

Biology/Phenology

REPRODUCTIVE DIFFERENCES BETWEEN SEX RATIOS IN PEAR PSYLLA

Greg T. Hannig and John E. Dunley

Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

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Pear psylla is a serious pest of pear in the Pacific Northwest. In a previous study comparing the effectiveness of several insect growth regulators (IGRs) in the control of pear psylla, there was a large amount of variation in replicate response in IGR bioassays. There are many possible reasons why this variation may have occurred, several of which have been examined in previous studies. This study examines one possible cause of this variation, which is a difference in fecundity due to the age of adult pear psylla collected from the field. The effects of sex ratio on fecundity were also examined.

Approximately 5000 fifth instar pear psylla nymphs were taken from the field and brought into the laboratory by collecting leaves containing nymphs. Leaves were placed into a cage (62 x 36 x 36 cm) with 6-8 small pear seedlings (approximately 32 to 60 cm tall) where the pear psylla were allowed to develop into adults in 16:8 (L:D) artificial light and at 80°F. Once the majority of the nymphs had developed into adults, they were removed, sexed and kept in separate colonies (males in one cage, females in another). Six days after collecting the fifth instar nymphs, the adults were placed into small plastic tubes with a screen on one end and placed over small clean pear shoots. Pear shoots were placed into containers full of distilled water to prevent escape, which were then placed into cages.

Two different sex ratios (male:female) and three different mating regimes (1 mating, 2 discrete matings, and continuous mating) were combined for a total of six treatments, replicated four times each. The first treatment consisted of 1 male and 1 female, mating only once for 48 hr before the experiment had begun. The next treatment was 1 male and 1 female with 2 mating events, one before the experiment and the other 15 days into the experiment (each mating event was limited to 48 hr). Another treatment was 1 male and 1 female, with continuous mating throughout the experiment. There were 3 additional treatments that had the exact same mating regimes, but the sex ratio was 5 males to 5 females.

Two days after the adults are placed into the tubes, all male adults are removed from all treatments, except in the continuous mating treatments. The female adult psylla of all treatments and males in the continuous mating treatments were moved to another set of fresh pear shoots and covered with plastic tube cages. Initial counts of eggs on the pear seedlings were taken at this time. The transfer of the adult psylla and initial egg counts were repeated every 2 to 3 days until 15 days following the original setup of the treatments. At this point, a second mating was allowed in the treatments with 2 matings by reintroducing virgin male psylla into the corresponding treatments. The males were removed at the next transfer of female psylla to fresh seedlings and the transfers continued until either there was no oviposition or there were no females to oviposit.

At each transfer and initial count of eggs, the shoots with eggs on them were labeled and set aside to be examined 12 days later. The final count of eggs was taken 12 days following the initial count to determine the number of unhatched eggs or mortalities. The eggs that were unhatched, remaining intact or not depleted in any way were considered to be infertile because they should have hatched by about 10 days after oviposition. Initial egg production was examined as well as egg survival.

There was significant difference in overall mean eggs laid per female per day between the two different sex ratios, with the only exception being that ratio 1:1, 1 mating was not significantly different from the 5:5 sex ratio. Despite this lack of statistical significance, the egg production of the 1:1 sex ratio was higher than the 5:5 sex ratio. Initial egg counts peaked at the beginning of the experiment, then declined over time for all combinations of sex ratios and mating combinations. The peak for the 1:1 sex ratio was higher than the 5:5 sex ratio. There was a second peak in the 1:1 sex ratio after the introduction of a virgin male after about 2 weeks, while a slight peak occurred in the 5:5 sex ratio at the beginning of the third week (figure below). No definite patterns were found in numbers of successful egg hatches and no significant differences existed between any of the treatments for mean percent egg survival over the entire experiment.

The differences between sex ratios in fecundity suggest that mating competition among male pear psylla appears to cause a decrease in overall egg production. The results of this study suggest that, as in many organisms, there may be a direct correlation between reproductive fitness and age. As the age of the pear psylla increases, their ability to produce eggs decreases. Ideas for future studies may include some of the following: whether the time between emergence and mating has an effect on mating and egg survival; whether patterns exist in oviposition timing; and what effects additional combinations of sex ratios have on fecundity.

