SHORT COMMUNICATION

The Effect of Isolation on Reproduction and Growth of *Pseudosuccinea columella* (Pulmonata: Lymnaeidae): a Snail-conditioned Water Experiment

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A snail-conditioned water experiment was conducted in Pseudosuccinea columella *to test the possible role of a chemical interaction between snails on the diminished growth and fecundity rates found for snails raised in pairs compared to those raised in complete isolation. The results permit to discard the hypothesis of an inhibition of growth and reproduction between snails due to factors released into the water.*

Key words: *Pseudosuccinea columella* - *Fasciola hepatica* - Lymnaeidae - life-history - snail-conditioned water

The hermaphrodite lymnaeid snail *Pseudosuccinea columella* (Say 1817) can be found in many water-bodies throughout the western and central regions of Cuba. This species has been demonstrated, naturally or experimentally, as an effective intermediate host for *Fasciola hepatica* in several countries (Malek 1985). Recently Gutierrez et al. (2001) performed a similar experiment and found that snails reared in isolation attained a greater size and laid more eggs than those raised in pairs. Three possible causes could explain the slower growth rate and reduced fecundity in paired snails: a chemical interaction between individuals by releasing an inhibition factor into the water; a direct inhibition by physical contact between pairs (e.g. during copulation) or a less productive mating system (outcrossing) in snails with the possibility to outcross. In the present study we designed a snail-conditioned water experiment in order to demonstrate the possible role of chemical interaction in the reduction of growth rate and fecundity observed between paired snails.

Snails for this experiment originated from a laboratory strain of *P. columella* (Parque Lenin). All mollusks were divided in three groups. 1. Paired group: 20 newly-hatched individuals raised in pairs; 2. Isolated control group: 10 newly-hatched snails raised in isolation simultaneously to paired snails; 3. Isolated snail-conditioned-water group (SCW): 10 snails raised in isolation using the same water that snails of the paired group had used the previous week. Snails of all groups were reared in Petri dishes following the methodology of Sanchez et al. (1995). Snails were moved once a week into a new dish and in all cases excess of uneaten algae was observed during the whole experiment. Besides, no snail was ever seen attached to the dish cover. These two evidences indicate that neither food nor space was a limiting factor for any group. The number of eggs laid in each dish was counted weekly under a stereo microscope. The size of each snail was measured weekly with a caliper of 0.1-mm precision. Values of mean shell sizes and fecundity rates (number of eggs per snail) were calculated and plotted for all groups. A repeated-measures ANOVA (Lindman 1974) was performed to test the significance of differences between groups for the shell size. The number of eggs produced per snail was compared between groups by a Kruskal-Wallis test (Kruskal & Wallis 1952) and a post-hoc Newman-Keuls test (Milliken & Johnson 1984). As it was impossible to determine the number of eggs produced by a single snail in the paired group, the total number of eggs produced by each pair every week was divided by two for the statistical analysis. Comparisons were made only from week 3 to 15, as out of those limits either there was no reproduction or the sample sizes were too small due to snail mortality. Significant differences were considered for $p < 0.05$

No significant differences were observed between the two groups of isolated snails for the shell size. However, they differed significantly from paired snails ($F = 1.6382$, $p < 0.05$), especially in weeks 14 and 15. Isolated snails displayed a higher growth rate than paired snails (Fig. 1A). Fecundity rates were higher for isolated than for paired snails (Fig. 1B) and significant differences were found for the number of eggs per snail ($H = 70.460$, $p < 0.001$). The post-hoc test showed that significant differences were found only between paired and isolated snails ($p < 0.05$) and not between isolated-SCW and isolated-control snails ($p > 0.05$).

These observations permit us to rule out the hypothesis of a possible chemical inhibition of growth and reproduction between snails by the release of excretory-secretory products into the water, as suggested by Florin et al. (2000) who observed the same effect on *Lymnaea elodes* Say, 1821. The diminished growth and fecundity rates observed in paired snails may be due either to a more direct inhibitory influence between partners (e.g.

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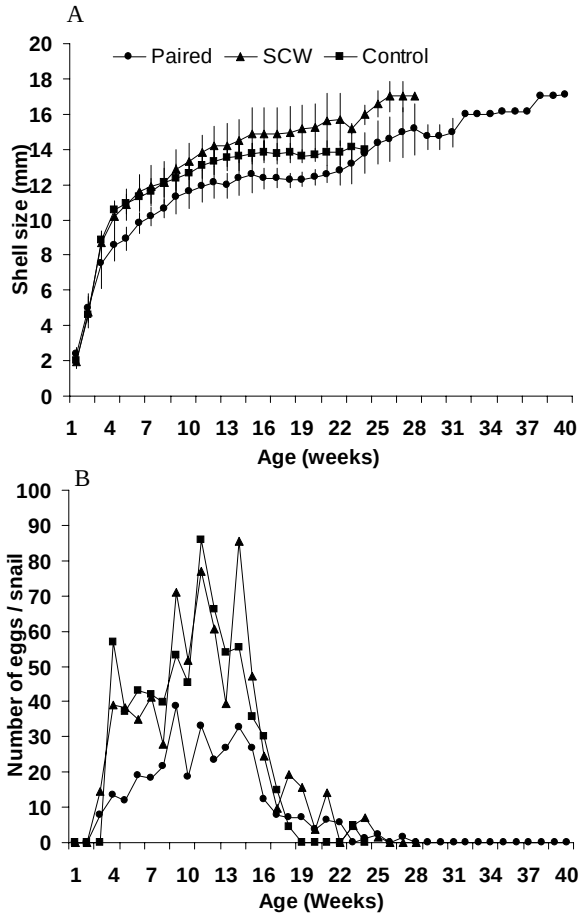

Fig. 1: growth (A) and fecundity (B) rates of three experimental groups of *Pseudosuccinea columella*.

during copulation) or to the dominant mating system, selfing being probably more productive conferring single snails a reproductive advantage. Recent genetic studies in natural populations of lymnaeids demonstrate the existence of a very high within-group monomorfism, suggesting the predominance of selfing over outcrossing in this group (Jabbour-Zahab et al. 1997). Our data agree with those of other workers (DeWitt & Sloan 1958, Florin et al. 2000) who recorded higher lifetime fecundities and growth for isolated than for paired lymnaeid snails. Conversely, other studies show that in some lymnaeid species, isolation decreases fecundity (Smith 1981, Van Duivenboden 1985).

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