

25

BULLETIN ZOOLOGISCH MUSEUM

22649



UNIVERSITEIT VAN AMSTERDAM

Instituut voor Zeewetenschappelijk onderzoek
Institute for Marine Scientific Research
Prinses Elisabethlaan 69
8401 Bredene - Belgium - Tel. 059 / 80 37 15

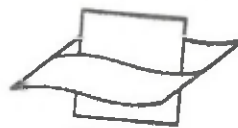
Vol. 2 No.12 21 - IV - 1972

PRELIMINARY NOTES ON A REVISION OF THE LICHOMOLGIDAE, CYCLOPOID COPEPODS MAINLY ASSOCIATED WITH MARINE INVERTEBRATES

ARTHUR G. HUMES

&

JAN H. STOCK



Vlaams Instituut voor de Zee
Flanders Marine Institute

ABSTRACT

The family Lichomolgidae Kossmann, 1877 is raised to the rank of a superfamily and subdivided into 5 families (3 of them new). Keys are provided to 76 genera belonging to the Lichomolgoidea (32 new), which embrace 324 species. The new genera are diagnosed and of all genera the type-species is indicated.

The poecilostome family Lichomolgidae Kossmann, 1877, contains at present a large number of heterogeneous genera and species whose interrelationships in many cases have not been clear. The substantial increase in recent years in the numbers of newly recognized species has emphasized the need for a revisionary study of this family of copepods.

With the objective of such a revision in mind we have undertaken a restudy of the Lichomolgidae, work which has been in progress over the past four years. We propose to divide Kossmann's family into five families, three of them new, and all included in a new superfamily. Seventy-six genera (32 new) are characterized, including 324 species (37 new). Previously known species are recorded from 73 new hosts. The complete revision by Humes & Stock, containing redescrptions of certain known species, descriptions of new taxa, synonymies, and host records, is currently in press.

The publication of these preliminary notes will indicate the scope and content of the revisionary study. These pages also bring together in a convenient shortened form the major taxonomic concepts adopted, leaving the detailed descriptions for the complete revision. Diagnoses of all old and new genera and descriptions and figures of all new species will be found in the forthcoming revision.

The preparation of this paper has been aided by a grant (GB-8381X) to the first author from the National Science Foundation of the United States.

Superfamily LICHOMOLGIDOIDEA new superfamily

First antenna usually 7-segmented. Second antenna either 4-segmented or 3-segmented by a fusion of the last two segments. Mandible simple, without terminal elements, but often attenuated into a slender lash. Maxilliped present in both sexes, prehensile in the male.

Legs 1-4 typically with 3-segmented exopods and endopods, but these frequently reduced or sometimes absent. Leg 5 with at most a single free segment, in some cases lacking a free segment entirely, armature usually consisting of three elements, two of them on the free segment if present.

Usually associated with marine invertebrates, in some cases evidently parasitic, with the body form modified or transformed.

KEY TO THE FAMILIES OF THE SUPERFAMILY LICHOMOLGIDOIDEA

1. Exopods of legs 1 and 2 in the female 2-segmented, in the male 1-segmented Rhynchomolgidae n. fam.
Exopods of legs 1 and 2 in the female 3-segmented, in the male at least 2-segmented 2
2. Leg 5 without a free segment 3
Leg 5 with a free segment (except a short papilla in *Synapticola*) 4
3. Leg 4 endopod 3-segmented Urocoplidae n. fam.
Leg 4 endopod 1-segmented, reduced to a small knob or absent Pseudanthessiidae n. fam.
4. Leg 4 endopod 2-segmented, 1-segmented, reduced to a small knob, or absent; legs 1-3 endopods 3-segmented (except in *Amarda* and *Ravahina*); the reduction in the endopods occurring in a posterior to anterior series Lichomolgidae Kossmann, 1877
Legs 1-4 endopods 3-segmented in most genera; if leg 4 endopod 2-segmented, then legs 1-3 endopods also 2-segmented; the reduction of the endopods occurring in an anterior to posterior series Sabelliphilidae Gurney, 1927

Family SABELLIPHILIDAE Gurney, 1927

Legs 1-4 with 3-segmented rami in most genera. Certain genera with 2-segmented endopods, especially in the male, the reduction occurring in an anterior to posterior series as in males of *Scambicornus*. Leg 5 present in both sexes and with a free segment, except in *Synapticola* where in both sexes it is reduced to a short papilla and in *Thamnomolgus* where in the male it is reduced to a small lobe fused with the body.

KEY TO THE GENERA OF THE SABELLIPHILIDAE

1. Second antenna 3-segmented 2
Second antenna 4-segmented 3
2. Legs 1-4 with exopods and endopods 3-segmented in both sexes; leg 5 with a free segment
..... *Henicoxiphium* Illg & Humes, 1971
Legs 1-4 with 3-segmented exopods and 2-segmented endopods in both sexes; leg 5 without a free segment ..
..... *Synapticola* Voigt, 1892
3. Second antenna with one claw on third segment and 3 or 4 claws on fourth segment 4
Second antenna with claws not present on both of these segments 5
4. Rostrum bifid; second antenna with first two segments enlarged, second segment with a toothed crest and fourth segment with four claws *Sabelliphilus* M. Sars, 1862
Rostrum not bifid; second antenna with first two segments not enlarged; second segment without toothed crest and fourth segment with three claws *Myxomolgus* n. gen.
5. Second antenna with one claw on third segment, fourth segment without claws 6
Second antenna with 1-3 terminal claws, but without a claw on third segment 11
6. Ventral keel on genital segment of female and on first postgenital segment of male; endopods of legs 1-4 in both sexes 2-segmented *Calypsarion* Humes & Ho, 1969
Without a ventral keel on genital segment of female or on first postgenital segment of male; endopods of legs 1-4 not entirely 2-segmented in both sexes 7
7. Body much elongated with broad triangular cephalosome; legs 1-4 with all exopods and endopods 3-segmented in both sexes; leg 4 endopod with formula 0-1; 0-1; I, I, 1, 1, 1; egg sacs very long with nearly linearly arranged eggs *Lecanurius* Kossmann, 1877

- Body not unusually elongated and cephalosome not broadened; legs 1-4 with 3-segmented exopods, but endopods sometimes 2-segmented; leg 4 endopod with formula other than in *Lecanurius*; egg sacs not unusually long and eggs not linearly arranged 8
8. Legs 1-4 in both sexes with rami 3-segmented except leg 1-3 with endopod 2-segmented; rostrum a slender beak; endopod of leg 4 with formula 0-0; 0-0; I, III, I *Calypsina* n. gen.
Legs 1-4 in female with 3-segmented rami, but in male some endopods 2-segmented; rostrum rounded or weakly developed; endopod of leg 4 with formula other than in *Calypsina* 9
9. Mandible with a large spinelike element on base; leg 4 with endopod in female 0-1; 0-1; II, I, in male 0-1; II, I, I *Lichothuria* Stock, 1968
Mandible without a large spinelike element on base; leg 4 with endopod having formula unlike *Lichothuria* 10
10. Legs 1-4 with 3-segmented rami, except in the male legs 1-2 having 2-segmented endopods and legs 3-4 having 3-segmented endopods; leg 4 with endopod in both sexes having formula 0-1; 0-1; I, II, II *Scambicornus* Heegaard, 1944
Legs 1-4 with 3-segmented rami, except in male with all endopods 2-segmented; leg 4 with endopod in female 0-1; 0-1; I, II, II and in male 0-1; I, II, II, I *Caribulus* n. gen.
11. Second antenna with one terminal claw 12
Second antenna with more than one terminal claw 15
12. Caudal ramus with two median terminal setae vestigial *Diogenella* Stock, 1968
Caudal ramus with two median terminal setae normally developed 13
13. Third segment of leg 3 endopod with four elements; leg 5 in female with a free segment, in male with the segment fused with body *Thamnomolgus* Humes, 1969b
Third segment of leg 3 endopod with five elements; leg 5 in both sexes with a free segment 14
14. Terminal lash on second maxilla much shorter than adjacent seta *Diogenidium* Edwards, 1891
Terminal lash on second maxilla longer than adjacent seta *Herrmannella* Canu, 1891
15. Second antenna with two terminal claws 16
Second antenna with three terminal claws 17
16. Second maxilla lacking an auxiliary lash; maxilliped in female 2-segmented with blunt tip *Lichomolgium* Kossmann, 1877
Second maxilla with an auxiliary lash; maxilliped in female 3-segmented and prehensile *Serpuliphilus* n. gen.
17. Leg 4 endopod with formula 0-1; 0-2; III; leg 3 endopod with 0-1; 0-2; I, II, 2 *Paranthesius* Claus, 1889
Leg 4 endopod with formula 0-1; 0-1; II; leg 3 endopod with 0-1; 0-1; II, II, 2 or I, III, 2 *Modiolicola* Aurivillius, 1882

Calypsarion Humes & Ho, 1969.

Type-species.- *Calypsarion carinatum* (Stock, 1968).

Calypsina n. gen.

Type-species.- *Calypsina changeuxi* (Stock & Kleeton, 1963).

Caribulus n. gen.

Type-species.- *Caribulus sculptus* (Humes, 1969d).

Diogenella Stock, 1968.

Type-species.- *Diogenella spinicauda* Stock, 1968.

Diogenidium Edwards, 1891.

Type-species.- *Diogenidium nasutum* Edwards, 1891.

Henicoxiphium Illg & Humes, 1971.

Type-species.- *Henicoxiphium redactum* Illg & Humes, 1971.

Herrmannella Canu, 1891.

Type-species.- *Herrmannella rostrata* Canu, 1891.

Lecanurius Kossmann, 1877.

Type-species.- *Lecanurius intestinalis* Kossmann, 1877.

Lichomolgium Kossmann, 1877.

Type-species.- *Lichomolgium sardum* Kossman, 1877.

Lichothuria Stock, 1968.

Type-species.- *Lichothuria mandibularis* Stock, 1968.

Modiolicola Aurivillius, 1882.

Type-species.- *Modiolicola insignis* Aurivillius, 1882.

Myxomolgus n. gen.

Type-species.- *Myxomolgus myxicolae* (Bocquet & Stock, 1958).

Paranthesius Claus, 1889.

Type-species.- *Paranthesius anemoniae* Claus, 1889.

Sabelliphilus M. Sars, 1862.

Type-species.- *Sabelliphilus elongatus* M. Sars, 1862.

Scambicornus Heegaard, 1944.

Type-species.- *Scambicornus hamatus* Heegaard, 1944.

Serpuliphilus n. gen.

Type-species.- *Serpuliphilus tenax* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with two terminal claws. Maxilliped in the female 3-segmented and prehensile, the last segment very long and clawlike. Legs 1-4 with 3-segmented rami. Leg 4 exopod with the third segment having II, I, 5. Leg 4 endopod with the formula 0-1; 0-1; II. Associated with serpulid polychaetes.

Synapticola Voigt, 1892.

Type-species.- *Synapticola teres* Voigt, 1892.

Thamnomolgus Humes, 1969b.

Type-species.- *Thamnomolgus robustus* Humes, 1969b.

Family LICHOMOLGIDAE Kossmann, 1877

Legs 1-4 usually with all rami 3-segmented except the endopod of leg 4 which is 1- or 2-segmented. Reduction occurring in a posterior to anterior series, as in *Rakotoa* with a vestigial leg 4 endopod, *Ravahina* with endopods of legs 3 and 4 vestigial, and *Amarda* with endopods of the first two legs 2- or 3-segmented, endopods of legs 3 and 4 absent (in this genus leg 3 exopod is 2-segmented and leg 4 exopod is absent). Leg 5 present in both sexes and with a free segment (in a few genera, for example, *Octopicola*, not clearly delimited from the body).

KEY TO THE GENERA OF THE LICHOMOLGIDAE

(Two genera, *Philoconcha* and *Paraphiloconcha*, have been omitted from the key on account of lack of information in the existing descriptions.)

1. Second antenna 3-segmented 2
 Second antenna 4-segmented 11
2. Legs 1 and 2 with 3-segmented exopods and 2- or 3-segmented endopods; leg 3 with 2-segmented exopod, endopod absent; leg 4 absent *Amarda* n. gen.
 Legs 1-3 with 3-segmented rami; leg 4 with 3-segmented exopod and 1- or 2-segmented endopod 3
3. Rostrum with slender needlelike process; claws on second antenna pectinate *Macrochiron* Brady, 1872
 Rostrum rounded, triangular, or broadly truncated but lacking a needlelike process; claws on second antenna not pectinate 4
4. Leg 4 with endopod 1-segmented 5
 Leg 4 with endopod 2-segmented 6
5. With broad shield-shaped prosome; second antenna with two terminal claws; leg 4 endopod armed with II, 1 ..
 *Aspidomolgus* Humes, 1969a
 Prosome not unusually broad; second antenna with one terminal claw; leg 4 endopod armed with II
 *Sewellociron* Humes, 1969c
6. Second antenna with two or three terminal claws *Astericola* Rosoll, 1889
 Second antenna with one terminal claw 7
7. Leg 4 with endopod having formula 0-1; II 8
 Leg 4 with endopod not thus armed 9
8. Mandible with basal area distal to indentation having on its convex side four slender digitiform processes; first segment of first antenna with four setae *Schedomolgus* n. gen.
 Mandible with basal area distal to indentation having on its convex side a large hyaline expansion; first segment of first antenna with one seta *Spaniomolgus* n. gen.

9. Leg 4 with endopod having formula 0 - 1; I; mandible with basal area distal to constriction having on its concave side two lobes with serrated margins *Prionomolgus* Humes & Ho, 1968a
 Leg 4 with endopod having more than one element on second segment; mandible with basal area distal to constriction having on its concave side a row of spinules 10
10. Urosome in female 5-segmented, in male 6-segmented but with segment of leg 5 fused with genital segment; basis of leg 4 laterally elongated *Stellicola* Kossmann, 1877
 Urosome in female 4-segmented, in male 5-segmented (though in both sexes there may be a slight indication of division of anal segment); basis of leg 4 not laterally elongated *Synstellicola* n. gen.
11. Legs 1-4 with rami 3-segmented except for endopod of leg 4 or endopods of both legs 3 and 4 which are vestigial and represented only by a small unarmed knob 12
 Legs 1-4 with all rami 3-segmented except endopod of leg 4 which is either 1- or 2-segmented 13
12. Only leg 4 with vestigial endopod; legs 1-4 with inner coxal seta; second maxilla with long digitiform process on first segment *Rakotoa* n. gen.
 Both legs 3 and 4 with vestigial endopod; legs 1-4 lacking inner coxal seta; second maxilla without a long process on first segment *Ravahina* Humes & Ho, 1968a
13. Leg 4 with endopod 1-segmented 14
 Leg 4 with endopod 2-segmented 20
14. Fourth segment of second antenna with four terminal claws; leg 5 a minute lobe; body elongated with slender prosome *Octopicola* Humes, 1957
 Fourth segment of second antenna with less than four terminal claws; leg 5 with a distinct free segment; body cyclopiform, prosome not unusually slender 15
15. Endopod of leg 4 unarmed *Haplomolgus* Humes & Ho, 1968a
 Endopod of leg 4 armed 16
16. Second antenna with a claw on third segment in addition to either one or two terminal claws 17
 Second antenna without a claw on third segment 18
17. Second antenna with one terminal claw; leg 4 with endopod having two spines
 *Lichomolgeila* G.C. Sars, 1918
 Second antenna with two terminal claws; leg 4 endopod having two spines and a seta
 *Kelleria* Gurney, 1927
18. Leg 4 endopod armed with two spines and a seta *Telestacicola* n. gen.
 Leg 4 endopod armed with only two spines 19
19. Leg 4 with endopod in female almost as long as exopod, in male much shorter than exopod; second antenna with one terminal claw *Paramacrochiron* Sewell, 1949
 Leg 4 with endopod in both sexes much shorter than exopod; second antenna with two terminal claws (except one clawlike spine in *P. fucicolum*) *Pseudomacrochiron* Reddiah, 1969
20. Leg 4 with second segment of endopod bearing only one element 21
 Leg 4 with second segment of endopod bearing more than one element 24
21. Second antenna with one terminal claw 22
 Second antenna with three terminal claws 23
22. Leg 4 with endopod having formula 0 - 1; I; second maxilla with long digitiform process on first segment
 *Andrianellus* n. gen.
 Leg 4 with endopod having formula 0 - 0; I; second maxilla without such a process on first segment
 *Monomolgus* Humes & Frost, 1964
23. Body modified with prosome in female pointed anteriorly; leg 4 with endopod having formula 0 - 1; I; mandible a broad blade abruptly attenuated distally; third exopod segments of legs 1-4 with only three spines
 *Gelastomolgus* Humes, 1968
 Body cyclopiform with prosome in female rounded anteriorly; leg 4 with endopod having formula 0 - 1; I; mandible with broad base and slender attenuated blade; third exopod segments of legs 1-4 with four spines
 *Debruma* n. gen.
24. Leg 4 with second segment of endopod bearing more than two elements 25
 Leg 4 with second segment of endopod bearing two elements 26
25. Leg 4 with endopod having formula 0 - 1; II, I; mandible with slender base merging into long attenuated lash; leg 4 with third exopod segment having armature II, I, 5 *Ascidioxynus* n. gen.
 Leg 4 with endopod having formula 0 - 1; II, 3, or 0 - 1; II, 2, or 0 - 1; I, 3; mandible with large basal area indented; leg 4 with third exopod segment having armature III, I, 4, or III, I, 5, or I, 1, I, 5
 *Indomolgus* Humes & Ho, 1966
26. Leg 4 with endopod having first segment unarmed *Xenomolgus* n. gen.
 Leg 4 with endopod having an inner element on first segment 27
27. Labrum with a pair of prominent ventrally directed anterolateral setae; leg 4 with endopod having formula 0 - 1, 2; maxilliped in female slender, with greatly elongated third segment *Nasomolgus* Sewell, 1949
 Labrum without such setae; leg 4 with endopod having different formula; maxilliped in female not elongated
 28
28. Leg 4 with endopod having formula 0 - 1; 1, I *Anisomolgus* n. gen.
 Leg 4 with endopod having different formula 29
29. Leg 4 with endopod having formula 0 - I; II 30
 Leg 4 with endopod having formula 0 - 1; II 31
30. Second antenna with one terminal claw; second maxilla in male with large proximally directed seta
 *Meringomolgus* n. gen.

- Second antenna with two terminal claws; second maxilla in male without such a seta *Acanthomolgus* n. gen.
31. Second antenna with one claw on third segment and three or four terminal claws 32
Second antenna without claw on third segment but with 1-4 terminal claws 34
32. Second antenna with three terminal claws; mandible with toothlike process on convex edge *Acaenomolgus* n. gen.
Second antenna with four terminal claws; mandible without toothlike process on convex edge 33
33. Female with prosome strongly inflated, and with a median ventrally produced postoral structure terminating in two small hooks *Lichomolgides* Gotto, 1954
Female with prosome not inflated and without such a hooked structure *Zygomolgus* n. gen.
34. Second antenna terminally with one claw and one clawlike spine *Epimolgus* Bocquet & Stock, 1956
Second antenna terminally with different armature 35
35. Mandible of simple type, with slender base merging gradually into long attenuated lash *Lichomolgus* Thorell, 1859
Mandible of more complex type, with large base often indented on convex side and variously ornamented; lash variable, very short to long 36
36. Second antenna with one terminal claw 37
Second antenna with two terminal claws (or in *Doridicola fishelsoni* with one claw and one long spine) 43
37. Mandible with a scalelike area on convex side of base 38
Mandible without a scalelike area but with digitiform processes or tooth on convex side 40
38. Mandible with lash reduced, and represented only by a small pointed process *Colobomolgus* n. gen.
Mandible with a long pectinate lash 39
39. Leg 4 with third exopod segment II, I, 5 *Paramolgus* n. gen.
Leg 4 with third exopod segment III, I, 5 *Paraduridicola* n. gen.
40. Mandible with convex side of base bearing a proximally directed tooth *Odontomolgus* n. gen.
Mandible with convex side of base bearing one or more small digitiform lobes 41
41. Second maxilla with a large digitiform process on first segment *Panjakus* n. gen.
Second maxilla without such a process 42
42. Mandible with convex side of base bearing two small digitiform lobes; leg 4 with third exopod segment II, I, 5 *Anchimolgus* n. gen.
Mandible with convex side of base having a roughened area followed by a digitiform process; leg 4 with third exopod segment III, I, 5 *Zamolgus* n. gen.
43. Mandible with very short lash 44
Mandible with long lash 45
44. Mandible with convex side of base having a scalelike area with spinules; lash of second maxilla not "folded"; leg 4 with third exopod segment III, I, 5 *Contomolgus* n. gen.
Mandible with convex side of base having a large hyaline area without spinules; lash of second maxilla "folded"; leg 4 with third exopod segment II, I, 5 *Ascetomolgus* n. gen.
45. Mandible with convex side of base bearing a tooth 46
Mandible with convex side of base bearing a scalelike area with spinules 47
46. Tooth on mandible proximally directed; leg 4 with third exopod segment II, I, 5 *Plesiomolgus* n. gen.
Tooth on mandible distally directed; leg 4 with third exopod segment III, I, 5 *Paredromolgus* n. gen.
47. Mandible with basal area beyond indentation densely spinose; free segment of leg 5 with distal inner process *Pennatulicola* n. gen.
Mandible with basal area beyond indentation with a row of spinules on concave side and scalelike area with row of spinules followed by a serrated fringe on convex side; free segment of leg 5 without a distal inner process 48
48. Leg 4 with third exopod segment II, I, 5 *Metaxymolgus* n. gen.
Leg 4 with third exopod segment III, I, 5 *Doridicola* Leydig, 1853

Acaenomolgus n. gen.

Type-species.- *Acaenomolgus protulae* (Stock, 1959).

Acanthomolgus n. gen.

Type-species.- *Acanthomolgus exilipes* (Humes & Ho, 1968b).

Amarda n. gen.

Type-species.- *Amarda cultrata* n. sp.

Distinguishing characters.- Body transformed. Second antenna 3-segmented, with a single terminal claw. Mandible with a winglike process on the convex side of the base; lash relatively short and smooth. Legs 1-3 similar in both sexes with reduced armature. Legs 1-2 with 3-segmented exopods and 2-segmented endopods. Leg 3 with 2-segmented exopod (0-0; I, II) but lacking an endopod. Leg 4 absent in both sexes. Leg 5 in both sexes with a small free segment not clearly delimited from the body. Associated with madreporarian corals.

Anchimolgus n. gen.

Type-species.- *Anchimolgus digitatus* (Humes & Ho, 1968a).

Andrianellus n. gen.

Type-species.- *Andrianellus exsertidens* n. sp.

Distinguishing characters.- Body modified. Second antenna 4-segmented, with a single terminal claw. Second maxilla with the first segment bearing a long digitiform process. Legs 1 - 4 with 3-segmented rami except for leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment having II, I, 5. Leg 4 endopod 0 - 1; I. Associated with madreporarian corals.

Anisomolgus n. gen.

Type-species.- *Anisomolgus protentus* (Humes & Frost, 1964).

Ascetomolgus n. gen.

Type-species.- *Ascetomolgus plicatus* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with two terminal claws. Mandible with a very short lash. Second maxilla with a lash of peculiar form ("folded"). Legs 1 - 4 with 3-segmented rami, except for leg 4 endopod which is 2-segmented. Leg 4 exopod with II, I, 5. Leg 4 endopod with 0 - 1; II, the seta on the first segment being naked. Leg 1 endopod of the male with the third segment having I, I, 4 instead of I, 5 as in the female. Associated with octocorals.

Ascidioxynus n. gen.

Type-species.- *Ascidioxynus floridanus* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with two terminal claws. Mandible of simple form, with the slender base merging into a long pectinate lash. Legs 1 - 4 with 3-segmented rami, except leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment having II, I, 5. Leg 4 endopod with the formula 0 - 1; II, 1. Associated with ascidians.

Aspidomolgus Humes, 1969a.

Type-species.- *Aspidomolgus stoichactinus* Humes, 1969a.

Astericola Rosoll, 1889.

Type-species.- *Astericola clausi* Rosoll, 1889.

Colobomolgus n. gen.

Type-species.- *Colobomolgus dentipes* (Thompson & A. Scott, 1903).

Contomolgus n. gen.

Type-species.- *Contomolgus loboceansis* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with two terminal claws. Mandible with a very short lash. Legs 1 - 4 with 3-segmented rami, except for leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment having III, I, 5. Leg 4 endopod with 0 - 1; II, the seta on the first segment naked. Leg 1 endopod of the male with the third segment having I, I, 4 instead of I, 5 as in the female. Associated with alcyonaceans.

Debruma n. gen.

Type-species.- *Debruma clavelinae* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with three terminal claws. Mandible with the base bearing a slender bipectinate blade. Maxilliped of the female 2-segmented, the second and third segments fused. Legs 1 - 4 with 3-segmented rami, except for leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment II, I, 5. Leg 4 endopod having the formula 0 - 1; I. Associated with ascidians.

Doridicola Leydig, 1953.

Type-species.- *Doridicola agilis* Leydig, 1853.

Epimolgus Bocquet & Stock, 1956.

Type-species.- *Epimolgus trochi* (Canu, 1899).

Gelastomolgus Humes, 1968.

Type-species.- *Gelastomolgus spondyli* Humes, 1968.

Haplomolgus Humes & Ho, 1968a.

Type-species.- *Haplomolgus montiporae* Humes & Ho, 1968a.

Indomolgus Humes & Ho, 1966.

Type-species.- *Indomolgus brevisetosus* Humes & Ho, 1966.

Kelleria Gurney, 1927.

Type-species.- *Kelleria regalis* Gurney, 1927.

Lichomolgella G.O. Sars, 1918.

Type-species.- *Lichomolgella pusilla* G.O. Sars, 1918.

Lichomolgides Gotto, 1954.

Type-species.- *Lichomolgides cuanensis* Gotto, 1954.

Lichomolgus Thorell, 1859.

Type-species.- *Lichomolgus albens* Thorell, 1859.

Macrochiron Brady, 1872.

Type-species.- *Macrochiron fucicolum* Brady, 1872.

Meringomolgus n. gen.

Type-species.- *Meringomolgus facetus* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with a single terminal claw. Second maxilla sexually dimorphic, the outer (ventral) proximal element on the second segment in the female being minute, but in the male an unusually large proximally directed seta. Legs 1 - 4 with 3-segmented rami, except for leg 4 endopod which is 2-segmented. Third segment of leg 4 exopod III, I, 5. Leg 4 endopod with 0 - I; II. Leg 1 endopod of the male with the third segment having I, I, 4 instead of I, 5 as in the female. Associated with alcyonaceans.

Metaxymolgus n. gen.

Type-species.- *Metaxymolgus securiger* (Humes, 1964).

Monomolgus Humes & Frost, 1964.

Type-species.- *Monomolgus unihastatus* Humes & Frost, 1964.

Nasomolgus Sewell, 1949.

Type-species.- *Nasomolgus cristatus* Sewell, 1949.

Octopicola Humes, 1957.

Type-species.- *Octopicola superbus* Humes, 1957.

Odontomolgus n. gen.

Type-species.- *Odontomolgus actinophorus* (Humes & Frost, 1964).

Panjakus n. gen.

Type-species.- *Panjakus hydnophorae* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with a single terminal claw. Mandible with the basal area distal to the indentation having on the convex side a short distally directed digitiform process. Second maxilla with a large stout digitiform process on the first segment. Legs 1 - 4 with 3-segmented rami except for leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment having II, I, 5 or III, I, 5. Leg 4 endopod with 0 - 1; II, the seta on the first segment being

feathered. Leg 1 endopod of the male with third segment having I, I, 4 instead of I, 5 as in the female. Associated with madreporarian corals.

Paradoridicola n. gen.

Type-species.- *Paradoridicola squamiger* (Humes & Frost, 1964).

Paramacrochiron Sewell, 1949.

Type-species.- *Paramacrochiron maximum* (Thompson & A. Scott, 1903).

Paramolgus n. gen.

Type-species.- *Paramolgus politus* (Humes & Ho, 1967c).

Paraphiloconcha Yamaguti, 1936.

Type-species.- *Paraphiloconcha meretricis* Yamaguti, 1936.

Paredromolgus n. gen.

Type-species.- *Paredromolgus decorus* (Humes & Frost, 1964).

Pennatulicola n. gen.

Type-species.- *Pennatulicola pteroidis* (Della Valle, 1880).

Philoconcha Yamaguti, 1936.

Type-species.- *Philoconcha amygdalae* Yamaguti, 1936.

Plesiomolgus n. gen.

Type-species.- *Plesiomolgus organicus* (Humes & Ho, 1967a).

Prionomolgus Humes & Ho, 1968a.

Type-species.- *Prionomolgus lanceolatus* Humes & Ho, 1968a.

Pseudomacrochiron Reddiah, 1969.

Type-species.- *Pseudomacrochiron parvum* (A. Scott, 1909).

Rakotoa n. gen.

Type-species.- *Rakotoa proteus* n. sp.

Distinguishing characters.- Body modified. Second antenna 4-segmented, with a single terminal claw. Second maxilla with the first segment bearing a long digitiform process. Legs 1 - 4 with 3-segmented rami except for leg 4 endopod which is vestigial and represented only by an unornamented lobe which may bear a minute distal lobe suggesting a 2-segmented condition. Armature of legs 3 - 4 reduced, leg 3 endopod being 0 - 1, 0 - 2; 1 and leg 4 exopod I - 0; 0 - 1, I, 3. Associated with madreporarian corals.

Ravahina Humes & Ho, 1968a.

Type-species.- *Ravahina tumida* Humes & Ho, 1968a.

Schedomolgus n. gen.

Type-species.- *Schedomolgus arcuatipes* (Humes & Ho, 1968a).

Sewellochiron Humes, 1969c.

Type-species.- *Sewellochiron fidens* Humes, 1969c.

Spaniomolgus n. gen.

Type-species.- *Spaniomolgus compositus* (Humes & Frost, 1964).

Stellicola Kossmann, 1877.

Type-species.- *Stellicola thorelli* Kossmann, 1877.

Synstellicola n. gen.

Type-species.- *Synstellicola affinis* (Humes & Ho, 1967d).

Telestacicola n. gen.

Type-species.- *Telestacicola angoti* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with two terminal dentate claws. Legs 1-4 with 3-segmented rami except for leg 4 endopod which is a single segment. Leg 4 exopod with the third segment having II, I, 5. Leg 4 endopod with II, 1, the seta being feathered. Leg 1 endopod of the male with the third segment having I, I, 4 instead of I, 5 as in the female. Associated with telestacean octocorals.

Xenomolgus n. gen.

Type-species.- *Xenomolgus varius* n. sp.

Distinguishing characters.- Body transformed, elongated. Second antenna 4-segmented, with terminally one claw and one long almost clawlike seta. Mandible with a very short naked spiniform lash. Legs 1-4 with 3-segmented rami except for leg 4 endopod which is 2-segmented. Last segment of the exopod of legs 1-3 with III, I, 4; III, I, 4; and II, I, 2 respectively. Last segment of the endopod of legs 1-3 with I, 5; I, II, 3; and II, 1. Leg 4 exopod with the last segment III, I, 1. Leg 4 endopod with 0-0; II. Considerable variation in the armature of legs 1-4. Inner coxal seta on all four legs usually absent. Associated with madreporarian corals.

Zamoligus n. gen.

Type-species.- *Zamoligus tridens* n. sp.

Distinguishing characters.- Second antenna 4-segmented, with a single terminal claw. Mandible with the basal part having on its convex side a slender proximally directed digitiform process. Legs 1-4 with 3-segmented rami, except for leg 4 endopod which is 2-segmented. Leg 4 exopod with the third segment having III, I, 5. Leg 4 endopod having the formula 0-1; II, the seta on the first segment being naked. Leg 1 endopod of the male with the third segment having I, I, 4 instead of I, 5 as in the female. Associated with alcyonaceans.

Zygomolgus n. gen.

Type-species.- *Zygomolgus tenuifurcatus* (G.O. Sars, 1917a).

Family UROCOPIDAE n. fam.

With the characters of *Urocopia*.

Urocopia G.O. Sars, 1917b.

Type-species.- *Urocopia singularis* G.O. Sars, 1917b.

Family PSEUDANTHESSIIDAE n. fam.

First antenna usually 7-segmented, but 3- or possibly 6-segmented in *Kombia*. Legs 1-4 with a reduction occurring in a posterior to anterior series. In *Heteranthessius* and *Pseudanthessius* with 3-segmented rami except leg 4 endopod which is 1-segmented or reduced to a small knob (in one species of *Heteranthessius*). In *Meomicola* legs 1 and 2 with 3-segmented rami and leg 3 exopod 3-segmented, leg 4 exopod 1-segmented, legs 3 and 4 endopods absent. In *Temnomolgus* legs 1 and 2 with 3-segmented rami, leg 3 reduced to a small sclerotization with two setae, leg 4 absent. In *Kombia* legs 1 and 2 with 3-segmented exopods and 2-segmented endopods, leg 3 exopod 3-segmented but endopod absent, leg 4 absent. Leg 5 without a free segment and represented by two or three elements.

KEY TO THE GENERA OF THE PSEUDANTHRESSIIDAE

1. Leg 4 absent 2
 Leg 4 present, though in some cases much reduced 3
2. Legs 1 and 2 with 3-segmented exopods and 2-segmented endopods; second antenna with one terminal claw
 *Kombia* Humes, 1962
 Legs 1 and 2 with 3-segmented rami; second antenna with two terminal claws
 *Temnomolgus* Humes & Ho, 1966
3. Leg 3 with 3-segmented exopod, endopod absent; prosome truncated anteriorly
 *Meomicola* Stock, Humes & Gooding, 1963
 Leg 3 with both rami 3-segmented; prosome not truncated anteriorly 4
4. Leg 4 endopod represented only by a small segment or knob without spines or setae or with reduced elements;
 body of female transformed, with swollen prosome *Heteranthressius* T. Scott, 1904
 Leg 4 endopod 1-segmented with two well-developed elements; body of female cycloform, not transformed...
 *Pseudanthressius* Claus, 1889

Heteranthressius T. Scott, 1904.

Type-species.- *Heteranthressius dubius* (T. Scott, 1904). (See also T. Scott, 1903).

Kombia Humes, 1962.

Type-species.- *Kombia angulata* Humes, 1962.

Meomicola Stock, Humes & Gooding, 1963.

Type-species.- *Meomicola amplexans* Stock, Humes & Gooding, 1963.

Pseudanthressius Claus, 1889.

Type-species.- *Pseudanthressius gracilis* Claus, 1889.

Temnomolgus Humes & Ho, 1966.

Type-species.- *Temnomolgus eurynotus* Humes & Ho, 1966.

Family RHYNCHOMOLGIDAE n. fam.

With the characters of *Rhynchomolgus*.

Rhynchomolgus Humes & Ho, 1967b.

Type-species.- *Rhynchomolgus corallophilus* Humes & Ho, 1967b.

REFERENCES

- AURIVILLIUS, C.W.S., 1882. Bidrag till kannedomen om Krustaceer, som lefva hos Mollusker och Tunikater. Ofvers. K. Vetensk. - Akad. Förh., 39 (3): 31-67, pls. V-VII.
- BOCQUET, C. & J.H. STOCK, 1956. Copépodes parasites d'invertébrés des côtes de la Manche. II. Sur un Lichomolgide parasite des Gibbules, *Lichomolgus* (*Epimolgus*) *trochi*. Arch. Zool. exp. gén., 94 (notes et revue, 1): 10-16, fig. 1-2.
- & -----, 1958. Copépodes parasites d'invertébrés des côtes de France, VI. Description de *Paranthressius myxicolae* nov. sp., Copépode semi-parasite du Sabellidae *Myxicola infundibulum* (Renier). Proc. Kon. Nederl. Akad. Wetensch., Amsterdam, (C) 61 (2): 243-253, figs. I-IV.
- BRADY, G.S., 1872. Contribution to the study of the Entomostraca, VII. A list of the non-parasitic marine Copepoda of the north-east coast of England. Ann. Mag. nat. Hist., (4) 10 (55): 1-17, pls. II-VI.
- CANU, E., 1891. Les Copépodes marins du Boulonnais, V. Les semi-parasites. Bull. sci. France Belgique, 23: 467-487.
- , 1899. Sur *Lichomolgus trochi*, nov. sp., Copépode nouveau parasite d'un mollusque. Trav. Stat. zool. Wimereux, 7: 73-79, 592, pl. VIII, figs. 1-10.
- CLAUS, C., 1889. Ueber neue oder wenig bekannte halbparasitische Copepoden, insbesondere der Lichomolgiden- und Ascomyzontiden-Gruppe. Arb. zool. Inst. Univ. Wien, 8 (3): 1-44, pls. I-VII.
- DELLA VALLE, A., 1880. Sui Coriceidi parassiti, e sull'anatomia del gen. *Lichomolgus*. Mitt. zool. Stat. Neapel, 2: 83-106, pl. V, figs. 1-30, pl. VI, figs. 31-58.
- EDWARDS, C.L., 1891. Beschreibung einiger neuen Copepoden und eines neuen copepodenähnlichen Krebses, *Leuckartella paradoxa*. Arch. Naturgesch., (57) 1 (1): 75-104, pls. III-V.
- GOTTO, R.V., 1954. *Lichomolgus cuanensis* n.g., n. sp., an ascidicolous copepod occurring in *Trididemnum tene-rum* (Verrill). Parasitology, 44 (3/4): 379-386, figs. 1-20.
- GURNEY, R., 1927. Zoological results of the Cambridge expedition to the Suez Canal, 1924, XXXIII. Report on the Crustacea-Copepoda (littoral and semi-parasitic). Trans. zool. Soc. London, 22 (4): 451-577, text-figs. 105-168.

- HEEGAARD, P., 1944. A new copepod (*Scambicornus hamatus*) parasitic on a Japanese holothurian. Vidensk. Medd. Dansk naturh. Foren., 107: 359-366, figs. 1-10.
- HUMES, A.G., 1957. *Octopicola superba* n. g., n. sp., Copépode Cyclopoïde parasite d'un Octopus de la Méditerranée. Vie Milieu, 8 (1): 1-8, pls. I-II, figs. 1-22.
- , 1962. *Kombia angulata* n. gen., n. sp. (Copepoda, Cyclopoida) parasitic in a coral in Madagascar. Crustaceana, 4 (1): 47-56, figs. 1-38.
- , 1964. New species of *Lichomolgus* (Copepoda, Cyclopoida) from sea anemones and nudibranchs in Madagascar. Cahiers ORSTOM Océanogr., 1963, 6 (ser. Nosy Bé II): 59-130, figs. 1-197.
- , 1968. Two new copepods (Cyclopoida, Lichomolgidae) from marine pelecypods in Madagascar. Crustaceana, suppl. 1: 65-81, figs. 1-64.
- , 1969 a. *Aspidomolgus stoichactinus* n. gen., n. sp. (Copepoda, Cyclopoida) associated with an actinarian in the West Indies. Crustaceana, 16 (3): 225-242, figs. 1-69.
- , 1969 b. Cyclopoida copepods associated with antipatharian coelenterates in Madagascar. Zool. Mededel., 44 (1): 1-30, figs. 1-98.
- , 1969 c. A cyclopoid copepod, *Sewelochiron fidens* n. gen., n. sp., associated with a medusa in Puerto Rico. Beaufortia, 16 (219): 171-183, figs. 1-27.
- , 1969 d. Copepods of the genus *Scambicornus* (Cyclopoida, Lichomolgidae) associated with holothurians in the West Indies. Stud. Fauna Curaçao, 29 (109): 79-95, figs. 1-83.
- HUMES, A.G. & B.W. FROST, 1964. New lichomolgoid copepods (Cyclopoida) associated with alcyonarians and madreporarians in Madagascar. Cahiers ORSTOM Océanogr., 1963, 6 (ser. Nosy Bé II): 131-212, figs. 1-236.
- HUMES, A.G. & J.S. HO, 1966. New lichomolgoid copepods (Cyclopoida) from zoanthid coelenterates in Madagascar. Cahiers ORSTOM Océanogr., 4 (2): 3-47, figs. 1-143.
- & -----, 1967 a. New cyclopoid copepods associated with the alcyonarian coral *Tubipora musica* (Linnaeus) in Madagascar. Proc. U. S. nation. Mus., 121 (3573): 1-24, figs. 1-69.
- & -----, 1967 b. New cyclopoid copepods associated with the coral *Psammocora contigua* (Esper) in Madagascar. Proc. U. S. nation. Mus., 122 (3586): 1-32, figs. 1-115.
- & -----, 1967 c. Two new species of *Lichomolgus* (Copepoda, Cyclopoida) from an actinarian in Madagascar. Cahiers ORSTOM Océanogr., 5 (1): 3-21, figs. 1-53.
- & -----, 1967 d. New species of *Stellicola* (Copepoda, Cyclopoida) associated with starfishes in Madagascar, with a redescription of *S. caeruleus* (Stebbing, 1900). Bull. Brit. Mus. (nat. Hist.), (Zool.) 15 (5): 201-225, figs. 1-141.
- & -----, 1968 a. Lichomolgoid copepods (Cyclopoida) associated with corals in Madagascar. Bull. Mus. comp. Zool., Harvard Univ., 136 (10): 353-413, figs. 1-259.
- & -----, 1968 b. Cyclopoid copepods of the genus *Lichomolgus* associated with octocorals of the family Nephtheidae in Madagascar. Proc. U. S. nation. Mus., 125 (3661): 1-41, figs. 1-113.
- & -----, 1969. Cyclopoid copepods parasitic in holothurians in Madagascar. J. Parasitol., 55 (4): 878-894, figs. 1-82.
- HUMES, A.G. & J.H. STOCK (in press). A revision of the Lichomolgidae, cyclopoid copepods mainly associated with marine invertebrates. Smithsonian Contributions to Zoology.
- ILLIG, P.L. & A.G. HUMES, 1971. *Henicoxiphium redactum*, a new cyclopoid copepod associated with an ascidian in Florida and North Carolina. Proc. biol. Soc. Wash., 83 (49): 569-577, figs. 1-26.
- KOSSMANN, R., 1877. Entomostraca (1. Theil: Lichomolgidae). In: Zool. Ergeb. Reise Küstengeb. Rothen Meeres, erste Hälfte, IV: 1-24, pls. I-VI.
- LEYDIG, F., 1853. Zoologische Notizen, 1. Neuer Schmarotzerkrebse auf einem Weichthier. Z. wiss. Zool., 4 (3/4): 377-382, figs. 1-5.
- REDDIAH, K., 1969. *Pseudomacrochiron stocki* n. g., n. sp., a cyclopoid copepod associated with a medusa. Crustaceana, 16 (1): 43-50, figs. 1-3.
- ROSOLL, A., 1889. Ueber zwei neue an Echinodermen lebende parasitische Copepoden: *Ascomyzon comatulae* und *Astericola Clausii*. Sitzungsber. math. naturw. Cl. K. Akad. Wiss. Wien, 97 (1): 188-202, figs. 1-8.
- SARS, G.O., 1917 a. An account of the Crustacea of Norway with short descriptions and figures of all the species, 6, Copepoda, Cyclopoida, XI & XII, Clausidiidae, Lichomolgidae (part): 141-172, pls. LXXXI-XCVI. (Bergen Mus., Bergen).
- , 1917 b. *Urocopia singularis* G.O. Sars, a peculiar semiparasitic copepod from great depths of the North Atlantic Ocean. Bergens Mus. Aarbok 1916-17, 1 (naturvidensk. Raekke, 4): 1-11, figs. 1-15.
- , 1918. An account of the Crustacea of Norway with short descriptions and figures of all the species, 6, Copepoda, Cyclopoida, XIII & XIV, Lichomolgidae (concluded), Oncaeidae, Corycaidae, Ergasilidae, Clausidiidae, Eunicicolidae, Supplement: 173-225, pls. XCVII-CXVIII. (Bergen Mus., Bergen).
- SARS, M., 1862. Beskrivelse med Afbildninger af fire nye parasitiske Copepoder. Forh. Vidensk.-Selsk. Christiania, 1861: 134-141.
- SCOTT, A., 1909. The Copepoda of the Siboga Expedition, I. Free-swimming, littoral and semi-parasitic Copepoda. Siboga Exped., 29a: 1-323, pls. I-LXIX.
- SCOTT, T., 1903. On some new and rare Crustacea collected at various times in connection with the investigations of the Fishery Board for Scotland. Ann. Rept. Fish. Bd. Scotland, 1902, 21 (3): 109-135, pls. II-VI.
- , 1904. Notes on some rare and interesting marine Crustacea. Ann. Rept. Fish. Bd. Scotland, 22 (3): 242-261, pls. XIII-XV.
- SEWELL, R.B.S., 1949. The littoral and semi-parasitic Cyclopoida, the Monstrilloidea and Notodelphyoida. John Murray Exped. 1933-34, sci. Repts., 9 (2): 17-199, text-figs. 1-41 and 1 map.

- STOCK, J.H., 1959. Copepoda associated with Neapolitan invertebrates. *Pubbl. Staz. zool. Napoli*, 31 (1): 59-75, figs. 1-8.
- , 1968. Copepoda endoparasitic of tropical holothurians. *Bull. zool. Mus. Univ. Amsterdam*, 1 (9): 89-105, figs. 1-16.
- STOCK, J.H. & G. KLEETON, 1963. Copépodes associés aux Invertébrés des côtes du Roussillon, 1. *Vie Milieu*, 13 (4): 681-702, figs. 1-11.
- STOCK, J.H., A.G. HUMES & R.U. GOODING, 1963. Copepoda associated with West Indian invertebrates, IV. The genera *Octopicola*, *Pseudanthessius* and *Meomicola* (Cyclopoida, Lichomolgidae). *Stud. Fauna Curaçao*, 18 (77): 1-74, figs. 1-24.
- THOMPSON, I.C. & A. SCOTT, 1903. Report on the Copepoda collected by Professor Herdman, at Ceylon, in 1902. *Rept. Govt. Ceylon Pearl Oyster Fish. Gulf of Manaar, suppl. Repts.*, 7: 227-307, pls. I-XX.
- THORELL, T., 1859. Till kännedom om vissa parasitiskt lefvande Entomostraceer. *Öfvers. K. Vetensk.-Akad. Förh.*, 16 (8): 335-362.
- VOIGT, W., 1892. *Synapticola teres* n. g., n. sp., ein parasitischer Copepode aus *Synapta kefersteinii* Sel. *Z. wiss. Zool.*, 53 (Suppl.): 31-42, pl. V.
- YAMAGUTI, S., 1936. Parasitic copepods from mollusks of Japan, I. *Jap. J. Zool.*, 7 (1): 113-127, pls. VII-XIII.

Arthur G. Humes
Boston University Marine Program,
Marine Biological Laboratory
Woods Hole, Massachusetts 02543
U.S.A.

Jan. H. Stock
Institute of Taxonomic Zoology (Zoölogisch Museum)
Plantage Middenlaan 53
Amsterdam C.
The Netherlands

Received: March 10, 1972

Requests for exchange or sale of this publication should be addressed
to the Administration of the Zoological Museum of the University of Amsterdam

0430506-028-724

BUI