

THE GENERA *APOMATUS* AND *PROTULA* (POLYCHAETA, SERPULIDAE)

By Jean Hanson

Bedford College, University of London

(Text-fig. 1)

During an investigation of the blood systems of serpulids I have found that the pattern of the superficial blood vessels on the ventral surface of the thorax of the larger forms is a useful character for distinguishing the different genera, and sometimes is a reliable feature for distinguishing between the different species of a genus (e.g. *Serpula* and *Protula*). These blood vessels can easily be seen in living animals and are also visible in formalin-preserved specimens. Details of this matter will be published elsewhere.

Meanwhile, I wish to comment on the taxonomy of the genera *Apomatus* and *Protula*. The four western European species of these genera were obtained in the Gulf of Naples, and it was found that *Apomatus ampulliferus* Philippi, *A. similis* Marion and Bobretzky, and *Protula tubularia* (Montagu) all have the same type of superficial ventral thoracic blood system, whereas *P. intestinum* (Lamarck) is strikingly different in this respect. In *P. intestinum* (Fig. 1A) the trans-septal vessels (*tsv*) extend over the surface of the thorax and join the ventral vessel (*vv*); the vessels supplying the postero-ventral flange (*pvf*) of the thoracic membrane (*tm*) arise from the ventral vessel; the ventral vessel gives off other small vessels on to the surface of the thorax. In *P. tubularia*, *Apomatus similis* and *A. ampulliferus* (Fig. 1, B, C, D) the trans-septal vessels enter two ventro-lateral vessels (*vlv*) which terminate posteriorly in the flange of the thoracic membrane; the superficial blood system does not communicate with the ventral vessel. When specimens of these three species are handled they give off a strong odour which has never been encountered in *P. intestinum*; it resembles a mixture of machine-oil, oranges and iodine.

By taxonomists (e.g. Fauvel, 1927) the two genera are separated from each other by the presence of opercula in *Apomatus* and their absence in *Protula*. The most reliable feature distinguishing respectively *Apomatus similis* from *A. ampulliferus* and *Protula intestinum* from *P. tubularia* is the shape of certain abdominal chaetae. However, *Apomatus similis* has the same type of abdominal chaetae as *Protula tubularia*, and *Apomatus ampulliferus* has the same type of abdominal chaetae as *Protula intestinum*. The branchial crowns of these four species are readily autotomized when the animals are handled. When the crown with its opercula is lost *Apomatus similis* is indistinguishable from *Protula tubularia*; but the characteristic blood system of *P. intestinum* makes it easy to

distinguish from *Apomatus ampulliferus*. On two occasions I have found apparently intact specimens of *A. ampulliferus* without opercula. They were distinguishable from *Protula tubularia* by their abdominal chaetae and from *P. intestinum* by their ventral thoracic blood systems. Thus it seems necessary to reconsider the validity of using the operculum as the diagnostic character for separating the operculate genus *Apomatus* from the non-operculate genus *Protula*.

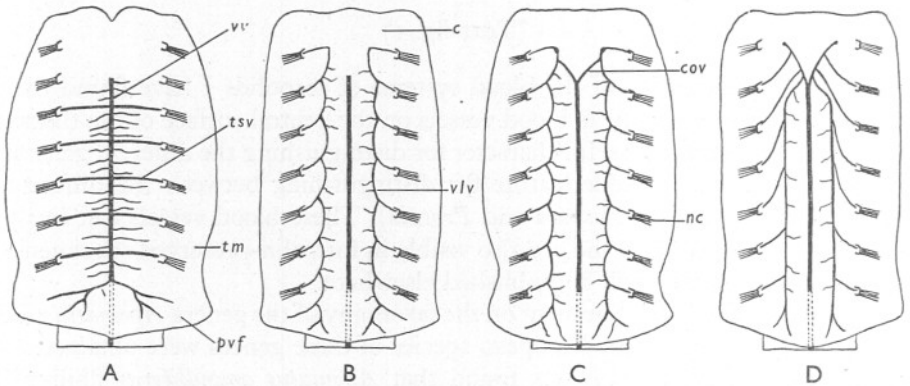


Fig. 1. Diagrams of superficial blood vessels on ventral surface of thorax. The collar has been turned forward. A, *Protula intestinum*; B, *P. tubularia*; C, *Apomatus similis*; D, *A. ampulliferus*. c, collar; cov, circum-oesophageal vessel; nc, notopodial chaetae; pvf, postero-ventral flange of thoracic membrane; tm, thoracic membrane; tsv, transverse vessel; vlv, ventro-lateral vessel; vv, ventral vessel.

The serpulid operculum and its peduncle represent a modified branchial filament. As Zeleny (1905) has shown, the existing serpulids can be arranged in a series reflecting the probable course of evolution of the operculum and its peduncle.

- (i) Forms such as *Protula* without an operculum.
- (ii) *Salmacina dysteri* with swollen tips to all its filaments. (Faulkner (1930) found that in her material the tips of the filaments were variable, some, none or all being swollen.) Similar swollen tips are noticeable on the filaments of the operculate species *Vermiliopsis infundibulum* (Philippi) and of the sabellid *Jasmineira candela* (Grube).
- (iii) Forms such as *Filigrana implexa* with two equally well-developed opercula, and *Apomatus* with a functional and a reserve operculum, all borne by filaments which in all other respects are just like non-operculate filaments.
- (iv) Forms like *Pomatoceros* and *Hydroides* with one operculum, or with a functional and a reserve operculum borne by peduncles which are devoid of pinnules.

This series suggests that in the genera *Apomatus* and *Filograna* the filaments bearing opercula are in the process of evolving from ordinary branchial filaments. Hence less importance should be attached to the presence or absence of an operculum in the genera at the base of the series (*Protula*, *Apomatus*, *Salmacina*, *Filograna*) than in the genera later in the series (the rest of the serpulids). In the latter group of serpulids differences in opercular structure are accompanied by differences in other features and the opercula can satisfactorily be used for distinguishing genera. Within the former group of serpulids, however, *Apomatus* closely resembles *Protula*, and *Filograna* closely resembles *Salmacina* in most features, except that *Apomatus* and *Filograna* possess opercula whilst *Protula* and *Salmacina* do not. I suggest that a more natural scheme of classification would be obtained by combining *Apomatus* and *Protula* into one genus, and *Filograna* and *Salmacina* into another genus.

I suggest also that the genera *Apomatus* and *Protula* should be revised to reflect the close similarity between *P. tubularia* and the two species of *Apomatus*, and the dissimilarity of *Protula intestinum*. Fauvel (1927) has already commented on the similarity of *Apomatus similis* and *Protula tubularia* and has suggested that the former might be a young form of the latter. On the French coast (Fauvel, 1927) *Apomatus similis* is smaller than *Protula tubularia*; at Naples also this was usually so, but I found two specimens of *Apomatus similis* of the same size as *Protula tubularia*.¹

The taxonomy of *Salmacina* and *Filograna* is similarly in need of revision. Faulkner (1930) has noticed operculum-like swellings at the tips of some or all of the non-operculate filaments of some specimens of *F. implexa* and *Salmacina dysteri*, and has agreed with McIntosh (1922-23) that the separation of the operculate genus *Filograna* from the non-operculate genus *Salmacina* is unsatisfactory, because in other respects they are closely similar. Faulkner considers that *Filograna implexa* and *Salmacina incrustans* are identical except that the former possesses opercula. According to Fauvel (1927), *Filograna* is bisexual, thus differing from *Salmacina* which may be hermaphrodite; but Faulkner has found hermaphrodite specimens of *Filograna implexa*.

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SUMMARY

It is suggested that the genera *Apomatus* and *Protula* should be revised to reflect the close similarity between *P. tubularia* and the two species of *Apomatus*, and the dissimilarity of *Protula intestinum*. It is further suggested

¹ McIntosh (1922-23) suggests that there is only one species of *Apomatus* (*A. ampulliferus*) and only one species of *Protula* (*P. tubularia*).

that the presence or absence of an operculum is not a sufficiently important character for distinguishing *Apomatus* from *Protula*, or *Filigrana* from *Salmanica*; and therefore that these two pairs of genera should be fused into two genera.

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