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Bioecology of *An. philippinensis* in Andaman group of Islands

M.K. Das[a*], B.N. Nagpal[b], Aruna Srivastava[b] & M.A. Ansari[b]

[a]*Malaria Research Centre (Field Station), Malacca, Car Nicobar Island;* [b]*Malaria Research Centre, 20 Madhuban, Delhi, India*

Studies on bioecology of *An. philippinensis* a vector of malaria was carried out in eight islands of the Andaman group. It was found that *An. philippinensis* preferred to rest and bite outdoors. Maximum biting was observed during 1800 to 2100 hrs on both cattle and human bait. The maximum breeding of *An. philippinensis* was recorded in slow moving stream followed by ponds with vegetation. The breeding sites infested with *Chara* and *Spirogyra* algae were most favourable whereas, with *Lemna* and *Oscillatoria* were unfavourable for the proliferation of this species. The breeding association of *An. philippinensis* was found with other seven anopheline species in different breeding habitats.

Key words *An. philippinensis* bioecology – Andaman – *Anopheles* distribution – biting behaviour – breeding association

An. philippinensis is an important malaria vector in South Asia and Southeast Asia—Bangladesh, Mayanmar and India although the species is reported from Borneo, China, Hainan Island, Java, Malaysia and Philippines. In India it is recorded from Andaman Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Goa, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Tripura and West Bengal.

Developmental activities are known to bring radical changes in the terrain system. In the island ecosystem these changes become more pronounced. In Andamans large areas have been deforested for construction of new roads and for setting up of new settlements for rehabilitations of refugees, construction of dams, irrigation, urbanization, etc. In addition to this, inter island transportation (ship services) has increased several times resulting in population migration. The bioecology of *An. philippinensis* was studied in Meghalaya by Rajagopal[1], and in West Bengal by Sen[2]. However, the findings reported by Christophers[3] in Andaman Island are old and scanty. The present studies were carried out during February 2000 to February 2001 and reported in the present communication.

Material & Methods

Adult mosquito and larval collections were made from eight areas—Hutbay, Port Blair, Baratang, Kadamtala, Betapur, Rangat, Mayabander, Diglipur of Andaman groups. Indoor resting collections were undertaken from human dwellings and cattlesheds in the morning hours just after the sunrise (0500 to 0800 hrs), while outdoor resting were undertaken from open sheds, bushes and vegetation, during day time (0800 to 1100 hrs). Evening resting and biting collections were made in and around the cattlesheds and human dwellings during 1730 to 2100 hrs. Evening biting collections on cattle bait were also carried out from 1730 to 2130 hrs. Mosquitoes were

[*]*Corresponding author*

collected by aspirator method. Four all nights (1700 to 0500 hrs) man and cattle biting collections were made at Hutbay. Larvae and pupae were collected with the help of a dipper (9.5 cm diam and 300 ml capacity) and pasture pipettes from ricefields, ponds, marshy area, tanks, ditches, stream, forest nullah, waterfall streams, seepage water of dams and creeks, and these were kept in the field laboratory unit until adult emergence. All newly emerged mosquitoes were killed by ether and dry mosquitoes were packed in a wide mouth plastic vial. The packed mosquitoes were brought to Malaria Research Centre (Field Station), Car Nicobar laboratory for further processing. In the laboratory the specimens were rehydrated, relaxed and pinned on a cork sheet for identification and storage in the entomological boxes. The mosquitoes were identified using the keys of Christophers[3,4], Barraud[5], Nagpal and Sharma[6] and catelogue of Knight and Stone[7].

Results & Discussion

A total of 9721 mosquitoes belonging to ten species—*An. sundaicus, An. dirus, An tessellatus, An. barbumbrosus, An. kochi, An. karwari, An. barbirostris, An. insuelaeflorum, An vagus* and *An. philippinensis* were collected. Out of 9721 mosquitoes 4111 (42.29%) were *An. philippinensis*. The maximum number of specimens — 1227 (12.62%) were collected from Hutbay Islands. This was followed by Port Blair–1077 (11.07%) and Mayabander–588 (6.04%) specimens. Out of 4111 specimens 2528 (61.49%) specimens were collected during the biting time (1800–2100 hrs) on cattle. Similar observation was observed by Rajagopal[1] in Meghalaya who recorded 1417 (66.52%) specimens of *An. philippinensis* out of 2130 specimens collected during cattle biting in the evening hours in five months from June to November.

From the outside shelters—shrubs and fence, 1387 specimens were collected. These included mosquitoes during their pre- and post-biting resting phases of the species. In the evening collections only 154 mosquitoes were found resting indoors—cattlesheds, human dwellings and mix dwellings. Nandi *et al*[8] also observed the similar findings from Boko area of Assam. These results of biting and resting collection depict that *An. philippinensis* in Andaman group of Islands is predominantly a zoophilic species.

Whole night human and cattle bait collections: Results of four whole night collections carried out in Hutbay (Little Andaman) in four months (April to July) on human and cattle baits outdoor are given in Figs. 1 & 2.

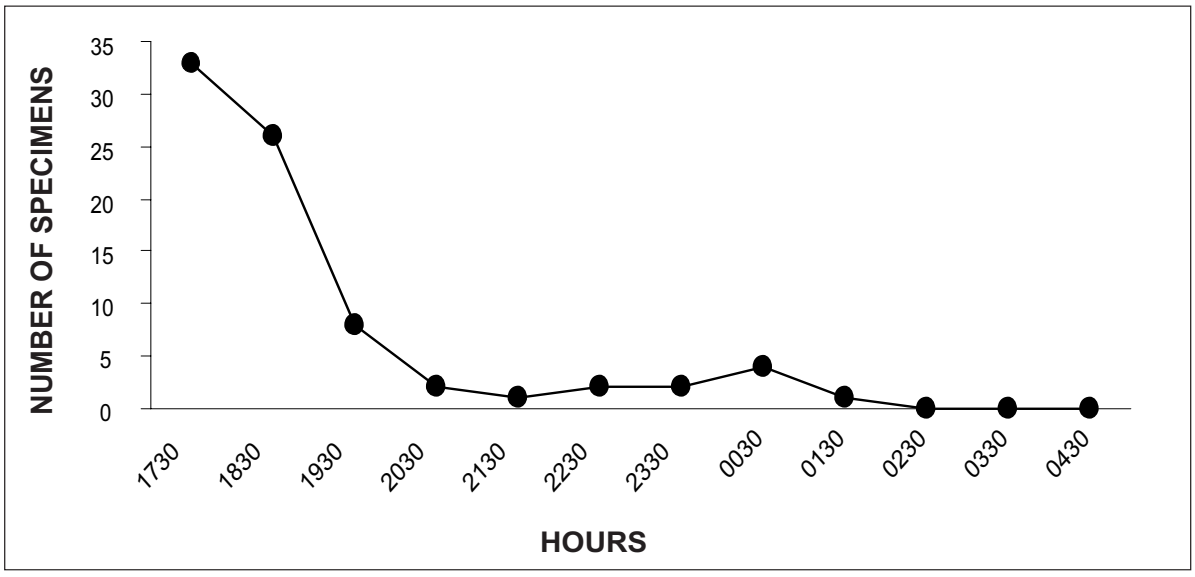

Fig. 1: Biting habit of *An. philippinensis* on human bait in Hutbay (Outdoor)

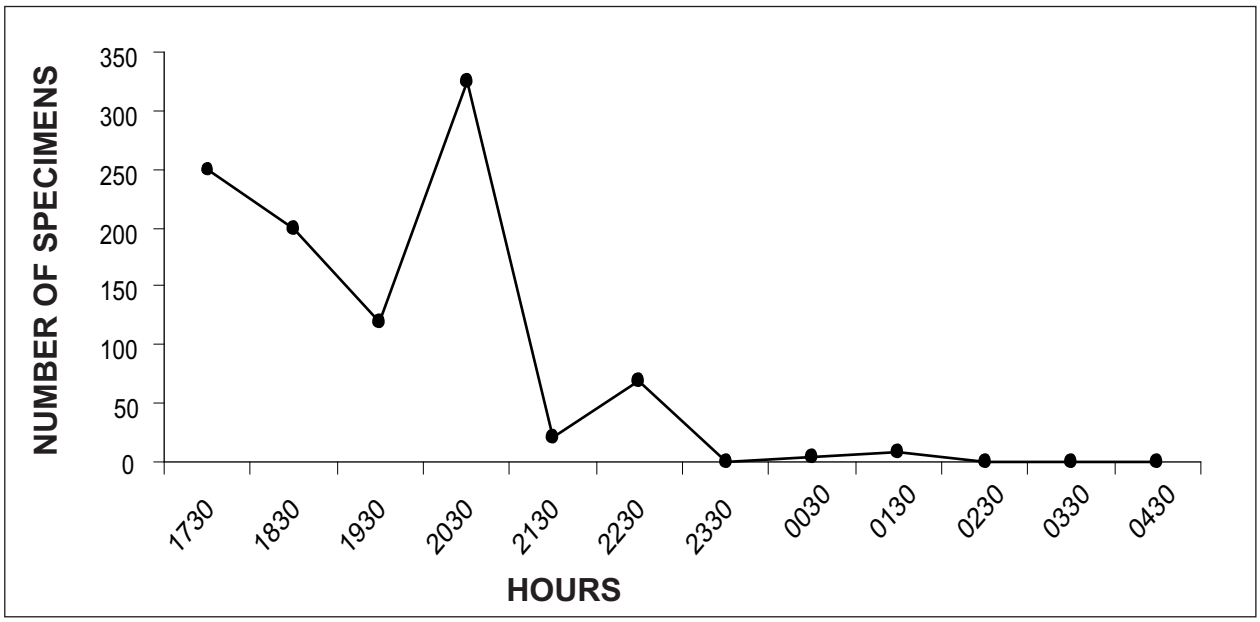

Fig. 2: Biting habit of *An. philippinensis* on cattle bait in Hutbay (Outdoor)

On human baits just after the dusk, the peak biting was observed between 1730 and 1830 hrs (33 specimens). Thereafter the biting slowly declined and 2030 hrs biting was negligible. After 0130 hrs, not even a single specimen was collected. Similar type of observation on human bait was observed by Rajagopal[1] in Meghalaya, whereas on cattle bait two peaks were observed—first peak between 1930 and 2030 hrs (310 specimens) and the second peak was observed from 2230 to 2330 hrs (62 specimens). After 2330 hrs only one specimen was collected.

Day time indoor collections: In indoor collection during morning hours only six specimens of *An. philippinensis* were collected from cattlesheds. Out of these, four specimens were collected from Hutbay and two specimens were collected from Sipighat (Port Blair). It is noteworthy to mention here that during morning hours no specimen of *An. philippinensis* was collected from human dwelling in the eight islands during the entire study period.

Results of morphological identification revealed that more than 94.8% specimens were *An. philippinensis* and only 5.2% specimens were *An. nivipes* as per the key of Nagpal and Sharma[6]. From Port Blair maximum number of *An. nivipes* (71 specimens) were identified.

Larval ecology: A total of 1679 adults of *An. philippinensis* emerged from 12 breeding sites of study areas. The maximum number in 474 emerged from streams followed by 301 from ponds and 272 from forest nullah (Table 1).

The most favourable and unfavourable breeding sites of *An. philippinensis* in the Andaman group of Islands are summarised in Table 2. The species prefer to breed in association with aquatic vegetation. Similar type of breeding association was observed from other parts of the country and in the neighbouring country[9–13]. The breeding of *An. philippinensis* was not recorded in creeks, mangrove area and polluted drain with and without vegetation. It reveals that species prefer to breed in fresh and clean water and salinity is limiting factor.

The breeding of *An. philippinensis* was found associated with seven species—*An. sundaicus, An. barbirostris, An. tessellatus, An. barbumbrosus, An. kochi, An. vagus* and *An. insulaeflorum.* The breeding association

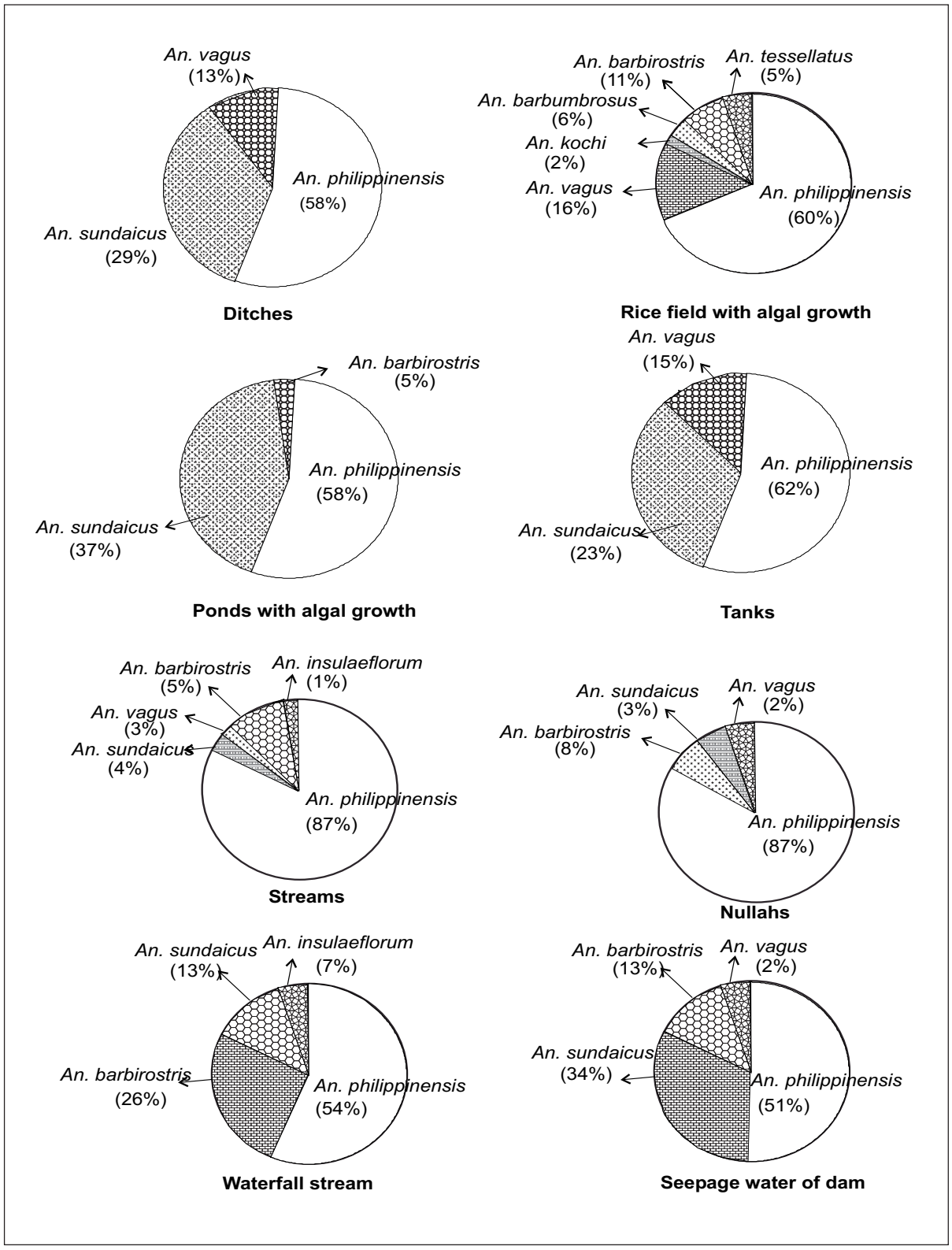

Fig. 3: Breeding association of *An. philippinensis* with other anophelines species in different breeding habitats

Table 1. Emergence of *An. philippinensis* from different breeding sites of Andaman group of Islands

Islands	Marshy area with algal growth	Ponds	Rice fields	Tanks	Ditches	Streams	Forest nullahs	Waterfall streams	Seepages water of dam	Total
Hutbay	77	21	17	19	11	217	151	43	46	602
Diglipur	–	35	21	19	–	88	33	–	–	196
Mayabander	–	41	17	22	31	72	45	–	–	228
Baratang	–	52	35	21	7	22	–	–	–	137
Rangat	–	35	12	23	17	31	–	–	–	118
Betapur	–	36	–	17	21	–	–	–	–	74
Kadamtala	51	42	39	28	–	44	22	–	–	226
Sipighat (Port Blair)	–	39	47	–	7	–	21	–	–	114
Total	128	301	188	133	94	474	272	43	46	1679

Table 2. Characterisation of breeding sites of *An. philippinensis* in the Andaman group of Islands

Breeding	Very favourable	Favourable	Unfavourable
Breeding place	Streams, Nullahs, Ponds	Rice fields, Tanks, Ditches, Marshy areas, Seepages water of dam	Creeks, Mangrove areas, Polluted water drains
Vegetation type	*Chara, Spirogyra*	Green algae, Free floating algae, Submerged vegetation	*Lemna, Oscillatoria*
Types of water	Clean, Exposed to sunlight	Clean sunlight shaded place	Polluted water, Shaded place, Heavy rainfall and Heavy flowing of water

of *An. philippinensis* with other anophelines in different habitats is given in Fig. 3. The species was found breeding in association with five species—*An. tessellatus, An. barbirostris, An. barbumbrosus, An. kochi* and *An. vagus* in rice fields with algal growth and with four species namely *An. vagus, An. sundaicus, An. insulaeflorum* and *An. barbirostris* in the streams. The maximum association was recorded with *An. sundaicus* in seven breeding places followed by *An. barbirostris* and *An. vagus* in six breeding places all in fresh waters.

This is the first report on the bioecology of *An. philippinensis* from the Andaman group of Islands. *An. philippinensis* which is a secondary vector in northeastern India may be playing a similar role in malaria transmission in the inland areas of the Islands. This bioecology of *An. philippinensis* will help in assessing its role in the transmission of malaria, if any and in its control in Islands.

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