



1) The mosquito heads were macerated in 10% KOH solution in vials that were bathed in boiling water for about two minutes. The KOH solution was then poured out, and the heads with residual solution were washed with hot water (55°C).

2) After dehydration with 95% alcohol and clearing in xylene-cresote mixture, the mosquito heads were dissected one by one in thin Canada balsam with minute dissecting needles under stereoscopic microscope. The head was held at the either compound eye with one needle, and at the clypeus with another, and the clypeus was carefully and slowly pulled apart, so as to isolate the mouth parts together with the cibarium and pharynx from the rest of the head.

3) The pharynx was removed from the cibarium, and the shagreened area which lies over the cibarial teeth was brushed aside. The cibarium was arranged properly in the mounting medium on the slide glass, and left overnight, then another drop of the medium was added, and a cover glass lowered, so as to avoid folding or twisting of the dissected specimen.

RESULTS

For a general description of the morphology of the cibarium, it is suggested to refer to papers reported by Sinton and Covell⁽¹⁰⁾, and Barraud and Covell⁽²⁾. The structure of the cibarium is highly complex, and can be best understood by a reference to Plate I, Figs. 1 and 2. These two drawings are given as a guide to the morphology of the various parts referred in the following description. It must be noted that no cibarial teeth are present on the posterior border of the cibarium in males (compare Plate I, Fig. 3 with Plate II, Fig. 7). Results obtained from the examinations of the 8 species of female culicines are given below.

It was found that the size of the cibarium, the characteristic of the lateral flange, the

width between the posterior ends of the two lateral flanges, the size and number of the cibarial teeth, the length and distribution of the palatal papillae, and the number of the smaller dorsal papillae constitute valuable aids in specific diagnosis of the species.

1) *Culex (Culex) vagans* Wiedemann, 1828. (Plate II, Fig. 4).

Cibarium 222 to 249 μ long, 93 to 110 μ wide; shape of lateral flange somewhat straightened; the portion of clypeal phragma beside lateral flange well developed; width between the posterior ends of the two lateral flanges 86 to 94 μ ; cibarial teeth short, blunt, about 7 to 9 μ long, arranged in one row, 23 to 26 in number; teeth arising from the posteromedial side of lateral flange poorly developed; the four palatal papillae at most 2 times as long as the width of their bases, grouped in two widely separated pairs, usually set close to lateral edge of anterior hard palate, the two papillae of the same pair either approximated to or separated from each other; the smaller dorsal papillae usually 6 in number, grouped in two rows, 3 in each row, set along both sides of anterior hard palate.

2) *Culex (Culex) neovishnui* Lien, 1968. (Plate II, Fig. 5).

Cibarium 232 to 263 μ long, 94 to 109 μ wide; shape of lateral flange more or less curved; width between the posterior ends of the two lateral flanges 96 to 107 μ ; cibarial teeth short, relatively pointed, about 7 to 9 μ long, arranged in one row, 27 to 35 in number; teeth arising from the posteromedial side of lateral flange well developed; the four palatal papillae at most 2 times as long as the width of their bases, widely separated from one another, rarely set close to either edge of anterior hard palate; the smaller dorsal papillae variable in number, 4 to 6, grouped in two rows, usually 2 or 3 in each row, set along both sides of anterior hard palate.

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3) *Culex (Culex) pipiens quinquefasciatus* Say, 1823. (Plate II, Fig. 6).

Cibarium 238 to 279 μ long, 100 to 117 μ wide; lateral flange comparatively stout, strongly sclerotized; width between the posterior ends of the two lateral flanges 98 to 111 μ ; cibarial teeth short, blunt, about 9 to 10 μ long, arranged in one row, 27 to 32 in number; teeth arising from the posteromedial side of lateral flange well developed; the four palatal papillae at most 2 times as long as the width of their bases, more or less separated, somewhat kept apart from both edges of anterior hard palate; the smaller dorsal papillae usually 5 to 6 in number, grouped in two rows of almost equal number, set along both sides of anterior hard palate.

4) *Culex (Culex) fuscocephalus* Theobald, 1907. (Plate II, Fig. 7).

Cibarium smaller than in other species, only 195 to 236 μ long, 82 to 104 μ wide; lateral flange strongly sclerotized; the apex more or less blunt; the portion of clypeal phragmā beside lateral flange poorly developed; the portion of dorsal plate between the two lateral flanges much more strongly sclerotized except for a clear small oval region just behind dorsal apodeme; width between the posterior ends of the two lateral flanges 85 to 96 μ ; cibarial armature composed of two rows of slender cibarial teeth, 23 to 32 teeth in each row; teeth of the second row more or less fine: each tooth measuring 11 to 13 μ in length; teeth arising from the posteromedial side of lateral flange well developed; cibarial bar poorly developed; the four palatal papillae at most 2 times as long as the width of their bases, more or less separated, somewhat kept apart from both edges of anterior hard palate; the smaller dorsal papillae variable in number, 5 to 7, usually 6, grouped in two rows of 2 to 4, set along both sides of anterior hard palate.

5) *Culex (Lutzia) fuscianus* Wiedemann, 1820. (Plate III, Fig. 8).

Cibarium large, 304 to 371 μ long, 129 to 168 μ wide; lateral flange and the portion of dorsal plate between two lateral flanges fairly strongly sclerotized except for a clear small oval region behind dorsal apodeme; width between the posterior ends of the two lateral flanges 132 to 150 μ ; cibarial teeth remarkably developed, fairly long, about 11 to 13 μ in length, arranged in one row, 21 to 26 in number; teeth arising from the concave aspect of the cibarial bar cone-shaped, those from the convex part more or less rod-shaped; teeth arising from the posteromedial side of lateral flange poorly developed; the four palatal papillae arising together from a clear area on medioposterior part of anterior hard palate, very much like long spines; the papillae about 4 times as long as the width of their bases; the smaller dorsal papillae variable in number, 8 to 12, usually 10, grouped in two rows of 4 to 6, set along both sides of anterior hard palate.

6) *Culex (Culex) bitaeniorhynchus* Giles, 1901. (Plate III, Fig. 9).

Cibarium considerably large, 271 to 292 μ long, 105 to 132 μ wide; width between the posterior ends of the two lateral flanges 115 to 130 μ ; cibarial teeth relatively long, about 11 to 12 μ in length, arranged in one row, 22 to 26 in number; bases somewhat thick and enlarged, tapering towards the apical ends; several teeth at center much more rod-shaped than those at sides; teeth arising from the posteromedial side of lateral flange well developed; posterior hard palate embellished with many minute spines; the four palatal papillae approximated together on central part of anterior hard palate; the papillae somewhat long, spine-like, about 3 times as long as the width of their bases; the smaller dorsal papillae variable in number, occasionally 6, usually 7 to 10, grouped in two rows, mostly equal in number, set along both sides of anterior hard palate.

7) *Culex (Culex) annulus* Theobald, 1901. (Plate III, Fig. 10).

Cibarium 207 to 244 μ long, 90 to 121 μ wide; the portion of dorsal plate between the two lateral flanges slightly sclerotized; the four ventral papillae usually arranged in a transverse line close to and behind the ventral flange; width between the posterior ends of the two lateral flanges 85 to 104 μ ; pointed rod-like cibarial teeth arising from thin cibarial bar; the teeth somewhat long, about 10 to 12 μ in length, arranged in one row, 24 to 29 in number; teeth arising from the posteromedial side of lateral flange poorly developed; the four palatal papillae about 3 times as long as the width of their bases, concentrated in the middle part nearby the narrow extension of anterior hard palate; the smaller dorsal papillae also variable in number, occasionally 6, usually 7 to 11, grouped in two rows, mostly equal in number, set along both sides of anterior hard palate.

8) *Culex (Culex) tritaeniorhynchus summorosus* Dyar, 1920. (Plate III, Fig. 11).

Cibarium 214 to 250 μ long, 103 to 129 μ wide; width between the posterior ends of the two lateral flanges 94 to 104 μ ; cibarial teeth very numerous, 30 to 34, arranged in one row; each tooth filamentous except for a thick base, about 18 to 19 μ in length; teeth arising from the posteromedial side of lateral flange well developed; the four palatal papillae about 3 to 4 times as long as the width of their bases, sometimes separated from one another, usually approximated together; the smaller dorsal papillae occasionally 6, usually 7 to 8 in number, grouped in two rows, mostly equal in number, set along both sides of anterior hard palate.

It must be noted that the number of the cibarial teeth does not include the thin tufted teeth which can be seen on the posteromedial side of the lateral flange in any species mentioned above.

For an easy reference and practical use,

a key to these 8 species of culicine mosquitos based on the morphology of the cibarium of females is given below.

1. Palatal papillae short, at most 2 times as long as the width of their bases; the bases separated from one another; smaller dorsal papillae usually less than 6 in total number.....2.
- Palatal papillae long, usually 3 to 4 times as long as the width of their bases; the bases approximated together; smaller dorsal papillae usually more than 7 in total number.....5.
- 2(1). Lateral flange usually weakly sclerotized; palatal papillae set close to the edge of anterior hard palate.....3.
- Lateral flange usually strongly sclerotized; palatal papillae set apart from the edge of anterior hard palate...4.
- 3(2). The portion of clypeal phragma beside lateral flange well developed; width between the posterior ends of the two lateral flanges 86 to 94 μ ; cibarial teeth usually 23 to 26 in number.....
- C. vagans*
- The portion of clypeal phragma beside lateral flange poorly developed; width between the posterior ends of the two lateral flanges 96 to 107 μ ; cibarial teeth usually 27 to 35 in number....
- C. neovishnui*
- 4(2). Width between the posterior ends of the two lateral flanges 98 to 111 μ ; cibarial teeth 9 to 10 μ in length, arranged in one row.....*C. P. quinquefasciatus*
- Width between the posterior ends of the two lateral flanges 85 to 96 μ ; cibarial teeth 11 to 13 μ in length, arranged in two rows.....*C. fuscocephalus*
- 5(1). Cibarium above 266 μ in length.....6.
- Cibarium below 265 μ in length.....7.
- 6(5). Cibarium above 300 μ in length; bases of cibarial teeth relatively wide; the region, where the palatal papillae

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- arise, clear.....*C. fuscatus*
 Cibarium below 299 μ in length; bases
 of cibarial teeth relatively narrow;
 the region, where the palatal papillae
 arise, cloudy.....*C. bitaeniorhynchus*
 7(5). Cibarial teeth thick and short, 10 to 12
 μ in length, 24 to 29 in number;
 ventral papillae usually arranged in
 a transverse line.....*C. annulus*
 Cibarial teeth thin and long, 18 to 19 μ
 in length, 30 to 34 in number; ventral
 papillae usually arranged in an irre-
 gular line..... *C. tritaeniorhynchus*
summorosus

DISCUSSION

As may be seen from the description given above, the possibility of using morphological characteristics of the female cibarium for specific identification of culicine species is positively confirmed in the present study.

The size of the cibarium among the culicines examined was found somewhat variable even in the same species, however, they still bear some diagnostic value. For example, the cibarium of *C. fuscatus* is obviously larger than that of other species. On the contrary, that of *C. fuscocephalus* is the smallest among the 8 species.

The cibarial teeth forming an armature at the posterior border of the females of *C. fuscocephalus*, *C. bitaeniorhynchus*, *C. P. quinquefasciatus*, and *C. tritaeniorhynchus* have been described by Barraud (1934)⁽¹⁾, Barraud and Covell (1928)⁽²⁾, and Bram (1967)⁽³⁾. The present study not only confirmed their findings, but also further demonstrated the presence of the second row of fine and slender teeth beneath the first row in *C. fuscocephalus* (Plate II, Fig. 7), and the apically pointed teeth in *C. bitaeniorhynchus* (Plate III, Fig. 9).

The number of the smaller dorsal papillae and the distribution of the palatal papillae, which were overlooked by the previous workers, are particularly of great diagnostic im-

portance. Four of the 8 species examined usually possess no more than 6 smaller dorsal papillae and 4 widely separated short palatal papillae; while the other 4 species usually possess no less than 7 smaller dorsal papillae and 4 closely approximated long palatal papillae (compare Plate II, Figs. 4 to 7 with Plate III, Figs. 8 to 11). It is worthy to mention that *C. neovishnui* and *C. annulus* were apparently treated as the same species⁽⁴⁾ in the past on Taiwan. Although these two species were identified as two separate species later^(7,8), they are still occasionally confused when identification is made only by the external features. The problem can be satisfactorily solved, because the two species are found significantly different from each other in the morphology of the cibarium (compare Plate II, Fig. 5 with Plate III, Fig. 10).

On the whole, it seems possible that the study of the morphology of the cibarium may render valuable assistance in taxonomy of the culicine mosquitos, and further work on these lines is in progress.

SUMMARY

The morphology of the cibarium of 8 species of the female culicine mosquitos was studied. It was found that the size of the cibarium, the characteristic of the lateral flange, the width between the posterior ends of the two lateral flanges, the size and number of the cibarial teeth, the size and distribution of the palatal papillae and the number of the smaller dorsal papillae possess demonstrable specific differences in each species.

The key for the differentiation of female culicines based upon the morphology of the cibarium is given.

In view of these findings, it seems possible that the study of the morphology of the cibarium will become acceptable as aid for identification of the culicine species.

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家蚊類口腔形態之研究

第一報 臺灣臺北地區常見之八種家蚊

陳慶源

(1972年2月23日受理)

關於蚊類之種別鑑定，一向都以外部形態，尤其是體表所分佈的鱗片，細毛等之特徵為主要依據。但是這些特徵往往會脫落消失，而影響到那些血統親近的種類很難正確地加以鑑別。

早在四十多年前，Sinton and Covell⁽¹⁰⁾ 及 Barraud and Covell⁽²⁾ 等學者曾提到雌性蚊類口腔形態有多種不同形式的特徵。但這些差異與種別間之關係如何，未為學者們所注意。本篇研究之目的為欲藉口腔形態上之差異，尋求對於各種家蚊分類鑑別之可能性。作者先從臺北地區常見之家蚊，諸如：熱帶家蚊、白頭家蚊、遊蕩家蚊、白吻家蚊、環紋家蚊、

三斑家蚊、二斑家蚊和黃尾家蚊等八種，選取雌性者着手研究。結果發現憑藉其口腔形態上之差異，足可鑑別出這些家蚊種類。本篇並列有簡要鑑別表，可供參考應用。

尤其值得一提的，白吻家蚊和環紋家蚊過去在臺灣曾經一直被誤認為同屬一種。後來雖正式被分離為兩種，可惜僅憑其外表特徵，仍舊尚有被混淆不清之困擾。但經本篇研究，作者發現該兩種家蚊在雌性者的口腔形態上，確有十分明顯之差異，可以很容易地加以鑑別。

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Explanation of lettering on plates:

AHP:	Anterior hard palate
CA:	Cibarial armature
CB:	Cibarial bar
Clp:	Clypeus
CPh:	Clypeal phragma
CSD:	Common salivary duct
CT:	Cibarial tooth
DA:	Dorsal apodeme
LDP:	Larger dorsal papilla
LF:	Lateral flange
LL:	Labral lever
(M):	Mouth (in outline only)
MDP:	Membranous dorsal plate
PA:	Pigmented area
(Ph):	Pharynx (in outline only)
PHP:	Posterior hard palate
PPa:	Palatal papilla
SA:	Shagreened area
SDP:	Smaller dorsal papilla
SP:	Salivary pump
SVP:	Sclerotized ventral plate
VF:	Ventral flange
VP:	Ventral papilla

Explanation of Plates I. to III.:

- Fig. 1. *Culex pipiens quinquefasciatus*. Lateral view of the cibarium and part of the pharynx of the female (the latter indicated in dotted line).
- Fig. 2. *Culex pipiens quinquefasciatus*. Dorsal view of the cibarium of the female (the shagreened area unremoved).
- Fig. 3. *Culex fuscocephalus*. Dorsal view of the cibarium of the male.
- Fig. 4. *Culex vagans*. Dorsal view of the cibarium of the female.
- Fig. 5. *Culex neovishnui*. Dorsal view of the cibarium of the female.
- Fig. 6. *Culex pipiens quinquefasciatus*. Dorsal view of the cibarium of the female.
- Fig. 7. *Culex fuscocephalus*. Dorsal view of the cibarium of the female.
- Fig. 8. *Culex fuscanus*. Dorsal view of the cibarium of the female.
- Fig. 9. *Culex bitaeniorhynchus*. Dorsal view of the cibarium of the female.
- Fig. 10. *Culex annulus*. Dorsal view of the cibarium of the female.
- Fig. 11. *Culex tritaeniorhynchus summosus*. Dorsal view of the cibarium of the female.
(The shagreened area not shown in Figs. 4 to 11)

Plate I.

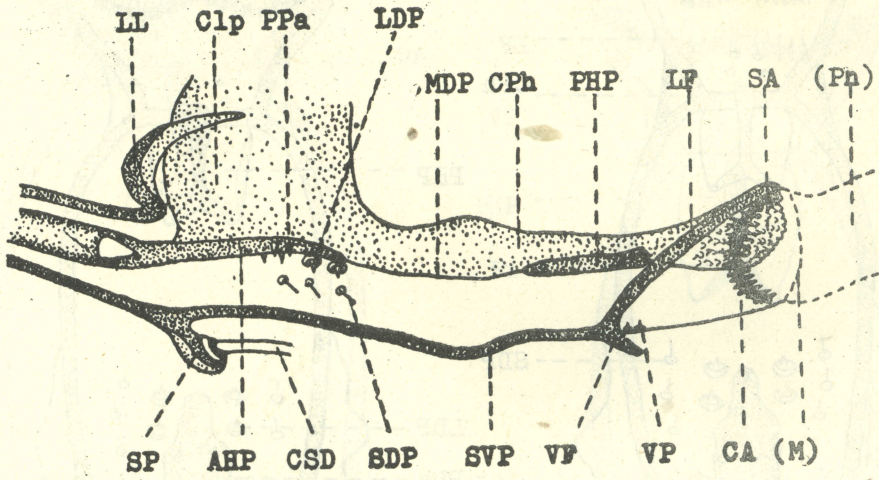


Fig. 1.

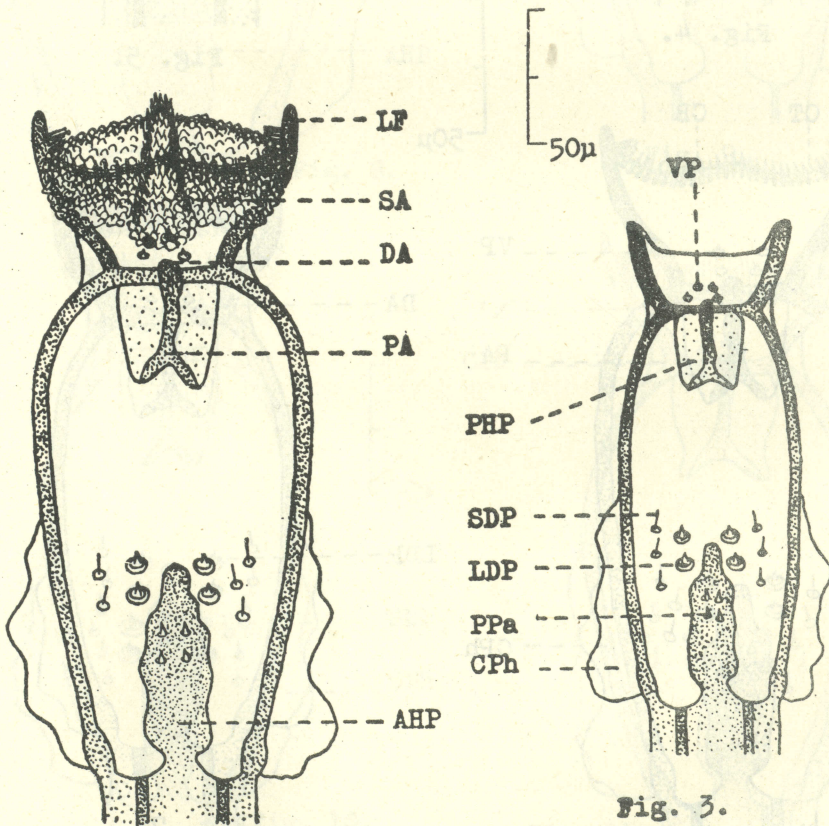


Fig. 3.

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Plate. II.

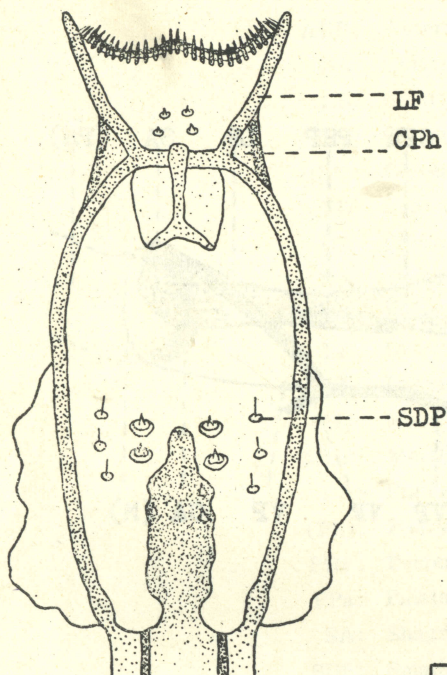


Fig. 4.

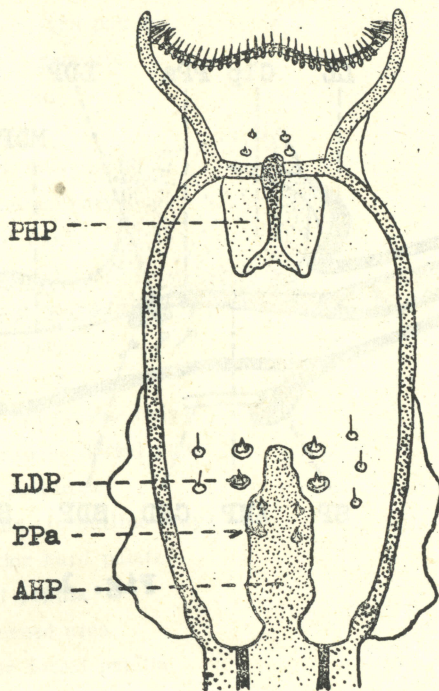


Fig. 5.

50μ

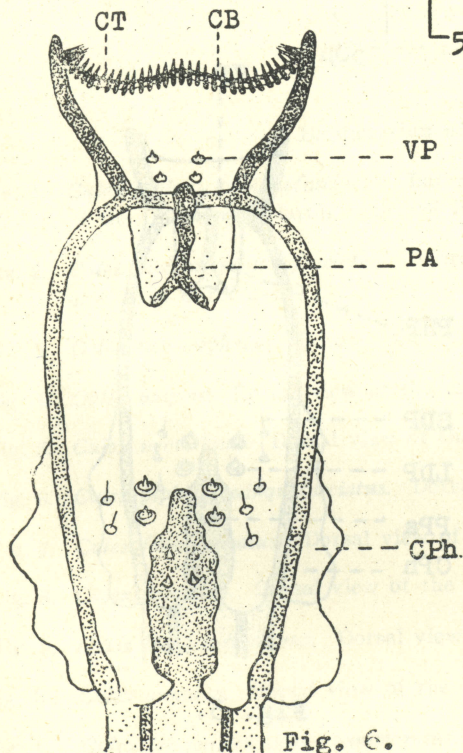


Fig. 6.

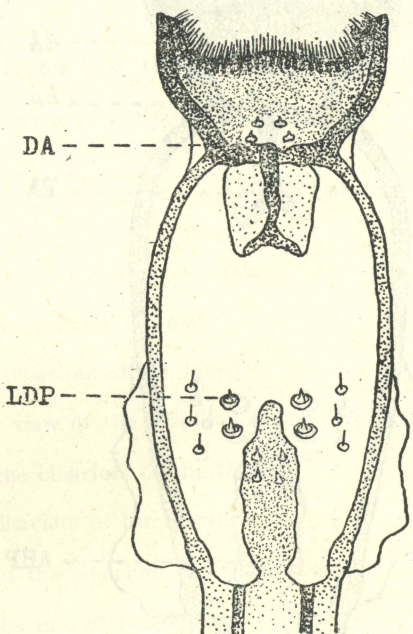


Fig. 7.

Plate. III.

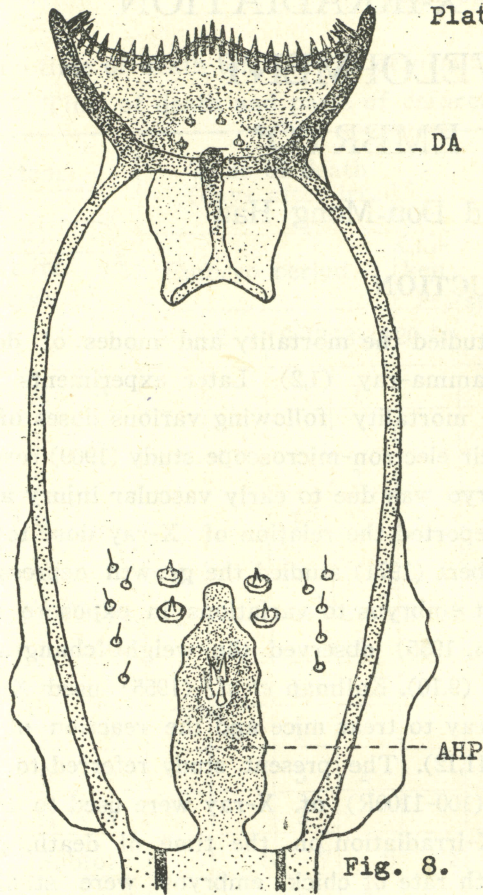


Fig. 8.

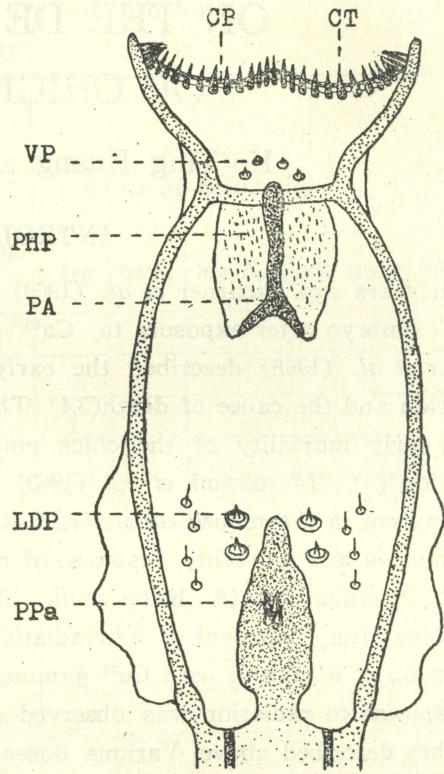


Fig. 9.

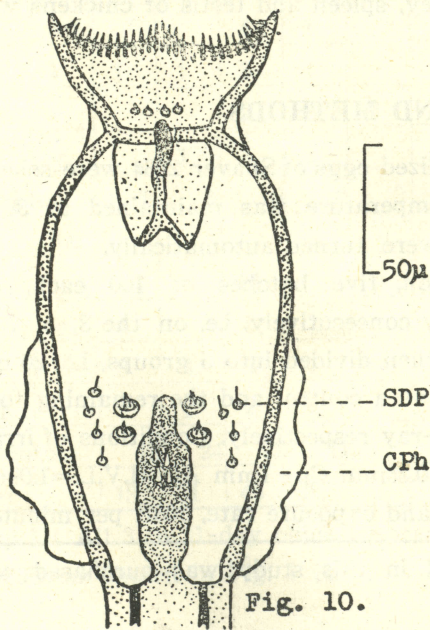


Fig. 10.

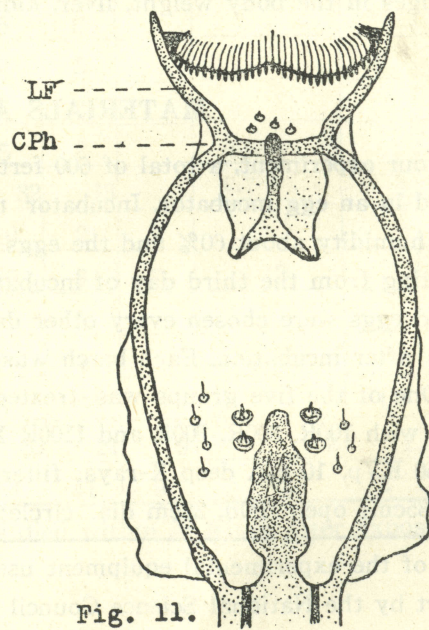


Fig. 11.