

ANOPHELES (ANOPHELES) CUCPHUONGENSIS: A NEW SPECIES FROM VIETNAM (DIPTERA: CULICIDAE)

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ABSTRACT. *Anopheles (Anopheles) cucphuongsensis*, a new species, is described and illustrated in the adult, pupal and larval stages. Comparisons are made between this species and *An. (Anopheles) alongensis*. Based on those comparisons, the *Anopheles alongensis* group is proposed, consisting of two species: *An. alongensis* and *An. cucphuongsensis*. The differences between this group and the *An. culiciformis* group are described.

INTRODUCTION

In May 1981, while collecting mosquitoes in the Cuc-Phuong National Forest located in northern Vietnam, some *Anopheles* larvae were found that had unusual characteristics. The larvae were transported to the laboratory of the Institute for Malariology, Parasitology and Entomology in Hanoi where they were reared. After careful examination and comparison with other anopheline species, the specimens were found to belong to a new species named here as *An. cucphuongsensis*.

DESCRIPTION

Female. The female (Fig. 1a,b,d,e), except as noted below, is uniformly dark brown. On the head, the vertex has erect dark brown scales. These scales are broader than in members of the *An. aitkenii* group but narrower than those of *An. sintonoides* Ho, a member of the *An. culiciformis* group. The frons has a tuft of very long white setae mixed with lanceolate white scales. Between the eyes and the vertex are many small lanceolate scales which are pale at the base and dark brown at the apex. There is no tuft of scales on the clypeus. The proboscis is dark and long and the forefemur/proboscis ratio ranges from 0.87 to 0.94, with a mean of 0.90. The palpi are slender, approximately equal to the length of the proboscis (2.48mm/2.50mm), with 2 apical segments slightly swollen. The mesonotum has a tuft of white scales on the mid-frontal border and three distinct longitudinal rows of black setae extending from the frontal border to the base of the wings. On fresh specimens the pleura are pale and the propleuron has a single seta. On the hind margin of the scutellum there is a row of strong setae. The wings have no pale spots. The legs are uniformly dark. The abdomen is mottled gray-brown with long dark brown setae on the hind margin of the segments. The cerci are pale.

Male. The male (Fig. 1c, f, g, h) is like the female except that the antennae have more and longer setae which form whorls. The palpi are approximately as long as the proboscis and the 2 club-like apical palpomeres are flattened.

The genitalia are very much like that of *An. alongensis* Venhuis, but with more leaflets on the apex of the aedeagus (from 10 to 20 leaflets on one side), which are serrated along the edges (Fig. 1h).

Pupa. The pupal trumpet (Fig. 2c) has a meatal cleft about 58% as long as the trumpet. The lateral spines (seta 9) are very small on segment III, but are well developed and darkly pigmented on segments IV to VII. Those on segment VII are long, about 1/2 the length of the segment. On segment VIII seta 9 has 9-20 branches. Seta 5 on segments IV-VII is very long, approximately as long as segment V, and with 7-15 branches. This seta on the other segments may be simple or have up to 5 branches at the tip. The paddle is elongate with a refractive margin about 2/5 the length of the paddle. The paddle has small lateral serrations and a dense long fringe on the lateral and mesal borders. Seta 1-P is very long and filiform with a hooked tip.

Larva. The larva (Fig. 2a,b) is quite different from members of the *An. culiciformis* group, but has some of the characteristics of *An. alongensis*. On the head, the inner clypeal seta (2-C) is very long, simple and widely separated. The distance between the bases of both 2-C is wider than the distance between 2-C and 3-C on one side. Seta 3-C is about 1/2 the length of 2-C and has 2-5 branches; 4-C is well developed with 6-16 branches and reaches the tip of 3-C. Setae 5, 6 and 7-C are well developed and branched along the stem. Seta 5-C is the longest, reaching the base of 4-C. Seta 1-A is small with 3-8 branches inserted about 1/7 of the way up from the base of the antenna; 8-C and 9-C are short, simple or bifid; 11-C is as long as the antenna and plumose from the base on both sides of the central stem.

On the thorax, the dorsal lateral integument is covered with finely pilose spicules. Seta 1-P is well developed with 4-9 branches; 2-P is the longest of the shoulder setae with 11-21 branches; 3-P is simple. Setae 1-3-P separated. Seta 9-P has 3-6 branches beginning from the middle of the stem; 11-P is spinose with 3-5 branches; 10,12-P are long and simple; 9,10-M and 9,10-T are simple. Seta 3-T is not fan shaped, but branched and plumose with 5-11 branches (Fig. 2b).

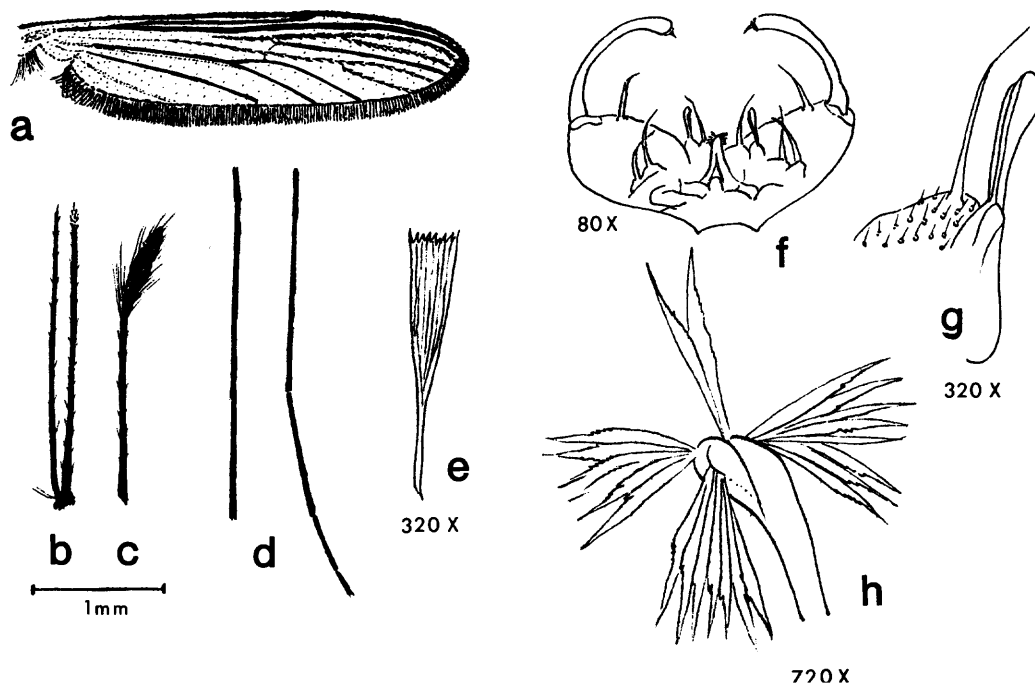


Fig. 1. *Anopheles cucphuongensis*, adult. a. wing; b. left palp and proboscis of female; c. palp of male; d. hindtarsus; e. vertexscale; f. male genitalia, dorsal view; g. right claspette; h. apex of aedeagus with leaflets.

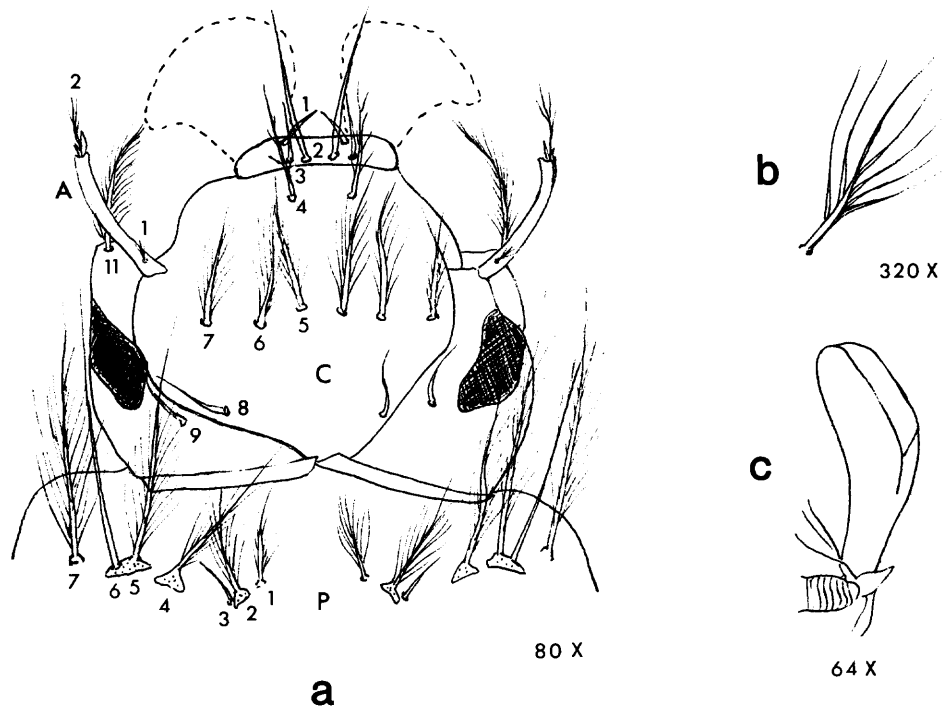


Fig. 2. *Anopheles cucphuongensis*, larva and pupa. a. head and the first thoracic segment of larva, dorsal view; b. seta 3-T; c. trumpet of pupa.

As on the thorax, the sides and dorsum of the abdominal terga are densely covered with simple, fine, pilose spicules. Seta 1-I is very small and hardly visible. Seta 1-II-VII is well developed, fan-shaped; the lateral seta of segment III (6-III) is developed with 6-10 branches. Seta 6-V is developed with 3-7 branches along the stem. The tergal plates are small. Seta 9-I-VI is spinous and well developed. The pecten has 18-24 spines which are long and equally denticulate at the base. The pecten seta (2-S) has 3-6 branches.

Egg. The characteristics of the egg are unknown.

Type Data. The holotype female together with slides of its pupal and larval skins have the following collection data: Vietnam, Ha Nam Ninh, Hoang-Long, Cuc-Phuong, V.1981, Nguyen Duc Manh and team, collected as larva from a rock pool in limestone within the Cuc-Phuong National Forest. Allotype male with slide of pupal and larval skins, same data as holotype. Paratypes: 11♀, 15♂ with pupal and larval skins on slides, same data as holotype, 7 pairs of pupal and larval skins on slides, 14 slides of 4th instar larvae; 20 slides of stage I-III larval skins, same data as holotype. Other paratypes: 12 slides of 4th instar larvae, Qui-Hop district, Nghe-Tinh province, VII.1982; 2 slides of 4th instar larvae, Ban-Sen Island, Ha-Long Bay, V.1983. The holotype, allotype and paratypes are deposited in the Museum of the Institute of Malariology, Parasitology and Entomology, (Museum IMPE) Hanoi, Vietnam. Paratypes are deposited in the collections of the Smithsonian Institution and the British Museum (Natural History).

Distribution. This is the first report for this species. The specimens were found in: Cuc-Phuong, Ha-Nam-Ninh province (1981); Qui-Hop district, Nghe-Tinh province (1982); Ban-Sen Island, Ha-Long Bay (1983); and Quang-Ninh District (1971), Quang-Binh Province, Vietnam (Nguyen Duc Manh, unpublished). All the sites consisted of larval collections from holes in limestone.

DISCUSSION

Anopheles alongensis is known only from the type locality, Ha-Long Bay, adjacent to Hai-Phong, Vietnam (Harrison and Scanlon 1975). According to Bonne-Wepster and Swellengrebel (1953), *An. alongensis* was first described by Venhuis (1940) from 6 larvae. Galliard and Ngu (1940) also presented a short note on a similar species collected at the same locality which they named *An. tonkinensis*. Later, additional specimens were collected, reared and fully described in detail by Galliard and Ngu (1946) (still under the name *An. tonkinensis*). *Anopheles tonkinensis* was synonymized under *An. alongensis* by Senevet (1947). The single female specimen which Galliard and Ngu sent to Edwards at the British Museum in 1946 was initially lost. The specimen was later recovered and described by Reid (1979).

The discovery and description of *An. cucphuongsensis*

helps place *An. alongensis* and *An. cucphuongsensis* in their correct positions within the subgenus *Anopheles*. Previously, the *An. culiciformis* species group consisted of five species: *An. alongensis*, *An. culiciformis* Cogill, *An. kyondawensis* Abraham, *An. sintoni* Puri, and *An. sintonoides*. This grouping was formed by Reid and Knight (1961) and the most recent review with a key to the larvae of all species within the group is found in Reid (1968). Although *An. alongensis* and *An. cucphuongsensis* do have characteristics which group them together, they have many characteristics which are quite different and set them apart. These differences include the separation of the larval inner clypeal setae (2-C), the structure of the larval subantennal setae (11-C) (Table 1), the length of the palpi on the female and characters of the male genitalia (Table 2). Because of these differences, *An. alongensis* is separated out from the *An. culiciformis* group and included with *An. cucphuongsensis* to form a new species group called the *Anopheles alongensis* group. The two species included in the *An. alongensis* group are not yet known to be vectors of human disease. In Vietnam they appear to occur only north of 16°N latitude.

The larvae of *An. alongensis* and *An. cucphuongsensis* are both found in fresh water in rock holes. *Anopheles alongensis* was found breeding in a shaded area at the bottom of a rock cave while *An. cucphuongsensis* was found breeding in shaded rock clefts within the forest.

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Table 1. Comparison of *An. alongensis* and *An. cucphuongensis*.

Stage/character	<i>alongensis</i>	<i>cucphuongensis</i>
Adult		
Propleural setae	3	1
Leaflets of aedeagus	5 pairs	10-20 pairs
Pupa		
Seta 5-V-VII	Simple or with distal branches	Multi-branched along the stem only
Larva		
Setae 3,4-C	Simple	Branched
Setae 5,6,7-C	Undeveloped	Developed
Seta 1-P	Short with 10-12 branches	Long with 4-9 branches
Seta 3-T	Fan-shaped with 14 leaflets	Branched, plumose 5-11 branches
Seta 6-III	Thin and slightly branched	Developed with 6-10 branches
Seta 6-VI	Short, delicate 3-6 branches at tip	Developed with 3-7 branches along the stem
Pecten	12 long teeth, 13 short teeth alternating	18-24 teeth, long and equal
Seta 2-S	Simple	Branched
Dorsal and lateral integument	Bare	With small fine spicules

Table 2. Comparison of *An. alongensis* and *An. culiciformis* groups.

Stage/character	<i>alongensis</i> group	<i>culiciformis</i> group
Adult		
Female	Palps and proboscis approximately same length.	Palps shorter than proboscis
Male: Claspette	Setae forming club	Setae separate
Leaflets of aedeagus	Lanceolate	Hairlike
Larva		
Seta 2-C	Widely separated	Close together
Seta 11-C	Long, branched with short stem	Short, branched distally
Setae 5,6,7-C	Strong or weakly developed	Weakly developed
Immature habitat	Rock pools in limestone	Cavities in trees or bamboo

Anopheles (Anopheles) alongensis Venhuis. Mosq. Syst. 11:11-13.

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