

Morphology of Undescribed Male and Immature Mosquitoes of Aedines In Japan. 2. *Aedes (Finlaya) Koreicoides**

Masazumi SAKAKIBARA

Department of Medical Zoology, Research Institute of Endemics, Nagasaki University
and Kune Mine Hospital, Sakuma-machi, Sizuoka Prefecture

Nanzaburo OMORI

Department of Medical Zoology, Nagasaki University School of Medicine
and Research Institute of Endemics, Nagasaki University

日本産ヤブカ類の未記載雄及び未成熟期の形態。2. *Aedes (Finlaya) koreicoides*. 榊原正純, 長崎大学風土病研究所衛生動物学研究室, 静岡県佐久間町久根鉱業所病院。大森南三郎, 長崎大学医学部医動物学教室, 長崎大学風土病研究所。

Sasa et al. (1950) described from adults of both sexes and male genitalia, a new species, *Aedes (Finlaya) koreicoides* resembling *Aedes (F.) koreicus* Edwards, 1917 in ornamentation of adults but quite differing in characters of male genitalia. The specimen of *Aedes koreicoides* was found by them in late S. Yamada's collections of mosquitoes from Korea and Hokkaido which were being classified by him as *Aedes koreicus*. The immature mosquitoes of the species has never been known.

The junior author collected by chance a strange larva resembling *Aedes nipponicus* LaCasse et Yamaguti, 1948. On rearing them he obtained adult seemed as *Aedes koreicoides* and on precise examination we identified this to be *Aedes (Finlaya) koreicoides*. Here, the supplementary descriptions of adults and the description of larva and pupa will be made on this species.

MALE (description from 4 adults)

Head. Proboscis and palpus all dark scaled. Palpus slightly shorter (about 9/10ths) than the proboscis, not noticeably swollen or curved, 6-7 very

short hairs apically on segment III, 18-20 fairly long hairs along IV and 2 long stout ones near the tip of the segment, 26-28 short and moderate hairs along V.

Vertex with longitudinal median broad band of narrow pale scales; a line of narrow pale scales along the dorsal surface of the eye margin; lateral portion of vertex with flat-lying pale scales; an area of dark scales between median pale band and lateral pale portion, this area narrow anteriorly, diminishing posteriorly; a very small anterior dark spot in lateral pale portion in some specimens; a number of forked upright scales dorsally from eye margin to nape, pale in color and sparsely on anterior portion, while dark and more densely in posterior portion especially along submarginal level to nape.

Thorax. Scutal integument brown; covered with narrow dark and yellow scales. The yellow ones arranged as follows: A distinct median line forked at prescutellar bare space; a submedian line on each side becoming parallel on posterior one-fourth with an outer posterior submedian line which arises

* Contribution from the Research Institute of Endemics, Nagasaki University No. 387 and Contribution No. 95 from the Department of Medical Zoology, Nagasaki University School of Medicine.

at a level slightly anterior to the middle of scutum and extending to its posterior margin; a marginal diffused line nearly all around the scutum; a sparsely scaled curved line along the scutal suture connecting marginal line and outer submedian line. Mid scutellar lobe with narrow white scales mainly in middle part; lateral lobes apparently bare. Pleural: Paratergite with a line of broad white scales; anterior pronotum with a patch of similar scales; posterior pronotum with a curved line of narrow yellowish scales along the dorsal margin, and posterior patch of broad white scales; postspiracular area with only 1-2 broad white scales at its posterior margin; subspiracular area with an oblique line of broad white scales below spiracle long dorso-anterior sternopleural margin; sternopleuron with a prealar (below the knob) patch, upper and lower-posterior sternopleural patches of broad white scales; mesepimeron with upper and middle patches or a large coalesced one of similar scales. Legs: Coxae with broad white scales; fore femur dark dorsally, with an anterior faint white line in a basal third, posterior surface with a broad white band from near base to apex, this band broad basally tapering gradually at about two-thirds, slightly broadening again towards apex; mid femur dark dorsally, posterior surface with white band throughout the segment, large at base covering dorsal surface narrowly, tapering gradually into a broad ventral band, at apex ventro-lateral pale area gets near or coalesced dorsally; hind femur dark dorsally excepting apex, widely white ventro-laterally tapering and disappearing nearly at the middle of the segment, apical ventro-lateral white area extended laterally and coalesced dorsally at apex. Tibiae dark with a small ventro-lateral white area at base, this extending dorsally in a variable amount. Fore tarsi with a narrow basal white band on I, II-V all dark; mid tarsi with basal white band on I-III, about $1/9-1/7$, $1/4-1/3$, and $1/3-1/2$ length of each segment, IV and V all dark; hind tarsi with basal white band on I-IV, about $1/8-1/6$, $1/3$, $1/2$, and $1/2-2/3$ length of each segment, V all dark. Fore and mid tarsal claws unequal,

the larger claw with a conspicuous median tooth of round tip and a finer acute laterobasal tooth, smaller claw with a sharp basal tooth; hind claws equal, small and simple. Wing dark scaled, 2.8-3.2mm in length; costa without pale scales on both side; 2-3 very short yellowish hairs near base of vein 1, but scarcely visible in magnification of 12.5×3 . Halter pale, knob with greyish dark and pale scales.

Abdomen. Tergite I with broad dark scales at middle, lateral margin with broad white scales. Tergite II-VI with basal narrow band which broken or hardly connected with baso-lateral large white spots, VII dorsal dark, with dorso-lateral large white spot. VIII widely white dorsally, with lateral white spots. Most of sternites with basal yellowish white bands.

Genitalia (Plate I, C). Basistyle covered with numerous scales, large and short hairs on outer surfaces; about 2.7-2.9 times as long as broad; with no apical lobe but with a prominent patch of dense hairs on apical inner surface, and a prominent tongue-like basal lobe bearing densely long and short bristles, the longer ones slightly longer than the basal width of basistyle.

Dististyle long, slender, and curved; pilose on inner surface; with two bristles near apex; about $2/3$ as long as basistyle. Claw long, bifid at tip, about $2/5$ as long as dististyle. Claspette stem pilose, with 3 fairly long bristles near apex; filament broad, blade-like, broadened medially, flat in lateral view, longer than the basal width of basistyle. Lobes of ninth tergite with 4-5 stout bristles. Ninth sternite with two long bristles. Mesosome simple and oval. Tenth sternite heavily chitinized, with a short stout apical claw.

FEMALE (description from 4 adults)

Wing: 3.2-3.5mm in length. In general, similar to the male. Palpus and proboscis all dark; palpus about $1/5$ the length of proboscis. Torus with a few minute dark scales and a number of very short hairs mesally. Forked upright narrow dark scales of vertex more numerous than

in male ; marrow dark scales on anterior submedian area of vertex also slightly more numerous. Extremities of longitudinal yellow scaled lines at anterior and posterior margin on scutum separated by dark scaled areas, instead of being connected by marginal yellow scales in male. Mid scutellar lobe with narrow yellowish scales admixing a few dark ones laterally ; lateral lobes with a few narrow dark scales. Postspiracular area with 1-7, usually 2, 3 broad white scales at posterior margin.

Mid femur also with a very faint line of white scales on anterior surface in a basal one-third of the segment. Fore tarsus additionally with narrow pale basal band on II ; mid tarsus with slightly broader basal pale band on I-III, additionally with a pale basal band of variable length on IV in some specimens ; hind tarsus each with nearly the same or slightly broader band on I-IV. Tarsal claws equal, fore and mid each with one tooth, hind slightly smaller and simple. Abdominal dorso-basal white bands much smaller or reduced, being disconnected with lateral white patches.

LARVA (description from 3 larvae and 4 larval skins of 3♂♂ and 1♀)

Closely resembles the larva of *Aedes (F.) nipponicus* Lacasse et Yamaguti, 1948. (See Plate I, A and B and also Tables 1, 2, and 3)

Head (Plate I, A) : Preclypeal long and slender. Head hair 4, 5, 6, 7, and 11 well developed branched hairs. Roots of 5 usually slightly posterior to or nearly on the line of roots 7, these hairs usually slightly posterior to the level connecting antennal bases. The distance between the roots of 5 nearly the same or slightly wider than the distance 5 and 7 of one side. 6 anterior by about 1/3 distance between roots 5 and slightly outer to 5. 4 fairly internal to 5 and a little nearer to the level of roots 6. *Antenna* fairly long and slender ; shaft spinulate coarsely and finely ; with one seta, one spine, and one proximally chitinized digitiform process at tip and two setae near tip, one long and the other nearly 1/3 the length of the former ; antennal hair inserted

dorso-laterally at a level slightly lower than the middle, fairly exceeding or nearly equal to the tip of the shaft.

Anal segments (Plate I, B) : Siphon, index 2.9-3.3, with small oval acus on base (omitted, however, in the figure) ; siphonal hair with 3-6 long branches, inserted at a level slightly basal to middle, and some distance apart from the end of the line of pecten teeth. Pecten teeth slightly larger towards tip, base of tooth rather wide one-third, with several small and a large denticles along the widened edge. Saddle narrowly incomplete ventrally, with small spines on posterior surface ; saddle hair usually single ; inner caudal tuft of dorsal brush with 3-4 (rarely 5) branches ; outer long and single ; ventral brush of 10 tufts with each 2-4 or rarely more branches. Anal gills long and rounded at tip, longer dorsal ones 2.3-2.4 times and shorter ventral ones 1.8-1.9 times as long as the saddle. Comb with 6-17 scales in a very irregular line ; basal half of the scale flattened and fringed finely, apical half strong and sharply pointed.

The larva of *Aedes (F.) koreicooides* resembles that of *Aedes (F.) nipponicus* and accordingly the branching of hairs and the number of some structures will be compared in Tables 1 and 2. The measurements in *koreicooides* were made with 3 larvae and 4 larval skins of 3 males and one female, and in *nipponicus* were mainly quoted from Yamaguti and LaCasse (1950).

PUPA (Plate I, D)

The branching of hairs on segment VIII and the shape of paddle very similar to those of *Aedes nipponicus*. Hair 8 on VIII long, with 2-4 subequal barbed branches ; hair 5 slender, single and simple. Paddle oval in shape ; the length 1.4-1.6 times as long as the width ; margin finely pilose at apical one-third ; paddle hair rather long, single or rarely bifid, simple or finely barbed. Trumpet rather long (longer than in *nipponicus*).

TAXONOMIC DISCUSSION

Sasa et al. (1950) showed a double median line

Table 1 Branching of hairs of *Aedes koreicoides*
comparing with that of *Aedes nipponicus*

Part	Hair number after Belkin	<i>nipponicus</i>		<i>koreicoides</i>		Part	Hair number after Belkin	<i>nipponicus</i>		<i>koreicoides</i>		Remark	
		Range	Range		Remark			Range	Range				
			extreme	usual					extreme	usual			
Head	4	6-12	10-18	12-15	developed	Meso-thorax	4	1- 2	1- 2	1- 2			
	5	8-18	3- 8	4- 6			5	1	1- 2	1	rarely 2		
	6	7-12	4-10	6- 8			6	3	3- 4	3- 4			
	7	6-16	4-14	8-11			7	1	1	1			
	8	1- 2	2- 3	2			8	4- 6	5- 6	5- 6			
	9	4- 7	2- 4	2- 4			9	4- 5	3- 5	4			
	10	1- 4	3- 4	3				10	1	1	1	very long	
	11	10-30	8-18	11-16				11	1- 2	2- 3	2- 3	minute	
	12	2- 4	2- 4	2- 3				12	1	1	1	long	
	Pro-thorax	13	1- 2	2- 3	2- 3			13	8-10	7-12	7- 9		
		14	1- 3	1	1			14	3- 6	6- 9	6- 9		
		15	2- 4	2- 4	2- 4			Meta-thorax	1	3- 6	1- 5	2- 3	
		Ah	6-13	3- 7	4- 6		developed		2	1	1- 2	1- 2	
		0	7- 9	5- 8	5- 8				3	2- 5	3- 4	3- 4	
1		4-11	2- 3	2- 3	} tandem	4	2- 5		1- 3	2- 3			
		2	1	1		5	2- 5		1	1	minute		
		3	3- 5	2- 6		2- 3	6		1	1	1		
		4	1- 2	2		2	7		4- 9	3- 7	4- 6		
5		2- 3	2- 3	2		8	6- 7		5- 7	5- 7			
6		1	1	1		9	3- 5		3- 4	3- 4			
7		3- 6	2-3	2- 3			10		1	1	1	very long	
8		4- 9	2	2	rarely 3 short		11		1- 2	2	2	minute	
9		2	1	1	rarely 2		12		1	1	1	short	
10	1	1	1		13	3-10	3- 5		3- 5				
11	1	1	1	short	Pentad	1	3- 7		2- 3	2- 3			
12	2- 3	1- 3	1- 3	rarely 5		3	4- 8	4- 5	4- 5				
14	2- 3	1- 3	1- 3			5	4- 8	4	4				
Meso-thorax	1	4- 7	1- 4	3		Siphonal hair		4- 6	2- 6	3- 4			
	2	1	1	1	rarely 2	Saddle hair		1- 4	1	1	rarely 2		
	3	1- 2	1	1		Anal brush		see text					

Ah : Antennal hair

Table 2 Numbers of teeth and scales of *Aedes nipponicus* and *A. koreicoides*

Structures	<i>nipponicus</i>		<i>koreicoides</i>	
	Range	Remark	Range	Remark
Mentum teeth	17-21	Arranged in a row	19-23	Arranged quite irregularly
Comb scales	8-13		6-17	
Pecten teeth	16-24		10-21	

of yellow scales on scutum. In our specimens of 8 males and 9 females, however, all with only a single line. It seems therefore that the median line tends to appear double. The other characteristics are nearly same as given in the original description by them. As suggested by them, at least judging from the ornamentation of adults, this species seems to be a member of *Chrysolineatus* subgroup (of group D in subgenus *Finlaya*) proposed by Knight (1952). However, one thing to be noticed is that the postspiracular area of this species is nearly bare having only one or two broad white scales in male, and 1-7, usually 2,3 in female at its posterior margin, and another one is that this species has no ventrobasal line of white scales on costa of the wing.

The adults of this species resembles closely *Aedes* (*F.*) *koreicus* which is distributed in Korea and Hokkaido. *Aedes japonicus*, widely distributed in Japan from Hokkaido to Kyushu, resembles closely *Aedes koreicus*, having not rarely a white basal band

on the IV hind tarsal segment. Consequently, to distinguish with each other is needed. Table 3 may give a key to adults of these three species.

Aedes koreicoides has a conspicuous basal lobe on basistyle in male genitalia. This seems that this species is standing alone not only in *Chrysolineatus* subgroup but in group D of subgenus *Finlaya*.

Larva quite differs among those of group D and resembles *niveus* subgroup of group H. Among the subgroup this species resembles closely *Aedes* (*F.*) *nipponicus* LaCasse et Yamaguti, 1948. However, *koreicoides* differs from *nipponicus* in the following characters: Head hair No. 5 far behind and slightly posterior to the level of 7 or these hairs roughly in a horizontal line, and this line again slightly posterior to or rarely on a level connecting antennal bases, instead of the level of 7 being slightly anterior to the level of antennal base, and 5 being anterior to or on the level of 7; ventral brush in this species of ten tufts, while in *nipponicus* the brush of 8 tufts.

Table 3 Comparison of pleural patches

Species	Paratergite	Subspiracular	Postspiracular
<i>koreicoides</i>	with	with	with only 1-2 scales in male, 1-7, usually 2,3 in female
<i>koreicus</i>		with (1)	with dense patch (2)
<i>japonicus</i>	without	without	with dense patch

(1) Knight (1947) and Yamaguti and LaCasse (1950)

(2) Yamaguti and LaCasse (1950)

Additionally, the differences in the number of branching of hairs especially of those shown by gothic type in Table 1 are also helpful for differentiating this species from *nipponicus*.

BIONOMICS

The larvae were collected on September 5, 1959 for the first time and on March 10, 1960, and on May 13, 1960 in a large tree hole. The tree hole is in jungle at the slope, about 550 meters above the sea, of Mt. Tochu (900 meters above the sea) in Misakubo town, Iwata-gun, Sizuoka Prefecture, Japan. The hole is about 50cm in diameter and 250cm in depth. The water was nearly always reddish in color and was about 7.0 in PH. Since the discovery of the larvae of *Anopheles (A.) omorii* Sakakibara, 1959, on July 21, 1956 in this tree hole, continuous larval survey has been made and eleven mosquito species have been collected: ten species having been reported by Sakakibara (1960) and a species being dealt with in this report.

List of mosquito species collected
in the tree hole

- (1) *Anopheles (Anopheles) omorii* Sakakibara, 1959

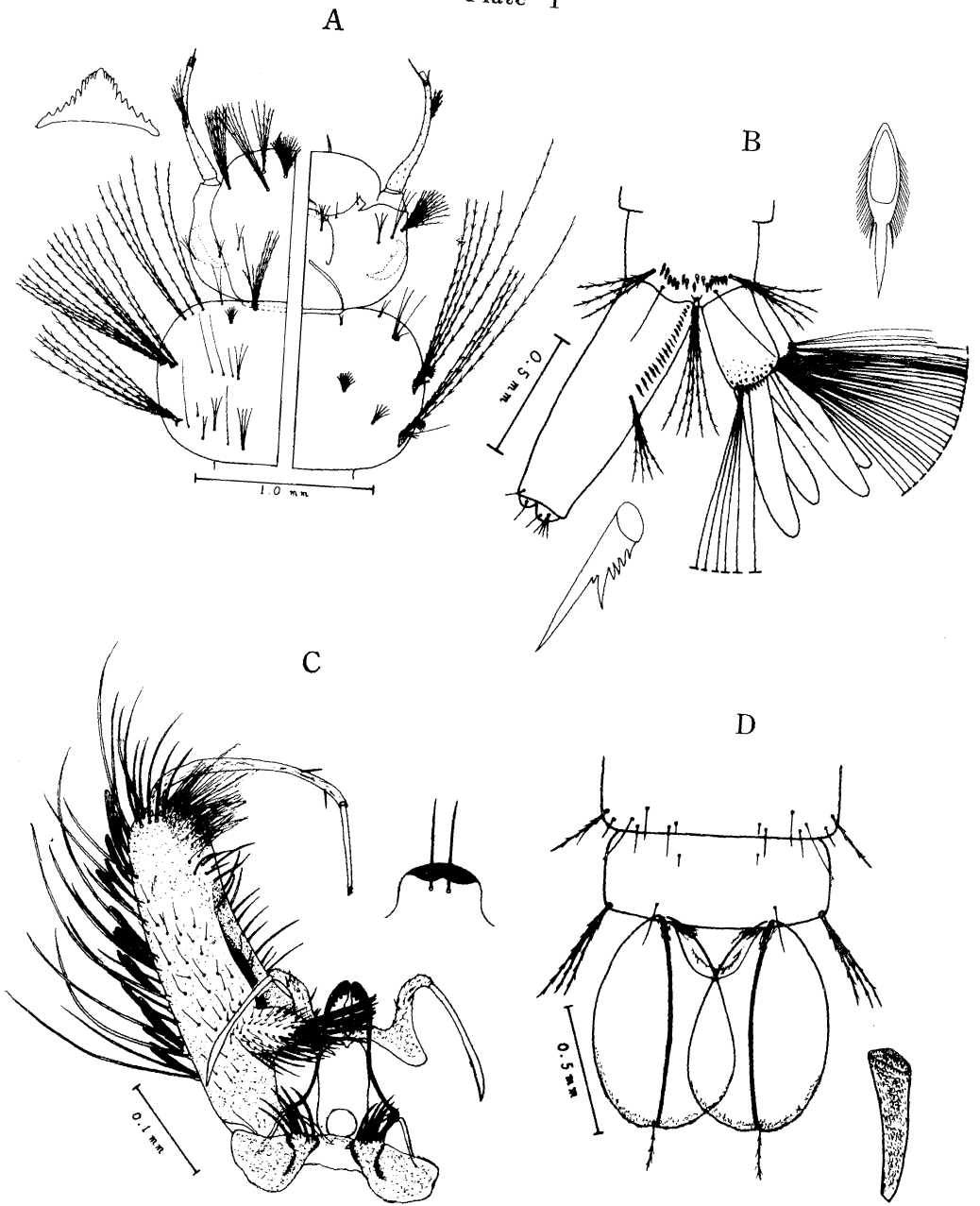
- (2) *Culex (Culiciomyia) kyotoensis* Yamaguti et LaCasse, 1952
 (3) *Tripteroides (Triptsroides) bambusa* Yamada, 1917
 (4) *Armigeres (Armigeres) subalbatus* (Coquillett, 1898)
 (5) *Megarhinus towadensis* Matsumura, 1916
 (6) *Aedes (Finlaya) kobayashii* Nakata, 1956
 (7) *Aedes (Finlaya) buranoki* Sasa et Ishimura, 1951
 (8) *Aedes (Finlaya) japonicus* (Theobald, 1901)
 (9) *Aedes (Stegomyia) galloisi* Yamada, 1921
 (10) *Aedes (Stegomyia) albopictus* (Skuse, 1895)
 (11) *Aedes (Finlaya) koreicoides* Sasa et al., 1950

The authors wish to express their sincere appreciation to Prof. M. Miyagawa of Nagoya University School of Medicine for his invariable encouragement to continue the work, and to Miss S. Ito of the Department of Medical Zoology, Research Institute of Endemics, Nagasaki University for her assistance in drawing the figures. They also wish to acknowledge their indebtedness for the assistance received during the course of this work from the Director of Kune Mine, the staffs of Kune Mine Hospital and to the officers of Misakubo Forestry Office.

REFERENCES

- 1) **Barraud, P. J.** : The fauna of British India, Ceylon and Burma. Diptera, Vol. V, 1934.
 2) **Belkin, J. N.** : A revised nomenclature for the chaetotaxy of the mosquito larva (Diptera : Culicidae). Amer. Midl. Nat., 44(3) : 678—698, 1950.
 3) **Belkin, J. N.** : The homology of the chaetotaxy of immature mosquitoes and a revised nomenclature for the chaetotaxy of the pupa (Diptera, Culicidae). Proc. Ent. Soc. Wash., 54(3) : 115—130, 1952.
 4) **Colless, D. H.** : Notes on the Culicine mosquitoes of Singapore IV. The *Aedes niveus* subgroup (Diptera, Culicidae) : Introduction and description of five new species and of one new subspecies. Ann. Trop. Med. Paras., 52(4) : 468—483, 1958.
 5) **Colless, D. H.** : Notes on the Culicine mosquitoes of Singapore V. The *Aedes niveus* subgroup (Diptera, Culicidae) : Previously described species and keys to adults and larvae. Ann. Trop. Med. Paras., 53 (2) : 166—179, 1959.
 6) **Edwards, F. W.** : Genera Insectorum, Diptera, Family Culicidae, 1932.
 7) **Knight, K. L.** : The *Aedes (Finlaya) chrysolineatus* group of mosquitoes (Diptera : Culicidae). Ann. Ent. Soc. Amer., 40(4) : 624—649, 1947.
 8) **Knight, K. L.** and **Chamberlain, R. W.** : A new nomenclature for the chaetotaxy of the mosquito pupa, based on a comparative study of the Genera (Diptera : Culicidae). Proc. Helminth. Soc. Wash., 15(1) : 1—10, 1948.
 9) **Knight, K. L.** and **Hull, W. B.** : The *Aedes* mosquitoes of the Philippine Islands 1. Keys to

Plate 1



species. Subgenera *Mucidus*, *Ochlerotatus* and *Finlaya* (Diptera, Culicidae). Pacific Sci., 5(3): 211—251, 1951.

10) Knight, K. L. and Marks, E. N.: An annotated checklist of the mosquitoes of the subgenus *Finlaya*, genus *Aedes*. Proc. U. S. Nat. Mus., 101: 513—574, 1952.

11) Sakakibara, M.: On the seasonal distributions of the larvae of *Anopheles (A.) omorii* and nine other mosquito species found in a tree hole. Endem. Dis. Bull. Nagasaki, 2(3): 236—242, 1960.

12) Sasa, M., Kano, R. and Hayashi, S.: A new species of mosquito, *Aedes koreicoides* n. sp., from Hokkaido. Japan. J. Exp. Med., 20: 627—629, 1950.

13) Sasa, S. and Nakahashi, Y.: A new species of the *Aedes (Finlaya) niveus* subgroup of mosquito from Japan. Japan. J. Exp. Med., 22(3): 257—265, 1952.

14) Yamaguti, S. and LaCasse, W. J.: Mosquito fauna of Japan and Korea, 1950.

EXPLANATION OF PLATE

- Plate I, A: Head and thorax of the larva of *Aedes (F.) koreicoides*
 B: Anal segments of the same
 C: Male genitalia of the same species
 D: Anal segments of the pupa of the same

総 括

静岡県下戸中山の森林内の一樹穴から1960年3月10日、5月13日に一種の蚊幼虫を採集し飼育羽化せしめた成虫を精査した結果、佐々等(1950)が新種として記載した *Aedes (Finlaya) koreicoides* と同一種である事を確めた。佐々等は♀、♂成虫の外部形態及び♂の外部生殖器の記載をしているが標本が古かった故もあって不十分な所もあり、吾々はその記載に多少不備な点のある事も認めたので、♀、♂成虫の外部形態及び♂の外部生殖器の再記載を行い、同時に本種の幼虫及び蛹の記載を行った。

♀、♂の外部形態は *japonicus* や *koreicus* に近いが、第3表に示すように、本種ではSubspiracular area に斜線をなす鱗片群があるのに *japonicus* ではこれを欠く点で、又、本種のPostspiracular area には広い白色鱗片が♂では僅かに1、2、♀でも2、3枚が、而もそのareaの後端に生ずるに過ぎないのに反して、*koreicus* (Yamaguti and LaCasse, 1950による) 及び *japonicus* では、そのareaを蔽う程度の鱗片群を生ずる点で異なる。

♂の外部生殖器はそのBasistyleに顕著な基葉のある点で、近似種群とは著しく異なる。

幼虫は *niveus* group のものに近く、特に *nipponicus* に近似するが、本種では触角が稍細長く、小刺は疎で小である。亜先端毛は1本は長く、1本は短い。頭部のNo.5及びNo.7毛はより後方に位置する。第8腹節の側鱗は極めて不規則に生ずる。尾葉が非常に長い。末端節のVentral brushは10房よりなる(*nipponicus* では8房からなる)。以上の諸点は *nipponicus* と比較して、本種の著しい相違点であるが更に第1及び2表に示したような諸毛の分岐数の多少の差も鑑別の助けとなる。