REPORT ON ASCIDICOLE COPEPODA COLLECTED DURING THE MELANESIA EXPEDITION OF THE OSAKA MUSEUM OF NATURAL HISTORY, OSAKA, JAPAN

AUTHOR(S):

Illg, Paul L.

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REPORT ON ASCIDICOLE COPEPODA COLLECTED DURING THE MELANESIA EXPEDITION OF THE ÔSAKA MUSEUM OF NATURAL HISTORY, ÔSAKA, JAPAN[1)2)]

PAUL L. ILLG[3)]

Department of Zoology, University of Washington, Seattle, Washington, U.S.A.

With 8 Text-figures

This paper reports on a collection of ascidicole copepods obtained from the ascidians presented by Dr. R.L.A. CATALA, of the Aquarium of Noumea, New Caledonia, to the Melanesia Expedition of the Ôsaka Museum. The specimens were kindly sent to me by Dr. Takasi TOKIOKA of the Seto Marine Biological Laboratory, Sirahama, Japan. Dr. TOKIOKA furnished the identifications of the ascidian hosts; indeed, the copepod specimens were mainly observed and set aside by him in the course of the study of the collection of ascidians. He has published the result of his research on this material (TOKIOKA, 1961). The actual series of specimens of copepods is small, but it is of the greatest interest. The three species belonging to the family Notodelphyidae are all undescribed forms. One of these represents a genus new to science, and one which is particularly remarkable in structural peculiarities in a family already noted for the range of bizarre modifications of body form. These results strongly suggest that a great expansion of our knowledge of this interesting group of copepods awaits the extension of exploration and study of the ascidians of the tropical Indopacific region.

I wish to express sincere thanks to Dr. Takasi TOKIOKA for sending me this material and for many kindnesses in connection with the completion of the study.

List of Ascidian Hosts and their Associates

Ascidia sydneiensis samea (OKA):

1 amphipod, unidentified

1 cyst-like structure, unidentified

Doropygus catalai, new species, 3 females

1) Scientific Results of the Melanesia Expedition, No. 21.

2) Contributions from the Ôsaka Museum of Natural History, No. 111 and also Contributions No. 527 from the Seto Marine Biological Laboratory.

3) Support of research by Grant GB-6474X, National Science Foundation, is acknowledged.

Apodelphys lamellipes, new genus, new species, 4 females
Paramphiascella pacifica VERVOORT, 1962, 1 male

Cnemidocarpa areolata (HELLER):
1 amphipod, unidentified
1 calanoid copepod, planktonic, accidental, not identified

Symplegma oceania TOKIOKA:
1 fragment, probably family Ascidicolidae

List of Species of Copepoda

Family Notodelphyidae (Cyclopoida):
Paranotodelphys constricta, new species, host?.
Doropygus catalai, new species, host, *Ascidia sydneiensis samea* (OKA).
Apodelphys lamellipes, new genus, new species, host, *Ascidia sydneiensis samea* (OKA).

Family Ascidicolidae (Cyclopoida):
Fragment, unidentified, host *Symplegma oceania* TOKIOKA; from test.

Family Diosaccidae (Harpacticoida):
Paramphiascella pacifica VERVOORT, 1962, host *Ascidia sydneiensis samea* (OKA).

Report on the Species

Genus *Paranotodelphys* SCHELLENBERG, 1922

In the collection there is a single, considerably mutilated specimen, separated from the host in the processes of collecting and preserving. However, the animal, a mature female, remains sufficiently distinctive to demonstrate readily it represents a hitherto undescribed species of *Paranotodelphys* SCHELLENBERG, 1922. The genus was proposed for three species, another was transferred from a second genus (ILLG, 1958), and there have been four additional species recently described in detail (OOISHI, 1963; STOCK, 1967). There now should be a sound basis for a more substantial appreciation of the genus. For most of the significant characters there is a considerable range of variation. In a monographic survey of notodelphyids (ILLG, 1958), I considered SCHELLENBERG's original definition and general concept broad enough to include *Pseudonotodelphys phallusiae* GURNEY, 1927, and accordingly transferred this species and synonymized the genus. At that time I added a species to the closely related genus *Notodelphyopsis* SCHELLENBERG, 1922. My present inclination, after review of the species, would be to combine the genera. However, there remains a very substantial character of the adult females for distinction of the two series, namely a 4–segmented versus a 5–segmented urosome. Only two males, from different species, and few developmental stages have so far been found. It is

possible fuller information on the males and immature stages would help to clarify the taxonomic situation. Only two species have so far been assigned to *Notodelphyopsis* (ILLG, 1958). They differ substantially from each other, with a range of variation in characters of the appendages almost coinciding with the corresponding range in the more numerous species of *Paranotodelphys*. The full series has a strong cohesiveness. As the older authors indicated by their names, there is a high degree of affinity with the genus *Notodelphys*. The main body articulation is exactly the same; the number of urosomal segments corresponds in *Notodelphys* and *Paranotodelphys* and is one less in *Notodelphyopsis*. It is striking to note that all the reports so far point strongly to the probability the complex of two genera is faunistically an Indopacific assemblage. The cluster of species found in and near the Gulf of Suez, and the sprinkling occurring mainly eastward suggest to me that a considerable expansion of the roster of species can be expected as the Indian Ocean and tropical Pacific are explored for ascidians and ascidicole copepods.

Since a substantial collection of ascidicole copepods made in the Indian Ocean survey of the early 1960's remains unreported, I refrain here from a taxonomic regrouping, in the hope that details from additional species will afford the indications as to whether generic lines can be drawn. At this time, therefore, I retain *Notodelphyopsis* for *N. falcifera* and *N. perplexa*. SCHELLENBERG was in error in the use of the gender of his genus and I followed his mistake (ILLG, 1958). *Notodelphyopsis falcifera* SCHELLENBERG was very well described, but scarcely any illustration was provided. OOISHI (1962) has redescribed the species with excellent full illustration.

Some slight modifications applied to the excellent key of STOCK (1967) furnish the basis for an expanded key to females in this complex of species.

Key to species of Notodelphyopsis and Paranotodelphys, females

1a) Urosome 4–segmented ..... *Notodelphyopsis* 2
b) Urosome 5–segmented ..... *Paranotodelphys* 3
2a) Body depressed, antennule 7–segmented. *N. falcifera* SCHELLENBERG, 1922
b) Body compressed, antennule 9–segmented. *N. perplexa* ILLG, 1958
3a) Basipod of P_4 very elongate (free lateral margin several times longer than articulated margin) 4
b) Basipod of P_4 much wider than long 5
4a) Incubatory pouch globular. Caudal ramus twice as long as anal segment. *P. gracilis* SCHELLENBERG, 1922
b) Incubatory pouch shield-shaped. Caudal ramus only slighly longer than anal segment. *P. scutiformis* SCHELLENBERG, 1922
5a) Basipod of mx_1 with 2 or 3 setae.....6
b) Basipod of mx_1 with 1 seta 8
6a) Basipod of mx_1 with 3 setae. *P. longicauda* SCHELLENBERG, 1922
b) Basipod of mx_1 with 2 setae 7

7a) Mxp with 2 setae on segment 3. A_1 9–segmented. *P. villosa* OOISHI, 1963
b) Mxp with 3 setae on segment 3. A_1 8–segmented. *P. constricta*, new species
8a) Mx_2 with 2 setae on 5th segment. Mxp with 2 setae on 3rd segment. P_4 with 4 spines and 5 setae on 3rd exopod segment. *P. phallusiae* (GURNEY, 1927)
b) Mx_2 with 3 setae on 5th segment. Mxp with 3 setae on 3rd segment. P_4 with 3 spines and 5 setae on 3rd exopod segment.....9
9a) Caudal ramus about as long as anal segment. A_1 9– or 10– segmented 10
b) Caudal ramus about twice as long as anal segment. A_1 11–segmented. *P. furcifera* STOCK, 1967
10a) Body slender. A_1 10–segmented. Basal two segments of A_2 fused. *P. saccata* STOCK, 1967
b) Body clumsy. A_1 9–segmented. Basal two segments of A_2 free. *P. engeli* STOCK, 1967

Paranotodelphys constricta, new species

(Figures 1, 2)

Type: Holotype, female, appendages dissected and mounted on 2 microslides. (Cat. Nos. OMNH Cop 001–002, Ôsaka Museum of Natural History, Ôsaka, Japan).

Type locality: Noumea, New Caledonia.

Host: Unknown

Description: Female (figs. 1, 2): General features: Total length, based on measurements of individual seen in profile, taken from anterior-most projection of cephalosome to end of terminal piece of urosome (caudal rami lacking on available specimen), 2.3 mm. Body (figs. 1a, 1b) delimited into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds, metasome consisting of three relatively normal leg-bearing segments, and inflated incubatory region: a complex, bearing fourth and probably fifth legs, and totally enclosing brood-pouch. Fifth legs probably represented by two minute ventral prominences somewhat separated just at posterior edge of complex. Articulation of metasome and urosome between incubatory complex and anatomically seventh thoracic segment. Urosome (fig. 1, c) slender, with slight taper posteriorly, composed of 5 well-defined elements, with following approximate proportional lengths: 1.5:1.5:1.0:1.0:2.5. Indications of genital apparatus, apparently a vulva at midline, and diverging sclerotized seminal tubes, at the posterior third of first urosomal segment, suggesting this segment is actually one of the thoracic series.

Head structures: Anterior margin of head prolonged ventrally as very long

blunt-conical rostrum, reaching about to distal margin of second segment of antennule. Eight-segmented antennule (fig. 1, d) slender but short, reaching only to posterior third of cephalosome. Appendage with very distinctive outline, deriving from marginal expansion of second segment, contrasting with markedly slender third segment. Resulting aspect somewhat geniculate. Taper of distal 5 segments

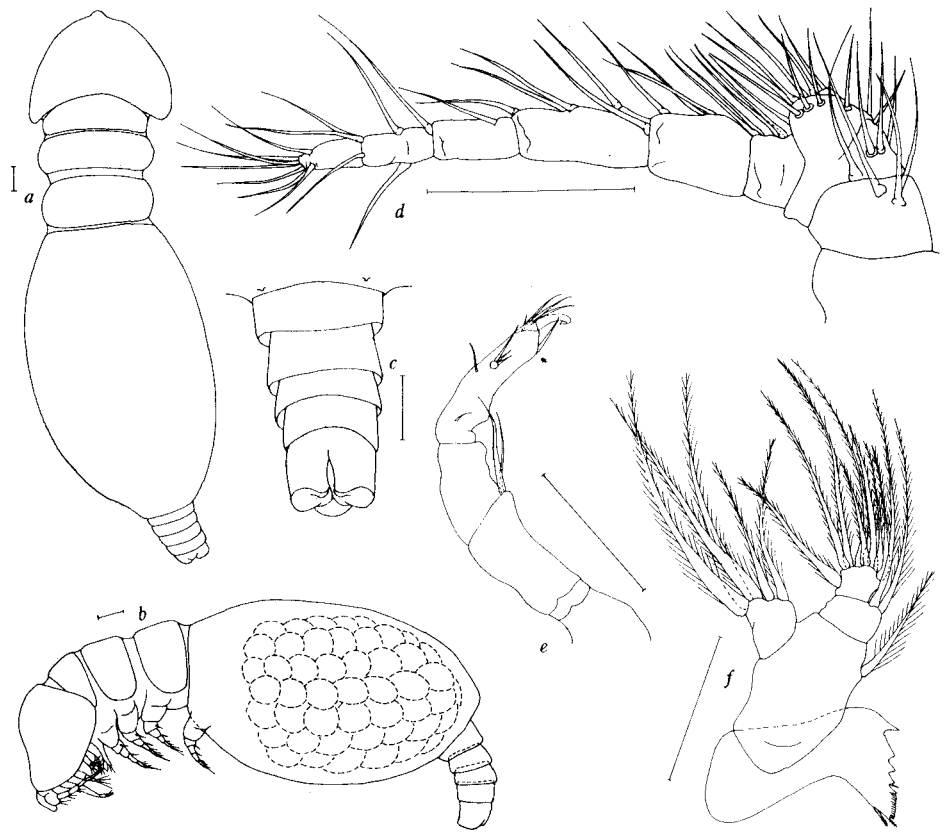

Fig. 1. *Paranotodelphys constricta*, new species. Female: a, habit, dorsal view; b, habit, lateral; c, urosome (lacking caudal rami); d, antennule; e, antenna; f, mandible. The scales referring to a, b, c represent 0.1 mm. The remaining scales represent 0.01 mm.

very gradual, each segment only slightly narrower than next proximal. Setal formula as follows: Segment I–3 setae; II– about 17 setae; III–4 setae; IV–3 setae; V–4 setae; VI–2 setae; VII– about 5 setae; VIII– about 8 setae. Differentiation of aesthetes from setae in this complement not possible in present state of material.

Antenna (fig. 1, e) composed of three segments, of following approximate

proportional lengths, basal to distal: 5.0:4.0:6.0. A right-angled flexure between clearly articulated second and third segments. A diagonal articulation setting off first from second segment in a joint apparently of limited mobility. Two long, subequal setae inserted on inner margin of segment 1 at distal articulation. Inserted near outer margin of segment 3 at intervals only roughly equal to about a fourth of length of margin a single proximal seta, a single second seta, and a trio of setae not far beyond midpoint. On distal margin inserted a stout tapered, curved hook, accompanied by 3 curved, stiffened, bluntended setae in a group and 2 additinoal setae.

Mandible (fig. 1, f) consisting of bimerous protopodite and bimerous endopodite and unimerous exopodite. Masticatory lamella with 4 major teeth, some accessory spinules and setules, proximal row of closely set denticles and most proximally group of setules. Long basipodite bearing a seta at about the distal sixth of medial margin. Proximal segment of the endopodite bearing 2 subequal setae at the distal medial corner. On distal margin of second segment 7 setae in a close-set row, one seta being offset, thus lying directly behind fourth seta of this series. Slightly separated from the row of setae, an eighth seta, on basal part of lateral margin. Segmentation of exopodite suppressed, integumental folds perhaps indicating flexures. This ramus bearing 5 setae along medial and terminal margins. Setae long, graduated in length and terminal seta longest, basally.

Maxillule (fig. 2, g) consisting of obscurely bimerous protopodite and unimerous rami. Laterally near distal margin of the coxopodite an epipodite, represented by long stout seta and a short more distal setule. Two expansions of coxopodite apparently representing endites. Major endite prolonged and bearing 7 setae of varying dimensions along medial margin. Secondary endite represented by reduced prominence from which extending non-articulated seta. Medial margin of basipodite bearing 1 laterally directed short seta and a long, distally directed seta at distal medial corner. Each of these setae inserted on a considerable prominence. Endopodite bearing 6 setae: a distal trio, 2 medial setae markedly shorter than others and inserted on an emargination, and a sixth seta just subapical on lateral margin. Exopodite of almost semicircular outline with 4 setae arranged along straight lateral margin in compact row.

Large basal segment of pentamerous maxilla (fig. 2, h) bearing 4 endites, proximal of which bearing 3 setae; second, 1 seta; third, 2 setae; fourth, 2 setae and a proximal setule. Second segment produced medially as long, slender falcate process. Inserted with this process a slightly longer slender seta. Third and fourth segments each bearing 1 long, slender seta, inserted at distal medial corner. Small fifth segment bearing 3 subequal apical setae.

Maxilliped (fig. 2, i) trimerous, basal segment constituting about two-thirds of total mass and bearing 9 setae arranged in 2 groups on medial margin. Proximal group consisting of 3 setae arranged in regular row at about midpoint of margin and

a smaller seta offset onto face of segment. Distal group consisting of marginal quartet and solitary seta offset onto face of segment. Second segment elongate, without armature except for a basal medial row of conspicuous but fine cilia. Terminal segment small, truncate, bearing 3 subequal setae. There is a small lateral lobe on the distal margin of the second segment, at the articulation of the terminal segment. Swimming legs: First swimming legs (fig. 2, j) consisting of bimerous protopodites

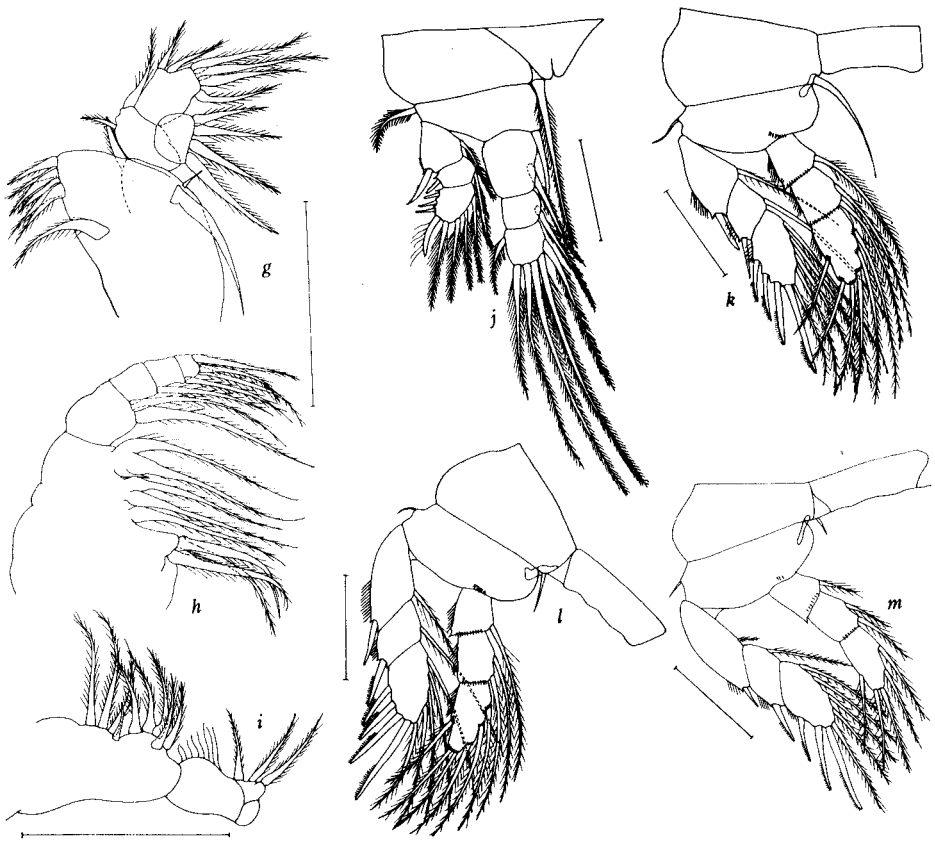

Fig. 2. *Paranotodelphys constricta*, new species. Female: g, maxillule; h, maxilla; i, maxilliped; j, first leg; k, second leg; l, third leg; m, fourth leg. The scales accompanying the figures represent 0.01 mm.

and trimerous rami. Intercoxal plate large and subtriangular in outline. Inserted on the distal medial corner of coxopodite a seta reaching about to distal margin of apical segment of endopodite. Outline of basipodite trapezoidal, with lateral margin very reduced. Inserted on lateral margin a slender seta reaching about distal margin of first segment of exopodite. A slender spine articulating on medial distal corner of basipodite and reaching to proximal third of second segment of

endopodite. Endopodite extending far beyond exopodite. Basal segment comprising about half length of ramus and bearing single seta just beyond midpoint of medial margin. Second segment bearing single seta at middle of medial margin. Terminal segment bearing 2 medial setae, 3 terminal setae, and 1 lateral seta in emargination at proximal third of lateral margin. Exopodite flexed as usual in species of *Notodelphys*. Basal and second segments each bearing spine at distal lateral corner and seta at or near distal corner of medial margin. Terminal segment with 3 lateral spines, 1 terminal spine, 1 terminal seta, and 3 medial setae. All spines on lateral margin subtended by weak spinous processes. Spine of second segment and proximal spine of distal segment short, about one-third to one-half as long as spine of basal segment or the approximately equal terminal spine.

Second legs (fig. 2, k) with bimerous protopodites, trimerous endopodites and Trimerous exopodites. Medial seta of coxopodite well developed. Lateral seta of basipodite reduced to a setule. Endopodite about equal to exopodite. Basal segment of endopodite comprising about a fourth of ramus, with 1 seta at distal medial corner. Ornamentation of spinules on distal margin. Second segment with 2 medial setae and distal marginal ornamentation of spinules. Terminal segment subrectangular in outline, bearing 3 medial setae, 1 terminal seta, 2 lateral setae, medial and lateral setae inserted in slight emarginations. Exopodite straight, basal and second segments each with 1 lateral spine, 1 medial seta. Terminal segment with 3 lateral spines, 1 terminal spine, 1 terminal seta, 4 medial setae. Spines roughly graduated in length basal to distal, apical spines much the longest.

Third legs (fig. 2, l) in general resembling second legs, with exception that endopodite slightly smaller in proportion to exopodite, and bearing 2 apical setae and a single lateral seta, total number of setae remaining the same. Seta of coxopodite reduced, seta of basipodite much reduced.

Fourth legs (fig. 2, m) differing from third leg in further reduction of endopodite in proportion to exopodite and in armature, having one less seta on medial margin of terminal segment of endopodite and one less lateral spine on terminal segment of exopodite. In addition, setae of endopodite, seta of basal segment of exopodite, lateral seta of basipodite and medial seta of coxopodite very much reduced.

Fifth legs possibly represented by pair of minute protuberances near posterior border of ventral surface of incubatory complex, seen before clearing specimen in lactic acid.

Caudal rami lost on only available specimen.

Remarks: The name of the species refers to the distinctive aspect of the antennule, the narrow third segment appearing markedly constricted in contrast to the second.

Genus *Doropygus* THORELL, 1859

There has been a recent great expansion of the number of species known in this

genus. The type species, *Doropygus pulex* THORELL, 1859, although widely reported, remains very poorly understood, taxonomically and biologically. Some recent discussions, based on detailed descriptions and figures, begin to marshall evidence to deal with what is apparently a complex of species, rather feebly differentiated morphologically (ILLG, 1958; ILLG and DUDLEY, 1961, 1965; DUDLEY, 1966; STOCK, 1967). Other individual species and some possible species-groups within the genus offer puzzling aspects. The new species described below seems to have affinities with *Doropygus longimatrix* SCHELLENBERG, 1922 and *D. apicatus* STOCK, 1967, suggesting that perhaps a "*longimatrix*-complex", in the Indopacific, is somewhat comparable to the predominantly Atlantic "*pulex*-complex". See further discussion below, following the species description, under the rubric "Remarks".

Doropygus catalai, new species

(Figs. 3, 4, 5)

Types: Holotype, female (Cat. Nos. OMNH Cop 003–004, Ôsaka Museum of Natural History), and paratypes, 13 females (2 dissected and mounted on microslides; Cat. Nos. OMNH Cop 005–007, Ôsaka Museum of Natural History).

Type locality: Noumea, New Caledonia.

Host: *Ascidia sydneiensis samea* (OKA). OMNH. Asc. 004.

Description: Female (figs. 3, 4, 5):

General features: Body (fig. 3, a) large, robust, principal portion of cephalosome measuring about 2 mm overall. Body delimited into cephalosome, metasome, urosome. Lateral lobes of cephalosome expanded in outline and directed somewhat laterally. In dorsal view head half again as wide as succeeding anteriormost metasomal elements; thus distinctive in appearance. Cephalosome supporting appendages through maxillipeds. Metasome of first 4 leg-bearing segments, fourth posteriorly inflated to enclose brood-pouch. Metasome much fused, in some specimens only first segment clearly delimited, but others indicated. Articulation of metasome and urosome between anatomically thoracic segments of fourth swimming legs and fifth legs, however, considerable fusion of this joint. Urosome slender, obscurely 6–segmented. First and second urosomal segments partially fused. Segments with following approximate proportional lengths (although some margins difficult to determine, and also urosome characteristically disposes itself in a curved arrangement in the longitudinal axis): 1:2:3.1:3:2:1, measured ventrally, anterior to posterior. Anal segment of urosome with deep anal cleft, resulting processes divergent.

Head structures: Apically on head a short, broad rostrum, widely curved in dorsal outline (fig. 3, b). Ten-segmented antennule with distinctive aspects of posture and configuration. Outline sinuate, tapering in superficial aspect. Basal portion, composed of first three segments, deceptive in appearance. Superficial aspect of

usual stout, somewhat tapered basal portion, as characteristic through genus. However, first two segments, particularly, with flattening, accompanied by considerable expansion anteriorly. Extended margin so produced then rolled back ventrally and posteriorly, so apparent anterior margin of basal portion of appendage actually edge of fold. Much of usual marginal ornamentation of second segment of other species here seen as though lying on surface. Appendage as seen in un-

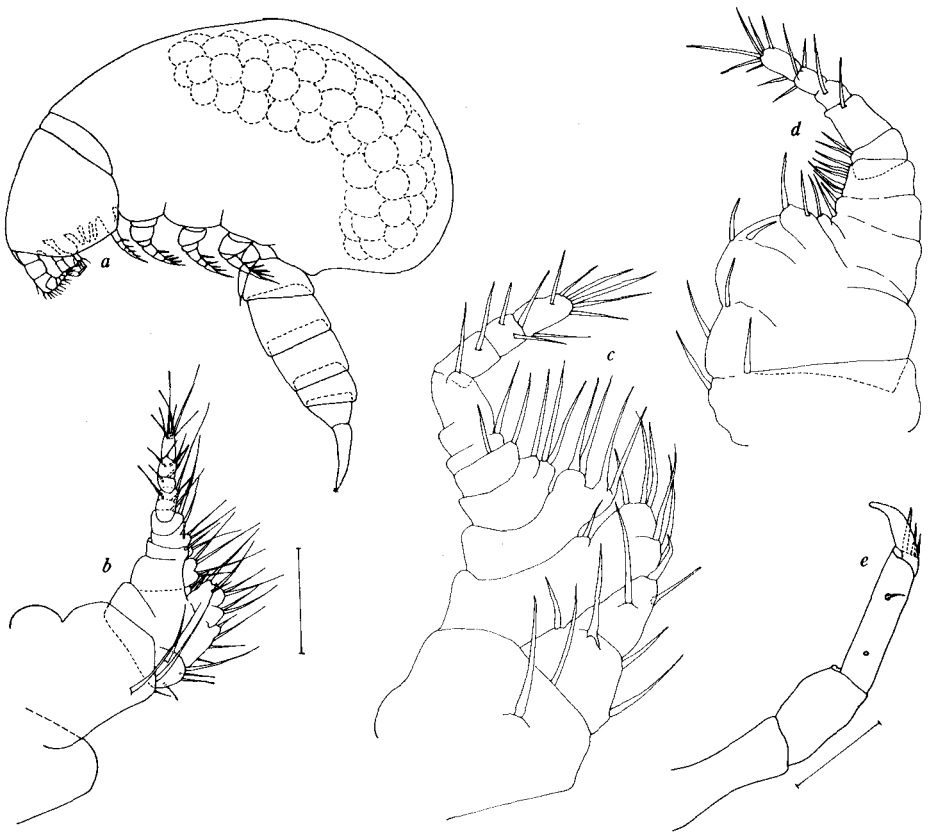

Fig. 3. *Doropygus catalai*, new species. Female: a, habit, lateral view; b, antennule; c, antennule, enlarged; d, antennule, flattened by drying; e, antenna. The scales accompanying figures b, e represent 0.01 mm. The setation of the antennule is incompletely represented.

flattened preparation (fig. 3 b, 3 c). Antennule flattened by drying (fig. 3, d). Segment 3, viewed after drying, showing setae born on considerable, flat, lobe-like expansion. Second segment including proximal triangular setiferous piece often set off as free segment in many notodelphyids. Approximate setal formula follows; setation incompletely shown on figures, due to great difficulty of working with contortions of appendage. Approximate setal formula: segment I–2 setae; II–14 setae,

1 hook; III–4 setae; IV–2 setae; V–3 setae; VI–2 setae; VII–4 setae; VIII–2 setae; IX–4 setae; X– about 7 setae. In general setae very short and slender. Longest setae on segments I, VI, VII, VIII, X.

Antenna (fig. 3, e) slender, elongate, trimerous. Setal armature much reduced. Segment 3 with minute setule on inner margin at about distal third. On distal margin heavy curved hook, and inserted on its area of articulation basally 3 small, subequal setae.

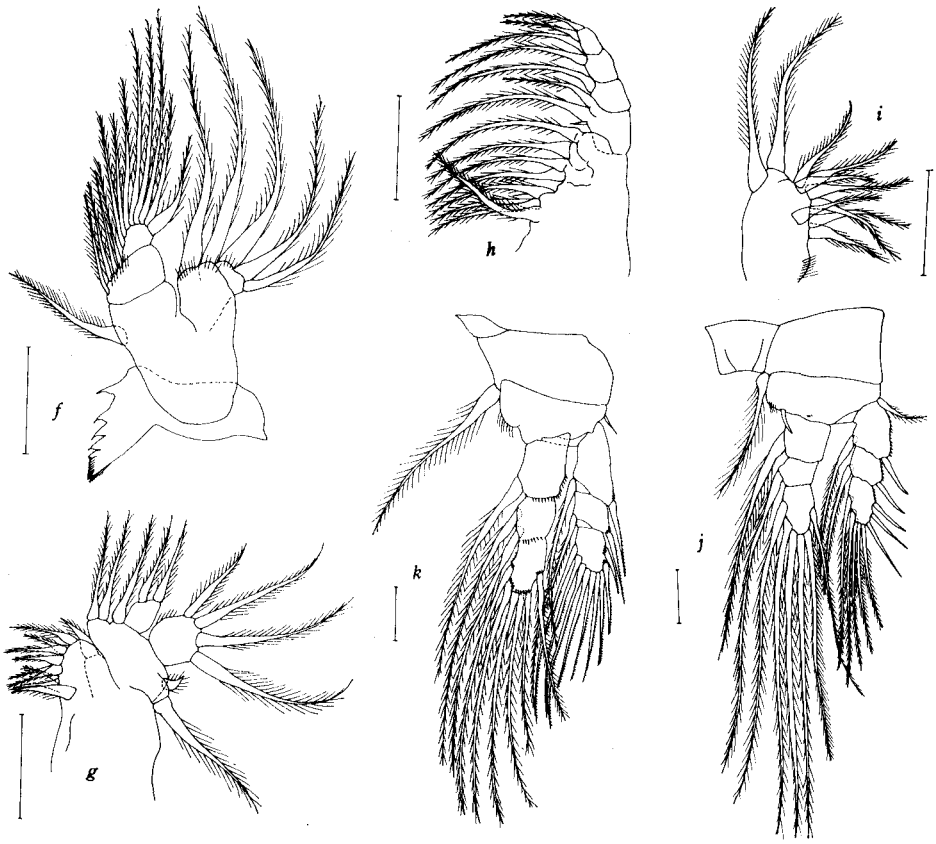

Fig. 4. *Doropygus catalai*, new species. Female: f, mandible; g, maxillule; h, maxilla; i, maxilliped; j, first leg; k, second leg. The scales represent 0.01 mm.

Mandible (fig. 4, f) with bimerous protopodite, bimerous endopodite, unimerous exopodite. Masticatory lamella of coxopodite with 4 unequal teeth, row of closely set denticles and 2 separated proximal setules. Basipodite broad, with single seta rather far distal on medial margin. Segment 1 of endopodite indicated by 4 graduated setae on margin, but proximally incompletely articulated with basipodite. Distal segment with 8 setae arranged around apex and extending along much of medial

margin. Exopodite massive, bearing 5 very large setae on medial margin and terminally. Setae somewhat graduated, smallest apical. Cuticular lines indicate flexures of the segment which are not true articulations.

Maxillule (fig. 4, g) with obscurely bimerous protopodite and unimerous rami. Epipodite represented by seta and more distal setule. Major endite bearing 9 subequal setae on medial margin. Secondary endite represented by lobe-like process terminating in a setiform projection. Basipodite bearing 3 distally directed equal setae on terminal margin. Endopodite reduced, bearing 2 terminal setae. Exopodite with 4 setae on margin, most proximal longest.

Maxilla (fig. 4, h) pentamerous, narrow, segments in relatively straight line. Long basal segment about as long as remaining segments combined, with 4 endites. Basal endite with 3 subequal setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae. Second segment about as wide as long, produced medially as short, feeble, falcate process. Obscurely articulated proximally to process, 1 much longer seta and reduced setule. Segment 3 longer than broad, with long seta on distal medial corner. Segment 4 with seta at distal medial corner. Segment 5 reduced, with 3 setae, 2 terminal shorter than medial.

Maxilliped (fig. 4, i) unimerous. Setae on medial margin of broad basal portion crowded, but arranged in 2 groups of 3 proximal and 5 distal. In each group 1 seta offset onto face of segment, other setae marginal. On distal lateral corner, with apparently a common articulation, 2 distally directed, long, subequal setae.

First swimming legs (fig. 4, j) with bimerous protopodites and trimerous rami. Intercoxal plate broad. Coxopodite with seta, inserted on distal medial corner, reaching about to third segment of endopodite. Inserted on lateral margin of basipodite a reduced seta, reaching about distal third of lateral margin of first segment of exopodite. Spine inserted on distal medial corner of basipodite slender and reaching about to middle of first segment of endopodite. Basal segment of endopodite long and wide, bearing single large seta on medial margin. Second segment with 1 seta at middle of medial margin. Terminal segment with 2 medial setae, 3 terminal setae, 1 lateral seta in emargination near midpoint of lateral margin. Exopodite not flexed. Basal segment longest, with 1 large lateral spine and 1 medial seta. Second segment with 1 lateral spine and 1 medial seta. Terminal segment with 3 lateral spines, 1 terminal spine, 1 terminal seta, 3 medial setae. Spines of exopodite distinctive by being almost subequal in length. Most basal and most apical spines longest, as usual.

Second legs (fig. 4, k) with bimerous protopodites, apparently bimerous endopodites and trimerous exopodites. Medial seta of coxopodite very well developed. Lateral seta of basipodite reduced to minute setule. Endopodite exceeding exopodite, 2-segmented. Basal segment of endopodite comprising about one-third of ramus, with 1 seta at approximate distal third of medial margin. Ornamentation of spinules on distal and medial margin. Basal portion of distal segment with 2 medial setae,

distal and medial spinules. Terminal portion subrectangular in outline, bearing 2 medial setae, 3 terminal setae, 1 lateral seta. Exopodite straight, basal and second segments each with 1 lateral, somewhat setiform spine, 1 medial seta. Terminal segment with 3 lateral setiform spines, 1 terminal setiform spine, 1 terminal seta, 4 medial setae, all rather distal on segment.

Third legs (fig. 5, l) in general resembling second legs, with exception that endopodite larger in proportion to exopodite.

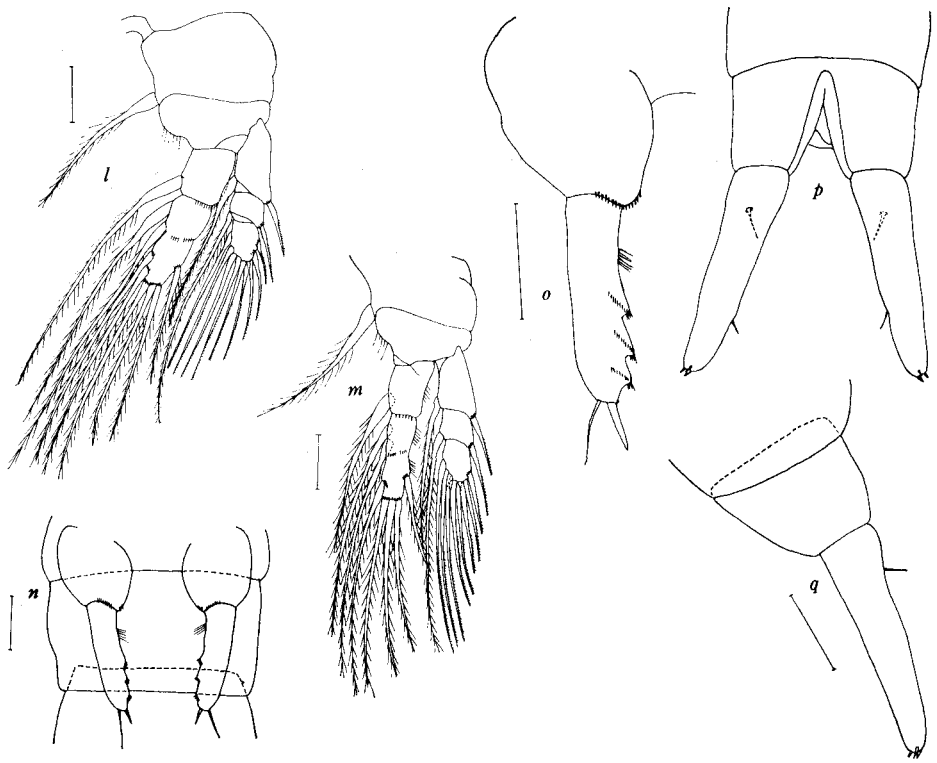

Fig. 5. *Doropygus catalai*, new species. Female: l, third leg; m, fourth leg; n, fifth legs, *in situ* on urosome; o, fifth leg, enlarged; p, anal segment and caudal rami; q, caudal ramus. The scales represent 0.01 mm.

Fourth legs (fig. 5, m) differing from third leg in reduction of endopodite in proportion to exopodite, similar in coalescence of distal 2 segments to apparently a single very elongate segment, and differing in armature. Three setae on medial margin of terminal segment of endopodite, 3 terminal setae and 1 lateral seta. Basal 2 segments of exopodite, as usual, each with lateral setiform spine and medial seta. Terminal segment with 2 lateral setiform spines, 1 terminal setiform spine, 1 terminal seta and 4 medial setae.

Fifth legs (fig. 5, n) bimerous, basal segment obscurely articulated with body surface, the pair with an obscure connecting plate. Medial row of distal spinules on basal segment. Second segment very long, bearing terminally a slender lateral seta and a stout, stiffened medial seta. Three rows of very fine, closely appressed spinules ornamenting medial margin, each row flangelike, set on a conspicuous medial projection of the margin (fig. 5, o).

Caudal ramus (fig. 5, p; 5, q) long, very slightly tapered. Three minute subequal setules inserted on distal margin. Anatomically lateral setule at about proximal fourth of ramus, but on dorsal surface. A medial setule at about distal fourth. Anal segment with deep cleft at anus so rami appear to be borne on a strongly bifid structure; this is similar to the condition in *Doropygus pulex*.

Remarks: There is no species of *Doropygus* so far recorded from the very wide-ranging and fairly well known host of this form. STOCK (1967) described *D. apicatus* from the closely related and sometimes very similar appearing *Phallusia nigra*, from the Dahlak Archipelago, Ethiopia. STOCK pointed out the fairly close resemblance of his species to *D. longimatrix* SCHELLENBERG, 1922. *D. catalai* shows features of the older species and also bears some close resemblances to *D. apicatus*. It is possible, since the hosts are closely related, that the latter two are also somehow genetically related species. The five stout, well developed setae of the substantial mandibular exopod ally *D. catalai* with *D. longimatrix* and *D. apicatus*, and serve to differentiate all three species readily from the "*pulex*-complex" of species (see above, p. 180, and STOCK, 1967, pp. 22–23, 26).

The most distinctive feature of *D. catalai* is the 10–segmented antennule, of characteristic configuration. In segmentation, it differs from all the other species cited above. It has a great resemblance to *D. apicatus* and *D. longimatrix* in the expansion of the more basal segments of this appendage, but the condition is decidedly more extreme in *D. catalai*. The posture of the antennule could well apply to SCHELLENBERG's designation of an "S-shape" for *D. longimatrix*. This author did not figure the appendage so there really is no very good basis in this feature for differentiation of the two forms. The count of 9 segments, given by SCHELLENBERG, could possibly be applied to *D. catalai*, based on a misinterpretation of the intricate folds and inflections of the appendage. Therefore the deficiencies of SCHELLENBERG's presentation create a distinct puzzle with regard to this and some other aspects of our species. In his summary statement, however, SCHELLENBERG states features of *D. longimatrix* he considers diagnostic, and we can show enough substantial differences from these to substantiate differentiation of *D. catalai*: in *D. longimatrix*, the form of the broodsack was considered distinctive (to which *D. catalai* does not conform); the fifth abdominal segment, lacking the distinctive cleft-like separation into two elements (*D. catalai* not conforming; in this regard like *D. pulex*); the curvature of the antennule (possibly conforming); the length and slenderness of the antenna (possibly con-

forming); the small size of the terminal claw of the antenna (distinctly not conforming); the slenderness of the posterior legs (not particularly significant on the basis of the information offered in SCHELLENBERG's description). The most readily obvious character would doutbless be the terminal claw of the antenna, and the differentiation of the two species could be well expressed in a key couplet: Antennal claw slender, less than half as wide as the supporting segment - *D. longimatrix*, versus Antennal claw stout as usual, essentially as broad basally as the supporting segment - *D. catalai*. *D. catai* and *D. apicatus* correspond more or less in the feature of the antennal claw but can be readily separated, in the female, by the form of the fifth leg. In *D. apicatus* the terminal segment is a relatively smoothly outlined lobe with feeble ornamentation. In *D. catalai* the terminal segment bears subterminal medial emarginations with strongly developed flange-like ornamenting elements in rows. In the latter species, also, it is possible that the seta of the basal segment, characteristic of many *Doropygus* species, is lacking.

This species is dedicated to Dr. CATALA in appreciation of his kindness in making available the collection of ascidians to the Expedition.

This species is possibly fairly common at Noumea. One specimen of the host, opened considerably subsequent to preservation and preliminary study, yielded 9 adult females, lying in the branchial basket.

Apodelphys, new genus

Type species: *Apodelphys lamellipes*, new species.

Taxonomic characters: The definition of this monotypic genus is provided in the description of the type species below. This form can be differentiated very readily from all other notodelphyids. Only species of *Lobodelphys* and *Gunenotophorus* approach it in the globular inflation of the body of the female. The constriction in the frontal plane of the metasome, markedly delimiting the pedigerous region from the incubatory complex, and the configuration of the incubatory complex are so far unique among the notodelphyids. In reduction of appendages there is resemblance to some genera so far having only vermiform representatives, but all such showing any correspondence at all lack at least one pair of mouthparts, and have legs of very different construction. The appendages correspond approximately to those of *Lobodelphys*, except in the considerably higher degree of development of the mouthparts in the present genus. The gender of the generic name is feminine.

Apodelphys lamellipes, new species

(Figs. 6, 7, 8)

Types: Holotype, female, Cat. No. OMNH Cop 008, Ôsaka Museum of Natural

History; and 4 paratypes, appendages of one of these dissected and mounted on a microslide, Cat. Nos. OMNH Cop 009–010, Ôsaka Museum of Natural History.
Type locality: Noumea, New Caledonia.
Host: *Ascidia sydneiensis samea* (OKA). OMNH. Asc. 004.
Description: Female (Figs. 6, 7, 8): General features: Body (figs. 6, a; 6, c) subcircular in outline, contained in an area of about 2.0 mm diameter, distinctively

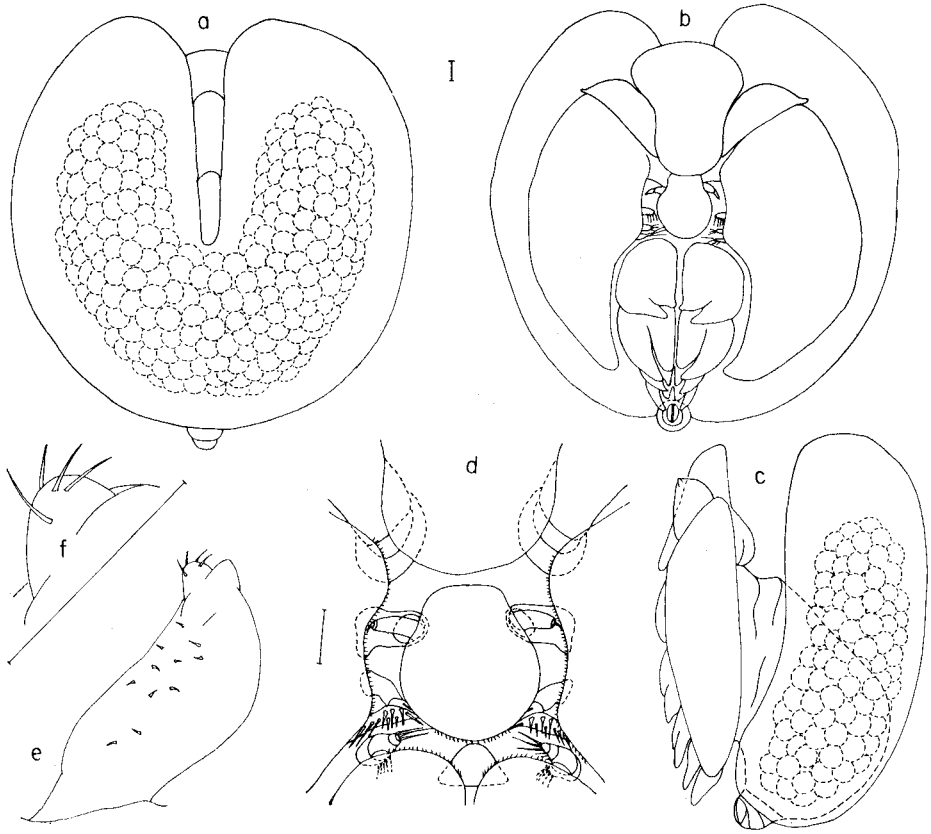

Fig. 6. *Apodelphys lamellipes*, new genus, new species. Female: a, habit, dorsal view; b, habit, ventral; c, habit, lateral; d, apex of rostrum and oral area, centering on labrum, *en face* view; e, antennule; f, apical lobe of antennule. The scale accompanying figures a and b represents 0.1 mm. The scales accompanying d, f represent 0.01 mm.

divided into cephalosome, metasome and metasome - urosome.

Body in lateral view (fig. 6, c) highly distinctive, comprised of a large ventral lobe supporting the appendages and a massive dorsal mass consisting mainly of the expanded incubatory complex with attached urosome; the two principal masses connected by a waistlike constriction. Large mass of numerous large eggs conspicuously visible in incubatory cavity.

Body in dorsal view (fig. 6, a) subcircular with a deep anterior cleft reaching about to the midpoint, the whole of this visible mass being the much modified incubatory complex. Egg mass in incubatory cavity a massive cylinder bent in a horse-shoe like arrangement with opening anteriorly directed, so that an arm of egg mass protrudes forward into each of main dorsolateral lobes of body. Visible in middorsal cleft a central structure involving part of the cephalosome and metasome. Protruding posteriorly a small portion of urosome. In ventral view body presenting a flattened ventral surface with mosaic-like arrangement of principal body elements (fig. 6, b). In the midline arranged successively very large rostrum, succeeded by relatively large labrum, succeeded by plate-like series of flattened legs, terminating with ventrally directed apex of urosome, bearing flattened caudal rami. Posteriolateral to rostrum, on either side, very enlarged, flattened antennule, succeded on either side by metasomal lobe, flattened ventrally. Detail of oral area (fig. 6, d) showing centrally placed large labrum, surrounded by depression outlined by rostrum apex, antennule bases, medial margins of metasomal lateral lobes, and anterior margins of first legs. Arranged along either side of labrum, anterior to posterior, relatively small antenna, mandible, maxillule, maxilla, and, invisible beneath surrounding lobes and margins of first legs, maxillipeds.

Appendages: Antennule (fig. 6, e) inflated, unsegmented, elongate sac, with abrupt apical taper. General pilosity of minute hairs covering most of surface (not illustrated). No readily determinable element of usual notodelphyid antennular ornamentation, but some long setae present on subapical lobe (fig. 6, f), and some long elements on general surface of appendage (fig. 6, e).

Antenna (fig. 7, g) bimerous, basal segment 1.5 times as long as and twice as wide as terminal segment. Margins of both segments sclerotized, of slightly sinuate outline. Terminal segment somewhat tapering. At apex a sclerotized, articulated hook. On outer margin of segment at about distal third, a reduced seta and minute setule arising from common articulation.

Mandibles (figs. 7, h; 7, i) without masticatory plate, complex, longer than wide. Basipodite much as usual, with distal, lateral seta and supporting modified rami. Endopodite obscurely bimerous, proximal portion bearing 2 unequal setae. Distal segment with 4 subequal setae in a flaring arrangement on broad terminal margin. Rather compressed exopodite bearing 4 subequal massive setae.

Maxillules (fig. 7, j) consisting of usual lobes, somewhat expanded in terminal outline. Rather clearly demarcated coxopodite expanded medially in gnathal lobe bearing marginal row of 4 subequal setae. Apical portion of appendage a complex, apparently centrally the basipodite, bearing, without articulation a proximal lateral lobe with 1 large seta, representing epipodite of distal portion of coxopodite, and, distally, unarticulated lobes representing rami. Medially basipodite bears 2 large marginal seta. Just distal to these a lobe, with 2 large setae, representing endopodite. Laterally and terminally, a flaring lobe, with 4 large marginal setae, representing exopodite.

Maxillae (fig. 7, k) obscurely tetramerous; appendage markedly tapering. Basal segment with heavy basal protrusion from which arising 2 setae, another protrusion with 2 setae just distal, and a distal endite bearing 2 setae. Second segment with 2 large marginal setae, a setule inserted on more proximal seta. Third segment with 1 marginal seta. Terminal segment with 3 unequal apical setae. Maxillipeds (fig. 7, l) minute and closely adhering to base of maxillae. Each a low, conical lobe with 5 subequal setae inserted in row along medial margin.

First leg (figs. 8, m; 8, n) large flattened plate-like structure with more massive proximal and lateral portion, possibly representing fused protopodite and exopodite,

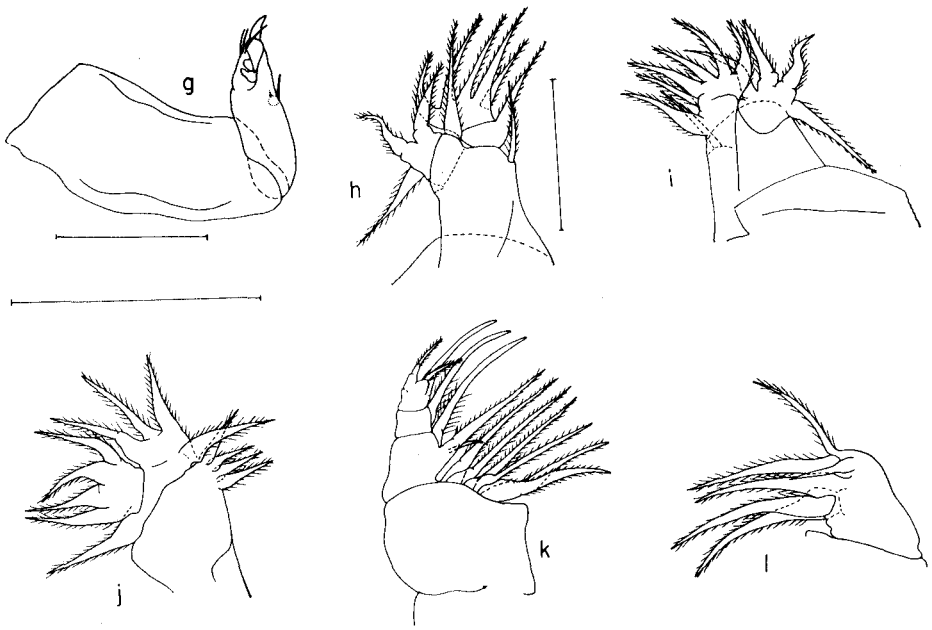

Fig. 7. *Apodelphys lamellipes*, new genus, new species. Female: g, antenna; h, mandible; i, mandible, another view; j, maxillule; k, maxilla; l, maxilliped. The scales accompanying g, h refer also to figures i, k and represent 0.01 mm. The scale above j also refers to l, and represents 0.01 mm.

curving around obscurely articulated medial distal piece, possibly endopodite. Usual armature of spines and setae reduced or lacking, perhaps represented in part by marginal articulated spinules (figs. 8, o; 8, p). Surfaces covered with pilosity of minute hair-like structures, as also the case in legs 2 to 4.

Second legs (figs. 8, q; 8, r) much like first in general pattern, but narrower and more elongate. Somewhat more strongly suggested articulation of outer ramus. Spinuliform marginal ornamentation (figs. 8, s; 8, t).

Third legs (figs. 8, u; 8, v) most complicated, with some suggestion of usual construction. Exaggerated elements of ornamentation on apical margins possibly

representing some part of usual notodelphyid armature (fig. 8, w, element on inner margin of endopod; fig. 8, x, element on inner margin of exopod; fig. 8, y, row of elements at tip of endopod; fig. 8, z, row of elements at tip of exopod).

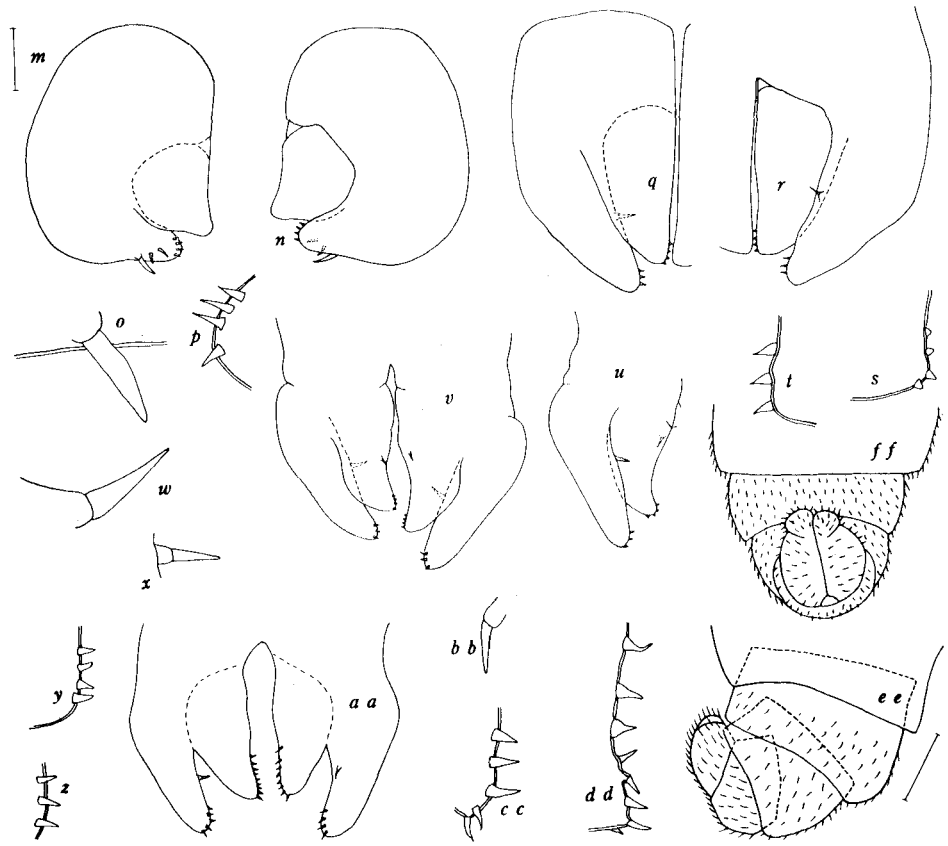

Fig. 8. *Apodelphys lamellipes*, new genus, new species. Female: m, first leg; n, first leg, opposite surface; o, setiform element of exopod-process; p, ornamenting spinuliform elements of exopod-process; q, second leg; r, second leg, opposite surface; s, spinuliform elements of endopod-process, second leg; t, spinuliform elements of exopod-process, second leg; u, third leg, posterior view; v, third pair of legs, anterior view; w, setiform element of outer ramus, third leg; x, setiform element of inner ramus, third leg; y, spinuliform elements of apex of endopod-process, third leg; z, spinuliform elements of apex of exopod-process, third leg; aa, fourth pair of legs; bb, setiform element of outer ramus, fourth leg; cc, spinuliform elements of exopod-process, fourth leg; dd, spinuliform elements of endopod-process, fourth leg; ee, urosome lateral view; ff, urosome, ventral view, presenting surface view of caudal rami. Detail of pilosity shown on ee, ff, also refers to general surfaces of m, n, q, r, u, v, aa, legs 1 to 4. The scales accompanying m and ee refer to figures m, n, q, r, u, v, aa, ee, ff and represent 0.01 mm.

Fourth legs (fig. 8, aa) basically somewhat like third, but with articulation and ornamentation suppressed (fig. 8, bb, element on inner margin of exopod; fig. 8, cc, elements at apex of exopod; fig. 8, dd, elements at apex of endopod).

Urosome (figs. 8, ee; 8, ff) small, segmented tail-piece, obscurely articulating on modified incubatory complex at its posterior margin. Probably 4 segments, including usual circumanal end-piece, supporting somewhat fused, inflated caudal rami. Each ramus with subterminal constriction and bulbous apex. Segments and rami with surface covering of minute hairs, illustrated in figs. 8, ee, 8, ff; here also representative of similar general pilosity over surfaces of legs 1 to 4. Posture of urosome characteristic. Borne on posterior central margin of dorsal incubatory metasome portion, urosome curving ventrally and presenting terminal surface, bearing flexed, plate-like caudal rami, as end-piece of central row of flattened elements in ventral mosaic of body parts (fig. 6, b).

Remarks: The name of the species refers to the notable expansion in outline and flattening of the parts of the usual swimming legs.

A specimen of the host, opened subsequent to the preliminary studies on the species, yielded an additional specimen. It was an adult female, with embryos at the point of hatching. It was located in the atrial cavity, lying in a depression formed in the underlying tissue, predominantly gonadal. It was impossible to determine if the depression was an artefact of preservation of the host, or if the copepod in some way eroded the tissue. It is interesting to note that the same host specimen, moderate in size, yielded also 9 adult females of *Doropygus catalai*, lying in the branchial basket.

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