

The Determination of Mosquito Females  
(Culicidae) by Microscopic Preparations of the Head<sup>1/</sup>

IV. A Key to Species of the Genus *Aedes*

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**ABSTRACT** A key to species of the genus *Aedes*, supplementary notes on some species, and basic quantitative indices for each of the 46 researched species are given.

In preceding works, the general features of taxonomic characteristics, a table for determining genera and subgenera, and keys for determining species other than those of the genus *Aedes*, were given (Gutsevich 1972, 1973). Below, a key to the species of *Aedes* is presented. At the present time, some of the species cannot be determined with certainty on the basis of preparations of the head. Such species are not listed separately in the body of the key, but some of their distinguishing characteristics are pointed out in the supplementary notes.

KEY TO SPECIES OF THE GENUS *AEDES*

- 1(4) A row of large hairs is located on the occiput behind the eyes; there are no other hairs behind them, only scales; on the posterior surface of the head, as in all species of mosquitoes, there is a thick cluster of hairs (subgenus *Stegomyia*).
- 2(3) The clypeus has scales; in the posterior half of the clypeus the point of their attachment is visible. The last 2 segments of the palps are of almost the same length. The width of the frons is 2-2.5 times the diameter of a facet. . . . . *A. aegypti* L.
- 3(2) The clypeus has no scales. The last segment of the palps is significantly longer than the second-to-last segment. The width of the frons is 3-4 times the diameter of a facet. . . . *A. galloisi* Yam.
- 4(1) Behind the row of large hairs on the occiput behind the eyes, there is a still greater or lesser number of hairs of a smaller size.
- 5(6) The segments of the antennae are relatively long, but the palps are short; Pa/A = 0.5-0.65 (see Table). Behind the row of large hairs on the occiput there are only a few smaller hairs. . . . .  
. . . . . *Aedes (Aedes) cinereus* Mg.

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- 6(5) The palps are longer;  $Pa/A = 0.7$  or more; as an exception it is 0.65. Behind the row of large hairs on the occiput behind the eyes, there is a relatively large number of hairs of a smaller size.
- 7(18) The hairs of the whorl at the base of the antennal segments are very long; thus, the length of the hairs of the 5th segment is about twice as great as the length of the segment.<sup>2/</sup> The palps, especially on the exterior side, are thickly covered with scales (subgenus *Finlaya*.)
- 8(9) The frons is relatively wide: it is 1.5-2 times the diameter of a facet (Europe). . . . . *A. geniculatus* Ol.
- 9(8) The frons is relatively narrow; as a rule, it is not wider than the diameter of a facet (Far East).
- 10(11) A regular row of large hairs is located behind the eyes on the occiput; behind them are two irregular rows of smaller hairs; further towards the rear, there is a space free of hairs. . . . .  
. . . . . *A. nipponicus* LaCasse and Yam.
- 11(10) The hairs are more or less evenly scattered along the occiput.
- 12(13) The palps are short;  $Pa/A$  is about one. The frons has no longitudinal suture. . . . . *A. alektorovi* Stack.
- 13(12) The palps are relatively long;  $Pa/A = 1.2-1.8$ . The frons either has a longitudinal suture or else it does not.
- 14(15) The segments of the antennae are shorter;  $Pa/A = 1.5-1.8$ ;  $A/Pr = 0.08-0.09$ . . . . . *A. togoi* Theob.
- 15(14) The segments of the antennae are longer;  $Pa/A = 1.2-1.5$ ;  $A/Pr$  as a rule is 0.1-0.11.
- 16(17) The index of  $Pa/Pr = 0.23-0.25$ . The space between the eyes on the lower side of the head is wider: it is 1.5-3 times the diameter of a facet. . . . . *A. koreicus* Edw.
- 17(16) The index of  $Pa/Pr$  is higher - about 0.28. The space between the eyes on the lower side of the head is very narrow, not exceeding the diameter of a facet (in view of insufficient materials the data is preliminary). . . . . *A. japonicus* Theob.
- 18(7) The hairs of the antennal whorl are shorter; the hairs of the 5th segment are 2-2.5 times longer than the segment itself. The palps are not so thickly covered with scales.

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<sup>2/</sup>Relatively long antennal hairs also characterize *A. vexans*, *A. pulchritarsis* and *A. kasachstanicus*. (see nos. 21, 46 and 38.)

## Basic Quantitative Indices

(Genus Species <i>Aedes</i> )	Pa/Pr	Pa/A	A/Pr	Number of Preparations (Measured)
<i>A. aegypti</i>	0.2—0.23	0.72—0.88	0.11—0.12	10
<i>A. galloisi</i>	0.2—0.23	0.85—1.11	0.11—0.13	9
<i>A. cinereus</i>	0.16—0.21	0.48—0.66	0.14—0.17	17
<i>A. geniculatus</i>	0.21—0.25	0.98—1.2	0.11—0.13	11
<i>A. nipponicus</i>	0.18—0.21	0.86—1.14	0.1—0.11	7
<i>A. alektorovi</i>	0.2—0.23	0.91—1.06	0.11—0.12	4
<i>A. togoi</i>	0.24—0.27	1.5—1.8	0.08—0.09	10
<i>A. koreicus</i>	0.23—0.25	1.27—1.51	0.09—0.1	10
<i>A. japonicus</i>	0.28	1.41	0.11	1
<i>A. aureus</i>	0.22	0.84—0.9	0.13	2
<i>A. vexans</i>	0.18—0.24	0.69—0.9	0.11—0.13	14
<i>A. flavescens</i>	0.27—0.3	1.23—1.49	0.11—0.13	14
<i>A. excrucians</i>	0.24—0.29	0.98—1.19	0.12—0.14	24
<i>A. behningi</i>	0.25—0.28	0.99—1.29	0.11—0.13	9
<i>A. cyprius</i>	0.24—0.29	1.12—1.31	0.1—0.11	11
<i>A. annulipes</i>	0.26—0.3	1.16—1.21	0.12	5
<i>A. fitchii</i>	0.24—0.29	1.04—1.29	0.11—0.12	12
<i>A. cantans</i>	0.24—0.27	0.94—1.16	0.11—0.14	21
<i>A. beklemishevi</i>	0.24—0.28	1.0—1.19	0.11—0.13	15
<i>A. mercurator</i>	0.24—0.27	1.03—1.26	0.11—0.13	4
<i>A. kasachstanicus</i>	0.25—0.27	1.0—1.14	0.13—0.14	7
<i>A. albescens</i>	0.3—0.32	1.32—1.59	0.11—0.13	12
<i>A. rejiki</i>	0.25—0.28	1.25—1.55	0.1—0.11	11
<i>A. caspius</i>	0.18—0.24	0.68—1.09	0.1—0.13	23
<i>A. stramineus</i>	0.22—0.25	0.92—1.12	0.11—0.12	10
<i>A. pulchritarsis</i>	0.22—0.24	0.88—1.02	0.12—0.14	14
<i>A. mariae</i>	0.21—0.22	0.84—0.9	0.12—0.13	13
<i>A. montchadskyi</i>	0.17—0.21	0.69—0.88	0.11—0.12	8
<i>A. impiger</i>	0.19—0.23	0.88—1.33	0.08—0.11	13
<i>A. nigripes</i>	0.17—0.22	1.02—1.28	0.07—0.09	11
<i>A. subdiversus</i>	0.21—0.24	0.92—1.07	0.1—0.11	11
<i>A. simanini</i>	0.17—0.22	0.74—0.95	0.1—0.12	11
<i>A. detritus</i>	0.15—0.21	0.65—0.88	0.1—0.12	10
<i>A. pullatus</i>	0.18—0.21	0.94—1.32	0.08—0.1	12
<i>A. riparius</i>	0.21—0.23	0.82—1.04	0.11—0.13	10
<i>A. diantaeus</i>	0.18—0.22	0.73—0.87	0.1—0.12	6
<i>A. intrudens</i>	0.17—0.23	0.67—0.93	0.1—0.12	12
<i>A. nigrinus</i>	0.17—0.19	0.95—1.08	0.08—0.09	8
<i>A. sticticus</i>	0.19—0.21	0.78—0.91	0.11—0.12	5
<i>A. cataphylla</i>	0.17—0.22	0.76—1.02	0.1—0.12	12
<i>A. leucomelas</i>	0.18—0.21	0.82—0.98	0.1—0.11	12
<i>A. communis</i>	0.19—0.22	0.83—1.17	0.09—0.1	12
<i>A. punctor</i>	0.16—0.22	0.78—1.1	0.09—0.12	11
<i>A. pionips</i>	0.16—0.19	0.83—1.04	0.08—0.1	11
<i>A. hexodontus</i>	0.15—0.2	0.76—1.08	0.8—0.1	12
<i>A. rempeli</i>	0.19—0.21	0.88—1.06	0.1	2
Total	—	—	—	479

- 19(20) The 3rd segment of the antennae is long, thin, and not thickened; its length is 6-7 times greater than its width. The frons has numerous (not less than seven) large hairs (only in the south of the Primorskii Region). . . . *Aedes (Neomelaniconion) aureus* Guts.
- 20(19) The 3rd segment of the antennae is more or less thickened, and its length is 4-5 times greater than its width. The frons often has few (2-7) large hairs; if there are more of them, then the 3rd segment of the antennae is clearly thickened.
- 21(22) On the 3rd segment of the antennae there are few microtrichia, especially in its distal quarter, where the microtrichia are isolated or do not exist at all. The longitudinal suture of the frons is usually (not always) interrupted; sometimes it is lacking altogether. . . . . *A. (Aedimorphus) vexans* Mg.
- 22(21) The 3rd segment of the antennae, including its distal part, has numerous microtrichia. The longitudinal suture of the frons is well developed in most cases, but in some species (see Nos. 43, 45-49) it is interrupted or lacking (subgenus *Ochlerotatus*).
- 23(42) The palps are long;  $Pa/Pr = 0.25-0.32$ ; as an exception it is 0.24. The index of  $Pa/A = 1.0-1.5$ .
- 24(39) The 2nd segment of the antennae does not have a bundle of scales on the exterior surface. The 5th segment of the palps is usually characteristically spine-shaped; more rarely it is elongated.
- 25(38) The 3rd segment of the antennae has no constriction before the apex. The scales of the palps are mainly narrow.
- 26(29) The eyes are approximated on the lower side of the head; the space between them is not greater than 4 times the diameter of a facet.
- 27(28) The palps are long, especially the 4th segment;  $Pa/A = 1.2-1.5$ . The 3rd segment of the palps has thick spine-shaped hairs. . . . .  
. . . . . *A. flavescens* Müll.
- 28(27) The palps are moderately long;  $Pa/A = 1.0-1.2$ ; as an exception it is 1.3. The 3rd segment of the palps has ordinary hairs. . . . .  
. . . . . *A. excrucians* Walk.  
. . . . . *A. behningi* Mart.
- 29(26) As a rule, the space between the eyes on the lower side of the head is not less than 4 times the diameter of a facet.
- 30(35) The frons is wider: at the anterior edge it is 2.5-4 times the diameter of a facet; towards the rear it widens greatly. The frons has numerous hairs and scales; there are usually 6-10 large hairs.

- 31(32) The basal segments of the flagellum of the antennae, as well as the palps, are yellow; the darker scales on the light yellow background of the palps stand out clearly. Large hairs are usually scattered along the entire frons. . . . . *A. cyprius* Ludl.
- 32(31) The basal segments of the flagellum of the antennae are not yellow. Large hairs are usually concentrated in the posterior half of the frons; in the anterior part of the frons there are many tiny hairs.
- 33(34) The basal segments of the flagellum of the antennae are light (Europe). . . . . *A. annulipes* Mg.
- 34(33) The basal segments of the flagellum of the antennae are dark; brown (Siberia). . . . . *A. fitchii* Felt et Young
- 35(30) The frons is narrower: it is 1-2.5 times the diameter of a facet. There are a few large hairs on the frons, usually 2-5.
- 36(37) The 3rd segment of the antennae is slender and long: 210-270 mk. The hairs on the interior side of the 4th segment of the palps are very thick. . . . . *A. cantans* Mg.
- 37(36) The 3rd segment of the antennae is slightly thickened and is usually shorter: 160-230 mk. The hairs on the interior side of the 4th segment of the palps are less thick. . . . . *A. beklemishevi* Den.  
. . . . . *A. mercurator* Dyar
- 38(25) The 3rd segment of the antennae has a constriction before the apex. The segments of the antennae are very slender and long. There are many wide scales on the palps. . . . . *A. kasachstanicus* Guts.
- 39(24) The 2nd segment of the antennae has a bundle of scales on the exterior surface. The 5th segment of the palps is sphere-shaped, egg-shaped, or cap-shaped.
- 40(41) The palps are long:  $Pa/Pr = 0.3-0.32$ . The length of the clypeus is almost equal to its width. The hairs behind the eyes do not stand out from among the other hairs on the occiput because of their dimensions. The frons has a longitudinal suture. *A. albescens* Edw.
- 41(40) The palps are shorter:  $Pa/Pr = 0.25-0.28$ . The length of the clypeus is usually less than the width. The large hairs behind the eyes clearly stand out because of their dimensions. The frons may or may not have a longitudinal suture. . . . . *A. refiki* Medj.
- 42(23) The palps are shorter:  $Pa/Pr = 0.16-0.23$ ; as an exception it is 0.24. The index of  $Pa/A = 0.7-1.2$ ; in rare cases it is 1.3.

- 43(44) The frons is wide (as a rule it is wider than the space between the eyes on the lower side of the head), and has numerous large hairs; usually there are 8-10 or more of them; occasionally there are 6-7  
..... *A. caspius* Pall.  
..... *A. stramineus* Dubitzky
- 44(43) In diameter the frons is not more than twice the diameter of a facet; its width is not greater than the space between the eyes on the lower side of the head. As a rule, there are no more than 7-8 large hairs on the frons.
- 45(50) The longitudinal suture on the frons is interrupted, incomplete, or non-existent.
- 46(47) The narrow, light scales on the apical part of the 4th segment of the palps are clearly distinguished from the dark scales of the remaining part of the segment. The hairs of the antennae are relatively long. . . . . *A. pulchritarsis* Rond.
- 47(46) The scales on the apical part of the 4th segment of the palps do not stand out because of their coloring. The hairs of the antennae are shorter, especially for *Ochlerotatus*.
- 48(49) The hairs bordering the eyes are not distinguished or are only faintly distinguished by their size from the hairs of the remaining part of the occiput. The 4th segment of the palps is only a little thicker at the apical part than it is at the base. As a rule, the 4th segment of the antennae has microtrichia. . . . . *A. mariae* Serg.
- 49(48) The hairs bordering the eyes from behind clearly stand out because of their large dimensions. The 4th segment of the palps is significantly thicker at the apical part than it is at the base (claviform). The 4th segment of the antennae does not have microtrichia  
..... *A. montchadskyi* Dubitzky
- 50(45) The longitudinal suture of the frons is well developed and complete.
- 51(56) The integuments are dark, especially those at the base of the antennae. The frons is relatively wide: 2.5-4.5 facets. The space between the eyes on the lower side of the head is not less than 5-6 facets. The 2nd segment of the antennae has scales on the exterior side.
- 52(55) The space between the eyes on the lower side of the head is not less than 6-8 facets (tundra, northern taiga).
- 53(54) A small mosquito: the proboscis is up to 2.8 mm long; the palps up to 540 mk in length; the total length of the 5th and 6th segments of the antennae is up to 230 mk. . . . . *A. impiger* Walk.
- 54(53) A larger mosquito: the dimensions of all three indices are greater than in the preceding. . . . . *A. nigripes* Zett.

- 55(52) The space between the eyes on the lower side of the head is not greater than 5-6 facets (forest-steppe, steppe) . . . . .  
. . . . . *A. subdiversus* Mart.
- 56(51) With a different arrangement of the characteristics.
- 57(58) The 4th segment of the palps is greatly thickened along the entire length. The scales of the palps are relatively wide. . . . .  
. . . . . *A. simanini* Guts.
- 58(57) The 4th segment of the palps is slender either along its entire length or else only near the base. As a rule, the scales of the palps are narrow.
- 59(60) The 4th segment of the palps is claviform; it is dark along the length of the widened part. The space between the eyes on the lower side of the head is narrow: 2-3 facets. There are also relatively wide scales on the palps. . . . .  
. . . . . *A. detritus* Hal.
- 60(59) The 4th segment of the palps does not stand out because of the dark coloring of the widened part or of the entire segment. The space between the eyes on the lower side of the head can be varied; more often it is more than 3 times the diameter of a facet. The scales of the palps are narrow.
- 61(66) The 4th segment of the palps is relatively long and slender; its length is approximately 5 times greater than its width.
- 62(63) The frons is wider: 2-4 facets. In most specimens, there are scales on the exterior side of the 2nd segment of the antennae. The index of Pa/A is greater than one; more rarely it is approximately one. The integuments of the body are often (not always) dark; brownish-black. . . . .  
. . . . . *A. pullatus* Coq.
- 63(62) The frons is narrower: 1-2 facets. There are no scales on the exterior side of the 2nd segment of the antennae. The index of Pa/A is less than one or else it is approximately equal to one. The integuments of the body are lighter; brown.
- 64(65) The antennal segments are longer; the total length of segments 5 and 6 is greater than 320 mk; the index of A/Pr = 0.11-0.13. There are no hairs on the interior surface of the 3rd segment of the palps, not counting the microtrichia. (The tarsi have light rings . . . . .  
. . . . . *A. riparius* D. K.
- 65(64) The antennal segments are shorter; the total length of segments 5 and 6 is not greater than 320 mk; the index of A/Pr = 0.09-0.1. There are a few hairs on the interior surface of the 3rd segment of the palps in addition to the microtrichia. (The tarsi are dark and have no light rings, as in all the other following species  
*A. communis* Deg.  
(partially)

- 66(61) The 4th segment of the palps is more or less thickened; its length is usually 3-4.5 times greater than its width.
  
- 67(74) There are no hairs on the interior surface of the 3rd segment, not counting the numerous microtrichia, among which may be found 1-2 longer hairs, as an exception.
  
- 68(69) The space between the eyes on the lower side of the head is wide: 6-8 facets. The 4th segment of the palps is more often straight and is not thickened; sometimes it is faintly thickened in the apical part. . . . . *A. diantaeus* H. D. K.  
 . . . . . *A. intrudens* Dyar
  
- 69(68) The space between the eyes on the lower side of the head is narrower; as a rule, it is not more than 6 times the diameter of a facet; but if it is wider, then there are scales on the exterior side of the 2nd segment of the antennae. The 4th segment of the palps is thickened; more often it is slightly bent.
  
- 70(71) The integuments are dark. The antennal segments are short; the total length of segments 5 and 6 is not greater than 230 mk; the index of A/Pr = 0.08-0.09. . . . . *A. nigrinus* Eck.
  
- 71(70) The integuments are ordinary; they are lighter. The antennal segments are of average length; as a rule, the total length of segments 5 and 6 is not less than 230 mk; the index of A/Pr = 0.1-0.12.
  
- 72(73) The surface of the antennal segments, particularly of segments 4 and 5, is not smooth; it is knobby. This is a relatively small mosquito. The length of the proboscis is not greater than 2.7 mm. There are no scales on the exterior surface of the 2nd segment of the antennae. . . . . *A. sticticus* Mg.
  
- 73(72) The surface of the antennal segments is smoother. These are average-sized mosquitoes; as a rule, the length of the proboscis is not less than 2.7 mm. The exterior surface of the 2nd segment of the antennae may either have scales or not. . . . *A. cataphylla* Dyar  
 . . . . . *A. leucomelas* Mg.
  
- 74(67) The interior surface of the 3rd segment of the palps has either a few (at least 3-4) or many hairs, in addition to the microtrichia.
  
- 75(76) The interior surface of the 3rd segment of the palps does not have many hairs; they are usually scattered along the length of the segment. . . . . *A. communis* Deg.  
 (partially)  
 . . . . . *A. punctator* Kirby  
 . . . . . *A. pionips* Dyar  
 . . . . . *A. hexodontus* Dyar



- 76(75) The interior surface of the 3rd segment of the palps has numerous hairs, which are mainly grouped in the apical part of the segment (in view of insufficient material the data are preliminary). . . .  
 . . . . . *A. rempeli* Vock.

#### SUPPLEMENTARY NOTES

Some species, which are similar in the head structure of the female, but which are not grouped in the above key, can still be determined to a certain degree of reliability in a number of cases.

1. *Aedes caspius* and *A. stramineus*. In the first species, the 4th segment of the palps is relatively shorter and is noticeably broadened towards the apex; the index of Pa/A is more often less than one; sometimes it is approximately equal to one. In the 2nd species, the 4th segment of the palps is longer and narrower; it is sometimes faintly enlarged in the apical part; the index of Pa/A is greater than one; more rarely it is approximately equal to one.

2. *Aedes excrucians* and *A. behningi*. In the first species, the 3rd segment of the antennae is relatively longer and is hardly thickened at all; there are usually 6-8 large hairs behind the eyes on each side; between them are located either intervals or smaller hairs. In the 2nd species, the 3rd segment of the antenna is on the average somewhat shorter and slightly thickened; there are usually 8-10 large hairs behind the eyes on each side; they are relatively thickly grouped, and in most cases they form a more or less regular row.

3. *Aedes beklemishevi* and *A. mercurator*.<sup>3/</sup> In the first species, the proximal segments of the flagellum of the antennae are light; the 4th segment of the palps is shorter; in the 2nd species the proximal segments of the flagellum of the antennae are dark; the 4th segment of the palps is longer.

4. *Aedes diantaeus* and *A. intrudens*. No reliable distinctions in the head structure of females of the 2 species named have been discovered.

5. *Aedes cataphylla* and *A. leucomelas*. In the first species, there are many hairs and scales on the upper side of the 2nd segment of the antennae, some of which usually (but not in all specimens) extend onto the exterior side, following the contour of the segment. In the 2nd species, there are fewer hairs and scales on the 2nd segment of the antennae; they do not follow the contours of the segment.

6. *Aedes communis*, *A. punctor*, *A. pionips*, and *A. hexodontus*. In the first species, the 4th segment of the palps is relatively slender; it is not

<sup>3/</sup>This mosquito was formerly designated as *A. riparius ater*. The discovery of larvae helped to establish which species it belongs to (Danilov, 1974). It is possible that *A. mercurator* would be more correctly considered a subspecies of *A. stimulans* Walk.

thickened in the apical part or else it is weakly thickened; the 3rd segment of the palps is also relatively slender. In *A. punctator*, the 4th and 3rd segments of the palps are thinner, but in *A. pionips*, the 4th segment of the palps is, as a rule, greatly thickened. In most (but not in all) specimens of *A. pionips*, the color of the integuments is dark. *A. hexodontus*, as a rule, is characterized by the dark or very dark color of the integuments.

With this present communication, the publication of keys for determining genera, subgenera, and species of mosquitoes of the fauna of the USSR by preparations of the head of females is completed. It goes without saying that in determining mosquito species, it is desirable to have at least a brief description of each species according to a given group of characteristics, in addition to the keys. Such material is available to us, but in view of the large number of researched species (80), its publication is impossible within the framework of journal articles. Further study of the head structure of the female, and utilization of the given material in combination with other characteristics, will probably permit the methods of determining to be improved and allow for the discovery of other structural details which have possible diagnostic significance.

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Editor's Note: Throughout this series of four papers by Dr. A. V. Gutsevich, translated into English and published in Mosquito Systematics, there appears frequently in the keys the Russian word "poloska" following the word "lobnoi." From the manner in which "lobnoi poloska" is used, it seems certain that it refers to the interocular portion of the frons; however, the literal translation of these words is "frontal stria." Because of the uncertainty attending this situation, I have changed "frontal stria" to frons wherever it occurs. Quite possibly this will in some cases result in interpretation difficulties.