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原 報

The pupae of Japanese *Anopheles*

BY

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INTRODUCTION

Since M. Yamada (1936) made taxonomical descriptions about four kinds of pupae of Korean *Anopheles*, Takada (1949) made a brief description on the pupa of *A. lindesaii japonicus*, Mizukawa (1950) observed the external form of *A. sinensis*, Kaida (1951) compared of *A. lesteri* pupa with that of *A. sinensis*, Asanuma & Nakagawa (1954) constructed the key to the genera based on pupal chaetotaxy of Japanese mosquitoes and figured the abdomen of *A. sineroides* pupa, and La Casse & Yamaguti (1955) illustrated four species and one subspecies of the Japanese anopheline pupae with figures of important parts, but they did not make any description.

The author has made a comparative study on the pupae of six species of the Japanese *Anopheles*, and has found some characters available for distinguishing these from one another. The author will hereby report the result of his work.

MATERIALS AND METHODS

Specimens observed are as follows:

Anopheles sinensis from Niigata Pref.

Anopheles lesteri from Niigata Pref.

Anopheles yatsushiroensis from Fukuoka and Kumamoto Prefs.

Anopheles sineroides from Niigata Pref.

Anopheles koreicus from Kumamoto Pref.
Anopheles lindesaii japonicus from Shizuoka Pref.

Specimens of *A. lindesaii japonicus* were obtained from the culture of larvae collected in mountain streams. As to the other anophelines, engorged females were collected from cow-barns and reared separately in a test tube under the room temperature (about 20–28°C). Each of them was fed on diluted sugar solution from a saturated cotton pad stuffed in the test tube. The criterion of species was made by examining characters of eggs deposited. Then the eggs were transferred to Petri dishes to permit their incubations. Hatched larvae were fed with yeast in a laboratory until they became pupae.

The pupal pelts thrown off in the water by emergence of the adults were preserved in a 10 % formalin solution. These pelts were mounted in a gum-chloral solution and were observed under the binocular microscope.

KEY TO THE SPECIES OF THE JAPANESE *ANOPHELES*

The terminology of external form of the pupa used in this paper is given in Table 1.

1. Male palpal sheath prolonged at the tip (Fig. 3, a). Hairs 2 of III and IV abdominal segments usually branched more than seven (Table 3). Lateral spines (hair 8) translucent, with rounded apices (Fig. 7, 1-4). Hairs 1 of abdominal segments usually branched (Table 2). . .

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Table 1. Terminology of the pupa

Cephalothorax

Head	{	Vertical plate	
		Clypeal plate	
		Supraocular plate	
		Ocular plate	Hairs CT 1-3
		Antennal sheath	
		Sheaths of mouth parts	
		Labrum sheath	
		Mandibular sheath	
		Maxillary sheath	
		Palpal sheath	
		Labial sheath	
Thorax	{	Dorsal plate (Dp)	Hairs CT 4-9
		Median ridge (Mr)	
		Pronotal process (Prp)	
		Trumpet (Tr)	
		Wing sheath (Ws)	
		Leg sheaths	
		Metanotum	Hairs MT 10-12
		Metanotal bar (Mtb)	

Abdomen

- Tergite (I-VIII) (Tg)
- Sternite (II-VIII) (Sn)
- Pleural membrane (III-VII) (Plm)
- Intersegmental membrane (II-VIII)
- Postero-median projection of VIII tergum (Pmp)
- Paddle (Pd)
- Genital pouch (Gp)

Hairs :	Segment	Tergite	Sternite
	I	2-8, 10	-----
	II	1-8, 10	absent
	III-V	0, 1-8, 10	9, 11-13
	VI, VII	1-8, 10	9, 11-13
	VIII	1, 5, 8	13

- (*sinensis* group) 2
- Male palpal sheath as long as that of the female. Hair 2 of III and IV abdominal segments usually branched less than six (Table 3). Hairs 1 of abdominal segments usually simple (Table 2). Lateral spines (hair 8) with pointed apices (Fig. 7, 5, 6)4
2. A pair of remarkable dark marking on the dorsal plate between both trumpets (Fig. 2, a)..... *lesteri*
No remarkable dark markings on the dorsal plate3
3. Wing sheath with spotted dark markings along the veins (Fig. 2, b)..... *sinensis*
Wing sheath with obscure yellowish to dark brown markings along the veins.

- *yatsushiroensis*
4. Paddle broad. Trumpet expanded
..... *koreicus*
Paddle slender (Fig. 6). Trumpet tubular (Fig. 4, b) *lindesaii japonicus*

DESCRIPTIONS

Sinensis group

For the taxonomical convenience, M. Otsuru (1952) treated the following closely allied four Japanese *Anopheles* as the *sinensis* group, namely *A. sinensis*, *A. lesteri*, *A. yatsushiroensis* and *A. sineroides*. This group is distinguished from other Japanese *Anopheles* by following characters.

Male palpal sheath prolonged at the tip.

Table 2. Number of branches of the abdominal hairs 1

Segments		II	III	IV	V	VI	VII	VIII
Species								
<i>A. sinensis</i>	♂	2~3 2.08	2~4 2.92	2~4 2.67	2~4 2.58	2~5 2.83	1~4 2.83	1~2 1.50
	♀	2~3 2.08	2~6 3.00	2~5 2.92	2~4 2.58	2~6 2.83	1~5 2.67	1~2 1.42
<i>A. lesteri</i>	♂	3~6 4.23	3~6 4.00	3~5 3.85	2~5 3.62	2~4 2.92	2~4 2.62	1~4 1.92
	♀	3~5 4.17	4~6 4.42	3~5 3.92	2~5 3.67	2~4 3.42	2~4 2.75	1~3 2.08
<i>A. yatsushiroensis</i>	♂	2~4 3.08	2~4 3.00	2~4 3.42	3~4 3.33	2~4 3.17	2~4 2.91	1~2 1.50
	♀	2~4 2.91	2~5 3.58	2~4 3.17	2~4 3.25	2~4 2.83	2~4 2.75	1~2 1.25
<i>A. sineroides</i>	♂	3~5 3.45	3~5 3.33	2~4 2.75	2~4 2.58	1~4 2.58	2~3 2.33	1~3 1.42
	♀	2~5 3.50	2~4 3.08	2~4 2.92	1~5 2.53	1~3 2.27	2~5 2.42	1~2 1.33
<i>A. koreicus</i>	♂	1 1.00	1~2 1.17	1 1.00	1 1.00	1 1.00	1 1.00	1 1.00
	♀	1 1.00	1~2 1.08	1 1.00	1 1.00	1~2 1.08	1 1.00	1 1.00
<i>A. lindesau japonicus</i>	♂	1 1.00	1 1.00	1 1.00	1~2 1.08	1 1.00	1~2 1.17	1 1.00
	♀	1~2 1.08	1 1.00	1~2 1.08	1 1.00	1~2 1.08	1~2 1.17	1 1.00

Trumpet expanded, lightly pigmented or slightly dark. Wing sheath with a certain pattern. Hairs 1 of abdominal segments usually branched. Hairs 2 and hairs 5 of III and IV abdominal segments usually well branched. Hairs 8 (lateral spines) translucent, short, with rounded apices. Hair 8 of VIII segment usually well branched.

1. *Anopheles (Anopheles) sinensis*

Wiedemann, 1828

(Description based on 12 males
and 12 females)

Pupal pelt moderately pigmented.

Cephalothorax: Vertical plate somewhat squarish, with some polygonal sculptures at the center and at the base. Male palpal sheath prolonged at the tip and clearly distinguished from that of the female. Antennal sheath and leg sheaths with dark brown bands. Trumpet expanded, somewhat shoe-shaped, lightly pigmented, the slit of trumpet at the hind margin (mental cleft) broken into deeply. Wing sheath

with spotted dark brown markings along the veins. Leg sheaths with numerous brown bands. Longitudinal wrinkles of metanotal bar not so striking. Either side of the metanotum with an obscure dark marking.

Abdomen: Paddle broad; buttress and midrib slightly pigmented, the latter obscure towards posteriorly. External toothed margin of the paddle about two-thirds of the length; fringe hairs small and scattered. Male genital pouch slightly pigmented on the distal half (Fig. 5, a). Hairs 1 of abdominal segments usually branched. Hair 2 of III segment with 9-26 branches, usually 12-21; hair 2 of IV, 9-18. Hair 5 of III, 10-32, usually 13-22; hair 5 of IV, 9-29, usually 13-25. Hairs 8 (lateral spines) translucent, tapering towards apices, but with rounded apices. Hairs 8 of II-VII segments gradually enlarged towards posterior segments, the largest spine on VII segment. Hair 8 of VIII segment 12-24 branched, average 17.8.

2. *Anopheles (Anopheles) lesteri*

Baisas et Hu, 1936

(Description based on 12 males
and 13 females)

Pigmentation pattern generally well-developed (Fig. 1 and Fig. 2, a)

Cephalothorax: Male palpal sheath prolonged at the tip. A pair of dark markings on the dorsal plate between both trumpets. Several dark spots before the trumpet and at the base of wing sheath. Trumpet expanded, somewhat dark. Wing sheath with yellowish to dark brown patterns along the veins, usually adding dark brown cross stripes. Dark brown bands of antennal sheath and leg sheaths, and metanotal markings are generally darker than those of *sinensis*. Pigmentation around roots of each metanotal hair.

Abdomen: Pigmentation present around roots of hairs 3, 4, 5 and 6 of I segment, hairs 3 and 5 of II segment, hairs 3 of III-VII segments and hair 1 of VIII segment; sometimes around roots of hair 4 of III segment and hairs 12 of V-VII segments; rarely hairs 5 and 6 of III segment and hair 4 of IV segment. Moreover some obscure dark markings on the tergites of abdominal segments. Generally pigmentation is gradually weakened towards posterior segments. Hair 2 of III segment 7-12 branched, usually 11-16; hair 2 of IV, 5-17, usually 9-13. Hair 5 of III, 12-34; hair 5 of IV, 16-35. Hair 8 of each segment closely resembles that of *sinensis*.

3. *Anopheles (Anopheles) yatsushiroensis*

Miyazaki, 1951

(Description based on 12 males
and 12 females)

Cephalothorax: Male palpal sheath prolonged at the tip. Trumpet expanded, lightly pigmented. Wing sheath resembles that of *lesteri*. Leg sheaths with numerous brown bands.

Abdomen: Male genital pouch and paddle resemble those of *sinensis*. Hairs 1 of abdominal segments usually branched. Hair 2 of III segment 7-22 branched; hair 2 of IV, 9-23. Hair 5 of III, 6-24 branched; hair 5 of IV, 13-31. Hair 8 of VII segment stumpy, its index of length/width 2.59-4.07, average 3.59 in the male, 3.41 in the female. Hair 8 of VIII with branches as many as those of *sinensis*.

4. *Anopheles (Anopheles) sineroides*

Yamada, 1924

(Description based on 12 males
and 12 females)

Cephalothorax: Male palpal sheath prolonged at the tip. Trumpet expanded, lightly pigmented. Wing sheath with yellowish to dark brown stripes along the veins. Brown bands of leg sheaths faint or absent.

Abdomen: Male genital pouch and paddle resemble those of *sinensis*. Hairs 1 of abdominal segments usually branched. Hair 2 of III segment 7-19 branched, usually 14-19; hair 2 of IV, 8-20, branched, usually 9-13. Hair 5 of III, 10-22, usually 13-18; hair 5 of IV, 9-17, usually 9-14. Hair 8 of VII stumpy, its index of length/width 2.82-4.65, average 3.82 in the male, 3.73 in the female. Hair 8 of VIII with branches as many as those of *sinensis*.

5. *Anopheles (Anopheles) koreicus*

Yamada et Watanabe, 1918

(Description based on 6 males
and 12 females)

Cephalothorax: Male palpal sheath as long as that of female. Trumpet expanded, somewhat dark. Wing sheath resembles that of *lesteri*. Brown bands of leg sheaths almost absent.

Abdomen: Male genital pouch and paddle resemble those of *sinensis*. Hairs 1 of abdominal segments usually simple. Hairs 2 of III and IV segments with 2-6 branches. Hairs 5 of III and IV segments with 4-10 branches usually 5-8. Hairs 8 of II-VII segments black, with pointed or slightly rounded apices, index of length/width of hair 8 of VII segment 5.56-10.10, average 7.22 in the male, 6.78 in the female. Hair 8 of VIII segment with 7-16 branches, average 11.2 in the male, 13.4 in the female.

6. *Anopheles (Anopheles) lindesaii japonicus*

Yamada, 1918

(Description based on 12 males
and 12 females)

Cephalothorax: Male palpal sheath as long as that of female. Trumpet tubular, yellowish brown. Wing sheath with faint pigment along the veins. Leg sheaths without any band.

Table 3. Number of branches of hairs 2, 5 and 8, and indices length/width of hair 8 of VII segment and paddles

		Hairs 2		Hairs 5		Hair 8	Hair 8, VII	Paddle
		III	IV	III	IV	VIII	length/width	length/width
<i>A. sinensis</i>	♂	14~26 19.09	12~17 14.50	13~32 19.25	11~29 17.33	12~13 17.64	4.29~5.39 4.86	1.24~1.40
	♀	9~12 16.00	9~18 14.09	10~27 17.50	9~24 16.92	12~24 18.00	4.00~4.73 4.40	1.33
<i>A. lesteri</i>	♂	11~21 13.84	5~14 9.92	15~34 23.83	16~35 28.62	15~22 19.54	3.08~5.19 4.42	1.32~1.50
	♀	7~18 13.91	8~17 12.97	12~33 20.67	17~35 28.08	17~27 20.25	3.65~4.97 4.36	1.40
<i>A. yatsushiroensis</i>	♂	7~22 12.25	9~19 12.50	6~21 12.55	13~30 21.10	15~21 18.50	3.00~4.07 3.59	1.24~1.59
	♀	8~22 16.25	9~23 13.92	10~24 17.00	17~31 22.58	15~21 18.00	2.59~4.06 3.41	1.31
<i>A. sineroides</i>	♂	7~18 13.58	8~13 11.42	12~19 14.83	9~17 12.50	10~22 17.00	3.09~4.65 3.82	1.46~1.57
	♀	13~19 16.27	9~20 12.00	10~22 15.25	10~16 12.00	15~25 18.92	2.82~4.42 3.73	1.50
<i>A. koreicus</i>	♂	2~5 3.33	2~4 3.00	4~8 6.17	5~7 5.83	7~13 11.17	6.08~8.33 7.22	1.38~1.55
	♀	2~6 4.12	2~6 3.50	6~10 7.50	5~8 6.42	10~16 13.42	5.56~10.10 6.78	1.47
<i>A. lindesai japonicus</i>	♂	2~5 3.00	1~3 1.91	2~4 3.00	2~4 3.09	7~15 10.33	15.33~82.02 19.48	1.73~1.99
	♀	2~5 3.08	1~3 1.83	2~4 2.67	2~5 2.73	9~14 12.17	13.59~22.67 18.78	1.82

Abdomen: Male genital pouch evenly pigmented or somewhat darker on the distal half. Paddle elongated, its index of length/width 1.73-1.99, average 1.82, fringe hairs long and thick, terminal hair long, simple. Hairs 1 of abdominal segments usually simple. Hair 2 of III segment with 2-5 branches; hair 2 of IV, 1-3. Hairs 5 of III and IV segments with 2-4 branches. Hairs 8 of IV-VII segments slender, with pointed apices; hairs 8 of II and III segments of very small spine (Fig. 7, b6), hair 8 of VIII segment with 7-15 branches, average 10.3 in the male, 12.7 in the female.

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Plate I

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Ohmori: The pupae of Japanese *Anopheles*

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Explanations of Plate

Fig. 1. Dorsal and ventral aspects of metanotum and abdomen — *A. lesteri*

Fig. 2. Dorsal plates and wing sheaths
a *A. lesteri*
b *A. sinensis*

Fig. 3. Palpal sheaths of *A. sinensis*
a male, b female

Fig. 4. Trumpets
a *A. sinensis*
b *A. lindesaii japonicus*

Fig. 5. Genital pouches of *A. sinensis*
a male, b female

Fig. 6. Paddle — *A. lindesaii japonicus*

Fig. 7. Lateral spines
a VII abdominal segment
b II abdominal segment
1 *A. sinensis*
2 *A. lesteri*
3 *A. yatsushiroensis*
4 *A. sineroides*
5 *A. koreicus*
6 *A. lindesaii japonicus*

* Written in Japanese

Two new mosquito records from Japan

(Diptera: Culicidae)

Taxonomical and ecological studies on mosquitoes of Japan

(Part 13)

BY

Jun Hara

Taxonomical and ecological project on the mosquitoes of the northern parts of Honshu, Hokkaido and on the high mountainous regions of Japan have been carried out by the author and the members of his department, and since 1955 many surveys were done in Hokkaido, Towada District in Aomori Prefecture, Oze in

Gumma Prefecture, and on Japan Alps. Many new records of distribution of the species found already in the certain part of Japan, such as *Aedes* (*Ochlerotatus*) *punctor* at Oze and *Culiseta kanayamensis* at Oze and Kamikochi, were obtained by these surveys and new record species from Japan, such as *Aedes* (*Aedes*) *ros-sicus* (type locality: Ussuri Land, Siberia) was found in Towada District and the detail was reported by the author in 1958.

Successive survey was done from 13th to 25th of May, 1959 and two noteworthy

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