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IS THE ABUNDANCE OF THE AMPHIPOD *GAMMARUS MINUS* AFFECTED BY THE SNAIL *FONTIGENS NICKLINIANA*?

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ABSTRACT

The amphipod *Gammarus minus* is common in springs and low-order streams of the mid-Appalachians west to the Ozarks. Glazier et al. (1992) suggested that the abundance of *G. minus* may be adversely affected by the presence of the watercress snail, *Fontigens nickliniana*. I tested this hypothesis by comparing the population densities of *G. minus* in 4 spring runs with *F. nickliniana* and 4 without *F. nickliniana*. Contrary to expectation, I found no effect of snail presence on the abundance of *G. minus*. I also found that dissolved oxygen levels appeared to be lower in spring runs with versus without *F. nickliniana*.

Key Words: Amphipod, competition, dissolved oxygen, Fontigens nickliniana, Gammarus minus, *snail, springs.*

INTRODUCTION

The amphipod *Gammarus minus* is common in springs and low-order streams of the mid-Appalachians west to the Ozarks (Holsinger 1976). There have not been many comparative studies of spring macroinvertebrate communities undertaken in North America, and no studies have been done on the relationship between the *Fontigens nickliniana* and *G. minus* (D.S. Glazier, personal communication). Glazier et al. (1992) reported a possible negative relationship between the abundance of *G. minus* and the presence of the watercress snail, *F. nickliniana*. *F. nickliniana* is abundant in hardwater springs, usually with dense macrophytic coverage (Glazier and Gooch 1987). The goal of my research was to test this hypothesis by examining the abundance of *G. minus* in spring runs with and without *F. nickliniana*, and to investigate abiotic parameters that might affect that relationship.

METHODS AND MATERIALS

I studied 8 spring runs within a 20-mile radius of Huntingdon, Pennsylvania, all of which contained *G. minus*. Four spring runs contained *F. nickliniana*, whereas 4 did not. Five random samples of both species were taken in each spring run using a small Surber-like sampler (area = 0.015 m^2). I used Pearson product moment correlation analysis to test for an association between the population densities of the snail and amphipod. I also measured water quality parameters at each of the eight spring runs.

In each spring run I measured dissolved oxygen using a model 58 Yellow Springs oxygen meter, pH using a model 88 Markson digital pH meter, and temperature and conductivity using a model 33 Yellow Springs conductivity meter. I also recorded the width and depth at three locales along each spring run and noted the nature of the vegetation and surrounding landscape. I used a two-sample t-test to compare

dissolved oxygen, pH, and conductivity between spring runs with versus without *F. nickliniana*. I considered differences to be significant if $P < 0.05$.

RESULTS

The population density of *G. minus* was not correlated with the population density of *F. nickliniana* (r = -0.011, P = 0.98) (Table 1). However, I found a marginally significant difference in dissolved oxygen levels between spring runs with versus without *F. nickliniana* (t = 3.16, df = 3, P = 0.051), but no differences in pH or conductivity (t = -2.18, -1.86; df = 3, 4; P = 0.12, 0.14, respectively).

Table 1. Population densities of Gammarus minus *and* Fontigens nickliniana *and water chemistry variables in 8 Pennsylvanian spring runs.*

Spring Run	Amphipods #/m^2	Snails #/m^2	Dissolved oxygen (mg/L)	pH	Conductivity (mho)
Petersburg	16.6	0.0	12.03	6.85	91.2
Emma	6.0	0.0	12.50	7.05	103
Right Fouse	0.0	0.0	9.36	6.91	113
McConnellstown	38.8	0.0	11.90	6.48	250
Hundred	7.8	8.6	9.83	7.33	215
Left Fouse	5.4	4.2	9.07	7.39	338
Camp Kanasataki	28.4	588.4	9.53	7.28	407
Greystone Farm	0.0	730.6	11.90	6.91	180

DISCUSSION

Both *G. minus* and *F. nickliniana* are detritivores and, therefore, the competitive exclusion principle (Gause 1934) predicts that *G. minus* and *F. nickliniana* should compete for food. However, my results suggest that these species are not competing enough to cause a population effect. Perhaps, the two species are actually feeding on different types of food, and/or prefer a different microhabitat in which to feed or they may feed at different times.

An alternative explanation for my results is that my sampling methods were not sufficient for accurately estimating the abundance of *G. minus*. After all, I only took 5 samples in each spring run. I also sampled during the day, whereas *G. minus* tends to be most active at night.

Lastly, the watercress snail appears to occur in spring runs with relatively low oxygen levels. Further work is needed to verify this apparent relationship and to explore whether competition is at all important between *G. minus* and *F. nickliniana* in Pennsylvanian spring runs.

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