Negative data on the occurrence of *Tropicorbis centimetralis* in Belo Horizonte (State of Minas Gerais)

by

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(With 5 tables, 1 graph, and 8 figures in the text).

INTRODUCTION

The existence of *Tropicorbis centimetralis* in Minas Gerais was mentioned by Lutz (1918), in his paper in which the description of that species was made. Not until 1934, however, did that author refer to the city of Belo Horizonte, where he did not find any species but *T. centimetralis*.

In 1938, Vianna Martins affirms that he never found in Belo Horizonte any mollusk which might surely be identified as *T. centimetralis*, inclusive in the places where Lutz found that species in abundance.

The data concerning the occurrence of *T. centimetralis* in the city of Belo Horizonte result solely from the observations of the two before-mentioned authors, whose conclusions are, indeed, absolutely contradictory.

The observation of many breeding places of planorbid snails in Belo Horizonte led us to accumulate some data which could guide us to a definitive solution of such disagreement. In contrast with the difficulties in distinguishing morphologically *T. centimetralis* from other related species, it seems to be much easier to verify the existence or inexistence of that snail in a given region. Since, according to Lutz, the maximum shell diameter in that species is about 10 mm, the statistical method is indispensable for analysing the problem. If, as the result of the biometric analysis, the hypothesis of incidence is to be rejected, its exclusion will be definitive; if the existence of one or more species approximately within the size range of *T. centimetralis* is indicated, then it will be necessary to resort to the experimental method and morphological study.
After examining numerous samples of planorbid snails from many breeding places disseminated over the city and its adjacencies, we chose four among the latter, which were thought to be representative of the various mean diameters observed. Those four breeding places were visited every month, during a year, from February 1949 to January 1950, and samples of snails were taken for our investigations.

Material and methods

Every capture had the duration of one hour. The snails were picked up individually to avoid taking the clusters which are eventually found. When snails were very abundant, the habitual rhythm of the capture movements was not accelerated. So, we attempted to obtain data which might be compared from the standpoint of the relative population densities, with the end in view to avail ourselves of them in further studies.

Both alive and dead specimens were collected, as well as empty shells. Every shell was measured through its greater diameter with a semi-millimetric scale; the fractional values up to $\frac{1}{2}$ mm were discarded, and those above $\frac{1}{2}$ mm were rounded to the next higher unit. The living specimens, and the well-preserved dead ones, were examined for larval stages of trematodes; in connection with the purpose of this paper, only the results concerning *Schistosoma mansoni* will be mentioned. Finally, the biometric data were submitted to statistical analysis.

Situation and aspect of the breeding places

Breeding place no. 1

In the grounds of the Instituto João Pinheiro, near the suburban station of Gameleira, there exists a system of irrigation canals, whose slow waters empty into a fast-moving brook. Snails are very rare in the latter.

Captures were made in one of the artificial canals (fig. 1), where the waters are controlled in order to be alternatively stagnant and flowing.

From the places where Lurz collected snails in Belo Horizonte, the Instituto João Pinheiro is the only one that was nominally mentioned by him, in his paper of 1934.

Breeding place no. 2

Situated near the station of Carlos Prates. It is a series of swampy depressions supplied with the waters from two sources that emerge from a cliff about 60 ft. high. If a southward extension of Valença Street is drawn, it will terminate at the brink of that cliff. The water runs southwards and is collected into the before-mentioned depressions
Paraense and Santos: Tropicorbis centimetratis

(fig. 2 a, b, c), thus supplying the conditions for the breeding of planorbid snails. The latter of those depressions (fig. 2 c), where the captures were made, is a shallow pond grown with Typhaceae (fig. 3), that empties into the river Arrudas by way of a narrow brook.

**Breeding place no. 3**

Situated within the urban center, in the Parque Municipal, bordering the Afonso Pena Avenue (the principal of the city). In this park the waters of the brook Acaba-Mundo, a tributary of the river Arrudas, are dammed into artificial lakes, where people use to play in rowboats (figs. 4 and 5). Fig. 6 is a view of the lake where the monthly captures were made.

**Breeding place no. 4**

According to our plans, the captures would be made in a part of the Córrego do Leitão (a tributary of the river Arrudas), near the locality Fazenda Velha, where in previous years we used to collect great number of snails. In February 1949, however, that brook was completely changed by rectification works. Many portions of its former course were meandrous and subdivided; in those places the weakened stream provided the conditions required for snails’ life. After the rectification the stream became too swift, and in spite of searching for snails during two hours along both banks, no one specimen was found. Then we decided to make the captures in a dead branch situated along the left margin, which was a part of the former bed of the brook, where numerous snails were found among an abundant aquatic vegetation (figs. 7 and 8).

**Results**

The data resulting from our observations are presented in tables 1, 2, 3, 4 and 5, and graph 1.

Inspection of the tables shows that snails under 12 mm in diameter were not available among several monthly samples. This happened in the breeding places nos. 2 (February), 3 (December and January), and 4 (March, May, June, July, October, November). Since it is admitted that *T. centimetralis* does not exceed 11 mm(*), we think unnecessary any further argumentation in order to corroborate the evidence that no population of *T. centimetralis* exists in any of the three before-mentioned breeding places.

It remains to be considered the breeding place no. 1, the data of which are presented in table 1.

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* According to Lutz (1918), the longest diameter of the shell averages one centimeter, with a variation of more or less one millimeter.
Absence of T. centimetralis according to the data of the tables

At the beginning of the captures (February 1949) we had at first sight a lively impression that we were dealing with a centimetralis-like population. The measurements subsequently made indicated that 85% of the specimens captured fell within the range from 1 to 11 mm. In the following months, however, the rate of snails within that range gradually decreased until 9% in October, showing an oscillating tendency during the last months.

It is worth noting that in five samples (June, July, August, October and November) specimens from 1 to 5 mm were not found. A sample range is highly probable to be smaller than the population range; therefore, it is admitted that the probability of the extreme values to appear increases proportionally to the sample size. However, the largest of our samples (October) did not include specimens under 6 mm; in the next smaller one (November) the specimens which might be taken for centimetralis had 9 to 11 mm, representing only 5% of the sample.

Admitting that we were dealing with two populations, one ranging within the centimetralis size and another of larger specimens, it would be highly unlikely that in November the former type were represented solely by individuals having an extremely large diameter, which are just the rarest ones in a normal distribution(**).

The arguments just present lead us not to accept the existence of a population of T. centimetralis in the breeding place no. 1.

Absence of T. centimetralis according to the data of graph 1

The occurrence of snails under 12 mm in diameter in every sample of the breeding place no. 1 makes it necessary to consider the hypothesis of the coexistence of T. centimetralis with a larger species in that place. Such hypothesis will be tested by analysing the distribution of the diameters of the snails captured in the breeding place no. 1 through the whole period of observation (graph 1).

That distribution describes a unimodal curve. The mode and the median are identical to one another and nearly the same as the mean. The difference between the mean and the mode is unimportant, owing

**Australorbis olivaceus**, whose greatest diameter as yet observed is 35 mm, may be mentioned as an example. Out of 4543 specimens collected in the breeding places nos. 2, 3 and 4, only two exceeded 30 mm; one with 31 and other with 32 mm. Out of 2414 captured in former years, only one had 32 and other 34 mm.

It is remarkable that the authors who discuss the question of planorbid species on the basis of their diameters often refer to the maximum diameter, which is the less frequent in a sample. Undeniably diameter would be more reasonably understood as it is in reality — a continuous variate, described by the mean and its measures of variation —, mainly taking into account that we are dealing with snails which do not show any characteristic allowing to distinguish the adult individuals from the growing ones.
to the fact that we used the millimeter as the unit of measure and the
tenth of millimeter in the mean computation. The interval \( x \pm \sigma \) includes
about 2/3 of the items.

The test of normality was applied to the present distribution,
giving the following results:

\[
x = -0.0729 \\
\eta = -0.1305
\]

Values of \( t \):

\[
x = 1.61 \\
\eta = 1.44
\]

Degrees of freedom: \( \infty \)

The negative value of \( x \) indicates a slight skewness with an excess
of items greater than the mean, displacing the peak toward the right;
this skewness was interpreted above as resulting from the subdivision
of the unit of measure in the mean computation.

The negative value of \( \eta \) indicates a small platykurtosis due to an
excess of moderate deviations.

However, since both \( x \) and \( \eta \) are not significant (5% level = 1.960),
it is evident that the sample tested was drawn from a normal population,
which is different from \( T. \) centimetalis.

**Absence of \( T. \) centimetalis among the snails infested with \( S. \) mansoni**

Table 5 shows the distribution, by diameters, of the planorbid
snails that were found infested with \( S. \) mansoni. It is seen that of 6324
specimens dissected (including all those which were captured alive
and the well-preserved dead ones) 161 were infested. The smallest di-
ameter at which the infestation was observed to occur was 10 mm,
with a single specimen, subsequently appearing two specimens of 12
mm. The other infested snails were distributed into the class intervals
from 13 to 30 mm.

It is seen, therefore, that only 1 of 161 infested snails fell within
the size range of \( T. \) centimetalis (the one with 10 mm). This observa-
tion is in disagreement with those of Lutz (1934), who suggested that
\( T. \) centimetalis would be the only transmitter of \( S. \) mansoni in the
State of Minas Gerais.
Biometric difference between the populations of each breeding place

Ending our observations, we report the results of the tests of significance applied to the differences between the mean diameters of the snails from each breeding place. Those results were as follows:

<table>
<thead>
<tr>
<th>Breeding places nos.</th>
<th>Differences</th>
<th>Values of $t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>2.48</td>
<td>17.7</td>
</tr>
<tr>
<td>2 and 3</td>
<td>2.18</td>
<td>12.3</td>
</tr>
<tr>
<td>3 and 4</td>
<td>2.22</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Degrees of freedom: $\infty$

The differences above are highly significant (1% level = 2.576), thus indicating the existence of four biometrically different populations. We believe, however, that biologically, such populations correspond to somatic modifications within the boundaries of a single species (*Australorbis olivaceus*), and that the observation of a greater number of breeding places will reveal the existence of biometrically intermediate populations, whose successive mean diameters will behave according to the null hypothesis.

Conclusions

After observing numerous breeding places of planorbid snails in the city of Belo Horizonte (State of Minas Gerais), we selected four among them, which seemed to be representative of the various mean diameters of the snails observed. Monthly captures were made during a year in those four breeding places. The biometric analysis of the samples indicated the absence of any *centimetralis* population (made up by individuals with 1—11 mm in diameter). The dissection of every snail showed that, with the exception of a single specimen with 10 mm, the infestation with *S. mansoni* occurred exclusively in specimens within the range from 12 to 30 mm.

The results of these observations indicate that *T. centimetralis* does not exist in Belo Horizonte.