

**Zoology.** — *Rhizocephalan parasites of crabs of the genus Metopograpsus.*  
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The present paper contains notes on Rhizocephala of the crabs *Metopograpsus messor* (Forsk.), *M. oceanicus* Jacq. & Luc. and *M. quadridentatus* Stimps. The three species have one common parasite, *Sacculina yatsui* Boschma, but, moreover, two of the crabs may be infested by another species of parasite. In *M. messor* this other parasite is *Sacculina plana* Boschma, in *M. quadridentatus* it is *Sacculina imberbis* Shiino. Whilst in *Sacculina yatsui* the external cuticle of the mantle possesses comparatively large excrescences the cuticle of the two other species of *Sacculina* is devoid of excrescences.

In the two species of *Metopograpsus*, therefore, an infestation with parasites is found similar to that in *Pachygrapsus crassipes* Randall, parasitized by *Sacculina yatsui* and *S. confragosa* (cf. BOSCHMA, 1935, 1936). But here the case is still more complicated, as shown by SHIINO (1943), who described *Sacculina imberbis* as a third species of Rhizocephalan parasite of *Pachygrapsus crassipes*. Matters now are becoming rather complicated for identification, as *S. imberbis* as well as *S. confragosa* do not possess excrescences, so that their differences are to be found in sectioned material only.

Up till now no Rhizocephalan parasites of crabs of the genus *Metopograpsus* have been commented upon. Though these parasites belong to already known species some of their peculiarities may be dealt with here to draw attention to individual variation and to show differences from previously described material.

### ***Sacculina yatsui* Boschma**

Snellius Expedition, Kambang near Timor, November 28, 1929, 1 ex. on *Metopograpsus messor* (Forsk.), dimensions of the parasite  $12\frac{1}{2} \times 6\frac{1}{2} \times 2$  mm.

Snellius Expedition, Kaledupa, Tukang Besi Islands, August 27, 1930, 1 ex. on *Metopograpsus messor* (Forsk.), dimensions of the parasite  $9 \times 4\frac{1}{2} \times 2$  mm.

Snellius Expedition, Tanah Djampea, February 21, 1930, 1 ex. on *Metopograpsus oceanicus* Jacq. & Luc., dimensions of the parasite  $11\frac{1}{2} \times 5\frac{1}{2} \times 2$  mm.

Dodinga, Halmahera, VON MARTENS leg. (collection Zoological Museum Berlin), 1 ex. on *Metopograpsus quadridentatus* Stimps., dimensions of the parasite  $17 \times 10 \times 5$  mm.

Japan, HILGENDORF leg. (collection Zoological Museum Berlin), 1 ex. on *Metopograpsus quadridentatus* Stimps., dimensions of the parasite  $15\frac{1}{2} \times 8\frac{1}{2} \times 5\frac{1}{2}$  mm.

The shape of the specimens is rather variable. The two specimens on *Metopograpsus messor* (fig. 1 a, b) are flattened and broadly oval, their mantle opening does not noticeably project above its surroundings, the

mantle shows a few grooves chiefly in its marginal part. The specimen on *M. oceanicus* (fig. 1 c) too is flattened, it is more or less panduriform, whilst the mantle opening lies at the top of a short tube; here again the mantle shows a few grooves. The specimens on *M. quadridentatus* are considerably thicker;

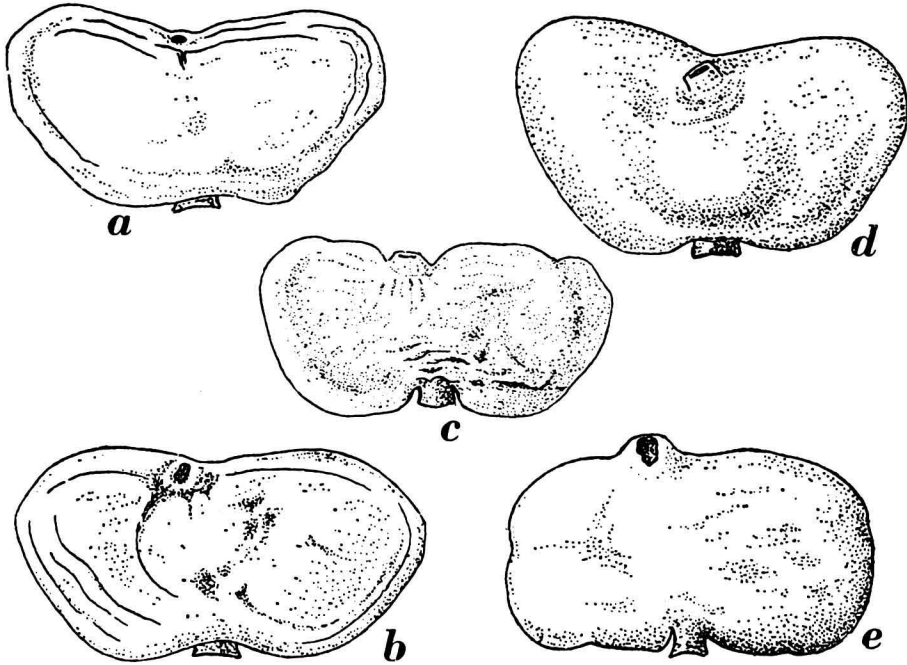


Fig. 1. *Sacculina yatsui*, left side of five specimens. a, on *Metopograpsus messor* from Kambang; b, on *Metopograpsus messor* from Kaledupa; c, on *Metopograpsus oceanicus*; d, on *Metopograpsus quadridentatus* from Dodinga; e, on *Metopograpsus quadridentatus* from Japan. a, c,  $\times 4$ ; b,  $\times 6$ ; d, e,  $\times 3$ .

in the Halmahera specimen (fig. 1 d) the anterior part is much broader than the posterior region, in the specimen from Japan (fig. 1 e) the posterior region is slightly broader than the anterior part. In these two specimens the surroundings of the mantle opening are raised above the mantle. In general the shape of these parasites is not strikingly different from that of specimens of *Sacculina yatsui* on *Pachygrapsus crassipes* (cf. BOSCHMA, 1936, fig. 1; SHIINO, 1943, fig. 1 F).

The male organs of the various specimens show some individual variation.

In the specimen on *Metopograpsus oceanicus* the ventral parts of the vasa deferentia are wide (fig. 2 a), on their inner wall they have a few ridges only. Towards the dorsal region they gradually become narrower and pass into the testes. Fig. 2 b shows the region in which the right vas deferens penetrates into the testis of this side. The right testis is slightly larger than the left.

In the specimen on *Metopograpsus messor* from Kaledupa the vasa

deferentia have a fairly wide lumen, their inner wall has numerous ridges (fig. 2 c). The left testis reaches its largest size in the region in which the right vas deferens passes into its testis (fig. 2 d). Towards the dorsal region the right testis becomes much larger (fig. 2 e).

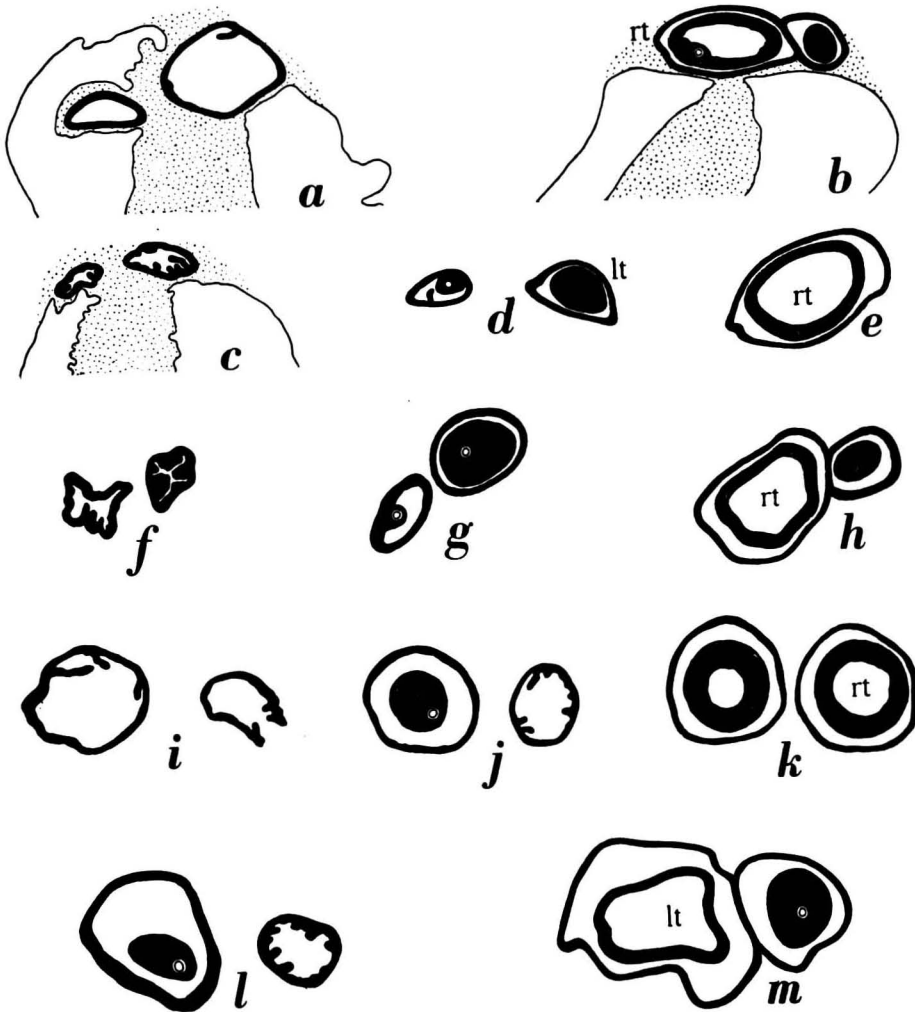


Fig. 2. *Sacculina yatsui*, transverse sections of the male genital organs of five specimens. a, b, on *Metopograpsus oceanicus*; c—e, on *Metopograpsus messor* from Kaledupa; f—h, on *Metopograpsus messor* from Kambang; i—k, on *Metopograpsus quadridentatus* from Dodinga, l, m, on *Metopograpsus quadridentatus* from Japan. lt, left testis; rt, right testis.  $\times 30$ .

The vasa deferentia of the specimen on *Metopograpsus messor* from Kambang are very narrow as their inner wall shows a strong development of ridges (fig. 2 f). The transition of the vasa deferentia into the testes is shown in fig. 2 g. The left testis does not become larger, whilst the right testis increases in size towards a more dorsal region (fig. 2 h).

The vasa deferentia of the specimen on *Metopograpsus quadridentatus* from Halmahera are wide, their inner wall has a few ridges only (fig. 2 i). The chitinous tube which forms the connexion of the left vas deferens with its testis is shown in fig. 2 j. In a more dorsal region the two testes become considerably larger, then they have approximately the same size (fig. 2 k).

In the specimen on *Metopograpsus quadridentatus* from Japan the vasa deferentia are wide, their wall has comparatively few ridges only. The transition of the left vas deferens in its testis is shown in fig. 2 l, that of the right vas deferens in its testis in fig. 2 m. In this specimen the right testis remains decidedly smaller than the left.

The individual variation in the structure of the male genital organs in these specimens is of the same order as that found in specimens on *Pachygrapsus crassipes* (cf. BOSCHMA, 1936, figs. 2, 3). Here too the vasa deferentia may have many or few internal ridges, and the two testes may be of equal size or decidedly unequal. In SHIINO's specimen of *S. yatsui* on *P. crassipes* also one of the testes is much larger than the other (cf. SHIINO, 1943, fig. 8 A).

In all the specimens of which sections were made the colleteric glands appear to have a flattened shape. Their canal system never is very strongly branched, the branches never are exactly arranged in one row parallel to the surface of the gland; as a rule there are two or more rows. The maximum number of canals in one longitudinal section of the colleteric glands is 26 in the specimen on *Metopograpsus oceanicus* (fig. 3 a), 19 in the specimen on *M. messor* from Kaledupa (fig. 3 b), 23 in the specimen on *M. quadridentatus* from Japan (fig. 3 c, d), and 31 in the specimen on *M. quadridentatus* from Halmahera (fig. 3 e, f). These numbers nicely correspond with those found in specimens on *Pachygrapsus crassipes* (26 and 28, cf. BOSCHMA, 1936).

Fig. 4 shows the excrescences of the external cuticle of the mantle of three of the specimens, viz., that on *Metopograpsus quadridentatus* from Halmahera (fig. 4 a), that on *M. quadridentatus* from Japan (fig. 4 b), and that on *M. oceanicus* (fig. 4 c). The specimens on *M. messor* possess excrescences of the same kind, showing a similar degree of individual variation. In each of the specimens in some parts of the mantle there occur isolated spines or compounds consisting of two or three spines only. In other parts of the mantle the spines may form compounds of rather large groups. Moreover, there is a great deal of variation in the thickness of the spines and their manner of spreading. Also the height of the spines shows a considerable degree of variation. The excrescences as a whole vary in height from 30 to 65  $\mu$ .

In the specimens of *Sacculina yatsui* on *Pachygrapsus crassipes* the excrescences of the external cuticle also have a height of 30 to 65  $\mu$  (cf. BOSCHMA, 1936). In these specimens, however, there is a stronger tendency of remaining isolated than in the specimens on the various species of *Metopograpsus*. In the specimens from the East Indies the spines of the

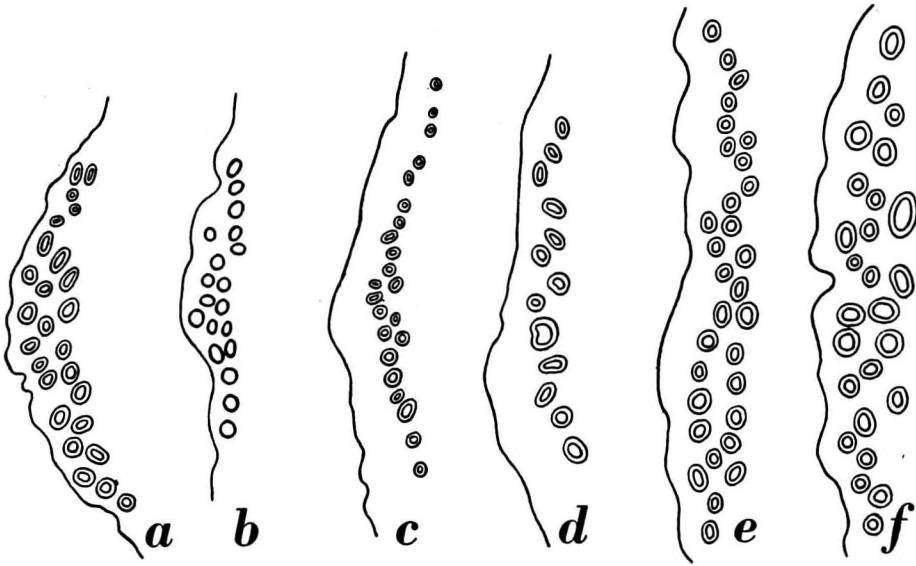


Fig. 3. *Sacculina yatsui*, longitudinal sections of the colleteric glands of four specimens. *a*, on *Metopograpsus oceanicus*; *b*, on *Metopograpsus messor* from Kaledupa; *c*, *d*, on *Metopograpsus quadridentatus* from Japan; *e*, *f*, on *Metopograpsus quadridentatus* from Dodinga. *a*, *b*,  $\times 80$ ; *c*, *d*,  $\times 45$ ; *e*, *f*,  $\times 90$ .

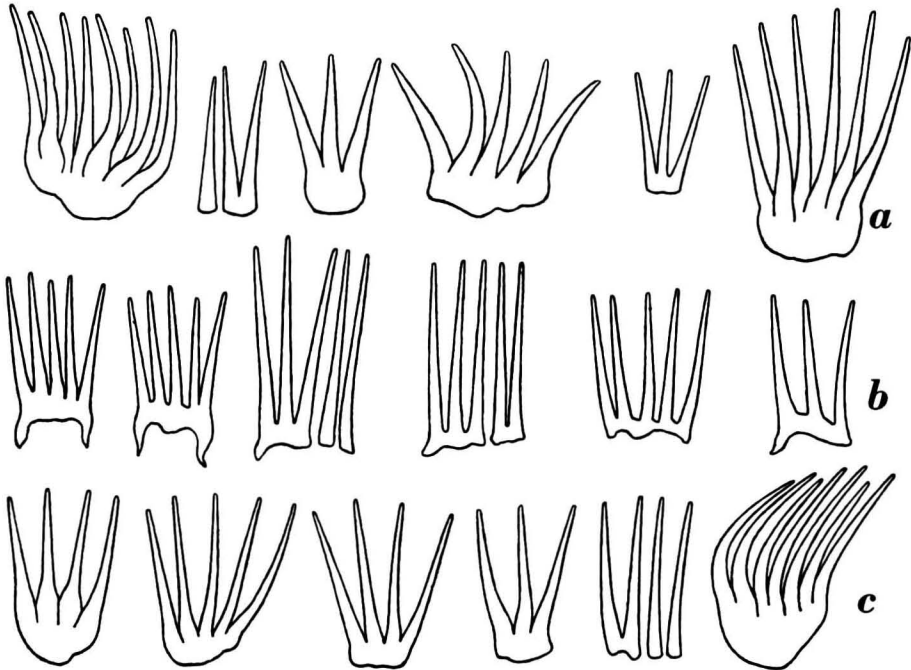


Fig. 4. *Sacculina yatsui*, excrescences of various parts of the external cuticle of three specimens. Upper row (*a*), on *Metopograpsus quadridentatus* from Dodinga; middle row (*b*), on *Metopograpsus quadridentatus* from Japan; lower row (*c*), on *Metopograpsus oceanicus*.  $\times 530$ .

excrescences are more strongly united than in the Japanese specimen on *M. quadridentatus*; in the former often there is a well developed basal part whilst in the Japanese specimen the basal part never becomes very thick. In this respect the Japanese specimen on *M. quadridentatus* is extremely similar to the specimens on *Pachygrapsus crassipes*, until now known from the Japanese region only. SHIINO's figure (1943, fig. 8 B) of *Sacculina yatsui* on *Pachygrapsus crassipes* also shows spines which for the greater part are not united with other spines.

*Sacculina yatsui* is strikingly similar to *S. leptodiae* Guérin-Ganivet. It is, indeed, not easy to find characters by which the two species can be distinguished. In general the tendency for isolated spines is larger in *S. yatsui*, but some specimens of *S. leptodiae* also show this kind of excrescences (cf. BOSCHMA, 1948). The canal system of the colleteric glands is more strongly divided in *S. yatsui*, whilst the canals in the glands of *S. leptodiae* almost without any exception are distinctly arranged in one row. It is impossible to give distinct data to prove with certainty that the two species are different.

#### *Sacculina plana* Boschma

Takao, South Formosa, May 29, 1907, SCHAUINSLAND leg. (collection Zoological Museum Munich), 3 ex. on one specimen of *Metopograpsus messor* (Forsk.), dimensions of the parasite  $8 \times 5 \times 2$  mm.

The specimens are from the same locality as the type material (cf. BOSCHMA, 1933), which were parasites of the crab *Grapsus strigosus* (Herbst). The species seems to have a tendency for gregariousness, as among the type material there are four crabs with two parasites each, and the three specimens in the present material all occur on one crab. The specimens are more or less oval (fig. 5 a), not strikingly different from the type specimen (BOSCHMA, 1933, fig. 7 i). As in the latter the mantle opening slightly protrudes over its surroundings.

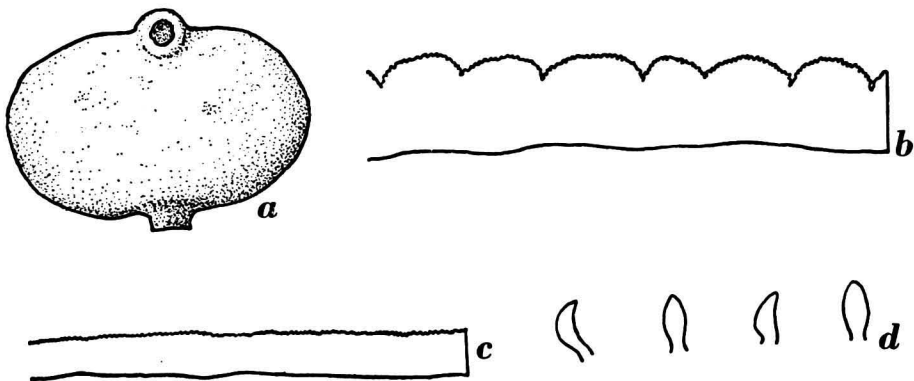


Fig. 5. *Sacculina plana*, specimen on *Metopograpsus messor*. a, left side; b, c, sections of the external cuticle; d, retinacula. a,  $\times 5$ ; b-d,  $\times 530$ .

The male genital organs correspond with those of previously described specimens (cf. BOSCHMA, 1933, 1937). The vasa deferentia are narrow tubes (fig. 6 a), the testes have completely united to one large sac. The passing of the left vas deferens into this common testis is shown in fig. 6 b, that of the right in fig. 6 c. Towards the dorsal region the common testis still somewhat increases in size (fig. 6 d).

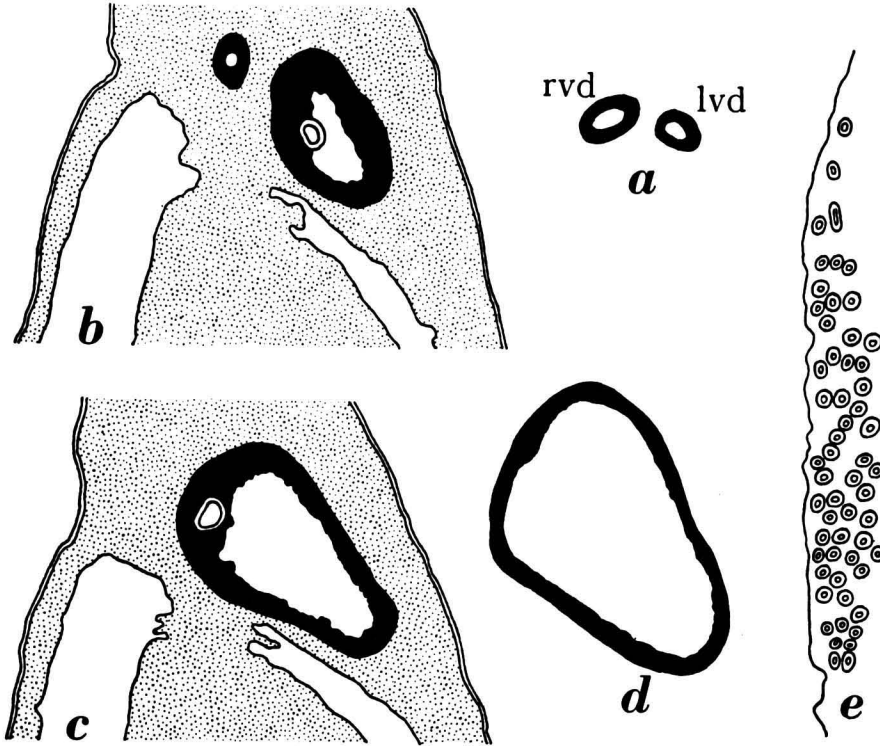


Fig. 6. *Sacculina plana*, specimen on *Metopograpsus messor*. a. transverse section of the ventral part of the vasa deferentia; b. posterior part of a longitudinal section showing the left vas deferens entering the testis; c. idem, showing the right vas deferens entering the testis; d. transverse section of the testis in its widest region; e. longitudinal section of one of the colleteric glands. *lvd*, left vas deferens; *rvd*, right vas deferens. a—d,  $\times 45$ ; e,  $\times 80$ .

A longitudinal section of one of the colleteric glands in the region of its most strongly branched part shows 57 canals (fig. 6 e). In the type specimen (cf. BOSCHMA, 1937, fig. 70 b) there are 59 of these canals.

The external cuticle of the mantle does not possess excrescences. Its surface is not entirely smooth, but slightly rough (fig. 5 b, c). In various parts it is somewhat grooved so that a transverse section has a more or less undulating surface. The thickness of this cuticle varies from 8 to 30  $\mu$ .

The internal cuticle of the mantle bears retinacula which consist of a single spindle only. The length of these spindles is from 12 to 15  $\mu$ , barbs were not found. In the type specimen the spindles are slightly larger (18  $\mu$ ).

**Sacculina imberbis** Shiino

Japan, HILGENDORF leg. (collection Zoological Museum Berlin), 1 ex. on *Metopograpsus quadridentatus* Stimps., dimensions of the parasite  $9 \times 4\frac{1}{2} \times 2$  mm.

The type specimens were living on the crab *Pachygrapsus crassipes* (cf. SHIINO, 1943). The shape of the specimen on *Metopograpsus quadridentatus* (fig. 7 a) is very similar to that of the specimen figured by SHIINO (1943, fig. 1 I).

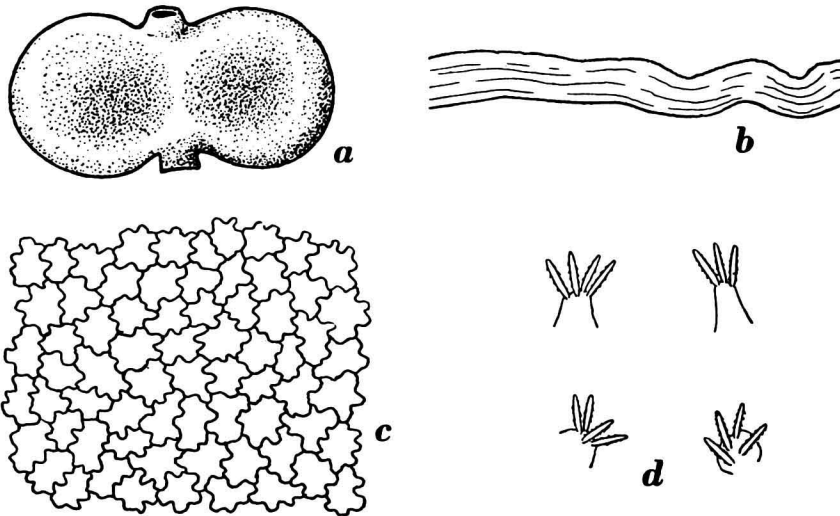


Fig. 7. *Sacculina imberbis*, specimen on *Metopograpsus quadridentatus*. a, left side; b, section of the external cuticle; c, surface of the external cuticle; d, retinacula. a,  $\times 4.8$ ; b—d,  $\times 530$ .

The male genital organs correspond with those of the type specimen described by SHIINO. They are found outside the visceral mass, in the region near the stalk (fig. 8 e). The vasa deferentia are narrow canals (fig. 8 a), their dorsal part has a distinct chitinous wall which penetrates into the ventral part of the testes (fig. 8 b). Towards the dorsal region the testes slightly increase in size (fig. 8 c, e) and gradually become narrower again (fig. 8 d).

The colleteric glands, which, as SHIINO remarks, are found near the anterior part of the visceral mass, are rather flat and possess a small number of canals only. In the present specimen this number is 14 in the most strongly branched region (fig. 8 f, g). Here the canals have a distinct chitinous wall, in SHIINO's specimen the chitin had not developed.

The external cuticle of the mantle (fig. 7 b, c) is rather thin ( $9-12 \mu$ ), it does not possess excrescences. Its surface shows small areas with an undulating contour (diameter of these areas 8 to  $15 \mu$ ).

The internal cuticle of the mantle bears numerous retinacula which are more or less regularly distributed over its surface (fig. 7 d, here the retinacula are placed at a much shorter distance from each other than in



reality). Each retinaculum bears three or four slender barbed spines of a length of 9 to 12  $\mu$ .

Undoubtedly the present specimen belongs to *Sacculina imberbis* Shiino. In SHIINO's specimen the external cuticle did not show the areas which

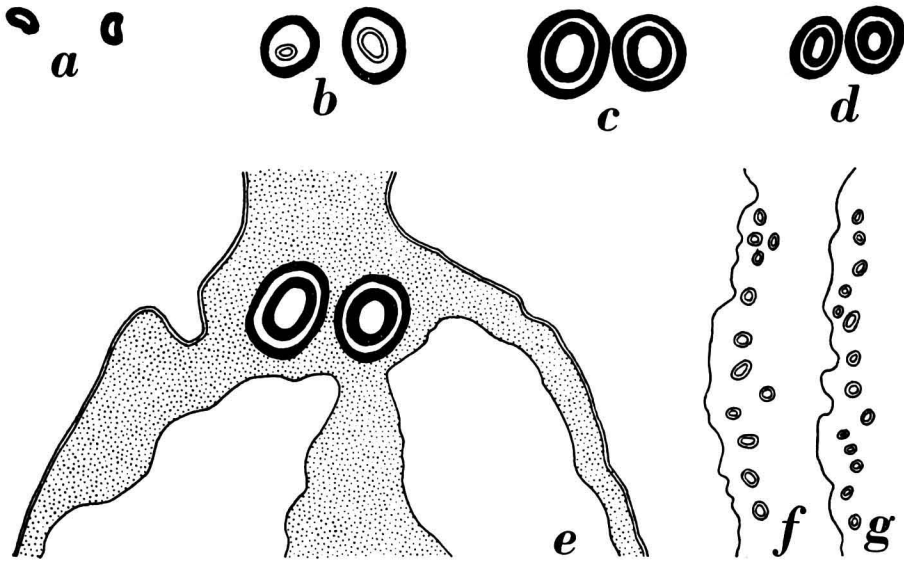


Fig. 8. *Sacculina imberbis*, specimen on *Metopograpsus quadridentatus*. a—d, transverse sections of the male genital organs; e, posterior part of a longitudinal section showing the testes (approximately the same region as c); f, g, longitudinal sections of one of the colleteric glands. a—e,  $\times 45$ ; f, g,  $\times 80$ .

occur in the present specimen. This difference is due to individual variation. Moreover, in many specimens of Sacculinidae which have these areas they are distinctly visible in certain parts of the mantle only. SHIINO did not find retinacula in his specimens. As they occur in the present specimen they undoubtedly also occur in specimens living on *Pachygrapsus crassipes*. But sometimes they are hard to find, especially when the internal cuticle is strongly adhering to the underlying tissues.

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