

ZOOLOGY

SACCULINA PULCHELLA, A RHIZOCEPHALAN PARASITE OF THREE DIFFERENT HOSTS

BY

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(Communicated at the meeting of June 24, 1950)

The specific characters of *Sacculina pulchella* were defined in the following manner (BOSCHMA, 1933, p. 223): "Male genital organs in the posterior part of the body, outside the visceral mass. Testes completely separated, more or less globular. Colleteric glands approximately in the central region of the lateral surfaces of the visceral mass, with a moderate number of tubes. External cuticle of the mantle covered with excrescences which consist of a kind of chitin differing from that of the main layers. The excrescences are short papillae with numerous spines at their tops and with a small number of root-like expansions at their bases. The height of the excrescences varies from 12 to 18 μ . Retinacula have not been found."

In the present paper besides some notes on the specimens on *Huenia proteus* de Haan that have been described in previous papers, the chief details are given of one specimen of *S. pulchella* on *Hyastenus brockii* de Man and two specimens on *Egeria arachnoides* Latreille, two hosts on which the parasite previously was not known to occur. The entire material at present available has the following data.

Seychelles, Western Indian Ocean, H. M. S. "Sealark", Sta. F 8, 34 fms., October 20, 1905, 1 specimen (holotype) on *Huenia proteus* de Haan (collection United States National Museum, Washington, D. C.).

Amirante, Western Indian Ocean, H. M. S. "Sealark", Sta. E 11, 25-80 fms., November 10, 1905, 1 specimen on *Huenia proteus* de Haan (collection United States National Museum, Washington, D. C.).

Snellius Expedition, Amboina, September 11-17, 1930, 1 specimen on *Hyastenus brockii* de Man.

Chittagong coast, "Golden Crown", August, 1908, 2 specimens on one specimen of *Egeria arachnoides* Latreille (collection Indian Museum, Calcutta).

With the description of *Sacculina pulchella* a figure was given of the excrescences of the external cuticle of the specimen on *Huenia proteus* from Amirante (BOSCHMA, 1933, fig. 3); this figure is reproduced here as text-figure 1. In a later paper (BOSCHMA, 1937) some more data were mentioned concerning the species, including figured sections of the male organs and of one of the colleteric glands. A longitudinal section of the type specimen and the excrescences of the external cuticle of the same specimen were figured in another paper (BOSCHMA, 1950); this paper

moreover contains a figure of the left side of the type specimen. In the two specimens on *Huenia proteus* the excrescences of the external cuticle are of a strongly similar shape; they consist of small papillae showing

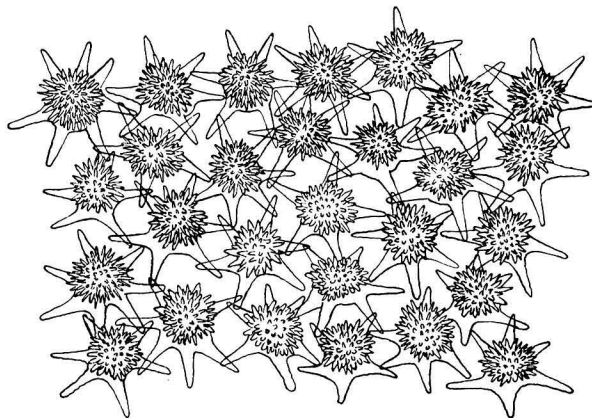


Fig. 1. *Sacculina pulchella*, specimen on *Huenia proteus* from Amirante. Excrescences of the external cuticle, surface view. From BOSCHMA (1933, fig. 5). $\times 530$.

numerous minute spines on their topmost flat surfaces and possessing a few root-like expansions in their lower parts, these roots adhering to the main layers of the cuticle.

The shape of the specimen on *Hyastenus brockii* (fig. 2a) is very similar to that of the larger specimen on *Egeria arachnoides* (fig. 2b). The two



Fig. 2. *Sacculina pulchella*. a, specimen on *Hyastenus brockii*, left side; b, the larger specimen on *Egeria arachnoides*, left side. a, $\times 6$; b, $\times 3$.

specimens are slightly oval, in both of them the mantle opening is a very narrow slit in the central part of the anterior region on the left side of the body. The surroundings of the mantle opening do not protrude above the surface. In contradistinction to these two specimens the type is distinctly kidney-shaped, whilst here the mantle opening is found at the top of a small tube (cf. BOSCHMA, 1950, fig. 1e). The dimensions of the type specimen are $5 \times 2\frac{1}{2} \times$ less than 2 mm; those of the specimen on *Hyastenus brockii* $6 \times 4 \times 2$ mm; those of the larger specimen on *Egeria arachnoides* $11 \times 8 \times 3$ mm. The smaller specimen on *Egeria arachnoides*, obviously a young specimen that recently had become external, does not exceed a size of 2 mm in any direction. In the two specimens of fig. 2 the mantle does not show any grooves or wrinkles, with the exception of the median

depression on the right surface caused by pressure of the median ridge of the abdomen of the host.

Parts of longitudinal sections of the specimen on *Hyastenus brockii* are shown in fig. 3. The first section (fig. 3a) shows the narrow right vas deferens and of the left male organ the region in which the vas deferens

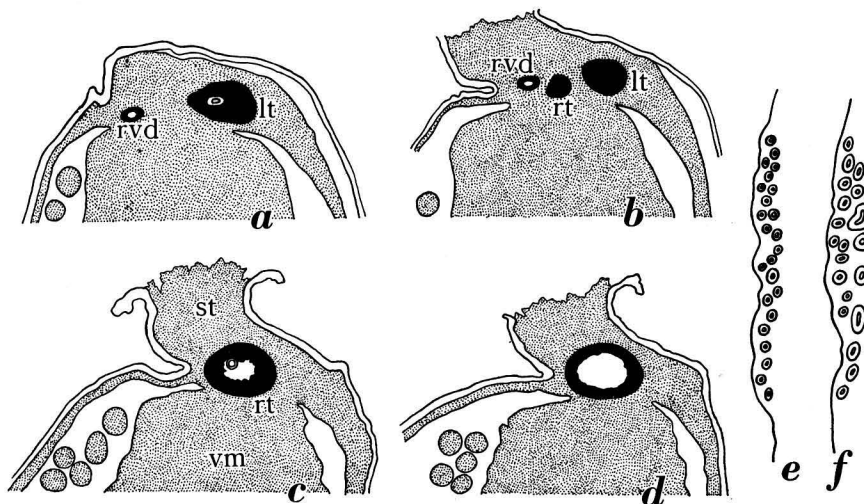


Fig. 3. *Sacculina pulchella*, specimen on *Hyastenus brockii*. *a-d*, posterior parts of longitudinal sections, *a* from a region ventral from the stalk, each following section from a more dorsal region. *e, f*, longitudinal sections of one of the colleteric glands. *lt*, left testis; *rt*, right testis; *rvd*, right vas deferens; *st*, stalk; *vm*, visceral mass. *a-d*, $\times 36$; *e, f*, $\times 64$.

is passing into the testis; here the cavity is lined with a distinct layer of chitin, a character found in all the species of the genus in which the vasa deferentia more or less abruptly pass into the testes. From this region the left testis does not appreciably increase in size, it soon reaches its dorsal end, so that in the next figured section (fig. 3b) the closed dorsal part of the left testis is visible. Here moreover the ventral part of the right testis appears. The latter has obtained its largest size in a slightly more dorsal region (fig. 3c), showing here moreover the narrow chitinous canal which forms the connexion between the vas deferens and the testis. Towards a still more dorsal region the right testis does not become appreciably larger, though its cavity becomes distinctly wider (fig. 3d). The figures show that in this specimen the right testis is found slightly behind the left.

Two sections of one of the colleteric glands are drawn in the same figure, the one (fig. 3e) from a more peripheral region than the other (fig. 3f). The glands contain a rather flat mass of branched canals, the latter have a comparatively thick layer of chitin. In the most strongly branched region of these glands a longitudinal section contains 24 canals.

The external cuticle of the mantle, which is comparatively thin (thickness 9 to 18 μ), bears excrescences of a similar shape as those of the type

specimen. The excrescences are small papillae which at least in their outer layers consist of a hyaline kind of chitin, differing from that of the main layers by its lack of affinity for stains. In sections of the cuticle the internal part of the excrescences often is slightly stained, proving that here the chitin is of a softer consistency. The excrescences have a height of 18 to 24 μ , at their upper surface they possess a great number of spines, and at their sides they show a few larger spines (fig. 4*a, b*). In surface

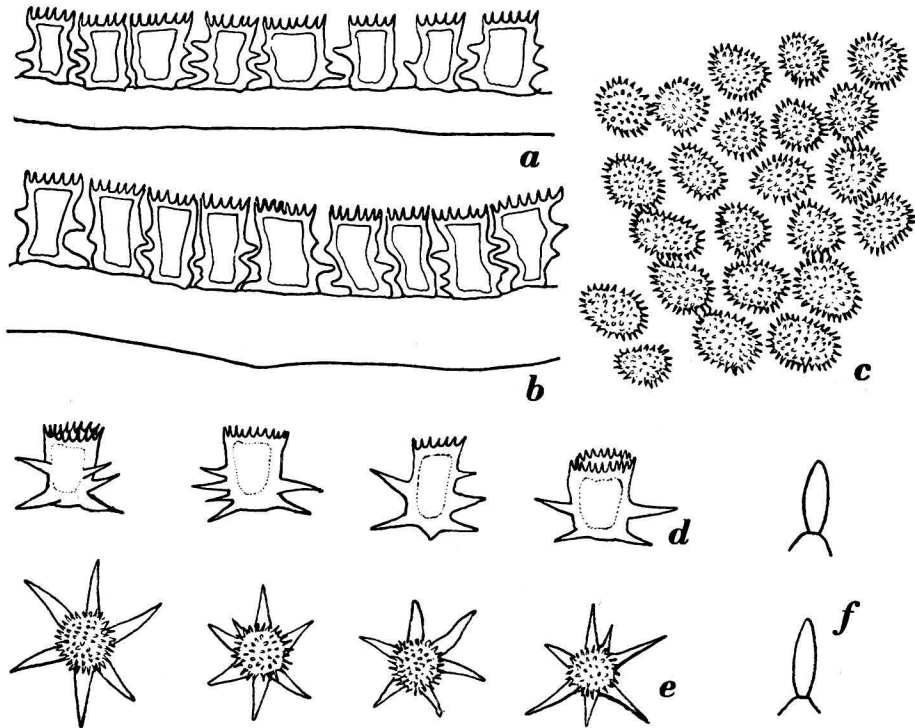


Fig. 4. *Sacculina pulchella*, specimen on *Hyastenus brockii*. *a, b*, sections of the external cuticle; *c*, excrescences of the external cuticle in surface view (top parts only); *d*, isolated excrescences in side view; *e*, isolated excrescences in surface view; *f*, retinacula. $\times 530$.

view it appears that the excrescences vary in diameter from 9 to 18 μ (fig. 4*c*; here the lateral spines of the excrescences have been omitted). The structure of the excrescences is best understood in isolated specimens scraped from the cuticle (fig. 4*d, e*). Then it appears that the large spines are not confined to the basal parts of the excrescences only, as the roots of the excrescences of the type specimen, but they project freely between the neighbouring excrescences; these spines may develop to a fairly large size, reaching a length of about 15 μ .

On the internal cuticle of the mantle a number of retinacula were found, which seem to have a fairly regular distribution over this cuticle. Each retinaculum (fig. 4*f*) consists of a small basal part and a single

spindle, the latter has a length of 18 to 24 μ . These spindles seem to be devoid of barbs.

In the larger specimen on *Egeria arachnoides* the male genital organs are very similar to those of the type specimen. The vasa deferentia have a narrow lumen, which in the region in which they pass into the testes shows a distinct layer of chitin (visible in the central part of the left male organ in fig. 5a). Towards the dorsal region the testes become distinctly larger (fig. 5b), but their cavities remain narrow. One of the testes is

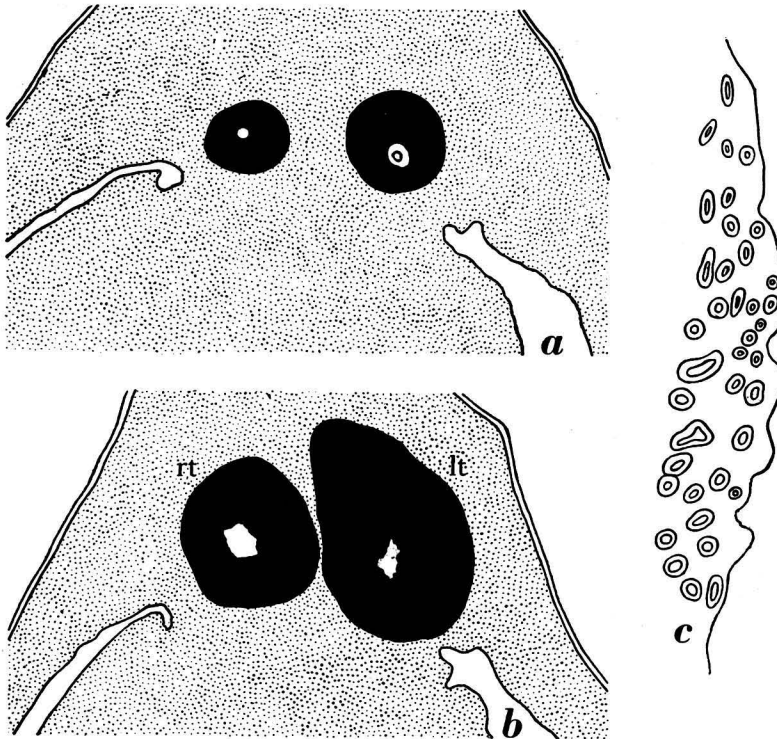


Fig. 5. *Sacculina pulchella*, larger specimen on *Egeria arachnoides*. a, posterior part of a longitudinal section in the region of the vasa deferentia; b, posterior part of a longitudinal section in the region of the testes; c, longitudinal section of one of the colleteric glands. lt, left testis; rt, right testis. a, b, $\times 36$; c, $\times 64$.

slightly larger than the other, but both male organs are fully developed.

The colleteric glands of this specimen again are rather flattened. They contain a slightly larger number of canals than those of the specimens dealt with above; in a longitudinal section of the most strongly branched region of these glands the number of canals may amount to 38 (fig. 5c). In this specimen again the canals possess a well developed layer of chitin.

The excrescences of the external cuticle in this specimen consist of cylindrical papillae composed of an outer layer of hard chitin showing no affinity for stains and an internal mass of softer structure that in the sections is slightly stained (fig. 6a, b). The height of the excrescences

varies from 12 to 21 μ , the main layers of the cuticle have a thickness varying from 9 to 20 μ . The excrescences at their tops are covered with numerous small spines, of which the marginal ones are somewhat larger than those in the centre of the upper surface. The diameter of the papillae

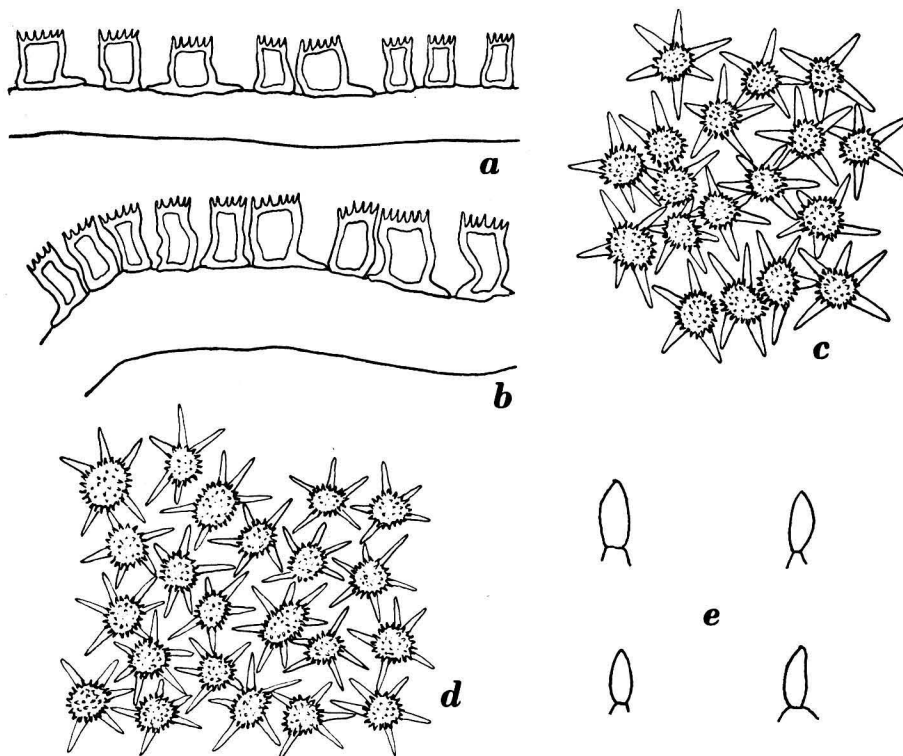


Fig. 6. *Sacculina pulchella*, larger specimen on *Egeria arachnoides*. *a*, *b*, sections of the external cuticle; *c*, *d*, excrescences of the external cuticle in surface view; *e*, retinacula. $\times 530$.

varies from 7 to 14 μ (fig. 6*c*, *d*). In their basal parts the excrescences possess a variable number of root-like expansions, which are adhering to the main layers of the cuticle. In some parts of the mantle these roots are rather strong (fig. 6*c*), in other parts they are much thinner (fig. 6*d*). The length of these roots as a rule is not more than 12 μ . In many parts of the cuticle the excrescences are more crowded than those represented in fig. 6*c* and *d*.

On the internal cuticle of the mantle there are a fairly large number of retinacula, which seem to be rather regularly distributed over the surface of this cuticle. These retinacula consist of a small basal part and a single spindle each. The spindles vary in length from 13 to 18 μ , they seem to possess no barbs.

The small parasite found on the same crab of the species *Egeria arachnoides* as the larger specimen has a more or less globular shape, slightly flattened laterally. Its larger diameter is about 2 mm. From this specimen

a series of longitudinal sections was made, which shows that the animal is very young and still immature. The two male organs occupy exactly the same position as those of the specimens dealt with above (fig. 7). The two

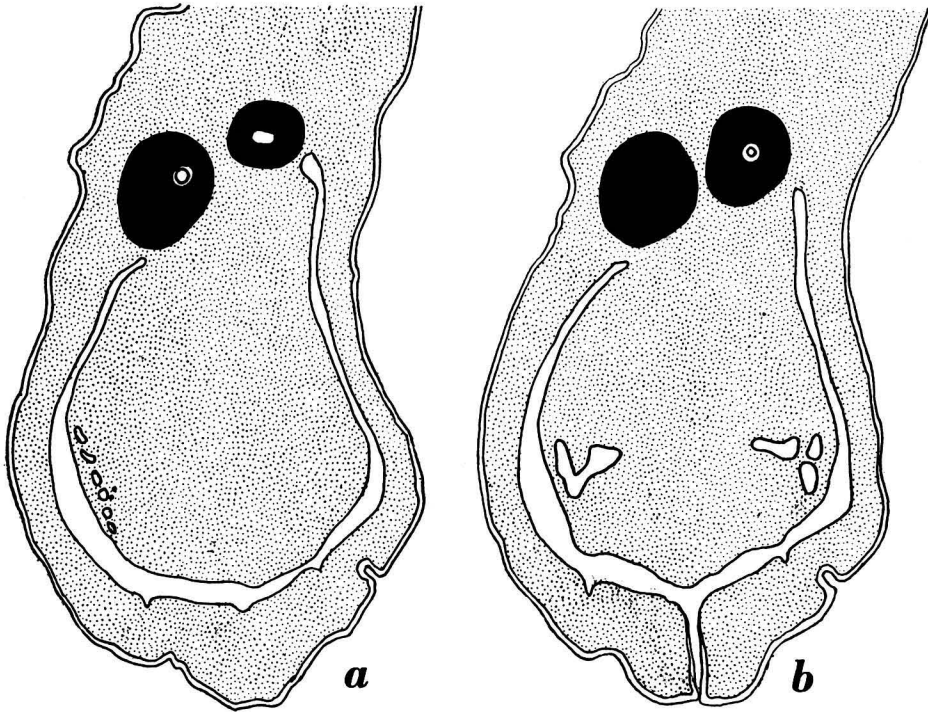


Fig. 7. *Sacculina pulchella*, smaller specimen on *Egeria arachnoides*, longitudinal sections, *a* from a more ventral region than *b*. $\times 54$.

male organs have an approximately equal size and a similar shape. In the two male organs the chitinous canal that forms the transition between the vas deferens and the testis is already distinctly visible, in one of the male organs this canal is found in a more ventral plane than in the other. Fig. 7*b* represents a median section showing the narrow mantle opening and the central parts of the colleteric glands, which here have a few rather wide canals only. In the more ventral section of fig. 7*a* one of the colleteric glands is present; though the section shows this gland in its most strongly divided part there are six canals only.

In this young specimen the external cuticle of the mantle is a thin layer of chitin (thickness approximately 6μ), which has a smooth surface, without any excrescences.

It is interesting that one specimen of *Egeria arachnoides* is infested by two parasites of extremely different sizes, the larger diameter of the one being 11 mm, that of the other about 2 mm. As the external cuticle of the smaller specimen does not bear excrescences it is not absolutely certain that the two specimens both belong to *Sacculina pulchella*. As, however, the

male organs in the two specimens correspond in every detail, it is highly probable that the two are conspecific. The differences found in the colleteric glands then may be explained by the fact that the small specimen is still immature, so that the colleteric glands have remained undeveloped.

As it is improbable that the young parasite is the result of an infection of the host in its fully adult state, the young external sac must have arisen as a recent bud from the root system of the older parasite. However this may be, the present case remains exceptional. When more than one Sacculinid parasite are found on one crab as a rule these parasites have reached about the same stage of development though they may markedly differ in size, usually on account of lack of sufficient space for a normal development.

The various specimens described above in all probability all belong to the species *Sacculina pulchella*. Among each other they show differences, but these seem to be too insignificant as peculiar specific characters. In the specimens on the three different crabs the male organs have a corresponding structure. There are slight differences, as in one the testes are found the one behind the other, and in the others more or less side by side, but this may be explained by individual variation. The same holds for the differences in the canal system of the colleteric glands. Leaving aside the very small specimen there is a difference between the larger specimen on *Egeria* and those on the other hosts. Whilst in the latter the number of canals is not much over 20, in the former this number is nearly 40. But this difference may have come about in connexion with the differences in size, the larger specimen on *Egeria* being much larger than those on the other crabs.

The excrescences of the external cuticle of the larger specimen on *Egeria* in every respect are similar to those of the specimens on *Huenia*. On the other hand the excrescences of the specimen on *Hyastenus* differ from those of the parasites of the other crabs by having spines freely extending laterally, not only in the extreme basal region and adhering to the main layers of the cuticle. This difference again may be the result of individual variation.

It is an important fact that in the specimen on *Hyastenus* as well as in the larger specimen on *Egeria* there are distinct retinacula of a peculiar shape. This decidedly points to the fact that these parasites are conspecific. In the specimens on *Huenia* no retinacula were found, but we may safely conclude that one of the specific characters of *Sacculina pulchella* is the possession of retinacula, each of which bears a single spindle only.

It is interesting to note that the three hosts of *Sacculina pulchella*, viz., *Huenia proteus*, *Hyastenus brockii*, and *Egeria archnoides*, all belong to the family Maiidae. As far as at present known the parasite therefore seems to be restricted to crabs of one family.

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