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THE GENUS *HEMICYPRIS* (CRUSTACEA, OSTRACODA) IN THE WEST INDIES

by

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SUMMARY

A worldwide list of species that have to be assigned to the genus *Hemicypris* is given. *H. exigua* n. sp. and *H. barbadensis* n. sp. are described. A redescription is given of *H. reticulata* (Klie, 1930), a species from Paraguay, which was also encountered in the Antillean islands. Descriptions of chaetotaxy are made according to the system of Broodbakker & Danielopol (1982). The morphology of the limbs of the three species is similar to that of the species of the genus *Heterocypris* encountered in the West Indies.

Like in the genus *Heterocypris*, a considerable amount of variation in mean carapace length is found. The relative length of some setae seems to be fairly constant within, and characteristic of, each species.

Some remarks are made on the ecology and the zoogeography of the three species.

RÉSUMÉ

Une liste complète d'espèces attribuées au genre *Hemicypris* est donnée. On décrit *H. exigua* n. sp. et *H. barbadensis* n. sp. Une redescription est présentée pour *H. reticulata* (Klie, 1930), une espèce de Paraguay, rencontrée aussi aux Antilles. La chétotaxie est décrite suivant le système de Broodbakker & Danielopol (1982). La morphologie des extrémités des trois espèces ressemble à celle des espèces du genre *Heterocypris* rencontrées aux Indes Occidentales.

Comme dans le genre *Heterocypris*, il existe une variation considérable dans la longueur moyenne de la carapace. La longueur relative de quelques setae est relativement constante et caractéristique pour chaque espèce.

Quelques observations sont faites sur l'écologie et la distribution des trois espèces.

*) Report 24 is published in the same issue of this journal.

1. INTRODUCTION

The first study concerning the Ostracoda of the West Indies, sampled by the Amsterdam Expeditions and Dr. P. Wagenaar Hummelinck, dealt with the genus *Heterocypris* (Broodbakker, 1982, 1983).

In the present paper the closely allied genus *Hemicypris* is treated. Of this genus three species are encountered in the West Indies, of which two are new to science. An overall view of the presently known distribution of these species is given in fig. 1. Lists of stations with the number of specimens found, mean carapace length and some other information are enumerated in tables III-V. For further details concerning the different stations, the reader is referred to Wagenaar Hummelinck (1940 a-b, 1953, 1981), abbreviated in the sequel as WH.

The present publication contains a taxonomic description of the three species according to the descriptive system of Broodbakker & Danielopol (1982), a comparison of mean carapace lengths between different stations and islands, and notes on the ecology and zoogeography of the species. Furthermore, a list is provided of all the species that have to be ascribed to the genus *Hemicypris*, as far as these could be retraced by the author (table I).

2. MATERIALS AND METHODS

More information about all the samples under study is given in Broodbakker (1982, 1983). The sample from

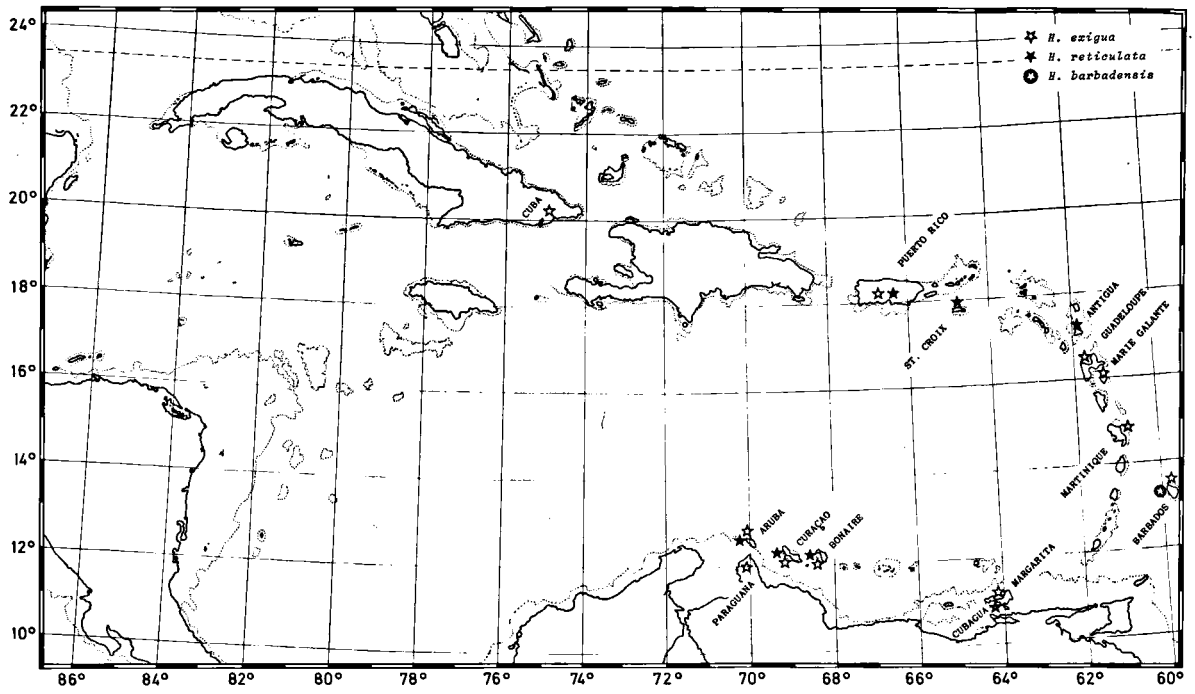

Fig. 1. Map of the Caribbean, showing (dotted) the 200 m line being the edge of the continental shelf. The distribution of *Hemicypris exigua* n. sp., *H. reticulata* (Klie, 1930) and *H. barbadensis* n. sp. is indicated.

Cuba was provided by Dr. L. Botosaneanu. The type-specimens are preserved in the ostracod collection of the Zoölogisch Museum, University of Amsterdam (ZMA).

From each station with more than 10 specimens of *Hemicypris* (and some samples with less than 10 specimens), the mean carapace length of adult females was measured. Measuring was done with a ruler on a sheet of white paper, on which the animals were projected by way of a camera lucida and a Reichert Diapan microscope. Twenty-five specimens of each species were dissected from one locality. Setae which seemed to have different relative lengths in the species were measured as well as some parts of the second antenna, thoracopods and furca, with the camera lucida. The mean relative lengths of these setae for the respective populations of two species were compared with the lengths of these setae in one specimen from each island on which the species were encountered.

3. TAXONOMIC PART

Family CYPRIDIDAE Baird, 1845
Subfamily CYPRIDINAE Baird, 1845

Genus **Hemicypris** Sars, 1903

The genus *Hemicypris* was established on the basis of *Hemicypris pyxidata* (Moniez, 1903), and its morphological and taxonomical characters have been adequately discussed by Purper & Würdig-Maciel (1974), Bate (1970, 1971), Victor & Fernando (1976, 1981) and Battish (1981). In the preceding decades the genus *Hemicypris* was not recognized as a distinct genus, but was considered part of the genus *Heterocypris* Claus, 1893, or of the genus *Cyprinotus* Brady, 1886 (e.g. Klie, 1932; Gauthier, 1933), because the morphology of the soft parts is about the same as in the genera *Heterocypris* and *Cyprinotus*. However, contrary to *Heterocypris*, the left valve of the carapace is denticulated and smaller, instead of the right valve. As opposed to the description of the genus by Sars (1903), the maxillae have respiratory plates, with 5 or 6 setae.

While in South America only females have been found of this genus, males are now known for some species encountered in Africa and Asia (see e.g. Lindroth, 1956; Battish, 1981). No males were found of the three species described in the present paper.

In table I a list is given of the species that have to be ascribed to the genus *Hemicypris*

TABLE I

List of species belonging or ascribed to the genus *Hemicypris*, with reference to the author(s) who first attributed them to this genus, and geographical distribution.

Hemicypris anomala (Klie, 1938)	Asia	Purper & Würdig-Maciel (1974)
Hemicypris aurita (Klie, 1939)	Kenya	Purper & Würdig-Maciel (1974)
Hemicypris barbadensis Broodbakker, 1983	Barbados	
Hemicypris decorata (Von Daday, 1910)	East Africa	Bate (1970)
Hemicypris dentatomarginata (Kiss, 1959)	Congo	Victor & Fernando (1978)
Hemicypris derweshensis Battish, 1981	India	
Hemicypris exigua Broodbakker, 1983	Antillean Islands	
Hemicypris dissona Victor & Fernando, 1976	India	
Hemicypris falcata Victor & Fernando, 1976	India	
Hemicypris fossulata (Vávra, 1898)	East Africa	Bate (1970)
Hemicypris fuelleborni (Von Daday, 1910)	East Africa	Bate (1970)
Hemicypris futunaensis Victor & Fernando, 1978	New Hebrides	
Hemicypris humbertii (Gauthier, 1933)	Madagascar	Bate (1970)
Hemicypris intermedia (Lindroth, 1956)	East Africa	Bate (1971)
Hemicypris inversa (Von Daday, 1913)	South West Africa	Bate (1970)
Hemicypris kaufmanni (Vávra, 1906)	Japan	Bate (1970)
Hemicypris kliei (Lindroth, 1956)	East Africa	Bate (1971)
Hemicypris levis (Hartmann, 1964)	Iran	Purper & Würdig-Maciel (1974)
Hemicypris malerkotlaensis Battish, 1981	India	
Hemicypris megalops Sars, 1903	Asia, Australia	
Hemicypris nonstriata (Lindroth, 1956)	East Africa	Bate (1971)
Hemicypris ovata Sars, 1903	Asia	
Hemicypris pailensis Battish, 1981	India	
Hemicypris pandei Bhatia & Singh, 1977	India	
Hemicypris paucipustulosa Victor & Fernando, 1981	Philippines	
Hemicypris? pellucida Sharpe, 1897	Illinois (U.S.A.)	Purper & Würdig-Maciel (1974)
Hemicypris posterotruncata Bate, 1970	Kenya	
Hemicypris pyxidata (Moniez, 1892)	Asia	Sars (1903)
Hemicypris rara (Klie, 1940)	Brazil	Purper & Würdig-Maciel (1974)
Hemicypris reticulata (Klie, 1930)	Paraguay, Antillean islands	Bate (1970)
Hemicypris salaria (Hartmann, 1962)	Chile	Purper & Würdig-Maciel (1974)
Hemicypris sp. (nec *congenera*) (Von Daday, 1910)	East Africa	This paper

because of the crenulation and the smaller size of the left valve. All species which could be retraced by the author are listed, together with a reference to the author(s) who first assigned the species to the genus *Hemicypris*.

The following remark concerns the last species listed in table I. Von Daday (1910) described a species of *Hemicypris*, which he thought to be *Cyprinotus congener* Vávra, 1898. The species described by Vávra was later placed in the genus *Heterocypris* by Klie (1939). However, according to Von Daday's description the species described by him must be a species of *Hemicypris* and certainly not *Heterocypris congener*. Therefore the name of this species will have to be changed.

Hemicypris exigua n. sp.
Figs. 2, 3, 4, 9B.

Material. — Holotype: ZMA Ost. 150.757, 1♀. Paratypes: ZMA Ost. 150.758, 24♀♀ on slides and about 350 undissected specimens.

Type-locality: WH 390, Curaçao, Pool at Museum in garden, Mundo Nobo, 12°06'05"N 68°56'35"W, 24.IV.1949.

The other stations where this species was found are listed in table III.

Geographical distribution known. — Venezuela (Peninsula de Paraguana, Isla de Margarita and Cubagua), Aruba, Curaçao, Bonaire, Barbados, Martinique, Guadeloupe, Marie Galante, Puerto Rico, Cuba.

Description

Carapace (figs. 2, 3):

In dorsal view greatest width behind the middle at 2/3 of the length. Right valve wider than and overlapping the left valve at all sides. The fine structure of the ventral and dorsal margin of the carapace is shown in figs. 2C-D and 3A-D. In lateral view the greatest height is somewhat behind the middle, being about 60% of the length of the carapace. Both valves regularly arched, dorsal margin passing first more or less straight but later smoothly in the posterior and anterior margins. Ventral margin nearly straight.

The carapace is whitish transparent, but this may be due to the conservation of the animals in formalin. Surface smooth with sparse hairs and scattered puncti (fig. 3E). Hinge adont. Muscle scars as typical of the Cypridinae. The inner surface of the carapace in the population of Cuba is reticulated (fig. 3F).

Left valve: Marginal pore canals indistinct. Presenting tubercles at the posterior, ventral and anterior margins. Inner lamellae of moderate width, anteriorly broader. Selvage slightly pronounced anteriorly and posteriorly. Flange anteriorly and anteroventrally more conspicuous.

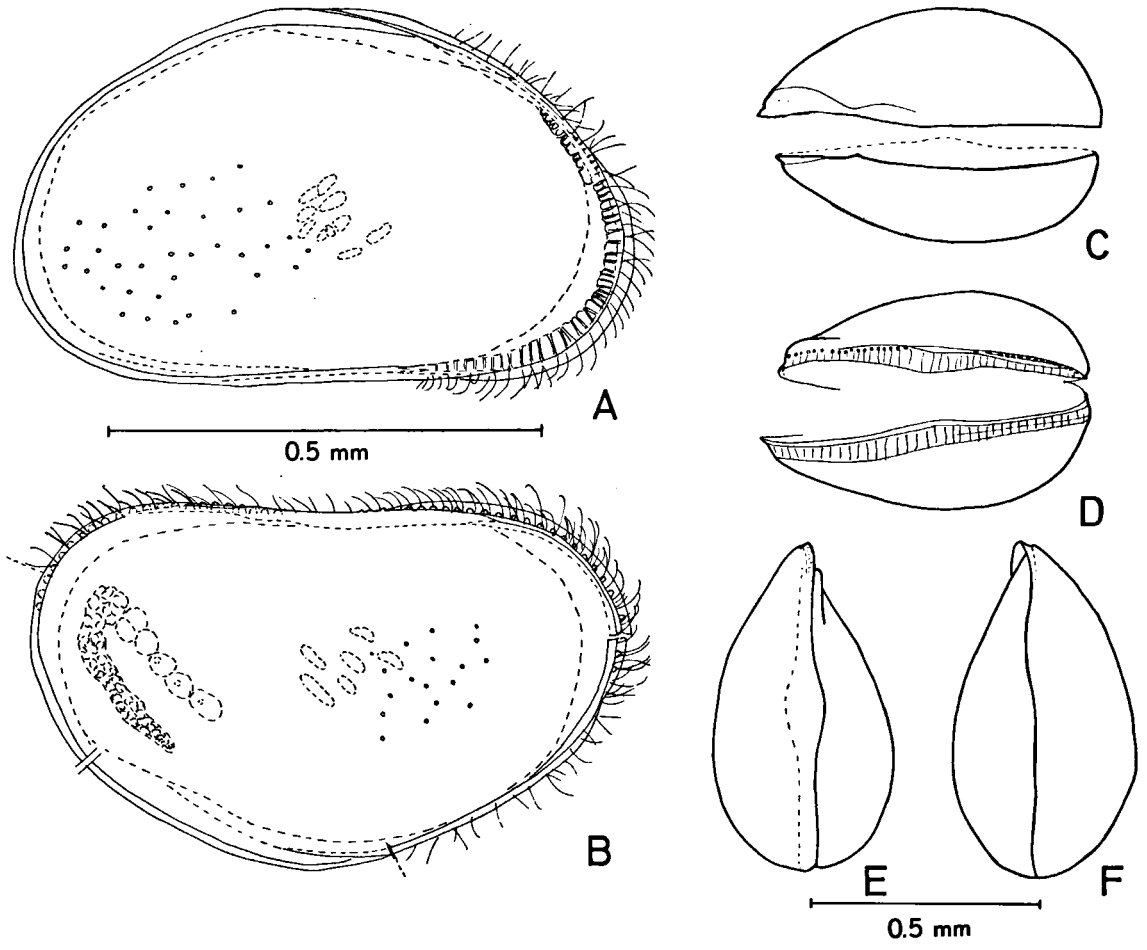

Fig. 2. *Hemicypris exigua* n. sp. (Mundo Nobo, Curaçao, WH 390; A-B, ♀ holotype; C-F, ♀ paratypes): A, lateral view of right valve; B, lateral view of left valve; C-D, valves in dorsal and ventral view, respectively; E-F, whole animal in ventral and dorsal view.

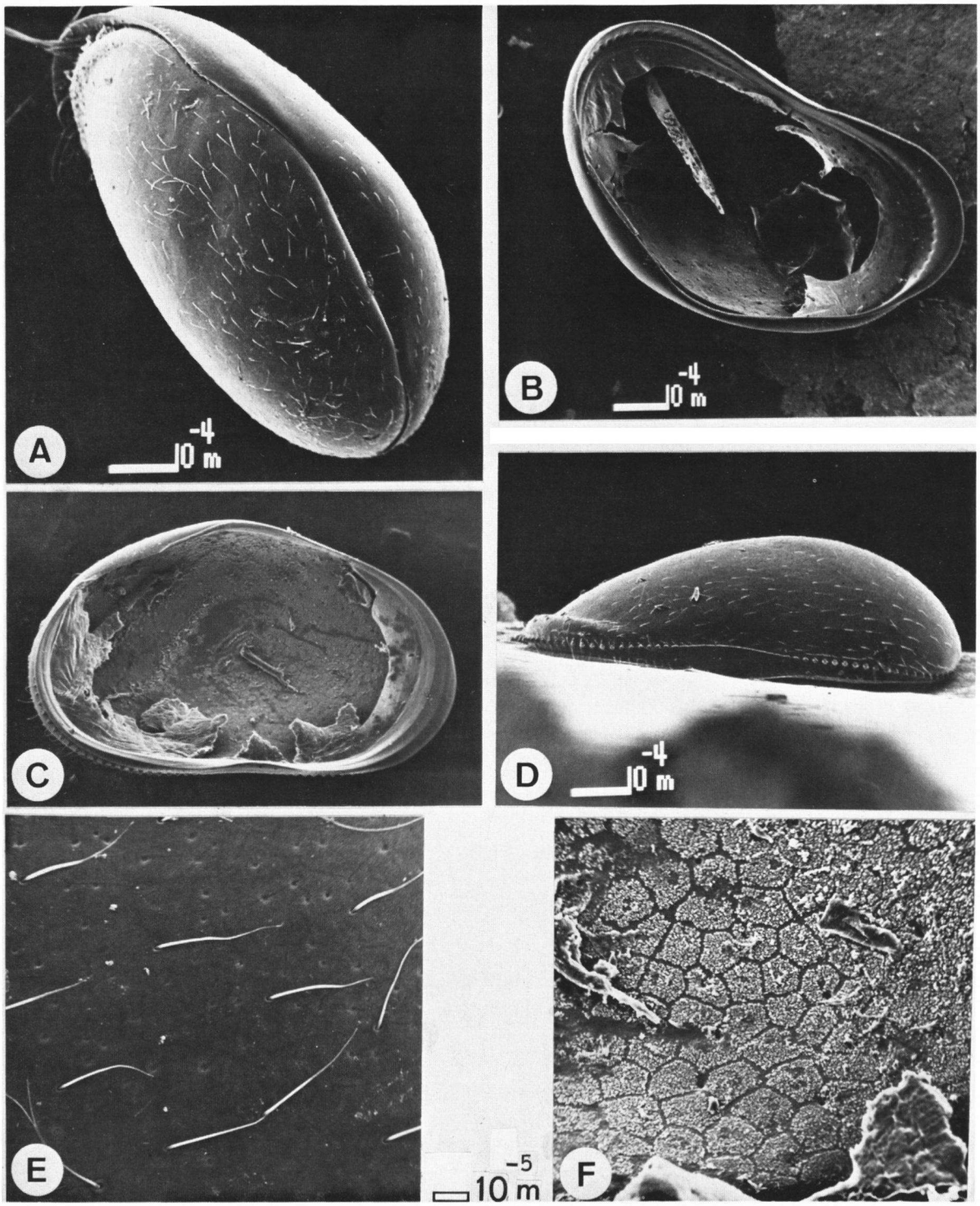

Fig. 3. *Hemicypris exigua* n. sp. (A, C, F, ♀ ♀ from Guantánamo, Cuba; B, D-E, ♀ ♀ paratypes from Mundo Nobo, Curaçao): A, whole animal in dorsal view; B-C, inner structure of right and left valve; D, ventral view of left valve; E, detail of outer surface; F, detail of inner surface.

Right valve: Marginal pore canals distinct at the anterior and anteroventral margins, simple and straight. In the highest anterior part the canals have moved backward. Inner lamellae moderately developed, anteriorly and dorsally broader than posteriorly. Flange anteriorly and anteroventrally very conspicuous. Selvage only slightly pronounced.

In the type-locality the mean length of the left valve is 0.68 ± 0.01 mm and the mean height is 0.40 ± 0.01 mm. The mean length of the right valve is 0.71 ± 0.02 mm and the mean height is 0.43 ± 0.01 mm (table II). In the other localities mean lengths range from 0.64-0.79 mm, while three specimens ranging from 0.79-0.84 mm in length were found in Puerto Rico (table III).

Antennula (A1) (fig. 4A):
E I: A-1*m*(pl), P-2*l*(pl)/E II: A-1*s*(pl), P-r/E III: A-1*m*, P-1*s*/E IV: A-2*l*, P-1*s*-1*m*(pl)/E V: A-2*l*, P-1*m*(pl)-1*l*(pl)/E VI: A-1*s*-2*l*, P-2*l*/E VII: D-y_a-1*m*-2*l*.
The proportional lengths of the segments III to VII are: 2.8 : 1.6 : 1.3 : 1 : 1.1, or: 1 : 0.6 : 0.5 : 0.4 : 0.4. The short seta of segment VI is 75% of the length of y_a, which is only slightly longer than segment III. Rome's organ is small and bottle-shaped. The anterior seta of E III is 1.23 ± 0.06, and the medium posterior seta of E IV is 1.22 ± 0.06 times the length of E III (table II).

Second antenna (A 2) (fig. 4C):
Pr: P-1*l*(pu)/Exo: 1*l*(pl)-2*s*/E I: In-5*l*(pu)-1*m*(pu), P-Y-1*m*(pa)/E (II + III): A-1*s*-1*m*, P-1*s*(t_1:pl)-3*m*($t_{2, 3, 4}$), D-y_2-1*m*(z_1)-2*l*($z_{2, 3}$)-3*m*($G_{1, 2, 3}$: 2ser)/E IV: D-y_3-2*m*($G_{M, m}$:ser)-2*s*.
The outer swimming bristle is 60-70% of the length of E I. The other five swimming bristles are 2.6-2.8 times the length of E I, which is about 1.75 times as long as the length of E III and G_1 together. The structure of A 2 is about the same as in the three *Heterocypris* species from the West Indies (Broodbakker, 1982). There are four t setae and three z setae with the same position as in female *Heterocypris*. The length of these setae is about the same too: seta z_1 is about 75% of the length of E I, z_2 and z_3 are somewhat longer than E I. G_1 and G_3 are about as long as E I; G_2 and G_M are about 80% of the length of E I. G_m is 65% of the length of E I. Relative lengths of some other parts are listed in table II.

Mandibular palp (Mdp) (fig. 4B):
I: In-1*m*-2*m*($S_{1, 2}$:pu)-α/II: In-3*l*(pu)-1*m*(pu)-β, Ex-2*l*-1*m*(pu)/III: In-1*m*-1*s*, Ex-4*m*, A-3*s*-γ/IV: D-3*m*(cs)-3*s*.
The α seta is thin and nearly half as long as the third segment. The β seta is broader, plumose, and 65% of the length of segment III, while the γ seta is still broader, constituting 35% of the length of segment III. Seta γ has setules as long as the seta itself. The segments III and IV both have a small seta at the interior side which has about the same shape as the α seta.

Maxillula (Mxu) (fig. 4E):
Mxup I: Ex-1*l*(pu)-1*m*(pu)-3*m*-1*s*/II: D-3cs-3*s*/Mastic 1: In-2*m*(pl), D-12*s*(cs)/2: D-8*s*/3: In-1*m*(pu), D-1*m*-2*m*(cs:ser)-4*s*.
The chelate setae of Mxup II are about 2.1 times as long as their segment. Mxup II is about as long as wide. The distal half of one of the chelate setae of mastic 3 is serrate at two sides, and the other one is serrate on one side. The two chelate setae are twice as long as Mxup II.

Maxilla (Max) (fig. 4D):
Pr: A-2a, In-b(pl)-d(pu)/Mastic: D-12*s*(pu)/Exo: P-6*m*(pu)/E: D-1*s*(pl)-2*m*(pl).
The morphology of the maxillae is the same as in the female *Heterocypris* species described in Broodbakker (1982). The branchial plate bears six setae like the type-species of the genus, as mentioned by Klie (1932).

Thoracopod 1 (T 1) (fig. 4F):
Pr: A-1*m*(pu)/E I: A-1*m*(pu)/E II: A-1*s*(pu)/E III: A-2*s*/E IV: D-2*s*-1*l*(G:ser).
The proportional lengths of segments I to IV and claw are: 5.6 : 3.3 : 3.0 : 1 : 10.5-11.7, or: 1.7 : 1 : 0.9 : 0.3 : 3.2-3.6. The setae of E I-III are 1.1, 0.8 and 0.6 times the length of E II, respectively (table II).

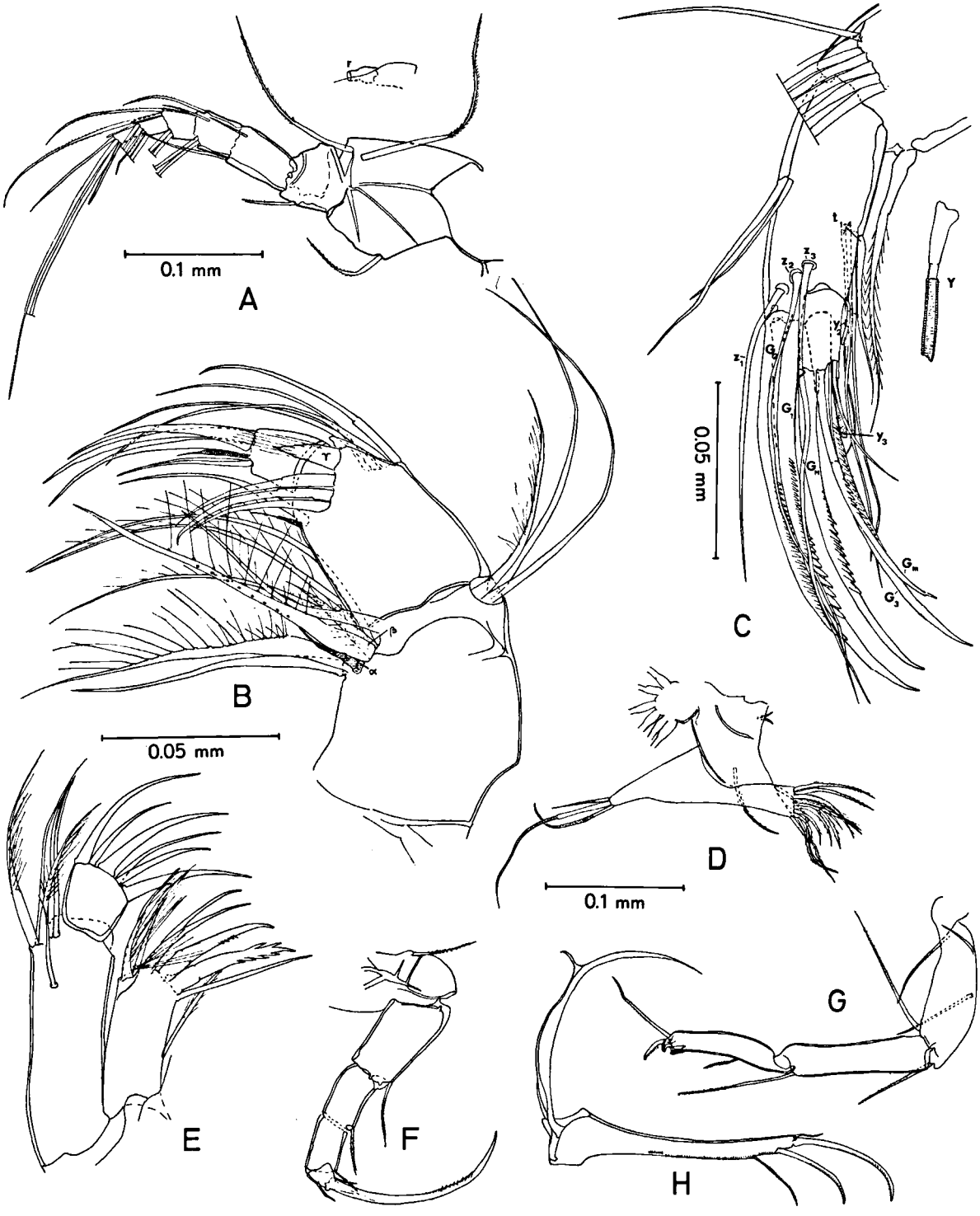

Fig. 4. *Hemicypris exigua* n. sp. (Mundo Nobo, Curaçao, WH 390, ♀ holotype): A, antennula with detail of Rome's organ; B, mandibular palp; C, detail of second antenna; D, maxilla; E, detail of maxillula; F, thoracopod 1; G, thoracopod 2; H, furca with furcal attachment.

Thoracopod 2 (T 2) (fig. 4G):
Pr: Ex-2*m*(pu), In-1*m*(pu)/E I: P-1*m*(pa)/E (II + III): P-1*s*(pa), D-Lo-pz_1/E IV: In-1*m*(pu)-CL-pz_2-1*s*(cs:ser).
The first and second podomere of the protopodite are completely fused, as are the second and third podomere of the endopodite. The distal part of E (II + III) and E IV form the typical "pincer" complex as in most Cypridinae. The short medial seta of E(II + III) is 25% and the exterodistal seta of the protopodite is 68-76% of the length of E I (table II).

The structure of T 1 and T 2 is the same as in *Heterocypris*.

Furca (Fu) (fig. 4H):
The furca is slightly pectinated at the lower two-thirds of the posterior side. The distal claws are pectinated for two-thirds of their length. The posterior seta is pappose. The relative lengths of claws, setae and ramus are as listed in table II. G_a is about half the length of R, which is about 14 times as long as wide. G_p is about three-fourths, and s_a is one fourth of the length of G_a. The posterior seta (s_p) is 75% of the length of G_p.

TABLE II

Length and height of carapaces and relative lengths of segments and setae (s) of appendages of the two new *Hemicypris* species in the type-localities, and of *H. reticulata* from St. Croix.

	H. exigua (WH 390) mean ± SD (*n*)	*H. reticulata* (St. Croix) mean ± SD (*n*)	*H. barbadensis* (WH 867) mean ± SD (*n*)
Carapace:			
Right valve length (mm)	0.71 ± 0.02 (24)	1.10 ± 0.03 (25)	1.15 ± 0.04 (25)
height (mm)	0.43 ± 0.01 (22)	0.62 ± 0.02 (25)	0.74 ± 0.03 (25)
Left valve length (mm)	0.68 ± 0.01 (24)	1.06 ± 0.03 (25)	1.09 ± 0.03 (25)
height (mm)	0.40 ± 0.01 (24)	0.59 ± 0.02 (25)	0.65 ± 0.02 (24)
(rest in %)			
A 1:			
s(E III)/E III	123 ± 6 (24)	230 ± 10 (25)	130 ± 6 (25)
s(E IV)/E III	122 ± 6 (24)	175 ± 8 (25)	105 ± 5 (24)
A 2:			
Y/E I	40 ± 2 (25)	33 ± 1 (25)	29 ± 1 (25)
E(II + III)/E I	60 ± 2 (25)	64 ± 2 (25)	65 ± 2 (25)
G_M/E I	81 ± 3 (25)	78 ± 3 (25)	79 ± 3 (25)
Swimming bristles/E I	270 ± 10 (25)	255 ± 10 (25)	240 ± 10 (25)
Outer swimming bristle/E I	64 ± 3 (24)	64 ± 3 (24)	62 ± 2 (25)
Mxu:			
Mxup II length/width	97 ± 5 (23)	109 ± 6 (21)	100 ± 8 (24)
Mxup cs II/Mxup II	210 ± 10 (24)	219 ± 8 (17)	224 ± 13 (24)
T 1:			
G/E II	338 ± 16 (25)	320 ± 10 (25)	326 ± 14 (25)
s(E I)/E II	109 ± 6 (25)	123 ± 4 (25)	136 ± 5 (25)
s(E II)/E II	80 ± 5 (25)	115 ± 5 (25)	116 ± 5 (25)
s(E III)/E II	59 ± 3 (25)	89 ± 4 (25)	91 ± 4 (24)
T 2:			
s(E II + III)/E I	25 ± 1 (25)	43 ± 2 (23)	43 ± 2 (23)
s(Pr: D)/E I	72 ± 4 (21)	85 ± 2 (25)	83 ± 2 (24)
Fu:			
G_p/G_a	72 ± 5 (25)	65 ± 2 (25)	72 ± 3 (25)
s_a/G_a	27 ± 3 (23)	40 ± 2 (25)	34 ± 2 (25)
s_p/G_p	75 ± 6 (24)	99 ± 2 (25)	99 ± 4 (25)
G_a/R	49 ± 2 (25)	53 ± 2 (21)	49 ± 2 (24) (furca bent strongly)

Copulatory organs (fig. 9B):
The female copulatory organs have no particular characteristics. The posterior side of the body is blunt and almost straight.

Hemicypris reticulata (Klie, 1930)
Figs. 5A-F, 6, 9C.

Heterocypris reticulatus Klie, 1930: 228-230, figs. 10-13.

Material. — St. Croix (U.S., Virgin Islands), Diamond Pool, 17°44'0"N 64°45'14"W, 13.I.1955; sampled by Dr. P. Wagenaar Hummelinck; 25 ♀ ♀ on slides used for measurement of limbs. The other stations where this species was encountered are listed in table IV.

Geographical distribution known: — Gran Chaco (Paraguay), Aruba, Curaçao, Bonaire, Antigua, St. Croix, Puerto Rico.

This species was described by Klie (1930) from Gran Chaco in Paraguay. However, Klie's description is very incomplete and his drawings are not quite clear. Gauthier (1933) made some better drawings of the carapace of the species when comparing it with *H. humbertii* (Gauthier, 1933) from Madagascar (Africa). Comparison with a paratype of *H. reticulata* revealed that there are only minor differences between the specimens from Paraguay and those from the Caribbean. The setae of A 1: E III-IV are shorter in the paratype, but the other setae measured have about the same relative length (table VI). The morphology of the carapace is the same.

Description

Carapace (figs. 5A-F):
In dorsal view greatest width behind the middle at 3/5 of the length. Right valve wider than and overlapping the left valve on all sides. The fine structure of the ventral and dorsal margins of the carapace is shown in figs. 5C-D. In lateral view the greatest height is slightly behind the middle, being about 56% of the length. Both valves are regularly arched, the dorsal margin passing smoothly in the posterior and anterior margins. Ventral margin almost straight. In the right valve the posterodorsal bend is somewhat more angled, but less than in the drawings of Klie (1930).

The carapace is whitish transparent, but this may be due to the method of conservation (in neutralized formalin). The inner surface is reticulated. As indicated by Klie (1930) and Gauthier (1933), there is a fine structure of reticulation within the reticulations. The reticulations were, however, not visible in SEM photographs, possibly because of the bad condition of the carapaces used. Surface sparsely ciliated. Hinge adont. Muscle scars as typical of the Cypridinae.

Right valve: Marginal pore canals distinct at the anterior and anteroventral margins, simple and straight. Inner lamellae moderately developed, anteriorly broader. Selvage not pronounced. Flange anteriorly and anteroventrally very conspicuous.

Left valve: Marginal pore canals distinct at anterodorsal margin while anteriorly the canals have moved backward, being extra short and barely visible. There are tuberculations at the anterior, anteroventral, posteroventral and posterior sides. Inner lamellae moderately developed, wider anteriorly. Selvage pronounced anteriorly. Flange anteriorly and anteroventrally conspicuous. In the different localities mean lengths range from 0.96-1.07 mm (table IV). Klie's specimens measured 0.96 mm.

Antennula (A 1) (fig. 6C):
E I: A-1*m*(pl), P-2*l*(pl)/E II: A-1*s*, P-r/E III: A-1*l*(pl), P-1*s*(pl)/E IV: A-2*l*, P-1*s*-1*m*(pl)/E V: A-2*l*, P-1*m*(pl)-1*l*(pl)/E VI: A-1*m*-2*l*, P-2*l*/E VII: D-y_a-1*m*-2*l*.
The proportional lengths of the segments III to VII are: 2.5 : 1.4 : 1.2 : 1 : 1, or: 1 : 0.6 : 0.5 : 0.4 : 0.4. The anterior seta of E III is 2.3 ± 0.1 and the medium posterior seta of E IV is 1.75 ± 0.08 times the length of E III (table II). The short seta of segment VI is about as long as E III, and about 1.6 times the length of y_a. Rome's organ is small and bottle-shaped.

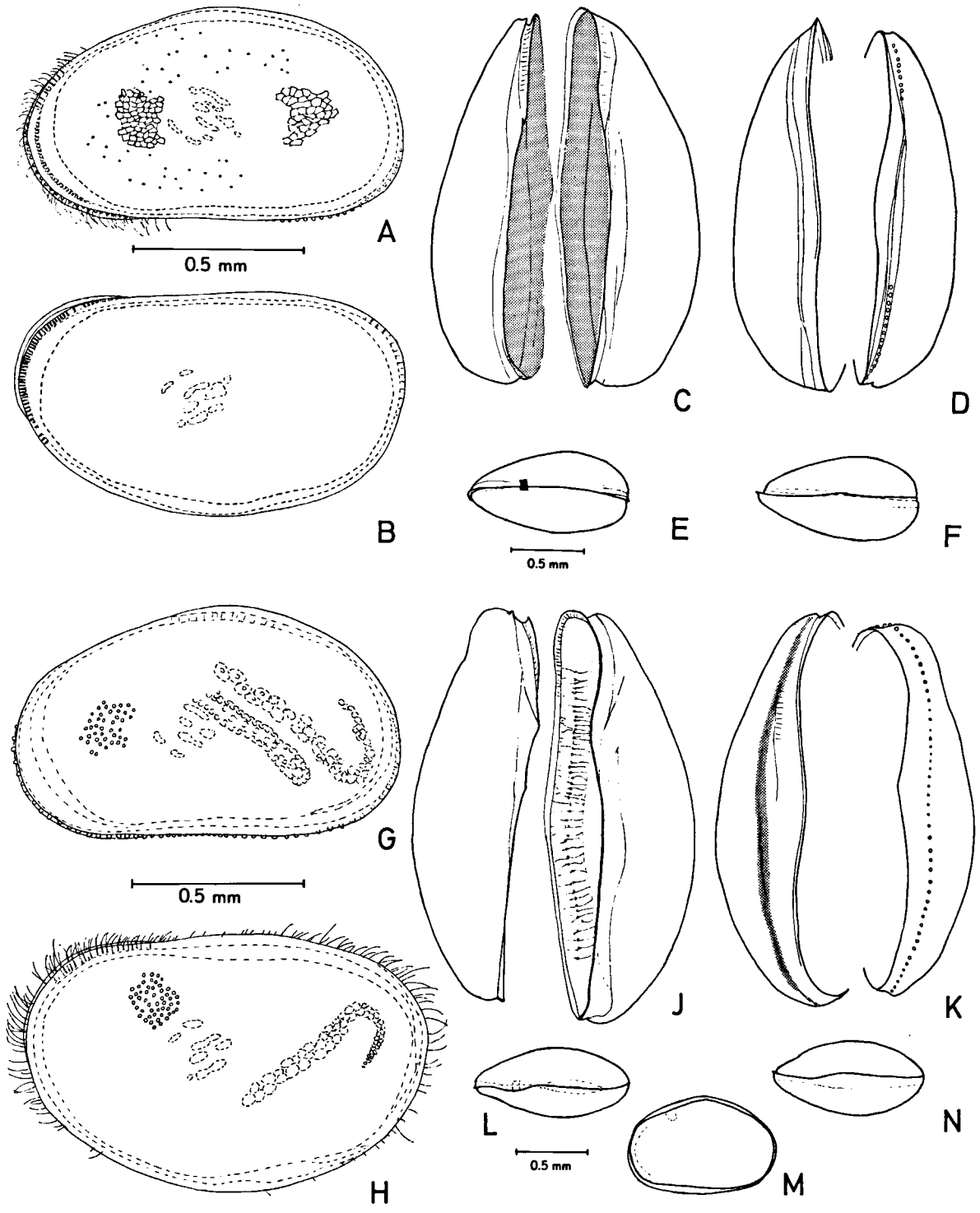

Fig. 5. A-F, *Hemicypris reticulata* (Klie, 1930) (♀ ♀ from Diamond Pool, St. Croix); G-N, *Hemicypris barbadensis* n. sp. (Cole's Pasture Pond, Barbados, WH 867; G-H, ♀ holotype; J-N, ♀ paratypes): A-B, G-H, left and right valves in lateral view; C-D, J-K, valves in dorsal and ventral view; E-F, L-N, complete animal in dorsal and ventral view; M, complete animal in lateral view.

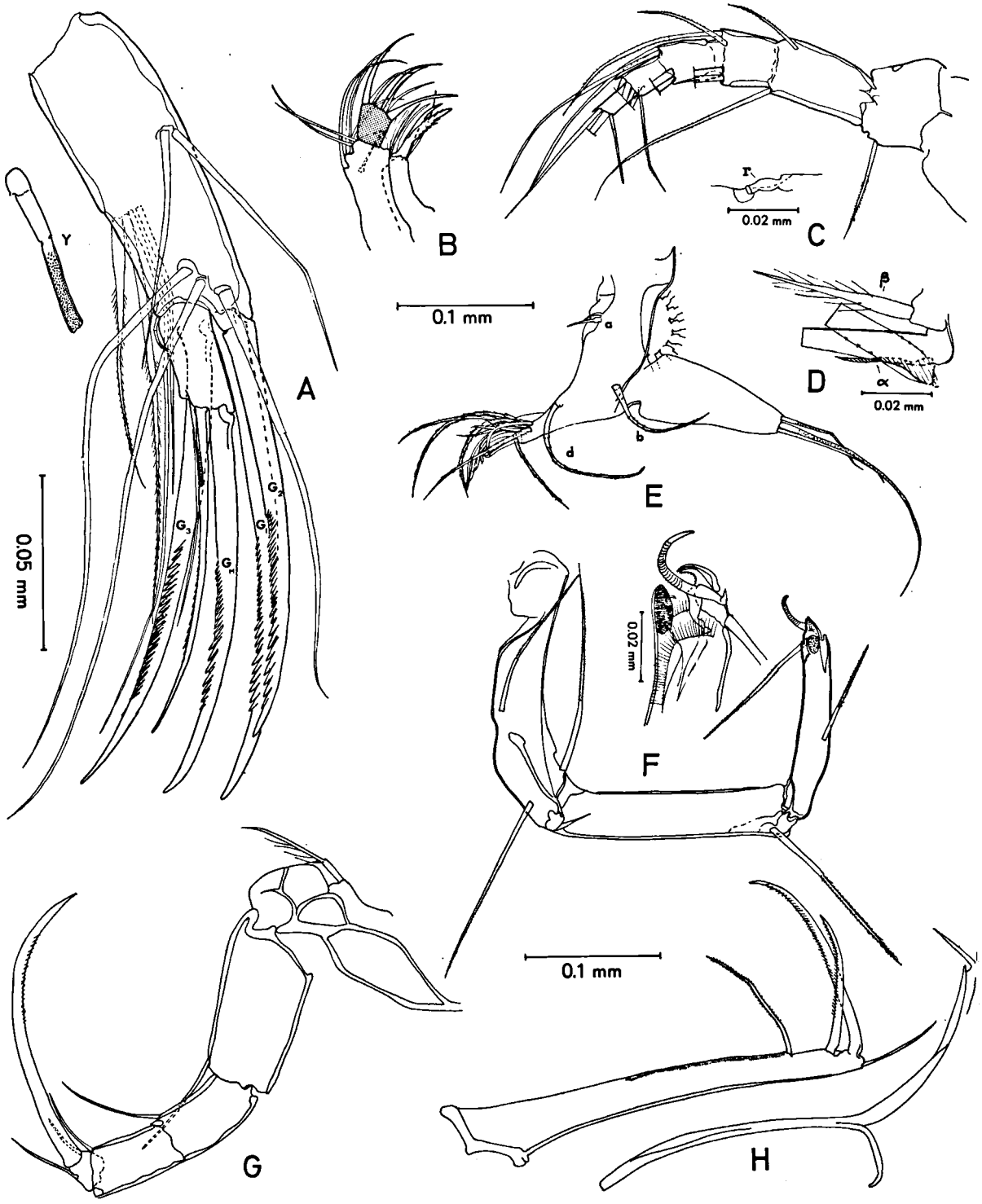

Fig. 6. *Hemicypris reticulata* (Klie, 1930) (♀ ♀ from Diamond Pool, St. Croix): A, detail of second antenna; B, detail of maxillula; C, antennula with detail of Rome's organ; D, detail with setae of mandibular palp; E, maxilla; F, second thoracopod with detail of pincer organ; G, first thoracopod; H, furca with furcal attachment.

Second antenna (A 2) (fig. 6A):
Pr: P-1*l*(pu)/Exo: 1*l*(pl)-2*s*/E I: In-5*l*(pu)-1*m*(pu), P-Y-1*m*(pa)/E(II + III): A-1*s*-1*m*, P-1*s*(t_1:pu)-1*m*(t_2:pu)-2*m*($t_{3,\ 4}$), D-y_2-1*m*(z_1)-2*l*($z_{2,\ 3}$)-3*m*($G_{1,\ 2,\ 3}$:2ser)/E IV: D-y_3-2*m*($G_{M,\ m}$:ser)-2*s*.
The outer swimming bristle is 61-67% of the length of E I. The other five swimming bristles are 2.4-2.7 times as long as E I, which is about 1.7 times the length of E (II + III) and G_1 together. The structure of A 2 is the same as in *H. exigua*, as are the relative lengths of the t and z setae, and G_M. Relative lengths of some parts are listed in table II.

Mandibular palp (Mdp), maxillula (Mxu), and maxilla (Max) (figs. 6D, B, E):
The structure and chaetotaxy of the mandibular palp, maxillula and maxilla, are the same as in *H. exigua*. Mxup II is as long as wide and the three chelate setae of the palp are 2.1-2.3 times the length of Mxup II.

Thoracopod 1 (T 1) (fig. 6G):
Pr: A-1*m*(pu)/E I: A-1*m*(pu)/E II: A-1*m*(pu)/E III: A-2*s*/E IV: D-2*s*-1*l*(G:ser).
The proportional lengths of the endopodal segments and claw are: 6.2 : 3.6 : 3.2 : 1 : 10.3-11.0; or with E II as reference: 1.7 : 1.0 : 0.9 : 0.3 : 3.1-3.3, which is about the same as in *H. exigua*. The setae of E I and E II, and the longer seta of E III, are 1.2, 1.2 and 0.9 times the length of E II, respectively, which is longer than in *H. exigua* (table II).

Thoracopod 2 (T 2) (fig. 6F):
The structure and chaetotaxy of this limb is the same as in *H. exigua*. The posterior seta of E (II + III) is 41-45% and the exterodistal seta of Pr is 83-87% of the length of E I. Both setae are longer than in *H. exigua* (table II).

Furca (Fu) (fig. 6H):
The furca and the distal claws are slightly pectinated at the lower two-thirds of the posterior side. The posterior seta (s_p) is pappose and as long as G_p. G_a is about half the length of R, which is 13-15 times as long as wide. G_p is 65% and s_a is 40% of the length of G_a. Both s_a and s_p are relatively longer than in *H. exigua* (table II).

Female copulatory organs (fig. 9C):
The female copulatory organs have no special characteristics. The posterior part of the body is blunt like in *H. exigua*, but it has two protuberances in the middle.

Hemicypris barbadensis n. sp.
Figs. 5G-N, 7, 8, 9A.

Material. — Holotype: ZMA Ost. 150.762A, 1 ♀. Paratypes: ZMA Ost. 150.762B, 24 ♀♀ on slides and about 300 undissected specimens.

Type-locality: WH 867, Barbados, Cole's Pasture Pond at Mill, St. Philip, 13°09′00″N 59°25′33″W, 6.VII.1967.

The other stations where this species was found are listed in table V.

Geographical distribution known. — Barbados.

Description

Carapace (figs. 5G-N, 7):
In dorsal view greatest width at about the middle. The width is half the length. Right valve wider than and overlapping the left valve at all sides. In lateral view greatest height at the middle. The height is 64% of the length in the right valve and 60% in the left valve. Both valves regularly arched, dorsal margin passing smoothly into the posterior and anterior margins. Ventral margin nearly straight in left valve and convex in right valve.

The carapace is whitish transparent, but this may be due to the conservation of the animals in formalin. Surface strongly pitted, in contrast with the other two species, with sparse hairs and scattered pore canals (fig. 7C). Hinge adont, muscle scars as typical of the Cypridinae.

Left valve: Marginal pore canals indistinct. Presenting strong tubercles at the anterior, ventral and posterior margins. Inner lamellae moderate, anteriorly broader. Selvage pronounced anteriorly. Flange anteroventrally more conspicuous.

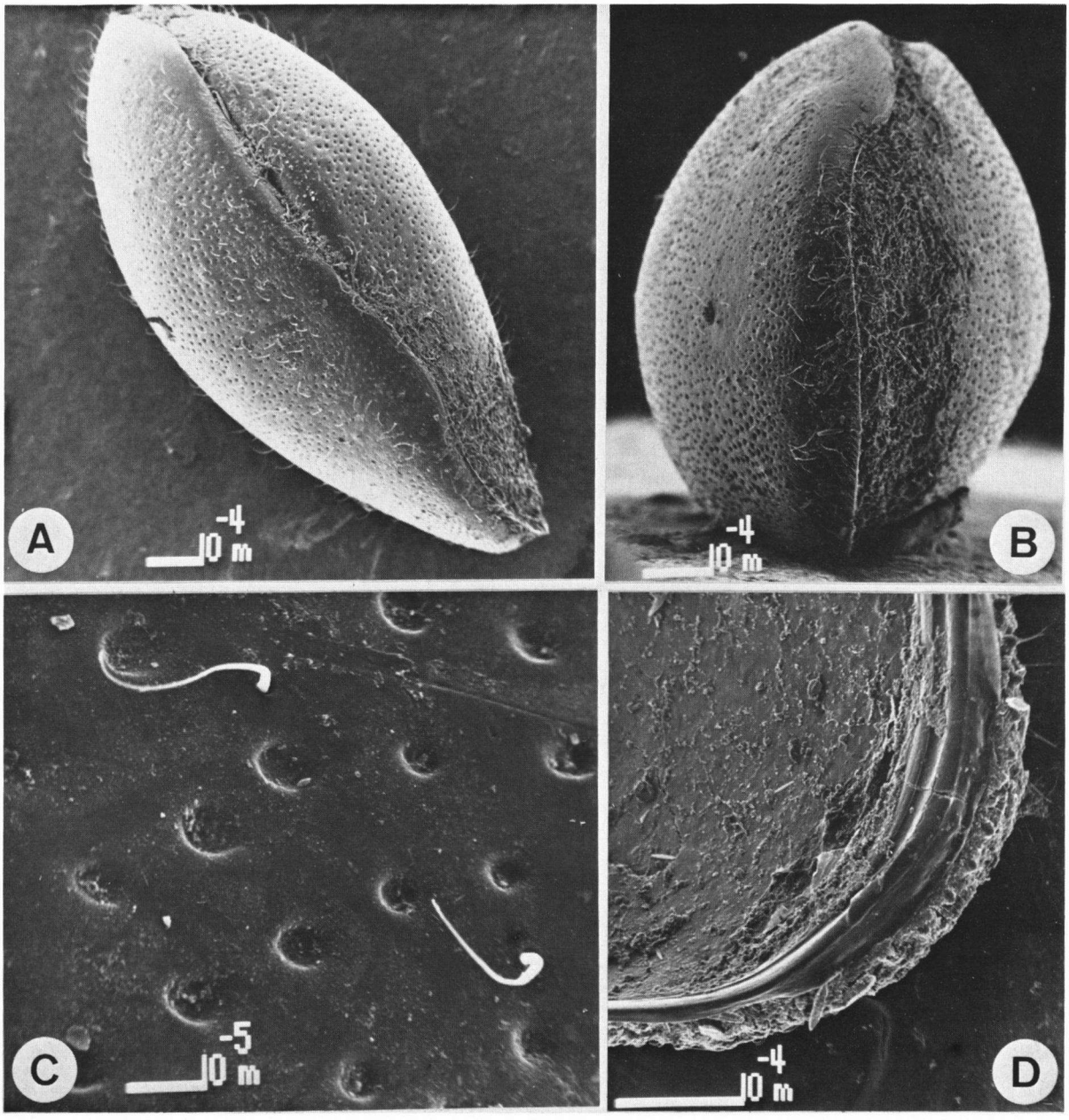

Fig. 7. *Hemicypris barbadensis* n. sp. (Cole's Pasture Pond, Barbados, WH 867; ♀ paratypes): A, carapace in dorsal view; B, carapace in anterior view; C, detail of outer surface; D, detail of inner lamella in left valve.

Right valve: Marginal pore canals only distinct at the anteroventral margin, straight and simple. Inner lamellae moderate, ventrally and dorsally broader. Selvage not pronounced. Flange anteroventrally more conspicuous.

In the type-locality the mean length of the left valve is 1.09 ± 0.03 mm and the mean height is 0.65 ± 0.02 mm. The mean length of the right valve is 1.15 ± 0.04 mm and the mean height is 0.74 ± 0.03 mm (table II). In the other localities mean lengths range from 1.11-1.20 mm (table V).

Antennula (A 1) (fig. 8A):
E I: A-1*m*(pu), P-2*l*(pu)/E II: A-1*s*(pl), P-r/E III: A-1*m*(pl), P-1*s*(pl)/E IV: A-2*l*, P-1*s*(pl)-1*m*(pl)/E V: A-2*l*, P-1*l*(pl)-1*l*/E VI: A-1*s*-2*l*, P-2*l*/E VII: D-y_a-1*m*-2*l*.
All long setae are provided with sparse long setules.

The proportional lengths of the segments III to VII are: 2.8 : 1.7 : 1.2 : 1.1 : 1, or: 1 : 0.6 : 0.5 : 0.4 : 0.4, which is the same as in both other species. The short seta of E VI is only slightly longer than y_a, which is 77% of the length of E III. The anterior seta of E III is 1.3 times the length of E III, which is about as long as in *H. exigua*, and the medium posterior seta of E IV is about the length of E III, which is shorter than in both other species (table II). Rome's organ is small and bottle-shaped.

Second antenna (A 2):
Pr: P-1*l*(pu)/Exo: 1*m*(pa)-2*s*(pl)/E I: In-5*l*(pu)-1*m*(pu), P-1*m*(pa)-Y/E(II + III): A-1*m*-1*s*, P-1*s*(t_1:pu)-3*m*($t_{2, 3, 4}$), D-y_2-1*l*(z_3)-2*m*(z_{1, z_2})-3*m*($G_{1, 2, 3}$:2ser)/E IV: D-y_3-2*m*($G_{M, m}$: 2ser)-1*s*-1*m*.
The outer swimming bristle is 60-64% of the length of E I, the same relative length as in the other two species. The other five swimming

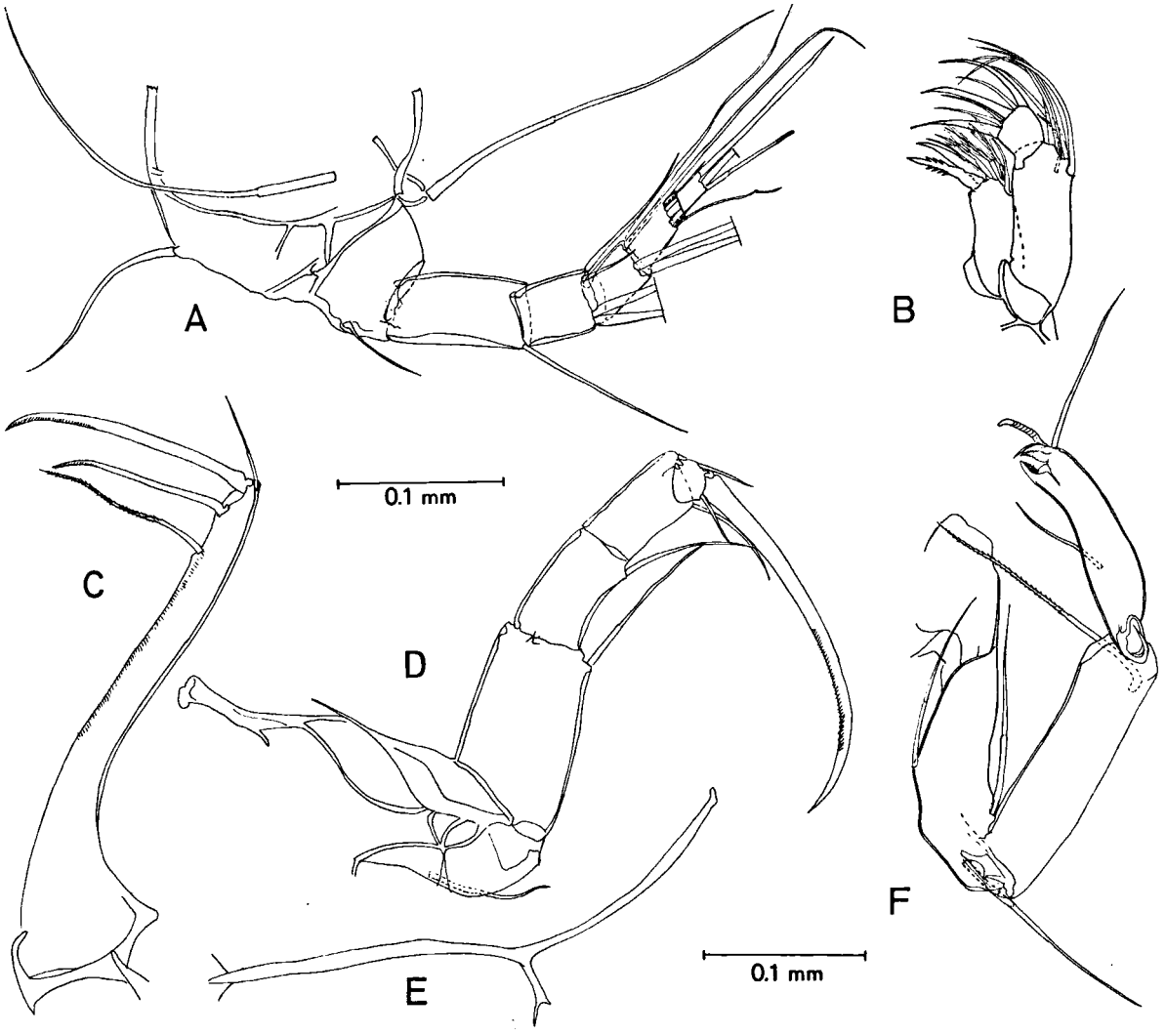

Fig. 8. *Hemicypris barbadensis* n. sp. (Cole's Pasture Pond, Barbados, WH 867; ♀ holotype): A, antennula; B, detail of maxillula; C, furca; D, first thoracopod; E, furcal attachment; F, second thoracopod.

bristles are 2.3-2.5 times as long as E I, which is about 1.5 times the length of E (II + III) and G_1 together. The structure of A 2 is the same as in the other two species, only Y is relatively shorter in *H. barbadensis*. Relative lengths of some parts are listed in table II.

Mandibular (Mdp), maxillula (Mxu) (fig. 8 B) and maxilla (Max):
The structure of these parts is the same as in the other two species. Mxup II is as long as wide and the three chelate setae of the palp are 2.1-2.4 times the length of Mxup II.

Thoracopod 1 (T 1) (fig. 8D):
The chaetotaxy of this leg is the same as in *H. reticulata*. The proportional lengths of the endopodites and claw are: 5.6 : 3.3 : 3.0 : 1 : 10.8-12.1, or with E II as reference: 1.6 : 1 : 0.9 : 0.3 : 3.1-3.4, which is about the same as in the other two species. The setae of E I and E II and the longer seta of E III are 1.3-1.4, 1.1-1.2 and 0.9 times the length of E II, respectively. The seta of E I is longer than in both other species and the other two setae have the same relative length as in *H. reticulata* (table II).

Thoracopod 2 (T 2) (fig. 8F):
The structure and chaetotaxy of this leg are the same as in both other species. The posterior seta of E (II + III) is 41-45% and the exterodistal seta of Pr is 81- 85% of the length of E I. Both setae have about the same relative length as in *H. reticulata* (table II).

Furca (Fu) (fig. 8C, E):
The terminal claws are pectinated for 1/3 of their length, and the ramus for half of its length. The posterior seta (s_p) is pappose and as long as G_p. G_a is half the length of R, which is 12-14 times as long as wide. G_p is 69-75% and s_a is 32-36% of the length of G_a. The seta s_a is relatively longer than in *H. exigua*, and shorter than in *H. reticulata* (table II). The relative length of s_p is the same as in *H. reticulata* and the relative lengths of G_a and G_p the same as in *H. exigua*. The basis of R is strongly bent, in contrast with the other two species.

Female copulatory organs (fig. 9A):
The organs protrude slightly posteriorly, and they are rounded, in contrast with the other two species.

Taxonomical affinities

This species very closely resembles *H. aurita* (Klie, 1939), from Kenya. The shape of the furca and female copulatory organs are about the

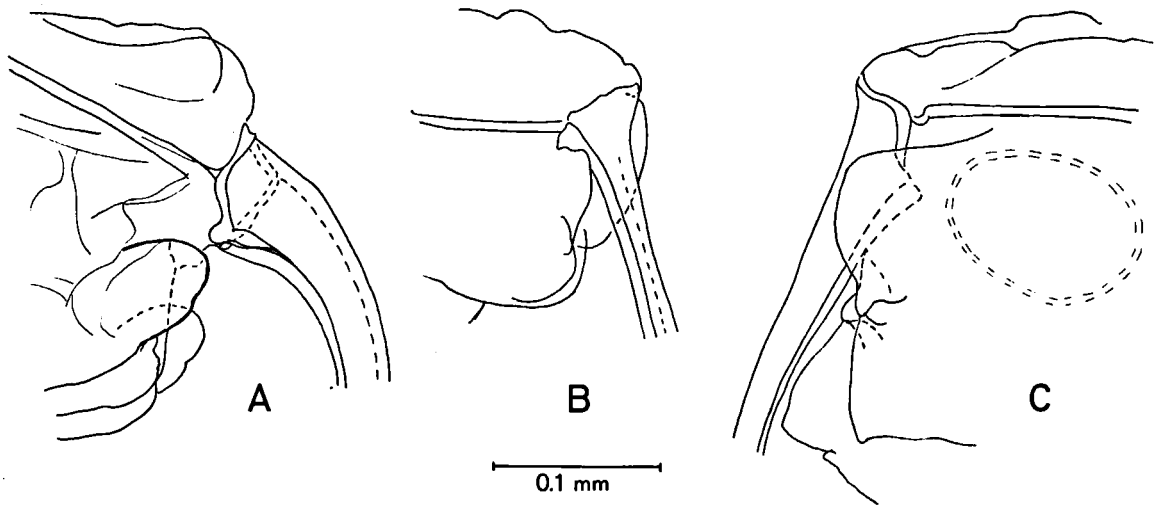

Fig. 9. Anterior part of the body in lateral view of West Indian *Hemicypris* (♀): A, *H. barbadensis* n. sp.; B, *H. exigua* n. sp.; C, *H. reticulata* (Klie, 1930).

TABLE III

Mean length of the carapace and some other data of the different samples containing *H. exigua*; *n* = number of specimens measured.

Station number	Date	Island or region	Type of habitat	No. of specimens	Carapace length (mm) mean ± SD (*n*)	Accompanying species of Ostracoda
WH 107	16.2.1937	Paraguana	large permanent pool, with clayish mud on limestone soil no vegetation (190 mg Cl^-/l)	6	—	*Cypris subglobosa* Sowerby, 1840 *Physocypria affinis* Klie, 1933
WH 98	9.12.1936	Aruba	large temporary muddy pool, algae (80 mg Cl^-/l)	6	0.65 - 0.73 (5)	*Stenocypris major* (Baird, 1859)
WH 100A	8.8.1962	Aruba	small, short-living, muddy pool, algae and *Chara*	22	0.76 ± 0.04 (22)	*Heterocypris antillensis* Broodbakker, 1982 *Potamocypris hummelincki* Klie, 1933
WH 401	30.12.1948	Aruba	large permanent pond, on diorite with sand and mud, no vegetation (18 mg Cl^-/l)	45	0.65 ± 0.03 (38)	*Heterocypris antillensis* *Stenocypris major* *Chlamydotheca hummelincki* Triebel, 1961
WH 635	4.5.1955	Aruba	small pond, much vegetation (220 mg Cl^-/l)	300	0.68 ± 0.02 (53)	*Hemicypris reticulata*
WH 390	25.4.1949	Curaçao	small temporary basin with some mud, much vegetation (725 mg Cl^-/l)	250	0.72 ± 0.02 (24)	*Stenocypris major* *Hemicypris reticulata* *Cypris subglobosa*
WH 391	4.1.1950	Curaçao	small temporary basin, algae and some detritus (600-1000 mg Cl^-/l)	± 200	0.67 ± 0.03 (41)	*Stenocypris major* *Cypridopsis* sp. *Darwinula stevensoni* (Brady & Robertson, 1870)
WH 396a	1.12.1948	Curaçao	large temporary pool, thick mud,	11	0.69 ± 0.03 (11)	*Heterocypris antillensis*
WH 396b	29.1.1949		blue algae and *Chara* (170 mg	8	0.63 ± 0.05 (8)	*Stenocypris major*
WH 396d	11.2.1949		Cl^-/l)	40	0.67 ± 0.02 (37)	*Cypridopsis* sp.
WH 397	24.8.1948	Curaçao	large semipermanent muddy pool,	6	—	*Cypris decaryi* Gauthier, 1933
WH 397a	1.12.1948		algae and vegetation (125-320 mg	13	0.68 ± 0.05 (10)	*Cypris subglobosa*
WH 397e	2.3.1955		Cl^-/l)	7	0.64 ± 0.03 (7)	*Stenocypris major* *Heterocypris antillensis*
WH 891	15.10.1967	Curaçao	shallow sheet of rainwater on	(carapaces)	0.70 ± 0.03 (27)	*Potamocypris hummelincki*
WH 891a	7.9.1968		limestone soil, mud with algae (800 mg Cl^-/l)	20	0.70 ± 0.03 (20)	*Heterocypris antillensis* *Cypretta* sp.
WH 943	27.3.1970	Curaçao	large, very muddy, temporary pond, no vegetation (60 mg Cl^-/l)	7	—	*Heterocypris antillensis* *Stenocypris major*
WH 50	25.3.1937	Bonaire	large, permanent, muddy pool, with rock detritus and vegetation (60 mg Cl^-/l)	27	0.67 ± 0.02 (24)	*Stenocypris major* *Cypris subglobosa* *Cypris decaryi*

Station number	Date	Island or region	Type of habitat	No. of specimens	Carapace length (mm) mean ± SD (*n*)	Accompanying species of Ostracoda
WH 51	3.3.1937	Bonaire	temporary pool with rock detritus and clayish mud, no vegetation (230 mg Cl^-/l)	130	0.65 ± 0.02 (50)	*Stenocypris major* *Potamocypris hummelincki* *Cypris decaryi* *Cypris subglobosa*
WH 935	12.3.1970	Bonaire	large muddy basin, no vegetation (200 mg Cl^-/l)	5 (+ 14 carap.)	0.65 ± 0.03 (16)	*Stenocypris major* *Cypris decaryi* *Hemicypris reticulata*
WH 9	21.5.1936	Cubagua	small permanent pool on limestone soil with chalky mud and rock, no vegetation (1550 mg Cl^-/l)	3	0.65-0.68-0.73	—
WH 12	20.5.1936	Margarita	semipermanent pool with sandy mud, no vegetation (120 mg Cl^-/l)	74	0.67 ± 0.02 (45)	*Physocypria affinis*
WH 867	6.7.1967	Barbados	large, very muddy, semipermanent pond, clayish soil on limestone, phanerogams and algae (140 mg Cl^-/l)	85	0.66 ± 0.03 (50)	*Potamocypris* sp. *Hemicypris barbadensis* *Cypris subglobosa* *Heterocypris margaritae* Margalef, 1961 *Stenocypris major* *Cypridopsis* sp.
WH 868	6.7.1967	Barbados	large temporary sheet of rainwater on clayish soil, *Alisma* and *Chara* (150 mg Cl^-/l)	40	0.67 ± 0.02 (31)	*Hemicypris barbadensis* *Cypris subglobosa*
WH 767	9.2.1964	Martinique	long, very muddy, permanent ditch with algae (1000 mg Cl^-/l)	± 350	0.66 ± 0.03 (51)	*Stenocypris major* *Cypretta* sp.
WH 749 (WH 750) (WH 756)	2.2.1964 (1.2.1964) (1.2.1964)	Marie Galante	large, muddy, semipermanent pool, much vegetation (100-300 mg Cl^-/l)	8 (3) (2)	0.79 ± 0.02 (8)	*Cypris subglobosa* *Chlamydotheca unispinosa* (Baird, 1862) *Stenocypris major* *Physocypria affinis*
WH 729	29.1.1964	Guadeloupe	large, muddy, permanent pond, cultivated soil (20 mg Cl^-/l)	40	0.73 ± 0.04 (31)	*Cypris subglobosa* *Stenocypris major*
WH 708	15.9.1963	Puerto Rico	long, constructed, floodgate in clayish soil, no vegetation (650 mg Cl^-/l)	3	0.79-0.81-0.84	*Cypris subglobosa* *Cypridopsis* sp.
Coll. Botosaneanu	11.12.1970	Cuba	sheet of rainwater near Guantánamo	38	0.74 ± 0.04 (30)	*Cypretta* sp. *Cyclocypris* sp. *Cypris* sp.

same, as are size and shape of the carapace. The valves are pitted in both species. According to the drawing of Klie (1939) the left valve of *H. aurita* is indented at the anterodorsal side. Furthermore, both chelate setae of mastic 3 in the maxillula are strongly serrate, while in *H. barbadensis* one is serrate at one side, and the other is very weakly serrate. Still this species seems to be more closely related to *H. barbadensis* than any other presently known *Hemicypris* species.

Concluding remarks

The soft part morphology of *H. barbadensis* is for the greater part the same as in the other two species, only the shape of the furca and the female copulatory organs are clearly different. The length of part of the setae is intermediate between *H. exigua* and *H. reticulata*, while the carapace is different from both species, but resembles that of *H. reticulata* most.

The soft part morphology of the *Hemicypris* species described in this paper is very much like that of the species of *Heterocypris* described from the Caribbean region (Broodbakker, 1982). The only real difference between these two genera is the structure of the carapace.

Reliable differences between species of *Hemicypris* are found in the structure of the carapace, while the relative length of some setae of A 1, T 1-2 and Fu can also be useful.

4. ECOLOGY OF THE SPECIES

Because of the many islands involved and the few samples from each island, it is impossible to correlate the environmental factors with the presence of the species by statistical comparison with all samples from the respective islands, as was done for the *Heterocypris* species in Broodbakker (1983). Therefore most samples are listed in tables III-V, together with most of the environmental factors measured and the mean length of the carapace of the species in each locality.

H. exigua (table III):
This is the most successful species of the three. It occurs in many islands and samples, almost always accompanied by other species of ostracods: most of the times with *Stenocypris major* (Baird, 1859), *Cypris subglobosa* Sowerby, 1840, and *Heterocypris antillensis* Broodbakker, 1982, but also with some other species, including *H. reticulata* and *H. barbadensis*.

It was encountered in temporary as well as in permanent, small and large, pools, ponds, basins, ditches and sheets of rainwater, with or without vegetation or algae. The bottom sediment was mostly muddy, on a clayish or limestone soil. The chlorinities ranged from 18-1600 mg Cl^-/l, and the depths from 0.2-3 m.

H. reticulata (table IV):
Only two large samples were available, from Puerto Rico and St. Croix, while in the other samples other species of ostracods were dominant, including *H. exigua* (once on Bonaire, Curaçao and Aruba). *Stenocypris major* was encountered in most samples with *H. reticulata*, while *Cypris decaryi* Gauthier, 1933, was found three times; *H. antillensis*, *Cypris subglobosa* and *Potamocypris hummelincki* Klie, 1933, were found twice.

H. reticulata was encountered in temporary and semipermanent, small and large pools, ponds and basins, mostly without vegetation. The sediment was mostly muddy, twice on a limestone soil, while for most other stations no data were available. The chlorinities ranged from 10-725 mg Cl^-/l, and the depths from 0.1-2 m.

H. barbadensis (table V):
This species was only encountered in five localities on Barbados: twice without other ostracod species, once with *Cypris subglobosa*, once with *Cypris subglobosa* and *H. exigua*, and once with these two species and four others.

The species was found in small and large, temporary and semipermanent pools, ponds and one sheet of rainwater, of low chlorinities (less than 320 mg Cl^-/l), with a depth of less than 1 m on a clayish and/or limestone soil.

Discussion and conclusions

The three species of *Hemicypris* were only encountered in epigean habitats, they were not

TABLE IV

Mean length of the carapace and some other data of the different samples containing *H. reticulata*; *n* = number of specimens measured.

Station number	Date	Island	Type of habitat	No. of specimens	Carapace length (mm) mean ± SD (*n*)	Accompanying species of Ostracoda
WH 707	19.9.1963	Puerto Rico	large, very muddy pool, no vegetation (10 mg Cl^-/l)	48	0.96 ± 0.03 (46)	*Heterocypris antillensis* *Stenocypris major* *Cypris subglobosa* *Cypris decaryi*
Coll. WH	13.1.1955	St. Croix	Diamond Pool	49	1.07 ± 0.03 (47)	*Cypridopsis* sp. *Stenocypris major*
WH 664	15.7.1955	Antigua	very muddy large pond with only few algae (135 mg Cl^-/l)	8	1.03 ± 0.03 (8)	*Potamocypris* sp. *Stenocypris major*
WH 52d	27.12.1948	Bonaire	small pool with clayish mud and rock, almost no vegetation, on limestone soil (90 mg Cl^-/l)	4	0.92 - 0.98 - 1.02 (3)	*Stenocypris major*
WH 54a	16.9.1948	Bonaire	same as WH 52d (195 mg Cl^-/l)	4	1.03 ± 0.05 (4)	—
WH 890	2.9.1967	Bonaire	large, drying, very muddy pool, no vegetation (80 mg Cl^-/l)	12	1.05 ± 0.04 (10)	*Potamocypris hummelincki* *Stenocypris major* *Heterocypris antillensis* *Cypris decaryi*
WH 935	12.3.1970	Bonaire	large, muddy basin, no vegetation (200 mg Cl^-/l)	4	0.84 - 0.90 - 0.92 (3)	*Stenocypris major* *Hemicypris exigua* *Cypris decaryi*
WH 390	25.4.1949	Curaçao	small temporary basin with some mud, much vegetation (725 mg Cl^-/l)	2	—	*Hemicypris exigua* *Stenocypris major* *Cypris subglobosa*
WH 635	4.5.1955	Aruba	small pond, much vegetation (220 mg Cl^-/l)	3	0.92 - 0.94 (2)	*Hemicypris exigua*

TABLE V

Mean length of the carapace and some other data of the different samples containing *H. barbadensis*; *n* = number of specimens measured.

Station number	Date	Island	Type of habitat	No. of specimens	Carapace length (mm) mean ± SD (*n*)	Accompanying species of Ostracoda
WH 787	21.2.1964	Barbados	small cemented pool, few algae (28 mg Cl^-/l)	18 (+ 60 carap.)	1.11 ± 0.03 (39)	—
WH 866	6.7.1967	Barbados	very muddy semipermanent pond on limestone, clayish soil, much vegetation (310 mg Cl^-/l)	6	1.20 ± 0.05 (6)	*Cypris subglobosa*
WH 867	6.7.1967	Barbados	semipermanent pond, clayish soil on limestone, with vegetation (140 mg Cl^-/l)	± 300	1.13 ± 0.04 (50)	*Potamocypris* sp. *Cypris subglobosa* *Hemicypris exigua* *Heterocypris margaritae* *Stenocypris major* *Cypridopsis* sp.
WH 868	6.7.1967	Barbados	large temporary sheet of rainwater on clayish soil, *Alisma* and *Chara* (150 mg Cl^-/l)	± 200	1.11 ± 0.04 (51)	*Hemicypris exigua* *Cypris subglobosa*
WH 869A	6.7.1967	Barbados	small pool, connected with spring, used for washing, algae (210 mg Cl^-/l)	20	1.15 ± 0.04 (17)	—

present in any (hypogean) sample of the Amsterdam Expeditions. Therefore these species are probably exclusively epigean, in which they are distinctively different from those of the genus *Heterocypris* which were found often in wells and other habitats in direct connection with the groundwater.

The species were often encountered in samples with one or more other species of ostracods, especially *Stenocypris major*, *Cypris subglobosa* and *C. decaryi*. *H. reticulata* and *H. barbadensis* never occurred together, but this may be due to the fact that *H. reticulata* has not been found on Barbados and that only a few samples with each of these species were available.

H. exigua was sometimes accompanied by *H. reticulata*, and in two out of five samples by *H. barbadensis*. However, *H. reticulata* was only found in small numbers in samples with *H. exigua* (table III). This could mean that there might be some degree of competition between these species. *H. exigua* and *H. barbadensis* do not seem to exclude each other competitively. In two samples from Barbados both species were present in large numbers.

The three species seem to be confined to the calcareous islands, calcareous regions of islands and clayish soil. The bottom sediment was muddy or very muddy in most localities. *H. barbadensis* appears to be a true freshwater species, *H. reticulata* a freshwater species slightly tolerant of oligohaline conditions, and *H. exigua* the most tolerant species, tolerating chlorinities up to 1.6 g Cl^-/l. *H. reticulata* was mostly found in waters without vegetation, and the other two species were found in all kinds of habitats with much, less, or no vegetation or algae.

The species live in stagnant waters of small and large dimensions, in temporary, semipermanent, and sometimes permanent habitats.

Apparently there is no competition in these types of habitat between *Hemicypris* and *Heterocypris* species. *Hemicypris exigua* was often found together with *Heterocypris antillensis*, *Hemicypris reticulata* twice with *Heterocypris antillensis*, and *Hemicypris barbadensis* once with *Hemicypris exigua* and *Heterocypris margaritae*.

5. DIFFERENCES BETWEEN POPULATIONS OF THE SPECIES

H. exigua (tables III, VI):

All populations of this species had comparable carapace shape and structure, except one from Cuba. In this population the carapace was reticulated in the same way as in *H. reticulata*. However, the shape and size of the carapace, and the soft part morphology was as in typical material. Therefore this population is assigned to *H. exigua* (figs. 3A, C. F).

Mean carapace length was calculated for each sample containing more than 10 specimens. This resulted in differences in mean carapace length between part of the samples. Like in *Heterocypris margaritae* Klie, 1933, the variation could be as much as 23 % of the smallest carapace length (Broodbakker, 1983). It was, however, observed that within each sample most of the animals were of smaller size, while a few were much larger. This means that there were often animals in one sample ranging from about 0.63 to 0.73 mm in length.

There is no correlation between carapace length and chlorinity for all stations together (r = 0.183). Neither is the variation in carapace length correlated with any of the other factors, like area of the habitat, depth, vegetation, soil or bottom sediment. In all types and classes there are both small and large animals.

At Aruba the mean carapace length ranges from 0.65-0.76 mm, with the larger animals in a small short-living pool. On Curaçao the variation is not large for the samples with more than 10 specimens. In pools sampled in different months (WH 396-397) there is some variation of the carapace length in time. However, numbers of animals measured were very small in most cases. In station WH 891 the mean carapace length was the same in 1967 and in 1968. There seems to be an amount of variation in time, as well as between stations, in these two islands.

On Bonaire only small animals were found (0.65-0.67 mm). On Cubagua, Margarita, Martinique (1 sample each) and Barbados (2 samples), animals of the same size as on

Bonaire were encountered (0.66-0.67 mm). In Cuba and Guadeloupe larger sized animals were found (0.73-0.74 mm), while the small samples from Marie Galante and Puerto Rico contained the largest animals.

Soft part morphology is practically the same in all islands. The length of the setae, chosen for comparison, is about the same in each island (table IV). Even in Cuba, where the carapace structure is different, these setae have the same relative length.

H. reticulata (tables IV, VI):
Most samples contained only a few specimens. The small samples from Bonaire and Aruba contained mostly small animals (0.90-1.02 mm), while two other small samples from Bonaire and a small sample from Antigua contained larger animals (1.03-1.05 mm).

Only two samples with many specimens of *H. reticulata* were found, one from St. Croix, with large animals (mean carapace length: 1.07 mm), and one from Puerto Rico, with small animals (mean carapace length: 0.96 mm). The specimens found by Klie (1930) in Gran Chaco (Paraguay) were 0.97 mm in length.

The difference in carapace length between Puerto Rico and St. Croix could mean that these populations are genetically different in some way. However, the structure and shape of the carapace is the same, and so is the soft part morphology and chaetotaxy. The selected setae measured have about the same relative lengths in all the islands (table VI).

H. barbadensis (table V):
All samples containing *H. barbadensis* are from the island of Barbados. Four of the five samples

TABLE VI

Relative length of some setae (in %) in *H. exigua* and *H. reticulata*, as measured in one specimen from each island, compared with the relative length of these setae in sample WH 390, Curaçao, and the sample from Diamond Pool, St. Croix, respectively.

Station no.	Island	A1	A1	A2	T1	T1	T1	T2	T2	Fu	Fu
or name		s(E III) / E III	s(E IV) / E III	Y/E I	s(E I) / E II	s(E II) / E II	s(E III) / E II	s(E II + III) / E I	s(Pr:D) / E I	s_a/G_a	s_p/G_p
H. exigua:											
WH 390	Curaçao	123 ± 6	122 ± 6	40 ± 2	109 ± 6	80 ± 5	59 ± 3	25 ± 1	72 ± 4	27 ± 3	75 ± 6
WH 100A	Aruba	123	120	39	100	73	53	25	—	26	71
WH 635	Aruba	121	121	41	104	77	61	25	65	29	71
WH 51	Bonaire	—	124	41	103	79	—	25	69	30	84
WH 9	Cubagua	121	127	40	103	72	59	23	65	—	77
WH 12	Margarita	124	121	41	104	85	59	27	—	33	72
WH 868	Barbados	128	122	40	112	76	64	24	68	28	76
WH 767	Martinique	130	—	41	100	77	61	24	76	28	74
WH 749	Marie Galante	119	128	39	112	81	65	24	67	24	77
WH 729	Guadeloupe	135	129	38	97	72	55	26	71	29	68
WH 708	Puerto Rico	124	133	38	107	77	50	26	66	26	70
Guantánamo	Cuba	113	132	37	114	82	50	25	72	26	74
H. reticulata:											
Diamond Pool	St. Croix	230 ± 10	175 ± 8	33 ± 1	123 ± 4	115 ± 5	89 ± 4	43 ± 2	85 ± 2	40 ± 2	99 ± 2
WH 707	Puerto Rico	222	150	31	129	117	86	43	87	40	100
WH 664	Antigua	235	175	32	129	111	89	46	88	39	100
WH 52d	Bonaire	230	163	32	121	108	85	45	88	39	100
WH 890	Bonaire	221	165	30	114	100	81	40	88	35	98
WH 935	Bonaire	238	163	33	139	111	75	44	90	41	98
WH 390	Curaçao	235	160	31	119	108	92	43	—	38	100
Gran Chaco	Paraguay	200	140	32	126	121	79	44	80	41	100

have carapace lengths which are comparable, and only one sample with a mere 6 specimens presented larger animals. However, variation in size within populations was very large as well. All samples contained many small juveniles of comparable size and adults ranging from 1.05 to 1.21 mm. Thus, for this species there are no real differences in morphology, shape and size between the samples.

Discussion and conclusions

There is no consistent relationship between carapace length and any of the environmental factors measured. Differences in mean carapace length between some islands could possibly be explained by genetical differences in the respective populations. Especially the population of *H. exigua* from Cuba presents some structural differences in the carapace, compared with other populations of this species. However, soft part morphology and chaetotaxy of all the populations within each species is practically the same. The relative length of some setae seems to be a very stable character in the species of *Hemicypris* described in this paper. Differences between the islands in carapace size are not accompanied by differences in chaetotaxy.

H. exigua seems to present animals of larger size on the islands north of Martinique. For *H. reticulata* not many data are available, but there is a large difference in size between animals from Puerto Rico and St. Croix.

It is possible that environmental factors like food abundance, pollution and other factors of water chemistry play the most important role in explaining the size differences, as postulated for the genus *Heterocypris* (Broodbakker, 1983). A comprehensive discussion of certain aspects concerning the cause of these size differences is provided by Broodbakker (1983).

Hartmann (1982) found that three cytherid species from the coast of Australia—*Mutilus pumila* (Brady, 1866), *Xestoleberis chilensis austrocontinentalis* Hartmann, 1978 and *Hiltermannicythere bassiounii* Hartmann, 1978—exhibit a degree of ornamental variation between populations. He found it impossible to correlate ornamental and size variation with any single environmental factor and concluded that genetical as well as environmental factors are responsible for the ornamental differences between populations of each species. Apparently we find another example of this phenomenon in the population of *H. exigua* from Cuba.

ZOOGEOGRAPHY

Up to the present only three species of *Hemicypris* were known from the neotropical region. *H. salaria* (Hartmann, 1962) from Chile is clearly different from the three species described from the Antillean Islands. *H. rara* (Klie, 1940) from Brazil has a carapace shape similar to that of *H. exigua*. However, in *H. rara* the right valve is indented instead of the left valve and it is a larger species (1.05 mm). The third species is *H. reticulata*, which seems to be quite widely distributed, considering the fact that it has been found in Paraguay as well as on the Antillean Islands.

Tressler (1949) described a specimen of *Cyprinotus ovatus* (Sars) from Brazil. This identification was not accepted by Victor & Fernando (1981). Considering the concise description and drawing, it is more probable that Tressler was dealing with a specimen of *H. reticulata*. The carapace of *H. reticulata* is comparable with the carapaces of a few African species, like *H. humbertii* from Madagascar, and *H. intermedia, H. kliei* and *H. nonstriata*, all described by Lindroth (1956) from East Africa.

H. exigua is morphologically most like *H. anomala* (Klie, 1938) from Asia. *H. anomala* has the same carapace shape and size, but it lacks the indentation of the left valve.

H. barbadensis seems to be very closely related to *H. aurita* (Klie, 1939) from Kenya, even more than to any of the other species from the Caribbean or South America. It could be that *H. aurita* has been introduced in Barbados directly by man. It is, however, impossible to verify this statement. Another possibility is that both species have the same ancestor. The problem of

the great geographical distance between the localities of both species and the absence of any other closely related species in the area between Barbados and Kenya, seems to favour the first assumption.

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