

**Intraspecific and intraguild effects on egg deposition  
by *Orius albidipennis* Reuter**

**Thesis**

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## Abstract

Oviposition site selection plays an important role in determining offspring survival and performance in insects. The relationship between oviposition site selection and offspring performance has been extensively studied in herbivorous and, to a lesser extent, strictly predaceous insects. Among herbivorous insects, oviposition site selection has often been found to be highly correlated with plant quality, while among predators, the proximity of potential prey has proved central to site selection. Although omnivory is widespread in many ecosystems, information on the oviposition site selection-offspring performance relationship is lacking for omnivorous insects. In omnivores, the similarity between the nutritional needs of adult and immature stages could be expected to intensify the tendency of adult females to oviposit at sites that are favorable for the survival and performance of offspring. Nevertheless, intraspecific competition, predation by natural enemies and intraguild predation are all factors that may influence the decision to accept or reject a potential oviposition site.

This study was aimed at deepening our understanding of oviposition site selection mechanisms among omnivorous insects. Several factors that may influence oviposition site selection were examined using the omnivorous bug *Orius albidipennis* Reuter (Heteroptera: Anthocoridae) as an experimental model. The effect of intraspecific competition on oviposition site selection was evaluated at various population densities, and hatching success was also noted. Host plants differing in nutritional quality were produced using two different levels of nitrogen fertilization, enabling us to examine the effect of plant quality on oviposition site selection. Finally, the influence of intraguild predators on site selection was investigated. In order to uncouple nutritional effects from treatment effects, an excess of prey was supplied in all experiments, except for those involving plant quality. Prey was always placed in the experimental arena at a distance from potential oviposition sites.

*O. albidipennis* females clearly preferred to oviposit on the region of the leaf surrounding the point of origin of the major veins, adjacent to the petiole. 69.8% of all eggs deposited were placed in this area, where egg density reached 33 eggs/cm<sup>2</sup>. The remaining 30.2% of the eggs were dispersed over the remainder of the leaf surface, where egg density reached only 0.22 eggs/cm<sup>2</sup>. Neither total oviposition per female

nor the pattern of egg distribution on the leaf were affected by intraspecific competition, although a statistically insignificant reduction in oviposition per female was observed where female population density exceeded 6 per leaf. Maximum oviposition was 8.27 eggs/female/day at a density of 6 females per leaf; minimum oviposition was 5.34 eggs/female/day at a density of 12 females per leaf. *O. albidipennis* females concentrated their eggs at the leaf vein origin site regardless of female density, and appeared to exploit this site to capacity. In the absence of intraspecific competition (1 female/leaf), 61% of the females observed oviposited exclusively at the vein origin site. Furthermore, at this density 100% of the eggs were inserted within the leaf tissue. At densities of 2 or more females per leaf, eggs were occasionally deposited on the upper leaf surface, unattached to the leaf substrate. The frequency of this phenomenon rose as the density of females increased to 6 per leaf, and then decreased with a further increase in female density. The proportion of hatching eggs at the vein origin site was 0.9, significantly higher than 0.74 observed on the remainder of the leaf.

Plant nitrogen level did not significantly affect oviposition site selection, total oviposition per female, or the distribution of eggs among leaf sites. In plant nutrition experiments, the distribution of eggs on the leaf was similar to that described above, with significantly greater numbers of eggs deposited at the vein origin site than on the rest of the leaf. 18.93 and 18.19 eggs/cm<sup>2</sup> were observed at the vein origin site of high and low nitrogen-fertilized plants, respectively. On the remainder of the leaf, 0.49 and 0.19 eggs/cm<sup>2</sup> were observed on high and low nitrogen-fertilized plants, respectively. In choice experiments, the females showed no significant preference for high nitrogen plants. Hatching success was significantly higher at the vein origin site than on the rest of the leaf on plants of both nitrogen regimes: at the vein origin site, a proportion of 0.59 and 0.60 of the eggs hatched on high and low nitrogen plants, respectively, while on the rest of the leaf, 0.29 and 0.30 of the eggs hatched, on high and low nitrogen plants, respectively.

The presence of intraguild predators significantly affected oviposition site selection by *O. albidipennis*. Although total oviposition per female did not differ in the presence or absence of predators, the proportion of eggs deposited at the vein origin site decreased significantly with the introduction of predators into the system. The magnitude of this effect was related to the predator's identity: In the presence of *O. laevigatus* females, a significant decrease in the proportion of eggs deposited at the

vein origin site was observed (0.42 and 0.62 in the presence and absence of *O. laevigatus*, respectively). An insignificant decrease was detected in the presence of *Coccinella undecempunctata* larvae (0.73 and 0.86 in the presence and absence of the predator, respectively). This difference proved crucial to *O. albidipennis* population growth in a ten-generation simulation. In the simulation, a hypothetical population founded by one *O. albidipennis* female produced  $3 \times 10^9$  females in the absence of intraguild predators,  $4.7 \times 10^5$  females in the presence of *C. undecempunctata* larvae, and  $5 \times 10^5$  females in the presence of *O. laevigatus*. The presence of *O. laevigatus* females (but not of *C. undecempunctata* larvae) seems to cause *O. albidipennis* to shift away from its preferred oviposition site at the leaf vein origin. It should be noted that *O. laevigatus* females display a preference for this same oviposition site. They seem, therefore, to successfully displace *O. albidipennis* from the site.

Results of this study indicate that our model omnivore, *O. albidipennis*, exhibits a significant preference for a particular oviposition site on the leaf. Its preferred oviposition pattern improves the likelihood of successful egg hatch. This optimal oviposition pattern is maintained in the presence of intraspecific competition, and is unaffected by plant nitrogen levels. The presence of intraguild predators results in a shift in the oviposition pattern and a reduction in the proportion of eggs deposited at the preferred site. A greater proportion of the total eggs is thus deposited at sites that support only minor hatching success, and the population growth of *O. albidipennis* is compromised. Knowledge of the factors affecting oviposition site selection among omnivorous insects, and an understanding of how they work, may facilitate predictive modeling of population dynamics. This is important in omnivorous species that serve as biocontrol agents, such as *Orius* spp.