

# On *Klieopsis* n. gen., with a redescription of *Cypridopsis horai* KLIE, 1927 (Crustacea, Ostracoda)

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## Abstract

*Klieopsis* n. gen. is here described to comprise the species *Cypridopsis horai* KLIE, reported from India. The new genus is characterized by an aberrant inner list on the RV, by a furca with a cylindrical trunk and by the reduction of two claws (G2 and Gm) on the A2 to short setae. After re-examination of the type materials, *Cypridopsis caerulelescens* KLIE from Kenya is synonymized with *K. horai*, which is here furthermore reported for the first time from Israel (surroundings of the Dead Sea). The latter specimens are extensively described, and a discussion on the taxonomic position of the new genus is offered. An apparently similar species from Sardegna, *Cypridopsis thymarum* TAGLIASACCHI-MASALA, 1968, is here formally referred to *Plesiocypridopsis*.

**Key words:** *Plesiocypridopsis*, Africa, India, Israel, taxonomy, morphology, ecology, zoogeography.

## Résumé

*Klieopsis* n. gen. est créé afin d'y inclure l'espèce *Cypridopsis horai* KLIE, décrite en Inde. Ce nouveau genre est caractérisé par un rebord interne aberrante sur la valve droite, par un furca à base cylindrique et par la réduction de 2 griffes (G2 et Gm) du A2, transformées en soies. Après un nouvel examen du matériel type, *Cypridopsis caerulelescens* KLIE du Kenya est mis en synonymie avec *K. horai*, qui en outre est ici rapporté d'Israël pour la première fois (environs de la mer Morte). Les spécimens d'Israël sont intensivement décrits et la position taxonomique du nouveau genre est discutée. Une espèce apparemment similaire de Sardaigne, *Cypridopsis thymarum* TAGLIASACCHI-MASALA, 1968, est ici formellement transformée à *Plesiocypridopsis*.  
**Mots-clefs:** *Plesiocypridopsis*, Afrique, Inde, Israël, taxonomie, morphologie, écologie, zoogéographie.

## Introduction

The non-marine ostracods of Israel are ill known. MARTENS *et al.* (in press) give a list of species thus far reported from this region. It appears that only a fraction of the number of taxa which could be expected in this area, has actually been reported to date. This gap in our knowledge is most disturbing, as it hampers the formulation of general zoogeographical hypotheses on this important area, transitional between three zoogeographical realms. The present paper is a contribution towards

a long term project on the revision of the ostracod fauna of the inland waters of the Levant.

In the first half of this century, the genus *Cypridopsis* commonly served to comprise all cypridid species with a reduced furca, with the exception of those ranked in *Potamocypris* and *Oncocypris*. As a result, however, *Cypridopsis* s.l. became a highly polyphyletic taxon, including various separate lineages. These were only gradually recognised during the past three decades. MARMONIER *et al.* (1989) listed 13 genera with Recent representatives and MEISCH (in press) gives a key to the West European cypridopsine genera.

In spite of this apparent progress, *Cypridopsis* s.l. still comprises a substantial number of species which do not belong there. New material of *Cypridopsis horai* KLIE, kindly given to us by Y. SPIRA (Jerusalem), showed that this is one of the species which needs to be removed from that genus. We here create a new genus to accommodate it, and discuss its position and affinities within the subfamily.

## Abbreviations used in text and figures

A1 = Antennula. A2 = Antenna. H = height of valves. im = inner margin. L = length of valves. lc = line of concrescence. LV = left valve. Md = Mandibula. Mx1 = Maxillula. Mx2 = Maxilla. ov = ovarium. RV = right valve. SEM = Scanning Electron Microscopy. T1 = first thoracopod. T2 = second thoracopod. vm = valve margin. ZIZM = Zoologisches Institut und Zoologisches Museum der Universität, Hamburg (Deutschland).

Chaetotaxy of the limbs follows the model proposed by BROODBAKKER & DANIELOPOL (1982), revised for the A2 by MARTENS (1987, 1989).

## Taxonomic descriptions

Class	Ostracoda LATREILLE, 1806
Subclass	Podocopa G.W. MÜLLER, 1894
Order	Podocopida SARS, 1866
Family	Cyprididae BAIRD, 1845
Subfamily	Cypridopsinae KAUFMANN, 1900

## DIAGNOSIS

Cyprididae with carapace generally small and elongated or rounded. Furcae flagellated in ♀, completely absent in ♂. T2 with terminal segment generally incompletely fused with the penultimate one. Hemipenis with parts c and d (d3-d4) built in a characteristic coil.

## REMARK

The following feature of the ♂ A2 could also be useful : seta z3 completely missing (a long seta in all ♀, a short seta in ♂ of other Cyprididae). The validity of this character for the entire subfamily, however, remains to be shown.

Genus *Klieopsis* n. gen.

## TYPE SPECIES

*Cypridopsis horai* KLIE, 1927 (here designated).

## DIAGNOSIS

A cypridopsine genus, with relatively small and elongated carapace; RV overlapping LV anteriorly, ventrally and posteriorly. RV furthermore with an oblique, erected and narrow inner list, the latter especially on the posterior side connected with the calcified part of the inner lamella by numerous short septa.

A2 with only three terminal claws in the female (G2 on penultimate and Gm on terminal segments reduced to a seta). Furcae with cylindrical rami, distally abruptly narrowing.

## DERIVATION OF NAME

The genus is named in honour of Walter KLIE, the German Crustacean specialist, who contributed so much

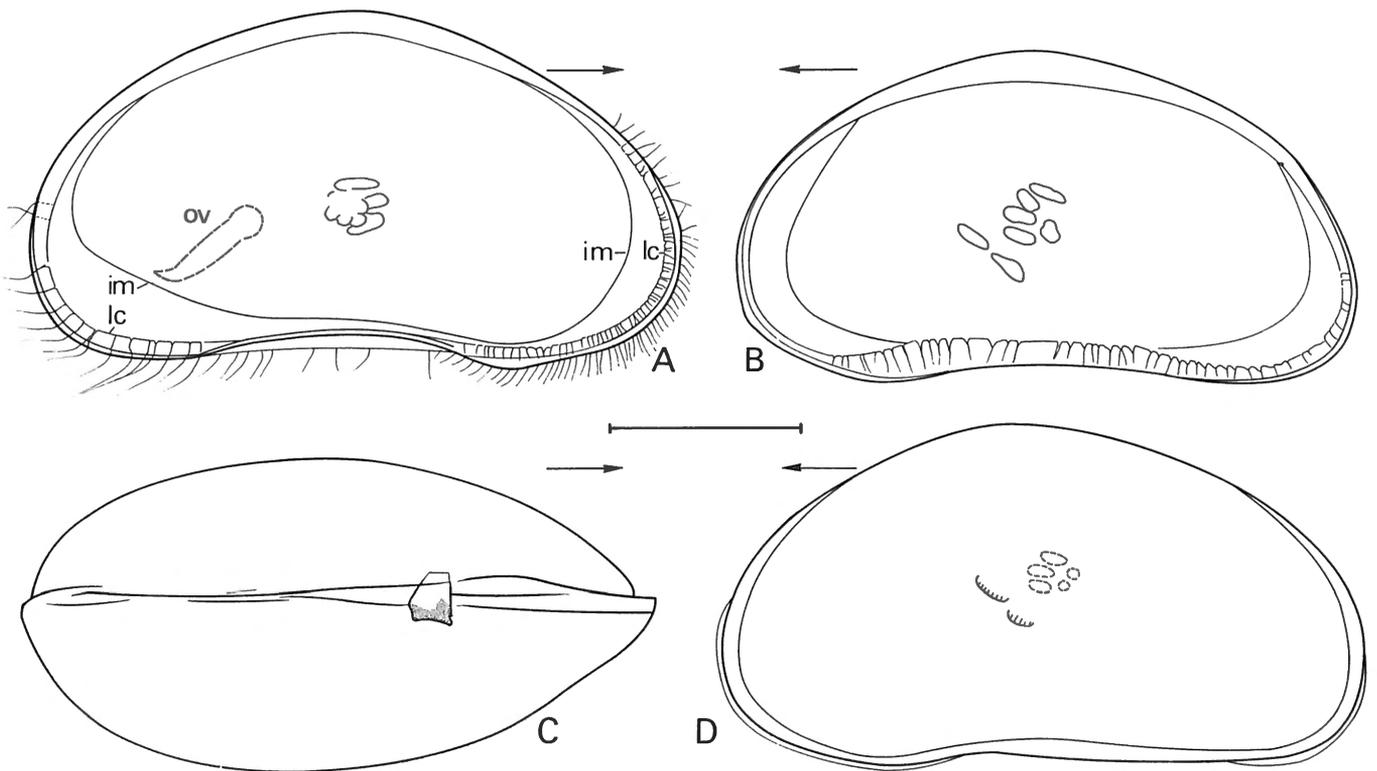


Fig. 1. — *Klieopsis horai* (KLIE), ♀, Israel.

A. LV, internal view (OC.1564). B. RV, internal view. C. Carapace, dorsal view. D. Carapace, left lateral view. Scale = 138  $\mu$ m for A, B, D; 132  $\mu$ m for C.

Fig. 2. — *Klieopsis horai* (KLIE), ♀, Israel. (E = OC.1564, A-D, F, G = OC.1565).

A. A2. B. A1. C. Mandibular coxa and mandibular palp (terminal segment not shown). D. Terminal segment of mandibular palp. E. Maxillular palp. F. Maxilla. G. Rake-like organs. Scale = 31  $\mu$ m for A-G.



to ostracod taxonomy and who described the present species. The ending "-opsis" refers to the final syllable of the generic name *Cypridopsis*.

**Klieopsis horai** (KLIE, 1927)

(Figs. 1-4)

1927 *Cypridopsis horai*, KLIE, *Records of the Indian Museum*, 29 (2) : 162-164, figs. 6-8.

1939 *Cypridopsis caerulescens* KLIE, *Internationale Revue der gesamten Hydrobiologie und Hydrographie*, 39 (1/2) : 142-145, figs. 57-60, nov. syn.

TYPE LOCALITY

India, Punjab, Tilok, Kangra Valley, in a moss cushion.

TYPE MATERIAL

(1) of *Cypridopsis horai* KLIE, 1927.

ZIZM.1095 : 7 ♀ in glycerine, with valves completely decalcified, collected from the above type locality by HORA on 24.05.1926.

ZIZM.1096 : c. 40 ♀ in glycerine, with valves completely decalcified, collected by HORA on 21.12.1926 from a moss cushion in Darjeeng, Eastern India. These specimens were also used by the author for the original description of the species, hence should be considered type material.

(2) of *Cypridopsis caerulescens* KLIE, 1939

ZIZM.1130 : c. 30 ♀ in glycerine, with valves completely decalcified, from mosses at a waterfall near Lokitang (Kenya), collected by P.A. CHAPPUIS on 16.02.1933.

OTHER MATERIAL INVESTIGATED

Five adult females and one juvenile from Ein Faskha, Dead Sea area (Israel); collected by Y. SPIRA in February 1984. The material was collected from a stream with a relatively strong current. E.C. = 7.13 mS/cm; dissolved oxygen = 5.55 ppm; water temperature 24.8°C, pH = 7.57.

These specimens are deposited in the collections of the Royal Belgian Institute of Natural Sciences (Brussels, nos. OC.1563-1568). The present redescription (including all illustrations) is based on these specimens.

REDESCRIPTION OF FEMALE

Carapace elongated, width and height c. 1/2 of length. In lateral view (Fig. 1D), RV overlapping LV on frontal, ventral and caudal sides. In dorsal view (Fig. 1C), carapace oval, anteriorly somewhat pointed, RV clearly

overlapping LV anteriorly and posteriorly, greatest width situated in the middle. Surface of shell smooth. Eye well pigmented, colour of preserved animals white (according to KLIE (1939) for *C. caerulescens*, colour of the animals is translucent, with a longitudinal narrow dorsal blue band). Adductor muscle scars (Fig. 4C, D) consisting of 3 horizontal (somewhat oblique) rows : first row consisting of one very small anterior and one large and elongated posterior scar; second row consisting of 2 subequal and rounded scars; third row with 1 large and rounded anterior scars, a small and elongated scar situated somewhat more ventrally. Two mandibular scars elongated.

RV (Figs. 1B, 4B) with greatest height situated in front of the middle (at c. 43-45 % of the total length). Posterior margin more narrowly rounded than anterior one, ventral margin convex. Inner lamella representing c. 13 % (on posterior side) and c. 8 % (on anterior side) of the total length of this valve. Normal pore canals more numerous along the anterior margin. Both anterior and posterior inner lamellae with a conspicuously erected inner list, internally set with pustules and with numerous vertical supporting septae (Figs. 4F-H).

LV (Figs. 1A, 4A) with greatest height situated in front of the middle (at c. 41 % of the total length); ventral side slightly convex and with well developed pore canals. Inner lamella representing c. 10 % (posterior side) and c. 9 % (anterior side) of the total length of the valve (Fig. 4I). No inner lists present, posteriorly with valve margin folded and somewhat inwardly displaced (Fig. 4E).

A1 (Fig. 2B) seven-segmented (I : A-1m(pl), P-2l(pl)/ II : A-1m(pl)/ III : A-1m(pl), P-1s/ IV : A-2(pl), P-2s/ V : A-2l, P-1m-1l/ VI : A-2l(pl)-1s(alpha). P-2l/ VII : D-3l-ya). Second segment wider than long, with a simple Rome-organ and a single short seta, the latter just reaching the end of the third segment. Sixth segment with four long and one short (alpha) setae. Terminal segment with aesthetasc Ya long (5.8 times the length of this segment).

A2 (Fig. 2A) with a three-segmented endopodite (Pr : P-1l/ Exo : 1l-2s/ EI : A-1m5s, P-Y-1m(pl)/ EII+III : A-2m, P-y1-2m(t<sub>1,2</sub>,pl). D-Y<sub>2</sub>-1m(z<sub>3</sub>)-2l(z<sub>1,2</sub>)-1m(G2:ser)-2l(G1,3:ser)/ EIV : D-1s-1s(Gm)-1m(GM:ser)-y<sub>3</sub>).

Aesthetasc Y representing 34 % of the length of EI, its hyaline end representing 36 % of its total length. Natory setae short, the second one being the longest, not reaching the distal end of penultimate segment; other setae reaching approximately to the middle of this segment. Only 2 t-setae present. Three z-setae well developed. Claws G1 and G3 well developed, representing 116 % and 100 % of the length of the first endopodal segment (EI), G2 reduced to a seta, representing 78 % of the length of EI. Claws GM and Gm on terminal segment representing respectively 80 % and 40 % of EI.

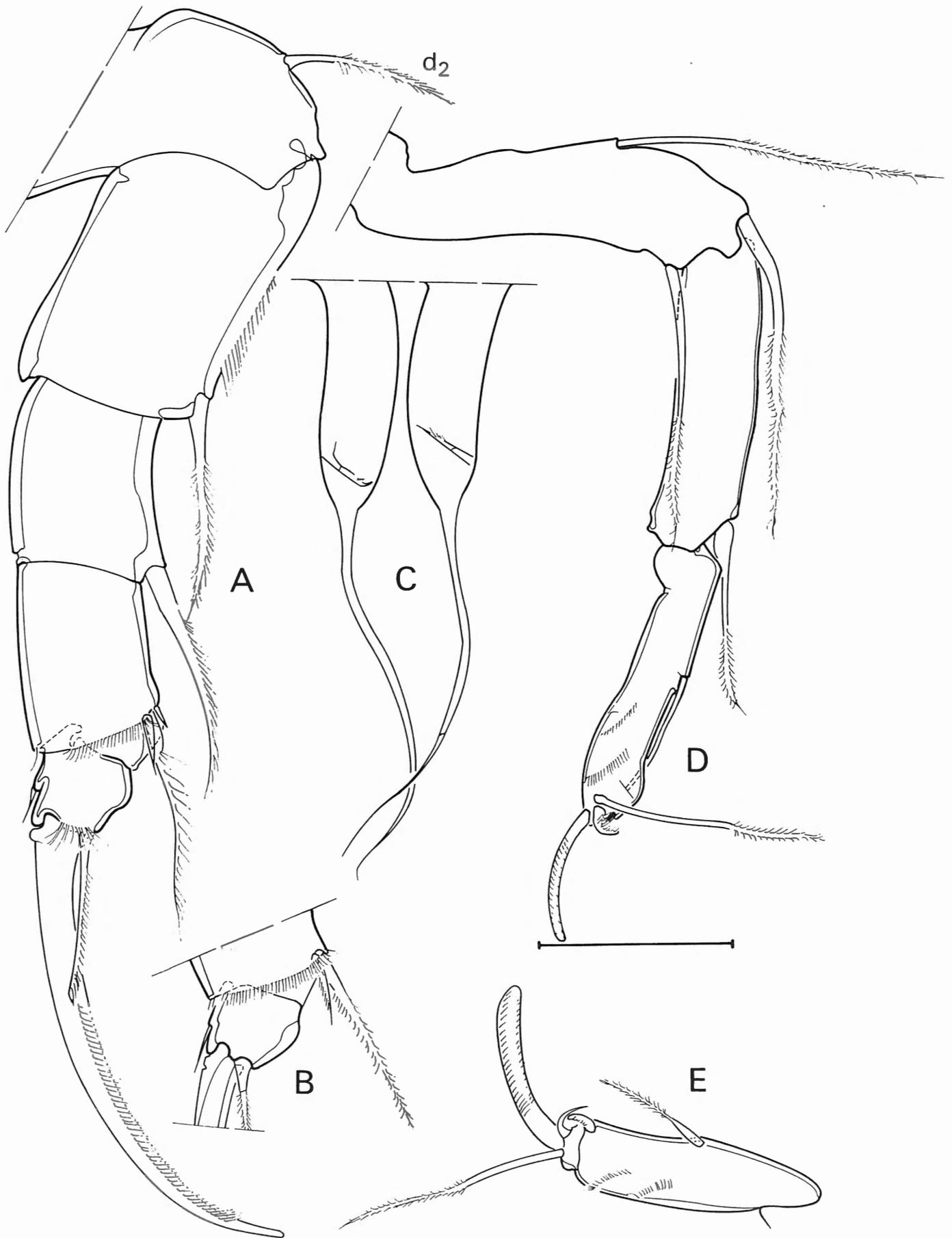


Fig. 3. - *Klieopsis horai* (KLIE), ♀, Israel. (A, C, D = OC.1564; B, E = OC.1565).  
 A. T1. B. detail of fourth segment. C. furcae. D. T2. E. T2, detail of third and fourth segment.  
 Scale = 31  $\mu$ m for A-E.

Aesthetasc  $y_3$  short, c. 27 % of the length of EI, its sensitive hyaline part representing c. 30 % of its total length.

Md-palp (Fig. 2C,D) (I: In-1s(alpha)-1l-1l(s1:pl)-1m(s2:pl)/ II: In-3m-1m(pl)-1l(beta), Ex-1m-2l/ III: In-2m, Ex-1l-3m, D-3m-1m(gamma:pu)/ IV: D-3s-1m-2m(cs:pu)). Alpha-seta narrow and smooth, beta and gamma setae plumose and well developed.

Mx1 (Fig. 2E) (I: Ex-1s-5m(pu)/ II: D-1m-5s). Palp with first segment bearing 5 apical and 1 subapical seta; second segment elongated (length c. 2.5 times basal width) and with 5 apical setae. Third endite with two slightly serrated bristles (Zahnborsten).

Mx2 (Fig. 2F) (Pr: A-2s(a+a')/ Masric: D-4s-6m/ Exo: P-2s(pl)/ E: D-1s(pl)-1m(pl)-1m(pl)). Respiratory plate consisting of 2 subequal, plumose branchial rays.

T1 (Figs. 3A,B) (Pr: A-1s(d2)/ EI: A-1m(pl) EII: A-1m(pl)/ EIII: A-1s-1m(pl)/ EIV: P-1s, D-1s(pl)-1l(Gser)). First and second endopodal segments bearing a single, long seta, exceeding the tip of the next segment: fourth segment bearing 1 subapical and 1 apical seta and distal claw, the latter relatively short and strong, c. 2.7 times the length of the second endopodal segment.

T2 (Figs. 3D,E) (Pr: P-1l(pl), A-1m(pl)-1l(pl) EI: P-1m(pl)/ EII+EIII: P-1s(pl)/ EIV: P-4s(LO, pz<sub>1</sub>, pz<sub>2</sub>), D-1s(pl)-1m(pl)). Third segment undivided, carrying two rows of setulae only, apically forming a pincer with the fourth segment; tongue relatively long.

Furca (Fig. 3C) whip-like, with a basal part showing parallel sides, a relatively short apical flagellum (c. 2-2.5 times length of basal part) and a short, subapical seta. Genital lobe without copulatory hooks.

Rake-like organs strong, with 3 large and 4 smaller teeth. Male unknown.

#### MEASUREMENTS

L = 0.45-0.46 mm (specimens from Israel); 0.44-0.49 mm (specimens from India and Kenya).

#### REMARKS

(1) The septa on the inner list of the RV, distinguishable with SEM-magnification only, are clearly designed to

strengthen the remarkably narrow and erected inner list. They occur both on the anterior and the posterior sides, but are especially conspicuous near the latter margin.

(2) When the carapace closes, anterior and posterior valve margins of the LV are embraced by both the corresponding valve margin and the inner list of the RV. This ensures a tight closure of the carapace and it is obvious that the erected and reinforced inner lists are an additional adaptation, which further optimizes this system.

(3) The posterior valve margin of the LV might have to be regarded as a selvage. In that case, the actual valve margin has all but disappeared, leaving only a row of long setae (arrowed in Fig. 4E) as a relict.

(4) There appears to be some variation in the relative length of the natatory setae on the A2 between the different populations of this species. In the specimens from Kenya (ex *K. caeruleascens*), the third and fourth setae are the longest; in the material from India (type populations of *K. horai*), the sixth seta is considerably longer and in the specimens from Israel (Fig. 2A), the second natatory seta is by far the longest. As these are the only morphological differences between these populations, we will not attach any taxonomic importance to this variability.

#### DISTRIBUTION

East-Africa, the Middle East and northern India.

#### Discussion

#### TAXONOMY

Amongst the cypridopsine species with reduced natatory setae on the A2, only the following have cylindrical (not triangular) furcal rami: *Cypridopsis horai* KLIE, 1927; *Cypridopsis careulescens* KLIE, 1939 and *Cypridopsis thermarum* TAGLIASACCHI-MASALA, 1968. The former two nominal species also have the following features in common: a carapace in which the RV ventrally overlaps the LV and reduced claws G2 and Gm (only 3 large claws on the ♀ A2). Their type materials (see above) were compared by one of us (CM) and it appeared that

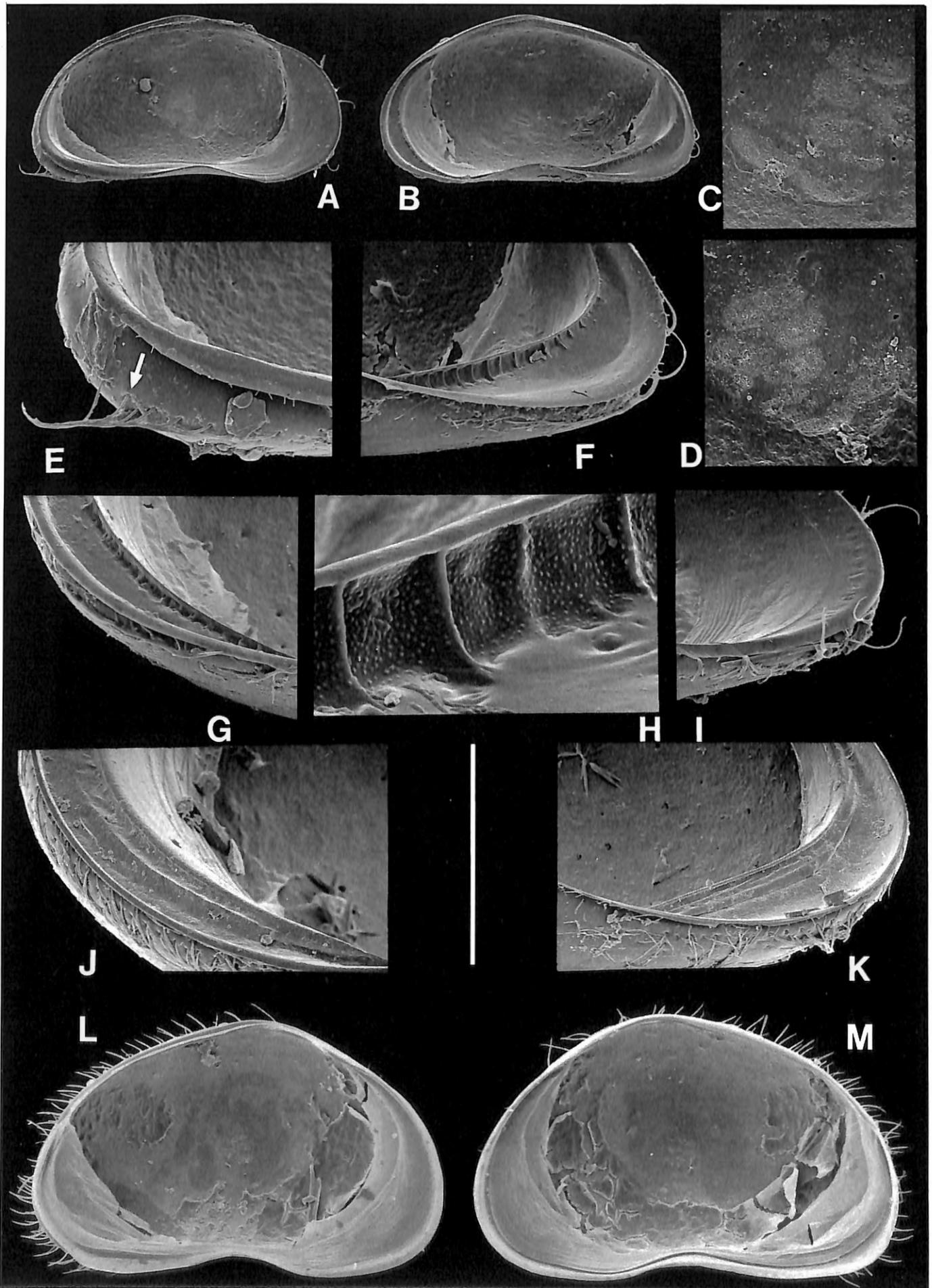
Fig. 4. — *Klieopsis horai* (KLIE) (A-I, ♀, OC.1563, Israel), *Bryocypris grandipes* RØEN (J.K. ♀, OC.1475, Cameroon) and *Plesiocypridopsis newtoni* (BRADY & ROBERTSON) (L.M. ♀, Strasburg).

*K. horai*: A. LV, internal view, B. RV, internal view. C. RV, internal view, detail of central muscle scars. D. LV, idem. E. LV, internal view, detail of posterior marginal morphology (valve slightly tilted). F. RV, idem. G. RV, internal view, detail of anterior marginal morphology (valve slightly tilted). H. RV, internal view, detail of posterior septa. I. LV, internal view, detail of anterior marginal morphology (valve slightly tilted).

*B. grandipes*: J. RV, internal view, detail of anterior marginal morphology (valve slightly tilted). K. Idem, detail of posterior marginal morphology.

*P. newtoni*: L. LV, internal view. M. RV, internal view.

Scale = 440 µm for L, M; 317 µm for A, B; 119 µm for K; 109 µm for F; 96 µm for C, D; 88 µm for E, G, I; 77 µm for J; 16 µm for H.



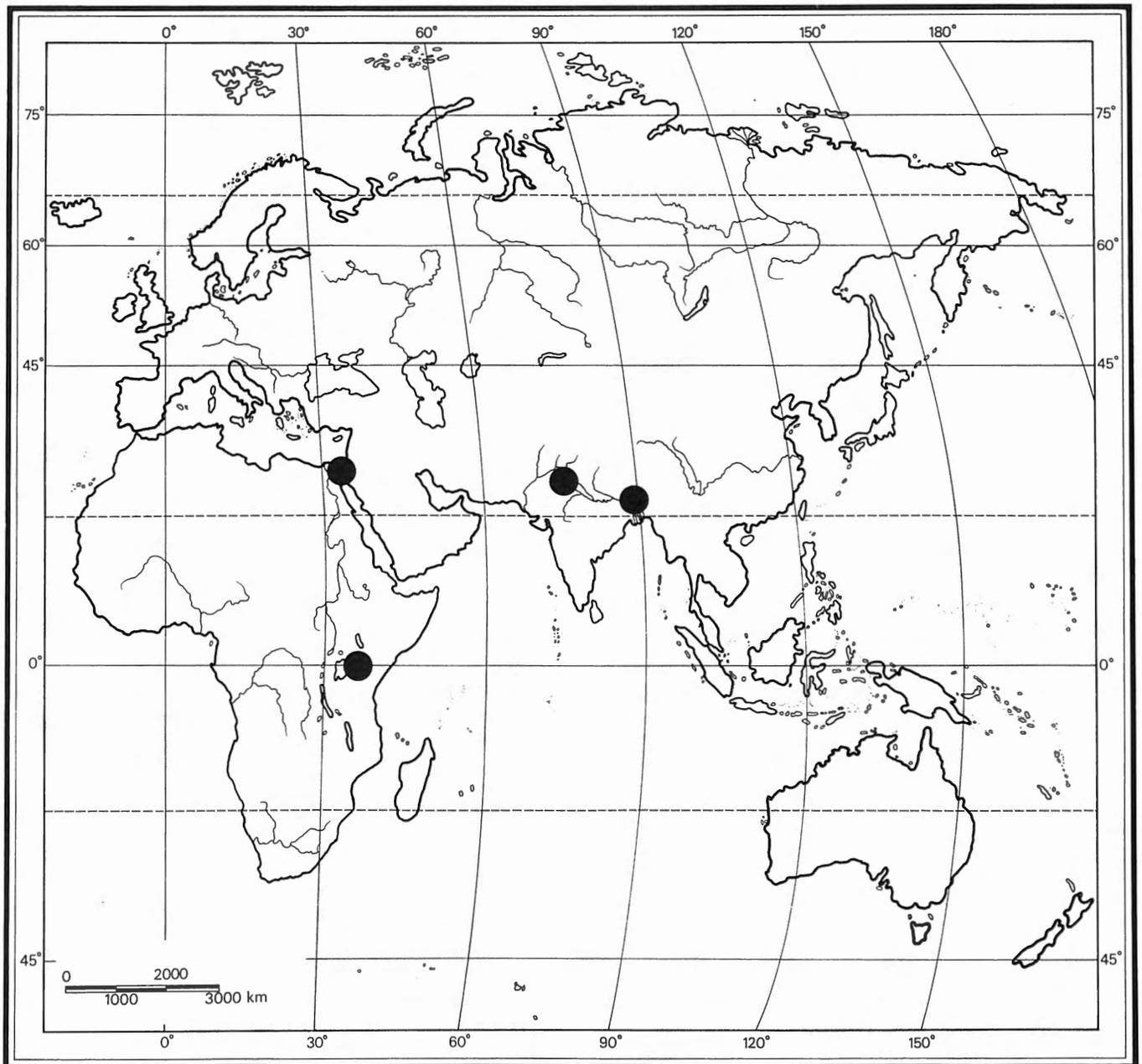


Fig. 5. – Localities of *Klieopsis horai* in Africa, Israel and India.

both taxa are identical. *Cypridopsis caerulea* is therefore here formally considered a junior synonym of *C. horai*.

Females of *C. thermarum* (see TAGLIASACCHI-MASALA, 1968) have much higher valves and have four large claws on the A2. The ventral overlap in this species remains unknown, but the above seems to indicate that this species simply has to be considered a genuine *Plesiocypridopsis* with reduced natatory setae. Both long and short natatory setae on the A2 can indeed occur in one and the same *Cypridopsis* genus, as was shown in the revision of West European *Potamocypris* (MEISCH 1984, 1985). The correct combination for this species is then *Plesiocypridopsis thermarum* (TAGLIASACCHI-MASALA, 1968) nov. comb.

*Klieopsis* n. gen. belongs to the group of genera with elongated (not globular) carapaces, showing a RV overlapping the LV anteriorly and ventrally. As such, it can at once be distinguished from *Cypridopsis* s.s. BRADY, *Austrocypridopsis* MCKENZIE, *Zonocypris* G.W. MÜLLER, *Neozonocypris* KLIE, *Tungocypridopsis* VICTOR, *Cavernocypris* HARTMANN, *Neocypridopsis* KLIE and *Notiocypridopsis* DE DECKKER. As it has an elongated terminal palp segment on the Mx1, it does not belong to the *Potamocypris* lineage within the *Cypridopsinae*.

*Klieopsis* n. gen. differs from *Sarscypridopsis* MCKENZIE, *Bryocypris* RØEN and *Tanganyikacypridopsis* MARTENS by the fact that it has a cylindrical, not a triangular furcal shaft.

The latter genus furthermore has an inwardly displaced posterior selvage on the LV and an aberrant chaetotaxy on the proximal segments of the A1 (MARTENS, 1985). *Bryocypris grandipes* RØEN (redescribed by MARTENS, 1989) is the only species in this genus. It superficially resembles *K. horai* and some further discussion is therefore necessary. *B. grandipes* has short natatory setae on the A2, has a RV overlapping the LV on anterior, posterior and ventral sides; has an oblique inner list on the RV and shows a similar morphology of the posterior margin of the LV. However, the trunk of the furcal ramus in *B. grandipes* is triangular, not cylindrical and the inner list on the RV is not erected, but double-folded and lacks the vertical reinforcing septae (Figs. 4J,K). Both species, however, have a very similar mode of life, as they occur in semi-terrestrial environments (mosses in splash zones). Some of the external similarities could therefore be homeomorphies as a result of adaptations to this particular environment, and we believe that there is no close phylogenetic relationship between *Bryocypris* and *Klieopsis* n. gen.

*Klieopsis* n. gen. and *Plesiocypridopsis*, on the other hand, share a number of important characters: both have a RV overlapping the LV on three sides and show a cylindrical furcal shaft. Especially the latter feature is here believed to be of considerable importance and indicates a close relationship between both genera. *Klieopsis* n. gen. differs from *Plesiocypridopsis* by two features mainly: the peculiar structure of the inner list on the RV and the additional reduction of claws G2 and Gm on the A2 to simple setae. *Plesiocypridopsis* has a broad posterior inner list on the RV, without any septa, which runs much closer to the postero-ventral margin (Figs. 4L,M), and has a normal chaetotaxy on the A2, i.e. with both G2 and Gm well developed claws. The character states in *Klieopsis* n. gen. can be regarded as apomorphic.

#### ECOLOGY AND ZOOGEOGRAPHY

As was already indicated above, *K. horai* was recorded

three times from a very similar habitat: mosses in the splash zones of waterfalls. It is not immediately obvious from which type of microhabitat the specimens from Ein Faskha were taken, but dense stands of algae occur and this could supply a similar habitat for the species. *K. horai* could actually be much more common than is known to date, especially in East Africa. It is indeed easy to miss this species, because of its small size and its specialized habitat.

The known distribution of *K. horai* (Fig. 5) is intriguing: all localities are situated around the Indian Ocean. This pattern allows us to present a hypothetical historical scenario on origin and dispersal of this species. The occurrence of taxa in both (East- and South) Africa and India, is by no means an exception and various examples are known. However, because no apparent speciation has occurred between Indian and African populations and because also intermediate populations are known from Israel, it would appear acceptable that the species dispersed either to India or to Africa via the Levant. This could have happened in a relatively recent epoch, definitely long after the Indian subcontinent parted from the African mainland. Furthermore, a scenario accepting a northward migration from East Africa, with the Nile as a carrier, to the Levant and from there to India, appears much more parsimonious than the inverse possibility.

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Dr Yoni SPIRA (Jerusalem) collected the specimens from Israel and kindly allowed us to study them. Prof. Dr G. HARTMANN and Mr H. PETERSEN organized the loan of the above mentioned type materials from the KLIE-collection (Zoological Museum, Hamburg). Mrs C. BEHEN and Mr J. CILLIS (Brussels) kindly offered technical assistance with the line drawings and with the SEM micrographs respectively. Dr R. ORTAL (Jerusalem) and Dr D. DANIELOPOL (Mondsee) read the manuscript and suggested important improvements.

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