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The Female Reproductive Organs and Genital Segments of *Anisolabis littorea* (White) (Dermaptera: Labiduridae)

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Abstract

THE female reproductive organs and genital segments of *Anisolabis littorea* (White) 1846 (Dermaptera: Labiduridae) are described. The histology of the former is also dealt with. The reproductive organs, with polytrophic ovarioles, are simple. Vestiges of an ovipositor are present, but the homologies of the parts are obscure. These, together with the spermatheca, may be useful in the systematics of Dermaptera, which at present are based on the male genitalia.

INTRODUCTION

THE writer has already (Giles, 1961) described the male reproductive organs and genitalia of *Anisolabis littorea* (White) 1846, the endemic coastal earwig of New Zealand. The present paper concludes the series on the reproductive systems of the species. However, it is intended to publish shortly a paper on the alimentary canal of *A. littorea.*

The female reproductive organs of *Anisolabis littorea* are of the form typical of oviparous insects. They are noteworthy for their simplicity, but it is not known whether this is a primitive or a derived condition. The reproductive organs of some other female Dermaptera have been described (see below), but little is known about their histology as a whole. In *A. littorea* there are no external genitalia, but two pairs of small sclerotised flaps (p. 301) beneath the subgenital plate may represent these structures. Large external female genitalia are absent from most Dermaptera, but two pairs of processes, probably representing the dorsal and ventral valvulae are found in many Pygidicranidae (Burr, 1916; Hincks, 1951, 1959). No use has been made of the female genitalia (of whatever form) in the systematics of the Dermaptera. It may well be that these structures could be useful in this regard.

As mentioned above, the reproductive organs and genital segments of a wide range of Dermaptera have been studied by a number of authors—most of the work being fairly generalised. Sharp (1895) figures and very briefly describes the ovaries of *Forficula auricularia* L. and of *Labidura riparia* (Pallas) 1773. Berlese (1909) illustrates and mentions the reproductive organs of *L. riparia* and

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of *F. auricularia.* He also figures some early stages of vitellogenesis in the latter species. Jordan (1909) deals with the reproductive organs and genital sternites of *Hemimerus talpoides* Walker 1871. The same structures of *Arixenia jacobsoni* Burr 1912 are figured and fully described by Burr and Jordan (1913).

Walker (1919) deals with the genital segments of the Dermaptera—principally *Forficula auricularia* and *Anisolabis maritima* (Gené) 1832. He figures (after Zacher, 1911) the genital sternites of these two species and also the ovipositor and genital sternites of *Kalocrania marmoricrura* (Serville) 1839 [= *Cranopygia marmoricrura* (Serville) 1839] and of *Echinosoma occidentale* de Bormans 1893 [= *Echinosoma afrum* (Palisot) 1805]. Nel (1929) figures and describes the developing and adult reproductive organs of *F. auricularia.* He says that there are no ovipositor valves associated with the 8th and 9th sternites. Snodgrass (1933) deals with the reproductive system of the Dermaptera and later (1935) illustrates and mentions the posterior portion of the reproductive organs and the genital sternites of *A. maritima.* Qadri (1940) very briefly describes the adult organs in *F. auricularia* and in *Hemimerus hanseni* Sharp 1895. He also traces the development of the reproductive organs in *F. auricularia* and mentions the status of the genitalia in the Dermaptera. The reproductive organs and genital sternites of *Hemimerus deceptus ovatus* Deoras 1941 are figured and briefly described by Deoras (1941, 1941a).

Chopard (1949) figures and mentions the reproductive organs of *Labidura riparia* and *Forficula auricularia.* He also describes the genitalia of *Kalocrania* [= *Cranopygia*] and *Echinosoma.* Bonhag (1956) deals with aspects of the histochemistry, particularly of periodic acid-Schiff-positive substances, in the developing oocyte of *Anisolabis maritima.* Imms (1957) figures the reproductive organs of *F. auricularia* and briefly discusses the organs in other species. The histology of the egg tube and of the developing oocytes of *A. maritima* are covered in detail by Arnold (1957).

Technique

As with the male, fresh specimens were examined in 1% saline, and most dissections carried out in 70% alcohol. Again, aqueous Bouin's Fluid or Eltringham's Fixative B (Eltringham, 1930) were used, and Ehrlich's haematoxylon counterstained with van Gieson proved satisfactory.

Acknowledgments

The writer's thanks are again due to Dr T. E. Woodward (now of the Department of Entomology, University of Queensland) for his helpful advice during the progress of this work at the University of Auckland. Mr C. D. Shorey, of the Department of Zoology, University of New England, again assisted with the photography.

OUTLINE OF THE STRUCTURE AND RELATIONS OF THE REPRODUCTIVE ORGANS AND GENITAL SEGMENTS

The female reproductive organs of *Anisolabis littorea* (Fig. 1) consist of a pair of ovaries, communicating by paired lateral oviducts with the short median oviduct which leads to the exterior at the bottom of a short pit-like genital chamber opening apparently between the seventh and eighth segments. The spermatheca opens on to the mid-dorsal aspect of the genital chamber behind the gonopore. There are no discrete accessory glandular structures. The organs are generally milky-white in colour.

The genital segments (Fig. 2) are the eighth and ninth, and these terga are reduced, fused to the tenth and overlapped by the seventh. The eighth and ninth sterna are reduced and divided, each portion being fused to the sides of the tenth tergum. Two pairs of small flaps near the anus may represent the vestiges of an ovipositor (p. 301). All these structures are covered by the seventh sternum which is enlarged to a triangular subgenital plate.

THE REPRODUCTIVE ORGANS

The Ovaries

Each ovary is roughly conical (Fig. 1) and small when the eggs are undeveloped. In this condition the ovaries lie ventro-laterally in the hinder part of the abdomen and may be mistaken at first for a portion of the fat body, which is then very extensive, white and granular. However, when the eggs are near maturity the ovaries become very large and lie dorso-laterally, often one in front of the other; then the alimentary canal is crowded into the thorax and the anterior part of the abdomen. In this latter condition, the fat body is very greatly reduced and transparent, but still granular. Each ovary is ensheathed in fat body and is richly supplied with tracheae. The suspensory ligament runs forward and ends in the fat body of the thorax.

The ovaries comprise five ovarioles which arise close together, and are almost certainly in a linear series. This is similar to the condition in *Labidura riparia,* but very different from that in *Forficula auricularia* (Dufour, 1828 and later authors' figures after Dufour).

The Ovarioles

This work was completed in 1950 and formed part of a general morphological study of the external and internal organs of *Anisolabis littorea.* The recent paper by Bonhag (1956), having an entirely different and specialised aim in view, has provided much information on the histochemistry of the oocyte of *Anisolabis maritima.* Arnold (1957) deals in great detail with the structure of the egg tube and with the developmental stages of the oocytes of *A. maritima.* The techniques used by Bonhag (1956) and Arnold (1957) have, as would be expected, revealed very much more detail than is brought to light here. The present writer's work on the ovariole was, of intent, much more general in scope than that of either of these two authors' and hence by comparison suffers in detail. However, it is included here for the sake of completeness in the description of the female reproductive organs of *A. littorea.* There is, of course, considerable similarity between the two species, but there are also some points of difference. Kornhauser (1921, 1925 and 1930) has also worked on oogenesis in *A. maritima* and Bauer (1933), Brauns (1912) and Korschelt (1891) have studied oogenesis in *Forficula auricularia.*

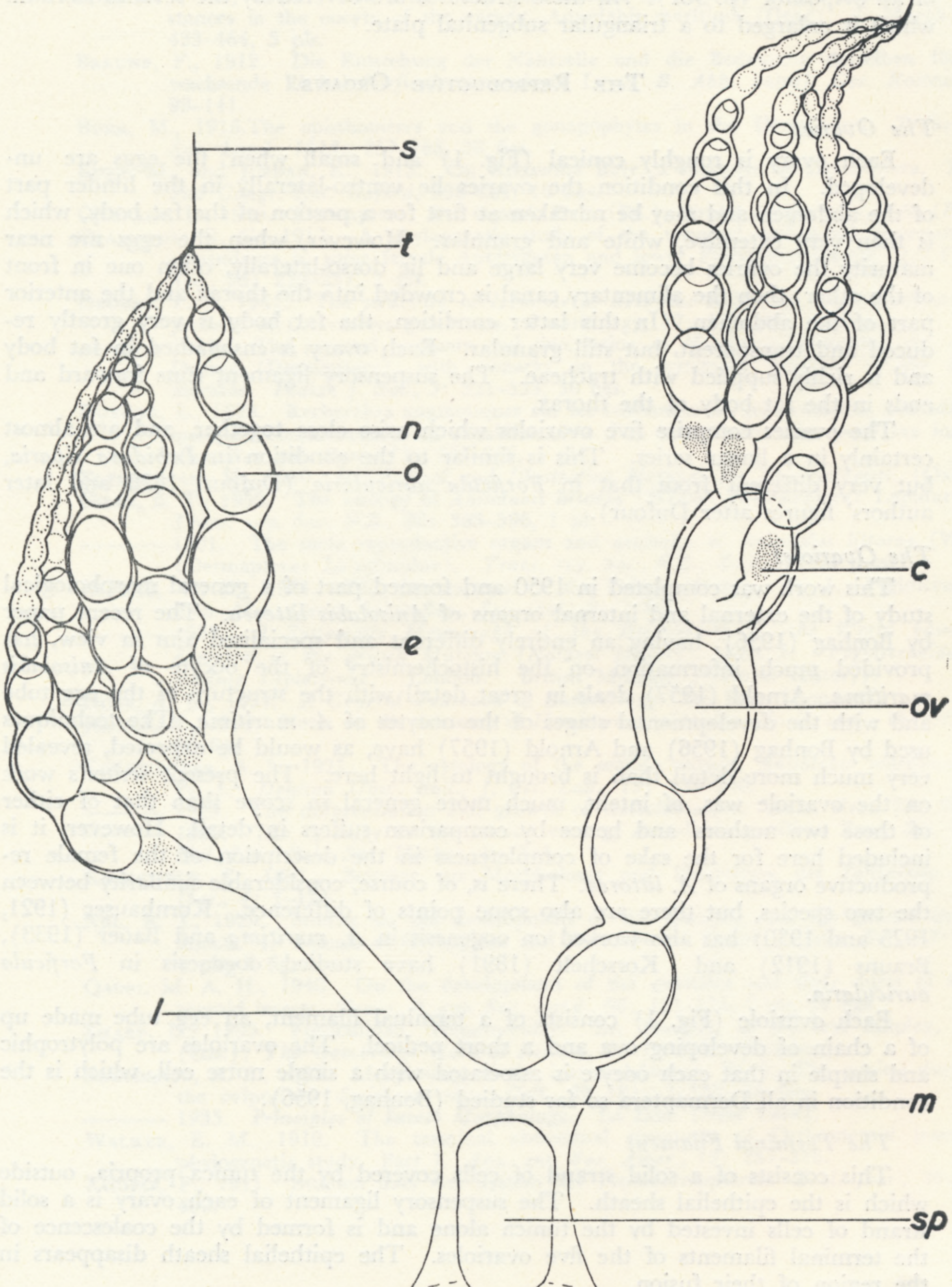
Each ovariole (Fig. 1) consists of a terminal filament, an egg tube made up of a chain of developing ova and a short pedicel. The ovarioles are polytrophic and simple in that each oocyte is associated with a single nurse cell, which is the condition in all Dermaptera so far studied (Bonhag, 1956).

The Terminal Filament

This consists of a solid strand of cells covered by the tunica propria, outside which is the epithelial sheath. The suspensory ligament of each ovary is a solid strand of cells invested by the tunica alone and is formed by the coalescence of the terminal filaments of the five ovarioles. The epithelial sheath disappears in the region of their fusion.

The Egg Tube

The wall of the egg tube (Fig. 3) is formed of the epithelial sheath surrounding the tunica propria. Apically the cells of the sheath are cubical, but basally, due to the distension of the follicles, the cells are flattened.



TEXT-FIG. 1.—Fig. 1—Female reproductive organs of *Anisolabis littorea* (White). *c*, corpus luteum; *e*, epithelial plug; *l*, lateral oviduct; *m*, median oviduct; *n*, nurse cell; *o*, oocyte; *ov*, ovum; *s*, suspensory ligament; *sp*, spermatheca; *t*, terminal filament. Scale line represents 1 mm.

The germarium is conical in general form and passes gradually into the vitellarium. Anteriorly there are many loosely packed cells which almost certainly become the follicle cells. Posteriorly a few larger cells may be distinguished from the rest and the tunica propria is apparently sparsely lined with small cells—doubtless the first of the follicle cells *in situ*. This corresponds with Zone I of Arnold (1957).

Behind this region differentiation occurs and each oocyte is associated with its nurse cell, which is already the larger cell and remains so until much later in development. The pair of cells are sometimes arranged lengthwise in the egg tube, with the nurse cell in front, but are commonly transverse. The nurse cell nucleus is large, spherical and darkly staining, whereas that of the oocyte is smaller and clear; these characters are retained by the respective nuclei during later stages of development. Small prefollicular cells occupy the interstices between the larger oocytes and nurse cells. The egg tube wall is virtually free from constrictions between successive groups of oocytes and nurse cells. This represents Zone II of Arnold (1957).

After this stage the oocytes, each with its own nurse cell, form a linear series, and it may be said that the vitellarium commences here. The nurse cell lies in front of its oocyte, as throughout the rest of development, within an envelope of follicular epithelium. Slight constrictions separate the older follicles which have a continuous epithelial lining. This is Zone III of Arnold (1957).

Later (Fig. 3) the ovariole wall is marked by constrictions separating the now rather larger follicles. Around the oocyte the epithelium is cubical and continuous, whereas around the nurse cell it is squamous and discontinuous. Separating nurse cell and oocyte is a ring of cells growing inwards from the follicular envelope. A lens of interfollicular tissue lies between the follicles.

The nurse cell is considerably larger than the oocyte (Fig. 3). The nucleus of the former is still very large, granular and darkly staining, but is now rather lobed, while that of the latter is again much smaller, ovoid and lightly stained, and lies next to the nurse cell. Many, but apparently not all, of the oocyte nuclei have a large droplet-like nucleolus. Some preparations show the nucleolus as described by Arnold (1957). The trophocyte pore (Bonhag, 1956) is apparently seen (Fig. 3) near the centre of the oocyte nucleus, but appears to be not yet functional. The oocyte cytoplasm is more darkly staining than the nucleus, but the opposite is true of the nurse cell, in which the cytoplasm adjacent to the oocyte appears to be vacuolate. Apparently the oocyte cytoplasm here is devoid of inclusions and of yolk precursor bodies (Bonhag, 1956), which in *Anisolabis maritima* are first seen slightly later (Arnold, 1957). This stage shows the maximum development of the nurse cell and corresponds with Zone IV of Arnold (1957).

Subsequently development of the oocyte proceeds apace (Fig. 4), accompanied by the degeneration of the nurse cell. Accumulation of yolk within the oocyte now commences. Near the follicular epithelium are the rather lightly staining precursor bodies. The yolk granules are arranged so that the smallest, usually spherical in shape, are towards the periphery of the oocyte and the largest nearer the centre. When yolk formation is complete the follicle starts secreting the chorion. The degenerating nurse cell becomes gradually disc-like and slightly depressed into the oocyte; the nucleus is now very much lobed.

With the growth of the oocytes, the follicle wall cells become flattened. At the same time the interfollicular tissue actively proliferates, resulting in the formation of the interfollicular plugs. Where ovulation has not taken place the epithelial plug is found behind the oldest oocyte (Fig. 5). This no doubt has the same origin as the interfollicular plugs, but is much larger than any of the latter and protrudes freely into the lumen of the pedicel. This stage corresponds with Arnold's Zone V.

After ovulation the cavity occupied by the oocyte is partially filled by the corpus luteum (Fig. 1) which in fresh specimens is olive-yellow in colour and would appear to be derived from the degenerated follicle.

The Pedicel

The pedicel (Fig. 5) is thin-walled, consisting of a lining of cubical epithelium resting on a sharply defined basement membrane, outside which is a thin connective tissue which includes a few muscle fibres. The internal epithelium is thrown up into a few low ridges.

The Lateral Oviduct

There is considerable difference in structure between the anterior and posterior portions of each lateral oviduct. In front, where the duct is of mesodermal origin, it resembles a pedicel, but the hinder portion (Fig. 6), which is of ectodermal origin, is similar to the median oviduct. Anteriorly the cubical lining epithelium, which rests on a readily discernible basement membrane, is thrown into a few low longitudinal ridges; the outer connective tissue contains a few muscle fibres which become more numerous further back along the duct. Posteriorly the cubical epithelial cells are invested by a smooth, cuticular intima which at first is discontinuous but gradually becomes entire. The epithelium rests on a fairly thick basement membrane and is thrown into numerous, tall ridges (Fig. 6). Many muscle fibres are irregularly arranged in the wide outer connective tissue matrix, some running into the folds of the epithelium. The whole is invested by a membranous sheath.

The Median Oviduct

The short median oviduct is much wider posteriorly than anteriorly (Fig. 1) and it is difficult to determine the exact position of the gonopore externally because the oviduct merges gradually into the genital chamber. A slight ridge, however, in front of the spermathecal opening would probably delimit the two regions. Marked changes in the histology of the wall also occur at the same place. The spermatheca opens dorsally into the genital chamber.

The lining epithelium rests on a pronounced basement membrane and consists of tall, granular cells, probably secretory in function (Fig. 7). Anteriorly the intima is fairly thin, but posteriorly it is much thicker and the surface is irregular. The muscle sheath consists of a wide inner zone of longitudinal fibres with a few circular ones outside. The whole is ensheathed in a delicate, apparently structureless membrane. Just in front of the spermathecal opening, the wall of the median oviduct undergoes a sudden change. The epithelial cells become flattened, the intima is thick and spinose, and the muscle sheath is virtually lost. This change occurs in the region of the ridge mentioned above and seems to demarcate the genital chamber.

The large pale cream spermatheca is like a rectangular cushion, with long axis running fore and aft, and lies close to the dorsal wall of the posterior portion of the median oviduct (Fig. 1). It extends forward almost to the lateral oviducts and backward over part of the genital chamber.

The spermatheca is comprised of a single, very long, coiled, cuticular tube ensheathed by a secretory epithelium, within a matrix of connective tissue and a few muscle fibres (Fig. 9). It is invested with fat body and is well supplied with tracheae. The duct opens into a slight depression in the mid-dorsal wall of the genital chamber through a fairly wide aperture. Here the tube itself is very thick, the inner surface bearing numerous blunt conical processes (Fig. 8); the

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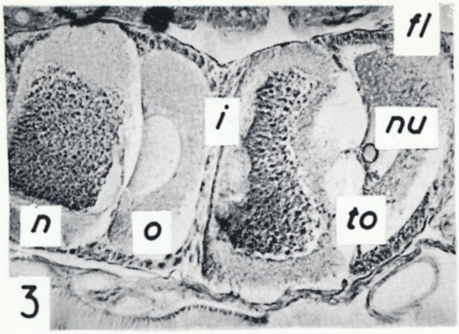
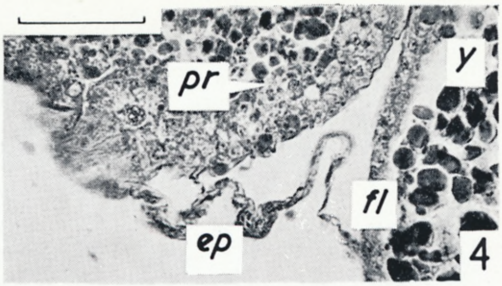
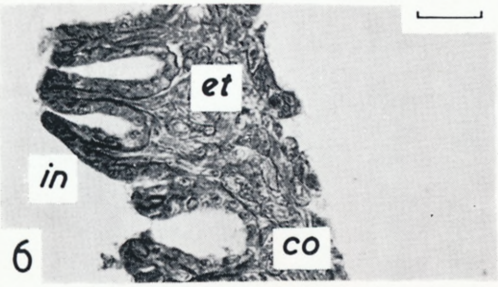
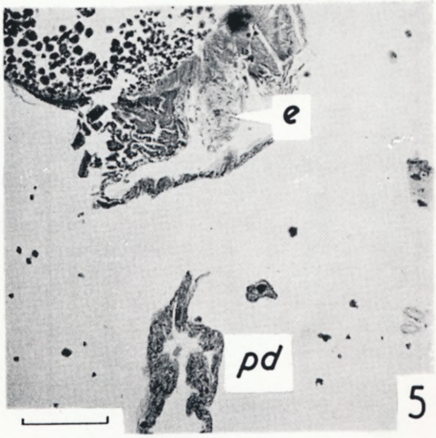
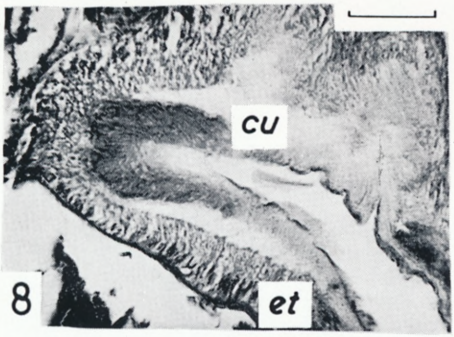










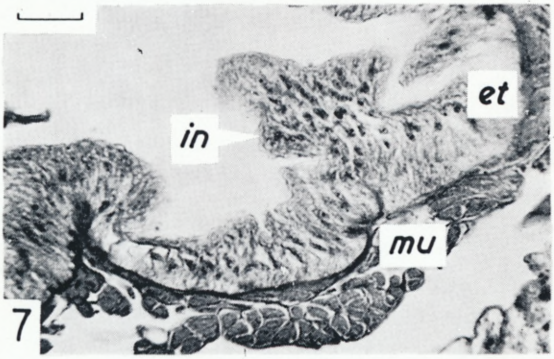


FIG. 3.—L.S. of ovariole soon after formation of follicles.
FIG. 4.—L.S. of margin of ovariole with late stage oocytes.
FIG. 5.—Section of epithelial plug (above) and pedicel (below).
FIG. 6.—T.S. of wall of lateral oviduct.
FIG. 7.—T.S. of wall of median oviduct.
FIG. 8.—Section of basal portion of spermatheca duct.
FIG. 9.—Section of coiled portion of spermatheca duct.

co, connective tissue; *cu,* cuticular tube; *e,* epithelial plug; *ep,* epithelial sheath; *et,* epithelium; *fa,* fat body; *fl,* follicle wall; *i,* interfollicular tissue; *in,* intima; *mu,* muscle sheath; *n,* nurse cell; *nu,* nucleolus; *o,* oocyte; *pd,* pedicel wall; *pr,* precursor bodies; *q,* quiescent spermatozoa; *to,* trophocyte pore; *y,* yolk granules. Scale lines represent 0.1 mm.

ensheathing epithelial cells are tall and granular. Both the wall of the cuticular tube and its lumen rapidly narrow, however, then remain constant throughout most of the length, except that a further very slight reduction in diameter is seen a short distance before the tube ends abruptly in the anterior portion of the organ. The epithelial cells surrounding the greatest length of the spermathecal duct are cubical and obviously secretory (Fig. 9).

The spermatheca might be useful in the systematics of the Dermaptera, but has not been used up to the present. With this possibility in view, an investigation of the organ throughout the group could be of value.

Copulation in *Anisolabis littorea* has been observed to take place at all times of the year and up to 11 months before egg-laying (Giles, 1953). In the course of the work it was found that adult females always had spermatozoa in the spermathecal tube (Fig. 9). The duct was usually filled with quiescent sperms which became active again on gently crushing the spermatheca in 1% saline, the sperms being progressively stimulated to activity as the saline passed along the tube. Nutrition of the sperms is undoubtedly carried on by the activity of the epithelium ensheathing the spermathecal tube. The complete absence of accessory glands of any kind is a noteworthy feature of the reproductive system.

THE GENITAL SEGMENTS

The genital segments of the female of *Anisolabis littorea* are the eighth and ninth, but the terga are considerably reduced and fused to the tenth tergum, forming a narrow band on the anterior edge of the latter (Fig. 2). The eighth and ninth sterna have virtually disappeared and the seventh is modified to the triangular subgenital plate which resembles that of the male but, of course, lacks the manubrium. In the female of *A. littorea* there are no external genitalia but a series of sclerotised patches and free flaps probably represent the vestiges of the ovipositor valves. For the interpretation of the valves it is necessary to consider also the reduced sclerites of the eighth and ninth segments.

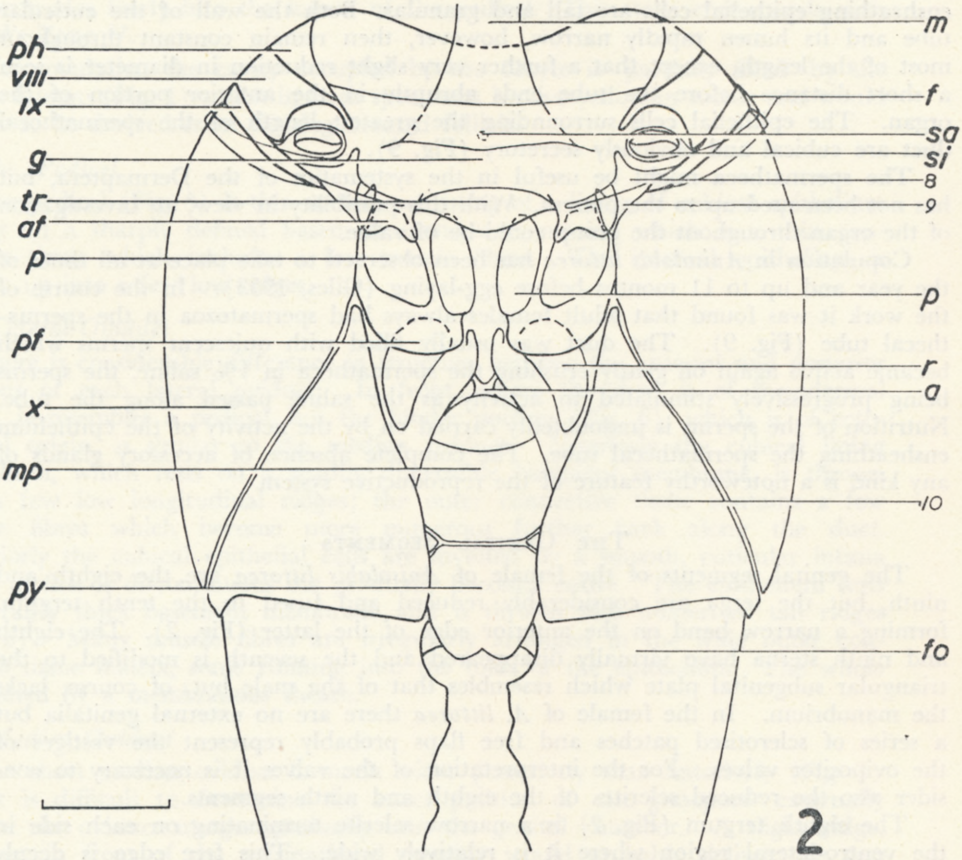
The eighth tergum (Fig. 2) is a narrow sclerite terminating on each side in the ventro-lateral region where it is relatively wide. This free edge is deeply concave around the eighth abdominal spiracle. The antecostal suture is submarginal and the antecosta at each side is developed to a large phragma.

The eighth sternum (Fig. 2) is divided into two small triangular plates each of which is situated behind the spiracle. The identity of these sclerites is confirmed by the presence on each of the typical antero-lateral projection of an abdominal sternum.

The ninth tergum is reduced to a very narrow strip and is fused to the eighth in front and the tenth behind (Fig. 2). Ventrolaterally it extends round to the same level as the eighth. A free flap is associated wtih the line of fusion to both the sclerite in front and that behind, but it has not been possible to tell whether these are parts of the terga or represent the intersegmental membranes. Internally there is a most complex arrangement of ridges representing the vestiges of the antecostae of the fused sclerites and the interior sutural ridges. These series of ridges commonly link up in an apparently indiscriminate manner.

The ninth sternum (Fig. 2) is also divided into two sclerites. Each is a small triangular plate in contact with the eighth sternite in front, the ninth tergum at the side and the tenth tergum behind. A very small process on the anterior margin is comparable with that of a typical sternum.

The membrane behind the subgenital plate (the seventh sternum) forms a sheet which runs, closely applied to the plate, forward to a line between the bases of the lateral processes of the eighth tergum where it is reflected backwards as a wide strip between the edges of the postgenital plates (Fig. 2). The genital chamber opens towards the anterior edge of the latter strip and many structures



TEXT-FIG. 2.—Fig. 2—Female genital segments of *Anisolabis littorea* (White) (subgenital plate removed). *a,* anus; *af,* anterior flap; *f,* free flap; *fo,* forceps; *g,* genital chamber; *m,* median oviduct; *mp,* metapygidium; *p,* sclerotised patch; *pf,* posterior flap; *ph,* phragma; *py,* pygidium; *r,* reniform sclerotisation; *sa,* spermathecal aperture; *si,* eighth abdominal spiracle; *tr,* transverse ridge; *VIII,* eighth abdominal tergum; *IX,* ninth abdominal tergum; *X,* tenth abdominal tergum; *8,* eighth abdominal sternum; *9,* ninth abdominal sternum; *10,* tenth abdominal sternum. Scale line represents 1 mm.

lie behind it, but only those of direct concern here will be considered. In the present study the genital chamber is regarded as the vestibule to the median oviduct, opening off the cavity above the subgenital plate. This arrangement is slightly different from that figured by Nel (1929) for *Foricula auricularia* where the gonopore is situated on the anterior line of folding of the membrane behind the subgenital plate. Nel regards the whole long cavity above the subgenital plate as the genital chamber.

The gonopore and genital chamber of *Anisolabis littorea* apparently occupy a segmental position with respect to the eighth tergum, but appear to be in front of the eighth sternum. However, because of the compression of the genital segments it is manifestly unwise to be emphatic on this point and probably best to follow Nel (1929) and regard the gonopore as opening between the seventh and eighth segments.

Behind the genital chamber is a short transverse ridge of unknown function. Posterior to this ridge and between the edges of the tenth tergum, is a line of four narrow patches of sclerotisation. In some specimens the outer patch on each side appears to be continuous with the ninth sternite, whereas in others it is separated from the latter by a narrow ribbon of membrane (Fig. 2). On each side of the anus is a reniform patch of sclerotisation. These closely resemble patches in the same position on the male.

Attached to each of the eighth sternites is a small, thin, lightly-sclerotised, free flap which is divided by a conspicuous indentation on the posterior edge into a small, elongate mesial portion and a larger, semi-circular lateral portion. There is also a free flap on each side behind the anterior sclerotised patches and partly overlapping the reniform patches. These flaps are lightly sclerotised and crescentic in shape.

From the relative positions of the two pairs of flaps and the eighth and ninth sternites it seems that these flaps (particularly the anterior pair) could reasonably be regarded as vestiges of the ovipositor valves. It is not, of course, possible to make precise determinations concerning these structures. Developmental studies would probably yield much of value in elucidating the problem. The writer has commenced this for a member of a closely related genus of the Labiduridae.

Female genitalia projecting beyond the subgenital plate are known in Dermaptera from certain Pygidicranidae only. Even these have only two pairs of valves, the basal elements are reduced and interpretation of the parts is not easy. Authors generally do not deal with the basalia, but all show the outer valves much larger than the inner pair, as is the case with the divisions of the interior free flap of *Anisolabis littorea.* Zacher (1911) records genitalia in *Kalocrania* spp. and *Dicrana* sp. [= *Cranopygia*] (Pygidicraninae) and in *Echinosoma* spp. (Echinosomatinae). Burr (1916) states that gonapophyses occur in the subfamilies Diplatyinae, Anataelinae, Pygidicraninae and Echinosomatinae (all Pygidicranidae). He also records them from the Allostethinae (Labiduridae), where "both pairs are in the form of short, rounded lobes, of about equal size"; obviously they do not project beyond the subgenital plate and probably resemble those in *Anisolabis littorea.* Crampton (1917) says that only certain earwigs have an ovipositor and figures that of *Echinosoma* sp. Walker (1919) reproduces Zacher's (1911) figures of the large genitalia of *Kalocrania marmoricrura* [= *Cranopygia marmoricrura*], and of *Echinosoma occidentale* [= *Echinosoma afrum*]. He also describes and figures the ventral genital segments of *Forficula auricularia* and of *Anisolabis maritima.* In neither of the last two species does he mention genitalia of any sort. Chopard (1949) says that no ovipositor is found among Dermaptera. He reproduces two of Zacher's (1911) figures of the genital segments of *Kalocrania* spp. [= *Cranopygia*] and very briefly describes the structures present. Hincks (1959) states that large genitalia are found in all subfamilies of the Pygidicranidae, except the Pyragrinae. He describes and figures those of four subfamilies and draws attention to the possibility of their systematic value.

The female genitalia are not used in the systematics of the Dermaptera, but they may well be useful in this regard; even vestigial structures of the type described here could be of value. The genitalia and the spermatheca considered together might be even more significant. This question may well repay investigation within the group, for identification of isolated female specimens is often impossible at present because of the lack of reliable taxonomic criteria for them. The male genitalia are most widely used.

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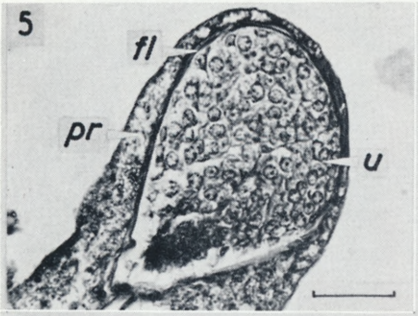
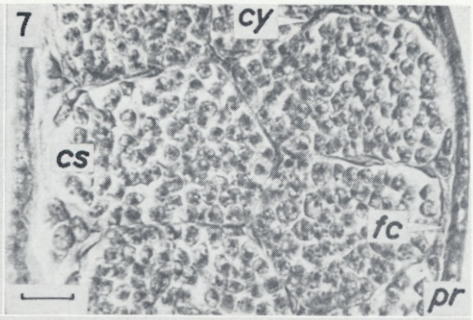
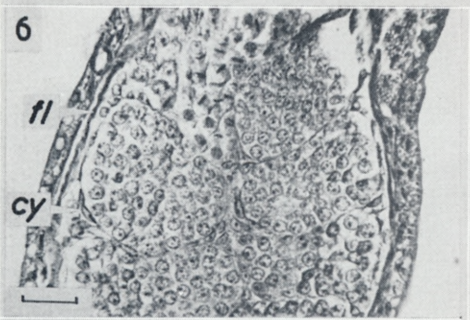
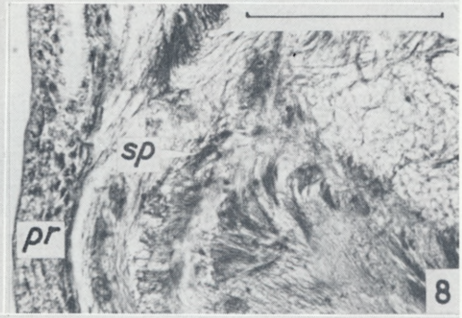
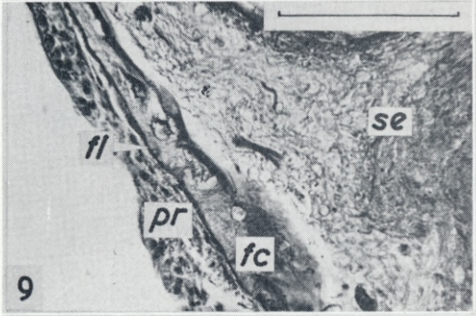
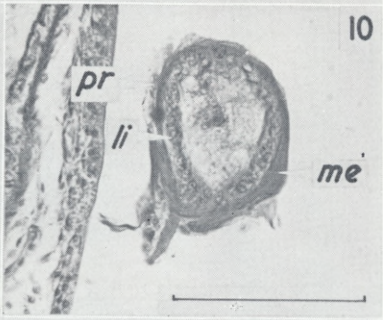


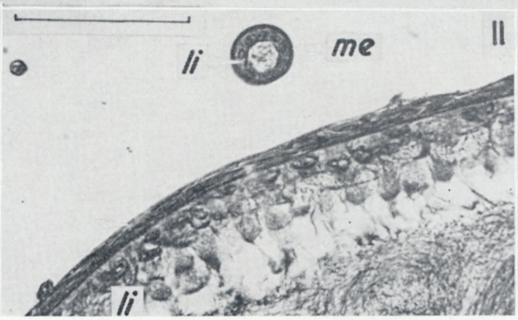






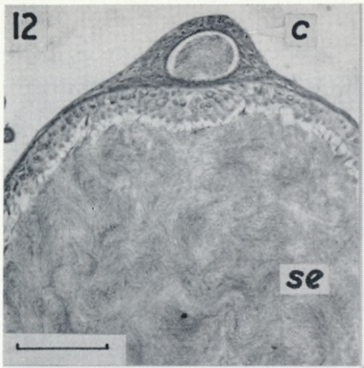


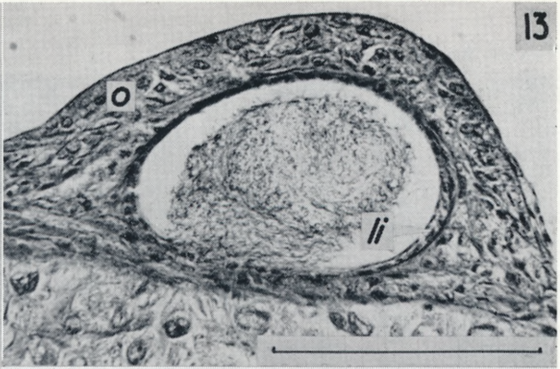


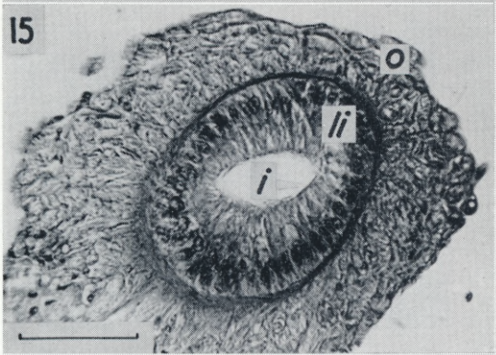


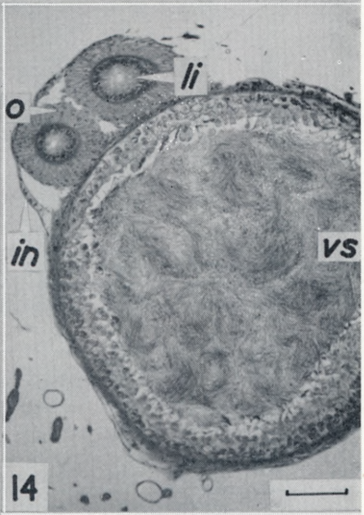
Scale lines represent 0.1 mm.

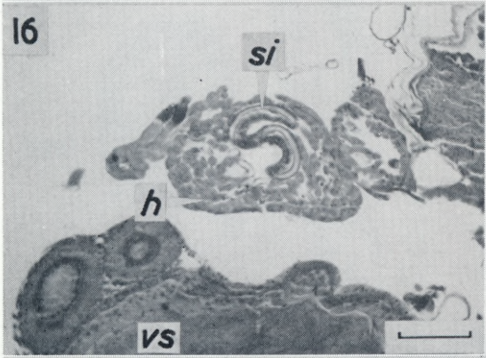
FIG. 5.—Section of germarium of a testis. FIG. 6.—L. S. of testis showing zone of spermatocytes at early stage; mitotic figures in one cyst. FIG. 7.—L. S. of testis showing zone of spermatocytes at late stage. FIG. 8.—L. S. of testis near base, showing sperm bundles. FIG. 9.—L. S. of testis wall near commencement of vas deferens. FIG. 10.—T. S. of vas deferens near testis (on left). FIG. 11.—T. S. of vas deferens (above) and vesicula seminalis wall (below).

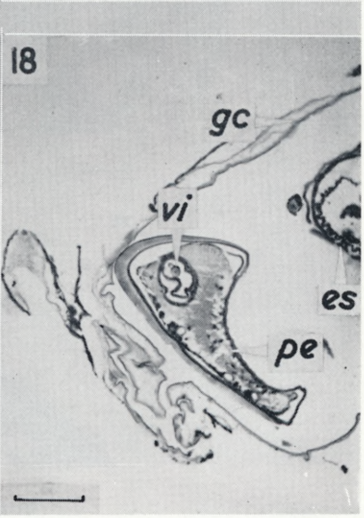












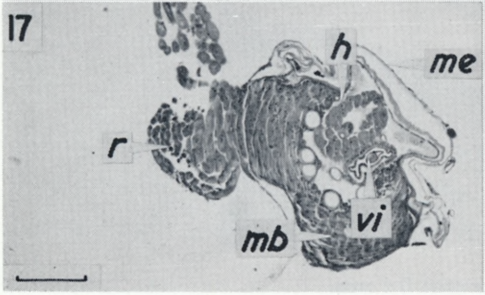


FIG. 12.—T. S. of vesicula seminalis and common ejaculatory duct. FIG. 13.—T. S. of common ejaculatory duct. FIG. 14.—T. S. of ejaculatory dilations attached to vesicula wall. FIG. 15.—T. S. of ejaculatory duct before passing through the muscle loop. FIG. 16.—T. S. of ejaculatory duct before entering the basal portion of genitalia, vesicula seminalis below and basal portion of genitalia at right. FIG. 17.—T. S. of basal portion of genitalia. FIG. 18.—T. S. of basal part of penis. *c*, common ejaculatory duct; *cs*, cyst; *cy*, cyst wall cells; *es*, eversible sac; *fc*, follicle lining cells; *fl*, follicle wall; *gc*, genital chamber; *h*, hollow muscle tube; *i*, intima; *in*, investment; *li*, lining epithelium; *mb*, muscle band; *me*, membrane; *o*, outer covering; *pe*, base of penis; *pr*, peritoneal sheath; *r*, retractor muscle; *se*, spermatozoa; *si*, sinuous duct; *sp*, sperm bundles; *u*, undifferentiated cells; *vi*, virga; *vs*, vesicula seminalis.