

## Notes on the *Aedes (Finlaya) chrysolineatus* Subgroup in Japan and Korea (Diptera : Culicidae)\*

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### Introduction

So far as the author is aware, three species viz. *Aedes (Finlaya) japonicus* (Theobald) 1901, *Aedes (Finlaya) koreicus* (Edwards) 1917 and *Aedes (Finlaya) koreicoides* Sasa, Kano and Hayashi 1950 have been known to occur in Japan and Korea, while *Aedes shintiensis* in Taiwan and Southern Ryukyu is now being considered as a subspecies, that is, *Aedes (Finlaya) japonicus shintiensis* Tsai and Lien 1950. Among these three species, *japonicus* which are known to occur in Japan, Taiwan, Korea, China and Soviet Far East, is closely related to *koreicus* from Korea, China and Japan(?), therefore, both the species have been frequently confused one another. Barraud (1934), Knight (1947 and 1968) and Yamaguti and LaCasse (1950) considered undoubtedly that *koreicus* would be a distinct species, being characterized by the following aspects:-

The larva has no enlarged simple pecten tooth which inserts beyond the base of the siphon hair tuft. The adult has prominent basal pale bands on segments I-IV of the

hind tarsus and subspiracular area bearing a line of broad white scales.

On the other hand, Edwards(1922) suggested that *koreicus* has a possibility to be a variety of *japonicus* and then Nakata(1954) recognized that the already-known characters of *japonicus* were variable and variability might be influenced remarkably by the environmental temperature. Sato (1958) also recorded that the conspicuous variations were observed in the characters of the mosquitoes of the *Aedes chrysolineatus* subgroup collected from a small rock-pool of Kamukotan area of Hokkaido and it was impossible to identify these mosquitoes as any one of *japonicus*, *koreicus* and *koreicoides*. The original description of *koreicoides* was made by Sasa et al (1950) on the adult mosquitoes collected from Hokkaido and later Sakakibara and Omori (1962) redescribed on adults, pupae and larvae of this species collected from Shizuoka prefecture, Honshu. This species, while nearest to *koreicus*, was considered to stand alone in the *chrysolineatus*

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subgroup proposed by Knight(1968).

In recent years have been accumulated at the hand a considerable number of the mosquitoes belonging to the *chrysolineatus* subgroup which were collected from Japan and Korea. On the basis of the descriptions of *japonicus*, *koreicus* and *koreicoides* in the reports of Knight (1947 and 1968), Sasa et al (1950), and Sakakibara and Omori(1962), the specimens examined were identified as

any of the above-mentioned three species.

In this paper, a comparative study was done on the morphology of these three species, especially on the variation of the important characters of *japonicus* and *koreicus* and from the results, the distinction of the two species and the subspecific status of the Taiwan-and-Ryukyu form, *Ae. japonicus shintiensis*, were discussed.

### Materials and Methods

The full-grown 4th inster larvae and pupae were collected from the fields and the half of them were preserved in the MacGregor's solution and they were reared with the yeast. The emerged adults were kept alive at least for 24 hours and them made pinning specimens. The larval and pupal skins got from the same mosquito were also examined occasionally. The terminology used in this paper conforms to that of Belkin(1962).

#### SPECIMENS EXAMINED

*Aedes japonicus*:- JAPAN, Hokkaido Sapporo 21 females, 17 males, 13 larvae, June to July 1966, collected by Miyagi. Honshu, Aomori Pref. 13 larvae, 8 July 1969, collected by Omori and Suenaga. Kyushu Nagasaki Pref.(including Tsushima Is.) 23 females, 13 males, 18 larvae, Apr. to Sept. 1969 and 1971, collected by Miyagi. Nagasaki Pref. 13 females and 9 males with corresponding larval and pupal skins, May 1971, collected by Miyagi. Ryukyu Is., Iriomote-jima, 10 females, 4 males, 27 larvae, July 1968, collected by Miyagi. KOREA, Cheju Is., 5 females, 2 males, 19 larvae, 8 Sept. 1970, collected by Wada. TAIWAN, Taipei, 6 females, 5 males (Cu-721), 3 Apr. 1969 and Taitung 4 larvae (Cu-259), 11 Feb. 1968, identified by Lien as *Ae. japonicus shintiensis*.

*Aedes koreicus*:- KOREA, Seoul, 6 females, 6 males, 18 larvae, Aug. 1969, identified by Lien as *koreicus*.

*Aedes koreicoides*:- JAPAN, Honshu, Shizuoka Pref. 3 females, 4 males, 9 larvae, May 1960 and April 1961, identified by Sakakibara and Omori as *koreicoides*.

*Aedes (Finlaya) japonicus* (Theobald)  
*Culex japonicus* Theobald, Mon. Cul. 1:385, 1901

*Aedes eucleptes* Dyar, Insect. Inscit. menst. 9:147, 1921; Edwards, Ind. Jour. Med. Res. 10:465, 1922(synonym).

*Aedes (Finlaya) japonicus*: Edwards, Bull. Ent. Res. 12:318, 1921; Stackelberg, Faunae de l'URSS, Insectes Dipteres, Family Culicidae, 3:182, 1937; Knight, Ann. Ent. Soc. Amer. 40: 631, Yamaguti and LaCasse, Mosq. Fauna Japan and Korea, 151, 1950; Hara, Japan. J. Exp. Med. 27:85, 1957; Bohart, Mosq. News, 19:196, 1959; Kurihara, Jap. J. Sanit. Zool. 14:195, 1963; Knight, Contrib. Amer. Ent. Inst. 2(5): 15, 1968; Kamimura Jap. J. Sanit. Zool. 19:30, 1968.

*Aedes (Finlaya) shintiensis* Tsai and Lien, J. Med. Ass. Formosa, 49:177, 1950; Lien, Pacif. Ins. 4:623, 1962 (as ssp. of *japonicus*); Knight, Contrib. Amer. Ent. Inst. 2(5):17, 1968(as ssp. of *japonicus*) **Syn. n.**

The following description is based on the redescription of Knight (1968) and on the examination of the specimens from Japan and Taiwan.

ADULT. Torus with pale broad scales medially; proboscis dark scaled entirely; vertex with dark upright forked scales, and with medial area of pale upright forked scales. Acrostical line on scutum broad, tending to appear double; dorsocentral line double on posterior half, the anterior end of outer portion bending outwards along

scutal angle; a broad diffused pale area over wing base. Paratergite and *ssp* (subspiracular area) without broad white scales; *ppm* (posterior pronotal area) with yellowish narrow curved scales anteriorly, a small patch of broad white scales ventro-posteriorly; considerable variation exists in the arrangement and amount of scales; *psp* (postspiracular area) with dense white scales; hind tarsus with prominent basal white bands on segments I-III, occasionally a few basal pale scales on segment IV. Male genitalia: lobes of IX tergite each with 3-8 setae; tergo-mesal margin of sidepiece with 5-6 strongly developed setae; basal tergo-mesal margin of sidepiece with 5-6 strongly developed setae; basal tergo-mesal lobe not particularly swollen.

LARVA: Head hairs 4, 5, 6-C with 2-6 branches; comb consisting of about 43-85 scales; each tooth slightly enlarged apically and bearing a rather even lateral and apical fringe; pecten with 10-24 teeth, with 1-5 ventral denticules along basal half of each tooth; 1-4 irregularly spaced non-denticulate teeth beyond base of siphon hair tuft; saddle with mostly simple scales on posterior margin.

#### VARIATIONS

Variations have been observed in several characters of the larval and adult specimens at hand.

(1) *Number of irregularly spaced enlarged simple pecten tooth which inserts the base of siphon hair tuft.*

Nakata (1954) pointed out that the development of the teeth tends to be influenced obviously by the temperature, being developed lesser degree in lower temperature (2.4-24.2°C) than in the higher temperature (30°C).

As shown in Table 1, the number of irregularly spaced enlarged simple pecten teeth

**Table 1.** Variation in number of simple pecten tooth inserted beyond siphon hair tuft in 4th instar larvae of *Ae. japonicus*

| Locality<br>(No. examined)         |     | No. pecten beyond siphon<br>hair tuft |      |      |      |      |
|------------------------------------|-----|---------------------------------------|------|------|------|------|
|                                    |     | 0                                     | 1    | 2    | 3    | 4    |
| Hokkaido<br>&<br>N. Honshu<br>(25) | L   | 0                                     | 10   | 12   | 2    | 1    |
|                                    | R   | 2                                     | 13   | 6    | 1    | 3    |
|                                    | Av. | 1.0                                   | 11.5 | 9.0  | 1.5  | 2.0  |
|                                    | %   | 4.0                                   | 46.0 | 36.0 | 6.0  | 8.0  |
| Kyushu<br>(23)                     | L   | 0                                     | 6    | 12   | 5    | 0    |
|                                    | R   | 0                                     | 6    | 9    | 7    | 1    |
|                                    | Av. | 0                                     | 6.0  | 10.5 | 6.0  | 0.5  |
|                                    | %   | 0                                     | 26.1 | 45.7 | 26.1 | 2.2  |
| Cheju Is.<br>(19)                  | L   | 0                                     | 5    | 9    | 2    | 3    |
|                                    | R   | 0                                     | 3    | 10   | 5    | 1    |
|                                    | Av. | 0                                     | 4.0  | 9.5  | 3.5  | 2.0  |
|                                    | %   | 0                                     | 21.1 | 50.0 | 18.4 | 10.5 |
| Ryukyu Is<br>(27)                  | L   | 0                                     | 0    | 4    | 13   | 10   |
|                                    | R   | 0                                     | 1    | 2    | 15   | 9    |
|                                    | Av. | 0                                     | 0.5  | 3.0  | 14.0 | 9.5  |
|                                    | %   | 0                                     | 1.9  | 11.1 | 51.9 | 35.2 |
| Taiwan<br>(4)                      | L   | 0                                     | 0    | 2    | 2    | 0    |
|                                    | R   | 0                                     | 0    | 2    | 1    | 1    |
|                                    | Av. | 0                                     | 0    | 2.0  | 1.5  | 0.5  |
|                                    | %   | 0                                     | 0    | 50.0 | 37.5 | 12.5 |
| Total<br>(98)                      | Av. | 1.0                                   | 22.0 | 34.0 | 26.5 | 14.5 |
|                                    | %   | 1.0                                   | 22.4 | 34.7 | 27.0 | 14.8 |

Abbreviations : L, Left side of individual specimen ; R, Right side of individual specimens ; Av. , Average number  $\left(\frac{L+R}{2}\right)$

**Table 2.** Variation in pale hind tarsal bands and white *ssp* scales in *Aedes japonicus* collected from Japan, Cheju Is. and Taiwan

| Locality<br>(No. examined)        |                  | Tarsal band on segment |                |               |               |                |               |              |               | Scales of <i>ssp</i> |   |                |               |
|-----------------------------------|------------------|------------------------|----------------|---------------|---------------|----------------|---------------|--------------|---------------|----------------------|---|----------------|---------------|
|                                   |                  | III                    |                | IV*           |               | IV             |               | ?            |               | P                    |   | O              |               |
|                                   |                  | ♀                      | ♂              | ♀             | ♂             | ♀              | ♂             | ♀            | ♂             | ♀                    | ♂ | ♀              | ♂             |
| 1. Hokkaido<br>38 : 21 ♀<br>17 ♂  | Av.<br>(%)       | 10.5<br>(50.0)         | 9.0<br>(52.9)  | 2.0<br>(9.5)  | 2.0<br>(11.8) | 7.0<br>(33.3)  | 5.5<br>(32.4) | 1.5<br>(7.2) | 0.5<br>(2.9)  | 2.0<br>(9.5)         |   | 19.0<br>(90.5) | 17.0<br>(100) |
|                                   | T. Av.<br>(T. %) | 19.5<br>(51.3)         | 4.0<br>(10.5)  |               |               | 12.5<br>(32.9) |               | 2.0<br>(5.3) |               | 2.0<br>(5.3)         |   | 36.0<br>(94.7) |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |
| 2. Kyushu<br>36 : 23 ♀<br>13 ♂    | Av.<br>(%)       | 17.0<br>(73.9)         | 12.5<br>(96.2) | 1.5<br>(6.5)  | 0.5<br>(3.8)  | 2.5<br>(10.9)  |               | 2.0<br>(8.7) |               |                      |   | 23.0<br>(100)  | 13.0<br>(100) |
|                                   | T. Av.<br>(T. %) | 29.5<br>(82.0)         | 2.0<br>(5.6)   |               |               | 2.5<br>(6.9)   |               | 2.0<br>(5.6) |               |                      |   | 36.0<br>(100)  |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |
| 3. Cheju Is.<br>7 : 5 ♀<br>2 ♂    | Av.<br>(%)       | 5.0<br>(100)           | 2.0<br>(100)   |               |               |                |               |              |               |                      |   | 5.0<br>(100)   | 2.0<br>(100)  |
|                                   | T. Av.<br>(T. %) | 7.0<br>(100)           |                |               |               |                |               |              |               |                      |   | 7.0<br>(100)   |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |
| 4. Ryukyu Is.<br>14 : 10 ♀<br>4 ♂ | Av.<br>(%)       | 10.0<br>(100)          | 4.0<br>(100)   |               |               |                |               |              |               |                      |   | 10.0<br>(100)  | 4.0<br>(100)  |
|                                   | T. Av.<br>(T. %) | 14.0<br>(100)          |                |               |               |                |               |              |               |                      |   | 14.0<br>(100)  |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |
| 5. Taiwan<br>11 : 6 ♀<br>5 ♂      | Av.<br>(%)       | 5.0<br>(83.3)          | 3.5<br>(70.0)  | 0.5<br>(8.3)  | 1.0<br>(20.0) | 0.5<br>(8.3)   |               |              | 0.5<br>(10.0) |                      |   | 6.0<br>(100)   | 5.0<br>(100)  |
|                                   | T. Av.<br>(T. %) | 8.5<br>(77.3)          |                | 1.5<br>(13.6) |               | 0.5<br>(4.5)   |               |              | 0.5<br>(4.5)  |                      |   | 11.0<br>(100)  |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |
| Grand total<br>106 : 65 ♀<br>41 ♂ | Av.<br>(%)       | 45.7<br>(73.1)         | 31.0<br>(75.6) | 4.0<br>(6.2)  | 3.5<br>(8.5)  | 10.0<br>(15.4) | 5.5<br>(13.4) | 3.5<br>(5.4) | 1.0<br>(2.4)  | 2.0<br>(3.1)         |   | 63.0<br>(96.0) | 41.0<br>(100) |
|                                   | T. Av.<br>(T. %) | 78.5<br>(74.1)         |                | 7.5<br>(7.1)  |               | 15.5<br>(14.6) |               | 4.5<br>(4.2) |               | 2.0<br>(1.9)         |   | 104<br>(98.1)  |               |
|                                   |                  |                        |                |               |               |                |               |              |               |                      |   |                |               |

Abbreviations : Av, Average number  $\left( \frac{\text{Left side} + \text{Right side}}{2} \right)$  ; P, Presence of white scales ; O, Absence of white scales ; ?, Specimen lost the hind leg, *ssp*, Subspiracular area ; \*, Progressive stage having a few pale scales on segment IV.

is variable, 1-4. The number is apparently higher in the specimens from Southern Japan (Ryukyu Is.) than in those from Northern Japan (Hokkaido). The frequency distribution in 25 specimens from Hokkaido (including 13 specimens from N. Honshu) is: 11.5 with 1, 9 with 2, 1.5 with 3, 2.0 with 4, very rarely 1.0 with 0, while 27 specimens from Ryukyu Is., the distribution is: 14 with 3, 9.5 with 4, 3 with 2, 0.5 with 1. The distribution of 23 specimens from Kyushu is very similar to that of 19 specimens from Cheju Is., showing intermediate between Hokkaido and Ryukyu specimens as follow: in the specimens from Kyushu 10.5 with 2,

6 with 1 and 3, 0.5 with 4; in the specimens from Cheju Is. 9.5 with 2, 4 with 1, 3.5 with 3, 2 with 4. In 4 specimens from Taiwan (identified as *Ae japonicus shintiensis* by Lien), the distribution is: 2 with 2, 1.5 with 3, 0.5 with 4. All of the examined specimens have 1-4 irregularly spaced pecten teeth except 2 from Hokkaido which have no irregularly spaced tooth on only one side.

(2) *The pale tarsal band on segment IV of hind leg.*

Nakata (1954) pointed out that the pale basal tarsal band on segment IV on hind leg is variable, being influenced by the temperature. As shown in Table 2, there is no

**Table 3.** Variation in white scales of *ppn* and pale upright forked scales of vertex in *Ae. japonicus* collected from Japan, Cheju Is. and Taiwan

| Locality<br>(No. examined)        |                | <i>ppn</i> with |                |                |                |                |               | Vertex with    |               |                |                |                |               |
|-----------------------------------|----------------|-----------------|----------------|----------------|----------------|----------------|---------------|----------------|---------------|----------------|----------------|----------------|---------------|
|                                   |                | A               |                | B              |                | C              |               | A*             |               | B*             |                | C*             |               |
|                                   |                | ♀               | ♂              | ♀              | ♂              | ♀              | ♂             | ♀              | ♂             | ♀              | ♂              | ♀              | ♂             |
| 1. Hokkaido<br>38 : 21 ♀<br>17 ♂  | Av.<br>(%)     | 12.0<br>(51.7)  | 16.0<br>(94.1) | 8.0<br>(38.1)  | 1.0<br>(4.8)   | 1.0<br>(5.9)   |               | 17.0<br>(81.7) |               | 4.0<br>(19.0)  | 17.1<br>(100)  |                |               |
|                                   | T.Av.<br>(T.%) | 28.0<br>(73.7)  |                | 9.0<br>(23.7)  |                | 1.0<br>(2.6)   |               | 17.0<br>(44.7) |               | 2.1<br>(55.3)  |                |                |               |
| 2. Kyushu<br>36 : 23 ♀<br>13 ♂    | Av.<br>(%)     | 4.0<br>(17.4)   | 7.0<br>(53.8)  | 13.5<br>(58.7) | 5.5<br>(42.3)  | 5.5<br>(23.9)  | 0.5<br>(3.8)  | 13.0<br>(56.5) | 4.0<br>(30.8) | 9.0<br>(39.1)  | 6.0<br>(46.2)  | 1.0<br>(4.4)   | 3.0<br>(23.1) |
|                                   | T.Av.<br>(T.%) | 11.0<br>(30.6)  |                | 19.0<br>(52.8) |                | 6.0<br>(16.7)  |               | 17.0<br>(47.2) |               | 15.0<br>(41.7) |                | 4.0<br>(11.1)  |               |
| 3. Cheju Is.<br>7 : 5 ♀<br>2 ♂    | Av.<br>(%)     |                 |                | 4.5<br>(90.0)  | 2.0<br>(100)   | 0.5<br>(10.0)  |               | 5.0<br>(100)   | 1.0<br>(50.0) |                | 1.0<br>(50.0)  |                |               |
|                                   | T.Av.<br>(T.%) |                 |                | 6.5<br>(92.9)  |                | 0.5<br>(7.1)   |               | 6.0<br>(85.7)  |               | 1.0<br>(14.3)  |                |                |               |
| 4. Ryukyu Is.<br>14 : 10 ♀<br>4 ♂ | Av.<br>(%)     |                 |                |                |                | 10.0<br>(100)  | 4.0<br>(100)  |                |               | 5.0<br>(50.0)  |                | 5.0<br>(50.0)  | 4.0<br>(100)  |
|                                   | T.Av.<br>(T.%) |                 |                |                |                | 14.0<br>(100)  |               |                |               | 5.0<br>(35.7)  |                | 9.0<br>(64.3)  |               |
| 5. Taiwan<br>11 : 6 ♀<br>5 ♂      | Av.<br>(%)     |                 | 0.5<br>(10.0)  | 4.0<br>(66.7)  | 3.5<br>(70.0)  | 2.0<br>(33.3)  | 1.0<br>(20.0) | 4.0<br>(66.7)  | 1.0<br>(20.0) | 1.0<br>(16.7)  | 2.0<br>(40.0)  | 1.0<br>(16.7)  | 2.0<br>(40.2) |
|                                   | T.Av.<br>(T.%) |                 | 0.5<br>(4.5)   | 7.5<br>(68.2)  |                | 3.0<br>(27.3)  |               | 5.0<br>(45.5)  |               | 3.0<br>(27.3)  |                | 3.0<br>(27.3)  |               |
| Grand total<br>106 : 65 ♀<br>41 ♂ | Av.<br>(%)     | 16.0<br>(24.6)  | 23.5<br>(57.3) | 30.0<br>(46.1) | 12.0<br>(29.3) | 19.0<br>(29.3) | 5.5<br>(13.4) | 39.0<br>(60.0) | 6.0<br>(14.6) | 19.0<br>(29.2) | 26.0<br>(63.4) | 7.0<br>(10.8)  | 9.0<br>(22.0) |
|                                   | T.Av.<br>(T.%) | 39.5<br>(37.3)  |                | 42.0<br>(39.6) |                | 24.5<br>(23.1) |               | 45.0<br>(42.5) |               | 45.0<br>(42.5) |                | 16.0<br>(15.1) |               |

Abbreviations : *ppn*, posterior pronotum ; A, most of the scales are broad white with a few narrow curved scales bearing only extreme dorsal border ; B, number of broad white scales nearly as many as yellowish narrow curved scales ; C, most of the scales are yellowish and narrow and with a few ventro-posterior white broad scales ; A\*, 0-6 pale scales bearing only medially ; B\*, 7-12 pala scales in broad medial area ; C\*, most of the scales are pale, except on postero-lateral area ; others as for Tables 1 and 2.

pale basal band on segment IV - in 7 Cheju specimens and in 14 Ryukyu specimens, but 12.5 out of 38 Hokkaido and 2.5 out of 36 Kyushu and 0.5 out of 11 Taiwan specimens have a complete white band on segment IV. Progressive stage which has a few pale scales on segment IV, to the development of the complete white band can be seen in the specimens from Hokkaido (4/38) and Taiwan (1.5/11). As stated by Kamimura(1968), the frequency distribution of the pale basal band on segment IV tends to be somewhat higher in the specimens from Hokkaido than the

others.

### (3) *Subspiracular* (ssp) scales

Normally this species has no broad white scales on subspiracular area. However, 2 (♀♀) out of 38 examined specimens from Hokkaido have one to two white broad scales on both sides of subspiracular area.

### (4) *Posterior pronotal* (ppn) scales

As stated by Knight (1968), posterior pronotal scaling is broad white and narrow yellowish, or mixed, considerable variation exists in the arrangement. The variations are classified into 3 groups according to the

degree of development of the whitish broad scales on *ppn*: A. most of the scales are broad white and a few narrow curved yellowish scales bearing only extreme dorsal border; B. number of broad white scales nearly as many as yellowish narrow curved scales; C. most of the scales are narrow and yellowish with a few white broad scales only on ventro-posterior area. The number of white broad scales tends to be somewhat higher in specimens from Northern Japan than in that from Southern Japan, but the difference is not well-defined. Specimens from Hokkaido usually (28/38) fall into A group and those from Ryukyu Is. usually fall into C group but specimens from Kyushu are variable, the frequency distribution is: 19 with B, 11 with A, 6 with C, showing similar tendency to the distribution of Taiwan specimens, that is 7.5 with B, 3 with C, 0.5 with A.

(5) *Pale upright forked scales vertex*

Most of the upright forked scales on vertex are back, with a few pale scales medially. The extent of the pale upright forked scaling is variable. The variations are classified into 3 groups according to the to degree of extension of the pale upright forked scales: A. 0-6 pale scales bearing only medially; B. 7-12 scales bearing on broad medial area; C. most of the scales are pale, except on posterolateral area. As shown in Table 3, the specimens from Hokkaido, Kyushu and Cheju Is. usually show A or B but Ryukyu specimens show B or C. The Taiwan specimens are variable being A (5/11), B and C (3/11) respectively.

REMARKS

This species is so closely to *koreicus* as to have been confused with the latter by various authors. However, comparing the many specimens of *japonicus* collected from Japan and *koreicus* from the type locality, Seoul,

Korea, the author has come to the conclusion that, in spite of the considerable variations are found in the important characters, *japonicus* may be distinguishable from *koreicus* by the following respects: 1. The adult has no scales on subspiracular area. 2. Usually white basal band on hind tarsal segment IV. 3. Larva has 1-4 irregularly spaced enlarged non-denticulate (simple) teeth which are inserted beyond base of siphon hair tuft.

It is considered that the Taiwan-and-Ryukyu form is distinct from the Japanese form, being treated as subspecies, *Ae japonicus shintiensis* Tsai and Lien. According to Lien (1962) two morphological features were cited as the primary differentiating characters for the 2 forms. The first of these is scales of *ppn*: in the specimens from Kyoto, "*ppn* with numerous broad pale scales on a large area and some narrow yellowish scales on extreme dorsal border", whereas specimens from Taiwan, "*ppn* with numerous narrow curved golden scales on a large area on upper and central parts, and few to several broad pale scales on extreme lower aspect". The second feature is upright forked scales of vertex: in the specimens from Kyoto "the upright forked scales on median area of vertex as dark as those on lateral areas", whereas in the specimens from Taiwan, these scales "on median area of vertex much paler than those on lateral area". Having compared the Japanese specimens with the Taiwan (kindly made available by Lien) and the Ryukyu specimens, the author has found that these two characters are quite variable, and the variability cannot be associated with each other nor with geographical distribution as shown in Table 3. Therefore, the author has come to the conclusion that *Aedes japonicus shintiensis* in Taiwan and S. Ryukyu should

be suppressed as a synonym of *Aedes japonicus* until additional morphological, biological and geographical data are available.

#### DISTRIBUTION

Japan(Hokkaido; Honshu; Kyushu; Shikoku; Ryukyu Is.), Taiwan, Cheju Is., Korea, China, Hong Kong and Soviet Far East.

#### BIOLOGY

The larva of this species breeds in various containers including granite cemetery basins, stream rock pools, bamboo cuts, tree-holes and artificial containers. This species may overwinter in the egg stage and the young larva is commonly found in the granite cemetery basins at early spring in company with *Culex kyotoensis* and *Aedes albopictus* in Nagasaki Prefecture, Kyushu. The adult bites human uncommonly. Kamimura(1968) observed that a large number of the females coming to attack him in the forest of Teine area, Hokkaido at early spring. It should be noted that two adults coming to bit man in the house near cemetery at night(22 Apr. 1971) and also the auther has collected the females attracted by the dry ice in the forest of Nagasaki at early spring.

This species has been reported as a vector of Japanese encephalities in Soviet (Grancenkov, 1964), but it has been considered

as unsuitable vector of Japanese encephalities in Japan.

#### *Aedes (Finlaya) koreicus* (Edwards)

*Ochlerotatus (Finlaya) koreicus* Edwards, Bull. ent. Res. 7:212, 1917.

*Aedes (Finlaya) koreicus*: Edwards, Bull. ent. Res. 12:318, 1921; Montschadsky, les Larves des moustiques(Fam. Culicidae) de l' URSS et des pays limitrophes, p. 301; Knight, Ann. ent. Soc. Amer. 40:633, 1947; Yamaguti and LaCasse, Mosq. Fauna Japan and Kores, 156, 1950.

This species is originally described from Seoul, Korea. Having examined 34 specimens (Seoul, Korea) identified with *koreicus* by Lien, the author has been convinced that *koreicus* is distinguished from *japonicus* by the following characters:-

1. Pecten composed of about 25 teeth, all of which have 2-6 serrate ventral denticules. Each tooth slightly larger than the more proximal one. No irregularly spaced non-denticulate tooth is present beyond the base of siphon hair tuft.
2. Posterior margin of saddle bearing a few spiculates and a very few spines dorsally.
3. Subspiracular area bearing a line of 2-20 white broad scales.
4. Hind tarsus have broad basal pale bands on segments I-IV, occasionally a few basal pale scales on segment V. There is no

**Table 4.** Variation in number of denticulate pecten tooth inserted beyond siphon hair tuft in 4th inster larvae *Aedes koreicus*\*

| Locality<br>(No. examined) | No. pecten beyond siphon hair tuft |      |      |   |     |
|----------------------------|------------------------------------|------|------|---|-----|
|                            | 0                                  | 1    | 2    | 3 | 4   |
| Seoul L                    | 8                                  | 5    | 4    | 0 | 1   |
| Seoul R                    | 10                                 | 4    | 2    | 0 | 2   |
| Korea Av.                  | 9.0                                | 4.5  | 3.0  | 0 | 1.5 |
| (18) %                     | 50.0                               | 25.0 | 16.7 | 0 | 8.5 |

\* No simple pecten tooth are found in this species. Abbreviations as for Table 1

**Table 5.** Variation in pale hind bands, white *ssp* scales, white *ppn* scales and pale upright forked scales of vertex in *Ae. koreicus* collected from Seoul, Korea

|                | Hind tarsal band on segment |               |              |              | Scale of <i>ssp</i> |              |   |   | <i>ppn</i> with |               |              |               | Vertex with    |               |              |               |
|----------------|-----------------------------|---------------|--------------|--------------|---------------------|--------------|---|---|-----------------|---------------|--------------|---------------|----------------|---------------|--------------|---------------|
|                | IV                          |               | V            |              | P                   |              | O |   | A               |               | B            |               | A*             |               | B*           |               |
|                | ♀                           | ♂             | ♀            | ♂            | ♀                   | ♂            | ♀ | ♂ | ♀               | ♂             | ♀            | ♂             | ♀              | ♂             | ♀            | ♂             |
| Av.<br>(%)     | 5.5<br>(91.7)               | 5.5<br>(91.7) | 0.5<br>(8.3) | 0.5<br>(8.3) | 6.0<br>(100)        | 6.0<br>(100) |   |   | 6.0<br>(100)    | 5.0<br>(83.3) |              | 1.0<br>(16.7) | 6.0<br>(100)   | 5.0<br>(83.3) |              | 1.0<br>(16.7) |
| T.Av.<br>(T.%) | 11.0<br>(91.7)              |               | 1.0<br>(8.3) |              | 12.0<br>(100)       |              |   |   | 11.0<br>(91.7)  |               | 1.0<br>(8.3) |               | 11.0<br>(91.7) |               | 1.0<br>(8.3) |               |

Number of examined specimens: 12(6 ♀♀ and 6 ♂♂)  
Abbreviations as for Table 1-3

definite differences in the male as well as the female genitalia between the two species.

#### VARIATIONS

As shown in Table 5, there is no considerable variation in the *ssp* scales, *ppn* scales and upright forked scales on vertex, but a slight variation is found in the number of the pecten teeth and the basal pale bands on hind tarsus.

(1) *Number of the denticulate pecten teeth inserted beyond base of siphonal hair taft.*

The species has about 25-30 denticulate teeth but no irregularly spaced enlarged simple teeth. The number of the denticulate teeth inserted beyond siphon hair taft is variable, as shown in Table 4. The frequency distribution in 18 specimens is 9 with 0; 4.5 with 1; 3 with 2, 1.5 with 4.

(2) *The basal pale bands in hind tarsal segments IV and V.*

As shown in Table 5, all of 12 specimens have distinct pale basal band on IV and one of them has also pale band on V.

#### DISTRIBUTION

Korea, Soviet and Japan(Hokkaido) ?

Yamaguti and LaCasse (1950) recorded *koreicus* as represent in the fauna of Japan but the record is questionable, considered to be misidentification of *japonicus*.

#### BIOLOGY

The larva is commonly found artificial containers about houses in Korea. Kobayashi (1932) reported that this species passes the winter in the egg stage, hatching in the spring when the ice melts. According to Yamada(1927) this species is not suitable intermedicate host of *Wuchereria bancrofti*.

Feng(1938) reported that this species has been proven experimentally to be a good transmitter of *Dirofilaria immitis* to dog in Peiping.

*Aedes (Finlaya) koreicoides* Sasa,  
Kano and Hayashi

*Aedes (Finlaya) koreicoides* Sasa, Kano and Hayashi, Jap. J. Exp. Med. 20: 627, 1950; Sakakibara and Omori, End. Dis. Bull. Nagasaki Univ. 4:15, 1962.

This species may be distinguishable from any other species of this subgroup by having torus with narrow black scales mesally; costa without ventro-basal dark scales; paratergite and subspiracular areas each with broad white scales; sidepiece of male genitalia with a prominent tongue-like basal tergomal lobe bearing densely long and short bristles; head hair 6-C of larva far anterior to head hair 5-C; hair 7-C on a level to 5-C; hair 4-C on a level to or slightly posterior to hair 6-C; comb with 6-17 scales arranged



in a irregular line, each scale with a lateral fringe of spines and a stout apical spine; no irregularly spaced simple pecten tooth is present.

#### REMARKS

Although *koreicoides* somewhat stands alone in the *chrysolineatus* subgroup proposed by Knight (1947 and 1968), Sasa et al (1950) and Sakakibara and Omori(1962) treated as one of the members of this subgroup. Knight (1968) assigned 11 (including 2 subspecies) to his *chrysolineatus* subgroup occurred throughout the Oriental and Palaerctic Regions but he did not assigned *koreicoides* to the subgroup.

The inclusion of *koreicoides* in the subgroup is open to question, since the larva differs in several respects from all the other species

of the subgroup and is closely similar to *Aedes (Finlaya) nipponicus* LaCasse and Yamaguti. However, on account of the ornamentation of suctum and legs, *koreicoides* is so similar to *koreicus* that it should be assigned to the member of the *chrysolineatus* subgroup until additional data are available.

#### DISTRIBUTION

This species is originally described from Hokkaido, Japan(Sasa et al, 1950) and known to occur in Honshu, Japan(Sakakibara and Omori, 1962; Kamimura, 1968).

#### BIOLOGY

The larva is not so common, being found in tree holes located in forest (Sakakibara and Omori, 1962). Biology of the adult is unknown.

### Conclusion

The three Japanese and Korean species belonging to the *chrysolineatus* subgroup are easily distinguishable by the following key:-

#### Adult

1. Paratergite with a line of broad white cales; torus with nimute dark scales mesally; wing without a ventro-basal line of white scales on costa; basimere with a defined basal tergomesal lobe, with densely long and short bristles.....  
..... *koreicoides*
- Paratergite without scales; torus with several broad pale scales mesally; wing with a ventro-basal line of white scales on costa; basimere without prominent basal lobe. .... 2
2. Subspiracular area with a line of broad white scales; hind leg with first 4 tarsomeres pale banded. ....*koreicus*
- Subspiracular area without scales; hind leg usually with first 3 tarsomeres pale

banded. .... *japonicus*  
(syn. : *shintiensis*)

#### Larva

1. Base of head hair 5-C slightly posterior to or in a rather transverse line of base of head hair 7-C; head hair 4-C 12-15 branched; comb consisting of 6-17 teeth, each tooth with lateral fringe of evenly developed spicules and a stout apical spine. .... *koreicoides*
- Base of head hair 5-C apparently anterior to base of 7-C; head hair 4-C 2-5 branched; comb consisting of more than 20 tooth, each tooth slightly enlarged apically and bearing a rather even lateral and apical fringe ..... 2
2. 1-4 irregularly spaced simple pecten teeth beyond base of siphon hair tuft; saddle with mostly simple spine on posterior margin. .... *japonicus*  
(syn.: *shintiensis*)

- Irregularly spaced simple pecten teeth absent; saddle with mostly spiculate scales on posterior margin. .... *koreicus*

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日本及び朝鮮産の *Aedes (Finlaya) chrysolineatus* Subgroup の蚊について (双翅目: 蚊科)

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摘 要

日本 (北海道, 青森, 長崎, 沖縄) 及び朝鮮 Seoul, Cheju Is. 産の *Aedes (Finlaya) chrysolineatus* subgroup に属する 294 個体 (成虫: 147, 幼虫 147) の標本は Knight (1947, 1968), 佐々 (1950), 及び榊原等 (1962) の記載に従って 3 種 *Aedes (Finlaya) japonicus* (Theobald) 1901, *Aedes (F.) koreicus* (Edwards) 1917, *Aedes (F.) koreicoides* Sasa et al 1950 に同定された. この内 *japonicus* は日本, 台湾, 朝鮮, 中国, ソ連に広く分布する種で, 朝鮮, 中国, 日本 (?) に分布する *koreicus* に酷似し, 両種を区別している主要な特長に変異が見られ, 屢 混乱が生じて来た. 著者は各地の標本をもとに主要な特長の変異性を調べ Seoul 産の *koreicus* と比較した結果, 両種の間次様な形態的特長を改めて確認した. 幼虫は *japonicus* では先方 1—4 本の呼吸管棘が異常に発達し, 棍棒状で広間隔に位置するのに対し, *koreicus* はすべての呼吸管棘が略同じ大きさで歯状をなし, 等間隔に位置する. 成虫では *japonicus* は ssp (subspiracular area) の白色扁平鱗を全く欠く (極稀に北海道産の標本に 1—2 個の白色扁平鱗が見られた) が *koreicus* では常に 2—20 個の白色扁平鱗を有する. 上記の他従来同定に用いられた後脚第 4 跗節の基白帯があげられるが, 変異しやすく, 特に北海道産は *koreicus* と同様第 4 跗節にも白帯を有する個体が多く, この特長だけでは両種は区別出来ない. 山口等 (1950) は北海道にも *koreicus* が分布することを認めているが *japonicus* の誤同定の可能性が大きく, 著者は *koreicus* は本邦に分布しないと考えている. 沖縄, 台湾の *japonicus* は日本本土産に比較して ppn (posterior pronotum) の白色扁平鱗が少なく, 頭頂中央部の白色直立又状鱗が多いことから亜種, *Aedes japonicus shintiensis* として連 (1962), 及び Knight (1968) は取扱っているが, この 2 形質は変異性にとみ, 九州産の同一地域から得た個体間にも可成りの変異が見られ, それ等の多くは台湾産と全く区別出来なかつたので台湾, 沖縄産も *japonicus* と同定し, *Ae. shintiensis* はここでは *japonicus* の synonym として取扱った.

佐々等 (1950) によって北海道から最初に記載された *koreicoides* は後に 榊原等 (1962) によって幼虫, 蛹が記載され, *chrysolineatus* subgroup に属する一種として取扱われて来たが最近 Knight (1968) が発表した東南アジア (日本含む) 産の *chrysolineatus* subgroup のモノグラフ中には本種は記録されていない. 榊原等が指摘している様に本種の幼虫の形態がこの subgroup に属するすべての種と大いに異なり, *Ae. (F.) nipponicus* LaCasse et al に似ているなど, 本種をこの subgroup に入れることには多少の疑問があり, 今後検討の余地はあるが著者は成虫の外部形態が *koreicus* に似ていることから本論文では Knight (1968) が提唱した *chrysolineatus* subgroup の一種として取扱った. 日本及び朝鮮産の 3 種は本文中の検索表によって容易に区別出来る.