

Anopheline mosquitoes of Myanmar-III.

Anopheles (Cellia) philippinensis Ludlow, 1902 &
Anopheles (Cellia) nivipes (Theobald), 1903 in
Myanmar and their differentiating characters

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Malaria workers in Myanmar have only recorded the prevalence of Anopheles philippinensis in the country and anopheles nivipes have not yet been identified in Myanmar. The Department of Medical Research (DMR) survey teams to Tha-bye-wa, Oktwin Township collected many specimens provisionally identified in the field as An. philippinensis. Iso-female lines were raised from wild caught female to prepare larval skin, pupal skin and adult specimens for detail morphological examination. The specimens collected from the forested foot-hill area of Tha-bye-wa was found to be An. nivipes, which was recorded for the first time in Myanmar. The distribution, seasonal prevalence, adult bionomics and larval habitats for both species, as described by previous workers were compared with the observations of the DMR survey teams.

INTRODUCTION

Anopheles (Cellia) philippinensis Ludlow has a very wide distribution in Myanmar. Khin Maung Kyi(1) recorded this species from all parts of the country and in all types of terrain. However, nobody has ever examined the morphological characters of this species, in Myanmar, in detail to differentiate it from Anopheles (Cellia) nivipes (Theobald). Apiwathnasorn(2) and Knight and Stone(3) did not include Myanmar in the distribution of An. nivipes although Reid(4) stated that An. nivipes distribution extended eastwards from Assam through Myanmar, Thailand, Malaya and possibly Indo-China. One of the authors (MP), while on a visit to Armed Forces Research Institute for Medical Sciences, Bangkok, was

encouraged by Dr. Ralph Harbach (now at Smithsonian Institution) to carry out studies on the prevalence of An. nivipes and its possible relationship to malaria transmission in Myanmar. The distribution, seasonal prevalence, breeding habitats and adult bionomics for both species were studied by DMR survey teams and the results are presented. The differentiating characters between the two species of Myanmar were also recorded.

Distribution

The distribution of An. philippinensis in Myanmar was described in detail by Khin Maung Kyi(1) and presented in Figure (1). The locations where An. philippinensis and An. nivipes have been recorded by DMR teams were presented in Table (1) and Figure (2).

Table 1. Locations where An. philippinensis and An. nivipes were collected by DMR teams

Locality	Township	Season	Topography and remarks on locations
<u>An. philippinensis</u>			
<u>YANGON DIVISION</u>			
Ye-sit-kan	Taik-kyi	June-Oct	Reservoir and catchment area with thick forest. Yangon Water Supply Centre. Low hills with some cultivated areas nearby
Kyauk-ain	Hlegu	Oct-Nov	Paddy cultivating plain area
<u>BAGO DIVISION</u>			
Bwe-chin, Phado	Kyauk-ta-gar	Aug-Oct	Paddy cultivation plain area
Hle-lan-gu	Thayarwady	Aug-Sept	Foot-hills village with paddy cultivation area nearby
A-le-kone	Gyo-bin-nauk	October	Paddy cultivation plain area about 5 miles from foot-hills
<u>MANDALAY DIVISION</u>			
Wetwun	Maymyo	Aug-Nov	Cultivated area on plateau about 3000 feet altitude
Se-daw-gyi	Madaya	Aug-Nov	Cultivated area by irrigation system. Close to foot-hills
<u>MON STATE</u>			
Kwan-ka-thaung Ward	Mudon	July-Oct	Mudon Town area with edge of Kwan-ka-thaung Ward near rubber plantation
<u>An. nivipes</u>			
<u>BAGO DIVISION</u>			
Tha-bye-wa	Oktwin	July	Foothill village surrounded by teak forest at an altitude of 700 feet
<u>MON STATE</u>			
Kwan-ka-thaung	Mudon	July	Mudon Town area with edge of Kwan-ka-thaung Ward near rubber plantation

Adult bionomic

Prevalence in relation to forest

Entomological survey teams from DMR recorded only An. nivipes during July at Tha-bye-wa village, which is situated deep inside a teak forest reserve areas. Anopheles philippinensis was not

collected at all in this area. At Kwan-ka-thaung (Myoma 4) ward, Mudon Town, which is close to light jungle and rubber plantations, An. nivipes was collected in the monsoon season but only at a ratio of 1:4 to An. philippinensis. In the paddy-cultivating plains of Kyauk-ain, Hle-gu Township, no An. nivipes was recorded

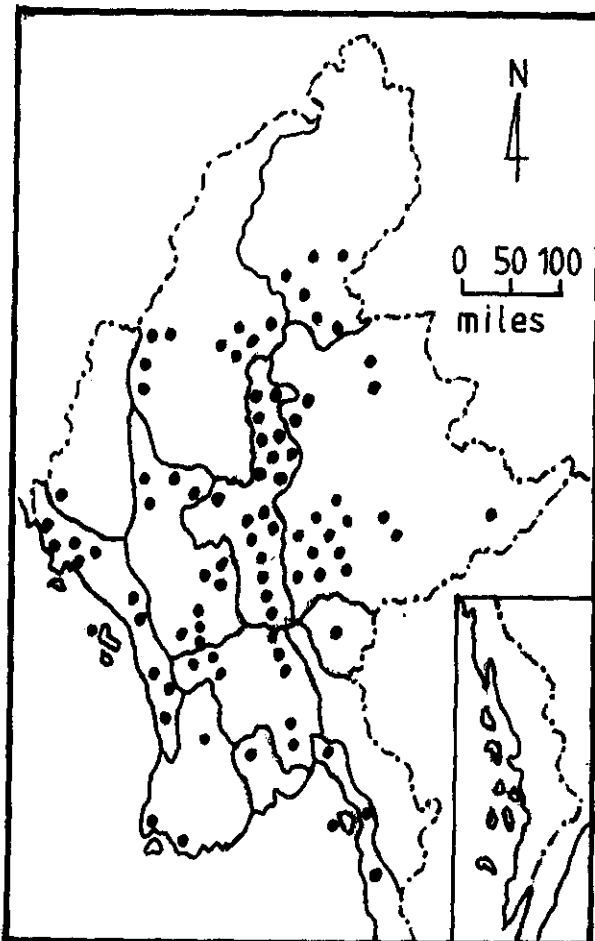


Figure 1. Recorded distribution of An. philippinensis by Khin Maung Kyi

at all in collections carried out in the monsoon and immediate post-monsoon months.

Anopheles nivipes was thus found to be associated with deep forest areas where it can be collected in significant numbers. An. philippinensis on the other hand, is more associated to paddy cultivation and breeds closer to human habitations. At Kwan-ka-thaung ward, DMR teams found An. philippinensis larvae breeding in earthen pots kept at the foot of stairs in houses washing feet.

Seasonal prevalence

Khin Maung Kyi(1) stated that An. philippinensis is prevalent from August

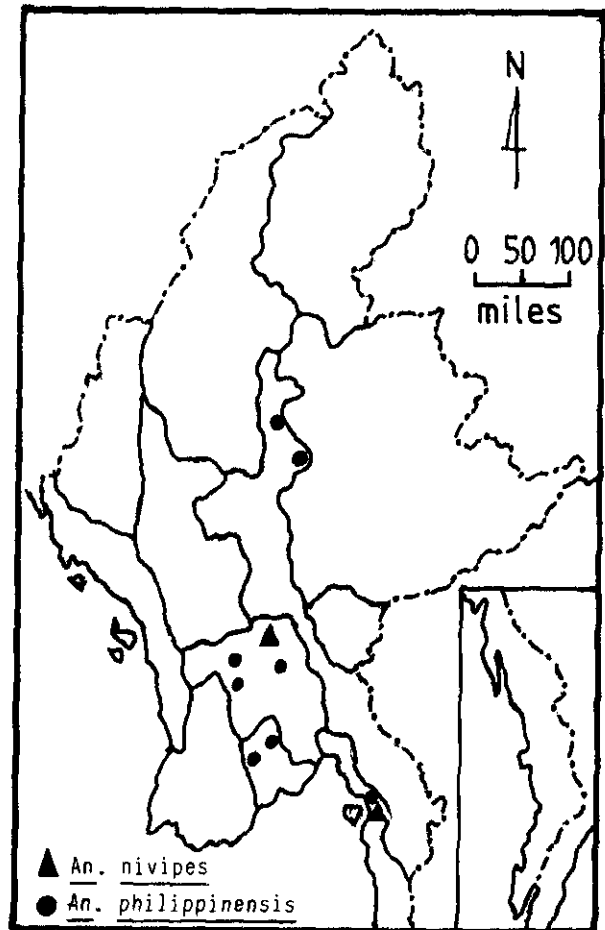


Figure 2. Recorded distribution of An. philippinensis and An. nivipes (DMR surveys)

to November with peak density in October. DMR survey teams also found this species in the latter part of monsoon with peak densities towards the end of September. However, by the end of November An. philippinensis could be collected only in small number in Kyauk-ain, Hle-gu Township.

Anopheles nivipes, was however, collected mainly during the rainy season in both Tha-bye-wa and Mudon. During subsequent surveys in the cool/dry and hot/dry seasons no An. nivipes could be collected. Its density was found to be highest in September at the end of Monsoon season in Tha-bye-wa.

Breeding sources

Khin Maung Kyi(1), quoting previous workers in Myanmar such as Feegrade and Macan, stated that An. philippinensis was found to breed in ponds, cultivated or derelict paddy fields, tanks and swamps. DMR survey teams found An. philippinensis breeding in small ponds near paddy fields and in paddy fields in association with An. annularis when the paddy plants are tall enough to provide good shade.

However, DMR teams could not detect any breeding source of An. nivipes at both Tha-bye-wa or Mudon although all potential breeding sources were surveyed thoroughly.

Biting habits

Host preference

Both An. philippinensis and An. nivipes were observed to be highly zoophilic by DMR teams. Myo Paing et al.(5) found that in Tha-bye-wa village, one night catch with human-baited bed net yield only 2 An. nivipes as compared to 11 specimens collected by cattle baited bed net placed nearby. Similarly, An. philippinensis was mainly collected from cattle-baited big bed nets.

However, Khin Maung Kyi(1) stated that at Innwaing village, Mawlamyine and at Ye-ta-khun-taung camp, Patheingyi, An. philippinensis was collected biting human-baits in large numbers during October 1970.

Time and place of biting

Both An. philippinensis and An. nivipes were found to bite mostly early in the night about 1900 to 2300 hours. Both the species are also almost always collected by outdoor biting catches and by cattle-baited big bed nets outdoors. DMR survey teams found very few An. philippinensis biting indoors. As for An. nivipes it was exclusively collected

from outdoor catches.

Daytime resting

No An. philippinensis or An. nivipes were found resting indoors during the daytime in all the areas surveyed although numbers of the DMR survey teams made special effort to collect daytime resting catches.

Relationship to malaria transmission

Khin Maung Kyi(1) stated that, in the absence of cattle, it is quite possible that An. philippinensis could act as a secondary vector during transmission season. In Bangladesh, Elias(6) assumed An. philippinensis to be a vector of major importance in the vast plain area of the country. From the results of DMR survey teams, taking into consideration its predominantly zoophilic biting habits, An. philippinensis could not be involved in malaria transmission in Myanmar.

In the forested mountainous border area between Myanmar and Thailand, An. nivipes was observed to be a secondary vector of malaria (Ralph Harbach, personal communication). In the DMR studies, at both Tha-bye-wa and Mudon, An. nivipes was predominantly zoophilic and it is assumed that in the presence of cattle, this species could not play a role in malaria transmission in Myanmar.

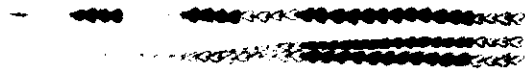
Toxonomic Discussion

The differentiation of An. philippinensis and An. nivipes was carried out according to Reid(4 & 7). The results of our studies showed some difference with the findings of Reid. The main difference was that we could easily identify An. nivipes accordingly from the larval skin slides, whereas Reid(7) stated that pupal skin characters were more diagnostic. In the Myanmar specimens, we found that the pupal characters such as the refractile border

Figure 3.

A. philippinensis

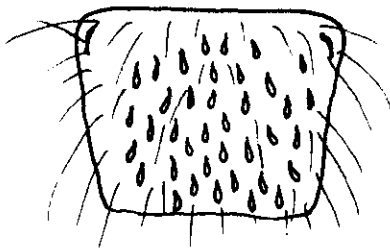
An. nivipes



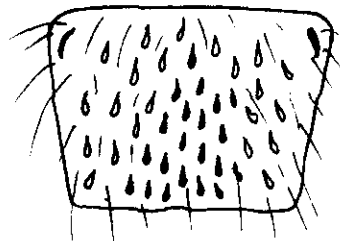
(a)



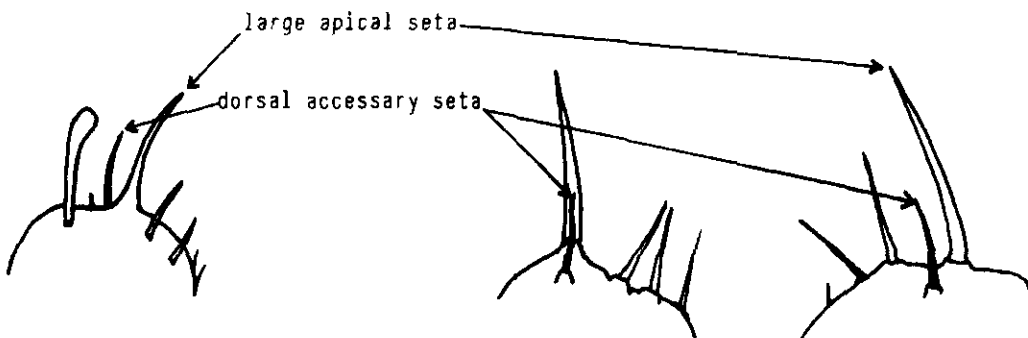
(b)



(c)



(d)



(External)

(in line)

(internal)

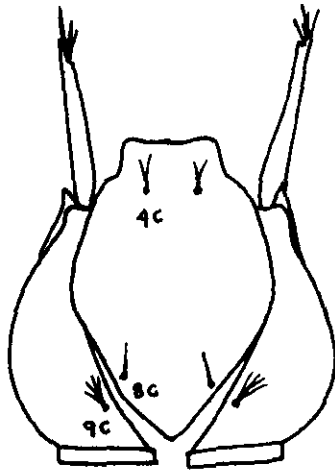
(e)

(f)

ADULT MORPHOLOGY

Figure 4.

An. philippinensis

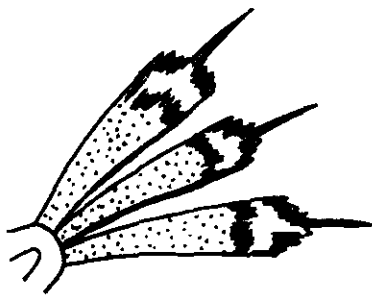


(a)

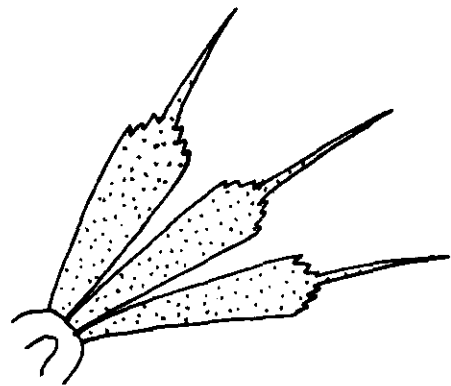
An. nivipes



(b)



(c)



(d)

length to total paddle length index and fringe teeth number were inconsistent. We could also differentiate the larval skin characters from freshly shed skins placed in a drop of water under cover slip, thus, developing a rapid method of differentiation. The adult male characters were found to be consistent and reliable.

Adult male characters

Figure (3a) shows the wing of An. philippinensis male with basal extension of dark mark on Vein R ending at the level of Presector pale (Psp) on costa.

Figure (3b) shows the wing of An. nivipes male with the basal extension of dark mark on Vein R extending basally to the level of Humeral dark (Hd) on costa.

Figure (3c) shows the An. philippinensis male sternite VIII (dorsal after rotation) with scales in the center of the segment all white, whereas in Figure (3d) An. nivipes sternite VIII the scales in the counter of segment were dark.

Differences in the male genitalia between the two species was also noted and conformed to the findings of Reid(4). As described by Reid, the accessory seta of harpago was either in line or internal to the large apical seta in An. nivipes Figure (3f) and in An. philippinensis external to the large apical seta (Figure 3e).

Larval skin characters

In the Myanmar specimens that we examined, larval characters were found to be diagnostic and very consistent. Figure (4b) shows the cephalic hairs of the two species where nivipes was found to have more branches in 4,8,9c as compared to An. philippinensis Figure (4a). According to Figure (4c,d) the palmate hair in Abdominal

segment III-IV show marked difference between the two species. We could observe fresh skin in a drop of water on a slide and differentiate between nivipes and philippinensis by this character alone. From the colonies of nivipes and philippinensis, blind trials were tried on fresh larval skin identification with very accurate results.

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