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NOTES ON SACCOLINA CARPILIAE
GUÉRIN-GANIVET (CRUSTACEA RHIZOCEPHALA)

by

H. BOSCHMA

Certain Rhizocephalan parasites of the crabs *Xanthias lamarcki* (H. M. E.), *Lybia tessellata* (Latr.), and *Glyptoxanthus vermiculatus* (Lam.) mutually so closely correspond in all their characters that undoubtedly they belong to the same species. When the characters of this species are defined it appears that these practically correspond with the characters of *Sacculina carpiliae* Guér.-Gan. There are slight differences, not easily to define, and consequently not fit for a distinct specific description. Provisionally, therefore, the parasites of the crabs mentioned above are regarded as belonging to *Sacculina carpiliae*.

The present paper contains notes on some specimens which undoubtedly belong to *Sacculina carpiliae* (parasites of *Carpilius convexus* (Rüpp.)), so that the particulars of the parasites of the crabs mentioned may be compared to those of the typical representatives of *Sacculina carpiliae*.

The data of the material dealt with here are:

Red Sea, Dr. Jousseume leg. (collection Paris Museum), 1 specimen on *Carpilius convexus* (Rüpp.), holotype of *Sacculina carpiliae* Guér.-Gan.

Zanzibar, Capt. F. R. Webb leg., February 1861 (collection Peabody Museum, New Haven, Conn.), 1 specimen on *Carpilius convexus* (Rüpp.).

Tamatave, Madagascar, W. Kaudern leg. (collection Stockholm Museum), 1 specimen on *Carpilius convexus* (Rüpp.).

Manin Island, C. Colm leg., 1912 (collection Munich Museum), 1 specimen on *Xanthias lamarcki* (H. M. E.).

Aranuka, Gilbert Islands, outer reef, S. Bock leg., November 3, 1917 (collection Stockholm Museum), 1 specimen on *Lybia tessellata* (Latr.).

Indian Ocean, Salmin leg. (collection Munich Museum), 1 specimen on *Glyptoxanthus vermiculatus* (Lam.).

Diagnosis of *Sacculina carpiliae* Guér.-Gan. Male genital organs in the posterior part of the body, outside the visceral mass, completely separated. Testes more or less globular, rather abruptly passing into the comparatively wide vasa deferentia. Colleteric glands with a small number of canals (up to 10 in longitudinal sections of the most strongly divided region). External cuticle of the mantle with groups of hyaline spines, consisting of a kind of chitin which is different from that of the main layers of this cuticle. The groups generally consist of more than 10 spines each, ex-

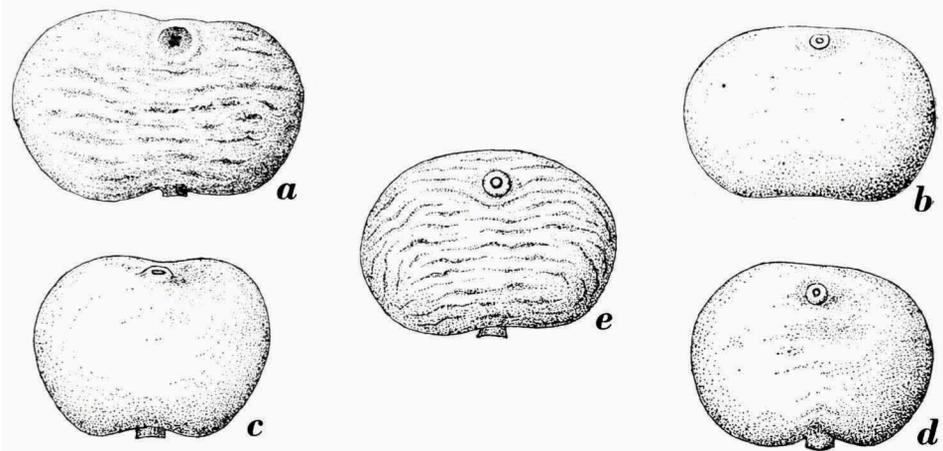


Fig. 1. *Sacculina carpiliae* Guér.-Gan. *a*, specimen on *Carpilius convexus* (Rüpp.) from Zanzibar; *b*, specimen on *Xanthias lamarcki* (H. M. E.); *c*, specimen on *Lybia tessellata* (Latr.); *d*, specimen on *Glyptoxanthus vermiculatus* (Lam.); *e*, specimen on *Carpilius convexus* (Rüpp.) from Madagascar. Left side. Greater diameter in mm: *a*, 12; *b*, 6; *c*, 6½; *d*, 8; *e*, 21.

ceptionally of compounds of 4 to 6. The spines of each group are united on a common, well developed basal part, they are not united on distinct branches, but take their origin from the basal part more or less independently. The spines of the excrescences may reach a length of 130 to 175 μ , the excrescences as a whole have a maximum height of 150 to 190 μ . Retinacula unknown, probably not occurring.

The specimens on *Carpilius convexus* (Rüpp.).

Guérin-Ganivet (1911) described the shape of the type specimen of *Sacculina carpiliae*; the two specimens on *Carpilius convexus* dealt with here largely correspond with the type. Both specimens (fig. 1 *a*, *e*) have a more or less oval shape, whilst the mantle appears to be strongly wrinkled. The dimensions of the specimen from Zanzibar are: greater diameter 12 mm, antero-posterior diameter 8 mm, smaller diameter 6 mm; those of the

specimen from Madagascar are: greater diameter 21 mm, antero-posterior diameter 14 mm, smaller diameter 6½ mm. In the two specimens the mantle opening occupies a corresponding place in the anterior region of the left side, the surroundings of the mantle opening do not notably project above the rest of the mantle.

Longitudinal sections were made from the specimen from Zanzibar and from that from Madagascar, so that the male organs and the colleteric glands could be examined in some detail.

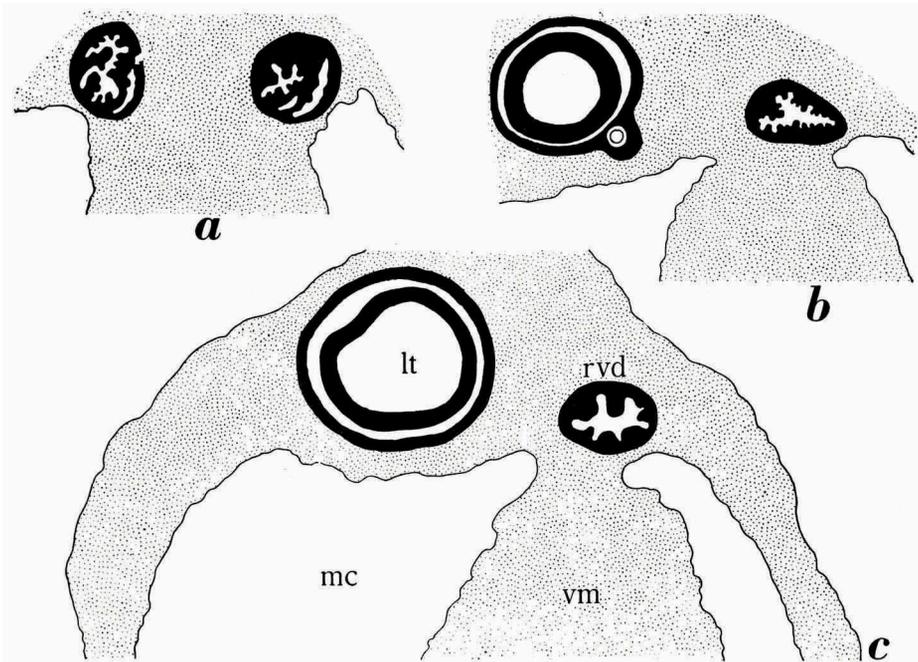


Fig. 2. *Sacculina carpiliae* Guér.-Gan., specimen on *Carpilius convexus* (Rüpp.) from Zanzibar, longitudinal sections of the posterior part of the body; *a* through the middle region of the vasa deferentia, each following section from a more dorsal region. *lt*, left testis; *mc*, mantle cavity; *rvd*, right vas deferens; *vm*, visceral mass. $\times 30$.

In the specimen from Zanzibar the larger part of the vasa deferentia is rather wide, but on account of strongly developed ridges on their inner walls the cavities of the vasa deferentia are rather reduced (fig. 2 *a*). In a more dorsal region the vasa deferentia become much narrower and pass into the testes, which have a more or less globular shape. In fig. 2 *b* the dorsal part of the left vas deferens, a narrow canal with a distinct inner chitinous tube, is passing the muscular sheath of the testis of the same side. In a more dorsal region the left testis reaches its largest size (fig. 2 *c*); the right

testis lies in a still more dorsal region, it has about the same size and structure as the left.

The male organs of the specimen from Madagascar are of approximately the same structure as those of the former specimen. Here again the cavities of the vasa deferentia are strongly reduced by a well developed system of ridges (fig. 3 *a*). In a more dorsal region the narrow canal which connects the vasa deferentia with the testes is found; fig. 3 *b* shows this narrow

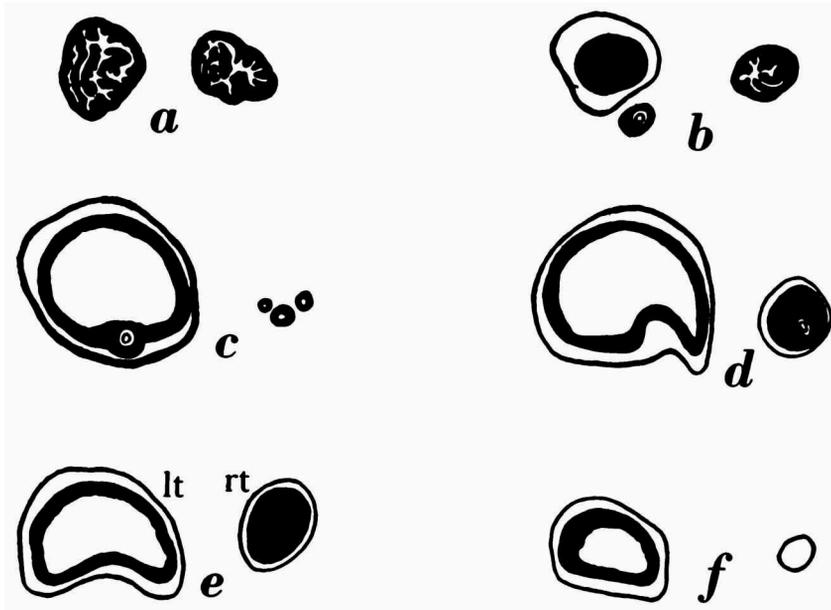


Fig. 3. *Sacculina carpiliae* Guér.-Gan., specimen on *Carpilius convexus* (Rüpp.) from Madagascar, transverse sections of the male organs; *a* showing the middle region of the vasa deferentia, each following section from a more dorsal region. *lt*, left testis; *rt*, right testis. $\times 18$.

canal of the left male organ, fig. 3 *c* the corresponding part of the right male organ. In fig. 3 *c* the narrow canal with its chitinous inner wall is passing the wall of the testis, in fig. 3 *d* the corresponding canal traverses the wall of the right testis. Fig. 3 *e* and 3 *f* show sections of the male organs in further dorsal planes. In this specimen the left testis is much larger than the right, the former has a fairly large cavity, whilst that of the latter has not developed.

The colleteric glands of the two specimens have an altogether similar shape and structure. In the specimen from Madagascar the canals do not show a distinct layer of chitin; in the figures (fig. 4 *a-c*) the walls of the

canals are represented. The glands possess a very small number of canals, up to 10 in longitudinal sections of the most strongly branched region of the glands. The canals are regularly arranged in a single row parallel to the surface of the gland.

In the specimen from Zanzibar the canals of the colleteric glands possess distinct chitinous tubes, these are drawn in fig. 4 *d-f*. Here again the canals

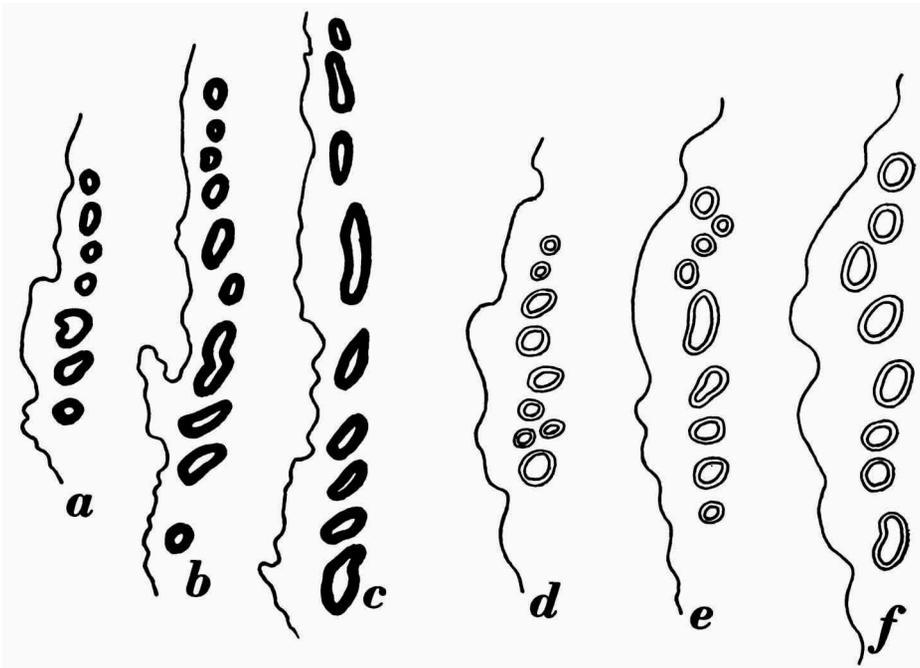


Fig. 4. *Saccolina carpiliae* Guér.-Gan., specimens on *Carpilius convexus* (Rüpp.), longitudinal sections of one of the colleteric glands. *a-c*, specimen from Madagascar; *d-f*, specimen from Zanzibar. *a* and *d* are from the peripheral region, each following section from a more central part. *a-c*, $\times 40$; *d-f*, $\times 60$.

of the colleteric glands nearly all are arranged in one row parallel to the surface. They occur in a small number only, the maximum number to be counted in one longitudinal section is 9.

A figure of one of the excrescences of the external cuticle of the type specimen was given in a previous paper (Boschma, 1936, fig. *a*). In fig. 5 of the present paper three excrescences of this specimen are represented. They show the basal parts only, the tops of all the spines having broken off. As it seemed advisable not to damage the type specimen more than necessary, no other parts of the mantle besides the portion with the broken excrescences

were taken from the specimen, especially as the available material allows of a direct comparison with excrescences of other specimens on *Carpilius convexus*. The excrescences of fig. 5 correspond in every important detail with those represented in fig. 6.

The excrescences of the external cuticle of the mantle of the specimen from Zanzibar (fig. 6 *a-c*) as a rule consist of rather numerous spines which are united on a well developed common basal part. The size and the number of spines of the excrescences vary to some degree in different parts of the cuticle. As a rule the excrescences have a total length (from the tops of the spines to the lower portion of the basal part) of 110 to 170 μ , the individual

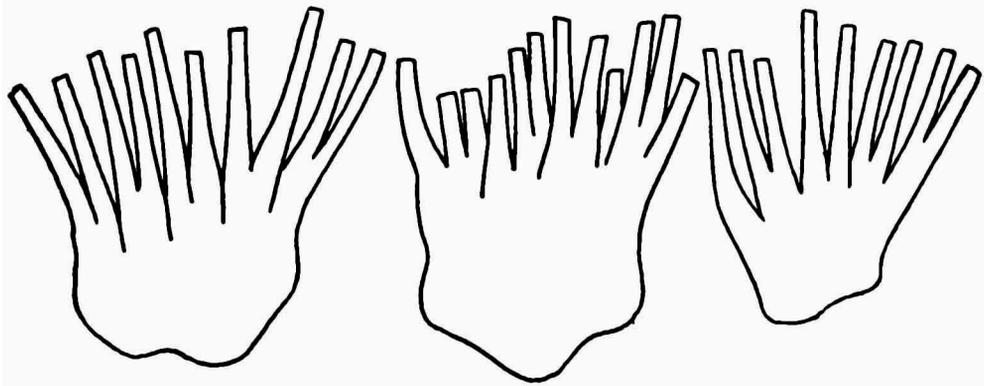


Fig. 5. *Sacculina carpiliae* Guér.-Gan., type specimen, excrescences of the external cuticle. $\times 530$.

spines vary in length from 65 to 120 μ . In certain parts of the mantle, e.g., in the neighbourhood of the stalk, the excrescences are decidedly smaller.

The excrescences of the external cuticle of the specimen from Madagascar (fig. 6 *d, e*) correspond closely with those of the former specimen, they show the same range of variation. Here the total length of the excrescences (basal part included) is from 110 to 130 μ , whilst the individual spines vary in length from 80 to 100 μ . Here again in some parts of the mantle, especially in the region of the stalk, there are smaller excrescences than those of the greater part of the cuticle.

On the parts of the internal cuticle of the mantle examined for this purpose no retinacula were found, so that in all probability these do not occur in the specimens.

The specimens on *Xanthias lamarcki* (H. M. E.), *Lybia tessellata* (Latr.) and *Glyptoxanthus vermiculatus* (Lam.).

The three specimens are of a similar more or less oval shape, and are

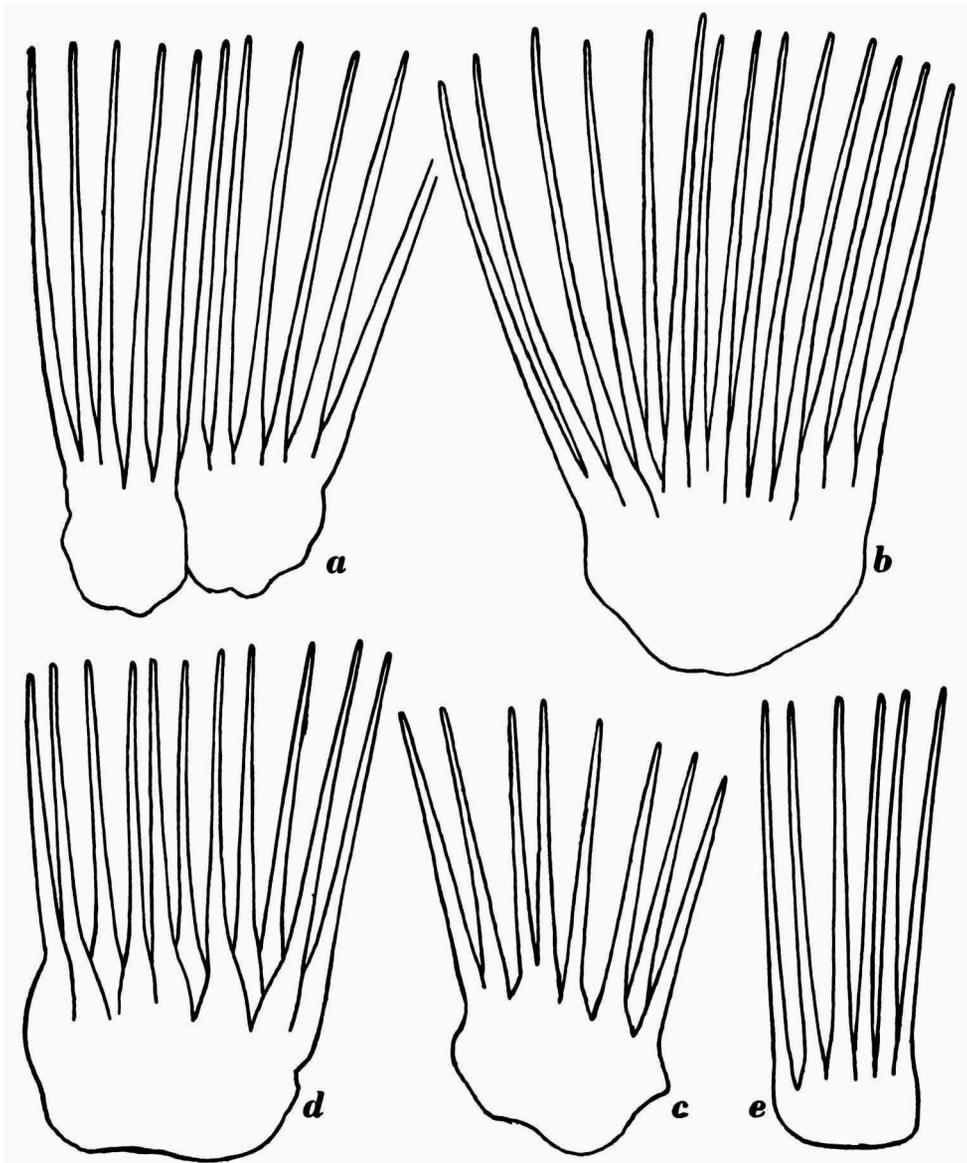


Fig. 6. *Saccolina carpiliae* Guér.-Gan., specimens on *Carpilius convexus* (Rüpp.), excrescences of the external cuticle. *a-c*, from the specimen from Zanzibar; *d-e*, from the specimen from Madagascar. $\times 530$.

not appreciably different in size. Their shape does not differ pronouncedly from that of the specimens on *Carpilius convexus*, but in contradistinction to these the mantle does not show any pronounced wrinkles or grooves. In the specimen on *Xanthias* (fig. 1 *b*) and in that on *Glyptoxanthus* (fig. 1 *d*)

the region of the mantle opening does not protrude noticeably above its surroundings, whilst in the specimen on *Lybia* (fig. 1 *c*) the mantle opening lies at the top of a very short tube. In the three specimens the mantle opening is found on the anterior region of the left side (the surface regarding the thorax of the host, cf. Boschma, 1948). The dimensions of the parasites are: specimen on *Xanthias*, $6 \times 4 \times 2$ mm; specimen on *Lybia*, $6\frac{1}{2} \times 5 \times 4$ mm; specimen on *Glyptoxanthus*, $8 \times 6 \times 3$ mm.

Of the three specimens longitudinal sections were made with not altogether excellent results, owing to the somewhat unsatisfactory state of preservation of the parasites and the brittleness of the material. The combined data

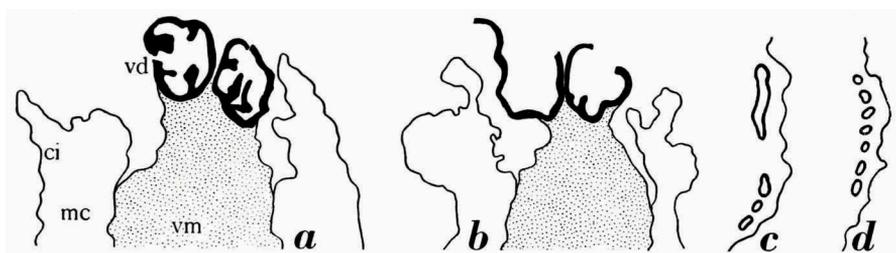


Fig. 7. *Sacculina carpiliae* Guér.-Gan., specimen on *Xanthias lamarcki* (H. M. E.). *a, b*, longitudinal sections of the posterior part of the body, in the region of the vasa deferentia. *c, d*, longitudinal sections of one of the colleteric glands, *c* from a more central region than *d*. *ci*, internal cuticle of the mantle; *mc*, mantle cavity; *vd*, vasa deferentia; *vm*, visceral mass. *a, b*, $\times 36$; *c, d*, $\times 64$.

derived from the three specimens, however, give a distinct idea of the characters of the species.

From the specimen on *Xanthias* the greater part of the male organs is lost, so that the ventral part of the vasa deferentia only is remaining (fig. 7 *a, b*). These organs are wide, they possess numerous ridges protruding into their lumen. In this specimen the internal cuticle has detached itself from the posterior part of the visceral mass, so that the exact position of the mantle cavity cannot be determined here.

Fig. 9 shows sections of the male genital organs of the specimen on *Lybia*. The vasa deferentia (fig. 9 *a*) possess a well developed system of ridges originating from their inner walls. In fig. 9 *b* the ventral part of the left testis surrounded by its muscular sheath, and the dorsal part of the right vas deferens are represented. The dorsal part of the vasa deferentia is much narrower than the ventral part of these organs, it gradually passes into the narrow canal with its strongly chitinized wall which is seen in the centre of the left testis in fig. 9 *b*. In fig. 9 *c* the chitinous canal which forms the transition of the vas deferens into the testis is seen in the muscular

sheath of the right testis. The cavity of this testis in this rather ventral region is not yet visible, it occurs in the left testis in the same section. In this specimen, in which the male organs probably have not yet reached full maturity, the lumen of the testes remains narrow.

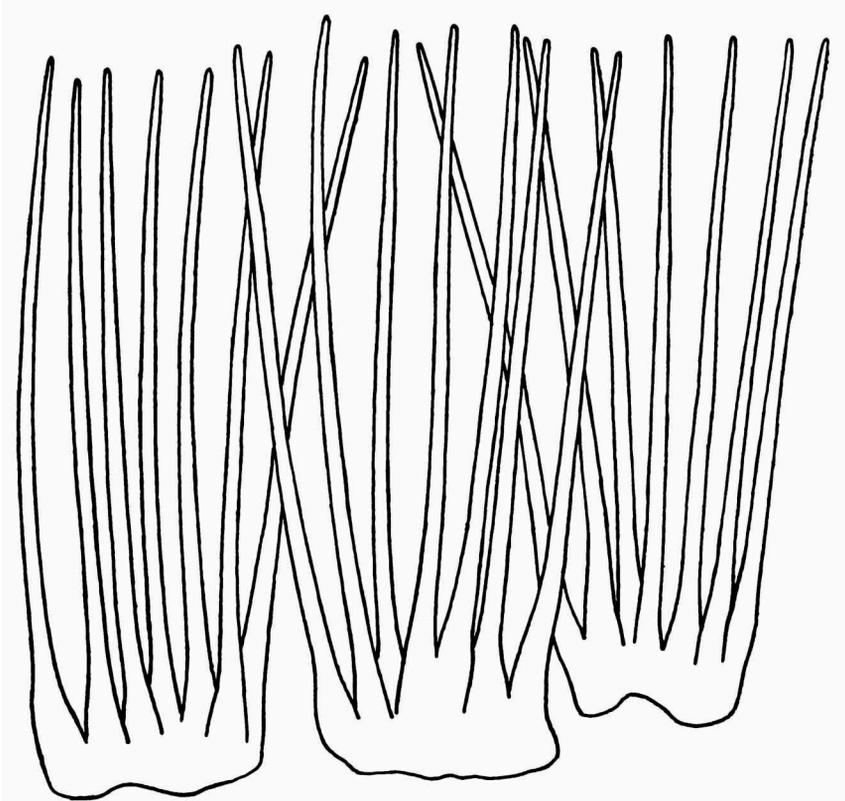


Fig. 8. *Sacculina carpiliae* Guér.-Gan., specimen on *Xanthias lamarcki* (H. M. E.), excrescences of the external cuticle. $\times 530$.

In the specimen on *Glyptoxanthus* the male organs are quite similar to those of the former specimen. The posterior parts of two longitudinal sections are represented here. One (fig. 11 *a*) is from the ventral region of the male organs, it shows the two vasa deferentia in their widest region where they contain numerous ridges. The other section (fig. 11 *b*) is from a more dorsal part, showing the region where the right testis reaches its largest size. In this specimen the right testis has a rather voluminous cavity, whilst the left testis remains smaller and has a narrow cavity only.

In the three specimens the colleteric glands have about exactly the same structure. The system of canals is very little developed, whilst in the peripher-

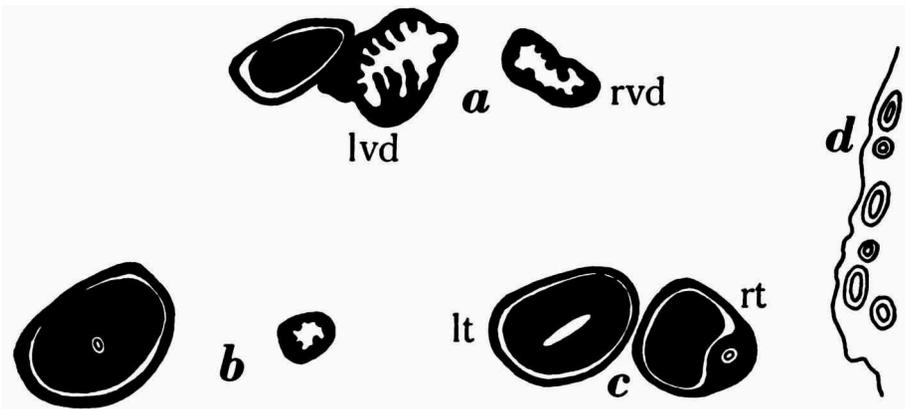


Fig. 9. *Sacculina carpiliae* Guér.-Gan., specimen on *Lybia tessellata* (Latr.). *a-c*, transverse sections of the male organs; *a* through the dorsal region of the vasa deferentia, each following section from a more dorsal part. *d*, longitudinal section of one of the colleteric glands. *lt*, left testis; *lvd*, left vas deferens; *rt*, right testis; *rvd*, right vas deferens. $\times 60$.

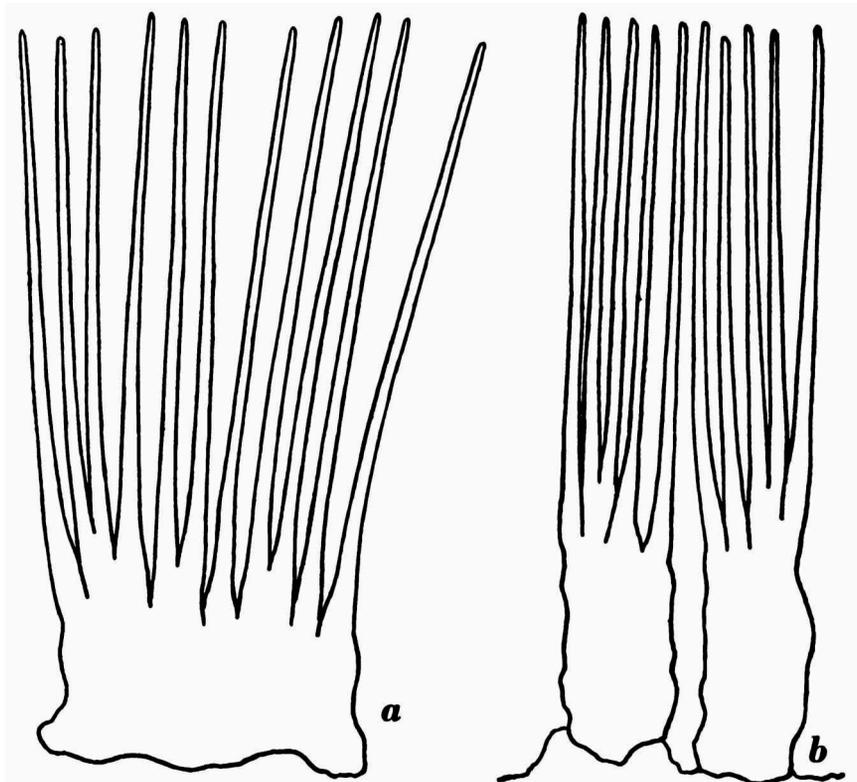


Fig. 10. *Sacculina carpiliae* Guér.-Gan., specimen on *Lybia tessellata* (Latr.), excrescences of the external cuticle. $\times 530$.

al region of the glands the canals are distinctly arranged in one row parallel to the surface of the gland. Two sections of one of the colleteric glands of the specimen on *Xanthias* are shown in fig. 7 *c, d*; here the maximum number of canals in one section is 7. One section of one of the colleteric glands of the specimen on *Lybia* is represented in fig. 9 *d*, this section, which is from the most strongly branched region, shows 6 canals. In fig. 12 *b-d* three sections are drawn of one of the colleteric glands of the specimen on *Glyptoxanthus*, in its most strongly divided part the canal system of this gland shows 7 canals.

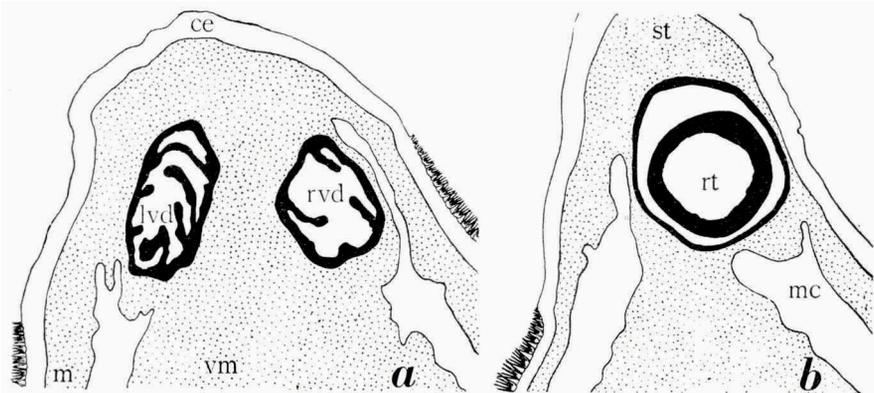


Fig. 11. *Sacculina carpiliae* Guér.-Gan., specimen on *Glyptoxanthus vermiculatus* (Lam.). Longitudinal sections of the posterior part of the body; *a* through the vasa deferentia, *b* through the dorsal part of the right testis. *ce*, external cuticle; *lvd*, left vas deferens; *m*, mantle; *mc*, mantle cavity; *rt*, right testis; *rvd*, right vas deferens; *st*, stalk; *vm*, visceral mass. $\times 40$.

The figures of the excrescences of the external cuticle of the mantle of the various specimens are drawn after longitudinal sections of the specimens, the excrescences as shown here represent sections, so that in reality they have many more spines than drawn in the figures. These figures show, however, all the necessary details for an exact comparison with the excrescences of the specimens on *Carpilius*, and with those of other species.

In the specimen on *Xanthias* (fig. 8) the excrescences of the cuticle reach a fairly large height, they may have a total dimension of 190μ . This is especially due to the great length of the spines which may have a length of 175μ , the common basal part as a rule has not undergone a strong development.

In the specimen on *Lybia* the greater part of the cuticle is covered by compounds consisting of numerous spines (fig. 10 *a*); in some parts of the mantle the compounds are slenderer and bear a rather small number

of spines (fig. 10 *b*). Here as a rule the common basal parts have more strongly developed than those of the former specimen. In this specimen the excrescences as a whole may reach a height of 190 μ , the individual spines as a rule are not longer than 150 μ .

The excrescences of the specimen on *Glyptoxanthus* (fig. 12 *a*) are very similar to those of the specimen on *Xanthias*, although they are somewhat shorter. In this specimen the excrescences may reach a height of 150 μ , whilst the individual spines as a rule are not longer than 130 μ .

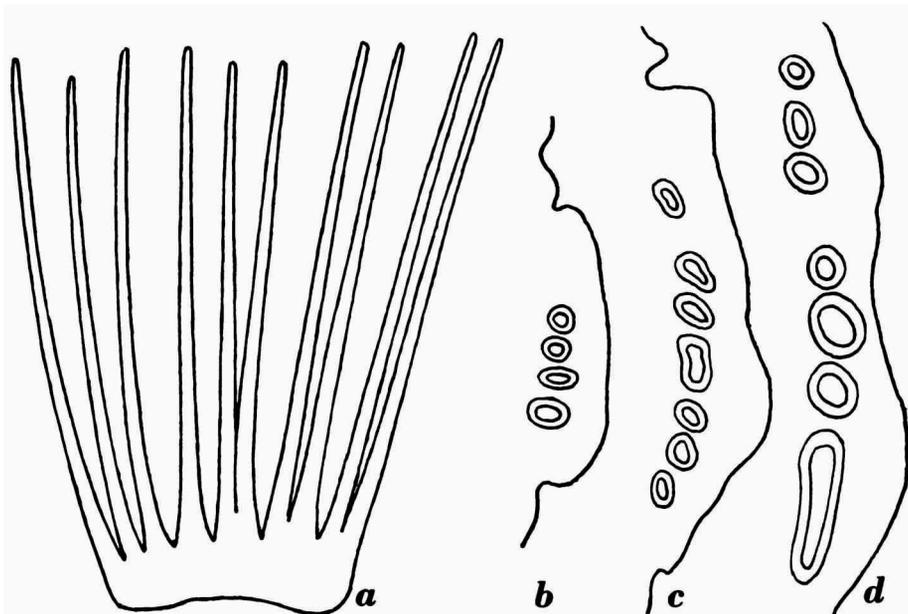


Fig. 12. *Sacculina carpiliae* Guér.-Gan., specimen on *Glyptoxanthus vermiculatus* (Lam.). *a*, excrescence of the external cuticle. *b-d*, longitudinal sections of one of the colleteric glands; *b* from a peripheral part, each following section from a more central part. *a*, $\times 530$; *b-d*, $\times 72$.

No retinacula were found on the parts of the internal cuticle examined for this purpose, so that in all probability these organs are lacking in the species.

The differences between the parasites of *Carpilius* and those of the other crabs are very insignificant. In the specimens on *Carpilius* the cavities of the vasa deferentia are greatly reduced by the strongly developed system of ridges, in the specimens on the other crabs this is less pronounced. In the specimens on *Carpilius* the colleteric glands have a few more canals than those of the specimens on the other crabs. As far as concerns the latter difference it must be taken into account that the parasites of *Carpilius* are

of larger size than those of the other crabs. The excrescences of the external cuticle of all the specimens dealt with in the present paper correspond in all important details. The differences mentioned above are of a too insignificant character for a specific distinction, so that it seems certain that all the specimens dealt with here belong to the one species *Sacculina carpiliae*.

Among the species of *Sacculina* which possess excrescences of a hyaline kind, consisting of groups of spines united on common basal parts, there is one, *Sacculina rotundata* Miers, which has excrescences of the same shape and size as those of *Sacculina carpiliae*. These two species have entirely different colleteric glands. In the most strongly divided part of the colleteric glands of *Sacculina carpiliae* a longitudinal section does not show more than 10 canals, whereas in *Sacculina rotundata* the canal system is so strongly developed that in a longitudinal section more than 100 canals may be counted.

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