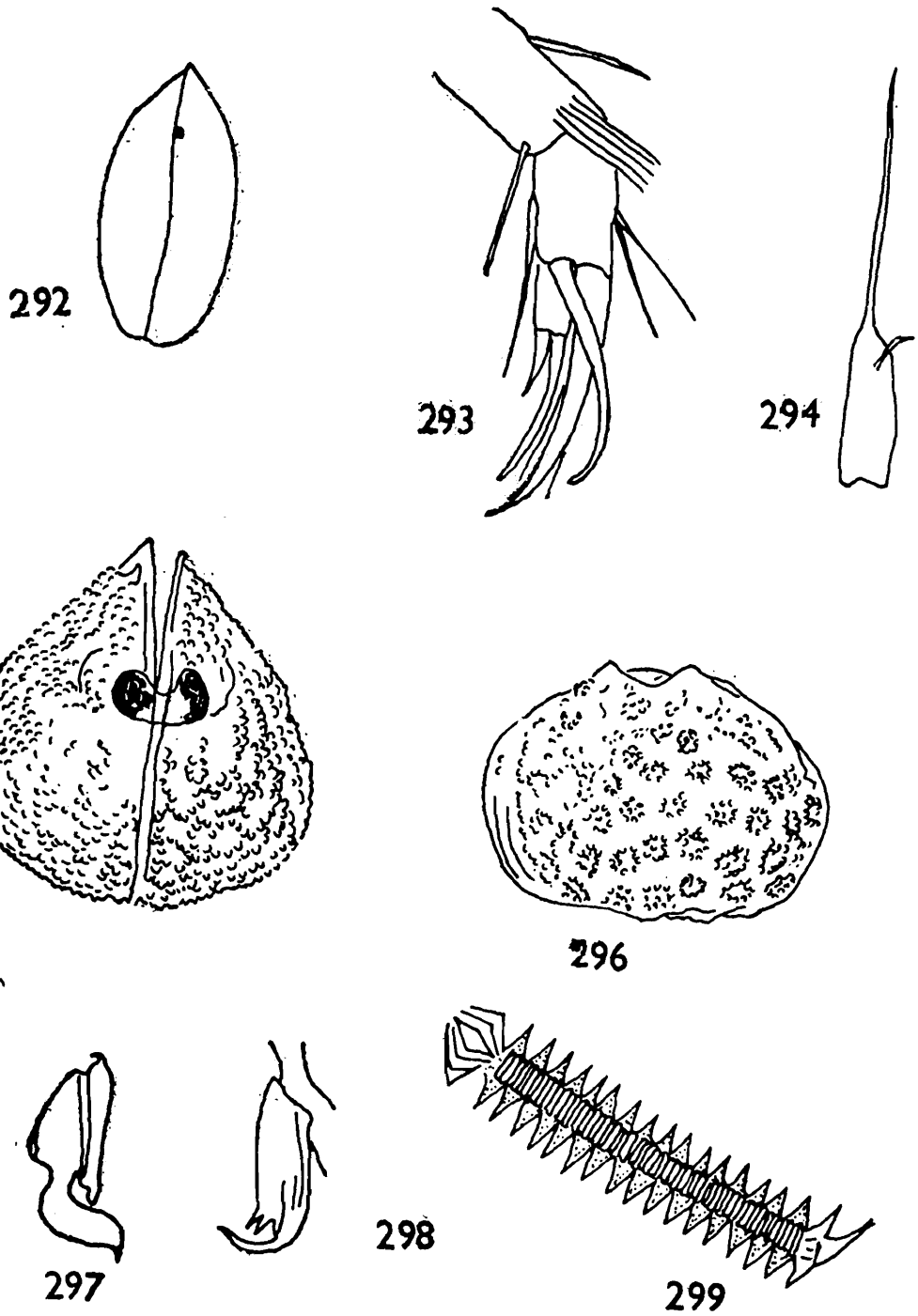
Indian species:

Only two species, *Oncocypris voeltzkowi* Müller, 1898 and *Oncocypris pustulosa* Gurney, 1916 are known.

Oncocypris voeltzkowi Müller, 1898

Female: Length of valves 0.5–0.6 mm. Carapace heavily ornamented, without any constriction in the anterior extremity; left valve large, overlaps the right (Fig. 295, 296). Natatory setae of the second antenna reaching beyond the tips of the terminal claws.

Male: Length of valves 0.50–0.52 mm. Prehensile palp of the first thoracic legs asymmetrical (Fig. 297, 298). Zenkers organ with 18 crowns (Fig. 299).



Figs. 292–299. *Cypridopsis horai* Klie, 1927. (After Klie, 1927). 292. Carapace, dorsal view. 293. Second antenna. 294. Furca. 295–299. *Oncocypris voeltzkowi* Muller, 1898. (After Muller, 1898). 295. Carapace, dorsal view. 296. Left valve, external view. 297. Right prehensile palp, Male. 298. Left prehensile palp, Male. 299. Zenkers organ.

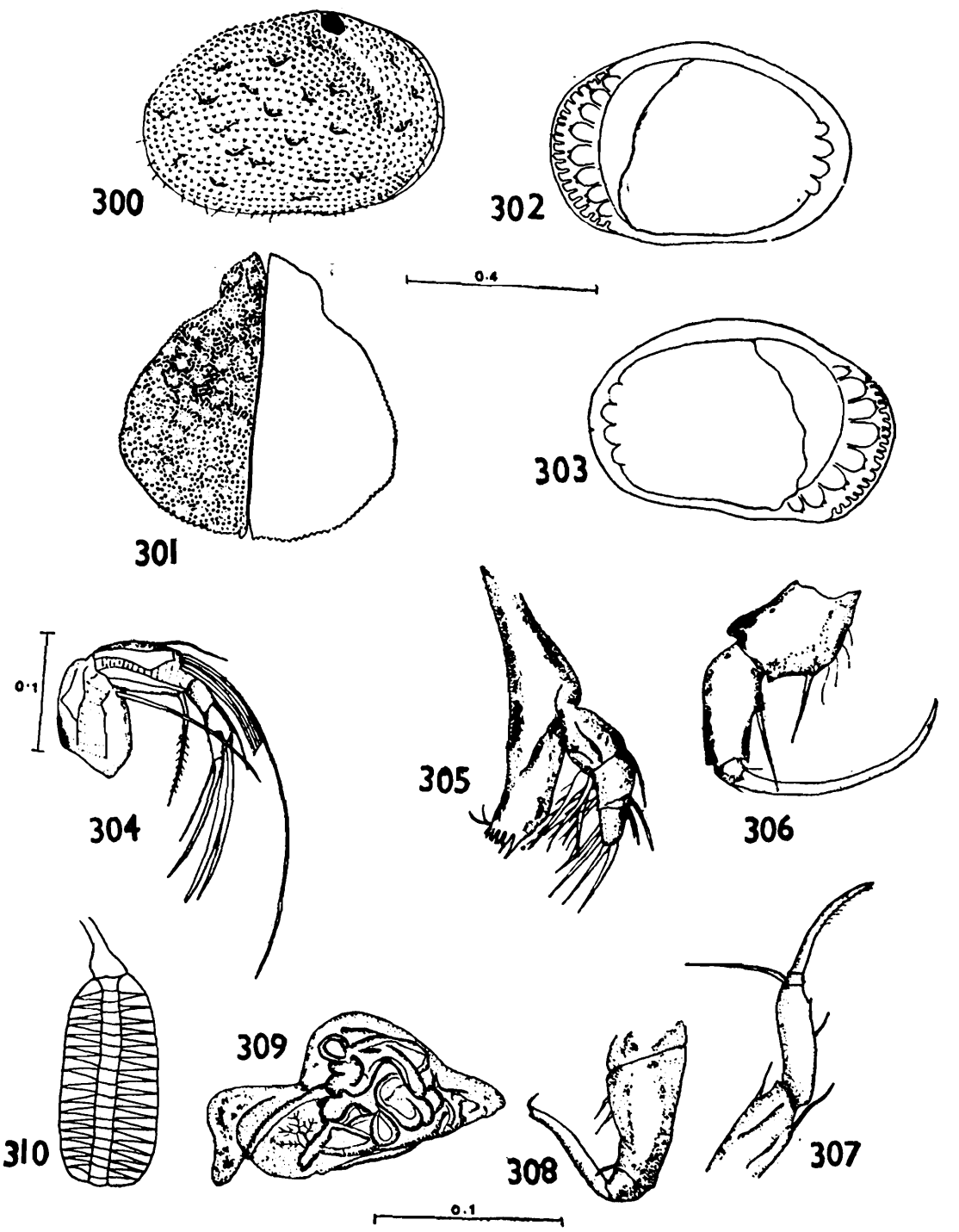
Remarks: Hartmann (1964) reported this species from India. Material not available during the present study. Figures adopted from Müller's (1898) original description.

Indian Locality: Ernakulam in Kerala.

Oncocypris pustulosa Gurney, 1916

Oncocypris pustulosa Gurney, 1916, p. 340, Pl. III, Figs. 17–21.

Female: Eyes large, united dorsally; colour brownish; valve overlap inconspicuous; valves tumid, anterior extremity with a significant constriction; anterior to the middle, dorsum angular, sloping posteriorwards; ventral margin straight; marginal zone of valves tuberculate and hairy; surface sculpturing is complex, with fine granulation and tuberculations superimposed with circular depressions; anterior and posterior margins of the valves with arches internally (Figs. 300–303). Length 0.60–0.62 mm; height 0.40–0.41 mm and width 0.56 2 mm 0.58 mm. Natatory setae of the second antenna reaching



Figs. 300–310. *Oncocypris pustulosa* Gurney, 1916. 300. Right valve, external view. 301 Carapace, ventral view, one valve showing ornamentation. 302. Right valve, internal view. 303. Left valve, internal view. 304. Second antenna. 305. Mandible. 306. Second thoracic leg. 307. Third thoracic leg. 308. Left prehensile palp, Male. 309. Hemipenis. 310. Zenkers organ. Measurements in mm.

beyond the tips of the terminal claws (Fig. 304). Mandible with molar shaped and pointed teeth (Fig. 305). Third maxillary palp with five spines. Second thoracic leg with a long slender claw; second and third segments undivided (Fig. 306). Third thoracic leg with a long claw and a reflexed seta (Fig. 307). Furca reduced to a flagellum.

Male: First thoracic legs modified as prehensile palps, left palp characteristic (Fig. 308). Hemipenis triangular (Fig. 309). Zenkers organ with 17 whorls (Fig. 310).

Remarks: *Oncocypris pustulosa* was previously reported from Southern India (Michael and Victor, 1975). This species differs from *O. voeltzkowi* (Müller, 1898; Triebel, 1963) in the shape and structure of the valves, male characteristics, and the third thoracic leg.

Indian Localities: Only from the South Western coastal ponds of Kerala.

Genus **Pseudocypretta** Klie, 1932

Generic diagnosis:

Subtriangular, tumid valves; dorsum boldly arched, umbonate medially; ventral margin straight, anterior and posteior margins rounded; right valve overlaps the left.

Indian species:

The only species recorded for this genus is *Pseudocypretta maculata* Klie, 1932.

Pseudocypretta maculata Klie, 1932

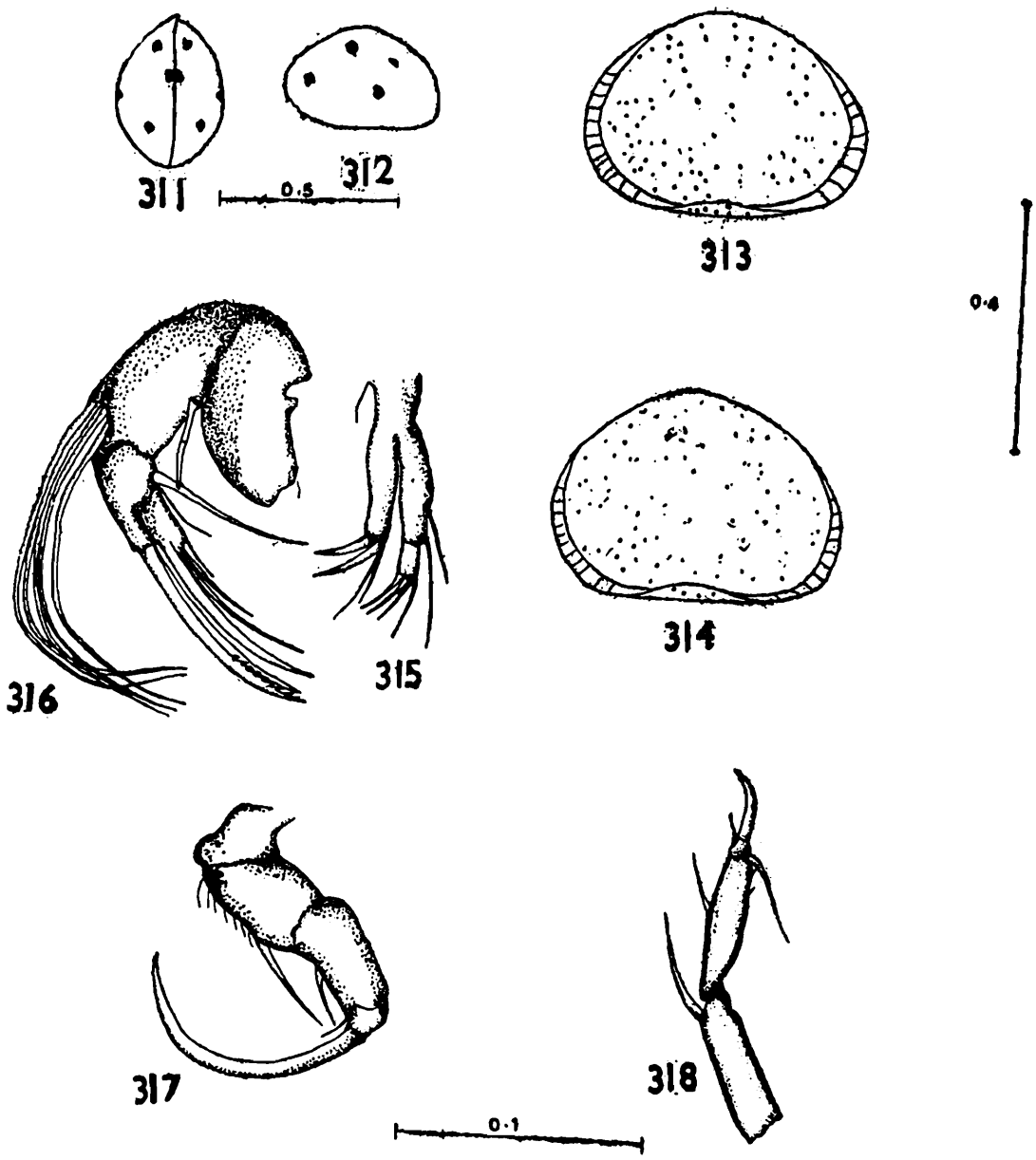
Pseudocypretta maculata Klie, 1932, p. 485, Fig. 66–73.

Female: Valves tumid, subtriangular; dorsum boldly arched; right valve overlaps the left; venter straight; anterior and posterior margins rounded with pore canals giving a striated appearance; valve surface with minute puncta and a few short hairs; each valve with four purple blotches laterally in the external view (Figs. 311–314). Length of the valves 0.45–0.46 mm; height 0.30–0.32 mm and width 0.32–0.34 mm. Natatory setae of the second antenna well developed, reaching to the tips of the terminal claws; claws smooth and long; sensory club two segmented (Fig. 316). Maxillary spines smooth (Fig. 315). Second leg with a long end claw (Fig. 317). Third thoracic leg with a short terminal segment having a long claw, a short seta, and a reflexed seta; dorsal margin of the penultimate segment lined with two or three spines (Fig. 318). Furca reduced.

Male: Not known.

Remarks: The inflated valves with four purple blotches in lateral view and six in dorsal view are characteristic of *P. maculata.* This species was first described from Sumatra and Java (Klie, 1932). Some of the specimens examined in the present study had faded, and the purple blotches were indistinct. The examination of soft parts, however, confirmed their identity as *P. maculata.* Loss of colouration may be due to the effect of preservation.

Indian Localities: Trivandrum in Kerala; Chembarambakkam, near Madras in Tamilnadu.



Figs. 311–318. *Pseudocypretta maculata* Klie, 1932. 311. Carapace, dorsal view. 312. Left valve, external view. 313. Left valve, internal view. 314. Right valve, internal view. 315. Maxillary spines. 316. Second antenna. 317. Second thoracic leg. 318. Third thoracic leg. Measurements in mm.

Genus **Physocypria** Vavra, 1897

Generic diagnosis:

Subovate to subtriangular valves; dorsum strongly arched to umbonate, venter slightly convex; valves unequal with either left or right larger; free margin of one valve serrate, spinose, or tuberculate. Furcal rami symmetrical, short and stumpy.

Indian species:

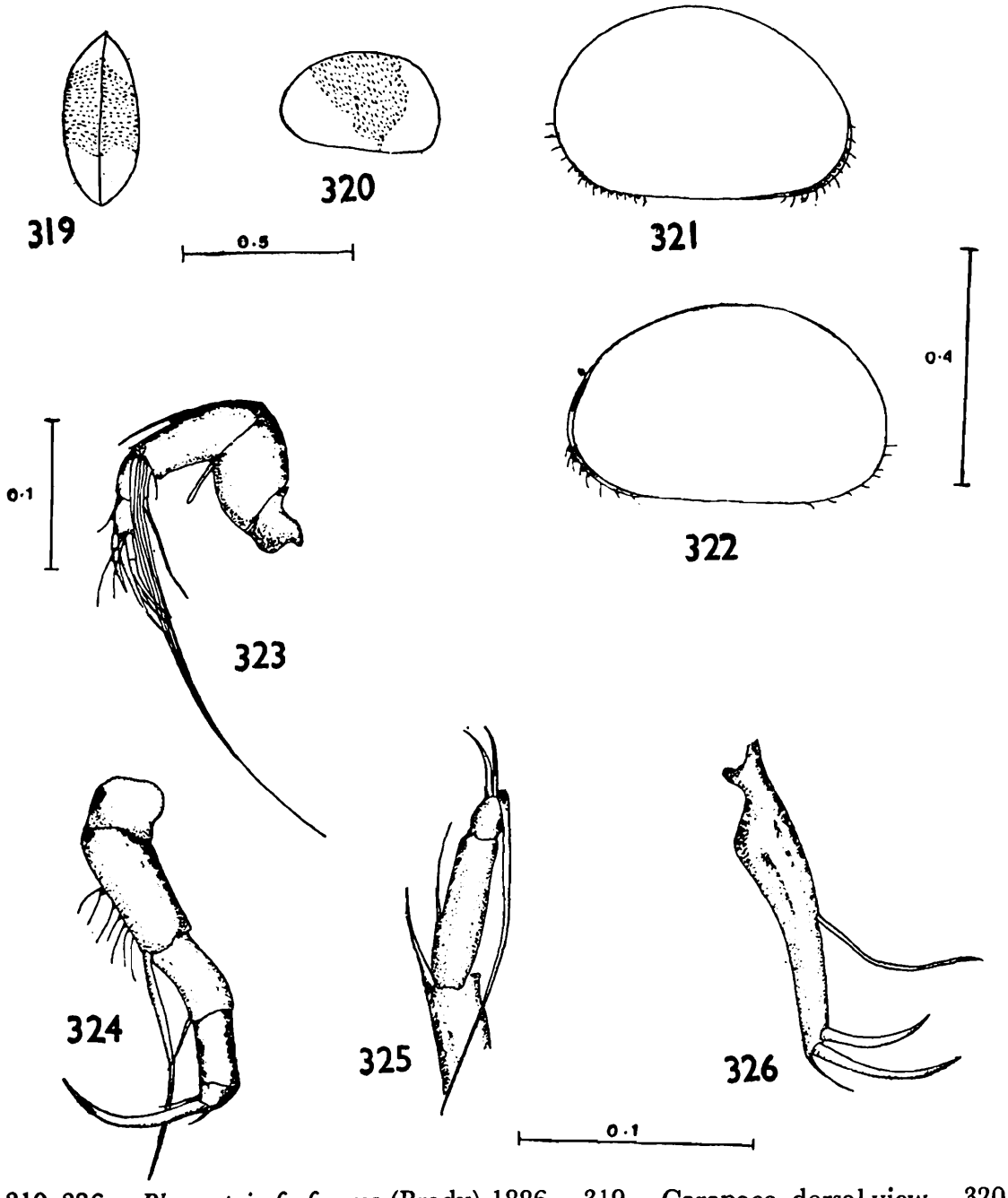
The following species are placed in this genus:—

Physocypria furfuracea (Brady) 1886; *Physocypria minutus* Victor and Michael, 1975. *Physocypria devai* Arora is placed in this genus provisionally. No material of this species was available for study. *Cypria javana* Müller, whose validity is doubtful, is also placed here.

Physocypria furfuracea (Brady) 1886

Cypris furfuracea Brady, 1886, p. 299, Pl. 38, Figs. 21–23a.
Cypris purpurascens Apstein, 1907, p. 227, Fig. R. a–o.
Physocypria tuberata Gurney, 1916, p. 341, Fig. 1a–3; Pl. 3, Fig. 22.

Female: Colour whitish, sometimes with a purple patch when alive. Valves subovate; dorsum convex, greatest height little behind the middle; left valve overlapping the right in the anterior extremity; anterior and posterior margins rounded; the valve margins hairy; both valves with a pellucid marginal zone; right valve with prominent tubercles on anterior and posterior margins, left valve smooth; valve surface smooth (Figs. 319–322) Length 0.49–0.53 mm; height 0.29–0.31 mm. Natatory setae of the second antenna well developed, reaching well beyond the tips of the terminal claws; exceeding more than twice the length of terminal claws; claws smooth (Fig. 323). Second segment of second thoracic leg with a single seta, longer than



Figs. 319–326. *Physocypria furfuracea* (Brady) 1886. 319. Carapace, dorsal view. 320. Left valve, external view showing a patch of colouration. 321. Right valve, external view. 322. Left valve, external view. 323. Second antenna. 324. Second thoracic leg. 325. Third thoracic leg. 326. Furca. Measurements in mm.

the combined length of third, fourth and fifth segments; end claw scythe-like, smooth (Fig. 324). Third thoracic leg with a short terminal segment armed with two claws and a long reflexed seta, seven times longer than the length of the terminal segment (Fig. 325). Furcal rami symmetrical, short and stout; dorsal seta placed in the middle of the ramus, longer than the terminal claw; terminal seta 1/2 the length of subterminal claw; length of the ramus 9.5× least width (Fig. 326).

Male: Not examined in the present study, though Gurney (1916) reported males from Ceylon.

Remarks: *Physocypria furfuracea* (Brady) 1886 is the senior synonym of *Physocypria tuberata* Gurney, 1916, and the latter was previously reportdd from India (Hartmann, 1964). This fact was revealed when the type specimens of Brady (1886), now deposited in Hancock Museum, were examined (Neale, personal communication). Brady (1886) described *Cypris furfuracea* as a new species from Ceylon, and later Gurney (1916) described *P. tuberata* from the same island. This confusion might have resulted from the inadequate description given by the original author. So, the present species, widely known as *P. tuberata*, is redescribed here as *Physocypria furfuracea* (Brady) 1886.

Indian Localities: Pandharpur in Maharashtra; Kathiawar Peninsula, Gujarat; Madurai Dt., Salem, Sri Rangam and Pondicheri in Tamilnadu; Kovur and Guntur in Andhra Pradesh.

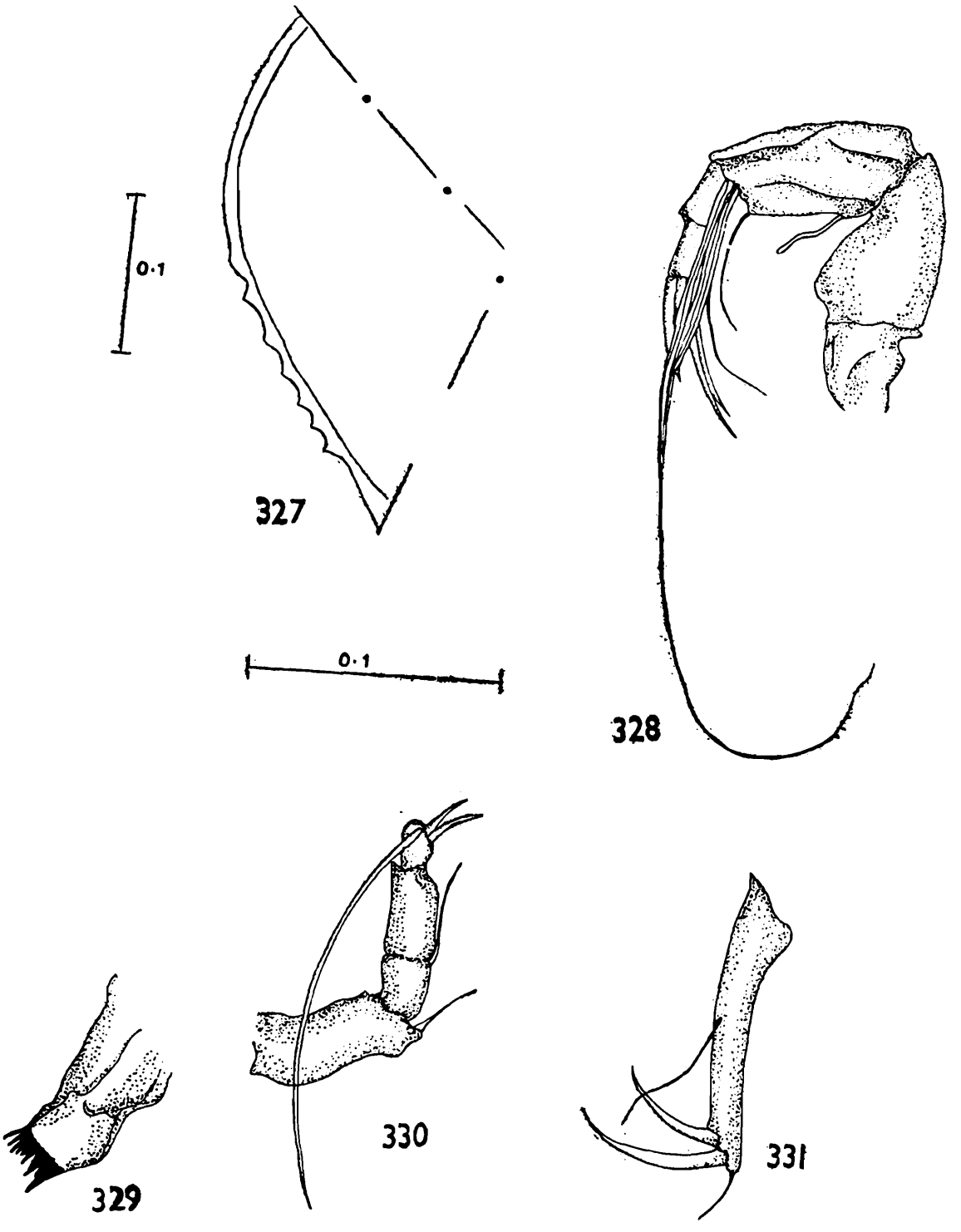
Physocypria minutus Victor and Michael, 1975

Female: Subovate valves; greatest height in the middle; larger left valve; anterior and posterior margins of the right valve with dentate projections (Fig. 327); valve surface smooth. Length of valves 0.55–0.60 mm and height 0.36–0.39 mm. Natatory setae of the second antenna well developed, reaching beyond the tips of the terminal claws, with one or two setae exceeding 3.5 times the length of the terminal claws (Fig. 328). Mandible with pointed teeth (Fig. 329). Second thoracic leg with a short seta in the second segment; end claw scythe-like. Terminal podomere of the third leg blunt with two claws and a long reflexed seta (Fig. 330). Furcal rami symmetrical, stout and short; dorsal seta longer than the terminal claw; terminal seta more than 1/2 the length of subterminal claw. Length of furcal ramus 8.5 × least width (Fig. 331).

Male: Not known.

Remarks: The dentate projections of the right valve and the incompletely divided penultimate podomere of the third thoracic leg are significantly different from *P. furfuracea*. The differences between *P. minutus* and other related species are adequately discussed in the original description (Victor and Michael, 1975).

Indian Localities: Trivandrum in Kerala; Nagamalai (West Madurai area) in Tamilnadu.

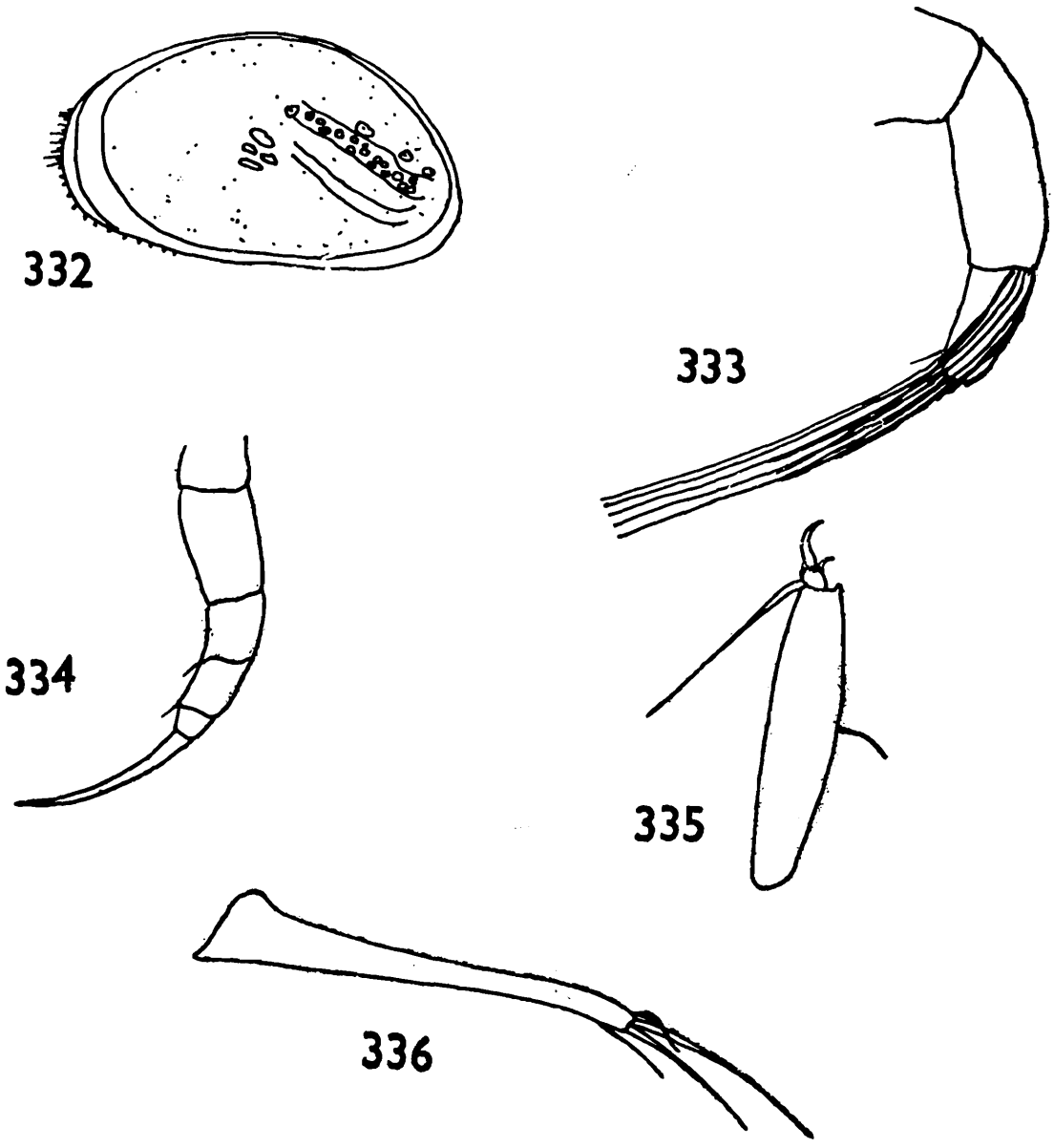


Figs. 327–331. *Physocypria minutus* Victor and Michael, 1975. 327. Posterior margin o the right valve showing dentate projections. 328. Second antenna. 329. Mandibular teeth. 330. Third thoracic leg. 331. Furca. Measurements in mm.

Physocypria devai Arora 1931 (?)

This species was described by Arora (1931) from Lahore. The original description (Figs. 333–336) indicates beyond doubt that this species is misplaced in the genus *Physocypria* and in our opinion, this species does not even belong to the family Cyclocyprididae. It is difficult to assess its current taxonomic status from the description.

Location of type material not known.



Figs. 332–336. *Physocypria devai* Arora, 1931 (After Arora, 1931). 332. Side view of right valve. 333. Second antenna. 334. Second thoracic leg. 335. Third thoracic leg. 336. Furca.

Cypria javana Müller 1906 (?)

Müller (1906) described *Cypria javana* from Java, and Klie (1927) recorded this species from Kerala (South Western India). This species, also recorded from Java and Bali (Klie, 1932), was found to be identical with *Cypris purfurascens* (of Apstein, 1907; not of Brady, 1886) from Ceylon. *Physocypria purfuracea* (Brady) 1886 compared with *Cypris purpurascens* of Apstein (1907) in the present study was found to be identical. If this be the case, there is a strong possibility that *Cypris javana* is nothing but a junior synonym of *Physocypria furfuracea*. Müller's (1906) type material, if and when located, will help to solve this problem.

Genus **Centrocypris** Vavra 1895

Generic diagnosis:

Strongly tumid, subquadrate valves; equal or unequal; surface spinose or tuberculate. Well developed natatory setae of the second antenna reaching beyond the tips of terminal claws. Symmetrical furca with slender terminal and subterminal claws.

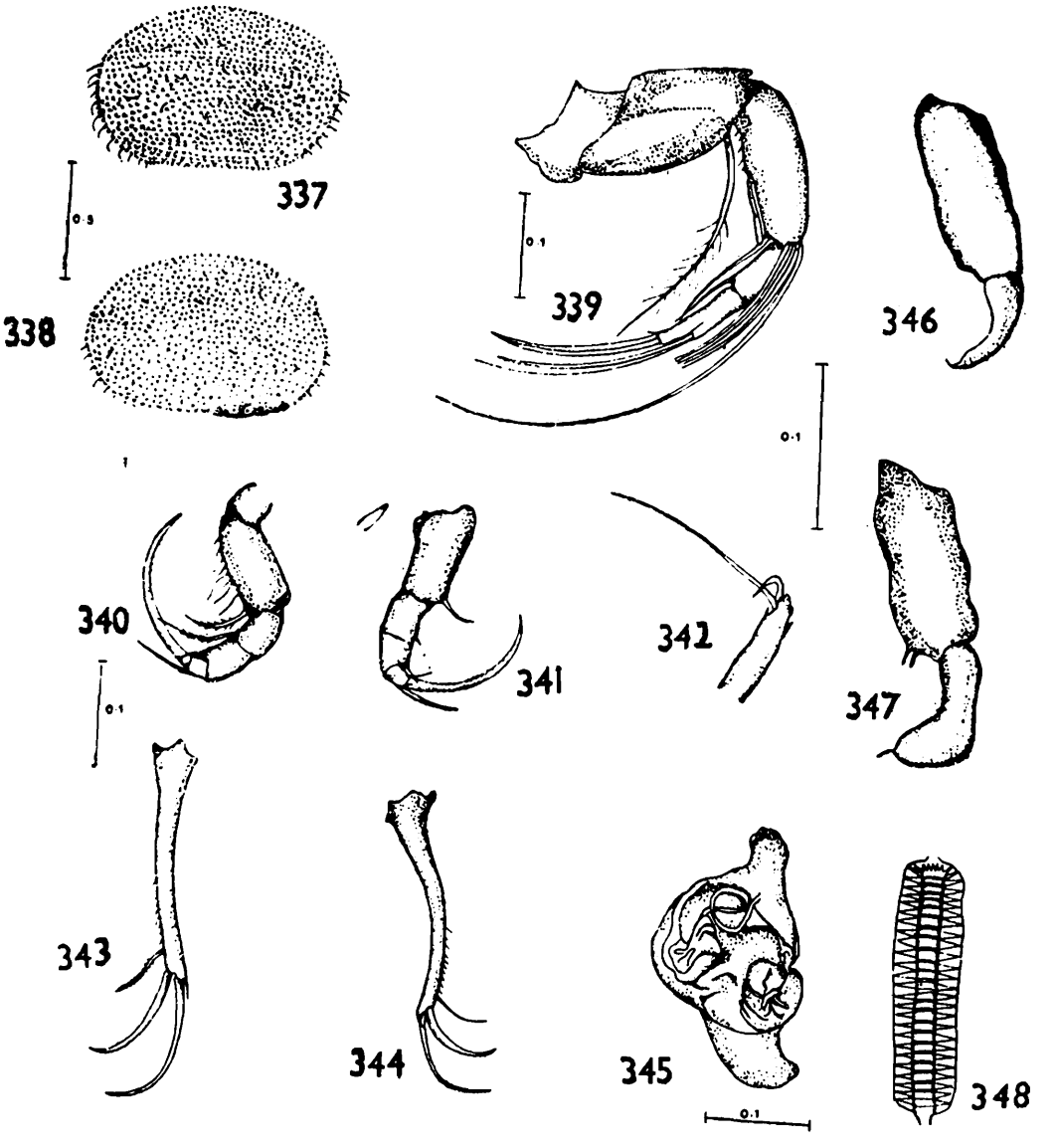
Indian species:

The two species known of this genus are *Centrocypris matthaii* (Arora) 1931 and *Centrocypris horrida* Vavra, 1895. *C. horrida* was not available for study. It is described and figured from Vavra (1895).

Centrocypris matthaii (Arora) 1931

Eurycypris matthaii Arora, 1931, p. 85, Pl. VII, Fig. 55.
Cypris matthaii (Arora) 1931: Michael and Victor, 1975, p. 511, Fig. 2, A–E.

Female: Colour whitish or greenish. Valves tumid, subquadrate; dorsum moderately convex, venter straight; anterior and posterior margins broadly rounded; valve margins spiny; surface heavily tuberculate with a sparse distribution of minute hairs (Figs. 337, 338). Length 0.97 mm; height 0.62 mm and width 0.67 mm. Natatory setae of the second antenna well developed, plumose, reaching beyond the tips of the terminal claws (Fig. 339). Third maxillary palp with six strong spines. Second leg with a long terminal claw,



Figs. 337–348. *Centrocypris matthaii* (Arora) 1931. 337. Left valve, external view, Female. 338. Right valve, external view, Female. 339. Second antenna, Female. 340. Second thoracic leg, Female. 341. Second thoracic leg, Male. 342. Third thoracic leg, Female. 343. Furca, Female. 344. Furca, Male. 345. Hemipenis. 346. Left prehensile palp, Male. 347. Right prehensile palp, Male. 348. Zenkers organ. Measurements in mm.

weakly pectinate; second and third segments with single seta each, setulate (Fig. 340). Terminal podomere of the third thoracic leg with a claw and a reflexed seta (Fig. 342). Furcal rami symmetrical, straight; terminal and subterminal claws slender and long; dorsal seta more than 1/2 the length of the subterminal claw, densely setulate; terminal seta short; dorsal margin with delicate hairs (Fig. 343).

Male: Valves with pigments. Second thoracic leg with shorter, smooth setae on second and third segments (Fig. 341). Prehensile palps of the first legs asymmetrical (Fig. 346, 347). Hemipenis triangular with a single broad lobe (Fig. 345). Furcal ramus slightly curved (Fig. 344). Zenkers organ with 24–26 crowns (Fig. 348).

Remarks: Arora(1931) described this species from Lahore as *Eurycypris matthaii*. Several populations were examined in the present study, and this species is redescribed as *Centrocypris matthaii*. Male, previously not known for this species, is described in detail.

Indian Localities: Madurai Dt., Trichy Dt., Ramnad Dt., Salem and Nagerkoil in Tamilnadu.

Centrocypris horrida Vavra, 1895

Centrocypris horrida Vavra, 1895, p. 18, Fig. 7, 1–9.
Centrocypris horrida Vavra, 1895: Hartmann, 1964, p. 140.

Female: Valves tumid, in lateral view subrectangular, margins armed with large, thick spines; mid dorsum and venter straight; surface tuberculate (Fig. 349, 350). Length 1.3 mm; height 0.8 mm and width 1.0 mm. Maxillary palp with four smooth spines; Terminal podomere of third thoracic leg with a complex arrangement of two curved claws and a stout claw-like projection (Fig. 351). Furca symmetrical; terminal and subterminal claws slender; dorsal seta more than 1/2 the length of subterminal claw; terminal seta short (Fig. 352).

Male: Known.

Remarks: Centrocypris horrida differs from *C. matthaii* in the valve shape, nature of spines on the valve margins, structure of the third thoracic leg terminal segment, and the furcal ramus.

Indian Localities: Palni Hills in Tamilnadu; Yanam swamp in Andhra Pradesh.

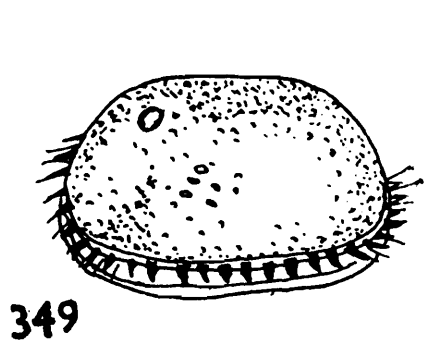
Genus **Indiacypris** Hartmann, 1964

Generic diagnosis:

Subrectangular valves; left valve larger than the right; valve overlap complete; margins of the left valve with septa, at least anteriorly. Third thoracic leg with three setae in the terminal segment. Symmetrical furca; dorsal seta placed above the mid dorsal region of the ramus.

Indian species:

Indiacypris dispar Hartmann, 1964 is the only species known from India. This species was not available for study. It is described and figured from Hartmann (1964).



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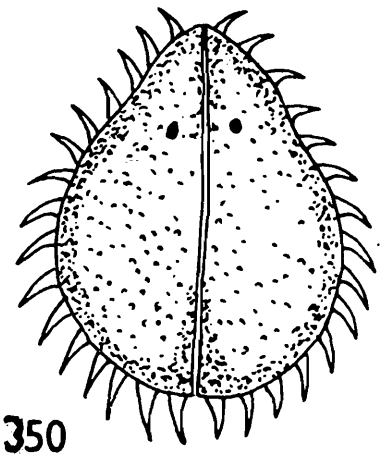

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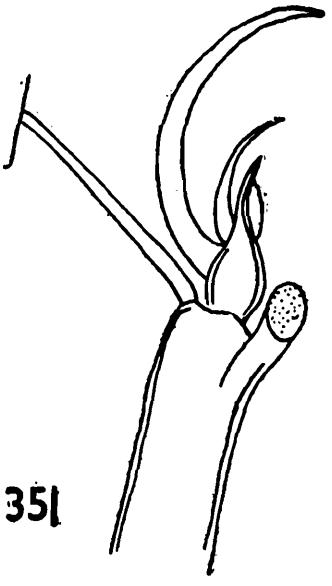

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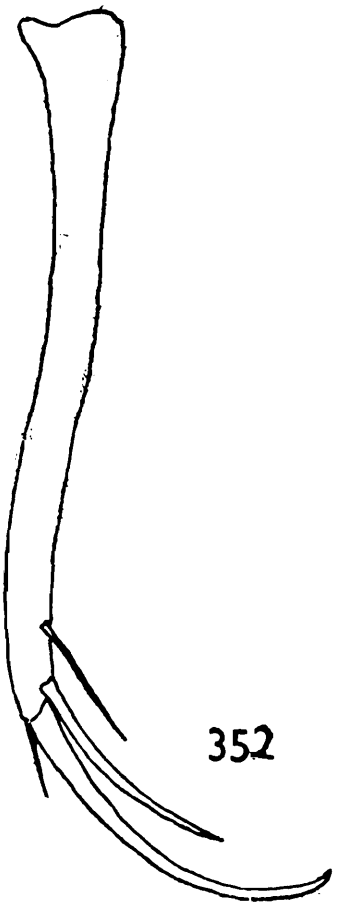

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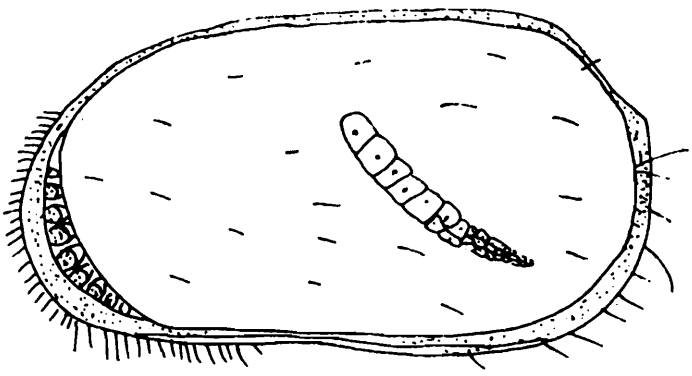
Figs. 349–352. *Centrocypris horrida* Vavra, 1895 (After Vavra, 1895). 349. Side view of the animal. 350. Carapace, dorsal view. 351. Third thoracic leg. 352. Furca.

Indiacypris dispar Hartmann, 1964

Female: Valves subrectangular, unequal; left valve completely overlaps the right; anterior margin of the left valve with distinctive septa (Figs. 353–355). Length of the left valve 0.92–0.95 mm and the right 0.75–0.78 mm; height of the left and right valves 0.50–0.52 mm and 0.45–0.46 mm respectively; width 0.31 mm. Terminal podomere of third leg small with three setae, of which one is reflexed; dorsal and ventral margins of the third leg ornamented with spination(Fig. 356). Furca symmetrical; dorsal seta placed near the proximal extremity, longer than the subterminal claw (Fig. 357).



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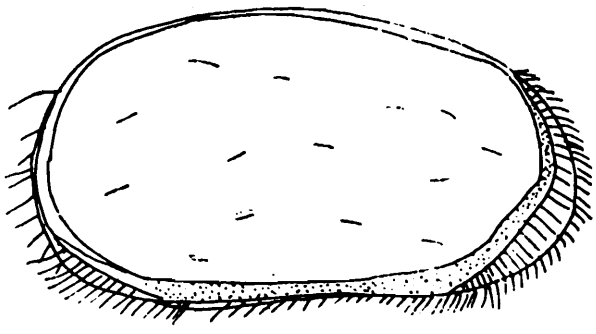

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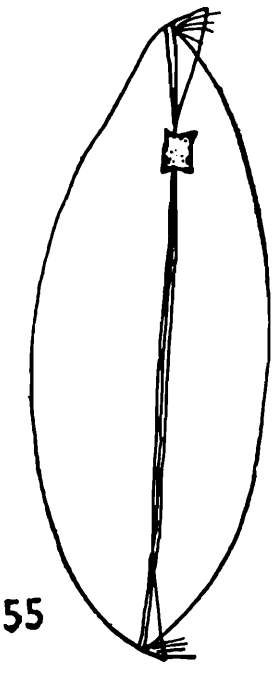

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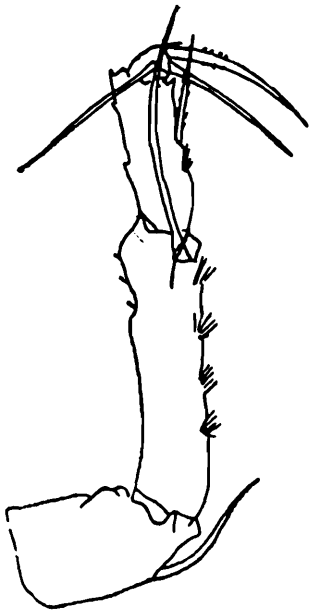

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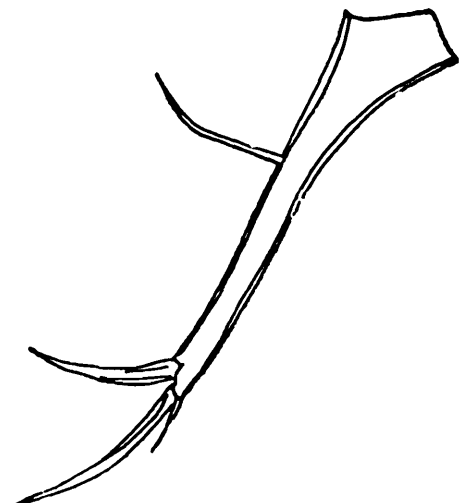

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Figs. 353–357. *Indiacypris dispar* Hartmann, 1964 (After Hartmann, 1964). 353. Left valve. 354. Right valve. 355. Carapace, dorsal view. 356. Third thoracic leg. 357. Furca.

Male: Known.

Indian Localities: Palni Hills in Tamilnadu; Ernakulam, Quilon in Kerala; Barsi, Kandheri and Aurangabad in Maharashtra.

Genus **Candonopsis** Vavra, 1891

Generic diagnosis:

Valves medium to large; elongate; laterally compressed; unequal; higher behind the middle, usually; inner duplicature broad anteriorly; thinly calcified. Natatory seeta of the second antenna absent.

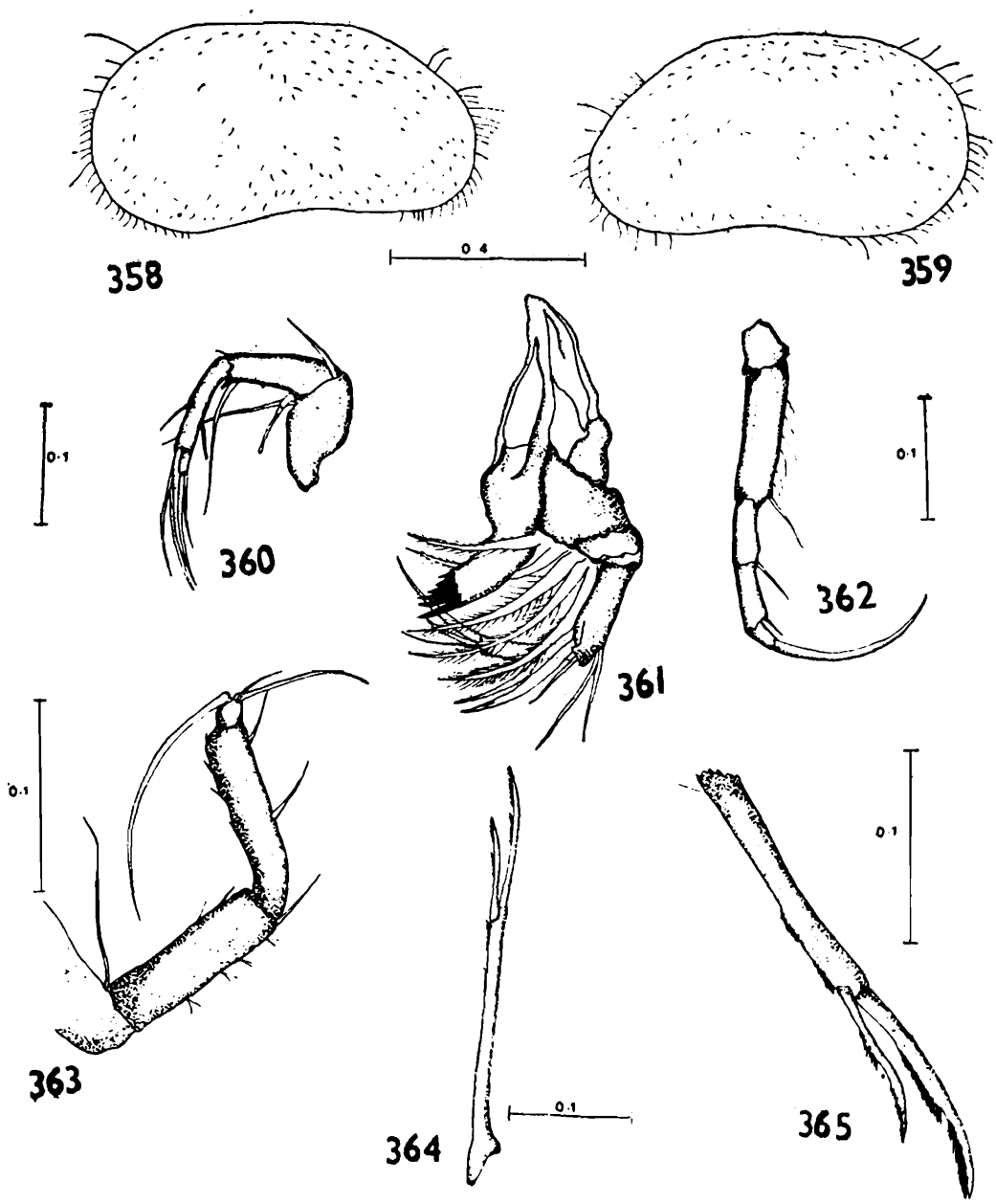
Indian species:

Candonopsis putealis Klie, 1932 is the only species recorded in the present study. It is the only species known from India.

Candonopsis putealis Klie, 1932

Candonopsis putealis Klie, 1932, p. 455, Fig. 24–31.

Female: Valves subrectangular; laterally elongate; anterior and posterior margins rounded, densely hairy; left valve little larger than the right; overlap insignificant; dorsum nearly straight; ventral margin slightly concave; valves thin, covered with minute hairs (Fig. 358, 359). Length 0.77 mm and height 0.40 mm. Second antenna slender; natatory setae absent; sensory club four-segmented; terminal podomere with four elongate claws (Fig. 360). Mandibular palp narrowly produced with a short basal segment, the terminal



Figs. 358–365. *Candonopsis putealis* Klie, 1932. 358. Right valve, external view. 359. Left valve, external view. 360. Second antenna. 361. Mandible. 362. Second thoracic leg. 363. Third thoracic leg. 364. Furca. 365. Distal end of the furca. Measurements in mm.

segment with two claw-like spines (Fig. 361). Slender second thoracic leg with a long, scythe-shaped, smooth terminal claw; second segment with a single seta; setae on all segments smooth; ventral margin of second segment lined with a row of hairs (Fig. 362). Terminal segment of the third thoracic leg short, with three setae of which one is reflexed and longer than the penultimate segment; penultimate segment with two setae on the ventral side, dorsal marign with three or four spines; segment previous to the penultimate podomere is lined with a row of paired spines on the ventral aspect and two distinct spines on the dorsal aspect (Fig. 363). Furca symmetrical; both dorsal and terminal setae absent; subterminal claw about 2/3 the length of terminal claw, both the claws armed with two distinct groups of spines; dorsal margin of the ramus lined with two groups of spines (Figs. 364, 365).

Male: Not known from India, though Klie (1932) reported males.

Remarks: Candonopsis putealis was described by Klie (1932) while reporting on the ostracod fauna collected during the Sunda Expedition in Indonesia. The present Indian specimens resembled the original description except for some differences noticed in the structure of third thoracic leg and the furcal ramus. The occurrence of *C. putealis* was rare, and only a few specimens were examined in the present study.

Indian Locality: Only one collection from Trivandrum, Kerala (South Western coast) contained this species.

Genus **Ilyocypris** Brady and Norman, 1889

Generic diagnosis:

Valves subquadrate; laterally compressed; dorsum straight or sulcate; surface pitted, pustulose, tuberculate, or smooth. Natatory setae of the second antenna well developed. Terminal segment of the third leg with three setae. Well developed furca short and symmetrical.

Indian species:

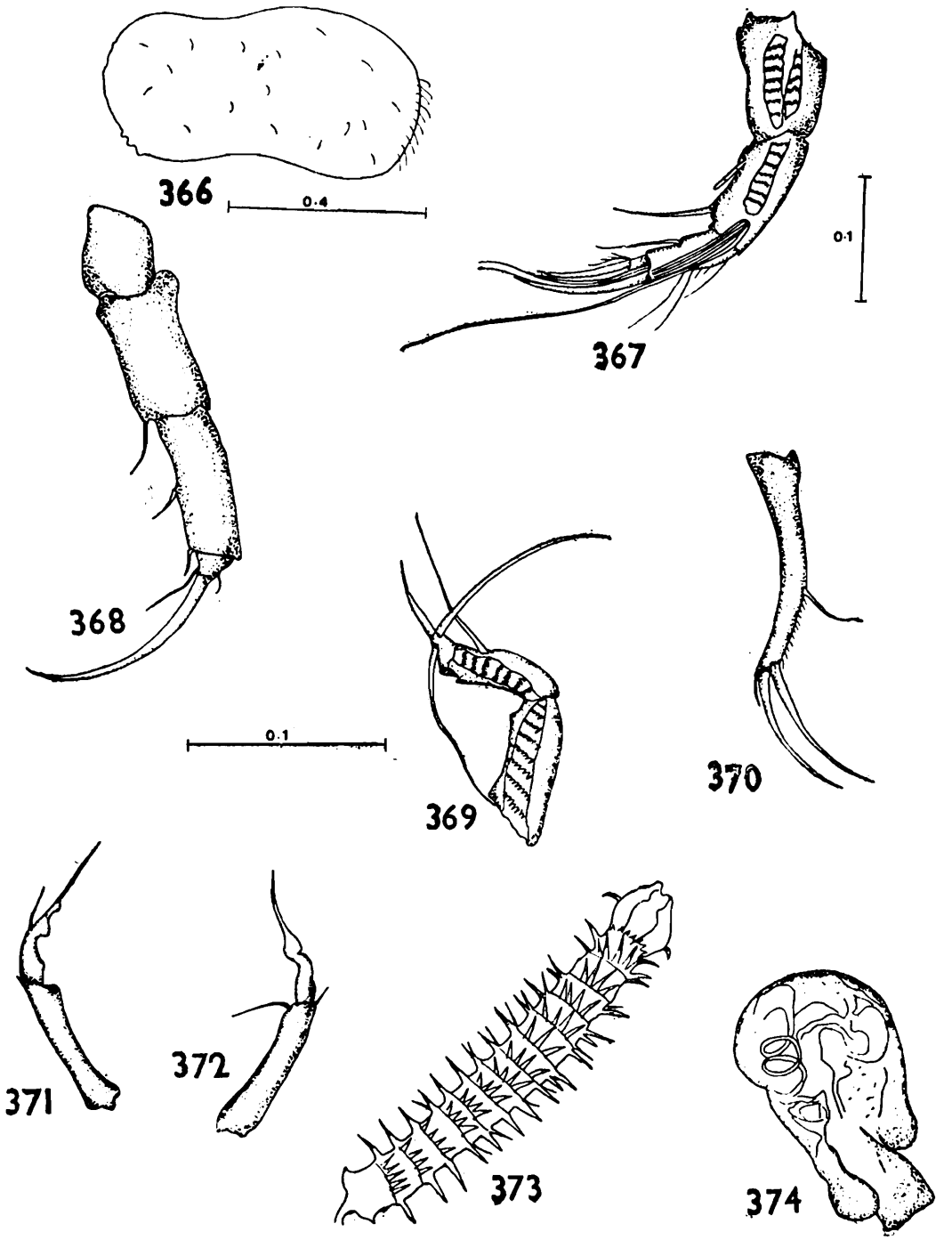
The following species are assigned to this genus:—

Illyocypris nagamalaiensis Victor and Michael, 1975; *Ilyocypris australiensis* Sars, 1889 and *Ilyocypris bradyi* Sars, 1890. *I. australiensis* and *I. bradyi* were not available for study. They are described and figured from previous work.

Ilyocypris nagamalaiensis Victor and Michael, 1975

Female: Equivalve; subrectangular; anterior and posterior margins rounded; surface granular with a sparse distribution of hairs; anterior margin hairy, posterior margin with blunt protuberances (Fig. 366). Length 0.51 mm and height 0.28 mm. Natatory setae of the second antenna well developed, reaching beyond the tips of the terminal claws; sensory club three-segmented (Fig. 367). Second thoracic leg with long, narrow claws (Fig. 368). Third thoracic leg with a short terminal podomere armed with three setae of which one is reflexed (Fig. 369). Furcal rami symmetrical; curved; terminal and subterminal claws almost equal in length; dorsal seta placed approximately at the middle of the ramus, half the length of subterminal claw; terminal seta short; dorsal margin of the ramus between dorsal seta and subterminal claw hairy (Fig. 370).

Male: Prehensile palps of the first thoracic leg asymmetrical (Figs. 371, 372). Hemipenis triangular with two lobes, one blunt and the other squarish (Fig. 374). Well developed Zenkers organ with 14 spinous crowns (Fig. 373).



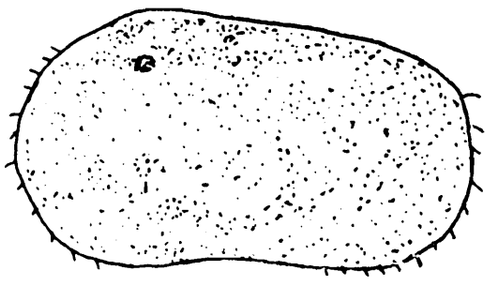
Figs. 366–374. *Ilyocypris nagamalaiensis* Victor and Michael, 1975. 366. Right valve, external view. 367. Second antenna. 368. Second thoracic leg. 369. Third thoracic leg. 370. Furca. 371. Left prehensile palp, Male. 372. Right prehensile palp, Male. 373. Zenkers organ. 374. Hemipenis. Measurements in mm.

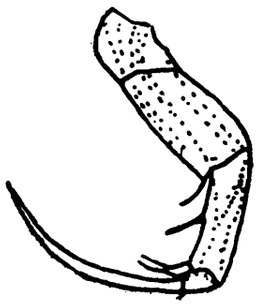
Remarks: This species differed from *Ilyocypris australiensis* in its shell characters, the structure of the third leg, the prehensile palps, and the hemipenis. The distinctly separated third and fourth segments of the second leg in *Ilyocypris bradyi*, are different from *I. nagamalaiensis*. *I. taprobonensis*, a new species described from Ceylon (Neale, personal communication), differed in the ornamentation, mid dorsal constriction of valves and also in the structure of the male prehensile palps.

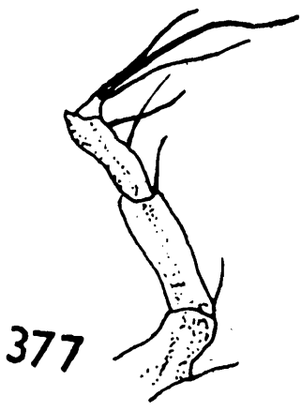
Indian Locality: Only from the rock pools in Nagamalai (West Madurai area) in Tamilnadu.

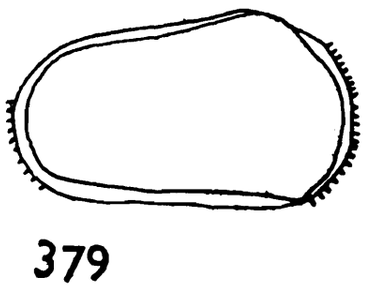
Ilyocypris australiensis Sars, 1889

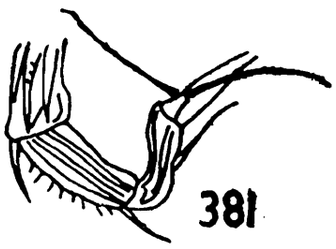
Ilyocypris australiensis Sars, 1889, p. 46, Pl. II, Figs. 5–8; Pl. VI.
Ilyocypris australiensis Sars, 1889: Sars, 1924., p. 143, Pl. IX, Figs. 18–25.

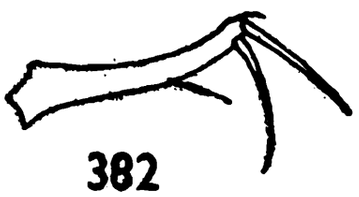












Figs. 375–382. *Ilyocypris australiensis* Sars, 1889 (After Sars, 1889). 375. Left valve. 376. Second thoracic leg. 377. Third thoracic leg. 378. Furca. 379–382. *Ilyocypris bradyi* Sars, 1890 (After Arora, 1931; Bronstein, 1947). 379. Left valve, internal, outline. 380. Second thoracic leg. 381. Third thoracic leg. 382. Furca.

Female: Valve oblongoquadrangular; laterally compressed; greatest height in front of the middle; anterior and posterior margins broadly rounded finely hairy, without protuberances; dorsum straight; venter sinuate (Fig. 375). Length 0.90 mm. Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Third and fourth segments of the second thoracic leg fused (Fig. 376). Terminal segment of the third thoracic leg with three setae (Fig. 377). Symmetrical furca; dorsal seta placed little below the middle of the ramus, nearly 1/2 the length of the subterminal claw (Fig. 378).

Male: Smaller, length of valves 0.84 mm.

Indian Locality: Known only from Aurangabad (Hartmann, 1964).

Ilyocypris bradyi Sars, 1890.

Female: Valves oblongoquadrangular with greatest height above the eye region; ventral margin straight; anterior and posterior margins rounded with protuberances; surface tuberculate (Fig. 379). Third and fourth segments of second thoracic leg distinctly divided (Fig. 380). Third leg, terminal podomere with three setae of unequal length (Fig. 381). Symmetrical furca; curved; length about 10 × least witdh; terminal and subterminal claw of equal length; dorsal seta less than 1/2 the length of subterminal claw; terminal seta very short (Fig. 382).

Male: Known.

Reported from Lahore (Arora, 1931).

DISCUSSION

All species of freshwater ostracods reported in the present study belong to the Superfamily Cypridacea Baird, 1845. These have been classified into five families, which include 19 genera representing 56 valid species. The system of classification followed in the present study is given in Table 2. Though there are several approaches to the classification of Ostracoda (Moore, 1961a; Van Morkhoven, 1962; Pokorny, 1965; Hartmann and Puri, 1974), no two taxonomists follow the same system. However, the authors are responsible for the classification followed in the present investigation.

Since the remarks given in the taxonomic description adequately discusses the status of each species, the following discussion will be restricted to supraspecific levels, with reference to Indian freshwater Ostracoda. A few taxonomic placements, as already indicated, are tentative and may need modification in future.

We have made a few comments on each family and tribe in regard to differing opinion as to classification. Our comments are designed to show why we have adopted our scheme of classification and generic placement.

FAMILY CYPRIDIDAE Baird, 1845:

This family, most richly represented in India (Table 2), is characterised by a furca well developed or reduced, in addition to the generalised Cypridacean characters.

TABLE 2.—Classification of Freshwater Ostracoda–Present Study

Family	*Subfamily*	*Tribe*	*Genera*	*No. of Species*
CYPRIDIDAE Baird, 1845	CYPRIDINAE Baird, 1845	Cypridini	*Cypris* Muller, 1776	4+2 (?)
		Eucypridini	*Eucypris* Vavra, 1891	1
			Strandesia Stuhlmann, 1888	10
		Cyprinotini	*Cyprinotus* Brady, 1886	4+1 (?)
			Heterocypris Claus, 1892	1
			Hemicypris Sars, 1903	4
		Dolerocypridini	*Candonocypris* Sars, 1895	1
	CYPRETTINAE Hartmann, 1964		*Cypretta* Vavra, 1895	4
	STENOCYPRINAE FERGUSON, 1964		*Stenocypris* Sars, 1890	6
			Chrissia Hartmann, 1957	3
			Parastenocypris Hartmann, 1964	1
	CYPRIDOPSINAE Kaufmann, 1900		*Cypridopsis* Brady, 1868	5
			Pseudocypretta Klie, 1932	1
			Oncocypris Muller, 1898	2
CYCLOCYPRIDAE Kaufmann, 1900			*Physocypria* Vavra, 1897	2+2 (?)
NOTODROMADIDAE Kaufmann, 1900			*Centrocypris* Vavra, 1895	2
			Indiacypris Hartmann, 1964	1
EUCANDONIDAE Swain,			*Candonopsis* Vavra, 1891	1
ILYOCYPRIDIDAE Kaufman, 1900			*Ilyocypris* Brady and Normann, 1889	3
			TOTAL ...	56+5 (?)

Subfamily CYPRIDINAE Baird, 1845:

Carapace subtriangular, subelliptical or ovoid; valve extensions like spines and processes may or may not be present. Natatory setae of the second antenna well-developed. Terminal segment of third thoracic leg with a claw and a seta.

Tribe Cypridini:

This tribe comprises the genera namely *Cypris* O.F. Müller; *Chlamydotheca* Saussre, 1858; *Globocypris* Klie, 1939 and *Riocypris* Klie, 1934 (McKenzie, 1971b). All the species of this tribe reported in India belong to the genus *Cypris*. The genus *Cypris* is the oldest valid generic name in the Ostracoda (Howe, 1962). The genera *Eurycypris* G. W. Müller and *Cypris* O. F. Müller are considered as synonyms (Swain, 1961; 1969; Michael and Victor, 1975). Earlier workers assigned most of the ostracod species to the genus *Cypris* (Baird, 1859; Brady, 1886; Moniez, 1892; Müller, 1898). Recent ostracod literature uses the term *Cypris* in a more restricted sense (Triebel, 1961). Now it is known that 'true' *Cypris* consists of relatively few species.

Tribe Eucypridini Bronstein, 1947:

Pokorny (1965) considers Eucypridini a synonym of tribe Cypridini; but, the latter always has a tumid carapace and fused third and fourth segment of the second thoracic leg in contrast to the former. This tribe is composed of the genera *Strandesia* Stuhlmann, 1888 which may be synonymous to *Neocypris* Sars (McKenzie, 1971b), *Eucypris* Vavra, 1891 and *Pseudocypris* Daday, 1908. The genus *Cypricercus* is eliminated from the tribe Eucypridini and is included under Cypricercini, established by McKenzie (1971c).

The Indian Eucypridines are represented by two genera, *Eucypris* and *Strandesia*. The genus *Strandesia* usually has a marked valve overlap, left over right and the slender furcal ramus, long, nearly half the length of the valves which distinguish it from *Eucypris*. Swain (1961) includes the presence of a wing like process on the right valve, dorsum and the presence of nodules on the inner margin of the left valve as generic characters. Though these characters are present in the type species *S. mercatorum*, it need not be a rule for the genus. Several species of this genus lack these characters (Müller, 1898; Klie, 1932; Hartmann, 1964). The shell processes, alae, and large spines may be valuable in species diagnosis and need not be considered as generic characters. Extreme caution is necessary when interpreting the nodules or tuberculiform projections, present in the inner margin of the left valve, which may otherwise cause confusion, especially with members of Tribe Cyprinotini.

Tribe Cyprinotini Bronstein, 1947:

Bronstein (1947) assigned two genera, *Cyprinotus* Brady, 1886 and *Heterocypris* Claus, 1893 in this tribe. Swain (1961) included two more genera *Hemicypris* Sars, 1903 and *Cyprinotoides* Masi, 1928. In contrast to this, Tressler (1959) and Pokorny (1965) consider the genus *Cyprinotus* as the only representative of this tribe and Van Morkhoven (1963), following the same approach, attributes subgeneric status to *Heterocypris*, *Hemicypris*, and *Cyprinotoides*. Lubimova *et al.* (1961) and Hartmann and Puri (1974) elevated this tribe to the subfamily Cyprinotinae. The reasons for the above mentioned divergence of opinion are worth discussing.

The tribe Cyprinotini shares all the basic structural features of the subfamily Cypridinae, especially in the soft parts, and the main differences are only in the structure of the valves. Hence, we prefer to treat this category as a tribe instead of elevating it to subfamily status.

The genus *Cyprinotus* was considered as the only representative of the Cyprinotini based on the asymmetrical valves, one overlapping the other and either one of them having tuberculations (Tressler, 1959; Pokorny, 1965). However, the shape of the valves, the nature of valve overlap, and the tuberculations of the valve margins show considerable differences. In the genus *Cyprinotus*, the valves have an elevated dorsum, the right usually higher than the left, with the left overlapping the right terminally and the right valve possessing tubercles on the free margin. In *Heterocypris* the valves are subovate, moderately elongate, left valve not higher than the right (Van Morkhoven, 1963), left valve tuberculated (Swain, 1961) always overlapping the right. The right valve overlaps the left in *Hemicypris* with the latter tuberculated, at least posteroventrally so (McKenzie, 1971). Some of these characters, though recognised by Van Morkhoven (1963) are considered to be of minor significance, deserving only subgeneric status. The taxonomic characters establishing validity of the Tribe Cyprinotini have a narrow spectrum of differences in valve structure, and any consistent pattern exhibited by a taxon must be given due consideration. So, in our opinion, the tribe Cyprinotini must comprise three genera *Cyprinotus*, *Heterocypris*, and *Hemicypris*. If *Cyprinotoides* Masi, 1928 differs from *Cyprinotus* only in its soft parts (Swain, 1961), a careful re-examination is necessary to confirm the validity of this genus. *Cypridonotus* Claus, 1893 is a typographical error (Howe, 1962; Van Morkhoven, 1963), and *Microcypris* Kaufmann, 1900 is a junior synonym of *Cyprinotus* Brady, 1886.

Tribe Dolerocypridini Kaufmann, 1900:

Candonocypris Sars, 1894 is the only genus of this tribe recorded in India. Swain (1961) placed this genus under the Subfamily Candoninae Daday, 1900. Since, the genus *Candonocypris* has structural features which are characteristic to the subfamily Cypridinae and completely different from the subfamily Candoninae, we agree with McKenzie (1971c) in assigning this genus to the tribe Dolerocypridini in the subfamily Cypridinae.

Subfamily CYPRETTINAE Hartmann, 1964:

Hartmann (1964) erected the tribe Cyprettini under family Cyprididae, and McKenzie (1971c) elevated this tribe to the subfamily Cyprettinae. Sohn and Kornicker (1973) felt that the morphology of the component genera was too poorly known to accept Cyprettinae as a subfamily. However, the subfamily Cyprettinae is justified on the basis of slender, leg-like furcal rami, better developed than that of Cypridopsines, and the well-developed radial septa in the anterior margin of the valves, apart from the usual characters of Cyprididae. Cypretta Vavra, 1895 is the only genus recorded in India for this subfamily.

Subfamily STENOCYPRINAE Ferguson, 1964:

Ferguson (1964) erected the subfamily Stenocyprinae based on morphological characters which included the elliptical or reniform, narrow, elongate shell with evenly arched or occasionally flattened dorsal margin, surface with scattered punctations and radial pore canal when present restricted to the anterior, posterior, and ventral margins. Hairs occur along all margins except the dorsum. Length is usually about twice the height, and, at the anterior end, the duplicature is extensive. Natatory setae of the second antenna barely reach the tips of the terminal claws, and the distal podomere of the third thoracic appendage carries a curved claw and a seta. The furcal rami are large, lamelliform, dissimilar, with dorsal margin of one or both rami either denticulate or pectinate. There is no dorsal seta, and the terminal and subterminal claws are heavily pectinate. Generally dioecious although the males of many species are not known.

Danielopol (1965) considered that four genera *Stenocypris*, *Acocypris*, *Herpetocypris*, and *Isocypris* have close affinities and Hartmann and Puri (1974) synonymised this subfamily with the Herpetocypridinae Kaufmann, 1900. But the asymmetry of the furca, the denticulation on its dorsal margin, and the absence of dorsal seta are exclusive characters which uphold the validity of Ferguson's subfamily. Stenocyprinae composes of three genera *Stenocypris* Sars, 1889, Chrissia Hartmann, 1857, and *Parastenocypris* Hartmann, 1964. All these genera are recorded in India.

Subfamily CYPRIDOPSINAE Kaufmann, 1900:

This subfamily was proposed by Kaufmann (1900) and is synonymous to Cypridopsides of Sars, 1925 (Hartmann and Puri, 1974) and Cypridopsini of Bronstein (1947). The members of this subfamily usually have a small to medium-sized carapace, reniform to subtriangular with moderately or strongly arched dorsum, ends rounded, valves more or less unequal with a pitted, spinose or pustulose surface and furcal ramus reduced to a flagellum. Three genera namely, *Cypridopsis* Brady, 1868, *Pseudocypretta* Klie, 1932, and *Oncocypris* are reported in the present study.

Swain (1961) classified *Pseudocypretta* in the subfamily Cypridinae but, this genus, with its tumid valves, reduced furcal flagellum and the undivided penultimate segment of the second antenna, is definitely a Cypridopsine, and, hence, reassigned to the subfamily Cypridopsinae. The pore canals in the anterior and posterior valve margins of *Pseudocypretta* are not similar to the strongly developed septa of the genus *Cypretta*. Moreover, the soft parts are characteristically Cypridopsine and completely different from those of *Cypretta*.

Müller (1898) established the genus *Oncocypris*, and, since then, ten species were described in this genus (Müller, 1898; Daday, 1910; Gurney, 1916; Lowndes, 1932; 1936; Tressler, 1937; Klie, 1938; 1939; Rome, 1962; Green, 1973). Swain (1961) placed this genus in Cypridinae but, this genus is characterised by a reduced furcal flagellum, a typical Cypridopsine affinity and shares some affinities with the family Notodromadidae, especially in is, ornamented valve characteristics. *Oncocypris* differs from Notodromadidae in the absence of a ventral keel, patterned internal shell structure, and the soft parts (McKenzie, 1971b). This genus can be tentatively placed in the subfamily Cypridopsinae, though most of the structural features are not displayed by any other genus in this subfamily. The genus *Oncocypris* is unique taxonomically and future studies (Victor, unpublished) may modiffy its present status.

Family CYCLOCYPRIDIDAE Kaufmann, 1900:

This famiy is characterised by generally subovate valves, tumid or moderately inflated carapace, natatory setae of the second antenna longer than the terminal claws, by at least the length of the claws, and the length of the reflexed seta exceeding the length of the penultimate podomere. Only one genus, *Physocypria* Vavra, 1897 is known for this family in India.

Physocypria can be readily distinguished from genera *Cyclocypris*, *Cyclocypria*, and *Cypria*, by the presence of spines, pustules, or tubercles on the anterior and posterior margins of one valve (Tressler, 1959; Swain, 1961: Delorme, 1970).

Family NOTODROMADIDAE Kaufmann, 1900:

The common notodromadid genera, *Notodromas* and *Newnhamia*, are not known on the Indian subcontinent. Two genera, *Centrocypris* and *Indiacypris*, are assigned to this family in the present study.

In the treatise, Swain (1961) placed the genus *Centrocypris* in subfamily Cypridinae, but, the valve characters of *Centrocypris* are related to notodromadids and McKenzie (1971b) considered this genus as a non-related homeomorph of the genera *Notodromas* and *Newnhamia*, despite the differences in soft part morphology. However, the medium sized, pustulose valves, and well developed symmetrical furca (thus eliminating the genus *Oncocypris*) indicate its closer affinity to notodromadids and hence this genus is assigned to the family Notodromadidae.

Hartmann (1964) assiged the genus *Indiacypris* to the tribe Notodromadini which is synonymous with the family Notodromadidae. The Indian representative. *I dispar*, was not examined in the present study, though a species from Ceylon, *Indiacypris luxata* (Brady), was scrutinised in detail (Neale and Victor, communicated) to verify the validity of this genus.

Family EUCANDONIDAE Swain, 1961:

The family Eucandonidae was erected, based on the structure of the second antenna as a major criterion in addition to other characters (Swain, 1961). Hartmann and Puri (1974) synonymised this family with the subfamily Candoninae. But the Candoninae always have reduced natatory setae, whereas all the taxa included in Eucandonidae lack completely the natatory setae. Accepting this character as a major difference, *Candonopsis*, the only genus recorded in India is placed in the family Eucandonidae. Hartmann (personal communication) prefers to treat this family Eucandonidae as a synonym of Subfamily Candoninae under the family Candonidae.

Family ILYOCYPRIDIDAE Kaufmann, 1900:

This family is characterised by oblongoquadrangular valves; dorsum mostly straight, parallel to the venter; surface usually rough, pustules, pits and protuberances common; natatory setae of the second antenna present; terminal segment of the third leg without claws but with three setae; furca short, symmetrical and well-developed. Family Ilyocyprididae is very-well-known, and there is a prevailing agreement among ostracod workers regarding the status of this family (Van Morkhoven, 1963; Pokorny, 1965; Delorme, 1970; Hartmann and Puri, 1974). The only genus reported from India is *Ilyocypris* Brady and Norman, 1889.

NOTES ON THE DISTRIBUTION OF FRESHWATER OSTRACODS IN INDIA

The present study, which attempts to provide an initial picture of freshwater ostracod distribution in India, is restricted to Peninsular India (Fig. 1), except for a few records involving other biogeographical regions. The distributional data on freshwater ostracods is meagre, even for Peninsular India, since a vast area remains to be explored. Detailed zoogeographical discussion on the distribution of Indian freshwater ostracods is beyond the scope of this study since the relevant data are not available. However, the available information and certain observations on the distribution of Indian freshwater ostracods are presented so that it may be improved upon and used by future workers with access to more extensive data.

Certain interesting patterns were, however, noted during the present study. For example, the genus *Oncocypris* was recorded only in the extreme southwest coast of the Peninsula. This genus has been previously recorded only from Africa, Madagascar, Ethiopia, Sri Lanka and Philippines. The reasons for the apparently restricted occurrence of *Oncocypris* are not known. A

number of ecological factors may be involved, but "comparatively little is known of the ecological requirements of Southern freshwater ostracods" (McKenzie, 1971b).

A certain faunal overlap of freshwater ostracods in Peninsular India and the Indomalaysian subregion is noted in the present study. Examples are *Candonopsis putealis*, *Pseudocypretta maculata*, *Chrissia humilis*, *Strandesia flavescens*, *Hemicypris pyxidata*, and *Cypridopsis dubia*. These species were originally described from Indonesia, Celebes and Sumatra (Sars, 1903; Klie, 1932).

Some species are very restricted in their distribution. *Stenocypris sewelli*, *Cypridopsis horai*, (Klie, 1927), and *Strandesia tuberculata* (Hartmann, 1964) were described from the Himalayan hill regions and were never recorded in the Peninsula. So also, *Cypretta fontinalis* and *Strandesia bicornuta* were described from the mountainous terrains of the Western Ghats in the Peninsula, but never recorded in the plains.

The question of endemism in Indian freshwater ostracods is worthy of consideration. The occurrence of 'giant' forms with a length of 3 mm or more is considered to be indicative of endemism in freshwater ostracods (McKenzie, 1971b). If this view is accepted, *Chrissia krishnakantai*, *Stenocypris biswasi*, *Stenocypris distincta* and *Candonocypris dentatus* can be considered as 'giant' endemic species for India. McKenzie (1971b), in his probably 'conservative data', recorded only one giant cyprididid for the whole of the Oriental region, but noted 23 'giant endemic' species for the Ethiopian region, 6 for the Australasian region, 8 for the Neotropic region and 5 for the Nearctic region. Neale (personal communication) found a new, giant Stenocyprine from Sri Lanka. Future work on freshwater ostracods of other areas in the oriental region may further alter this situation. However, no endemic genera of freshwater ostracods are definitely known for India, unlike Australia (*Mytilocypris*, McKenzie and Genus B, Löffler), Southern Africa (*Megalocypris*, Sars; *Acocypris*, Vavra; *Pseudocypris*, Daday; *Liocypris*, Sars; *Sclerocypris*, Sars, *Afrocypris*, Sars; *Apatelocypris*, Rome; *Hypselecypris*, Rome) and South America (*Amphicypris*, Sars).

Ostracods are relatively nonmobile, and their mode of dispersal is passive. Birds and insects have been known to act as vectors (Klie, 1939; Löffler, 1963; Sandberg, 1964; Thienemann, 1950). Mud gathered from the feet of aquatic birds in the Madurai area, Southern India, when cultured, yielded a population of *Stenocypris major* (Victor, unpublished). Freshwater Ostracoda can also be dispersed through passive transport with rice seeds (McKenzie, 1971b). There has been considerable evidence for this mode of dispersal in Europe (Moroni, 1962, 1967; Fox, 1965; Ghetti, 1973). The rice field ecosystem must be rich in species of aquatic Crustacea for this mode of dispersal to be effective, and this mechanism seems to be unimportant in India. Though 17 collections from Indian rice fields were examined, only three contained ostracods. Moreover, species diversity of all invertebrates in Indian rice fields seems to be low when compared to some other South East Asian countries (Fernando, in press; Victor unpublished).

Three hundred and fifty species of freshwater ostracods are known for Europe and 319 species for North America (Ferguson, 1958, 1968). McKenzie (1971) recorded 150 species for South Africa. Sri Lanka (Ceylon), an island south of Peninsular India seems to support 45 species (Neale, personal communication), and a total of 56 valid species has been recorded in India in the present study. This is not a final figure, and it seems that many species still remain to be described.

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SUMMARY

The present investigation is a comprehensive taxonomic study of freshwater ostracod fauna in Indian subcontinent. The taxonomy of all known freshwater Ostracoda is brought up-to-date and their status critically evaluated.

A brief introduction is given of the general structure of a typical freshwater Ostracod. The features which are used in diagnosis are described and illustrated.

Based on 314 collections examined by us and from records of the earlier work, a total of 61 species were known. Material of 32 species were actually examined and detailed descriptions are given. 24 species are described and figured from previous studies. The taxonomic validity of 5 species is considered doubtful. The following species namely, *Cypris decaryi* Gauthier, 1933; *Strandesia purpurascens* (Brady) 1886; *Strandesia flavascens* Klie, 1932; *Cypridopsis dubia* Sars, 1903; *Pseudocypretta maculata* Klie, 1932 and *Candonopsis putealis* Klie, 1932 are recorded for the first time in India. All previous records of Indian freshwater Ostracoda are critically examined, and all 61 species known from the subcontinent are described.

A provisional key is given for all freshwater ostracod species which are considered to be valid. The systematic classification followed in the present study is discussed in detail.

A vast area of the Indian subcontinent still remains to be explored, and relevant data on the zoogeographical distribution of freshwater ostracods is still lacking. However, the available information is presented briefly to show the known distribution of all Indian species.

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ADDENDUM

BATTISH, S. K. 1977. Record of genus *Pseudocypris* Daday, 1908 (Crustacea: Ostracoda) with the description of a new species from India. *Zool. J. Linn. Soc.*, **60:** 363–366.

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Further Comments:

Battish (1977) described a new species namely *Pseudocypris patialanensis* and this species closely resembles *Cypris dravidensis* (Victor & Michael, 1975) in the outline of the carapace. However, the lateral alae of *C. dravidensis* is not as characteristic of the genus *Pseudocypris* as mentioned by Sars (1924). Hence, we prefer to place *C. dravidensis* in the genus *Cypris* rather than in the genus *Pseudocypris*. Future workers deciding to transfer *C. dravidensis* to the genus *Pseudocypris* should be aware of the fact that this species is different from *P. patialanensis* and possibly is an intermediate form which does not conform to the generic characters of the genus *Pseudocypris* Daday, 1908. *C. dravidensis* is probably the same species which has been described by Neale (1977) as *C. latissima* from Sri Lanka.

Eucypris bispinosa (Victor & Michael) 1975:

K. G. McKenzie (personal communication) is of the opinion that this species may belong to a new genus.

Candonocypris dentatus Victor & Michael, 1975:

The original description placed this species in the genus *Candonocypris* irrespective of closer affinities with *Sclerocypris* in the male characters. However, K. G. McKenzie (personal communication) feels that this species might belong to the genus *Bharatcypris* currently being described by Dr. Battsh. Even then, this South Indian species might be different from the type species of the genus *Bharatcypris*. The original description of *Bharatcypris* is not available, and we have no means of comparing *C. dentatus*. If and when the description of *Bharatcypris* is available it will be worthwhile comparing it with *Sclerocypris rajasthanensis* and *Sclerocypris indica* described by Deb (1973), from a closely proximal geographical region. Rajasthan, in order to avoid further confusion.

Cypridopsis maduraiensis Victor & Michael, 1975:

K. G. McKenzie (personal communication), on the basis of the prehensile palps of the male, considers that this species should be transferred to the genus *Plesiocypridopsis*.

Centrocypris matthii (Arora) 1931:

K. G. McKenzie (personal communication) noted that *Centrocypris viridis* Neale, 1976 described from Sri Lanka is a junior synonym of *Centrocypris* Matthaii (Arora) 1931.