

## A CONTRIBUTION TO THE STUDY OF *SIMULIUM* AND *CULICOIDES* OF RIO DE JANEIRO: MONTHLY INCIDENCE AND BITING ACTIVITY

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*During March 1984 to February 1985, we captured simuliids and biting midges in the National Park of Tijuca, Rio de Janeiro. A study of monthly incidence and biting activity and their correlation to air temperature, relative humidity, and rainfall was made.*

Key words: *Simulium* - *Culicoides* - monthly incidence - biting activity - Rio de Janeiro

With the objective of gaining a better knowledge of the fauna and bioecological aspects of simuliids and biting midges of the Atlantic Forest of the Tijuca Massif, we captured specimens at the "Represa dos Ciganos" in the National Park of Tijuca from March 1984 to February 1985. This investigation was made by two independent groups. The biting midges were studied by the second author and the simuliids by the others authors.

This area, a forest reservation, was selected due to environmental and water systems which are favourable to the development of simuliids and biting midges.

### AREA OF STUDY

The National Park of Tijuca, a part of the Coastal Mountain Range (Serra do Mar), also known as Forest of Tijuca, is located at 22°55' 23°01'S and 43°12' 43°19'E.

The Forest of Tijuca is a tropical rain forest, complexly and densely vegetated and constituted largely of secondary jungle. Its fauna comprises numerous species of small mammals, birds, reptiles, amphibians and typical invertebrates of humid tropical forests.

The group of elevations present in the forest act as a barrier to the humid coastal winds and evaporation from the lakes of the Jacarepaguá plain, resulting in mean annual rainfall of more than 2000 mm.

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### MATERIAL AND METHODS

Bi-monthly visits to the area, with the capture of adult and immature simuliids and biting midges, were carried out. Only one capture per period was made due to heavy rainfall in August and December 1984.

The anthropophilic females were caught on the left margin of the Cabeças river at an altitude of approximately 350 m in the area of the "Represa dos Ciganos". Collections were made by two persons who acted simultaneously as bait and captor. The insects which tried to bite were caught through suction with the Castro catching tube and put in separate glass containers every hour. The simuliids were caught between 8:30 - 11:30 and 15:00 - 18:00 h, and the biting midges between 8:00 - 12:00 and 14:00 - 18:00 h. The results obtained in relation to hour of capture were calculated using Willians' mean.

During capture, the temperature, relative humidity, rain, and wind data were recorded hourly. Rainfall data were provided by the National Department of Meteorology.

The captured specimens were brought to the laboratory for identification and added to the collections. *Culicoides* were dissected and mounted between slide and cover slip with a phenol-balsam mixture by the method of Wirth & Marston (1968), or preserved in 70% ethanol. Simuliids were needled.

Part of the Cabeças river bed was selected for the capture of the immature simuliids. This area, just above the "Represa dos Ciganos", was divided in two stations: A and B. In station A the river flows rapidly through irregular terrain, has clear water and a rocky bed. In station B

the river bed is covered with sand and pebbles; the flow is rapid and turbulent due to rocks and underwood.

Immatures were caught between 11:30 – 14:00h. Water temperature and pH were recorded after every capture. Collected larvae were separated and fixed in 70% ethanol. Pupae were conditioned for eclosion in individual flasks and adults that emerged were either killed with needles or mounted between slides and cover slip with Canada balsam.

RESULTS

SIMULIIDS

*Adults:* Only *Simulium pertinax* was caught on human bait. Peak incidence was in June between 17:00 – 18:00 h. (Table I, Figs. 1, 2).

*Immatures:* The species of simuliids most frequently encountered in both stations A and B were *S. pertinax* (65%) and *S. subnigrum* (32.7%). *S. pertinax* was present year-round, predominating in June and September, being

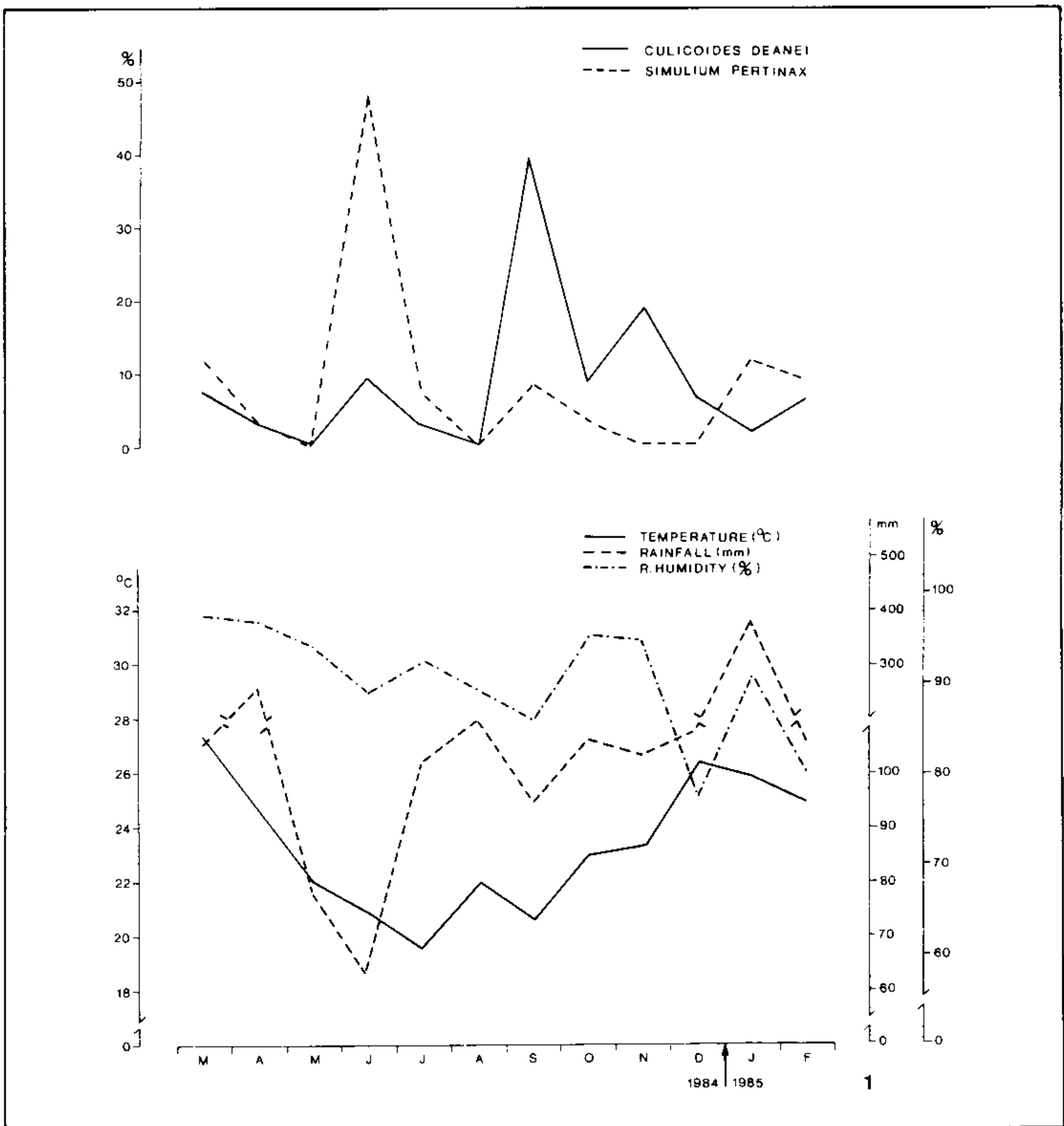


Fig. 1: Monthly incidence of *Simulium pertinax* and *Culicoides deanei* collected on human bait. Diagram showing the temperature, rainfall and relative humidity in the National Park of Tijuca, Rio de Janeiro.

TABLE I

Monthly number and percentage of *Simulium pertinax* and *Culicoides* in relation to the total number of female samples collected on bait at the "Represa dos Ciganos", Rio de Janeiro, March 1984 – February 1985

Species	1984											1985		Total	%
	M	A	M	J	J	A	S	O	N	D	J	F			
<i>SIMULIUM</i>															
<i>S. pertinax</i> Kollar, 1832	25	6	–	103	16	–	17	6	–	–	29	17	219	100	
Hours spent	12	12	12	12	12	6	12	12	12	6	12	12	132	–	
<i>CULICOIDES</i>															
<i>C. aragoi</i> , Tavares & Dias, 1980	–	1	–	–	–	–	–	1	1	–	–	–	3	0.2	
<i>C. deanei</i> Felipe-Bauer & Wirth, 1987	113	49	2	138	36	1	581	107	275	95	36	87	1520	91	
<i>C. debilipalpis</i> Lutz, 1913	6	9	6	7	3	4	10	13	2	1	1	23	85	5.1	
<i>C. limai</i> Barretto, 1944	–	–	–	1	–	2	1	–	–	–	–	–	4	0.2	
<i>C. neoparaensis</i> Tavares & Souza, 1978	–	–	–	–	–	–	–	2	–	–	–	–	2	0.1	
<i>C. paraensis</i> (Goeldi, 1905)	–	–	1	2	–	–	3	–	1	–	–	–	7	0.4	
<i>C. rachoui</i> Tavares & Souza, 1978	–	–	–	1	–	–	7	5	–	1	1	1	16	1	
<i>C. spp.</i>	–	–	1	5	–	1	10	–	6	–	4	7	34	2	
Total	119	59	10	154	39	8	612	128	285	97	42	118	1671	100	
Hours spent	16	16	16	16	16	8	16	16	16	8	16	16	176	–	

TABLE II

Monthly number and percentage of simuliids species eclosed in the laboratory in relation to the total number of immature samples collected at the "Represa dos Ciganos", Rio de Janeiro, March 1984 – February 1985

Species	1984											1985		Total	%
	M	A	M	J	J	A	S	O	N	D	J	F			
<i>S. anamariae</i> Vulcano, 1962	–	–	–	–	3	–	–	–	–	–	–	–	3	0.4	
<i>S. clavibranchium</i> Lutz, 1910	–	–	–	–	1	–	–	–	–	–	–	–	1	0.2	
<i>S. diversifurcatum</i> Lutz, 1910	–	–	1	3	4	–	–	–	–	–	–	–	8	1.3	
<i>S. inaequale</i> Paterson & Shannon, 1927	–	–	2	–	–	–	1	–	–	–	–	–	3	0.4	
<i>S. pertinax</i> Kollar, 1832	11	28	42	61	39	27	97	46	23	8	14	37	433	65	
<i>S. subnigrum</i> Lutz, 1910	–	1	9	25	41	39	26	47	10	16	2	2	218	32.7	
Total	11	29	54	89	88	66	124	93	33	24	16	39	666	100	

September the month of peak incidence. *S. subnigrum* was not encountered in March and showed peak incidence in July, August, and October (Table II).

No correlation could be found between

water temperature and pH and the collected immature species.

Outside of the capture area we also found other species: *S. rubrithorax*, *S. pintoii* and *Simulium* sp.

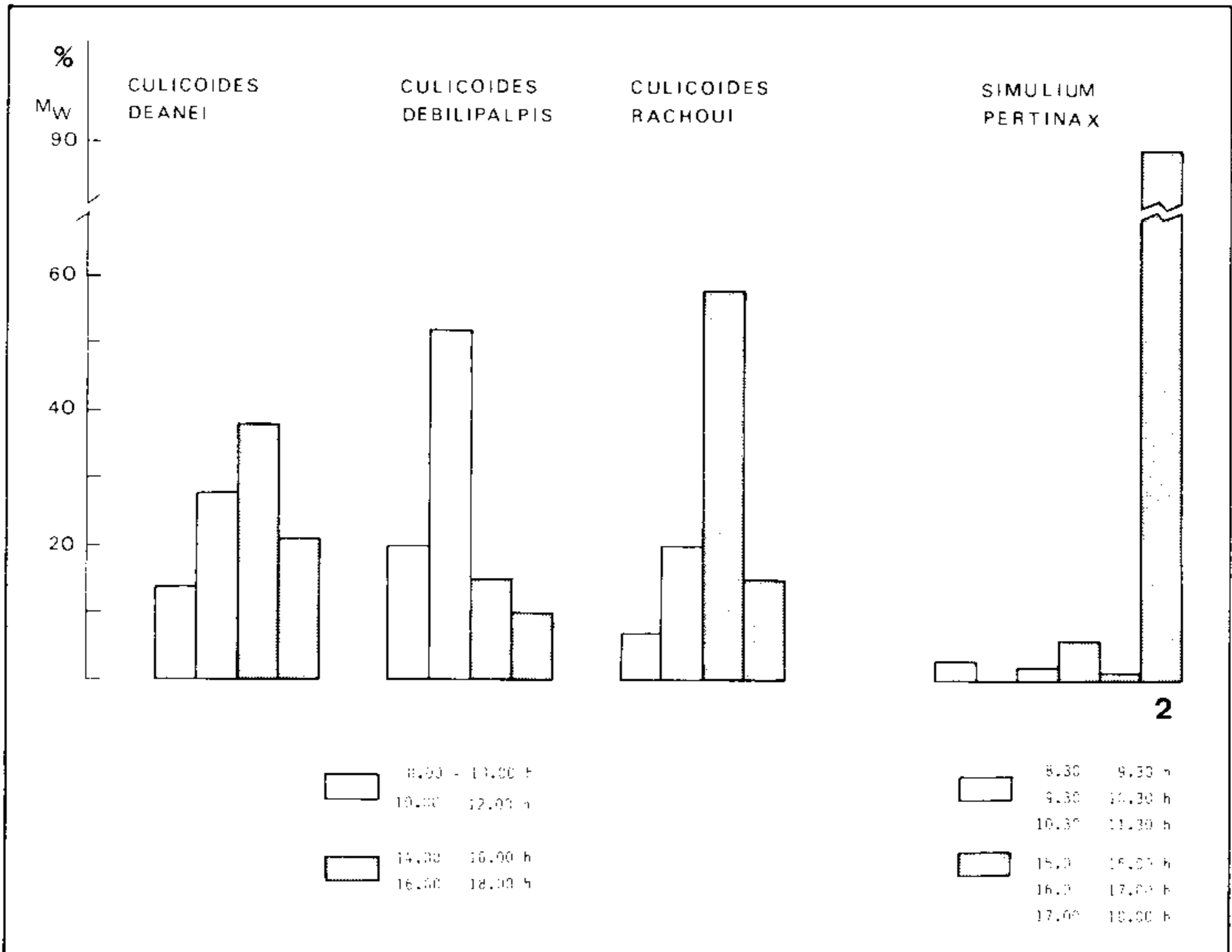


Fig. 2: Percentage per time period of species determined by Williams' mean (Mw): *Culicoides deanei*, *C. debilipalpis*, *C. rachoui* and *Simulium pertinax* based on human bait collection. March 1984 – February 1985.

BITING-MIDGES

Approximately 91% of the collected *Culicoides* consisted of *C. deanei*, while another 7% were represented by the following six species: *C. debilipalpis* (5.1%), *C. rachoui* (1%), *C. paraensis* (0.4%), *C. aragoi* (0.2%), *C. limai* (0.2%) and *C. neoparaensis* (0.1%); the remaining 2% consisted of *Culicoides* spp. *C. deanei* and *C. debilipalpis* were found year-round, as opposed to the other species (Table I).

The three predominant species appeared throughout the period of capture. *C. deanei* and *C. rachoui* were caught mainly between 14:00 – 16:00h, and *C. debilipalpis* predominantly between 10:00 – 12:00 h (Fig. 2).

The monthly incidence of *C. deanei* is presented in Fig. 1. Its peak was in September and its lowest frequency in May and August (Table I; Fig. 1). With regard to the collection periods,

we could observe that in September maximum density occurred between 14:00 – 18:00h (Fig. 1), while in November the greatest density occurred between 8:00 – 12:00 h.

DISCUSSION

According to data from the National Department of Meteorology at the "Alto da Boa Vista" station, Forest of Tijuca, the rainfall index for March 1984 to February 1985 was 2005 mm, which corresponds to this region's mean annual rainfall. Both simuliids and biting midges present incidence curves which are inversely proportional to the rainfall (Fig. 1).

No correlation could be found between temperature and relative humidity and the incidence of adult simuliids and biting midges (Fig. 1).

## SIMULIIDS

In Brazil, little is known about the biology of simuliids. Studies on bioecological aspects of some species were recently published by Dellome Filho (1978; 1985), Gorayebe (1981) and Lacey (1981).

Three rainfall peaks were observed in the area studied. The peak of April 1984 was the only one followed by an abrupt retraction and a period of maximum dryness in June. It was precisely during this dry season that the largest number of *S. pertinax* was captured on human bait, preferentially biting the legs (Table I; Fig. 1). However, the peak incidence of the species which eclosed from immatures in the laboratory was in September (Table II).

According to Dellome Filho (1985) *S. subnigrum* is anthropophilic. In our study, this species amounts to 32.7% of the total of 666 collected immature specimens and was never caught on human bait (Table I & II).

## BITING MIDGES

Studies reporting bioecological aspects of *Culicoides* have been made mainly with economically-important pest species. In Brazil, very little work has been done on this subject. Forattini, Rabello & Pattoli (1958) made some biological observations of *Culicoides* in natural conditions. Sherlock (1963) and Sherlock & Guitton (1964) studied *C. paraensis* in Salvador, Bahia. They focused on the hourly frequency and monthly incidence of this species.

The results of our study demonstrate the predominance of *C. deanei*, which is abundant in the area studied and definitely anthropophilic. This species is very eclectic in relation to its biting activity, which occurs during the whole day (Fig. 2). Even so, a larger incidence can be found in the morning between 9:00 – 11:00 h with peak activity between 10:00 – 11:00 h, and in the afternoon between 14:00 – 17:00h. This species appears suddenly in clouds composed of countless specimens which voraciously attack all the available parts of the body of the individuals used as bait.

Graph analysis demonstrates that the large percentage of *C. deanei* with relation to the other collected species was the main source of data for hourly frequency and monthly incidence of the *Culicoides* in the area studied. It can be observed, however, that the hourly distri-

bution of *C. debilipalpis* was different, prevailing in the morning between 10:00 – 12:00 h.

## RESUMO

**Contribuição ao estudo de *Simulium* e *Culicoides* do Rio de Janeiro: Incidência mensal e atividade de hematofagia** – No período de março de 1984 a fevereiro de 1985, capturamos simuliídeos e maruins no Parque Nacional da Tijuca, Rio de Janeiro. Correlacionamos a frequência mensal e a atividade de hematofagia com a temperatura ambiente, umidade relativa do ar e a precipitação pluviométrica.

Palavras-chave: *Simulium* – *Culicoides* – frequência mensal – atividade de hematofagia – Rio de Janeiro

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