

Studies on mosquitoes (Diptera: Culicidae) and anthropic environment. 12- Host-seeking behaviour of *Anopheles albitarsis* s.l. in South-Eastern Brazil*

Estudos sobre mosquitos (Diptera: Culicidae) e ambiente antrópico. 12 - Atividade hematófaga de Anopheles albitarsis s.l. na região Sudeste do Brasil

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Abstract

Results obtained with *Anopheles albitarsis* s.l. catches mainly performed through human bait at the Ribeira Valley region, SP (Brazil), are reported. Two species of the complex were recognized, namely *An. albitarsis* s.s. and species B. This latter predominated both in the rice fields and in the dwelling environments. The crepuscular rhythms showed an unimodal sunset pattern with most blood-seeking females caught during dusk. The absence of differences between indoor and outdoor behavior was confirmed for both species of the complex.

Anopheles. Ecology, vectors.

Resumo

Relatam-se os resultados de observações sobre o complexo *Anopheles albitarsis* realizadas mediante o emprego de isca humana em ambiente antrópico do Vale do Ribeira, SP (Brasil), constituído pela Estação Experimental de Pariquera-Açu. Reconheceu-se a presença de duas espécies representadas por *An. albitarsis* s.s. e outra, designada como espécie B. As coletas foram levadas a efeito em margens de campos irrigados para cultivo de arroz e no ambiente domiciliar. Em ambas, os resultados conseguidos foram paralelos, com maior abundância ocorrendo por ocasião dos meses chuvosos (novembro-março). Quando do período do crepúsculo vespertino, o ritmo de atividade mostrou-se nitidamente unimodal, com a maioria das fêmeas ocorrendo no lusco-fusco, isto é, correspondente à segunda unidade crep, das cinco em que foi dividido aquele período. Confirmou-se a equivalência, em nível de baixa densidade, do comparecimento intra e peridomiciliar. Dos representantes do complexo, a espécie B mostrou-se francamente predominante. Os resultados obtidos em matas residuais e em outra área da mesma região mostraram-se insignificantes no que concerne a esses anofelinos.

Anopheles. Ecologia de vetores.

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INTRODUCTION

As it is now recognized, the Ribeira Valley region of S. Paulo State (Brazil) currently presents a hypoendemic level of malaria. So far bromeliad-breeding *Anopheles* have usually been incriminated as vectors. However, ground breeding anophelines may become significant as a consequence of human activities. This may occur when the artificial flooding irrigation technique is employed for rice cultivation. Among those deserving attention, *Anopheles albitarsis* must be mentioned as particularly favoured by local agricultural practices (Forattini et al.⁴, 1993). This *Anopheles* is considered at the present time to be confined to temperate South America but it seems that various taxa exist within that species (Rosa-Freitas¹², 1989; Rosa-Freitas et al.¹³, 1990; Narang et al.⁹, 1993). Using the Random Amplified Polymorphic DNA Polymerase Chain Reaction (RAPD-PCR) technique Wilkerson et al.¹⁵ (1995) were able to identify four reproductively isolated taxa. In the area studied and here reported, two of these species were found: *An. albitarsis* s.s. ("A") and an undescribed species designated as species "B" (Wilkerson¹⁶, 1995).

Since the malaria eradication campaign, no local transmission related to *An. albitarsis* has been demonstrated. Nonetheless, the discovery of this potential vector has presented the opportunity of carrying out research into its behaviour in the man-made environment. During studies reported elsewhere, comparisons were made between the results obtained through the use of two different sampling techniques namely, Shannon trap at the rice fields and human bait in the houses (Forattini et al.⁶, 1995). The purpose of the present paper is to relate the results obtained using only human bait at the same locality. The objective was to compare the evening host-seeking activities in both environments. Additional data obtained at other places and by other sampling techniques are also reported.

STUDY AREAS

These studies were conducted at the same localities described by Forattini et al.^{3,4,6}, 1993, 1995. Outdoor and indoor adult collections were carried out in dwellings at the ES (Experimental Station) area in the BC ("Sítio Barra do Capinzal"). For purposes of comparison, collections were performed also at GA ("Sítio Galiléia") and at the ES irrigation system.

MATERIAL AND METHOD

Biting activity was fortnightly biweekly using two human bait collectors. They worked simultaneously, one of them indoors and the other outdoors. Mosquitoes that landed on the collectors were taken during a two-hour period starting at sunset. Daily crepuscular data were obtained from the National Almanac records for the local standard time. Collections were performed during the period from March 1994 to April 1995. During this same period, human bait collections were also performed every two weeks at the rice field margin. With respect to these catches, the sunset crepuscular period was divided into five crep units according to Nielsen^{10,11} (1961, 1963). The second of these was subdivided into five-minute intervals. This method was followed since during this period, the sky is twilight.

Under similar conditions, from February to April 1995, a small series of human bait catches was performed at GA inside the secondary vegetation. Further, collections were also carried out using a Shannon trap, in the remnant forest patches of the ES area, from January 1994 to January 1995. Also, at biweekly intervals these catches were scheduled at 17:00 - 20:00 hours. Finally, an aspiration technique also was used biweekly during the morning, in the ecotones and on the edges of the drainage ditches of the ES irrigation system, from January 1993 to April 1995 (Forattini et al.⁵, 1993).

Biting activity was expressed by Williams' mean (\bar{X}_w) (Haddow^{7,8}, 1954, 1960). The collections were computed separately for each crep unit and expressed as hourly arithmetic means (\bar{X}). Macroclimate data regarding rainfall and temperature levels were obtained from the records of the Pariquera-Açu Station of the "Instituto Agrônômico de Campinas" (Campinas Agronomic Institute) of S. Paulo State (Fig. 1).

As mentioned above, two cryptic species were found, already identified as A and B. The discrimination of the two was based on the proportion of dark on hindtarsomere 2 and the length of the prehumeral dark spot (Forattini et al.⁶, 1995).

RESULTS

A total of 5,650 *Anopheles albitarsis* s.l. females were collected. Practically all of them (5,647) were caught in the ES area. Of these 18.8% were identified as *An. albitarsis* s.s. (formerly designated as species A) and 81.2% as species B.

The Table shows the monthly numbers and Williams' means (\bar{X}_w) of both species collected on human bait in the open at the edges of the rice fields. Species B was five times more prevalent than A. Taking the macroclimatic rainfalls and temperatures into consideration the influence of the wet season is evident (Fig.1). The host-seeking pattern at sunset was unimodal for both mosquitoes, with most females

Table - Monthly numbers and Williams' means (\bar{X}_w) distribution of landing *Anopheles albitarsis* s.l. females caught on human bait in the ES area on the edges of rice fields (March 1994 - April 1995)*.

Months	N catches	<i>An. albitarsis</i> s.s.**			Species B			Total		
		n	%	\bar{X}_w	n	%	\bar{X}_w	n	%	\bar{X}_w
1994										
March	3	72	7.2	24.0	1,140	25.4	219.1	1,212	22.1	264.2
April	2	15	1.5	7.5	43	1.0	21.0	58	1.1	28.6
May	2	1	0.1	0.4	13	0.3	6.7	14	0.3	7.7
June	2	4	0.4	1.8	28	0.6	11.7	32	0.6	13.4
July	2	1	0.1	0.4	60	1.3	30.0	61	1.1	30.5
August	3	3	0.3	0.8	33	0.7	10.7	36	0.7	11.8
September	2	-	-	-	-	-	-	-	-	-
October	2	4	0.4	1.8	19	0.4	9.4	23	0.4	11.0
November	2	1	0.1	0.4	67	1.5	32.7	68	1.2	33.3
December	2	153	15.4	74.0	571	12.7	230.0	724	13.2	308.9
1995										
January	3	302	30.4	97.8	1,010	22.5	335.0	1,312	23.9	433.6
February	1	261	26.3	261.0	386	8.6	386.0	647	11.8	647.0
March	3	172	17.3	40.9	1,068	23.8	324.3	1,240	22.6	373.8
April	2	5	0.5	2.5	58	1.3	24.4	63	1.1	27.6
Total	31	994	100.0	7.8	4,496	100.1	40.5	5,490	100.1	47.3

* ES - Experimental Station. Species taxonomic status according to Wilkerson et al.¹⁵ (1995).

** Formerly Species A.

being caught at dusk (Figs. 2 and 3). Once again, species B was more frequent in the collections.

Overall, 122 blood-seeking females were caught in the ES dwellings (BC). Comparable numbers of both species were obtained from human collectors positioned indoors and outdoors: 62 *An. albitarsis* s.s., and 60 species B. As in the open rice fields, the influence of the wet season was evident (Fig. 4).

In the remnant forests of ES, only four species B females were caught in the Shannon trap. No specimens were collected inside these remnant forests by the use of the aspiration technique. Outside, it the number of females caught were as follows:

	<i>An. albitarsis</i> s.s.	species B
ecotones	1	-
drainage ditches	<u>3</u>	<u>27</u>
total	4	27

Finally, only two *An. albitarsis* s.s. and one species B females were obtained on human bait at GA, despite the favourable season (Fig. 1).

DISCUSSION

The results obtained by the use of human bait demonstrate a general agreement between adult abundance in the rice fields and in the houses. Practically all the material obtained was concentrated in the Experimental Station (ES) area and related to the two species of the complex, namely *Anopheles albitarsis* s.s. and species B. As the abundance was greater at the irrigation system, the results confirm what had been observed

earlier, including the pattern found in the domiciliary environment (Forattini et al.⁶, 1995).

During this study, the host-seeking sunset behavior showed a unimodal pattern at dusk. This agrees with observations made elsewhere (Chadee¹, 1992; Rubio-Palis and Curtis¹⁴, 1992). In the domiciliary environment, indoor and outdoor rhythms were similar for both species, although with low densities and limited to the first semester. This low density in dwellings has also been reported elsewhere in Brazil as, for example, in Rondonia State (Deane et al.², 1988).

In earlier observations no agreement has been reported regarding the monthly abundance, a between the domiciliary environment human bait catches and those made in the rice fields by the use of the Shannon trap (Forattini et al.⁶, 1995). However, in the present study covering the 1994-1995 cultivation cycle, this agreement was observed. Thus greater abundance, both in the rice fields and in the dwellings, was seen November on. Probably the use of the human bait technique at both places has something to do with it.

In conclusion, up to the present time research undertaken in the Ribeira Valley region suggests that the irrigation for rice farming increases the species density of the *Anopheles albitarsis* complex. This mosquito group deserves particular attention since it is regarded as an important epidemiological vector of malaria parasites and other infectious agents. Nevertheless, that significance may present considerable regional variation. However, it would seem advisable at this stage to pay attention to future agricultural development in the region.

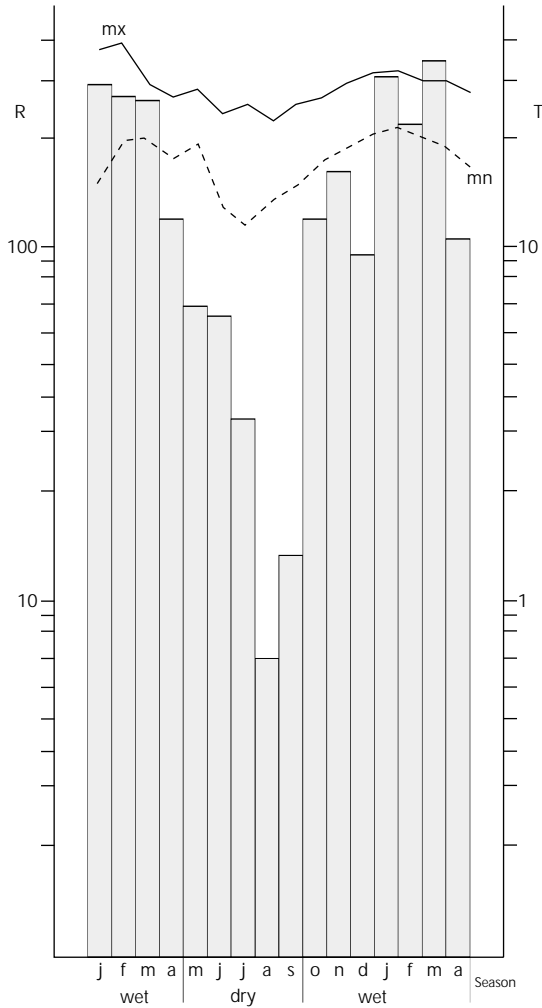


Figure 1 - Meteorological pattern of the study area. R - rainfall (mm) represented by bars. T - mean temperatures (°C), maximal (mx) and minimal (mn).

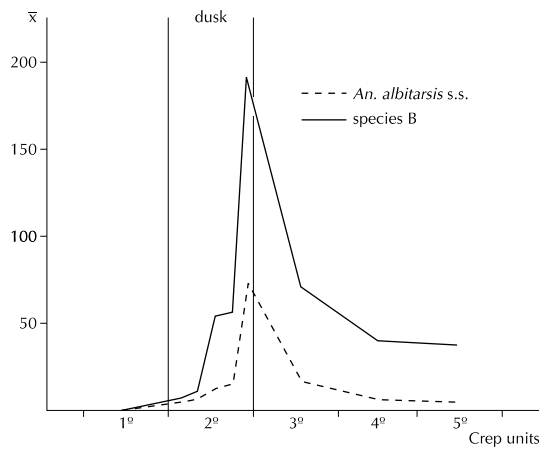


Figure 3 - Sunset distribution (five crepuscular units 1st - 5th) of females caught on human bait at the edges of the ES rice fields (\bar{x} - arithmetical mean).

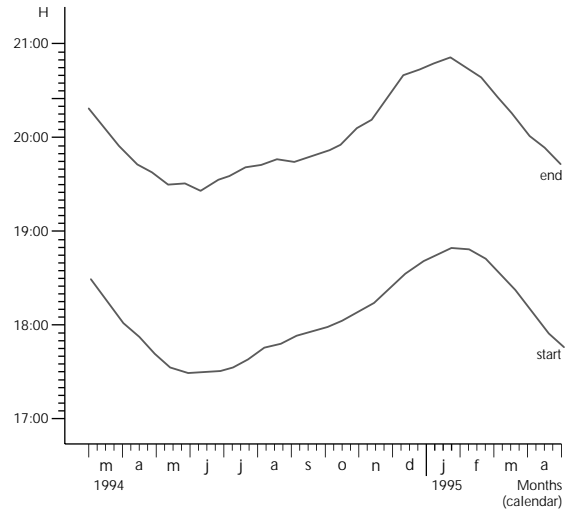


Figure 2 - Hourly intervals (H) of the 31 fortnightly human bait collections at the edge of the ES rice fields, during the sunset period from March 1994 to April 1995.

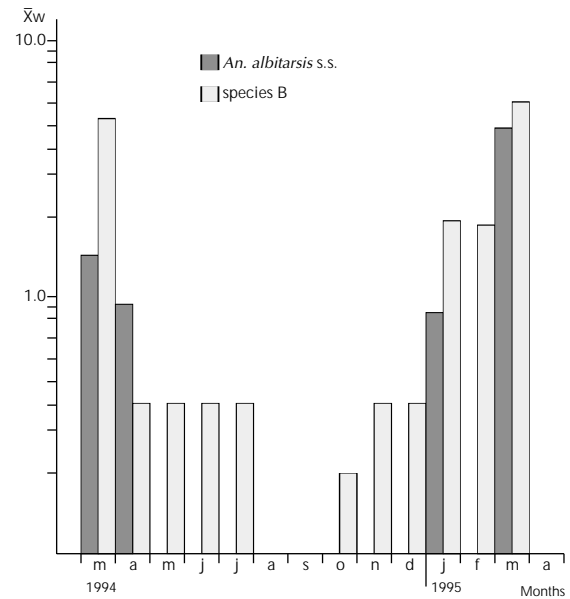


Figure 4 - Monthly distribution of Williams' means (\bar{x}_w) obtained by the use of human bait catches in the dwellings (BC) of the ES area.

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