MORPHOLOGY OF GENITALS IN MOSQUITO MALES REPORT I. STUDY OF GENITALS OF MALE MOSQUITOS OF THE GENUS AEDES

A. K. Shevchenko and N. S. Prudkina

Translation of "K morfologii genitaliyev samtsov komarov. Soobshcheniye I. Izucheniye genitaliyev samtsov komarov roda Aedes", Vestnik zoologii, No. 6, 1973, pages 40-47.

TRANSLATED BY:

S C I T R A N
1482 East Valley Road
Santa Barbara, California 93108
(805) 969-2413

UDC 595.771:591.467

MORPHOLOGY OF GENITALS IN MOSQUITO MALES
REPORT I. STUDY OF GENITALS OF MALE MOSQUITOS OF THE GENUS AEDES

A. K. Shevchenko and N. S. Prudkina*

It is common knowledge that the structure of the genitals of /40** male mosquitos are widely used to classify their genera, subgenera and species. But the structural details of individual parts of their genitalia have not yet been sufficiently studied and therefore cannot be completely used to determine close species, to revise the genus or close groups. We have studied the genitalia of male mosquitos of the genera Coliseta, Anopheles and Aedes. This report presents material precisely on this genus. A study was made of 11 species of the subgenera Ochlerotatus, one species (Aedes geniculatus) of the subgenera Finlaya, one species (Aedes vexans) of the subgenera Aedimorphus, one species (Aedes aegypti) of the subgenera Stegomyia and one species (Aedes cinereus) of the subgenera Aedes.

Parts of the genitalia of male mosquitos of the genus Aedes are modified IX and X segments. The majority of these parts are paired except the IX sternite, IX tergite and phallosomes (Figure 1). The base of the genitalia is surrounded by a ring which from the dorsal side is a sternite, and from the abdominal a tergite (when the mosquitos emerge from the chrysalis, their genitalia turn 180°).

The sternite of mosquitos of the subgenera Ochlerotatus and Finlaya (except the Crimean population of the species Aedes refiki) is almost rectangular, and that of the mosquitos of the subgenera Aedimorphus, Stegomyia, Aedes and Ae. refiki is elongated in a transverse direction. On the outside of the sternite apex there are a series of large hairs. The tergite encompasses the base of the

*Zaporozh Medical Institute, Kharkov State University.
**Numbers in margin indicate pagination in original foreign text.

genitalia from the abdominal side (its central and lateral-proximal part) and from the sides (its lateral-distal part). On the rear edge of the central part of the tergite there are two projections with strong bristles on the apex. Between the projections there is a more or less pronounced depression.

There are lateral appendages of the IX segment, the gonopods (valves) are on the sides of the hypopigium. Each gonopod consists of a gonocoxite (coxite) and gonostyle (style). The gonocoxite of a number of species of the Aedes genus has projections in the form of warts, apical and basal. The latter often has strong projections (their number and arrangement has a systematic value) or tapering plates. Towards the apex of the gonocoxite or somewhat below it (subgenus Aedes) the style articulates, towards the apex constricted (subgenera Ochlerotatus, Finlaya and Stegomyia), expanded with rod-shaped appendage (subgenus Aedimorphus) or bifurcated (subgenus Aedes). On the inner apex side of the sternite (subgenera Ochlerotatus and Finlaya) there are projections of the main region of the coxite, claspets consisting of two parts: main (trunk) and apex (wing). In male Aedes vexans (subgenus Aedimorphus) and Ae. aegypti (subgenus Stegomyia) instead of the projection, there are two expanded plates with common base and considerable quantity of hair at the apexes. These plates in both species are separated from the coxite, like other parts, are easily isolated from the hypopigium and evidently are projections of the main region of the coxite, identical to the claspets. In only /41 one species of our fauna, Ae. cinereus we did not find a similar part of the genitalia.

Towards the front of the claspets there are basal plates which rest by their lower edges at the base of the sternite, while the upper halves adjoin the phallosome. The latter occupies the central part of the hypopigium.

In males of the subgenera Ochlerotatus and Finlaya, the phallosome is slightly sclerotized and is a closed or semiclosed tube similar

to a pitcher of varying shape. In males of the subgenera Stegomyia, Aedimorphus and Aedes, the phallosome is very scleritized and is two converged plates crenulated at the apex, or consists of elongated loops merging at the base (subgenus Aedes).

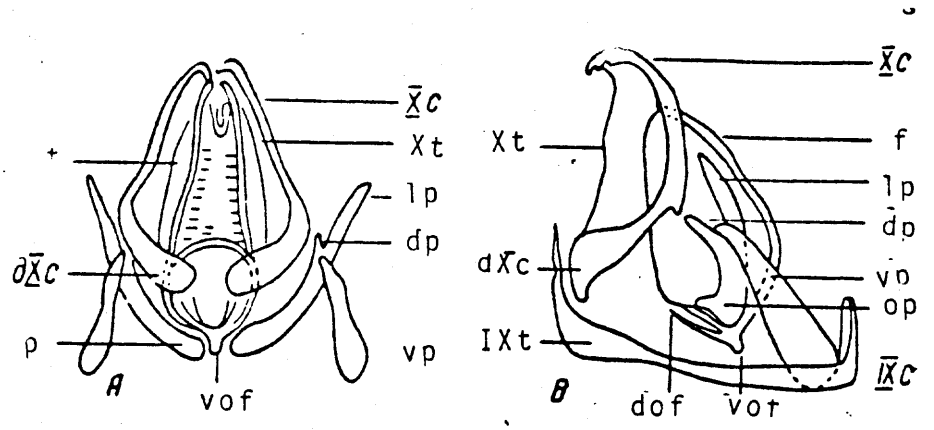


Figure 1. Plan for Structure of Genitalia of Male Mosquitos of the Genus Aedes (from Mohrig Warner, 1969)

Key:

a.	view from below	p.	paramers
b.	view from the side	lp.	lateral apex of the paramers
IXc.	ninth sternite	dp.	distal apex of the paramers
Xc.	tenth sternite	op.	base of the paramers
IXt.	ninth tergite	vp.	ventral plate
Xt.	tenth tergite	dXc.	distal edge of the tenth sternite
f.	phallosome		
dof.	distal part of the base of the phallosome		
vof.	ventral part of the base of the phallosome		

At the very front edge of the central part of the hypopigium there is a paired formation: the merging X sternite (less sclerotized anterior part) and the X tergite (more scleritized rear part) resting by their bases in the lobe of the IX tergite.

Study of the structural details of the genitalia of male mosquitos of the genus Aedes in the example of species from five subgenera

indicated that the closest among themselves are the subgenera Ochlerotatus and Finlaya. The remaining three subgenera differ significantly from them; of these three subgenera, Aedimorphus and Stegomyia are closer to each other. The subgenus Aedes is somewhat isolated (Figure 2)

In the subgenera Ochlerotatus among all our studied species (see table) one should isolate only Ae. refiki. It differs from the remaining species of subgenera in the structure of the sternite, claspets, and the presence (only in it and other species of the group) of tapering plates on the basal wart of the coxite and certain other signs. In addition, in contrast to other species on the respiratory tube (syphon) of the larvae there are additional hairs. Apparently it is expedient to isolate Ae. refiki like all the other species of the group rusticus, into a special subgenera Rusticoidus Shevitshenko et Prudkina.* Based on what has been said, we should consider the following sequence of subgenera in the Aedes genera to be more natural: Ochlerotatus L.-Arrib., Finlaya Theob., Rusticoidus Shev. et Prud., /44 Aedimorphus Theob., Stegomyia Theob., Aedes Meig. This refinement is necessary since different researchers put the subgenera in the most diverse sequence. A. S. Monchadskiy (1951) uses Ochlerotatus, Finlaya, Stegomyia, Aedes and Aedimorphus; A. V. Gutsevich, A. S. Monchadskiy and A. A. Shtakel'berg (1970) use Ochlerotatus, Aedimorphus, Finlaya, Stegomyia and Aedes; A. M. Dubitskiy (1970) uses Ochlerotatus, Aedes and Aedimorphus.

Studying the structure of the genitalia of the Aedes males, we took into consideration the structural features of individual sclerites and defined a number of indexes: Sc.--ratio of the width of the sternite (d) to its length (n); St.--ratio of the distance between /45 the projections of the IX tergite (l) to the width of the projections

*For precisely this reason the table presents ten not eleven species.

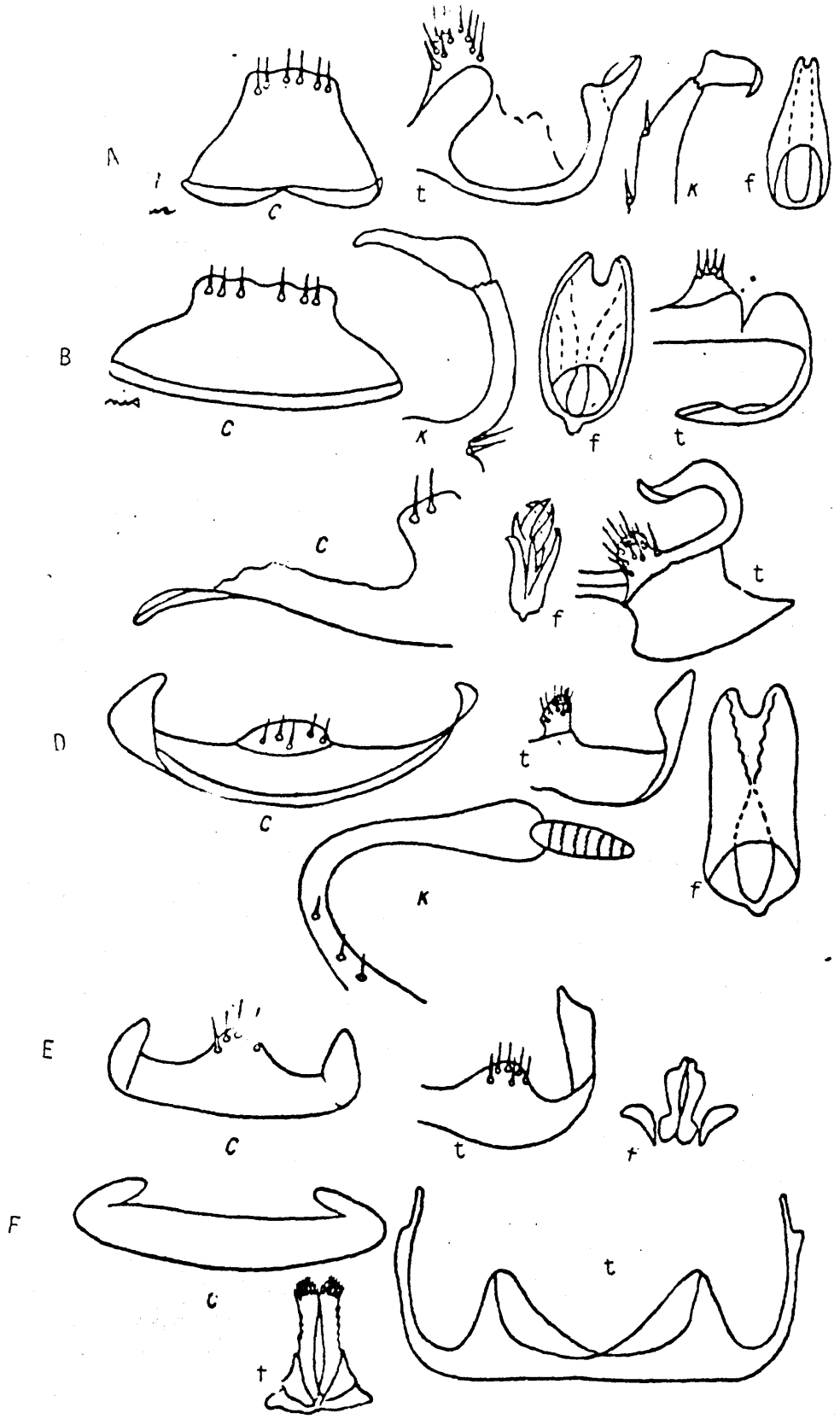
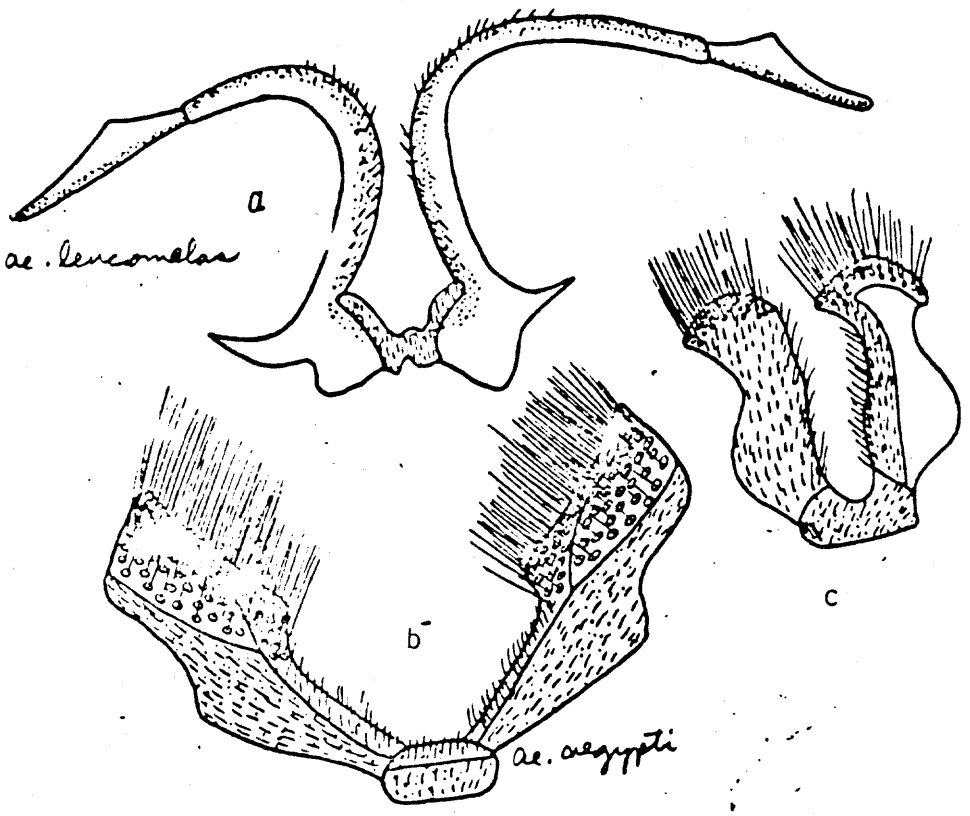


Figure 2. Structural Details of Male Genitalia
Key:

A. Aedes genikulatus
B. Ae. communis
C. Ae. cinereus
D. Ae. refiki

(Key continued on next page)

Figure 2. Key continued:
E. Ae. vexans
F. Ae. aegypti
c. sternite
t. tergite
k. claspet
f. phallosome



/43

Figure 3. Projections of the Main Part of Coxites
Key:
a. Aedes leucomulas
b. Ae. aegypti
c. Ae. vexans

at the base (c); Sk.--ratio of the length of the wing of the claspets (m) to its width (p); Sb.--ratio of the length of the claspet trunk (a) to the length of the wing (m). These indexes were adopted for mosquitos of the subgenera Ochlerotatus, Finlaya and Rusticoidus, as well as for the tergite of mosquitos of the subgenera Aedes. for Ae. vexans and Ae. aegypti, the indexes defining the main parameters of the sternites, tergites and claspets were somewhat altered: Sc.--ratio of the height (h) to the width of the sternite until its lateral

TABLE. MAIN INDICATORS OF INDIVIDUAL PARTS OF GENITALIA OF MALE MOSQUITOS OF THE SUBGENUS OCHLEROTATUS

(a) Вид	(b) Класпеты			Sk	Sb	(f) Тергит		Стернит (h)	
	(c) длина стволика, мк	(d) длина крыла, мк	(e) ширина крыла, мк			число щетинок, M (g)	St	число щетинок, M (i)	Se
Aedes caspuis									
dorsalis	92,1	104,7	23,7	4,4	0,9	6,0	0,6	8,0	1,7
Ae. cantans	192,5	147,0	59,6	2,4	1,3	8,0	1,7	13,5	1,7
Ae. behningi	168,0	138,6	21,0	6,6	1,2	8,0	0,9	14,0	1,5
Ae. excrucians	253,4	140,0	36,2	3,8	1,8	7,6	1,1	10,8	1,5
Ae. flavescens	134,4	140,7	20,7	6,8	0,96	8,0	1,0	13,0	1,6
Ae. communis	224,5	131,9	18,9	7,1	1,7	7,3	0,7	8,3	2,0
Ae. punctor	135,2	99,8	17,1	5,8	1,4	7,9	1,1	11,2	1,6
Ae. intrudens	149,1	126,0	37,8	3,3	1,2	10,0	0,4	10,5	1,4
Ae. cathaphilla	242,8	168,7	29,1	5,0	2,3	8,5	0,7	6,8	1,9
Ae. leucomelas	188,5	154,4	20,1	7,7	1,2	13,6	0,3	6,0	1,8

Key:
a. species
b. claspets
c. length of trunk,
d. length of wing,
e. width of wing,
f. tergite
g. number of bristles, M
h. sternite

edges bend (d); St.--ratio of the height of the tergite in the region of projections (r) to the distance between them (g); Sv.--ratio of the length of the projections of the main part of the coxite (n) to the plates at their apex (e). The principle measurements for determining indexes is shown in Figure 4.

TABLE. DETERMINING TABLE FOR SUBGENERA USING STRUCTURAL DETAILS OF MALE GENITALIA

1. (6) Projections of the main part of the coxite (claspet) have two-segments; the phallosome is slightly scleritized and has the shape of a pitcher.
2. (5) Coxite with more or less pronounced apex and basal warts, or one of them is developed.
3. (4) Basal wart covered with hair and bristles. Ochlerotatus L.-Arrib.
4. (3) Basal wart covered with tapering plates. Rusticoidus Shev. et Prud.

(Table continued on next page)

TABLE. Continued:

5. (2) Coxite without warts, or they are barely noticed. Finlaya Theob.
6. (1) Projections of main part of coxite have appearance of wide plates that are not divided into segments, or they are missing.
7. (10) In the center of the sternite there is a well-pronounced lobe.
8. (9) There are projections of the main part of the coxite. Aedimorphus Theob.
9. (8) There are no projections of the main part of the coxite. Aedes Meig.
10. (7) Sternite without central lobe; projections of the main part of the coxite have the appearance of wide plates and not separated into segments. Stegomyia Theob.

Characteristics of the Subgenera of Genus Aedes

Subgenus Ochlerotatus (for Aedes communis). The entire wing of the claspet is well scleritized, without lamellar expansion. Sk = 7.1. Length of the claspet trunk 224.5 μ. Sb = 1.7. There are two spines at the base of the uniformly expanded trunk. Between the central and lateral-proximal parts of the tergite there is a deep depression, both parts of the tergite are broad; the lateral-distal part is considerably narrower with obtuse angle expansion at the end. On projections of the IX tergite there are an average of seven bristles (5 - 11). St = 0.7. The IX sternite is low, gradually constricting towards the apex. The apex part is separated from the main by shallow depressions, the rear edge of the apex is wavy on the average with eight bristles (5 - 12). Sc = 2.0. The phallosome is uniformly wide, its rear edges do not come into contact and approach each other approximately in the middle of the phallosome. The apex of the phallosome has a broad and deep depression, the lobes are not crenulated.

The table presents indicators for some sclerites of the genitalia of males of this subgenera.

Subgenus Finlaya (for Aedes geniculatus). The entire wing of the claspet is sclerotized, without lamellar expansion. Sk = 6.9. The length of the trunk of the claspet is 88.8 μ. Sb = 1.0. The main half of the trunk is broader, at its apex and at the base there

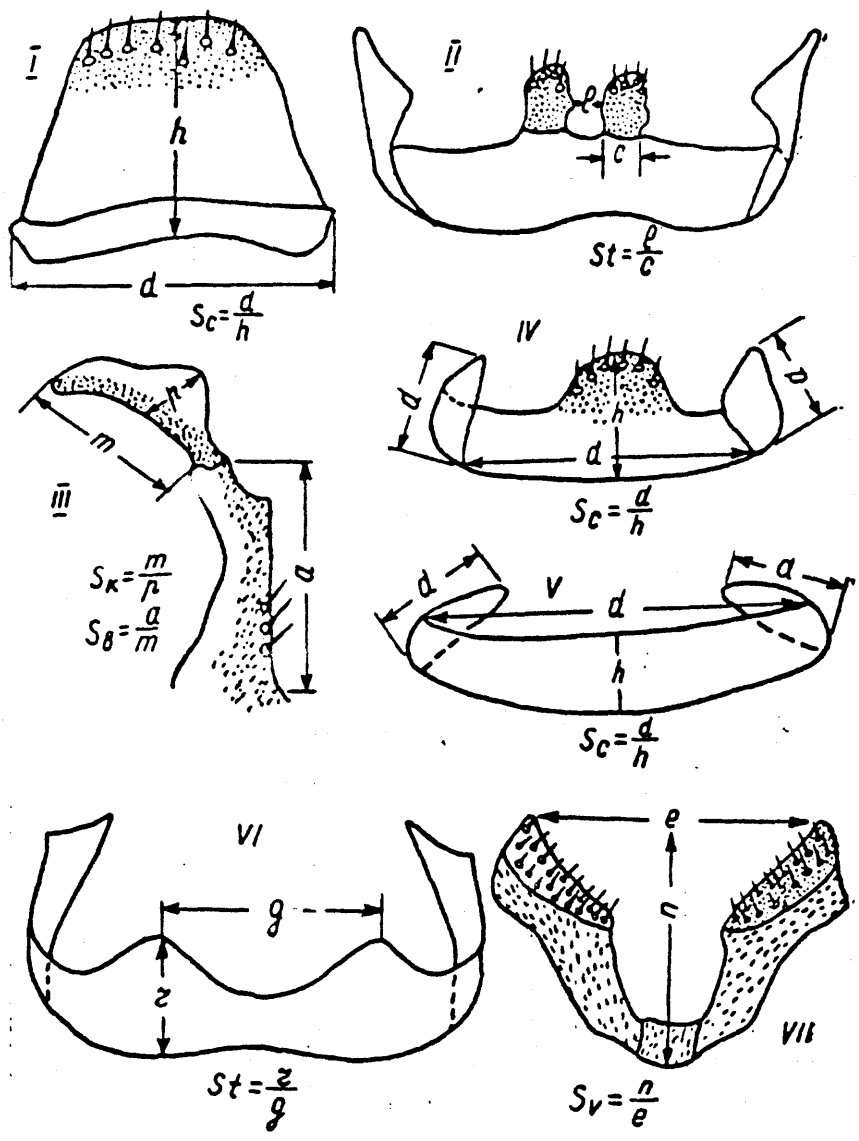


Figure 4. Principle of Determining Indexes
Key:
I-III. general type of measurements
IV-VII. measurements of Ae. vexans and Ae. aegypti, as well as in species with sternite extended in a transverse direction

is one spine. The central and lateral-proximal parts of the IX tergite are relatively wide, the distal parts are laterally constricted, with obtuse angle expansion on the ends. The depression between the /46
projections of the tergite is deep. The bases of the projections are very broad, descending to the upper edges of the depression. On the

projections there are five spines. St = 0.7. The IX sternite has a broad, very sclerotized base. The upper half of the base is uniformly constricted and passes into the apex of the sternite. In the middle of the rear edge of the apex there is a small projection with six bristles. Sc = 1.9. The phallosome is gradually constricted towards the apex, the edges of the rear wall are uniformly distant from each other; the apex of the phallosome does not have a depression, it is rounded.

Subgenus Rusticoidus. The wing of the claspet is fusiform 285.6 μ, at the base and apex the trunk is expanded, and the apex is clavate. Sk = 3.1. Along the main part of the trunk there are three spines one after the other. Sb = 3.9. The central and lateral-proximal parts of the IX tergite are wide with concave anterior edge; the lateral-distal part is constricted, with slightly expanded edge. The depression between the projections is wide and deep, on the projections there are an average of eight bristles (7 - 10). St = 0.9. The IX sternite is elongated, has the shape of a boat with convex central part, and it has five bristles. Sc = 4.8. The phallosome is very constricted in the middle, the apex part is expanded, the rear edge has a projection. The rear edges of the wall contact each other in the first half.

Subgenus Aedimorphus. The projections of the main part of the coxite are massive and parallel (somewhat constricted only in the beginning of the second half). Sv = 3. The length of the projections is 146.5 μ. The central part of the IX tergite is narrower, the lateral-proximal is expanded with indistinctly pronounced projections on which there are an average of 5.5 bristles (4 - 7). St = 0.4. The lateral-distal part of the tergite is uniformly narrow. The IX sternite is extended transversely with laterally bent edges. In the middle of its rear edge there is a projection on which there are an average of 5.3 bristles (4 - 7). Sc = 4.2. The phallosome is in the shape of two converged plates with thickened base and expanded apex, very sclerotized.

Subgenus Stegomyia. The projections of the main part of the coxite are massive, diverging, constricted at the base, and expanded in the second half. Sv = 0.7. The length of the projections is 210 μ. The central part of the IX tergite, expanding sharply, passes into the lateral-proximal with projections broad at the base and tapering at the apex. There are no strong bristles on the projections. St = 0.5. The lateral-distal part is uniformly narrow with tapering apex. The IX sternite is transversely extended with lateral-bent edges. On the sternite there is no projection or bristles, it is uniformly constricted towards the edges. Sc = 4.1. The second half of the phallosome is crenulated, it has the appearance of lobes that do not fuse to the end. The phallosome is very sclerotized.

Subgenus Aedes. There are no claspets or other projections of the main coxite. The central part of the IX tergite is relatively narrow, the lateral-proximal is expanded, with well pronounced projections on which there are an average of 13 bristles (9 - 18). St = 2.7. The lateral-distal part of the IX tergite is uniformly narrow. The IX sternite is extended in a transverse direction, with well pronounced projection in the middle of the rear edge. On the projection there are an average of 3.5 bristles (3 - 4). Sc = 3.3. The phallosome is a bundle of lobes connected in the main half and diverging at the apex, very sclerotized.

BIBLIOGRAPHY /47

Gutsevich, A. V.; Monchadskiy, A. S.; Shtakel'berg, A. A. Fauna SSSR. Nasekomyye dvukrylyye. Komary [Fauna of the USSR. Dipterous Insects. Mosquitos], 1970, vol 3, issue 4, Leningrad.

Dubitskiy, A. M. Krovososushchiye komary Kazakhstana [Blood Sucking Mosquitos of Kazakhstan], 1970, Alma-Ata.

Monchadskiy, A. S. Lichinki krovososushchikh komarov SSSR i sopredel'nykh stran [Larvae of Blood-Sucking Mosquitos of the USSR and Adjoining Countries], 1951, Moscow-Leningrad.

Mohrig, Warner Die Culicidae Deutschlands. Untersuchungen zur Taxonomie, Biologie und Ökologie der Einheimischen Stuchmucken. Parasitolog. Schr. Reihe, 1969, No 18.