

Mycophilus rosovula n. sp., a Notodelphoid Copepod
Parasitic within *B. (Botrylloides) leachii* Sav.,
with a Description of the Nauplius and Notes on
the Habits.

By

Peter Gray, Ph.D., A.R.C.S.,

Lecturer in Vertebrate Embryology in the Department of Zoology of the
University of Edinburgh.

With 2 Figures in the Text.

INTRODUCTION.

THE notodelphoid copepods parasitic within Ascidians have been generally ignored for a long time. In May 1932 the present writer collected a considerable number at Millport Marine Biological Station, and was amazed at the frequency with which they occur. It may be that the Clyde area is especially favourable to their development, or it may be that the season was particularly good, for about thirty specimens were collected of ten species, of which at least one—the subject of the present paper—was new to science. If this abundance of forms is indeed usual, it is difficult to understand why records are not more frequent, and it would be interesting to learn how frequently these fascinating and aberrant forms are lost in the course of class dissections of their hosts.

The genus *Mycophilus* was founded by Hesse (1865) for the species *roseus*, and was subsequently included by Sars (1921) in his family Entericolidæ. It is not proposed here to enter into a discussion as to the validity of that heterogeneous group the "Notodelphoidea," nor yet to question the equally doubtful "Entericolidæ," for it is the opinion of the present writer that this cannot properly be done without a knowledge of the internal anatomy, and, above all, of the reproductive system. It is hoped to bring forward an account of the internal organisation of some of the most typical Notodelphoids at an early date.

Generic peculiarities.

The genus differs strikingly from all other known copepods in the position of the anus, which opens in the median dorsal line between the 3rd and 4th (*M. roseus*) or 4th and 5th (*M. rosovula*) "trunk segments." The appendages are also peculiar in that they are devoid of setæ or

bristles of any kind, while these parasites are again unique in their egg-laying habits (*vide infra*). The general form is worm-like (Fig. 1, B and C), the body posterior to the anus being divided into an apparently variable number of "segments," the genital aperture being at the extreme posterior end. It appears very unlikely that the anus has in reality shifted forward over a number of segments and the present author would regard the whole body posterior to the anus as a backward extension of the last segment, which has itself acquired a pseudo-segmentation from continual expansion and contraction during the egg-laying season. The four body segments anterior to the anus each bear a pair of "legs"

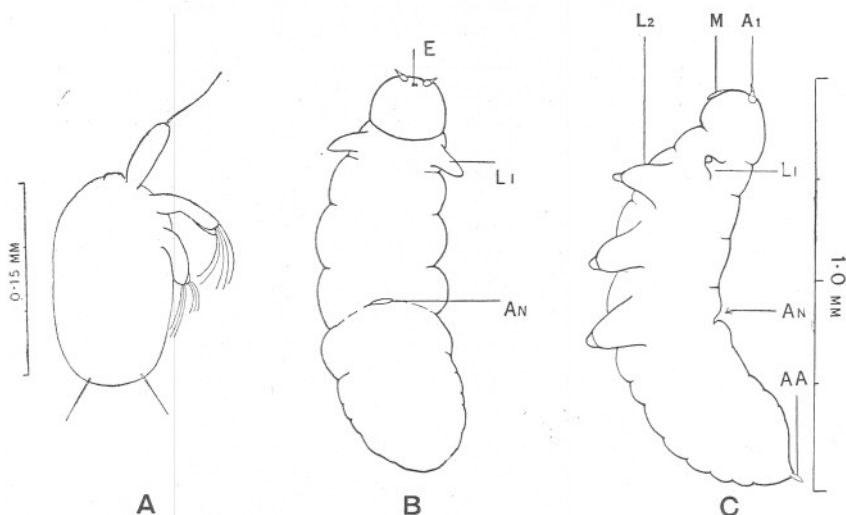


FIG. 1.—A. Nauplius of *Mycophilus rosovula*. Ventral aspect.

B. The same specimen. Dorsal aspect.

C. *Mycophilus rosovula* n. sp. ♀. Lateral aspect.

AA, abdominal appendage. An. anus. A1, first antenna. E, eye.

L1–L2, legs. M, mandible.

which are in reality lateral expansions of the body wall from which they are not separated by any articulation; each "leg" bears at its tip one (*M. rosovula*) or two (*M. roseus*) short rounded prominences, stated by Sars (*loc. cit.*) to be the "rudiments of the rami." The extreme posterior end of the body carries two small spatulate projections (AA, Fig. 1C) which may, or equally well may not, be the rudiments of the caudal rami; the present writer proposes to continue the use of the ambiguous term "abdominal appendages," already current for the analogous structures of other parasitic copepoda.

The head (Fig. 2) bears only four pairs of appendages of which the first two pairs are universally admitted to be the antennæ. The third pair is

variably termed mandible and maxilla; no useful decision can possibly be given on this point until the larval history is known and, since the nauplius is hatched with a perfectly normal mandible, this term will be employed in the specific description which follows. The fourth pair of

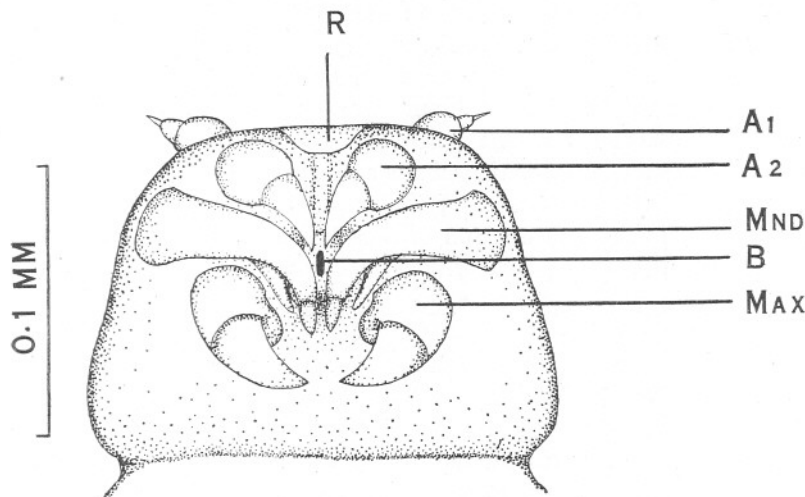


FIG. 2.—Mouth parts of *Mycophilus roseovula* ♀. Ventral aspect.
A1, A2, antennæ. B, mouth. Max, maxilla. Mnd, mandible. R, rostrum.

head appendages will correspondingly be referred to as maxillæ. The dorsal surface of the head bears a vivid scarlet eye, rectangular in shape and divided along the middle line by a colourless bar.

SPECIFIC DESCRIPTION.

Female. Body more or less recurved dorsally; head clearly demarcated. Antenna 1 of three segments, the basal considerably expanded; the whole conical in form, the terminal segment being greatly reduced. Antenna 2 as in *M. roseus*. Mandible inserted very close to the lateral margins of the head and bearing a larger uni-articulate palp than *M. roseus*. Maxillæ as in *M. roseus* but rather stronger. First leg inserted laterally upon the body, greatly reduced and bearing a single conical projection at the tip. Second, third and fourth legs as in *M. roseus* but with only a single "terminal projection."

Body colourless and translucent; the eggs awaiting deposition are of a dark orange-carminé and very conspicuous. Egg strings never formed.

Size of adult female 1.0 to 1.3 mm.

Male. Unknown.

This species may be distinguished instantly from *M. roseus* by the lateral placing of the reduced first legs. The present writer is unaware whether the "body" of *M. roseus* is in reality rose-red (as stated by Sars (*loc. cit.*)) or whether this appearance is due, as in the present example, to the colour of the eggs; in the former case there would here be an additional distinction between *M. roseus* and *M. rosovula*. It appears also doubtful whether the apparent difference in size between the two would remain valid were several hundred specimens to be examined.

The lateral attachment of the first legs, the widely spaced insertion of the mandibles and the position of the anus, together with certain minor differences in the appearance of the various appendages, would seem sufficient to justify the erection of a new species for which the name *rosovula* is accordingly proposed.

HABITS.

M. rosovula is found exclusively in the canals which run through the matrix of *B. (Botrylloides) leachii* Sav., through the transparent test of which the colour of the undelivered eggs can be seen with the naked eye. Very few colonies contained more than a single parasite, which was present in about 20% of those examined; no parasite was ever found in any other species of colonial ascidian, though both a *B. (Botryllus)* and a *Leptoclinum* were abundantly associated with the infected form.

The egg-laying habits are different from those of any other copepod at present known, in that the eggs are deposited singly or occasionally in patches of two or three. No cement is present, each egg being surrounded only with a thin transparent membrane. After a period, which is not less than five days (eggs already present in a colony hatched after five days' observation; eggs laid under observation failed to hatch), nauplii hatch out. The nauplius (Fig. 1 A), which has the form of a short cylinder with rounded ends and retains the rose colour of the egg, is very much larger than one would expect. The first antenna bears at its end a single, long-curved seta. The second antenna has three such setæ upon the main stem and two upon the inner ramus. The mandible is similar to the second antenna, but has three terminal setæ upon each ramus. There is a distinct, square rostrum in front and a pair of posterior setæ; the median eye is vivid scarlet and rectangular in outline.

The movements of the nauplius are much more rapid than its clumsy shape would lead one to suppose. The newly hatched larvæ soon leave the security of the canals and pass on to the top of the colony, on whose slightly rough surface their long curved setæ enable them to move with rapidity. Their motion strongly recalls that of *Lepisma* as they scuttle from the cover of one lump of debris to another, often vanishing into the

branchial cavities of the host at the least sign of danger. They are intensely timid and will not resume motion until any unusual movement of the water has ceased ; in this they differ markedly from the harpacticoid nauplii, with many of which they share the surface of the colony. If washed off by a sudden stream of water they swim in short sharp jerks but are unable to sustain the motion for long and soon fall to the bottom where they lie motionless for a second or two before recommencing their struggles ; if they should chance to fall on to any particle of debris equal in size to, or larger than themselves, they will remain clasped to it apparently indefinitely.

No success was attained in the attempt to rear these nauplii. One hatch survived for three days without undergoing a moult. The large numbers of unidentified, and at present unidentifiable, harpacticoid larval instars which are always present on the surface of compound ascidians, rendered valueless all attempts to reconstruct a life-history by collection.

The movements of the female adult are clumsy in the extreme. Fitting tightly into the canal, she moves with slow awkward wriggings of the body assisted by convulsive movements of the legs. One specimen observed moved 18 mm. in four hours and in this time deposited three eggs at about equal distances. Upon being dissected out from the host, the parasite immediately assumed the recurved shape seen in the drawings of the preserved specimens and continued to reproduce the motions slowly crawling. An isolated specimen was placed on the surface of a colony and managed to drag itself a distance of nearly 3 mm. before collapsing helplessly on its side. Upon being placed exactly over an inhalent aperture of the host, the parasite clawed its way inside but was found to be dead when dissected out three hours later.

It would seem, therefore, that infection of a new host must take place by a larval form and it is very difficult to account for the specific preference shown by the parasite.

I am indebted to Mr. Richard Elmhirst, Superintendent of the Millport Marine Biological Station, for the facilities he afforded me for the collection and examination of these parasites and for his invariably useful suggestions ; and to Professor J. H. Ashworth, F.R.S., for his helpfully critical examination of the manuscript.

LITERATURE CITED.

- HESSE. 1865. *Récherches sur les Crustacées rares ou nouveaux des côtes de France.* Ann. Sci. Nat. Zool., Ser. 5, Vol. 4, p. 289.
- SARS, G. O. 1921. *Crustacea of Norway*, Vol. 8.

