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RHIZOCEPHALA FROM NEW GUINEA. I

SACCULINA CARINATA KOSSMANN AND LOXOTHYLACUS KOSSMANNI NOV. SPEC.

by

H. BOSCHMA

In the collections brought together by Dr. L. D. Brongersma, Dr. L. B. Holthuis, and Dr. M. Boeseman, during their voyage to New Guinea and adjacent islands [1]), there are a number of crabs and hermit crabs bearing Rhizocephalan parasites. Some of the Sacculinidae of this collection are dealt with in the present paper.

Sacculina carinata Kossmann

Material examined:

No. 1333. Host *Thalamita admete* (Herbst), carapace breadth 18 mm; measurements of parasite 7 × 5 × 2½ mm (fig. 1*b*).

No. 1324A. Host *Thalamita admete* (Herbst), carapace breadth 14 mm; measurements of parasite 6½ × 4 × 2 mm (fig. 1*a*).

No. 1324B. Host *Thalamita admete* (Herbst), carapace breadth 10½ mm; measurements of parasite 6 × 3 × 1½ mm (fig. 1*c*).

No. 1334. Host *Thalamita admete* (Herbst), carapace breadth 10 mm; measurements of parasite 6 × 3 × 1½ mm (fig. 1*d*).

No. 1330. Host *Thalamita admete* (Herbst), carapace breadth 10½ mm; measurements of parasite 5½ × 3 × 1½ mm (fig. 1*f*).

No. 1328A. Host *Thalamita ?edwardsi* Borradaile, carapace breadth 7 mm; measurements of parasite 4 × 2½ × 1 mm (fig. 1*e*).

No. 1320. Host *Thalamitoides tridens* (A. Milne Edwards), carapace breadth 18 mm; measurements of parasite 7½ × 4 × 2 mm (fig. 1*g, h*).

All specimens from the reef W. of Sorido, Biak Island, shallow water, January and February, 1955.

Specific characters. Male genital organs in the posterior part of the body, outside the visceral mass. Vasa deferentia wide, their cavities divided by

1) The voyage was made possible by a grant of the Netherlands Organization for Pure Research (Z.W.O.) and support from the Government of Netherlands New Guinea and the Royal Netherlands Navy.

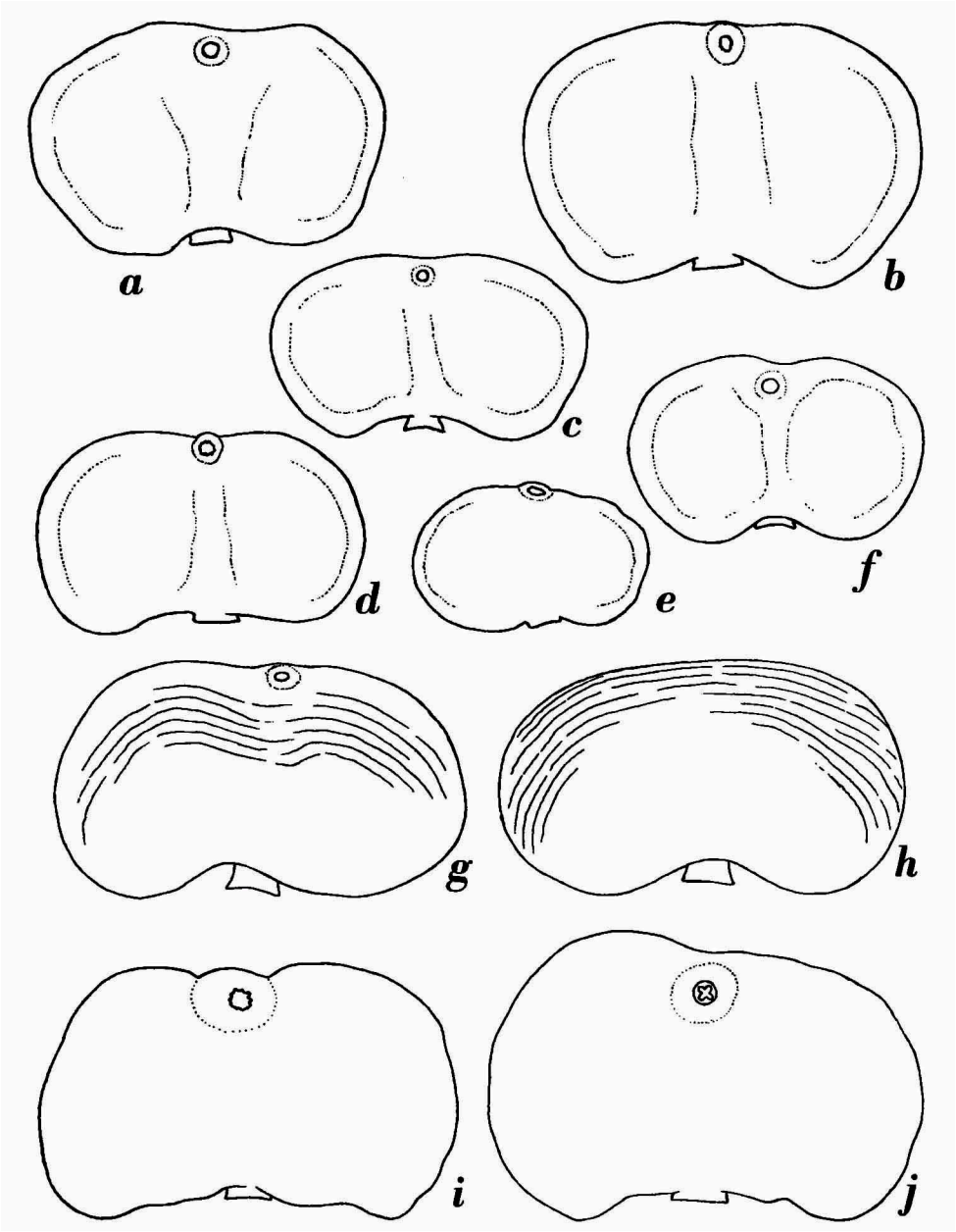

Fig. 1. *a-h, Sacculina carinata* Kossmann. *a-d, f,* left side of specimens on *Thalamita admete* (Herbst); *a,* no. 1324A; *b,* no. 1333; *c,* no. 1324B; *d,* no. 1334; *f,* no. 1330. *e,* left side of no. 1328A, the specimen on *Thalamita ?edwardsi* Borradaile. *g,* left side of no. 1320, the specimen on *Thalamitoides tridens* (A. Milne Edwards); *h,* same specimen, right side. *i, j, Loxothylacus kossmanni* nov. spec., left side of two specimens; *i,* no 1322; *j,* no. 1332. × 7½.

strongly developed ridges into numerous narrow slits; testes globular, of about equal size; the two parts of the male organs connected by a narrow canal with well developed chitinous inner wall. Colleteric glands with one row of tubes parallel to the surface of the visceral mass, the number of tubes very small, up to 7 in a longitudinal section. External cuticle with excrescences consisting of hyaline chitin different from that of the main layers. When completely developed the excrescences consist of a globular to cylindrical compact part embedded in the cuticle and a widely open cup-shaped part extending over the cuticle; this last mentioned part shows all stages of reduction leading to compact oval bodies often with minute central cavities. The length of the excrescences is up to 30 μ, the diameter is up to 15 μ. Retinacula unknown.

The description of the species by Kossmann (1872, p. 32) reads:

18. *S. carinata n. sp.* (Taf. I. Fig. 12.)

Gestalt der der Sacculina dentata, mit welcher unser Thier überhaupt grosse Ueber-

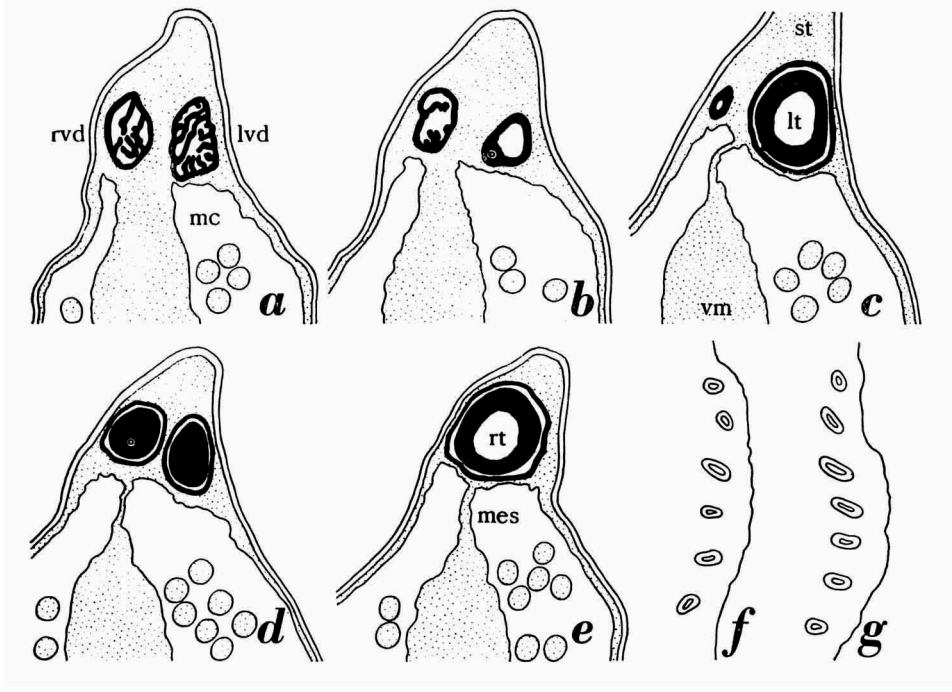

Fig. 2. *Sacculina carinata* Kossmann, specimen no. 1324A. *a-e*, posterior parts of longitudinal sections running from ventral (*a*) to dorsal (*e*) region of the male genital organs; *f*, *g*, longitudinal sections of the left colleteric gland. lt, left testis; lvd, left vas deferens; mc, mantle cavity; mes, mesentery; rt, right testis; rvd, right vas deferens; st, stalk; vm, visceral mass. Excrescences of external cuticle omitted. *a-e*, × 30; *f*, *g*, × 127.

einstimmung zeigt, in verkleinertem Maasstabe ähnlich, nur dass der hintere Rand einen scharfen Kiel bildet. Mund und Mantelöffnung wie bei S. dentata. Länge: 4,5 mm., Höhe: 5,7 mm.

Die Cuticula ist es nächst dem Grössenverhältnisse, welche diese Sacculina von der dentata unterscheidet. Sie ist so eigenthümlich, dass eine Verwechslung unmöglich ist, denn sie trägt auf der ganzen Manteloberfläche becherförmige Organe, wie sie Fig. 20 auf Taf. 1. theils von oben, theils von der Seite gesehen darstellt. Dieselben kehren ihre Oeffnung nach Aussen und waren an dem von mir untersuchten Exemplare ganz mit Schmutz gefüllt. Ihre Höhe ist 0,033 mm., ihr Durchmesser 0,015 mm. In seiner ganzen übrigen Anatomie bildet unser Thier ein verkleinertes Bild der Sacculina dentata.

Zahl der untersuchten Exemplare: 1. Wohnthier: Lupea sp. aff. L. hastatae. Fundort: Canal von Lapinig 6-10 Faden.

The anatomical characters of *Sacculina dentata* referred to in this description are that the circular colleteric glands lie in the centres of the lateral surfaces of the visceral mass, while the male genital organs are described

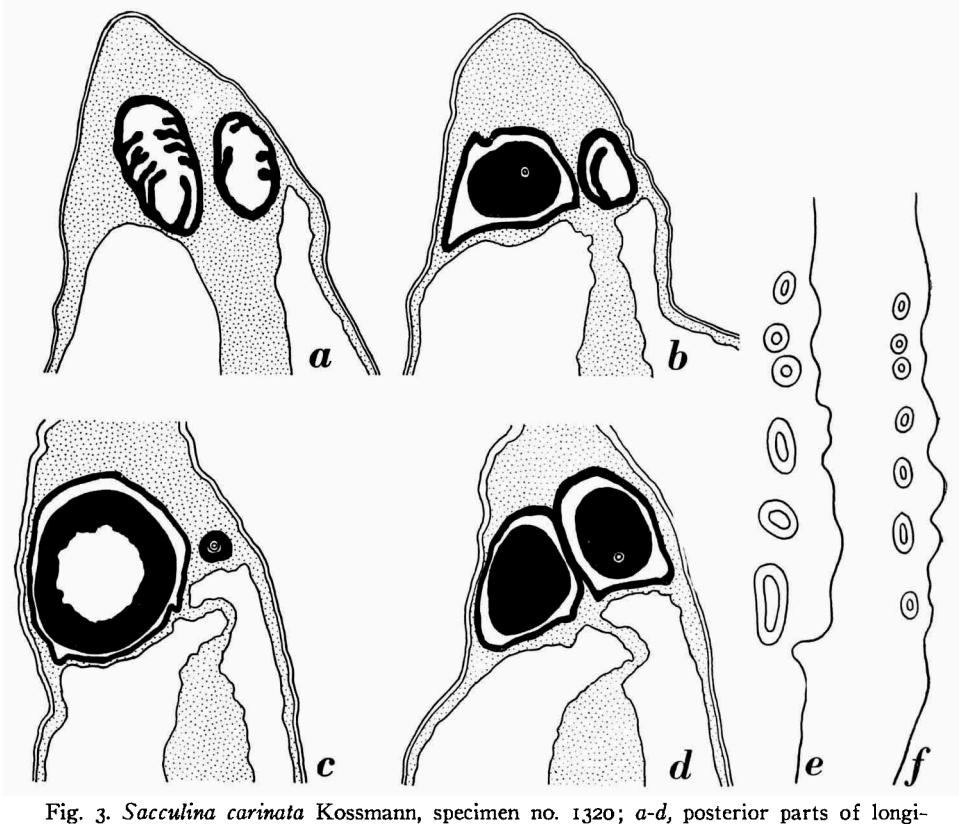

Fig. 3. *Sacculina carinata* Kossmann, specimen no. 1320; *a-d*, posterior parts of longitudinal sections, running from the region of the vasa deferentia (*a*) to the dorsal parts of the testes (*d*); *e, f*, longitudinal sections of one of the colleteric glands. Excrescences of external cuticle omitted. *a-d*, × 36; *e, f*, × 64.

with the following words: "Die paarigen kugelförmigen Hoden liegen dicht am Rüssel und haben einen kurzen, gegen seine Mündung hin stark anschwellenden Ausführungsgang" (l.c., p. 28).

Kossmann's description of *Sacculina carinata* corresponds entirely with the data mentioned above under "Specific characters" as far as the structure of the male organs and the peculiarities of the excrescences of the external cuticle are concerned (save a small difference in height of the excrescences), proving that the specimens enumerated above belong to this species. This proves, moreover, that in previous papers several specimens have been erroneously identified with *Sacculina carinata*.

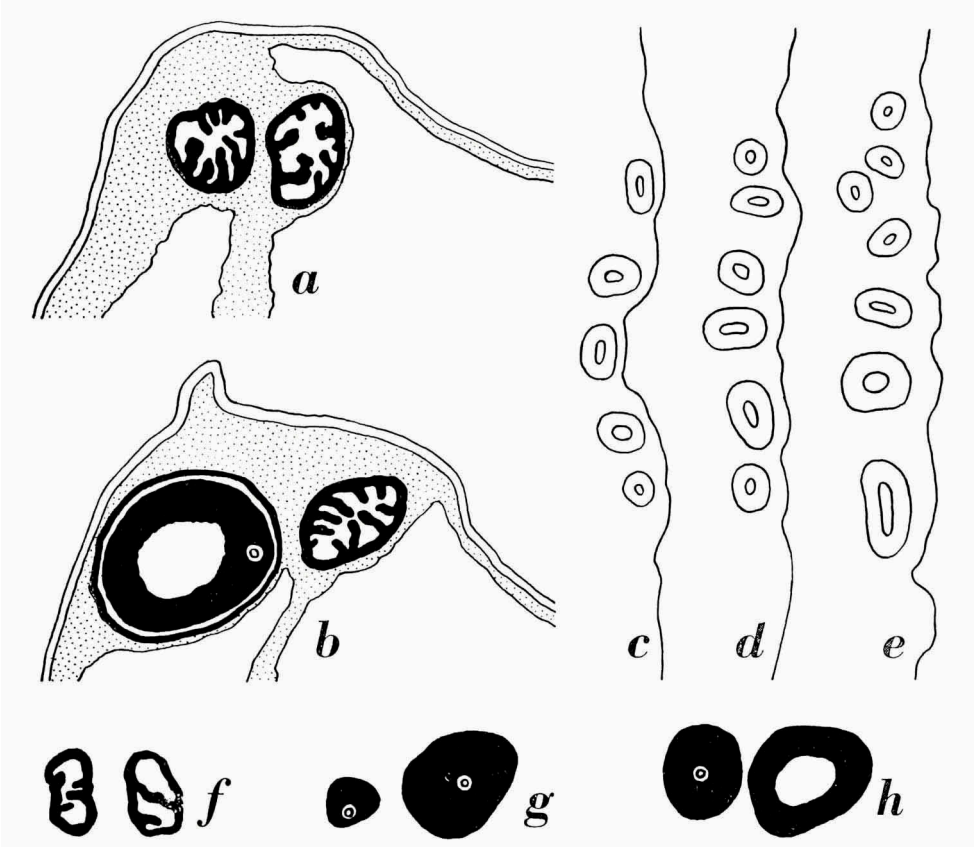

Fig. 4. *Sacculina carinata* Kossmann. *a, b,* specimen no. 1333, posterior parts of longitudinal sections, *a* through the vasa deferentia, *b* farther towards the dorsal region. *c-h,* specimen no. 1328A; *c-e,* longitudinal sections of one of the colleteric glands; *f-h,* transverse sections of the male genital organs, *f* through the vasa deferentia, the following sections farther towards the dorsal region. Excrescences of external cuticle omitted. *a, b, f-h,* × 45; *c-e,* × 190.

In the first paper dealing with the Rhizocephala of the Siboga Expedition (Van Kampen & Boschma, 1925) we gave the name *Sacculina carinata* to two specimens which have excrescences consisting of a solid basal part embedded in the cuticle and a hollow upper part extending over the cuticle, this upper part being closed above by a flat-topped plate beset with small spines. The similarity of these excrescences to those described by Kossmann in his species *Sacculina carinata* is not complete because Kossmann emphatically states that in his specimen the upper parts of the excrescences form open cups and in our specimens they are closed above, but we regarded these differences as irrelevant. In the cited paper we paid hardly any attention to the anatomical structure of the parasites, but in later publications the species with curved male organs were considered generically distinct from *Sacculina,* a fact which also became apparent in the specimens supposed to belong to *Sacculina carinata.* At first (Boschma, 1928) the specimens were removed to the genus *Drepanorchis,* later (Boschma, 1931b) they were placed in the genus *Loxothylacus.* Remarks on these specimens and other

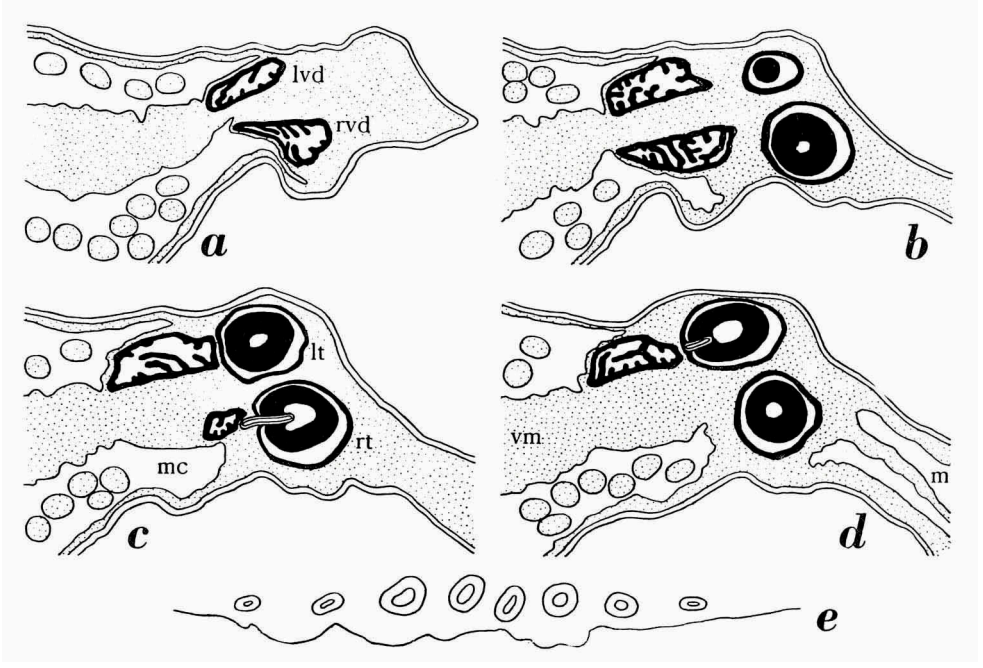

Fig. 5. *Sacculina carinata* Kossmann, specimen no. 1334. *a-d,* central parts of transverse sections through the posterior region, *a* farthest posteriorly, *d* farthest anteriorly; *e,* transverse section of one of the colleteric glands. lt, left testis; lvd, left vas deferens; m, mesentery; mc, mantle cavity; rt, right testis; rvd, right vas deferens; vm, visceral mass. Excrescences of external cuticle omitted. *a-d,* × 30; *e,* × 127.

parasites with corresponding characters are found, with the name *Loxothylacus carinatus,* in some other papers (Boschma, 1931a, 1940, 1949, 1950, 1955). All the time it was overlooked that Kossmann remarked that the anatomy of *S. carinata* closely corresponds with that of *S. dentata,* which has globular testes and short, wide vasa deferentia, proving that the species is generically distinct from *Loxothylacus.* For the supposed *Loxothylacus carinatus* in the present paper the name *Loxothylacus kossmanni* is proposed.

In the material collected by Dr. Holthuis at Biak Island there are five specimens on *Thalamita admete* (Herbst), one on *Thalamita ?edwardsi* Borradaile, and one on *Thalamitoides tridens* (A. Milne Edwards), which all have male organs as described by Kossmann for his species *Sacculina carinata,* four of the specimens moreover possessing excrescences as they

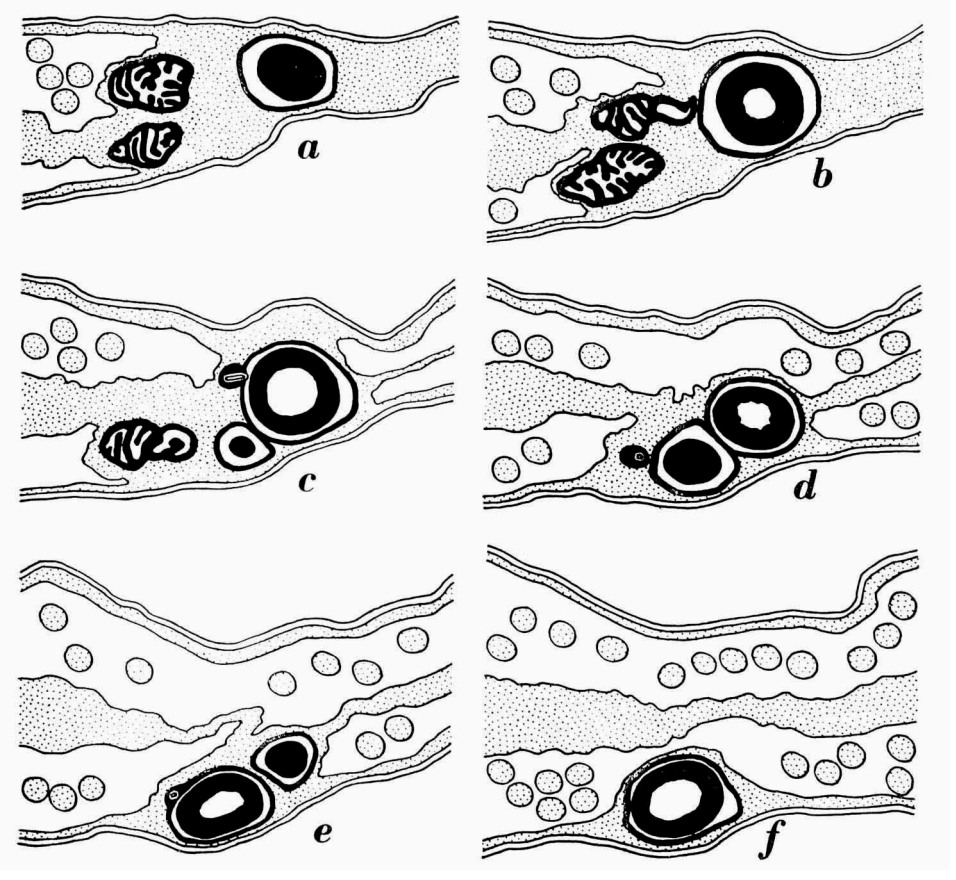

Fig. 6. *Sacculina carinata* Kossmann, specimen no. 1330, central parts of transverse sections through the posterior region, *a* farthest posteriorly, *f* farthest anteriorly. Excrescences of external cuticle omitted. × 36.

are typical of *S. carinata,* the others having excrescences of a modified appearance as they are not uncommon in the specimens showing the excrescences in full development. This proves without any doubt that this material constitutes the first additional specimens of *S. carinata* since the description of the species in 1872. It seemed worth while to illustrate the peculiarities of the seven specimens in a rather elaborate manner, showing the pronounced

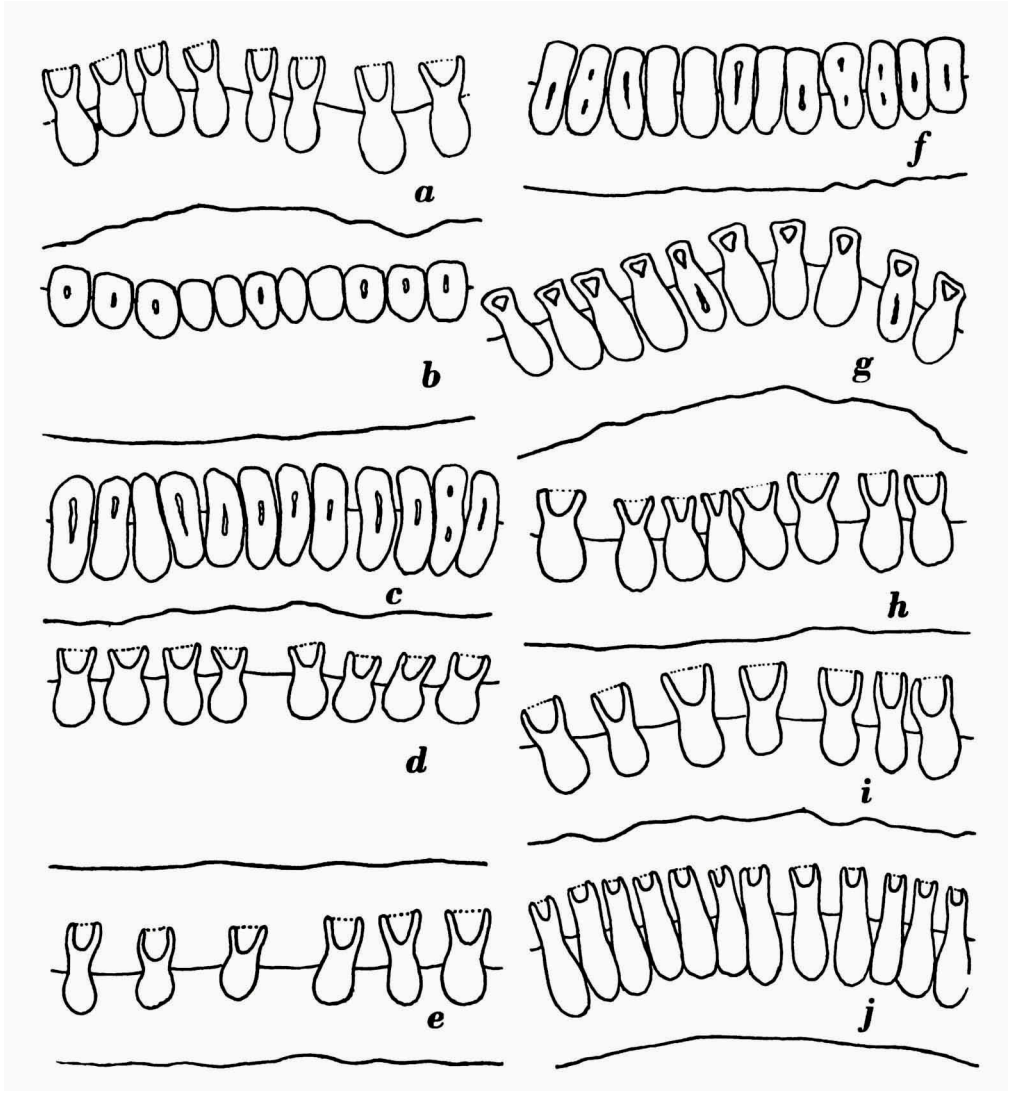

Fig. 7. *Sacculina carinata* Kossmann, specimen no. 1333, sections of the external cuticle. × 530.

individual variation, especially as far as the shape of the excrescences is concerned.

The five specimens infesting the crab *Thalamita admete* are of a rather uniform shape though slightly differing in size (fig. 1*a-d, f*). They are oval to kidney-shaped, the mantle opening occurring on the anterior border of the left side, not appreciably extending over the surface of the mantle. In all the five specimens there is a broad ridge running antero-posteriorly

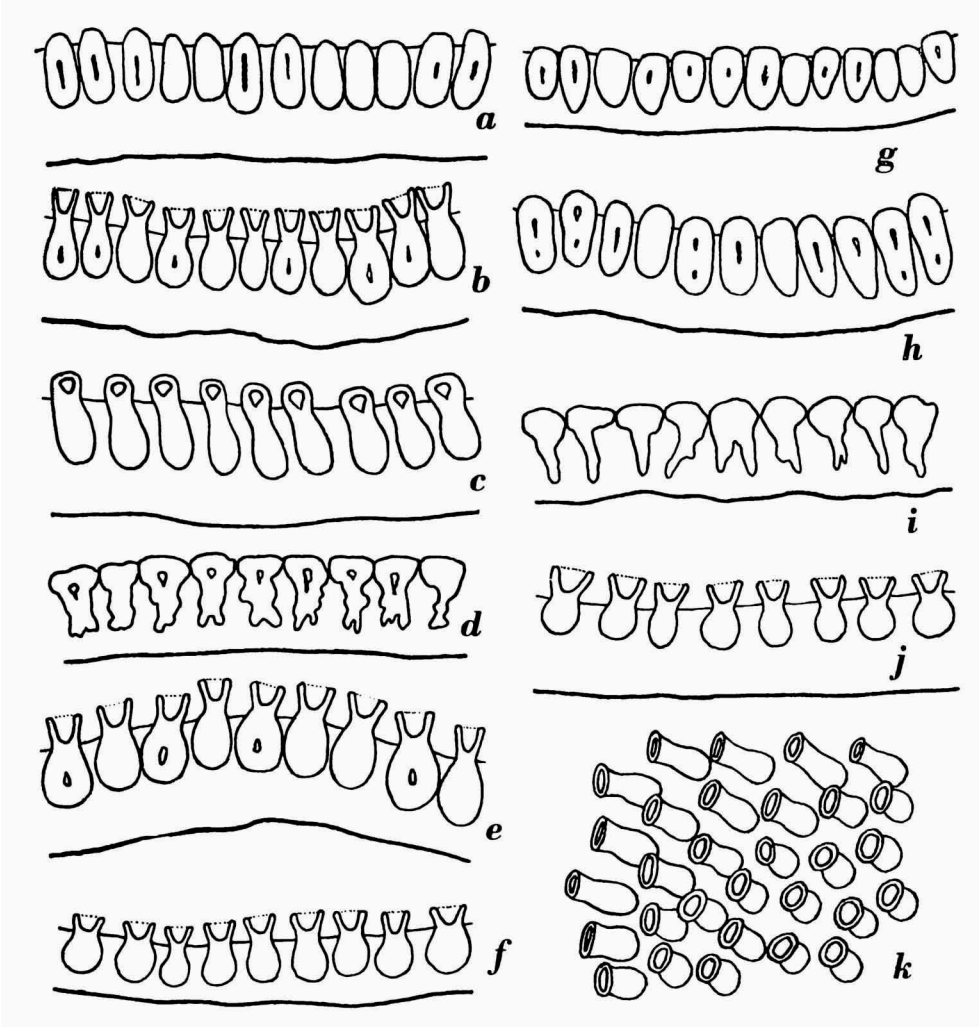

Fig. 8. *Sacculina carinata* Kossmann, sections of the external cuticle. *a-e*, specimen no. 1324B; *f-j*, specimen no. 1330; *k*, excrescences of the external cuticle of specimen no. 1330 in oblique surface view. × 530.

on the left side, while in the corresponding part of the right side there is a pronounced groove fitting against the median ridge of the abdomen of the host. It is interesting that the marginal part of the mantle forms a rather sharp keel (indicated by dotted lines in the figures), just as in

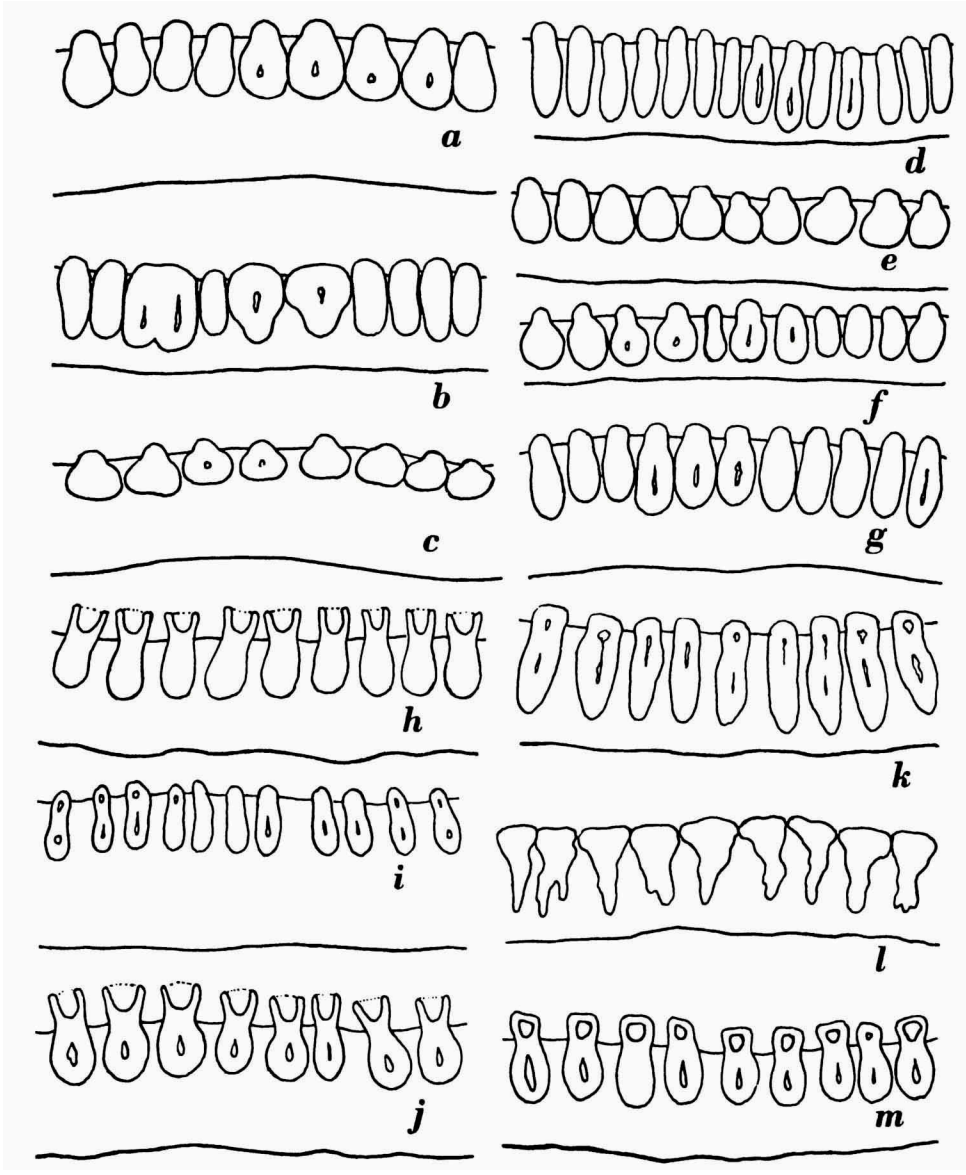

Fig. 9. *Sacculina carinata* Kossmann, sections of the external cuticle. *a-g*, specimen no. 1334; *h-m*, specimen no. 1324A. × 530.

the type specimen, which derived its scientific name from this character. The measurements of the five specimens (dorso-ventral diameter, antero-posterior diameter, and thickness from left to right side) are noted above in the list of material examined. The list, moreover, shows that there is some correlation between the size of the parasites and that of their hosts.

The specimen on *Thalamita ?edwardsi* is distinctly smaller (fig. 1*e*), probably in connexion with the smaller dimensions of the host. It has an oval shape, the mantle opening lying in the middle of the anterior region,

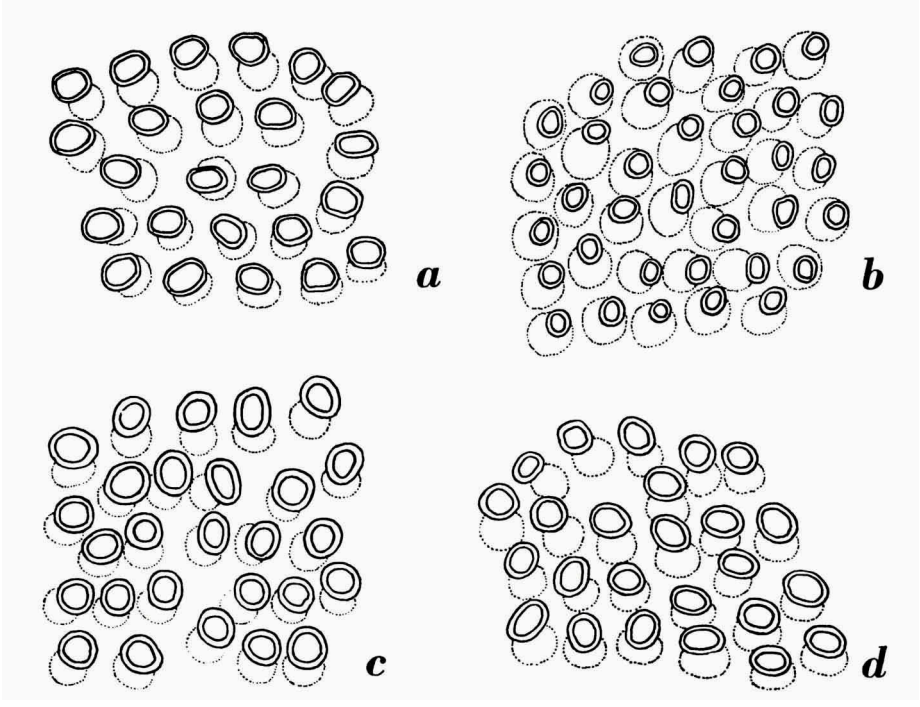

Fig. 10. *Sacculina carinata* Kossmann, excrescences of the external cuticle in surface view, upper margins in full lines, basal parts in dotted lines. *a, b,* specimen no. 1324A; *c, d,* specimen no. 1324B. × 530.

while there is not a distinct antero-posterior ridge on the left side. The marginal part is distinctly keeled.

The specimen on *Thalamitoides tridens* is of a rather different shape, it is broadly oval to kidney-shaped (fig. 1*g, h*). The mantle opening corresponds with those of the parasites of *Thalamita admete,* there is, however, not a distinct antero-posterior ridge on the left side, though the median groove of the right side is well developed (not indicated in the figure). This specimen does not possess the marginal keels as they occur in the

other specimens; here the mantle has a number of narrow grooves running parallel to the anterior margin.

For the study of the internal structure all the specimens were sectioned (two specimens on *Thalamita admete* transversely, the remaining five specimens longitudinally). The peculiarities of the male organs and of the colleteric glands proved to be of a rather uniform character, the individual variation being found chiefly in the excrescences of the external cuticle.

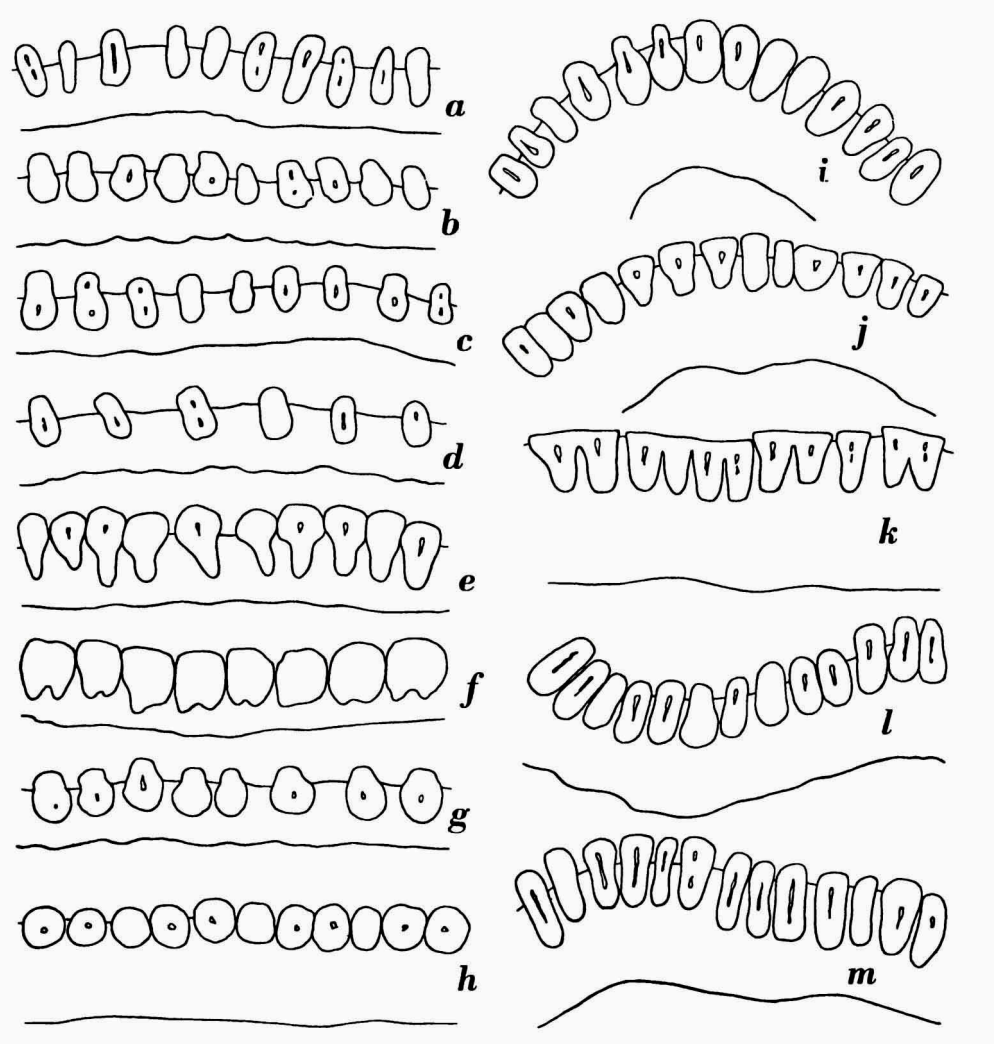

Fig. 11. *Sacculina carinata* Kossmann, sections of the external cuticle. *a-g*, specimen no. 1328A; *h-m*, specimen no. 1320. × 530.

Specimen no. 1324A, on *Thalamita admete,* has wide vasa deferentia with a great number of ridges extending from the inner walls (fig. 2*a*). The testes are globular, of approximately equal size, the one lying slightly behind the other (fig. 2*c*, *e*). The two parts of the male organs are connected by a narrow tube with distinctly chitinous inner wall (represented in fig. 2*b*

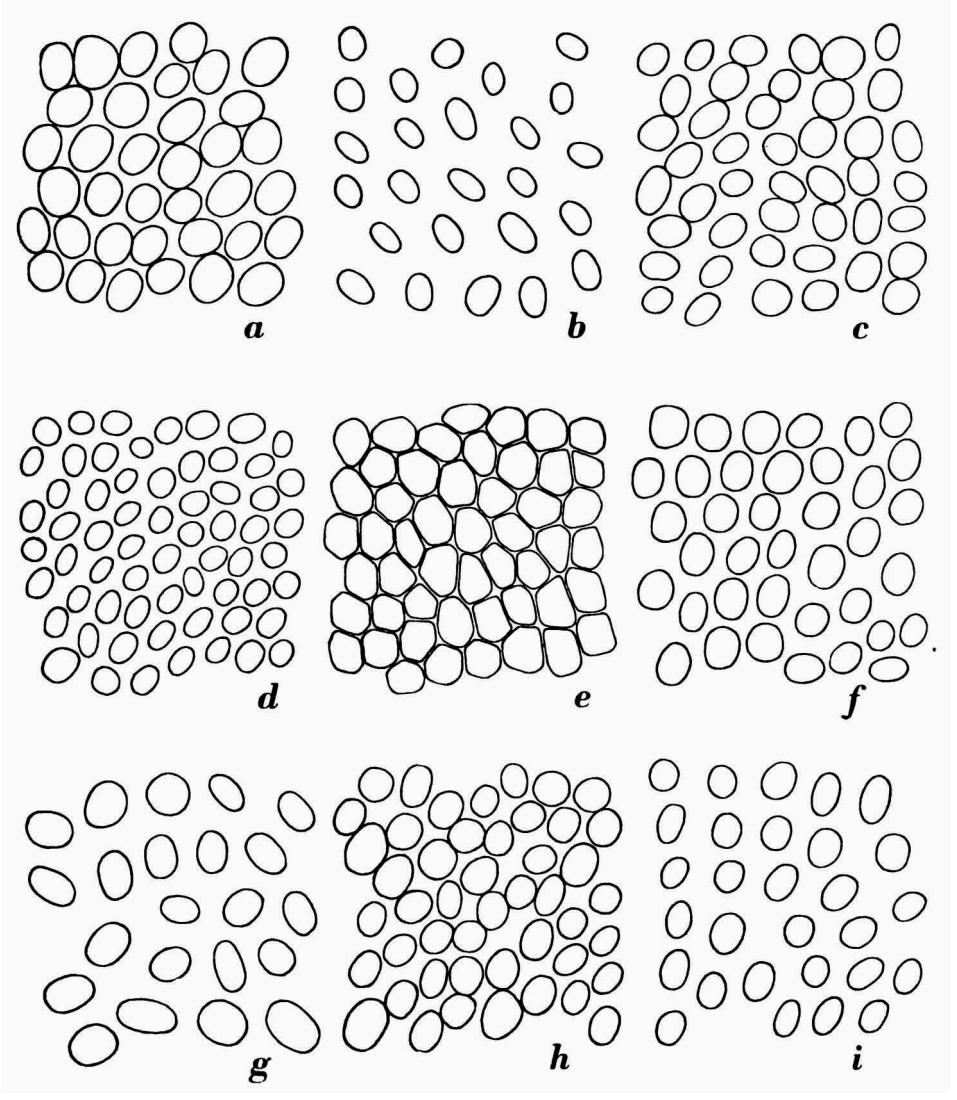

Fig. 12. *Sacculina carinata* Kossmann, distribution of the basal parts of the excrescenses in the external cuticle. *a-c*, specimen no. 1334; *d*, *e*, specimen no. 1324A; *f*, specimen no. 1324B; *g*, specimen no. 1333; *h*, *i*, specimen no. 1330. × 530.

and *d*). The figures show that the male organs are found in the posterior part of the body, outside the visceral mass.

The colleteric glands of specimen no. 1324A lie in the central part of each of the lateral surfaces of the visceral mass as flat masses each with one row of tubes (fig. *2f, g*). The maximum number of tubes counted in a longitudinal section is 7.

In the specimen on *Thalamitoides tridens,* no. 1320, the internal structure on the whole is as in the preceding specimen. In the vasa deferentia the ridges are somewhat less strongly developed (fig. *3a*), while the two testes are of unequal size, the one (fig. *3c*) being larger than the other (fig. *3d*), the former having a wide cavity, the latter remaining solid. The narrow chitinous tubes connecting the two parts of the male organs are shown in fig. *3b-d.*

In their position and in their shape the colleteric glands of the specimen on *Thalamitoides tridens* (fig. *3e, f*) correspond with those of specimen

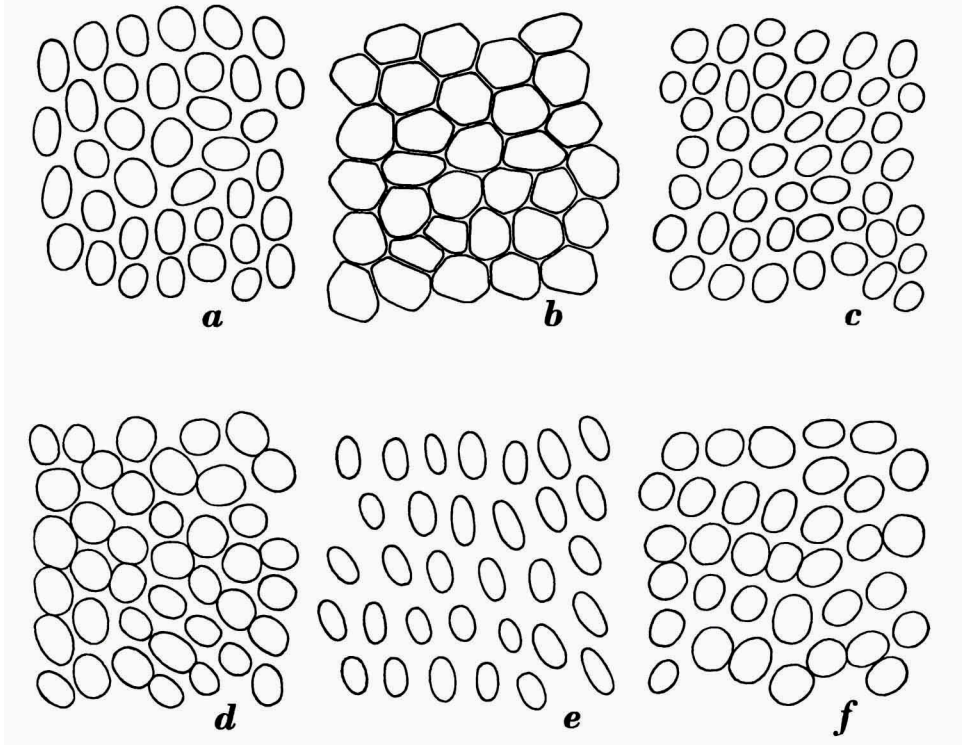

Fig. 13. *Sacculina carinata* Kossmann, distribution of the basal parts of the excrescences in the external cuticle. *a-c,* specimen no. 1320; *d-f,* specimen no. 1328A; × 530.

no. 1324A, the maximum number of tubes in a longitudinal section again being 7.

In the largest specimen on *Thalamita admete,* no. 1333, the visceral mass is reduced to a thin layer of tissue with very few developing eggs. At one side of the body the wide mantle cavity is almost entirely filled with a large female Bopyrid, while several small males are scattered around it. In this specimen the colleteric glands have an indistinct structure, the male organs, however, are well developed. The vasa deferentia are wide, showing numerous ridges on their inner walls (fig. 4*a*), the testes are globular, the one lying behind the other, being connected with the vasa deferentia by a distinct chitinous tube (fig. 4*b*).

In the rather small parasite of *Thalamita ?edwardsi,* no. 1328A, the male organs are similar to those of the previously mentioned specimens; the vasa deferentia have comparatively few ridges, one of the testes is solid, the other has a rather wide cavity; the chitinous tubes connecting the two parts of the male organs are distinct (fig. 4*f-h*).

The colleteric glands of no. 1328A closely correspond with those of the other specimens, again having 7 tubes in a longitudinal section of the region of strongest division (fig. 4*c-e*).

Specimen no. 1334, a parasite of *Thalamita admete,* was transversely sectioned. The sections of the male organs (fig. 5*a-d*) show that the vasa deferentia are rather wide, that the testes are globular, and that the two parts of the male organs are conneced by a narrow chitinous tube (shown in the right testis in fig. 5*c,* in the left in fig. 5*d*). In this specimen the two male organs are of an approximately equal size.

A transverse section of one of the colleteric glands of no. 1334 is drawn in fig. 5*e,* again characterized by its small number of tubes.

In specimen no. 1330, a parasite of *Thalamita admete,* also sectioned transversely, the male genital organs have almost exactly the same structure as those of no. 1334, each of the two testes having a rather wide cavity (fig. 6). The vasa deferentia have a few more ridges, reducing their cavities to mere slits (fig. 6*a, b*). The colleteric glands again correspond with those of the other specimens.

Especially the transverse sections, containing longitudinal sections of the male organs (figs. 5 and 6), show that these have the structure as figured by Kossmann for his species *Sacculina aentata* (Kossmann, 1872, Pl. II fig. 6), while of *Sacculina carinata* he remarked that its anatomical characters are those of the first named species though on a smaller scale.

The main layers of the external cuticle are of varying thickness, in no. 1333 from 24 to 48 μ, in no. 1324B from 22 to 30 μ, in no. 1330 from

15 to 25 μ, in no. 1334 from 15 to 38 μ, in no. 1324A from 25 to 32 μ, in no. 1328A from 12 to 18 μ, and in no. 1320 from 22 to 37 μ.

Sections of the external cuticle of no. 1333, a parasite of *Thalamita admete,* are drawn in fig. 7. In many parts of the cuticle the excrescences are of the shape as described and figured by Kossmann, showing a cup-like part extending above the cuticle, while their basal parts, of a more or less oval shape, remain embedded in the main layers of the cuticle (fig. 7*a, d, e, h, i*). The length of these excrescences varies from 18 to 28 μ, their thickness from 7 to 10 μ. The cup-like part generally is one-third to one-half of the length of the entire excrescences; sometimes it is considerably smaller, the excrescences appearing then much slenderer and slightly longer, up to 30 μ (fig. 7*j*). A modification of the cup-like type occurs when the upper part remains closed at its topmost region, the remains of the cup then form an inverted conical cavity (fig. 7*g*). A farther reduction of the shape of the excrescences leads to plug-like cylindrical bodies of a length of 18 to 28 μ and a thickness of 6 to 10 μ (fig. 7*c, f*) or even to shorter, nearly globular bodies of a length of 12 to 15 μ (fig. 7*b*). Especially the excrescences of more or less cylindrical shape often show a minute central cavity (fig. 7*c*). The distribution of the excrescences in the upper region of the cuticle is shown in fig. 12*g*, representing the basal parts as seen by deeper focussing.

The excrescences of no. 1324B, a parasite of *Thalamita admete,* are of a similar kind; they are distinctly cup-shaped (fig. 8*b, e*), or have a terminal cavity closed by a solid cover (fig. 8*c*), or are cylindrical (fig. 8*a*). In some parts of the cuticle the basal parts are not of an oval shape, but end in rather irregular roots (fig. 8*d*). The distribution of the excrescences in two parts of the cuticle is shown in fig. 10*c, d,* the cup-shaped parts indicated by full lines, the basal parts by dotted lines. A part of the cuticle in which the excrescences are rather more crowdedly placed is represented in fig. 12*f,* only the basal parts being shown.

Another parasite of *Thalamita admete,* no. 1330, again has excrescences of varying shapes, cup-shaped (fig. 8*f, j*), cylindrical (fig. 8*g, h*), or provided with irregular roots (fig. 8*i*). A surface view of a curved part of the cuticle shows the distribution of the excrescences, seen obliquely from above or for their whole length (fig. 8*k*). The distribution of the excrescences in the upper layers of the cuticle, as shown by transparency, is represented in fig. 12*h, i,* the basal parts in one of these being in rather close contact, in the other much more widely separated.

In no. 1334, again a parasite of *Thalamita admete,* all the excrescences appear to have undergone some reduction, no cup-shaped excrescences having

been found. They are cylindrical (fig. 9*d*, *g*) or irregularly globular, often more or less pear-shaped (fig. 9*a-c*, *e*, *f*). They often are very short (9-12 μ), and sometimes much thicker than in the other specimens (up to 17 μ, fig. 9*b*). The distribution of the basal parts in the cuticle is shown in fig. 12*a-c*; in these different parts the excrescences have a pronounced variation in size and in manner of occurrence, crowded or rather widely placed.

The remaining specimen on *Thalamita admete*, no. 1324A, again shows a certain amount of variation in the shape of the excrescences; these are cup-shaped (fig. 9*h*, *j*), have a fairly large cavity closed at the top (fig. 9*m*), are cylindrical of strongly varying size (fig. 9*k*, length 30 μ, fig. 9*i*, length 18 μ), or possess irregular roots (fig. 9*l*). The excrescences of two parts of the cuticle are represented in surface view in fig. 10*a*, *b*, the cup-shaped parts indicated with full lines, the basal parts with dotted lines; the figures show the variation in size of the cups and of the basal parts. Fig. 12*d*, *e*, representing the basal parts of the excrescences as they occur in two parts of the cuticle, shows that these are of strongly variable size and distribution, distinctly separated (fig. 12*d*) or in such a close contact that their contours have obtained a polygonal shape.

The parasite of *Thalamita ?edwardsi*, no. 1328A, has excrescences of a comparatively small size, varying in length from 9 to 18 μ. They often are irregularly globular to short cylindrical (fig. 11*a-d*, *g*), sometimes pear-shaped (fig. 11*e*) or short and broad (up to 15 μ) with small roots (fig. 11*f*). The variation in shape and the distribution of the basal parts is shown in fig. 13*d-f*, in some parts of the cuticle they occur rather crowdedly, in other parts they remain distinctly separated (even at rather wide distances, fig. 11*c*, *d*). Sometimes the basal parts have a pronouncedly oval contour (fig. 13*f*).

In no. 1320, the parasite of *Thalamitoides tridens*, the excrescences generally have a cylindrical shape (fig. 11*i*, *l*, *m*), sometimes they are conical (fig. 11*j*), with a tendency to unite into complexes of two to four (fig. 11*k*), and in certain parts of the cuticle they are of a globular shape with a diameter of about 9 μ (fig. 11*h*). The basal parts as occurring in three different regions are shown in fig. 13*a-c*; as a rule the excrescences remain distinctly separated, but sometimes, especially when they have grown to a fairly large size, they are closely joining and obtaining more or less polygonal contours (fig. 13*b*).

Retinacula have not been found on the fragments of the internal cuticle of each of the specimens which were examined in surface view; in all probability they do not occur in the species.

In addition to the constant structure of the male genital organs and of the colleteric glands, the peculiar cup-shaped excrescences form a distinct character of the species *Sacculina carinata*. In the specimens in which there are no cup-shaped excrescences there are chitinous structures exactly corresponding with those as they occur as a variation in specimens which in part of the cuticle have the cups. To emphasize this variation, and as arguments for the conspecifity of the various specimens, their peculiarities have been described at some length and the excrescences have been rather elaborately figured.

As a concluding remark it must be observed that Kossmann noted 0.033 mm as the length of the excrescences in his specimen of *Sacculina carinata*. In the specimens described in the present paper the excrescences are shorter, only exceptionally reaching a total length of 30 μ, while the smallest excrescences (fig. 8*f*) have about half this length. In this respect Kossmann's specimen evidently had reached the highest values in the range of variation.

Loxothylacus kossmanni nov. spec.

non *Sacculina carinata* Kossmann, 1872, p. 32.
Sacculina carinata Van Kampen & Boschma, 1925, p. 35.
Drepanorchis carinata Boschma, 1928, p. 171.
Loxothylacus carinatus Boschma, 1931a, p. 368; 1931b, p. 59; 1940, p. 276; 1949, p. 971; 1950, p. 148; 1955, p. 20.

Type specimen on *Caphyra laevis* (A. Milne Edwards), type locality Biak Island near New Guinea.

Material examined:

Siboga Expedition, Station 220 (Binongko, reef); 1 specimen on *Caphyra laevis* (A. Milne Edwards), 8½ × 5½ × 2½ mm. Figures: Van Kampen & Boschma, 1925, Pl. I fig. 12 (external shape), text-fig. 24 (external cuticle, retinaculum).

Banda, 1881, Semmelink leg.; collection Leiden Museum; 1 specimen on *Thalamita prymna* (Herbst), 9½ × 6½ × 4 mm. Figures: Van Kampen & Boschma, 1925, text-fig. 25 (external cuticle, retinaculum); Boschma, 1931b, fig. 38 (longitudinal sections); 1949, fig. 6 (male organs, colleteric gland); 1950, fig. 7*a* (situation of colleteric glands).

East Asia, April 19, 1911, Capt. Suenson leg., Miss Anthon don.; collection Copenhagen Museum; 1 specimen on *Portunus (Hellenus) hastatoides* (Fabricius), 8 × 5 × 2½ mm. Figures: Boschma, 1931a, fig. 33*m* (external shape), fig. 51*b, c, e* (external cuticle, retinaculum); 1949, fig. 7 (male organs, colleteric gland); 1950, fig. 7*b* (situation of colleteric glands).

Dr. Th. Mortensen's Pacific Expedition, off Jolo, Sulu Islands, March 19, 1914, 33-55 m; 1 specimen on *Lissocarcinus polybioides* Adams & White, 5½ × 4 × 2½ mm. Figures: Boschma, 1931a, fig. 33*k, l* (external shape), fig. 50 (longitudinal section), fig. 51*a, d* (external cuticle); 1949, fig. 8 (male organs, colleteric gland); 1950, fig. 7*c* (situation of colleteric gland).

Hongkong, Putnam leg.; collection Museum of Comparative Zoölogy, Cambridge, Mass.; 1 specimen detached from unknown host, 7 × 5 × 1½ mm. Figures: Boschma,

1949, fig. 1*c* (external shape); 1950, fig. 1 (male organs, colleteric gland), fig. 2 (external cuticle, retinacula), fig. 7*d* (situation of colleteric glands).

Snellius Expedition, Obi latu, April 23-27, 1930, shore or reef; 1 specimen on unidentified Portunid crab, 10 × 7 × 3 mm. Figures: Boschma, 1949, fig. 1*d* (external shape); 1950, fig. 3 (male organs, colleteric gland), fig. 4 (external cuticle, retinacula), fig. 7*h* (situation of colleteric glands).

Snellius Expedition, Amboina, October 17, 1930; 1 specimen on *Thalamita admete* (Herbst), 7 × 5 × 2½ mm. Figures: Boschma, 1949, fig. 1*e* (external shape); 1950, fig. 5 (male organs, colleteric gland), fig. 6 (external cuticle, retinacula), fig. 7*g* (situation of colleteric glands).

No. 1322, reef W. of Sorido, Biak Island, shallow water, February, 1955, 1 specimen on *Caphyra laevis* (A. Milne Edwards), 8 × 4½ × 2 mm. Figures: present paper, fig. 1*i* (external shape), fig. 14 (male organs), fig 16*a-c* (colleteric gland), fig. 17*a-d* (external cuticle, retinacula).

No. 1332, reef W. of Sorido, Biak Island, shallow water, January, 1955, 1 specimen on *Caphyra laevis* (A. Milne Edwards), 8 × 5 × 2½ mm. Figures: present paper, fig. 1*j* (external shape), fig. 15 (male organs), fig. 16*d, e* (colleteric gland), fig. 17*e-g* (external cuticle).

All the specimens enumerated above belong to an as yet undescribed species for which the name *Loxothylacus kossmanni* is here proposed. The species

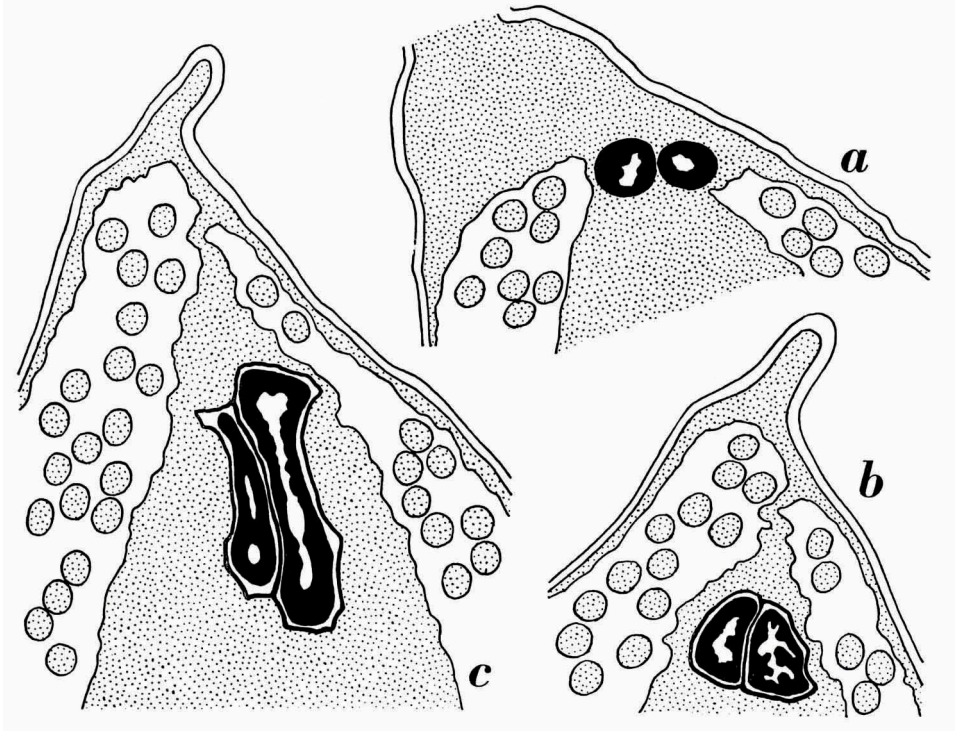

Fig. 14 *Loxothylacus kossmanni* nov. spec., specimen no. 1322. Posterior parts of longitudinal sections, *a* through the stalk, *b* farther towards the dorsal region, *c* through the dorsal parts of the testes. Excrescences of external cuticle omitted. × 45.

is in the first place to be characterized by the excrescences of the external cuticle, which have the structure as represented in fig. 17 of the present paper or are of a similar shape. The characters of the species have been repeatedly dealt with in previous papers (see list of synonyms above), in which the species was erroneously named *Loxothylacus carinatus* (Kossmann).

The two specimens of *Loxothylacus kossmanni* from Biak Island both

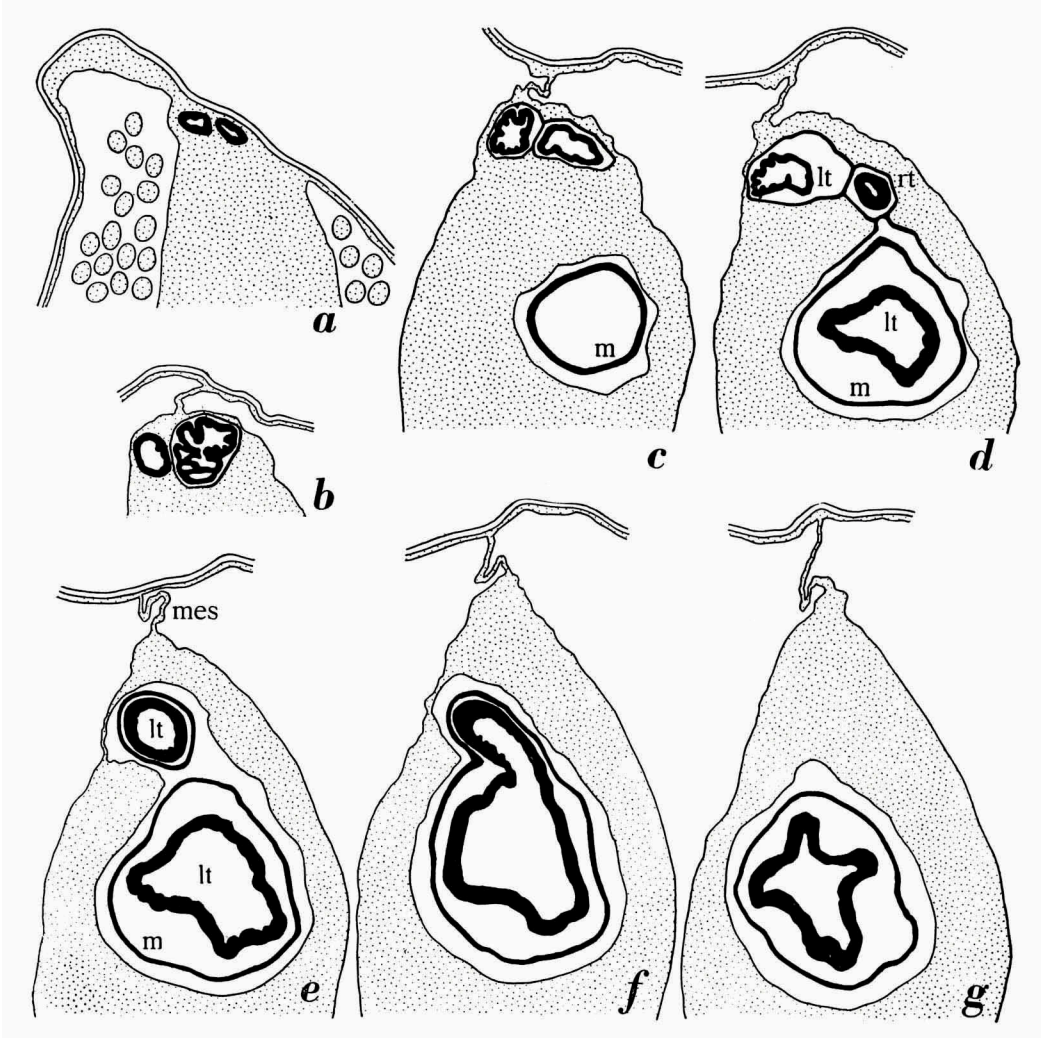

Fig. 15. *Loxothylacus kossmanni* nov. spec., specimen no. 1332. Posterior parts of longitudinal sections, *a* through the ventral parts of the vasa deferentia, each following section farther towards the dorsal region. Excrescences of external cuticle omitted. × 27.

are parasites of *Caphyra laevis*. They are of about equal shape and size (fig. 1*i*, *j*), both being broadly oval to kidney-shaped. The mantle opening lies in the centre of the anterior region of the left side, surrounded by a distinct sphincter, the parts around the mantle opening, however, not notably extending over the rest of the mantle. In one specimen, no. 1322, the mantle opening is irregularly circular (fig. 1*i*), in the other, no. 1332, it is cross-shaped

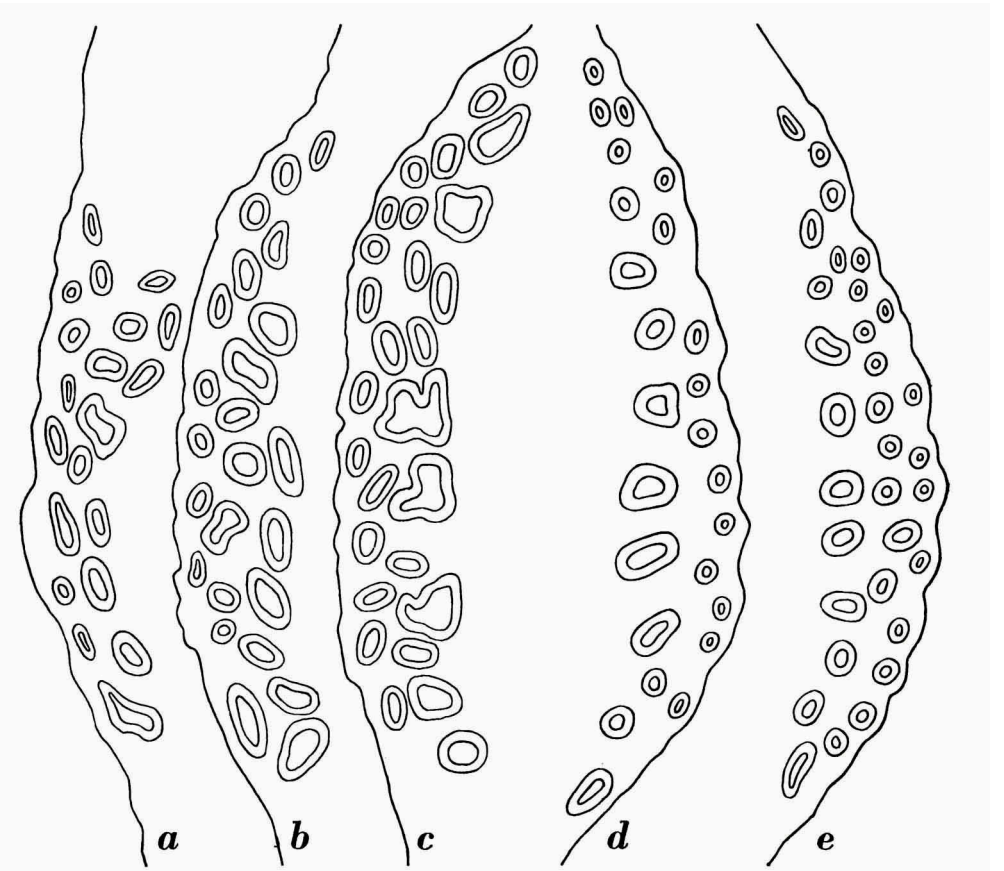

Fig. 16. *Loxothylacus kossmanni* nov. spec., longitudinal sections of colleteric glands. *a-c*, specimen no. 1322; *d*, *e*, specimen no. 1332. *a-c*, × 143; *d*, *e*, × 107.

(fig. 1*j*), as in the specimen on *Caphyra laevis* from the Siboga Expedition (Van Kampen & Boschma, 1925, Pl. I fig. 12). The two specimens have a pronounced groove running antero-posteriorly in the middle of the right side. At least in a part of the mantle of each of the two specimens the marginal region is distinctly compressed, forming a rather sharp ridge.

Of each of the two specimens a series of longitudinal sections was made.

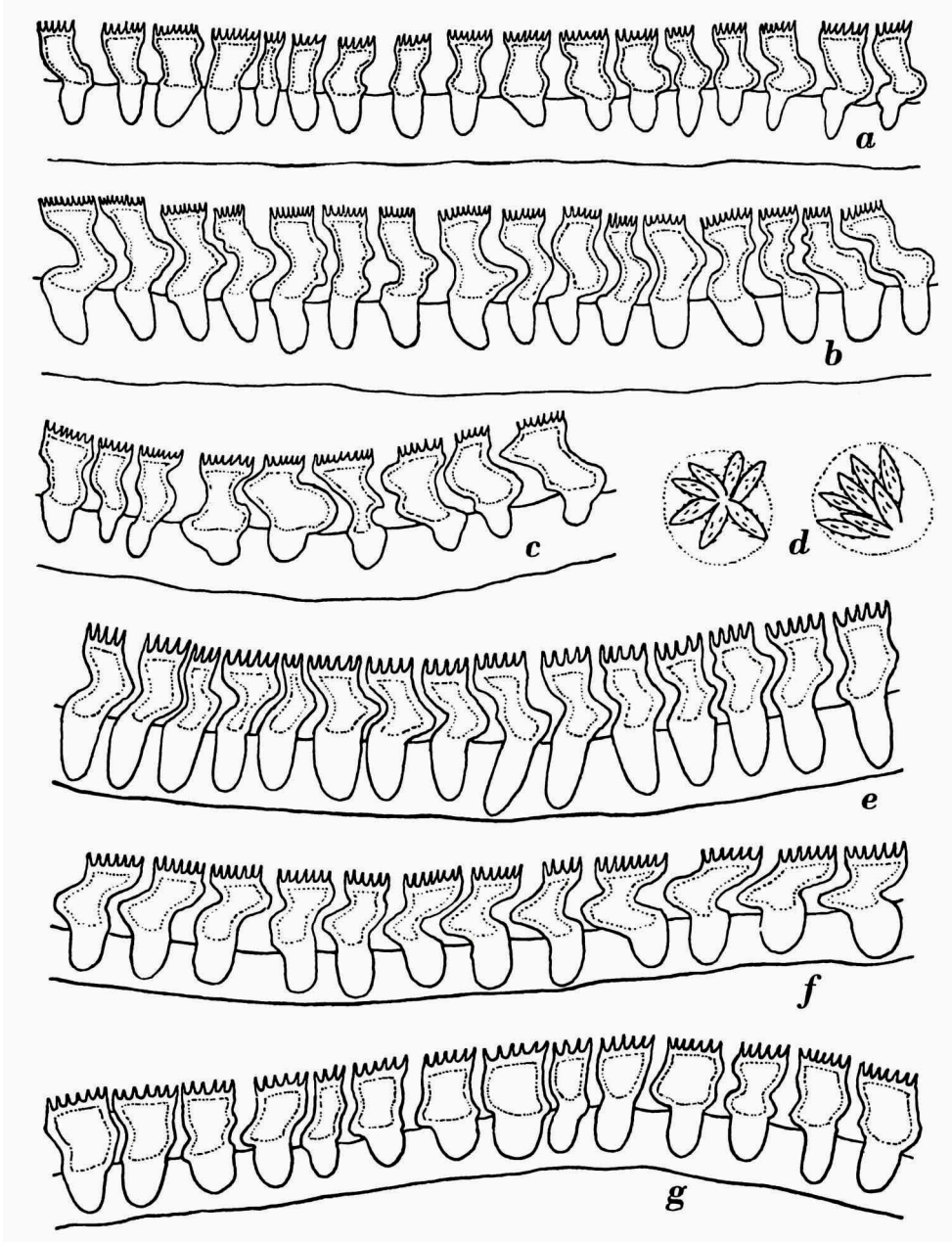

Fig. 17. *Loxothylacus kossmanni* nov. spec. *a-d*, specimen no. 1322; *a-c*, sections of the external cuticle; *d*, retinacula. *e-g*, specimen no. 1332, sections of the external cuticle. × 530.

In specimen no. 1322 the visceral mass is broadly attached to the region of the stalk, though to the right half only (fig. 14*a*); farther dorsally it appears that the mesentery is adhering to the mantle at some distance to the right of the median carina (fig. 14*b, c*), indicating one of the most important characters of the genus *Loxothylacus,* the asymmetrical attachment of the visceral mass.

The vasa deferentia are rather narrow cannals with comparatively thick walls running along the posterior margin of the visceral mass (fig. 14*a*); gradually they pass into the testes, which are surrounded by a muscular sheath, and which for a part of their course have more or less irregular cavities (fig. 14*b*). In their extreme dorsal parts the testes are distinctly curved, but the curvature runs chiefly in an anterior direction, a terminal bend in a ventral direction is very little pronounced (fig. 14*c*). The two testes lie close together but remain separated by their muscular sheaths.

In specimen no. 1332 the visceral mass is attached to the mantle at some distance from the muscular region from which the stalk takes its origin (fig. 15*a*). The vasa deferentia are narrow canals running along the posterior margin of the visceral mass (fig. 15*a*), without distinct region of demarcation they pass into the testes, which are surrounded each by its own muscular sheath, and in their ventral region have rather irregular cavities, these being divided into several incompletely separated parts by ridges extending from their inner walls (fig. 15*b, c*). The terminal part of the right testis is a rather narrow tube with a comparatively thick wall, the right testis has not a curvature in an anterior direction (fig. 15*d*). The left testis is much larger, and has a definite curvature, the terminal part distinctly extending anteriorly and ventrally (fig. 15*d*). The passage of the posterior turn of the curve into the anterior is shown in fig. 15*e, f;* the extreme dorsal part in fig. 15*g*. The terminal part of the left testis is enlarged into a comparatively wide sac, in some parts irregularly contracted. This contraction has brought about that the muscular sheath of the left testis (m in fig. 15) lies at some distance of the testis itself; curiously enough, this muscular sheath again is surrounded by a distinct cavity within the visceral mass.

In the two specimens the colleteric glands lie in the neighbourhood of the central parts of the sides of the visceral mass, slightly farther towards the anterior extremities than to the posterior. In no. 1332 the glands are larger than in no. 1322, but their structure is highly similar (fig. 16), though in no. 1332 (fig. 16 *d, e)* the tubes are somewhat more widely separated than in no. 1322 (fig. 16*a-c*). The maximal number of tubes counted in a longitudinal section is 29 in no. 1322 (fig. 16*c*) and 32 in no. 1332 (fig. 16*e*), numbers of about equal value.

In the two specimens the main (stainable) layers of the external cuticle are rather thin, generally having a thickness of 13 to 25 μ. The excrescences, hyaline plugs on the top of which there is an irregularly cylindrical part extending over the cuticle, which at its closed top is covered with numerous small spines, are of a corresponding structure in the two specimens. In no. 1322 (fig. 17*a-c*) the total length of the excrescences varies from 24 to 33 μ, their diameter from 7 to 18 μ. In no. 1332 (fig. 17*e-g*) the corresponding values are length from 27 to 42 μ, diameter from 7 to 18 μ. In some parts of the cuticle the upper portions of the excrescences are rather regularly cylindrical (fig. 17*a, g*), in other parts these portions have a somewhat twisted appearance, as if they were distorted by pressure from above. The figured parts show the variation in size and shape.

The retinacula (fig. 17*d*) have 6 to 10 spindles of a length of about 15 μ, beset with distinct barbs. They correspond with those found in other specimens of the list on a previous page.

The individual peculiarities of the nine specimens of *Loxothylacus kossmanni* that up to now have become known (see material examined) are:

Specimen on *Caphyra laevis* from Binongko. Male organs and colleteric glands unknown. Excrescences with distinct basal parts, total length 35 μ, length of basal parts 15 μ.

Specimen on *Thalamita prymna* from Banda. Visceral mass attached to the region of the stalk. The two testes of about equal size and shape, both distinctly curved. Colleteric glands with 53 tubes in a longitudinal section of the most strongly divided region. Excrescences with distinct basal parts, total length 55-60 μ, length of basal parts 27-30 μ.

Specimen on *Portunus (Hellenus) hastatoides* from East Asia. Visceral mass attached to the mantle at some distance from the stalk. Right testis large, terminal part distinctly curved in a ventral direction, left testis smaller, curved in an anterior direction. Colleteric glands with 48 tubes in a longitudinal section of the most strongly divided region. Excrescences with very small basal parts, total length 20 to 26 μ.

Specimen on *Lissocarcinus polybioides* from off Jolo. Visceral mass attached to the mantle at some distance from the stalk. Testes of about equal size and shape, both distinctly curved. Colleteric glands with 60 tubes in a longitudinal section of the most strongly divided region. Excrescences with very small basal parts, total length 20 μ.

Specimen on unknown host from Hongkong. Visceral mass somewhat obliquely attached to the region of the stalk. Right testis large, left little developed, both distinctly curved. Colleteric glands with 35 tubes in a longitudinal section of the most strongly divided region. Excrescences attached to

the upper surface of the cuticle, without basal parts as they occur in other specimens; total length of the excrescences 15 to 26 μ.

Specimen on unidentified Portunid crab from Obi latu. Visceral mass somewhat obliquely attached to the region of the stalk. Testes of about equal size and shape, both distinctly curved. Colleteric glands with 58 tubes in a longitudinal section of the most strongly divided region. Excrescences as a rule with well developed basal parts, total length 24 to 60 μ, basal parts one-third to one-half the total length of the excrescences.

Specimen on *Thalamita admete* from Amboina. Visceral mass attached to the mantle at some distance from the stalk. Right testis large, left much smaller, both male organs distinctly curved. Colleteric glands with 36 tubes in a longitudinal section of the most strongly divided region. Excrescences without basal parts as they occur in other specimens, attached to the upper surface of the cuticle; total length of the excrescences 22 to 33 μ.

Specimen no. 1322, on *Caphyra laevis* from Biak Island. Visceral mass somewhat obliquely attached to the region of the stalk. Testes not strongly different in shape and in size, both distinctly curved, chiefly in an anterior direction, not pronouncedly ventrally. Colleteric glands with 29 tubes in a longitudinal section of the most strongly divided region. Excrescences with distinct basal parts, total length 24 to 33 μ, basal parts about one-third this length.

Specimen no. 1332, on *Caphyra laevis* from Biak Island. Visceral mass attached to the mantle at some distance from the stalk. Left testis strongly enlarged, distinctly curved, the terminal part in a ventral direction; right testis rudimentary without curvature. Colleteric glands with 32 tubes in a longitudinal section of the most strongly divided region. Excrescences with distinct basal parts, total length 27 to 42 μ, basal parts one-third to one-half this length.

When a parasite is known to infest hosts belonging to different species, one of these must be selected as the typical host. Because the excrescences of the external cuticle of the specimens on *Caphyra laevis* (A. Milne Edwards) correspond in having a well developed basal part this crab is here designated as the typical host of *Loxothylacus kossmanni*. For the fixation of the type locality the choice is between Binongko (Siboga Expedition, Sta. 220, specimen described by Van Kampen & Boschma, 1925) and Biak Island (specimens nos. 1322 and 1332, described in the present paper). The anatomical peculiarities of the specimen from Binongko being unknown the best procedure is to choose one of the specimens from Biak Island as the type of the species. Because the male organs of specimen no. 1332 are of a somewhat aberrant shape, specimen no. 1322 (present paper figs. 1*i*, 14, 16*a-c*, 17*a-d*) is here selected as the type of the species.

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