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SACCULINA LEPTODIAE GUÉR.-GAN., A PARASITE OF THREE DIFFERENT CRABS

by

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The description of *Sacculina leptodiae* by Guérin-Ganivet (1911) was based on specimens infesting the crab *Xantho exaratus* (H. M. E.). Other specimens, identified as *S. leptodiae* or otherwise, have been mentioned in literature, so that the synonymy may be given as follows.

Sacculina leptodiae Guérin-Ganivet, 1911

Sacculina leptodiae Guérin-Ganivet, 1911. Type specimens on *Xantho exaratus* (H. M. E.) from Jibuti, Gulf of Aden, and from Grande Comore.

Sacculina rotundata (p. p.), Boschma, 1931. Specimen on *Pseudozius caystrus* (Ad. & White) from Ternate.

Sacculina leptodiae, Boschma, 1936. Type specimens on *Xantho exaratus* (H. M. E.).

Sacculina leptodiae, Boschma, 1937. Type-locality fixed as Jibuti, Gulf of Aden.

Sacculina leptodiae, Boschma, 1947. Specimens on *Thalamita stimpsoni* A. M. E. from Manoembai, Aroe Islands.

The present paper is based on the examination of 7 specimens on *Xantho exaratus* (H. M. E.), 20 specimens on *Thalamita stimpsoni* A. M. E., and 13 specimens on *Pseudozius caystrus* (Ad. & White). It proved that there is a certain amount of variation in the shape and size of the male genital organs, in the structure of the colleteric glands, and in the size and shape of the excrescences of the external cuticle. Specimens occurring as parasites on one species of crab among each other show a corresponding degree of variation as that found when specimens from various hosts are compared. It seems therefore safe to conclude that the

parasites of the three crabs, as far as they are characterized by corresponding excrescences of the external cuticle, really belong to one species.

In the present paper the specimens are indicated with their provisional numbers to avoid lengthy terms. The data concerning the material dealt with here are the following.

Specimens on *Xantho exaratus* (H. M. E.).

No. 373. Zanzibar, C. Cooke leg., March 20, 1865 (collection Mus. Comp. Zoöl., Cambridge, Mass.), 7 × 4 × 3 mm.

No. 603. Suez, Bannwarth leg., 1913 (collection Munich Museum), 9 × 5 × 2½ mm.

No. 1034 A. Port Blair, Andamans, S. W. Kemp leg. (collection Indian Museum, Calcutta, 9 × 5 × 4 mm.

No. 1091 A, B. Red Sea, Kossmann leg. (collection Zool. Inst. Heidelberg), A: 8 × 5½ × 3 mm, B: 9 × 6 × 3½ mm.

No. 1104. Jibuti, H. Coutière leg., 1897, holotype of *Sacculina leptodiae* Guérin-Ganivet (collection Paris Museum).

No. 1105. Grande Comore, Pobéguin leg., 1899, paratype of *Sacculina leptodiae* Guérin-Ganivet(collection Paris Museum).

Specimens on *Thalamita stimpsoni* A. M. E.

No. 785 A-E. Manoembai, Aroe Islands, October 11-14, 1929, Snellius Expedition, A: 11½ × 9 × 2½ mm, B: 12½ × 7 × 3½ mm, C: 11 × 7 × 4 mm, D: 5 × 4 × 1½ mm, E: 13 × 8 × 2 mm.

No. 815 A-O. Dobo, Aroe Islands, October 10, 1929, Snellius Expedition, A: 11 × 7½ × 2½ mm, B: 9 × 6½ × 2 mm.

Specimens on *Pseudozius caystrus* (Ad. & White).

No. 584. Ternate, Kükenthal leg.; from Dr. J. G. de Man's collection (collection Amsterdam Museum), 5 × 2½ × 1½ mm.

No. 695 C. Tidore, September 24-29, 1929, Snellius Expedition, 5½ × 3 × 1½ mm.

No. 770 A. Tidore, September 24-29, 1929, Snellius Expedition, 4½ × 2½ × 1 mm.

No. 800 A. Ternate, April 1-2, 1930, Snellius Expedition, 8 × 4½ × 2 mm.

No. 809 A. Morotai, June 3-7, 1930, Snellius Expedition, 8 × 3½ × 2 mm.

No. 902 A-D. Ternate, September 29, 1929, Snellius Expedition, A: 7½ × 4 × 1½ mm, B: 4 × 2 × 1 mm, C: 5 × 3 × 1½ mm, D: 5½ × 3 × 1½ mm.

No. 903 A. Leti, October 31, 1930, Snellius Expedition, 8 × 5 × 2 mm.

No. 987 A. Leti, October 31, 1930, Snellius Expedition, 6½ × 3 × 2 mm.

No. 992 A. Amboina, September 14, 1930, Snellius Expedition, 8 × 5 × 2 mm.

No. 1055. Gulf of Tadjourah, Faurot leg., 1895 (collection Paris Museum), 8 × 5 × 3 mm.

Though there is a fairly large amount of variation in the shape of the animals there is a general tendency for a broadly oval or panduriform shape (figs. 1, 2). The parasites of each of the crabs may differ considerably among each other, whilst a certain shape is not peculiar to parasites of a certain crab. As a rule the surface of the mantle is smooth to the naked eye, though occasionally the mantle may show grooves and wrinkles

(fig. 2 *c*), which may become rather distinct (fig. 1 *k*) or even may give the specimen a pronouncedly striated appearance (fig. 1 *a*). The mantle opening is found in the centre of the anterior border of the mantle, or, as generally, it has shifted slightly to the left side (the surface of the

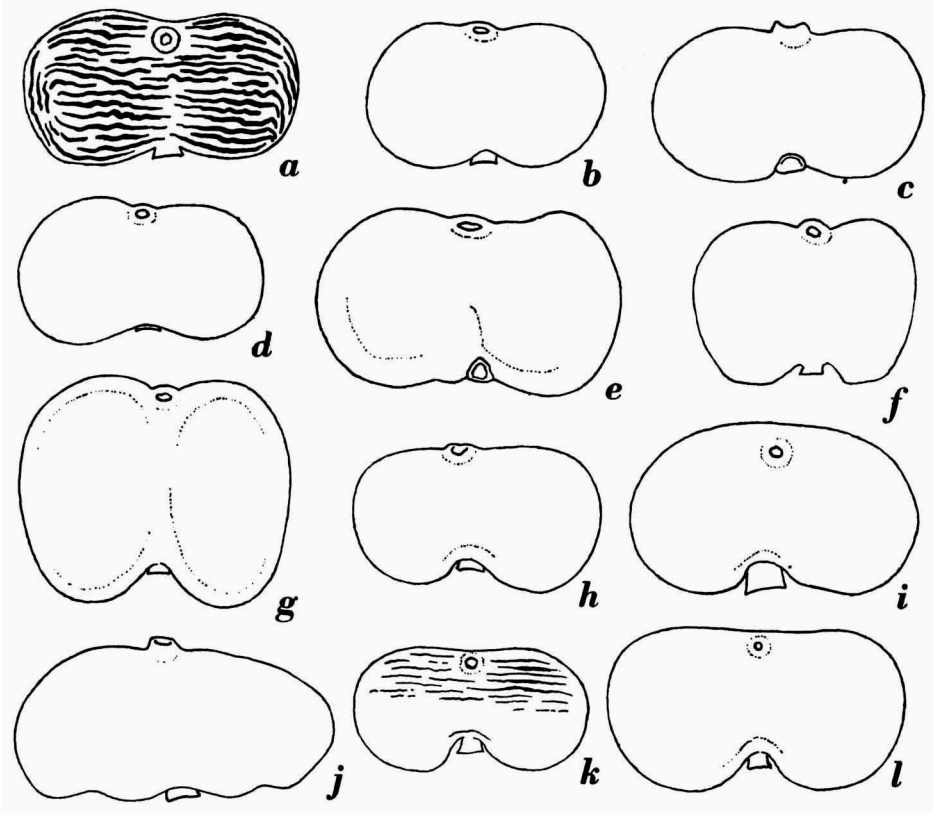

Fig. 1. *Sacculina leptodiae* Guér.-Gan., left side of various specimens. *a-d*, parasites of *Xantho exaratus* (H. M. E.); *a*, no. 1034 A; *b*, no. 373; *c*, no. 603; *d*, no. 1033 B1. *e-g*, parasites of *Thalamita stimpsoni* A. M. E.; *e*, no. 785 B; *f*, no. 815 B; *g*, no. 785 A. *h-l*, parasites of *Pseudozius caystrus* (Ad. & White); *h*, no. 903 A; *i*, no. 770 A; *j*, no. 987 A; *k*, no. 902 A; *l*, no. 809 A. The larger diameter of the specimens is: *a*, 9 mm; *b*, 6½ mm; *c*, 9 mm; *d*, 10 mm; *e*, 12½ mm; *f*, 9 mm; *g*, 11 mm; *h*, 8 mm; *i*, 4½ mm; *j*, 6½ mm; *k*, 7½ mm; *l*, 8 mm.

parasite touching the thorax of the host). In nearly all specimens the surroundings of the mantle opening do not protrude noticeably above the rest of the mantle. In some specimens, however, the mantle opening lies at the top of a short tube (fig. 1 *c*, *j*). There is a general trend of broadening of the body during growth, as illustrated in fig. 2, in which three specimens

from the same locality, parasites of the same host, are drawn on the same scale. The smaller specimen (fig. 2 *a*) has a roundish contour, in the next larger specimen (fig. 2 *b*) the dorso-ventral diameter is already appreciably larger than the antero-posterior diameter, whilst in the largest specimen (fig. 2 *c*) this difference is decidedly more pronounced. On the other hand in the specimen of fig. 1 *g* this difference is very insignificant, though its larger diameter is between that of the specimens of fig. 2 *b* and *c* (11 mm against 9 and 13 mm respectively).

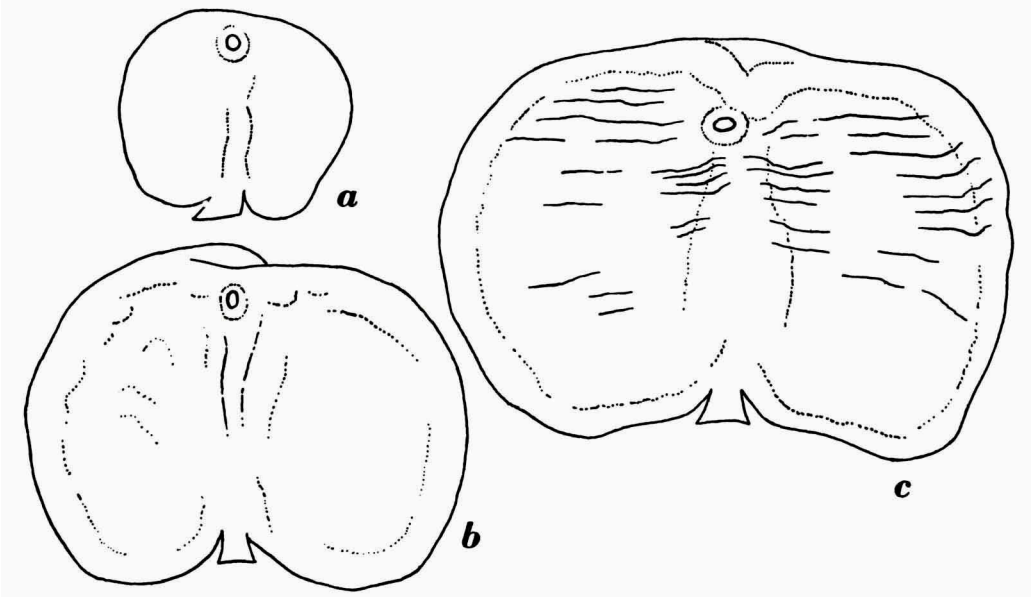

Fig. 2. *Sacculina leptodiae* Guér.-Gan., left side of three specimens on *Thalamita stimpsoni* A. M. E., enlarged on the same scale. *a*, no. 785 D; *b*, no. 785 F; *c*, no. 785 E. × 6.

In some respects the size of the parasites is dependent upon the size of their hosts, as on the larger species of crab, *Thalamita stimpsoni*, the parasites may attain a greater diameter of 13 mm. On the somewhat smaller crab *Xantho exaratus* the largest of the parasites has a greater diameter of 10 mm, whilst the parasites of the still smaller crab *Pseudozius caystrus* reach a maximum greater diameter of about 8 mm.

When a comparison of the sizes of specimens on the same host is made there is, however, no direct correlation of the size of the host and that of the parasite. A few instances may illustrate this.

Specimens on *Thalamita stimpsoni* A. M. E.

No. 785 A, measurements 11½ × 9 × 2½ mm, carapace breadth of host 28 mm.
No. 785 B, measurements 12½ × 7 × 3½ mm, carapace breadth of host 25 mm.
No. 785 C, measurements 11 × 7 × 4 mm, carapace breadth of host 29 mm.
No. 785 D, measurements 5 × 4 × 1½ mm, carapace breadth of host 25 mm.
No. 785 E, measurements 13 × 8 × 2 mm, carapace breadth of host 24 mm.
No. 785 F, measurements 9 × 7 × 2 mm, carapace breadth of host 19 mm.

Specimens on *Pseudozius caystrus* (Ad. & White)

No. 902 A, measurements 7½ × 4 × 1½ mm, carapace breadth of host 12 mm.
No. 902 B, measurements 4 × 2 × 1 mm, carapace breadth of host 12 mm.
No. 902 C, measurements 5 × 3 × 1½ mm, carapace breadth of host 12 mm.
No. 902 D, measurements 5½ × 3 × 1½ mm, carapace breadth of host 13½ mm.

In the following description of the peculiarities of the male organs, the colleteric glands, and the excrescences of the external cuticle of the mantle the specimens are arranged in groups of parasites on the same host.

Specimens on *Xantho exaratus* (H. M. E.).

The male genital organs of specimen no. 1091 B were studied in a series of longitudinal sections, showing transverse sections of the male organs (fig. 3 *a-d*). The vasa deferentia are rather wide, they also have a rather wide lumen as the system of ridges on their inner wall does not penetrate far into this lumen (fig. 3 *a*). Towards a farther dorsal region the vasa deferentia pass into the testes by a narrow canal with a strong chitinous wall (represented in fig. 3 *b* for the left testis, and in fig. 3 *c* and 3 *d* for the right testis). In the region of their most strongly developed part the testes consist of rather voluminous sacs (shown for the left in fig. 3 *c*, the right testis in fig. 3 *d* has not yet reached its largest size). In this specimen the diameter of the testes including their surrounding muscular sheath does not exceed about 500 μ, therefore the male organs do not protrude appreciably on each side of the median plane.

Of the specimen no. 1091 A a series of transverse sections was made, the male genital organs therefore appear in longitudinal section (fig. 3 *e, f*). The figures show that the vasa deferentia (the right is more fully represented) have about the same length as the testes, the latter are of a globular shape. In fig. 3 *e* the chitinous tube is visible by which the left vas deferens passes into its testis, fig. 3 *f* shows the corresponding part of the right male organ. In this specimen the size of the testes surrounded by their muscular layers is about 720 μ, so that they are distinctly larger than those of the former specimen.

Fig. 4 represents a transverse section of the posterior part of the body of specimen no. 1034 A, from the region in which the testes reach their largest size. In this specimen the testes with their muscular sheaths have a diameter of 1200 μ approximately, so that they project considerably beyond

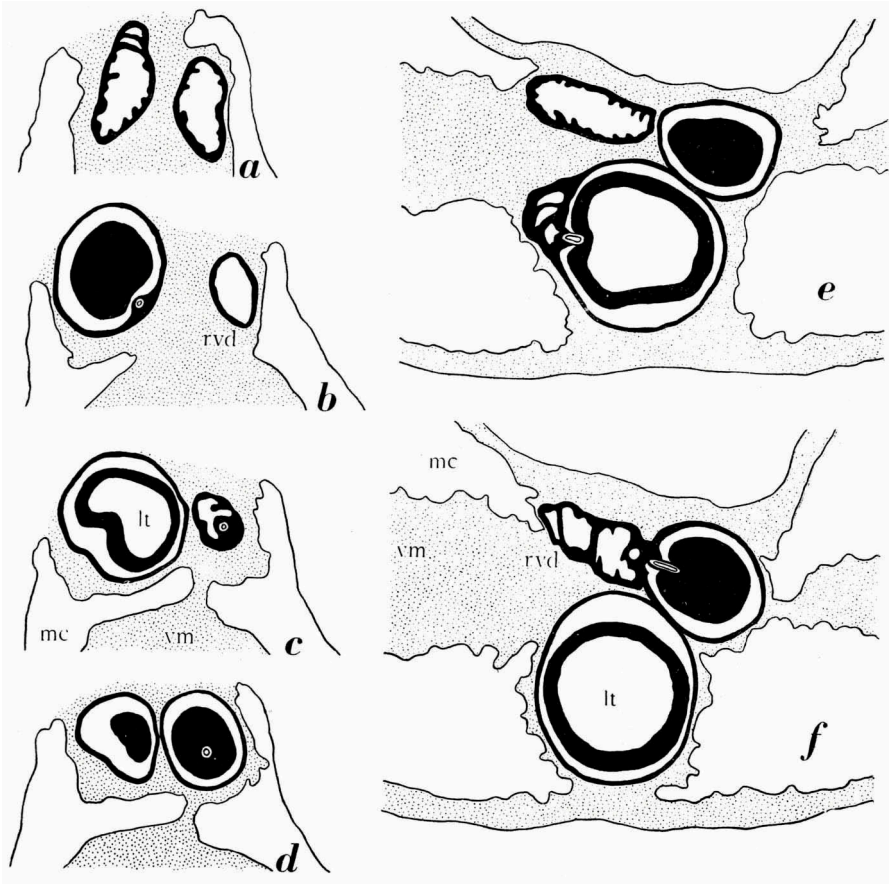

Fig. 3. *Sacculina leptodiae* Guér.-Gan. *a-d,* specimen no. 1091 B, longitudinal sections of the posterior part of the body; *a* showing the vasa deferentia, each following section from a more dorsal region. *e, f,* specimen no. 1091 A, transverse sections of the posterior part of the body, *f* from a slightly more anterior region than *e. lt,* left testis; *mc,* mantle cavity; *rvd,* right vas deferens; *vm,* visceral mass. × 36.

the median plane of the body.

The colleteric glands of the various specimens have a flattened shape and contain a small number of canals only. Longitudinal sections of the most strongly branched region of specimens nos. 603, 1091 B, and 373 are shown in fig. 5 *b-d,* they contain 10, 10, and 13 canals respectively. The

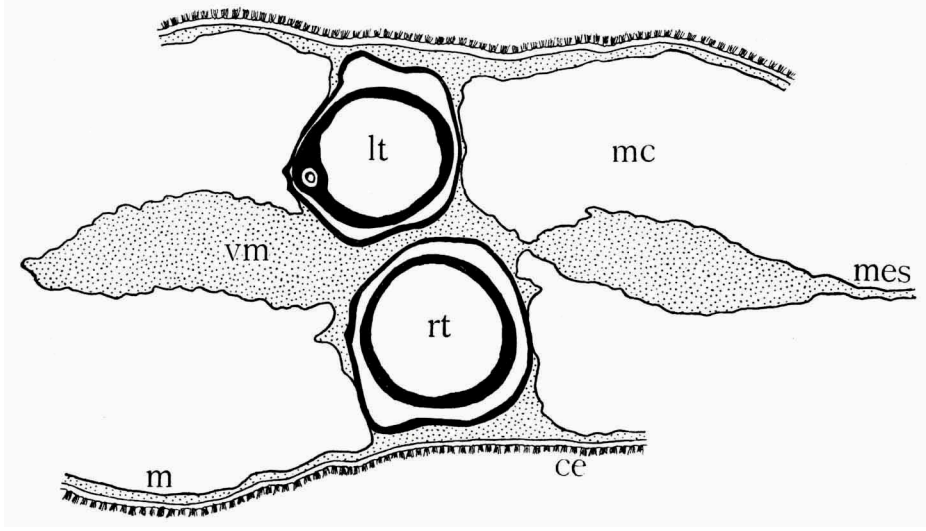

Fig. 4. *Sacculina leptodiae* Guér.-Gan., specimen no. 1034 A, transverse section through the posterior part of the body. *ce,* external cuticle of the mantle; *lt,* left testis; *m,* mantle; *mc,* mantle cavity; *mes,* mesentery; *rt,* right testis; *vm,* visceral mass. × 22.

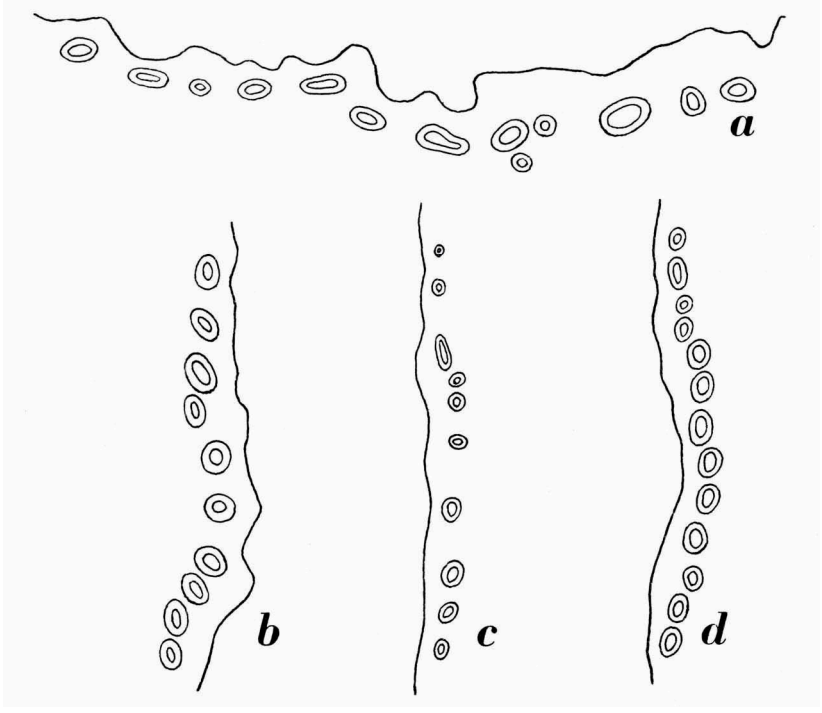

Fig. 5. *Sacculina leptodiae* Guér.-Gan. *a,* transverse section of a colleteric gland of specimen no. 1034 A. *b-d,* longitudinal sections of colleteric glands of various specimens. *b,* no. 603; *c,* no. 1091 B; *d,* no. 373. × 100.

canals are neatly arranged in a single row parallel to the surface of the visceral mass. A transverse section of a colleteric gland of specimen no. 1034 A is represented in fig. 5 *a*, it shows a similar structure as those of the other specimens.

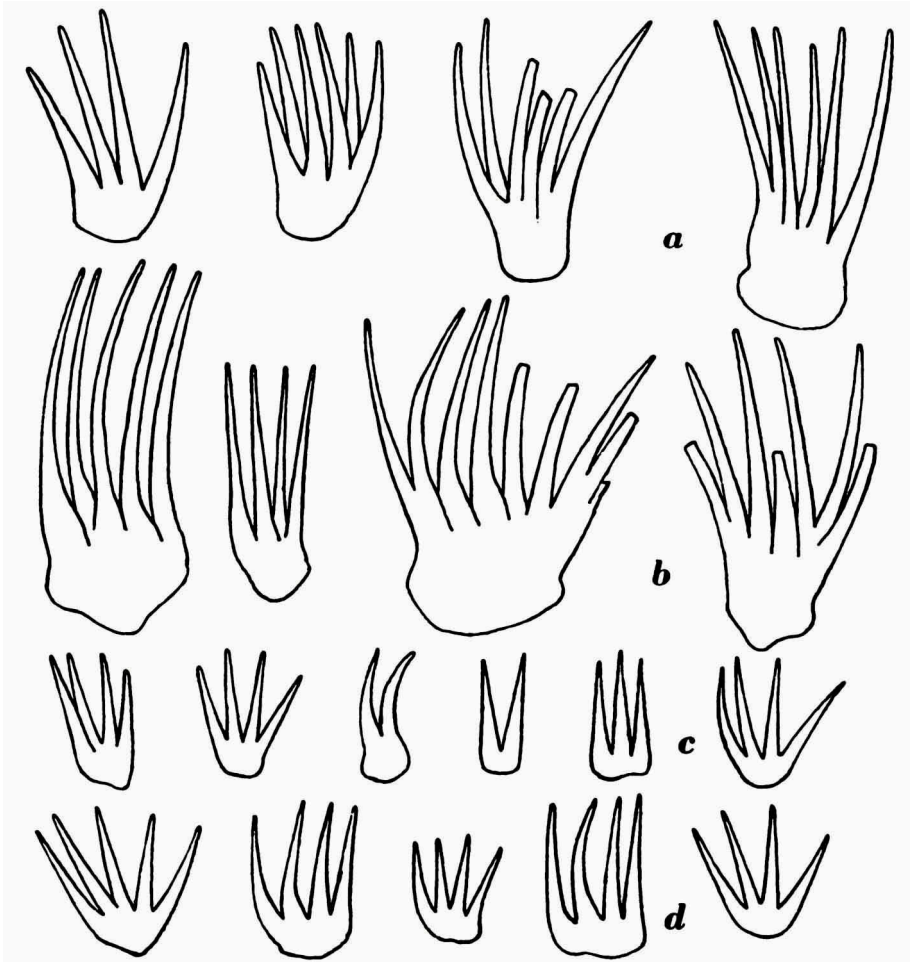

Fig. 6. *Sacculina leptodiae* Guér.-Gan. Excrescences of the external cuticle of the type specimens. *a, b,* specimen no. 1104; *c, d,* specimen no. 1105. × 530.

In each specimen there is a certain amount of variation in the shape and size of the excrescences of the external cuticle.

Eight of these excrescences of the holotype (specimen no. 1104) are shown in fig. 6 *a, b*. They may be composed of a few spines only, or may consist of a considerable number of spines. The size of the excrescences, including their basal parts, here is from 50 to 95 μ.

The excrescences of the paratype (fig. 6 *c, d*) are of a smaller size, they measure from 27 to 42 μ. Here again the excrescences may consist of a few united spines only or may form somewhat larger compounds, though the number of spines of the excrescences as a rule is smaller than in the holotype.

The excrescences of specimen no. 373 (fig. 7 *a*) again may consist of a

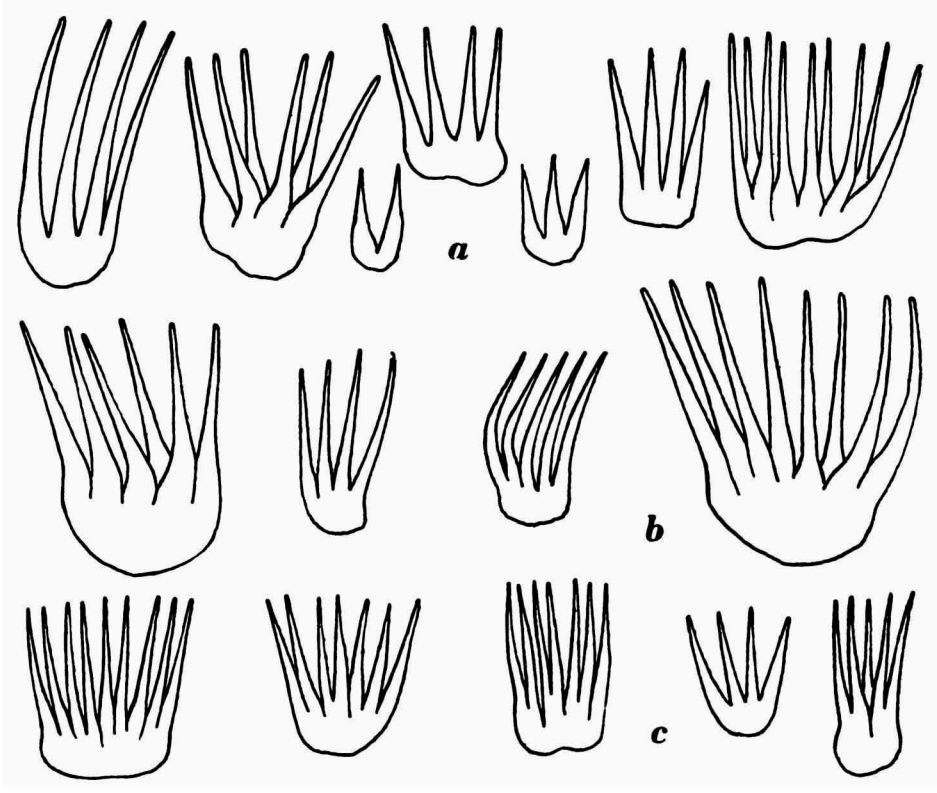

Fig. 7. *Sacculina leptodiae* Guér.-Gan. Excrescences of the external cuticle of various specimens. *a*, specimen no. 373; *b*, specimen no. 603; *c*, specimen no. 1034 A. × 530.

few spines or may form larger compounds. As a rule their size varies from 40 to 70 μ, though in some parts of the mantle there are excrescences of a smaller size, of a height of about 27 μ.

In specimen no. 603 (fig. 7 *b*) the excrescences as a rule are comparatively large, their total height varies from 45 to 78 μ. They may possess a few or a fairly large number of spines.

The excrescences of specimen no. 1034 (fig. 7 *c*) as a rule have somewhat thinner spines than those of the other specimens, in other respects

they are of the same shape. Here again the number of spines of each excrescence is rather variable. The total height of the excrescences is from 32 to 48 μ.

Specimens on *Thalamita stimpsoni* A. M. E.

In specimen no. 785 E, which has a greater diameter of 13 mm, the male

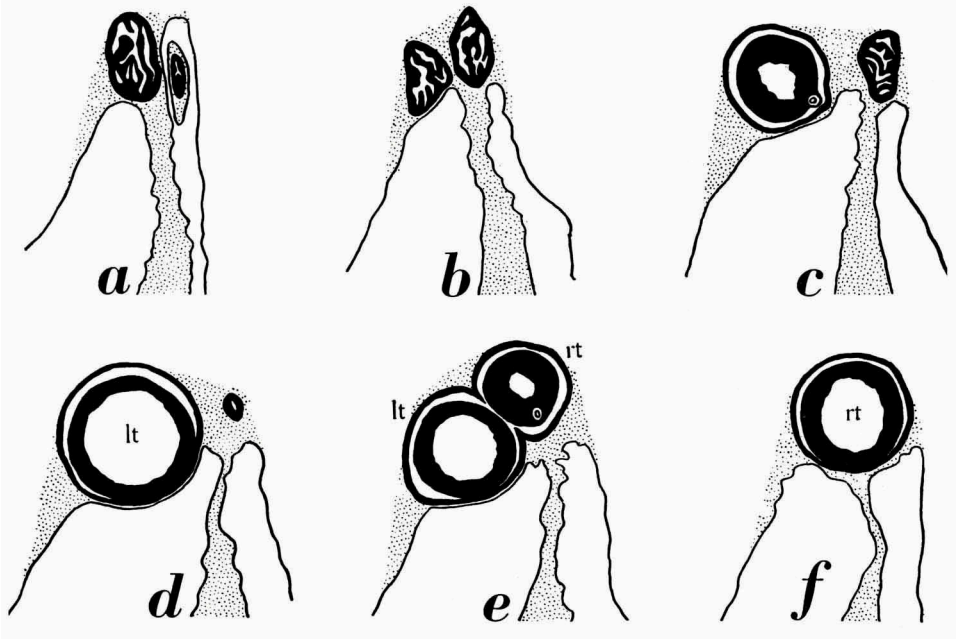

Fig. 8. *Sacculina leptodiae* Guér.-Gan., specimen no. 785 E, longitudinal sections through the posterior part of the body; *a* through the extreme ventral part of the vasa deferentia, each following section from a more dorsal region. *lt*, left testis; *rt*, right testis. × 22.

genital organs are well developed (fig. 8). In their ventral region the vasa deferentia are comparatively wide, on their inner walls they possess a great number of ridges so that their lumen is somewhat restricted (fig. 8 *a-c*). Before entering the testes the vasa deferentia become much narrower (cf. fig. 8 *d*, in which the right vas deferens is visible), and soon they form narrow canals with a strong chitinous wall. These chitinous canals penetrate the testes, this is represented in fig. 8 *c* for the left testis, and in fig. 8 *e* for the right. Sections in which the testes attain their largest diameter are those of fig. 8 *d* (for the left testis) and fig. 8 *f* (for the right testis). The larger diameter of the left testis with its muscular sheath in this specimen is about 880 μ, the right is slightly smaller.

In specimen no. 785 D, which is much smaller than the former, having a greater diameter of 5 mm, the shape of the male organs is very similar. Here again the vasa deferentia are rather wide (fig. 9 *a*), whilst they change into narrow chitinous canals when passing into the testes. The chitinous tube of the left male organ is seen in the centre of the left testis

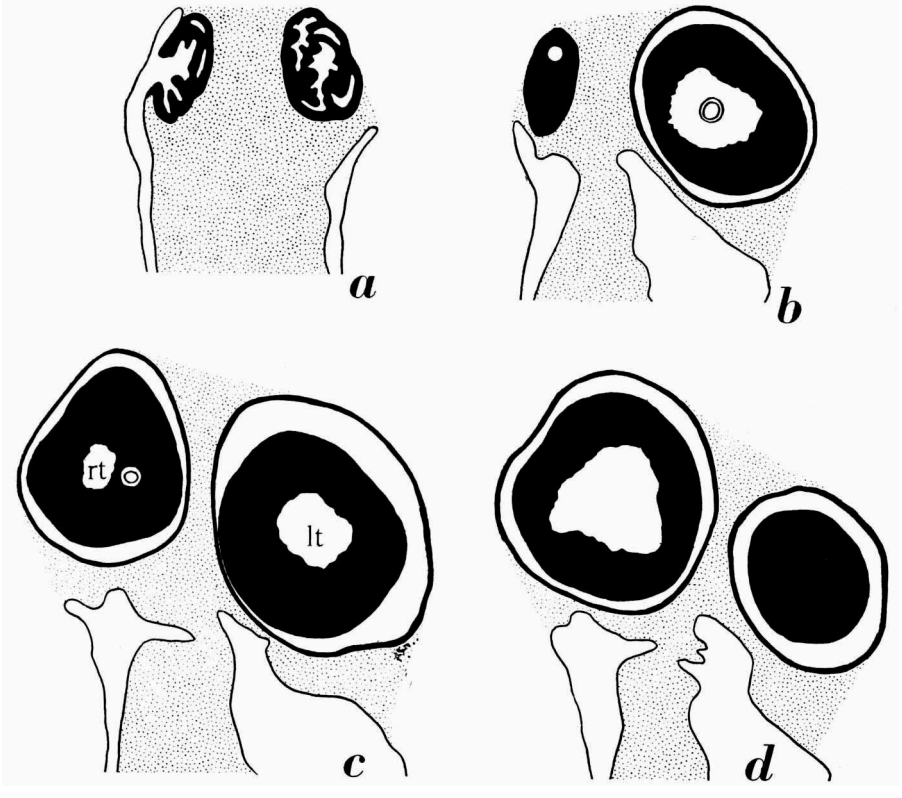

Fig. 9. *Sacculina leptodiae* Guér.-Gan., specimen no. 785 D, longitudinal sections through the posterior part of the body; *a* through the extreme ventral part of the vasa deferentia, each following section from a more dorsal region. *lt*, left testis; *rt*, right testis. × 80.

at the right side of fig. 9 *b*, the chitinous tube of the right male organ is seen to pass the wall of the right testis in fig. 9 *c*. In this specimen the larger diameter of the testes with their surrounding muscular layers is up to about 475 μ. In their manner of protruding to the side of the median plane they correspond almost completely with those of the former specimen.

In another specimen, one of fairly large size (no. 785 C, greater diameter 11 mm) the male genital organs are far less strongly developed. These

organs could be examined in a series of transverse sections of the body (fig. 10). In fig. 10 *a* both vasa deferentia are visible, the right in contact with its testis, distinctly showing the narrow chitinous canal which forms the connection of the vasa deferens with the testis. The left testis is rep-

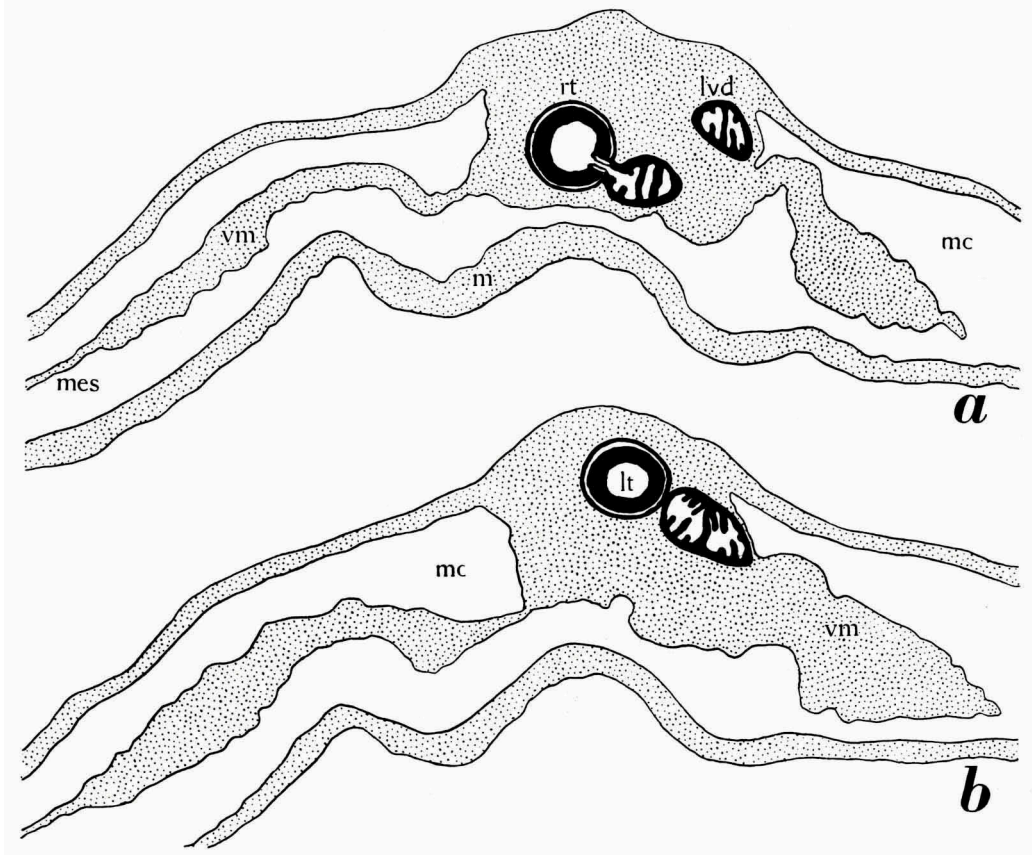

Fig. 10. *Sacculina leptodiae* Guér.-Gan., specimen no. 785 C, transverse sections through the posterior part of the body; *a* from a slightly more posterior region than *b*. *lt*, left testis; *lvd*, left vas deferens; *m*, mantle; *mc*, mantle cavity; *mes*, mesentery; *rt*, right testis; *vm*, visceral mass. × 22.

resented in fig. 10 *b* by a section of its most strongly developed region. In comparison to the two former specimens the male organs, and especially the testes, are very small, their larger diameter, including the muscular layers, is about 530 μ, a small value in comparison to the size of the specimen. The figure shows that the male organs occupy very little space of the posterior region of the body.

Specimen no. 815 B, which has a greater diameter of 9 mm, again has male genital organs of small size, especially as far as concerns the testes (fig. 11 *a-d*). The vasa deferentia (fig. 11 *a*) have about the same width as those of the other specimens, but the testes remain narrow, their larger diameter (fig. 11 *b, d*) with their surrounding muscular sheaths not exceeding 500 μ. The figures show at a glance that the male organs do

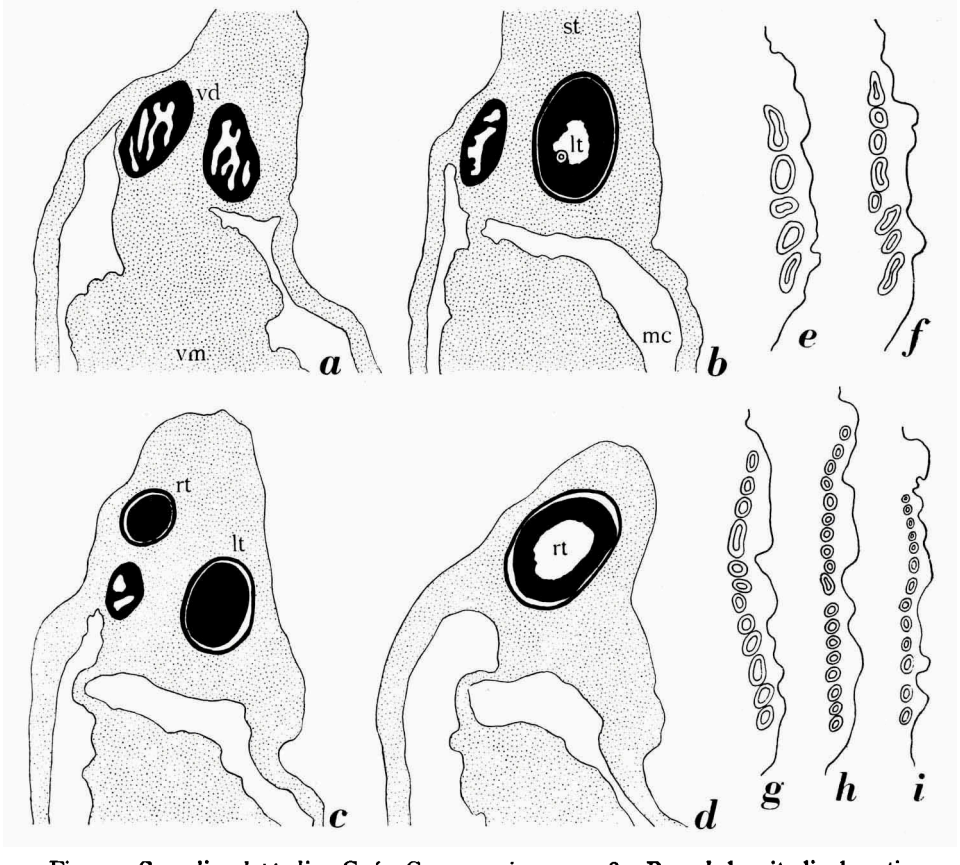

Fig. 11. *Sacculina leptodiae* Guér.-Gan., specimen no. 815 B. *a-d,* longitudinal sections through the posterior part of the body; *a* through the vasa deferentia, each following section from a more dorsal region. *e-i,* longitudinal sections of the left colleteric gland; *e* from the central region, each following section from a more peripheral part. *lt,* left testis; *mc,* mantle cavity; *rt,* right testis; *st,* stalk; *vd,* vasa deferentia; *vm,* visceral mass. *a-d,* × 36; *e-i,* × 64.

not occupy such a large space in the posterior region of the body as those shown in figs. 8 and 9.

As a rule the colleteric glands of the specimens on *Thalamita stimpsoni*

are, as usual in the species, flattened and possess a small number of canals only.

In specimen no. 815 B (fig. 11 *e-i*) the number of canals is comparatively large, as there may be 18 of these canals in a longitudinal section of the most strongly branched region (fig. 11 *h*). The figures show that the canals decrease in size from the centre towards the periphery of the gland.

Three longitudinal sections of one of the colleteric glands of specimen

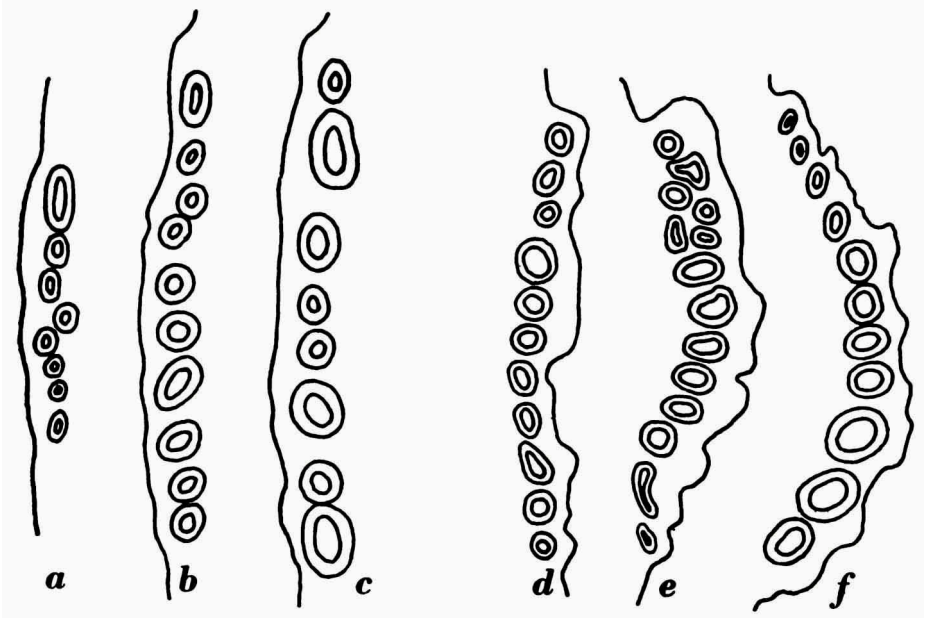

Fig. 12. *Sacculina leptodiae* Guér.-Gan., longitudinal sections of one of the colleteric glands of various specimens. *a-c*, specimen no. 785 D; *a* from the peripheral region, each following section from a more central part. *d*, specimen no. 785 A. *e*, specimen no. 815 A. *f*, specimen no. 785 B. *a-c*, × 128; *d-f*, × 72.

no. 785 D are drawn in fig. 12 *a-c*, in its most strongly branched part the colleteric gland shows 10 canals. In longitudinal sections of the most strongly branched region of the colleteric glands of specimens no. 785 A, no. 815 A, and no. 785 B the number of canals is 11, 14, and 11 respectively (fig. 12 *d-f*). The canals in these specimens are nearly completely arranged in a single row parallel to the surface of the visceral mass.

Excrescences of the external cuticle of 14 specimens (nos. 815 A, C-O) are shown in fig. 13 to illustrate the variation in shape and size. The figures show that the number of spines in these excrescences is subject

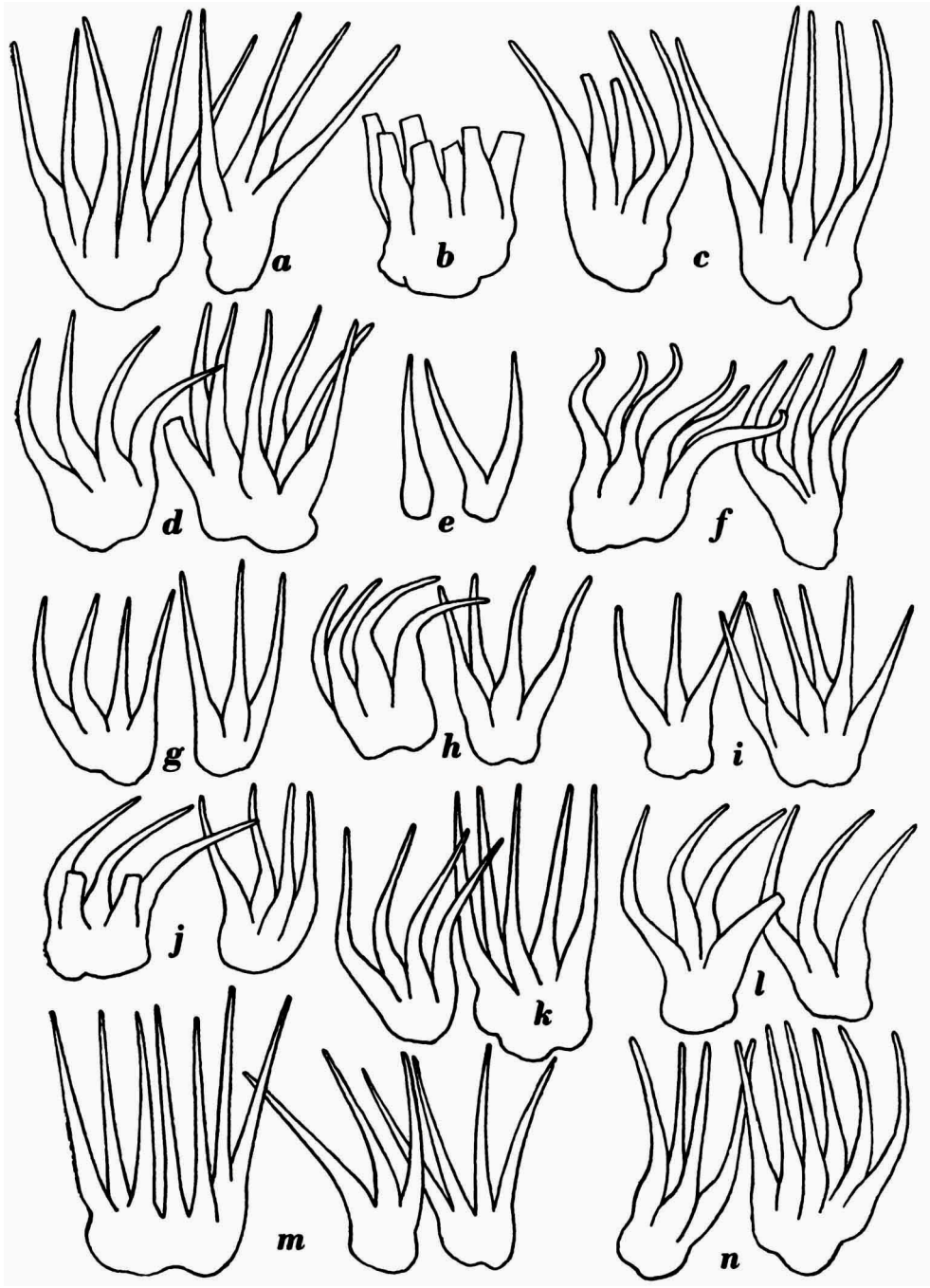

Fig. 13. *Sacculina leptodiae* Guér-Gan., excrescences of the external cuticle of various specimens. *a*, no. 815 C; *b*, no. 815 D; *c*, no. 815 E; *d*, no. 815 L; *e*, no. 815 G; *f*, no. 815 I; *g*, no. 815 K; *h*, no. 815 O; *i*, no. 815 M; *j*, no. 815 N; *k*, no. 815 H; *l*, no. 815 J; *m*, no. 815 A; *n*, no. 815 F. × 530.

to considerable variation. Moreover in many specimens the spines are straight whilst in others they are curved in various degree. The total height of these excrescences varies from 42 to 87 μ. Of some of the excrescences represented here some of the spines have broken off, in one (fig. 13 *b*) of all the spines the basal parts only are remaining.

Fig. 14 shows excrescences of the external cuticle of three other spec-

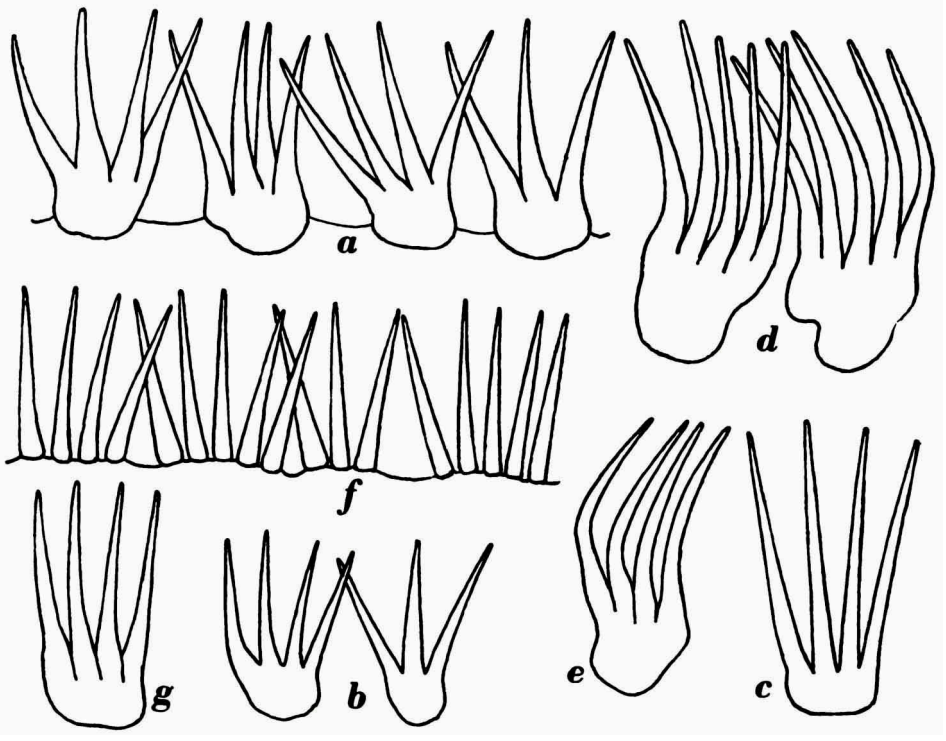

Fig. 14. *Sacculina leptodiae* Guér.-Gan., excrescences of the external cuticle of three specimens. *a-c*, no. 785 B; *d*, *e*, no. 785 A; *f*, *g*, no. 785 C. × 530.

imens (nos. 785 A-C). Here again there is a similar amount of variation in many respects. In one specimen (no. 785 C) large parts of the external cuticle are covered with spines which are more or less distinctly arranged in groups, but which are not united on common basal parts (fig. 14 *f*). In some parts of the mantle of this specimen, however, the spines are united into compounds of the usual shape (fig. 14 *g*). The compound excrescences figured here vary in length from 45 to 87 μ, the isolated spines of specimen no. 785 C (fig. 14 *f*) have a length of 40 to 45 μ.

In specimen no. 815 B the whole of the external cuticle is covered with isolated spines which, as the excrescences of the other specimens, consist

of chitin of a hyaline kind, different from that of the main layers, but which are not even arranged in groups. Sections of four parts of the external cuticle from different regions of the mantle are represented in fig. 15. The figure shows the isolated spines which do not have a tendency for an arrangement in groups. The spines may be more or less straight or somewhat curved, their size varies from 20 to 55 μ.

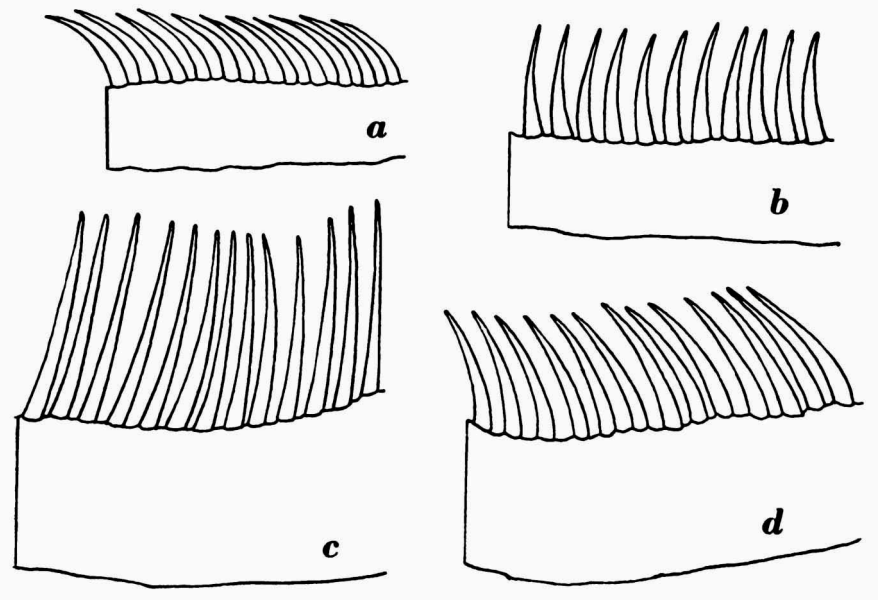

Fig. 15. *Sacculina leptodiae* Guér.-Gan., specimen no. 815 B, sections of the external cuticle from various parts of the mantle. × 530.

Specimens on *Pseudozius caystrus* (Ad. & White).

Fig. 16 shows transverse sections of the male genital organs of specimens nos. 800 A, 992 A, and 584. The parts of these organs in each of the specimens are of more or less corresponding shape and size. In specimen no. 800 A the right testis is much larger than the left, in specimen no. 992 A the left testis is much larger than the right, in specimen no. 584 the right testis is slightly larger than the left. The size of the largest testis surrounded by its muscular sheath in the three specimens is from 420 to 600 μ.

In specimen no. 1055 both testes are of a very large size, whilst the left is still somewhat larger than the right. In this specimen the testes are so large that there is no sufficient room for these organs in the posterior part of the body, so that they largely penetrate into the mantle cavity next to

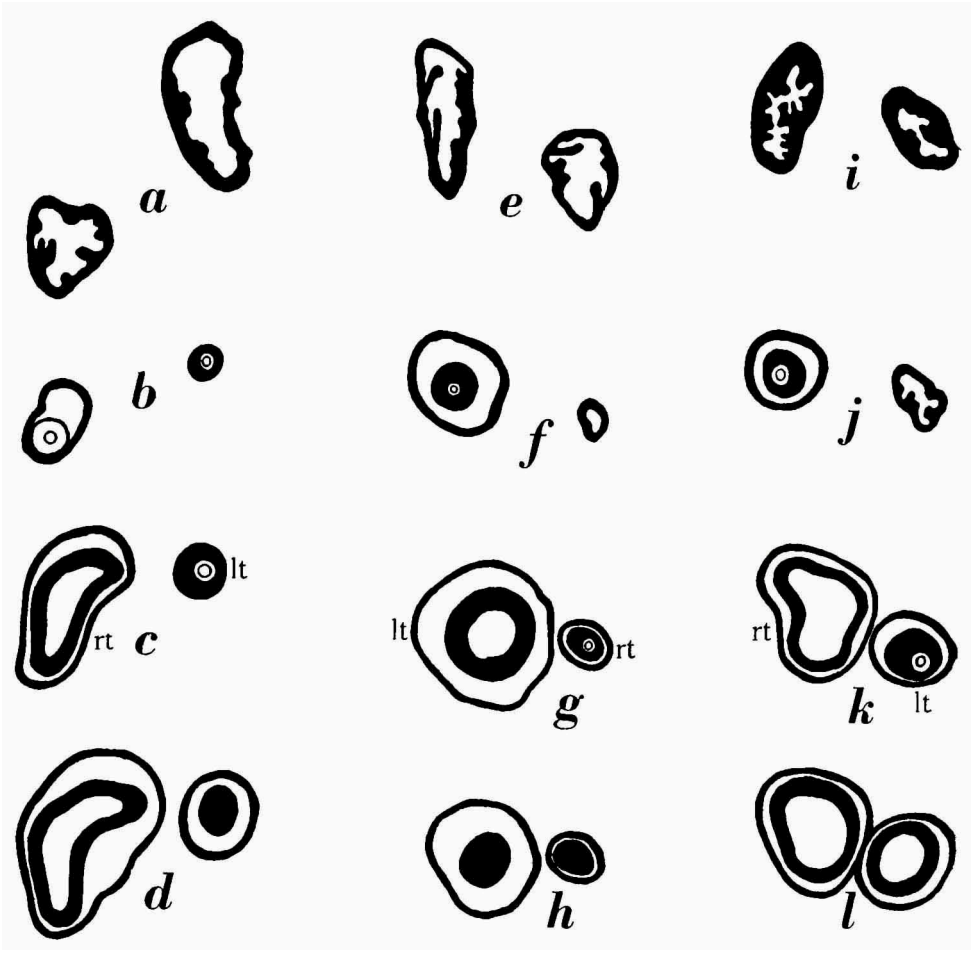

Fig. 16. *Sacculina leptodiae* Guér.-Gan., transverse sections of the male genital organs of three specimens. *a-d*, no. 800 A; *e-h*, no. 992 A; *i-l*, no. 584. The upper row shows sections through the vasa deferentia, each following row is from a more dorsal region. *lt*, left testis; *rt*, right testis. × 45.

the posterior part of the visceral mass (fig. 17). Though the specimen is not exceedingly large (greater diameter 8 mm) its left testis, including its surrounding muscular sheath, has a diameter of about 1150 μ.

Transverse sections of specimen no. 902 B show that here the right testis has very little developed (fig. 18 *c*), whilst the left testis has undergone a more normal development, though remaining comparatively small (fig. 18 *c*, *d*). As the specimen has a greater diameter of 4 mm the under-developed state of the male organs may be due to its being not yet full

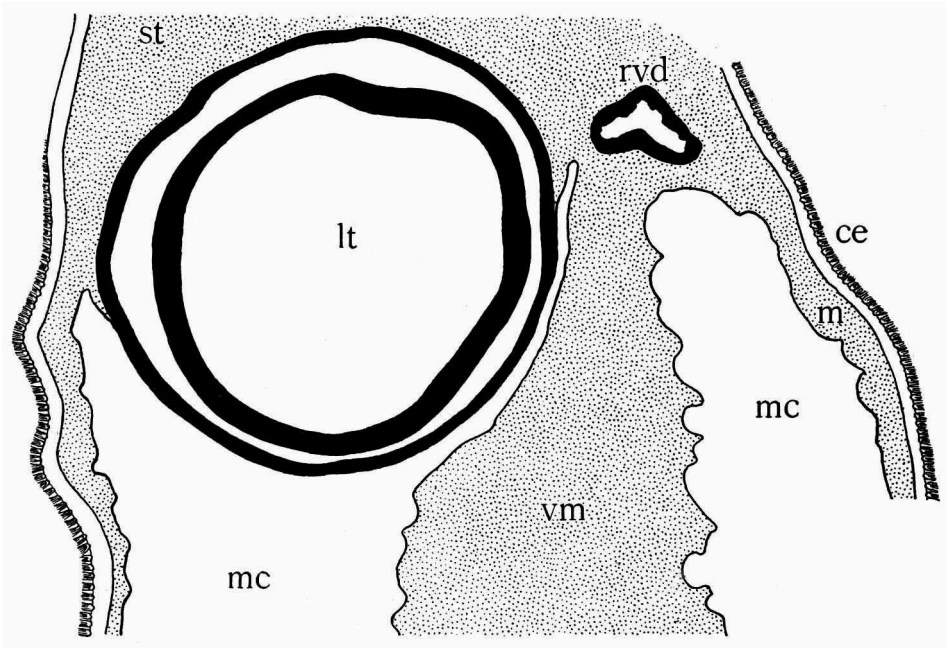

Fig. 17. *Sacculina leptodiae* Guér.-Gan., specimen no. 1055, longitudinal section through the posterior part of the body. *ce,* external cuticle; *lt,* left testis; *m,* mantle; *mc,* mantle cavity; *rvd,* right vas deferens; *st,* stalk; *vm,* visceral mass. × 54.

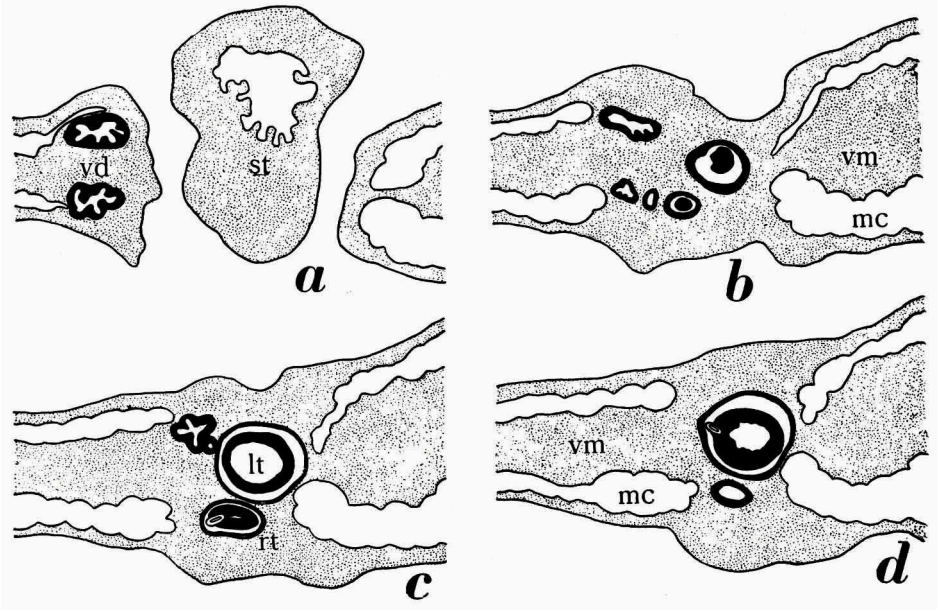

Fig. 18. *Sacculina leptodiae* Guér.-Gan., specimen no. 902 B, transverse sections through the posterior part of the body. *a* through the region of the stalk, each following section from a slightly more anterior region. *lt,* left testis; *mc,* mantle cavity; *rt,* right testis; *st,* stalk; *vd,* vasa deferentia; *vm,* visceral mass. × 30.

grown. The diameter of the left testis surrounded by its muscular sheath is 350 μ approximately.

Of specimen 902 D, which has a greater diameter of $5^1/_2$ mm, longitudinal sections were made in the sagittal plane. The section represented in fig. 19 shows one of the male organs in almost the whole of its extent. Here the vas deferens, especially in its ventral part, is rather voluminous, whilst the

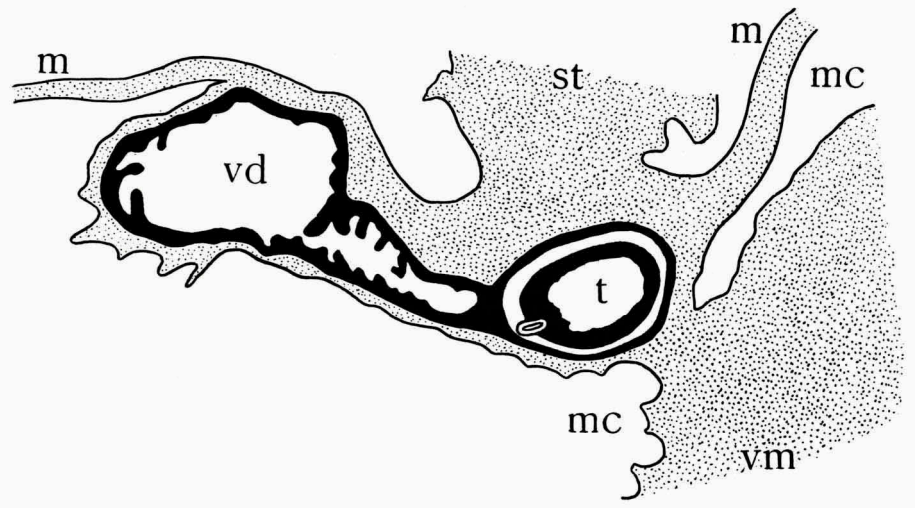

Fig. 19. *Sacculina leptodiae* Guér.-Gan., specimen no. 902 D, longitudinal (sagittal) section through the posterior part of the body. *m*, mantle; *mc*, mantle cavity; *st*, stalk; *t*, testis; *vd*, vas deferens; *vm*, visceral mass. × 54.

testis is of comparatively small size (its diameter is 440 μ approximately, including the muscular sheath). The figure moreover shows the chitinous canal which forms the connection between the vas deferens and the testis.

The colleteric glands of the specimens on *Pseudozius caystrus* closely correspond with those of the specimens on other hosts, though as a rule they show an exceedingly small number of canals. Longitudinal sections of the most strongly branched region of eight specimens are shown in fig. 20. The number of canals is 8 (*a*), 10 (*b*), 7 (*c*), 5 (*d*), 6 (*e*), 9 (*f*), 7 (*g*), and 8 (*h*). The canal system is arranged in one single row parallel to the surface of the visceral mass.

Excrescences of the external cuticle of seven specimens are shown in fig. 21. If various parts of the external cuticle of one specimen are compared it appears that there is a good deal of variation in the size and the shape of the excrescences, in their number of spines, and in the shape of the spines. The same obtains when the excrescences of various specimens

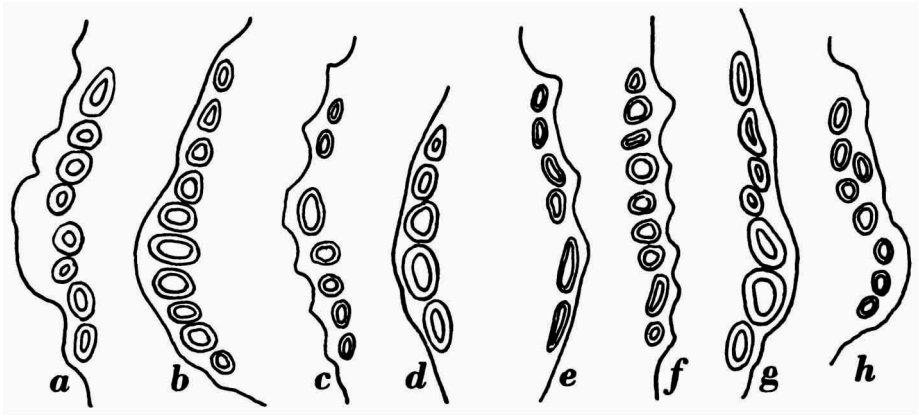

Fig. 20. *Sacculina leptodiae* Guér.-Gan., longitudinal sections of colleteric glands of various specimens. *a*, no. 800 A; *b*, no. 770 A; *c*, no. 987 A; *d*, no. 992 A; *e*, no. 903 A; *f*, no. 584; *g*, no. 902 A; *h*, no. 809 A. × 72.

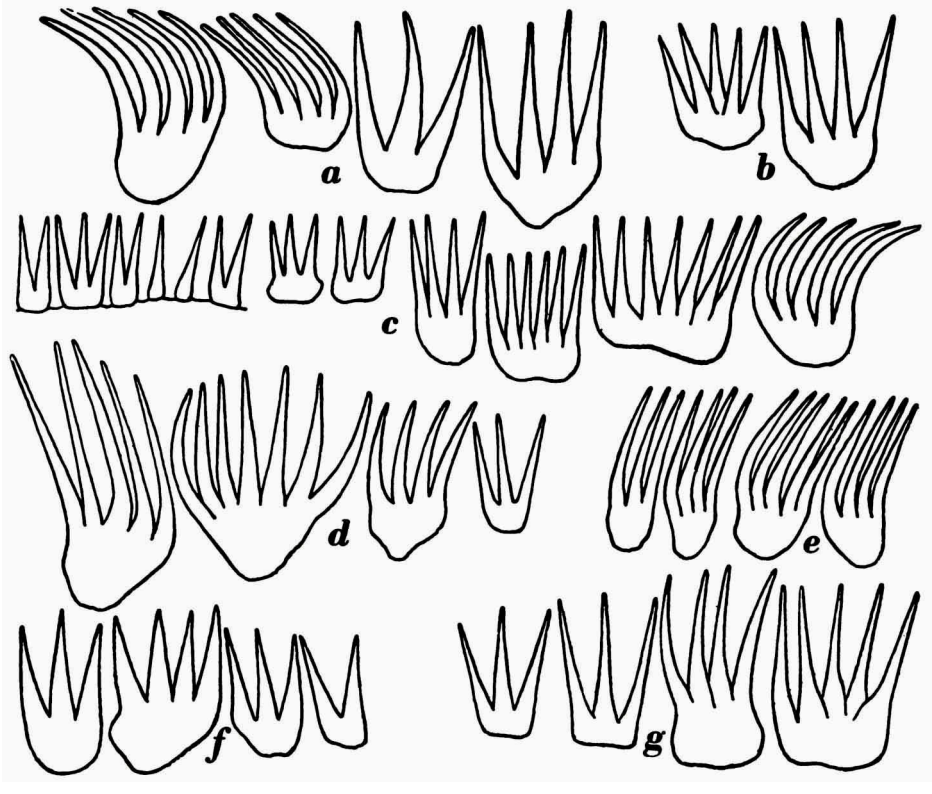

Fig. 21. *Sacculina leptodiae* Guér.-Gan., excrescences of the external cuticle of various specimens. *a*, no. 809 A; *b*, no. 695 C; *c*, no. 902 A; *d*, no. 584; *e*, no. 770 A; *f*, no. 987 A; *g*, no. 1055. × 530.

are compared. The total height of the excrescences represented in fig. 21 is from 22 to 70 μ.

Concluding remarks.

With the exception of specimen no. 815 B the material dealt with above is sufficiently homogeneous to regard all the specimens as representatives of the species *Sacculina leptodiae* Guér.-Gan. Differences between certain specimens living on different crabs are not more striking than differences between specimens infesting the same species of crab.

Specimen no. 815 B, however, is rather aberrant. In the first place its testes are rather small, but this may be also the case in other specimens, which otherwise have all the characters of the species. Moreover the colleteric glands of no. 815 B differ from those in other specimens by their large number of canals. As the maximum number of canals in a longitudinal section of other specimens is 14 this somewhat larger number (18) not necessarily needs to point to a specific distinction, it may be due to individual variation. In a previous paper (Boschma, 1936) I stated that the colleteric glands of *Sacculina leptodiae* have 16 to 24 canals in longitudinal sections of their most strongly branched region, in another paper (Boschma, 1937) this number was given as 15 to 30. These statements may be erroneous or may be based on specimens not examined in the present investigations. As far as concerns the material dealt with here specimen no. 815 B has the most strongly branched colleteric glands.

Specimen no. 815 B differs from the other specimens dealt with here chiefly in the excrescences of the external cuticle which are not arranged in groups (fig. 15). In another specimen, no. 785 C, the spines of the external cuticle may remain isolated, but then they are rather distinctly arranged in groups (fig. 14 *f*). The aberrant arrangement of the spines in specimen no. 815 B, however, may be due to individual variation, the peculiarity is not striking enough to regard it as of specific value.

It is interesting that in the two specimens in which the spines of the external cuticle remain wholly or for the greater part isolated the male genital organs show a development which remains below the ordinary. Attention has already been drawn to the small size of the testes in specimen no. 815 B (fig. 11 *a-d*) and in specimen no. 785 C (fig. 10), it is interesting that this small size of the testes corresponds with an incomplete development of the excrescences of the external cuticle. On the other hand in specimens with exceedingly large testes, as no. 1034 A (fig. 4) and no. 1055 (fig. 17) the excrescences of the external cuticle are of not uncommonly large size (cf. figs. 7 *c* and 21 *g*).

In a previous paper (Boschma, 1947) attention was drawn to the fact that during growth three different layers of external cuticle may occur in specimens of *Sacculina leptodiae* on *Thalamita stimpsoni*. In a very young specimen (no. 785 H, $3^1/_2 \times 3^1/_2 \times 1$ mm, Boschma, 1947, fig. 4) the first layer of external cuticle has a smooth surface or has insignificant small papillae, whilst the second layer bears papillae of larger size which on their tops possess a number of small spines. In a slightly larger specimen (no. 785 D, $5 \times 4 \times 1^1/_2$ mm, Boschma, 1947, figs. 2, 3) under this second layer the third cuticle is developing, which during further growth would have given rise to excrescences of the form peculiar to *S. leptodiae*.

The specific characters of *Sacculina leptodiae* may be defined in the following manner: Male genital organs in the posterior part of the body, outside the visceral mass, completely separated. Vasa deferentia comparatively wide, abruptly passing into the more or less globular testes. Colleteric glands with a moderate number of canals (5-18(-30?) canals in longitudinal sections of the most strongly branched region); the canals are nearly completely arranged in a row parallel to the surface of the visceral mass. External cuticle of the mantle with excrescences which consist of a hyaline kind of chitin, different from that of the main layers. These excrescences are composed of groups of spines which as a rule are united on common basal parts. The spines of each excrescence are not combined on branches, but each spine separately takes its origin from the basal part. The excrescences consist of comparatively few spines, the length of the excrescences as a whole varies from 20 to 95 μ. Retinacula unknown, probably not occurring.

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