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## VI. Distribution and Number of Sensilla Types.

The distribution and number of the different types of sensilla were studied thoroughly in the antennae of both sexes. This knowledge served as a basis for the experimental studies on the possible function of each type of sensilla in the female antenna in relation to the attraction of mosquitoes to the host.

### 1. Antenna of the female.

Tables 1, 2 and Fig. 13<sup>4</sup> give the detailed number and distribution of each type of sensilla on the various segments of the female mosquito's flagellum. The number was counted on the two sides of five antennae. The counting is more reliable in types of sensilla I, V, VI, and VII than in types II and III + IV, as the possibility of some error exists when counting the sensilla on the sides of the

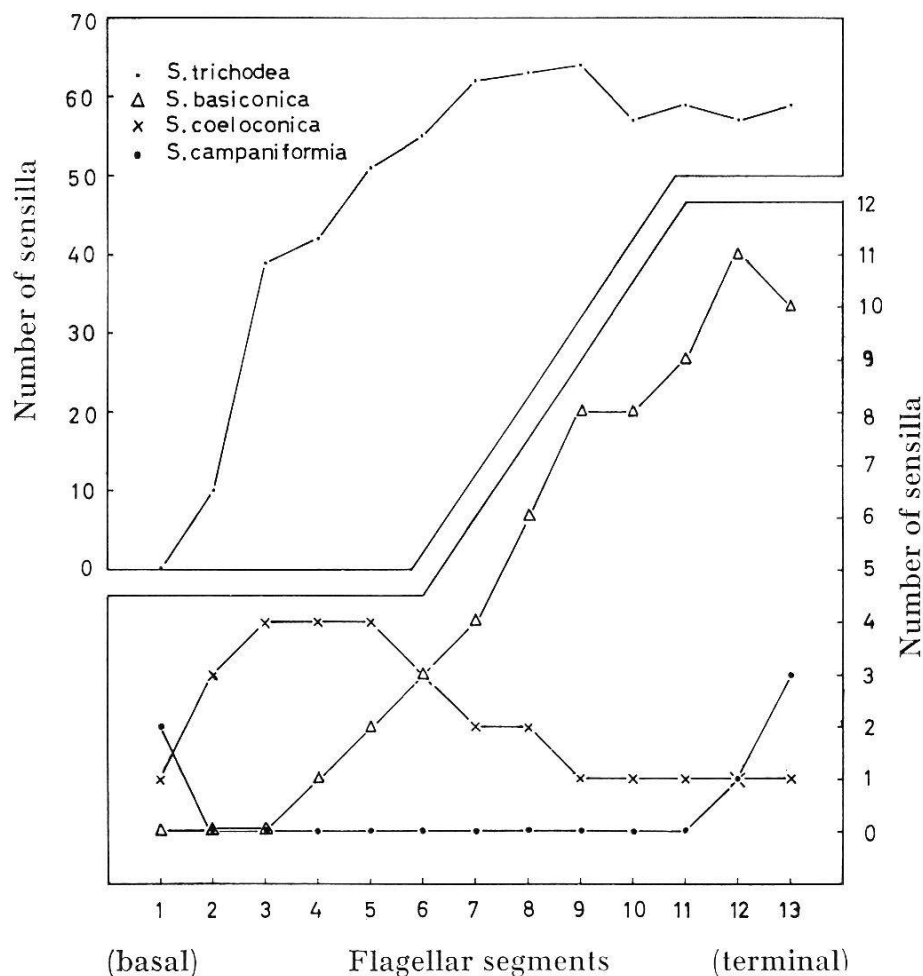


Fig. 13. Number of each type of sensilla trichodea, basiconica, coeloconica and campaniformia on the thirteen flagellar segments of the antenna of female mosquito *Anopheles maculipennis* (average of five flagella).

<sup>4</sup> Includes only types of sensilla III + IV, V, VI and VII.

TABLE 1.

*Distribution and number of long and short bristles or spines and sensilla trichodea in five female antennae.*

Flagellar segments	Type I Long bristles or spines						Type II Short bristles or spines						Types III+IV Sensilla trichodea					
	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age
1 (base)	undifferentiated																	
2	8	8	8	8	8	8	13	13	11	12	12	13	12	11	10	8	11	10
3	8	8	8	8	8	8	6	10	11	8	10	9	44	40	37	35	41	39
4	7	7	7	8	7	7	8	10	12	8	8	9	48	45	38	40	39	42
5	7	7	8	7	7	7	7	12	8	10	6	9	56	51	47	49	51	51
6	7	7	8	7	7	7	5	8	8	8	6	7	57	60	57	52	48	55
7	7	7	8	7	7	7	5	8	6	7	5	6	63	65	61	63	58	62
8	7	7	7	7	7	7	4	9	5	5	6	6	66	65	61	60	63	63
9	7	7	6	6	7	7	5	7	5	5	4	5	66	65	53	67	68	64
10	6	6	6	6	6	6	4	7	5	4	6	5	59	52	52	63	59	57
11	6	6	6	6	6	6	3	5	6	4	3	4	62	66	55	57	56	59
12	6	6	6	6	6	6	4	6	6	3	3	4	58	59	52	61	56	57
13 (tip)	6+4	6+4	6+4	6+4	6+4	6+4	2	2	4	2	4	3	67	52	57	58	60	59
Total							66	97	87	76	74	80	658	631	580	613	610	618

TABLE 2.

*Distribution and number of sensilla basiconica, coeloconica and campaniformia in five female antennae.*

Flagellar segments	Type V Sensilla basiconica						Type VI Sensilla coeloconica						Type VII Sensilla campaniformia					
	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Aver- age
1 (base)	0	0	0	0	0	0	1	1	2	2	1	1	2	2	2	2	2	2
2	0	0	0	0	0	0	3	3	3	3	3	3	0	0	0	0	0	0
3	0	0	0	0	0	0	3	4	4	3	4	4	0	0	0	0	0	0
4	1	1	1	1	1	1	3	4	3	4	4	4	0	0	0	0	0	0
5	1	2	2	2	2	2	4	4	3	4	4	4	0	0	0	0	0	0
6	2	3	3	2	3	3	3	3	3	3	3	3	0	0	0	0	0	0
7	4	4	3	3	4	4	2	2	2	2	2	2	0	0	0	0	0	0
8	7	7	5	5	7	6	2	2	2	2	2	2	0	0	0	0	0	0
9	9	7	9	8	8	8	1	2	1	1	2	1	0	0	0	0	0	0
10	8	8	9	8	8	8	2	1	1	1	1	1	0	0	0	0	0	0
11	11	8	10	10	9	9	1	1	1	2	1	1	0	0	0	0	0	0
12	11	11	11	10	10	11	2	1	2	1	1	1	1	1	1	1	1	1
13 (tip)	11	9	10	11	11	10	1	1	1	1	1	1	3	3	3	3	3	3
Total	65	60	63	60	63	60/62	28	29	28	29	29	29/28	6	6	6	6	6	6

In calculating the average, fractions were approximated to the next round figures.

segments. Some sensilla were broken; they were classified according to the form of the base.

*Type I* (Long bristles or spines).

It is found projecting in all directions from the colourless sub-basal area on segments 2 to 13 and near the apex of the last segment. The number is constant on the basal segments 2 and 3 (8 bristles), then it decreases towards the apex with 6 bristles on each of the last four segments 10, 11, 12 and 13; on the segments between, the number varies from 8 to 6. There are always 4 bristles just below the apical end of the last segment in a circle.

The longest bristles are usually seen on the outer side of the antennae and the smaller ones on the inner side<sup>5</sup>. The first segment possesses many undifferentiated bristles of between Type I and II, except for a small area at the base.

*Type II* (Short bristles).

It is distributed on segments 2 to 13, with the maximum number of bristles (average number 13) on segment 2; the number decreases towards the apex of the antennae with a minimum average of 3 bristles on segment 13. This type of sensilla is seen in different places on the segments and, particularly, near the top of each.

*Types III and IV* (S. trichodea).

They have the greatest number of sensilla on the antennae. These two types are distributed in such a way that it was difficult to count them separately. On the whole antenna there are from 580 to 658 sensilla with an average of 618 (in five antennae). Segment 1 lacks this type and segment 2 possesses a relatively small number (average 10 sensilla). The number rises to an average of 39 on segment 3 and remains at about this level with 42 on segment 4. On segments 5 to 13 the number varies between a minimum of 51 and a maximum of 64.

*Type V* (S. basiconica).

It is not found on the first three flagellar segments and one only is present on segment 4. The number increases gradually towards the apex of the antenna with usual variations of 1 or 2, and rarely 3 or 4, and reaches a maximum of 11 on the average on segment 12, and 10 on segment 13.

ROTH & WILLIS (1952) found in the female *Aedes aegypti* on

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<sup>5</sup> Observed in preparations of the whole head.

each of the 13 flagellar segments many thin-walled trichoid sensilla (Types III and IV) and occasional small peg organs (Type V).

*Type VI* (S. coeloconica).

This type is rarer than the previous one. It has one or two sensilla on segment 1, the highest number, 3 to 4, being on segments 2, 3, 4, 5 and 6; then it decreases to 2 on segments 7 and 8 and to an average of 1 on the remaining segments.

According to McINDOO (1918), NAGEL did not find any pits in the antennae of *Culex pipiens*, and SMITH (1919) obtained the same negative results on the same species. ROTH (1948) described the antenna of the male *Aedes aegypti*, and ROTH & WILLIS (1952) describe that of the female with their different types of sensilla; in no case is mention made of any pits.

It seems, according to these results, that pits are characteristic in the antennae of Anophelini and not so in Culicini.

*Type VII* (S. campaniformia).

It contains the smallest and most constant number of sensilla. Segment 1 carries two, segment 2 to 11 none, while segment 12 carries only one and segment 13 three. This organ is very near to the top in segments 1 and 12. In segment 13 both tips end with one and the third is found just below the circle of the four Type I sensilla.

The campaniform sensilla have been found by HOCHREUTHER (1912) in the antenna of *Dytiscus*, and by McINDOO (1918 a) distributed over the head, antennae, mouth parts, thorax and legs of the larva of *Allorhina* (Scarabaeidae).

## 2. Antenna of the male.

The flagellar segments 2 to 11 carry no sensilla, except for the whorls of fibrillae which project in all directions. No attention was paid to the number of fibrillae on the different segments.

Table 3 shows the distribution and number of the types of sensilla basiconica, coeloconica and campaniformia on segments 1, 12 and 13 in the flagellum of five antennae.

### *Segment 1.*

It carries very few sensilla of between Types I and II, undifferentiated in size, length and thickness, as well as a constant number (2) of campaniform sensilla which are seen near the top of the segment, and the whorl of fibrillae.

TABLE 3.  
*Distribution and number of sensilla basiconica, coeloconica and campaniformia in five male antennae.*

Flagellar segments	Type V Sensilla basiconica					Type VI Sensilla coeloconica					Type VII Sensilla campaniformia				
	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 5
1	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2
12	0	0	0	0	0	8	8	8	8	10	1	1	1	1	1
13	24	26	28	24	32	3	2	3	4	5	3	3	3	3	3
Total	24	26	28	24	32	11	10	11	12	15	6	6	6	6	6

*Segment 12.*

The sensilla are on the last two-thirds, whereas the basal third lacks any type except for the whorl of fibrillae. The short bristles number about 80; they are curved and stretched out in such a way as to cover the other, more delicate sensilla. Trichoid have the maximum number of sensilla, about 100, being found close to the surface of the segment. Coeloconic sensilla are usually constant, with 8 organs in the upper half of the segment. Segment 12 also possesses one campaniform organ near the top and none of basiconic sensilla.

*Segment 13.*

Comparing the number and distribution of the various types of sensilla in this segment with the previous one, we find that it carries fewer small bristles, about 12, and twice as many trichoid sensilla (about 200). It bears between 24 and 32 basiconic sensilla, which are rare at the base and increase towards the apex. There are less coeloconic sensilla, between 2 and 5, with an average of three, and more campaniform sensilla with a constant number of three, two in the tips and one in the last fourth of the segment. Eight large bristles project from the colourless sub-basal area.

From the number of the different types of sensilla on the different antennal flagellar segments (Tables 1, 2 and 3), we can see that the number of each type varies in a small range in each segment.

When comparing the total number of sensilla of each type in the whole antenna of females and males we find that there are nearly twice as many trichoid, basiconic and coeloconic sensilla in the female as in the male; of campaniform sensilla there is the same constant number (6) in both sexes.

## **VII. Reactivity of the Normal Female Mosquitoes towards the Attracting Factors.**

Before testing the behaviour of mosquitoes with certain sense organs missing towards the attracting factors, it was important at the beginning to test the behaviour of normal unoperated mosquitoes towards these factors and to ascertain the degree to which the factors differed in attractiveness.

In preliminary experiments the behaviour of the unoperated mosquitoes was tested towards an air stream carrying the following combinations of factors: