

***ANOPHELES (ANOPHELES) VIETNAMENSIS:*  
A NEW SPECIES IN THE *ANOPHELES HYRCANUS*  
GROUP FROM VIETNAM (DIPTERA: CULICIDAE)**

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**ABSTRACT.** *Anopheles (Anopheles) vietnamensis*, a new species from Vietnam belonging to the *An. hyrcanus* group, is described in the adult, pupal, and larval stages. It is compared to *An. paraliae* Sandosham, which it closely resembles.

**INTRODUCTION**

A thorough study of the anopheline mosquito fauna in Vietnam conducted between 1970-1990 concluded that the *Anopheles (Anopheles) hyrcanus* group consists of 12 closely related species and one form called sp. 1. Of the 12, three species are new. *Anopheles vietnamensis*, one of the new species, is described and illustrated in this report.

**DESCRIPTION**

Adults have narrow hindtarsal bands (usually apical only), the humeral crossvein lacks a scale patch, there is a short, pale apical wing fringe spot and a short dark mark on the base of vein Cu. Males lack a pale basal band on palpal segment 3. The aedeagus has five pairs of leaflets, the largest of which has a unique shape. The rim of the pupal trumpet is thin and simple and lacks the thickened areas and distinct sawtooth margin found in *An. lesteri* Baisus and Hu. Larvae have reduced branching of setae 8-C and 4-II, III on the abdomen. Eggs have a narrow deck that is about 0.143-0.167 as wide as the egg.

Superficially, the adults resemble those of *An. paraliae* Sandosham. The differences are as follows.

**Female** (Fig. 1.1). *Head*: Palpus with 4 pale distinct bands (30/30), the 3 apical bands are larger and clearer than the basal pale band. Basal segment usually has scattered pale scales. Vertex with short erect, yellow-brown scales posterior to ocular areas and postgena. Interocular space narrow, with long white

frontal setae. Posterior margin of the ocular area with row of short white scales. Thorax with yellow-brown setae and distinct eye spots on the mesonotum. Episternum with 2-6 pleural setae. *Wing*: Length 3.8-4.5 mm. Like *An. paraliae*, there are very small apical fringe spots, the widest extending from R<sub>1</sub> to R<sub>3</sub>, usually from R<sub>2</sub> to R<sub>3</sub>. Costa with scattered pale scales on basal third, and in 50% of the specimens (15/30), a pale interruption near the humeral crossvein. Remigium covered with dark scales and sometimes with narrow anterior row of pale scales. Humeral crossvein lacks a scale patch. R<sub>1</sub> completely dark scaled between the subcostal spot, when present, and the apical pale spot, tip covered with dark scales. R<sub>s</sub>-R<sub>2+3</sub> entirely dark scaled up to the fork. R<sub>2</sub> and R<sub>3</sub> have pale central portions. R<sub>4+5</sub> largely pale in the center, frequently with scattered dark scales on the distal half. M dark-scaled to the fork. M<sub>1+2</sub> and M<sub>3+4</sub> have pale central portions. Extreme base of Cu pale or with several dark scales then a pale area and a short well-defined dark mark that is separated by its length or more from the upper dark mark on vein 1A. Cu<sub>1</sub> and Cu<sub>2</sub> with short apical dark marks. Vein 1A with short upper dark mark, the apical dark mark usually equal to the length of the apical dark mark on Cu<sub>2</sub>. About 15% of the specimens have a distinct pale fringe spot on Cu<sub>2</sub>. *Legs*: Midcoxae lack pale scales or rarely have 1-2, and have 2-6 upper setae. Foreleg dark-scaled except for narrow apical pale bands or dorsal patches on tarsomeres 1-3 and infrequently a very narrow pale patch on 4. Midleg

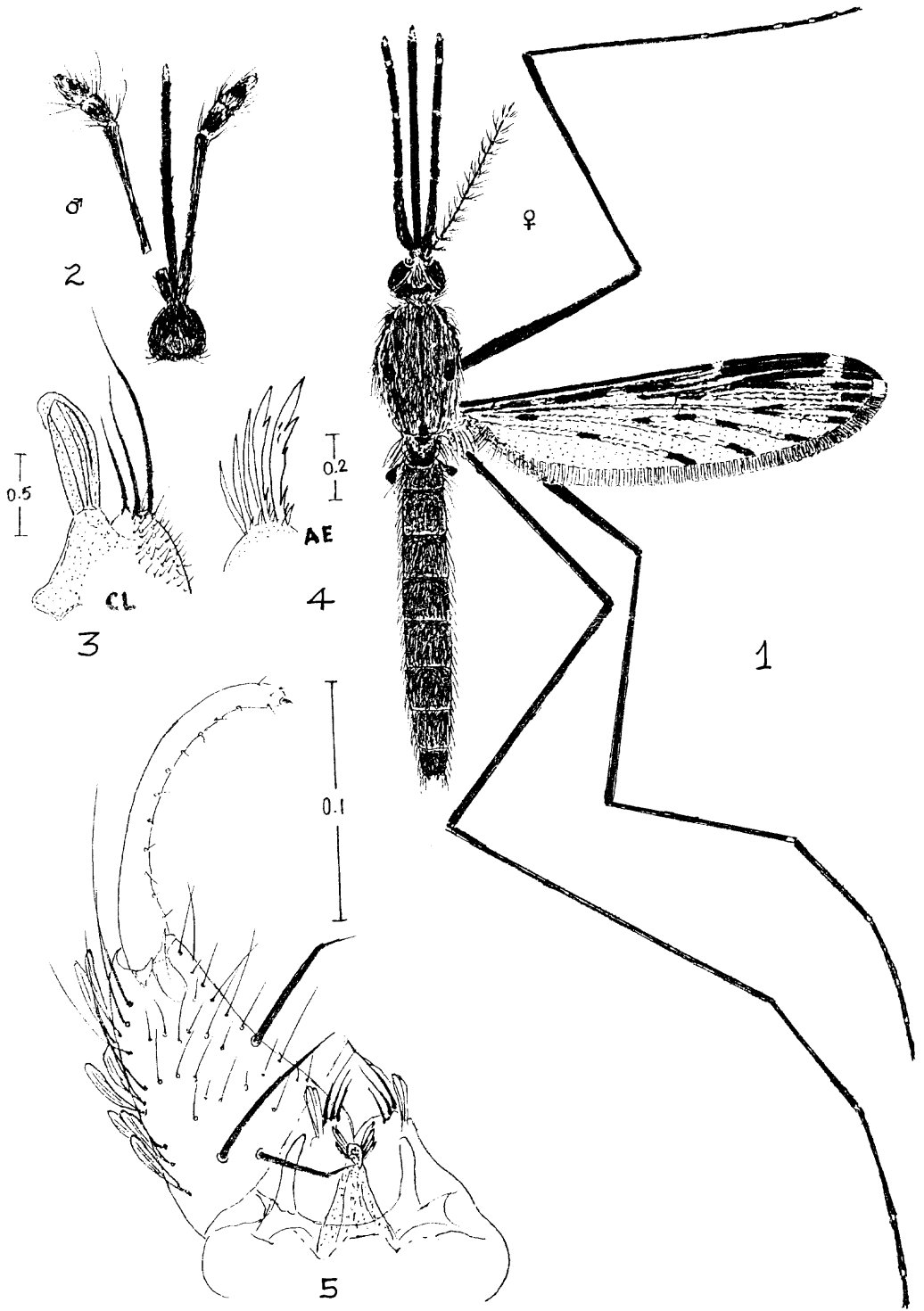


Fig. 1. *Anopheles vietnamensis* adult. 1, Female; 2, head; 3, claspette; 4, aedeagus; 5, genitalia of male.

like the foreleg. Hindleg dark-scaled except for white scales dorsally on the apex of the tibia and complete narrow apical pale bands on tarsomeres 1–4.

**Male** (Fig. 1.2,3,4,5). Palpus without pale basal band on segment 3. Wings essentially the same as the female except pale fringe spot at  $Cu_2$  on many specimens (10/14). Basimeres lack pale scales. Aedeagus with 5 pairs of leaflets, the largest has a unique shape with 1–3 larger teeth at the apex and 2–4 smaller ones at the base. The bases of all leaflets have 2–4 distinct teeth.

**Pupa** (Fig. 2). Wing case brown, with a barred or rectangular pattern on veins. Antennal case lacks dark spot at tip. Rim of the trumpet is uniform and lacks thickened sawtooth margin or vertical wrinkles. Abdomen and base of setae lack dark pigmentation. Setae 1 and 5 have relatively few branches: 1-VI has 2–7 branches; 5-III has 12–28 branches; 5-IV has 20–38 branches; 5-V has 16–28 branches; 5-VII has 1–10 branches; 9-VIII has well-developed branches. Refractile border of the paddle is about 0.70 times the total length of the paddle. Setae 1,2-P are single, or 1-P may be frayed.

**Larva** (Fig. 3). *Head*: Seta 2-C simple, 3-C has 28–48 branches forming a distinct tuft with branches difficult to count. Seta 4-C with 2–6 branches. Frontal setae 5,6-C have 11–18 and 14–19 branches, respectively. Seta 8-C with 6–10 branches, 9-C with 6–10 branches. Antennae with spicules primarily on the inner aspect. Seta 1-A is long and has 3–10 branches. *Thorax*: Seta 1-P simple or frayed with 2–3 branches near tip. Seta 2-P has 7–13 branches. Seta 14-P has 6–8 branches. Seta 4-M has 4–6 branches off a central stem, they are not sinuous. Seta 3-T palmate, with only a small number of unpigmented branches that lack filaments. *Abdomen*: Seta 1 with flattened unpigmented leaflets on segments I–II. On segments III–VI seta 1 leaflets developed and darkly pigmented. Pigment does not extend onto filaments. Seta 4 has relatively few branches: 5–8 on segment I, 3–6 on segment II, 3–4 on segment III, and 3–4 on segment V. Tergal plate on VIII elliptical with convex posterior margin. Pecten with 8 long teeth.

**Egg**. Length 490  $\mu$ m with narrow deck that is about 0.15 times as wide as the egg is long. There are 24–30 float ribs.

**Type data**. The holotype female and the allotype male, with their pupal and larval skins, and many additional paratypes were reared from pooled egg batches of five females collected during October 1981 in Muong Va commune in Song Ma District of Son La Province, which is in northwest Vietnam. Other paratypes including 15 females were collected from Bac Thai, Hoang Lien Son, Gia Lai, Kon Tum, Dac Lac, and Lam Dong provinces.

The holotype, allotype, and paratypes are in the Museum of the Institute of Malariology, Parasitology and Entomology in Hanoi, Vietnam. Paratypes are deposited in the collections of the Smithsonian Institution and the British Museum (Natural History).

**Distribution** (Fig. 4). This is the first report of this species. The specimens were found in Bac Thai, Hoang Lien Son, Sonla, Gia Lai, Kon Tum, Dac Lac, and Lam Dong provinces of Vietnam. All mosquitoes were collected in forested areas.

## DISCUSSION

The *An. hyrcanus* group was first formed by Reid (1953) and consisted of seven species. Since then many studies on the group have been conducted (Reid 1963, 1968; Feng 1964; Ma 1964, 1965a, 1965b, 1965c, 1966, 1981; Harrison 1972, 1973; Harrison et al. 1973; Harrison and Scanlon 1975; Xu and Feng 1975; Kanda and Oguma 1976, 1977a, 1977b, 1978; Dong 1985; Tran Duc Hinh et al. 1987; Nguyen Duc Manh 1988). These studies resulted in the addition of many new species to the group.

According to Harrison (1972), the *An. hyrcanus* group in Southeast Asia consists of two subgroups. The Nigerrimus Subgroup was created to include *An. nigerrimus*, *An. indiensis* (now called *An. nitidus*), *An. pursati*, and *An. pseudosinensis*. The Lesterei Subgroup includes *An. lesteri lesteri*, *An. lesteri paraliae*, *An. crawfordi*, and *An. peditaeniatatus*. The two remaining species, *An. argyro-*

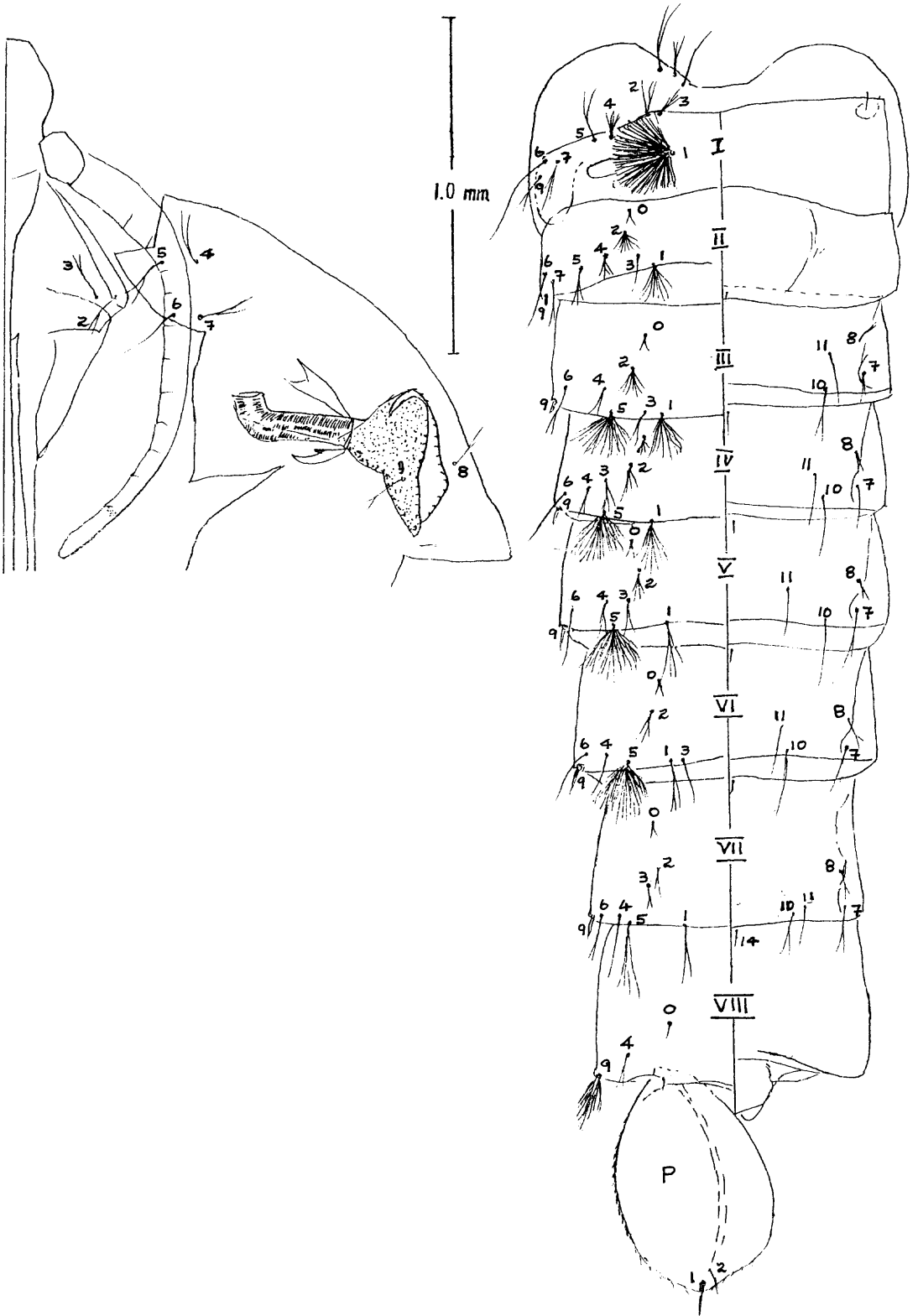


Fig. 2. *Anopheles vietnamensis* pupa.

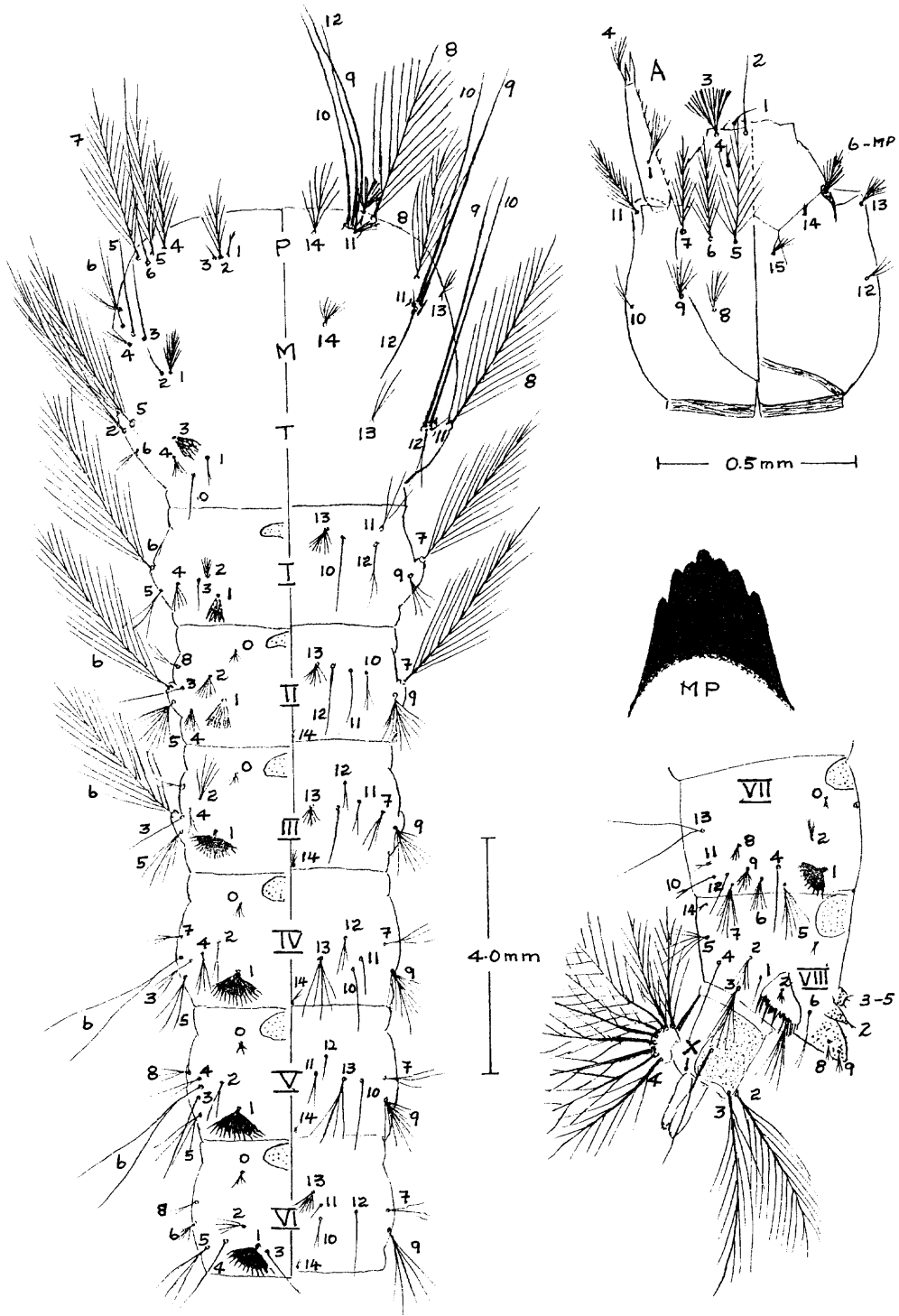


Fig. 3. *Anopheles vietnamensis* larva.

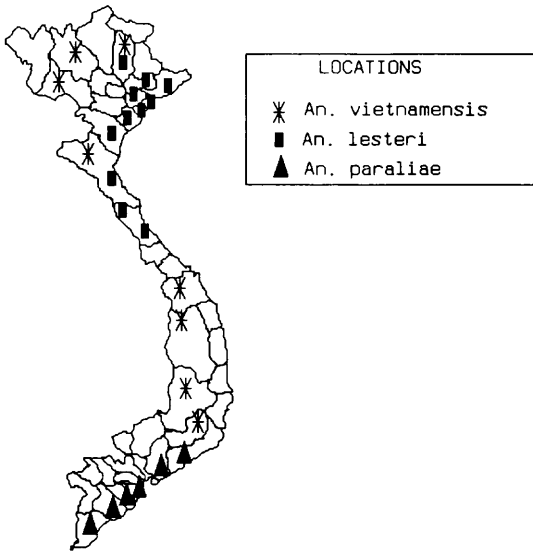


Fig. 4. Collection records of *Anopheles vietnamensis*, *An. lesteri*, *An. paraliae* in Vietnam.

*pus* and *An. sinensis*, did not fall into either of the two subgroups.

*Anopheles paraliae* and *An. pursati* both have the narrow apical wing fringe spots but otherwise have the characteristics of the separate subgroups.

Harrison and Scanlon (1975) reported that *An. lesteri paraliae* is distributed only in coastal areas of Malaysia (Peninsular Malaysia, Sabah, and Sarawak), Brunei, South Vietnam, and Thailand. *Anopheles lesteri lesteri* is found on both mainland China and the Philippines. Harrison et al. (1991) elevated *An. paraliae* to species status.

Studies on the *An. hyrcanus* group of mosquitoes in China (Xu and Feng 1975) resulted in the reports of a new subspecies, *An. lesteri anthropophagus*, and a new species, *An. kiangsuensis*. They belong to the Lesteri Subgroup. Ma (1981) stated that the subspecies *An. lesteri anthropophagus* should be considered a valid species and called *An. anthropophagus*.

In our studies in Vietnam, we have concluded that *An. lesteri* and *An. paraliae* are valid species. The first is distributed northward from 16° north latitude where specimens are collected from both forest and

coastal areas. *Anopheles paraliae* is found only in the coastal areas of southern Vietnam.

*Anopheles vietnamensis* is like *An. paraliae* in that both have a narrow apical wing fringe spot, but they differ in the structure of the trumpet rim. Also, *An. vietnamensis* is collected only in forested areas. This makes it a new species clearly separated from related species such as *An. paraliae*, *An. lesteri*, and *An. pursati*.

Further studies on the *An. hyrcanus* group are clearly needed. For example, the single female of *An. sinensis* with an unusually short apical fringe spot that was collected in Chiangmai Thailand (Harrison and Scanlon 1975) may actually be an *An. vietnamensis*.

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