

NEW FIELD OBSERVATIONS ON THE COMPETITIVE
DISPLACEMENT BETWEEN TWO SPECIES OF PLANORBID
SNAILS INHABITING NORTHEASTERN BRAZIL

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*Observations reported in the present paper have shown that *Biomphalaria glabrata* is being gradually displaced by *B. straminea* in coastal areas of two counties on the state of Pernambuco, Brazil, confirming former observations made in the same region.*

Hubendick (1958), for the first time, expressed the opinion that natural selection may favor an unsusceptible strain of the snail intermediate host of schistosomiasis, raising the possibility of the development of a method of biological control by competition between resistant and susceptible snail strains.

Richards (1970) development techniques for selection of refractory strains of *Biomphalaria glabrata* and *B. straminea* and suggested that the combination of certain genetic conditions could favor the process of natural selection of unsusceptible strains.

Wright (1971) commenting on Richards' paper states that such studies provide a most important basis for a possible method of biological control of the schistosome snail hosts.

Three species of *Biomphalaria* (*B. glabrata*, *B. straminea* and *B. tenagophila*) are well known snail intermediate hosts of *Schistosoma mansoni* in Brazil.

Paraense & Deslandes (1955) refer to the co-existence of *B. glabrata* and *B. straminea* in the state of Minas Gerais, mentioning however the infrequency of such occurrence. Paraense (1970) refers to old observations dating from 1917 when *B. glabrata* from Aracaju, introduced into the district of Manguinhos, Rio de Janeiro, displaced the

local population of *B. tenagophila*. The reverse occurred at Belo Horizonte where *B. tenagophila* have succeeded in eliminating *B. glabrata* from a small lake, suggesting that the principle of competitive exclusion could be an important factor influencing the distribution of the three planorbid snail species.

In the northeastern part of Brazil two species of *Biomphalaria*, known to be intermediate hosts of *Schistosoma mansoni*, are found: *B. glabrata* and *B. straminea*. The geographical distribution of these species is well known mainly through two extensive snail surveys carried out in that region by Lucena (1956) and Barbosa & Figueiredo (1969). In the state of Pernambuco, *B. glabrata* inhabits limited coastal areas while *B. straminea* is the dominant species occupying larger territories.

Although the two latter planorbid species are sympatric they have very seldom been observed to inhabit the same body of water (Barbosa, 1962; Barbosa & Olivier, 1958).

Barbosa (1973) had the unique opportunity of following the natural introduction of a small colony of *B. straminea* into a limited area inhabited exclusively by *B. glabrata* in the outskirts of the town of Recife. In this "natural experiment" *B. glabrata* was displaced by *B. straminea* within a period of three years.

Very recently, Guyard & Pointier (1979) suggested that in Martinique *B. glabrata*, a rare species at present, is being naturally replaced by *B. straminea*.

Michelson & Dubois (1979), working under laboratory conditions, have confirmed the field observations of Barbosa (1973). According to them *B. straminea* seems to be dominant species, and under certain circumstances may replace *B. glabrata*. In their experiments, Michelson & Dubois (1979) have shown that interspecific crowding reduces the fertility of *B. glabrata* and increases the hatch-rate of *B. straminea*, resulting in a significant increase in population density of the latter species at the expense of *B. glabrata*. Yet, *B. straminea* has shown great vagility and aggressiveness in invading territories occupied by *B. glabrata*.

In the current paper new field observations are described to indicate further the competitive superiority of *B. straminea* over *B. glabrata*.

METHODS

Since 1951, the coastal and forest regions of the state of Pernambuco have been utilized for frequent snail collections to service the research and routine activities carried out by the Research Center Aggeu Magalhães.

These extensive field activities, developed in the coastal region of the state of Pernambuco, particularly during the period 1951-1956, provided detailed knowledge of the distribution of *B. glabrata* and *B. straminea*.

From 1957 these field activities decreased and were intensively resumed in 1978 when some specimens of *B. straminea* were found in areas formerly occupied by *B. glabrata*. Data presented in the current paper on snail collecting were limited to the counties of Olinda and Paulista.

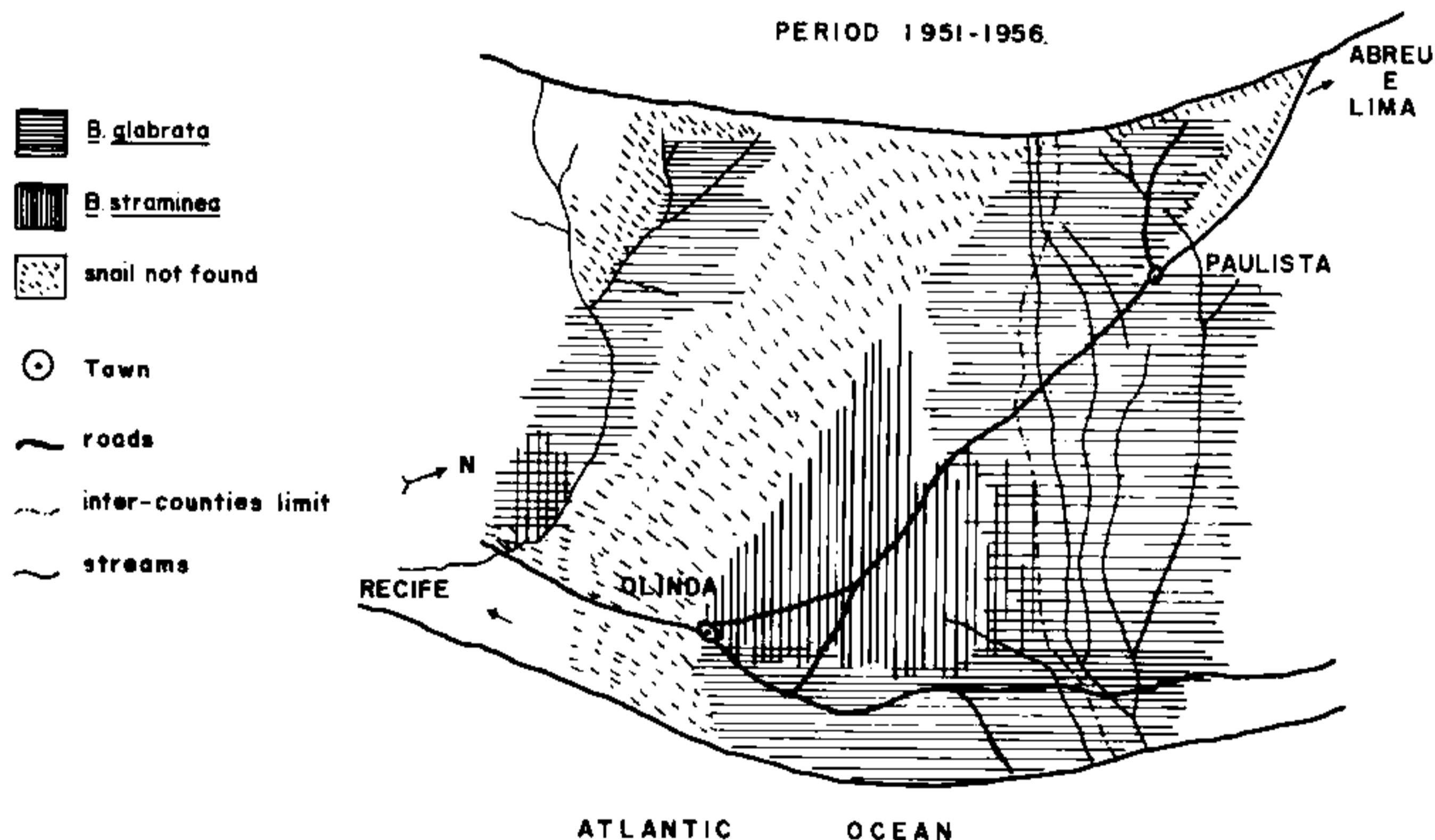
Snail collecting was carried out by well trained field workers and specific determination of the snails collected was undertaken by an experienced malacologist. In general *B. glabrata* and *B. straminea* can be readily distinguished on the basis of conchological features. However, in certain cases, particularly when dealing with small specimens, the determination was made by examination of the internal morphology.

RESULTS

Systematic collections carried out during the period 1978-79 in the territories formerly occupied by *B. glabrata* have demonstrated that *B. straminea* invaded new areas and in some of them became the only *S. mansoni* snail host present. In other words, *B. glabrata* have been excluded by *B. straminea* from a large part its former territory (Figs. 1 and 2).

FIGURE 1

DISTRIBUTION OF THE SNAIL INTERMEDIATE HOSTS OF *S. MANSONI* IN THE COUNTIES OF OLINDA AND PAULISTA, STATE OF PERNAMBUCO, BRAZIL.



At present, it is a hard task to find specimens of *B. glabrata* in the county of Paulista where it was the only species in the period of 1951-56. At that time, *B. straminea* was not known in that county. Although the data are not exactly comparable, Table I gives an approximate idea of the quantitative picture of the snail intermediate hosts in the counties of Olinda and Paulista during the two study periods (1951-56 and 1979-80).

Table I shows that in the county of Paulista during the period 1951-1956 *B. straminea* was not found among over 56,000 collected snails. The reverse is seen during the recent collecting period when only 141 *B. glabrata* specimens were found, while 9,194 *B. straminea* were collected. In Olinda, in the period 1979-1980, *B. glabrata* was still present in fairly large numbers. However, *B. straminea* has increased markedly during the interval of nearly two decades between the collecting periods.

TABLE I

Number of snails collected in the counties of Olinda and Paulista, state of Pernambuco, Brazil, during the periods 1951-1956 and 1979-80

Period	Olinda		Paulista	
	B. glabrata	B. straminea	B. glabrata	B. straminea
1951-56	9 301	917	56 586	0
1979-80	5 098	17 295	141	9 194

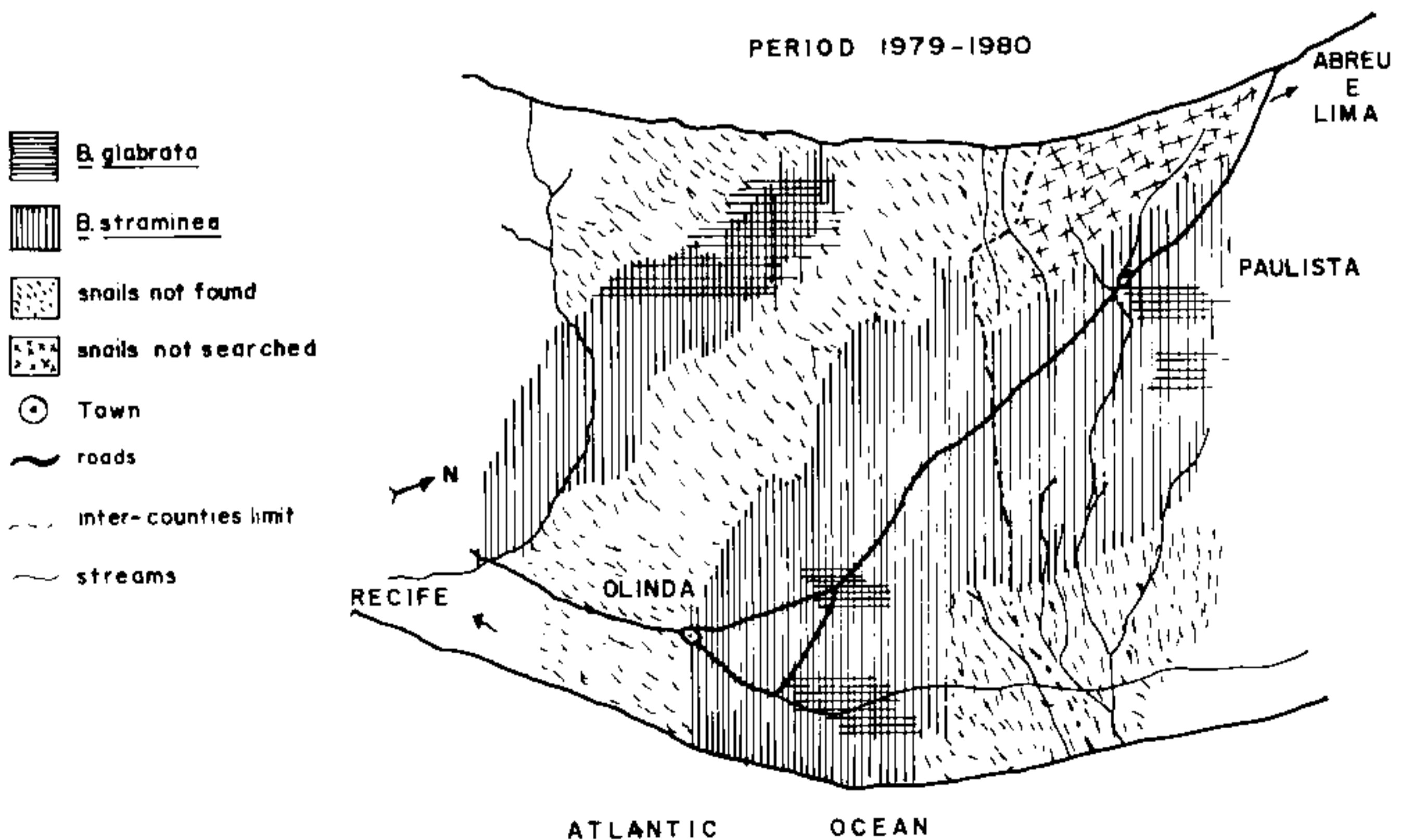
COMMENTS

Results presented in the current paper give more strength to the initial observation of Barbosa (1973) on the competitive displacement between the two well known snail intermediate hosts of *S. mansoni* in the northeastern Brazil.

Besides the area studied in the present paper, *B. straminea* has been found occupying other territories in the coastal areas of the state of Pernambuco formerly ex-

FIGURE 2

DISTRIBUTION OF THE SNAIL INTERMEDIATE HOSTS OF *S. MANSONI* IN THE COUNTIES OF OLINDA AND PAULISTA, STATE OF PERNAMBUCO, BRAZIL.



clusively inhabited by *B. glabrata*. These occasional observations, however, are not reported in the present paper.

The present distribution of the two planorbid species is the result of a process of displacement of *B. glabrata* that has occurred during the period 1957–1978. The phenomenon of the natural substitution of one species by another seems to be occurring rapidly in the present case. The substantial progress made by *B. straminea* indicate that is aggressive species ready to occupy the space left by a weaker competitor (*B. glabrata*).

In evolutionary terms, *B. glabrata* can be regarded as a less adapted species in comparison with *B. straminea* which seems to be the dominant species in this as well as in other regions of the American continent.

Recent observations of Guyard & Pointier (1979) suggest that *B. glabrata* is a species under extinction in Martinique island. This may explain irregular distribution of the above species in the Caribbean Islands.

Although Michelson & Dubois (1979) have indicated one condition favoring *B. straminea*, it is possible that other mechanisms might also play a major role in the competitive interactions.

The observations of Barbosa (1973) and Guyard & Pointier (1979), and the laboratory experiments of Michelson & Dubois (1979), indicate promising perspectives for studies on interactions between planorbid snails and emphasize the need for carrying out basic ecological and genetic studies in order to define characteristics of the natural populations of the intermediate hosts of schistosomiasis.

Studies on the above lines may result in the development of techniques applicable to the biological control of the snail hosts of the schistosomes.

RESUMO

Observações apresentadas neste trabalho mostram que *Biomphalaria glabrata* está sendo gradualmente deslocada por *B. straminea* em dois municípios do Estado de Pernambuco, Brasil, confirmando observações anteriores feitas na mesma região.

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