6. Biology/Phenology

THE AREAWIDE DISTRIBUTION OF *PANDEMIS* LEAFROLLER AMONG TREE FRUIT CROPS IN THE PARKER HEIGHTS DISTRICT

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In the Yakima Valley of Washington the population dynamics of *Pandemis pyrusana* (PLR) were studied in a 380 acre area of fruit production comprised of apple, pear, cherry, peach/ nectarine, apricot, and plum. Adult moths were trapped using low load (10% standard load) sex-pheromone baited traps and liquid food (fermented molasses) baited traps. Blocks were sampled for overwintering larvae, summer generation larvae, and fruit injury.

Pheromone baited sticky traps (10% pheromone load) and liquid food (fermented molasses) bait traps were placed throughout the study site at a rate of 1 trap per 5 acres. One hundred and seventy-eight traps were checked weekly and maintained as necessary. Blocks were sampled for larvae twice in the spring and once in the summer by checking 5 shoots from 20 trees within 50 m of each trap site. Just prior to harvest, apple and pear blocks were sampled for fruit injury. Thirty fruit on 20 trees were sampled within 50 m of each trap.

Overwintering larvae were found in all crops except peach/nectarine, apricot, and prune. The highest percent shoot infestations were found in non-bearing apples. Population densities were similar in apple and cherry and somewhat lower in pear. The percentage of infested shoots increased from the overwintering to the summer generation across the study site, except in pear. The summer larval population was roughly 4 times larger than the overwintering generation. This increase was greatest in cherry and non-bearing apple blocks, which increased roughly 5- fold and 11- fold, respectively. Typically, larvae were found in the upper canopy of sampled trees. Estimates of larval population density was affected by tree size. This bias may have accounted for the higher densities found in non-bearing apple blocks. Also, Fuji blocks contained shorter trees and had slightly higher larval densities than Delicious varieties.

Levels of fruit injury by PLR were low (< 0.1%) in apples and pears. Blocks with damaged fruit were clumped into two main areas, both of which were in close proximity to blocks of cherry and non-bearing apple with high summer larval densities. Furthermore, damaged fruit were clumped in small areas within these blocks. Fruit injury was well distributed among apple varieties. Fruit injury in pears was found only in one block of Bartlett.

Weekly moth catch data from both trap types displayed a well defined first and second flight of PLR. Second generation moth catch was roughly 3 times that of the first generation. A smaller increase in the capture by food bait traps than pheromone traps between generations might be due to the bait traps filling up with non-target species (primarily noctuids). First flight moth captures were relatively concentrated in certain areas near blocks of cherry and non-bearing apple, while second flight moth captures were much more dispersed throughout the study site. Highest single trap moth catches occurred late season in pear blocks. Mean seasonal moth captures in pheromone traps in apple, pear, and cherry were over 250 moths. Over the entire season, 3,336 moths were caught in food bait traps and 22,778 moths were caught in pheromone baited traps.

Catches of *Pandemis pyrusana* in food bait traps were separated from other lepidopteran species and sexed. The proportion of male versus female PLR was much higher during peak flight. The proportion of females increased in the period between flights.

The correlation of moth catch data from sex pheromone baited traps and food bait traps with larval densities and fruit injury levels were calculated to examine if these monitoring tools can predict pest populations within orchards. Moth catch in pheromone baited traps during the first flight did correlate slightly with summer larval densities and fruit injury levels. However, due to the variability of the data, many blocks in this study had very high trap counts while no larvae or injured fruit were reported. Conversely, some blocks had relatively low trap counts, but reported high larval densities and fruit injury.

Moth catch in liquid food bait traps during first flight also provided a reasonably good indicator of summer larval density and fruit injury. However, moth catch during second flight showed little correlation to fruit injury. The sex of captured moths does not appear to be a major factor in the predictive potential of food bait traps. Moth catch in pheromone baited traps during second flight was a better predictor of fruit injury than catch in bait traps. The poor results with bait traps for the second flight was likely due to these traps filling with large numbers of non- target insects.

One objective of this study was to compare the use of bait and sex pheromone traps in monitoring PLR. Ease of use was one important factor that we considered. Several problems exist with liquid food bait traps. These traps were not species specific, so PLR had to be distinguished from other species. The traps tend to fill up with noctuid moths and many species of flies. A significant percentage of the liquid-based traps when placed in direct sunlight dried up between our weekly checks, thus they need to be checked more frequently or placed in full shade. Finally, PLR caught in bait traps had to be sexed. In contrast, pheromone baited traps were much easier to maintain. However, these traps also have certain limitations. During peak flight the sticky liner quickly becomes covered with moths and moth scale which reduces their efficiency of capture. In some orchards these traps were filled with leafminers and flies. Also, paper traps lose their shape and effectiveness following repeated exposure to irrigation.

Results from this study were informative in revealing some aspects of the regional population dynamics of PLR in the Yakima Valley. Areawide suppression of PLR populations will likely require the management of non-bearing apple and cherry orchards throughout the summer.