

RESEARCH NOTE

Repeated Focal Mollusciciding for Snail Control in a Sugar-cane Area of Northeast Brazil

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The sugar-cane zone of northeast Brazil comprises a strip of fertile land next to the coast of five states (Rio Grande do Norte, Paraíba, Pernambuco, Alagoas and Sergipe). A schistosomiasis control campaign based on chemotherapy has been carried out in that area since 1977 by the National Health Foundation. Although prevalence rates decreased in the initial years of the campaign, they were back to pre-control levels by 1990 (L Rey 1992 *Bases da Parasitologia Médica* Ed. Guanabara Koogan chapter 18: 160-179).

Snail control is recognized as an important auxiliary tool against schistosomes (FS McCullough 1986 *Trop Med Parasit* 37: 181-184). According to G Webbe and P Jordan (1993 Control p. 405-451 in *Human Schistosomiasis*, Cab International Wallingford UK) mollusciciding should be used in combination with chemotherapy and other methods to achieve a cost-effective and long-lasting control of the disease. The only molluscicide currently used in control programmes is niclosamide (Bayluscide®). Regular applications of niclosamide are necessary to achieve control, due to the rapid reinvasion of the snail hosts after focal mollusciciding (WHO 1993 Technical Report Series 830 Geneva).

The present study aimed to evaluate the impact of repeated application of niclosamide on the relative abundance of the snail hosts. Four rural villages were chosen in São Lourenço da Mata, a well-studied, representative area of the sugar-cane zone of northeast Brazil; the only snail host in the area is *Biomphalaria straminea* (FS Barbosa, DPP Costa 1981 *Ann Trop Med Parasitol* 7: 541-552). Firstly, all water-bodies which could act as transmission foci in the villages were surveyed. At least 10 stations per village, including water-contact sites, were then demarcated for monthly snail sampling. The relative abundance of the snail population was estimated by the L Olivier and M Schneiderman (1956 *Exper Parasitol* 5: 109-117) method. Snail habitats adjacent to two of the villages, namely Caiará and São João, were subjected to mollusciciding, being treated at three-month intervals from September 1991 to June 1992 and once a month from September 1992 until August 1994. In flowing waters, Bayluscide® 70WP was dispensed by drip feed at the rate of 2 ppm per hour for 6 hr; in lentic habitats, spraying pumps were used at 2 ppm. Molluscicide was applied only if snails were found. In the other two villages, namely Camorim and Nossa Senhora das Dores, no snail control was undertaken. Differences in snail relative abundance between the areas were evaluated through the Wilcoxon test (L Wilkinson 1990 SYSTAT: The System for Statistics SYSTAT Inc Evanston chapter 8: 388-406).

The figure shows the relative abundance of *B. straminea* at monthly surveys from September 1991 to August 1994. No significant difference ($p > 0.05$) was detected in snail abundance between treated and untreated areas in year 1, when niclosamide was applied three-monthly. However, highly significant differences ($P < 0.001$) were found between the two areas in years 2 and 3, when the molluscicide was applied monthly. During these two years the monthly average of snail counts per man/minute/station was 10.9 in the untreated area and 0.6 in the treated one.

As shown in the Table, the total amount of niclosamide used in the first year of treatment (1991-92) was relatively small, and snail control was not achieved. In the second year (1992-93) a substantial reduction in snail population was observed, but increasing amounts of niclosamide were used. In the third year (1993-94) cost of niclosamide per person protected was only 21.8% of that in the previous year, and the snail population was kept at very low densities.

The present results are in accordance with those by P Coura-Filho et al. (1992 *Rev Inst Med Trop S Paulo* 34: 427-431) in a southeastern area, showing that the snail population can reestablish

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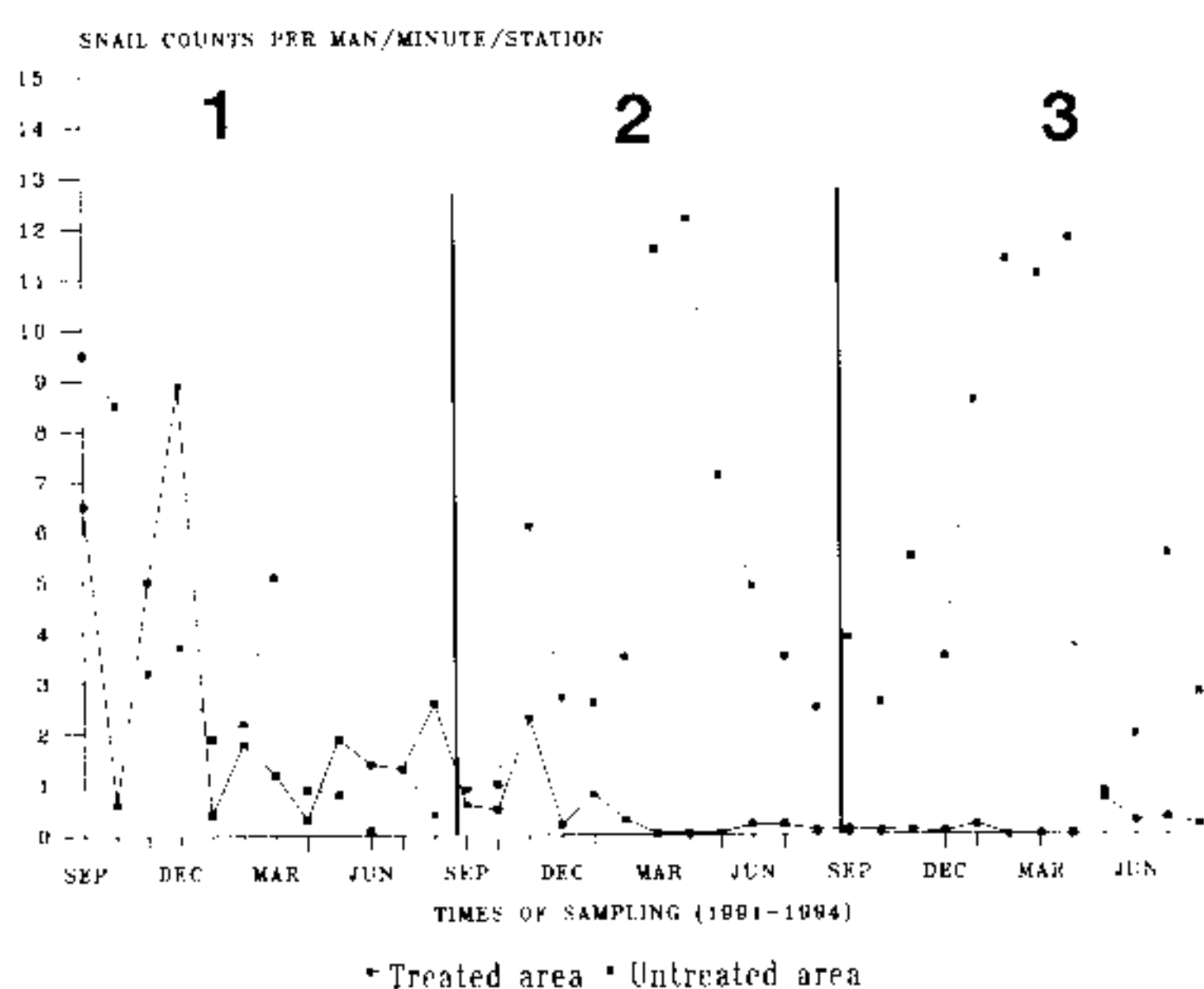
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TABLE

Periodicity of mollusciciding, snail counts, amount and cost of niclosamide in relation to the number of persons protected in the treated area. Year 1: September 1991 to August 1992; year 2: September 1992 to August 1993; year 3: September 1993 to August 1994

Year	Periodicity of mollusciciding	Snail counts per man/min/station	Amount (kg) of niclosamide	Number of persons	Cost per person protected (US\$) ^a
1	3-monthly	32.04	16.3	649	0.87
2	monthly	5.28	35.28	586	2.11
3	monthly	1.92	8.80	671	0.46

^a: at US\$ 35 per kg of niclosamide (G Webbe, P Jordan 1993 Control p. 405-451. In *Human Schistosomiasis*, Cab International Wallingford UK)



Relative abundance of *Biomphalaria straminea* from September 1991 to August 1994. In the treated area (solid line) molluscicide was applied three-monthly during the first year and monthly thereafter. In the untreated area (broken line) no snail control measure was carried out. Year 1: September 1991 to August 1992; 2: September 1992 to August 1993; 3: September 1993 to August 1994.

itself within three months after mollusciciding. However, this study also shows that focal application of niclosamide has a sustained, devastating effect on the population of *B. straminea*, provided the molluscicide is repeated frequently enough to prevent snail reinvasion. Cost of repeated mollusciciding may be high during the attack phase of snail control. In the maintenance

phase, when the snail hosts are found only occasionally, the cost per person protected may fall to a satisfactory level.

The study by Barbosa and Costa (*loc.cit.*) in the rural area of São Lourenço da Mata indicated that repeated application of niclosamide had relatively little impact on schistosomes, as infection rates were reduced substantially both in the treated and the untreated area. However, in their study the snails occurred at low densities (less than 1 snail per man/minute) throughout the period of monthly focal control (1969-1974). This would result in a low probability of transmission occurring even in the untreated area.

In the present study snail numbers were, on average, 18.2 times higher in the untreated area than in the treated area during the two years of monthly mollusciciding. In the former area some water-contact sites remained plentifully endowed with snails for most of that period, whereas in the latter the snail population was almost eradicated. The two areas are currently under investigation to verify whether repeated mollusciciding, used in conjunction with chemotherapy, has an impact on infection by *Schistosoma mansoni*.

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