Honey Bee Activity on 'Magness' and Pollenizer Pear Varieties

DEWEY M. CARON[1]

Most varieties of pear *(Pyrus communis L.)* are self-sterile and need pollination for adequate fruit set. Gardner *et al* (5) recommended that provision be made for cross-pollination when planting a pear or apple orchard unless it was definitely known to be unnecessary for the variety and local conditions. Despite such precautions in the planting of several pear orchards of 'Magness' variety in Maryland, however, yields have remained low (8).

The role of insects, especially honey bees, in pollinating apple and pear has long been recognized. Stephen (7) obtained a positive correlation between the number of bees and amount of fruit set in five pear orchards. Pear blossoms, however, are generally regarded as particularly unattractive to honey bees due to low nectar sugar and/or nectar availability and their scanty amounts of pollen (1, 4, 6). Vansell (9), for example, found the sugar concentrations of the nectars of two pear varieties to be quite low and speculated that both were below the point of attractiveness to honey bees. Butler (2) determined sugar concentration of pear to be next to the lowest of 15 plants examined in simultaneous bloom.

Honey bees visit flowers to collect nectar, pollen or both. Bees that deliberately scrabble for pollen usually touch the stamens and stigmas and thus could pollinate the flowers. Nectar gatherers may pollinate flowers depending on their behavior. Free (3) studied bee behavior on apples and concluded that those bees that stood on the anthers touched stigma and stamens and could pollinate but those that stood on the petals did not touch stigmas and thus could not effect pollination. The ratio of nectar-gatherers to pollen gatherers and the position of nectar gatherers on flowers varies widely on different days and at different times on the same day. Bees were often found to collect pollen when nectar was either unavailable or unattractive (3).

RESULTS

After several factors were ruled out as being responsible for the low yields of 'Magness', investigations were initiated in 1972 on aspects of honey bee pollination. Studies were conducted in the experimental 'Magness' orchard of the University of Maryland, Silver Spring, and in the randomized replicated orchard of 'Magness', 'Moonglow' and 'Bartlett' of the U. S. Dept. of Agriculture, Beltsville, Md. Blossom clusters were counted just prior to bloom on 4 random limbs of 12 trees of 'Magness' and the pollenizer varieties 'Moonglow' and 'Bartlett'. Honey bee colonies, at the level of

Table 1. Number of blossoms per cluster and percent clusters yielding mature pears. (Spring 1973).

Pear variety	No. blossoms/ cluster	% clusters with mature fruit
Magness	4.4[a]	.7[a]
Moonglow	7.4	38.2
Bartlett	6.4	28.0

[a]Means of counts on 4 limbs of 12 trees of each variety.

[1]Entomology Department, University of Maryland, College Park, Maryland 20742.

2½ colonies per acre, were moved into the orchard at bloom. At bloom, the number of blossoms per blossom cluster was counted on over 400 random clusters previously counted. In early August, the number of maturing pears was determined on counted limbs. Results are shown in Table 1. Less than 1% of the 'Magness' blossom clusters yielded a pear whereas the two pollenizer varieties had yields greater than 25 percent. 'Magness' had the fewest blooms per cluster of the 3 varieties counted.

Bee Behavior:

Assessments of the level of honey bee population working the different varieties was made by counting the number of foraging bees in individual trees. Counts were made by hand tallying honey bees observed on and about the blossoms of a single tree in a one minute walk around the tree. The first column of Table 2 summarizes the data of over 600 such counts. The number of honey bees on 'Magness' was considerably lower than on the pollenizer pear varieties. At times no bees were observed on 'Magness' and during marginal flight weather, if bees were present, they nearly always were found on the pollenizer varieties.

Honey bees were found to behave differently when visiting 'Magness' compared with bees visiting 'Moonglow' and 'Bartlett'. Some of the differences measured were the number of blossoms visited per cluster prior to moving to a different cluster, the average distance moved from one cluster to the next and the time of hovering above a blossom without landing. The data in Table 2 indicate a more active bee on 'Magness' and less concentrated foraging behavior compared to the activity on the pollenizer varieties.

Examining the foraging activities, it was found that of bees captured on 'Magness', 7% had pollen in the pollen baskets indicating pollen gathering behavior. An additional 52% had some pear pollen clinging to body hairs. Also, of the total, 40% had honey stomach loads of medium or larger size indicating the collection of nectar. Table 3 summarizes this data and gives the figures for the pollenizer varieties 'Moonglow' and 'Bartlett'. The very high incidences of pollen in the pollen basket and clinging to the body hairs of bees collected on the pollenizer varieties indicates the predominance of pollen collectors visiting pear. Nectar collection was insignificant on the pollenizer varieties.

While studies of individual behavior were being conducted, attempts were made to determine if greatly increased pollinating insect populations would result in adequate fruit set and yield. Honey bee colonies were placed in 4 different commercial orchards of 'Magness' and interplanted pollenizer pear varieties. One orchard received twice the number of colonies, one three times and two orchards five times the former number. It was not possible to check the orchards at bloom and judgement consisted of qualitatively assessing the fruit set as compared with previous years. Yields

Table 2. Behavioral aspects of the honey bee on 3 pear varieties. (Summary of more than 600 observations.)

Pear variety	Av. no. bees/tree observed/ minute	Av. no. blossoms/ cluster visited before moving to another cluster	Av. distance between visited clusters (inches)	% of bees hovering above blossom without landing
Magness	1.4	1.7	9.4	22.6
Moonglow	16.6	2.3	7.5	15.2
Bartlett	19.5	2.0	6.6	16.3

Table 3. Pollen and nectar collection by honey bees on 3 pear varieties.

Pear variety	Percent bees with		
	Pollen in pollen basket	Pollen grains on body	Medium or larger honey stomach
Magness	7	52	40
Moonglow	72	94	7
Bartlett	100	100	4

in the four orchards were not noticeably greater and none approached a level of yield that could be considered commercially acceptable. Although repeated in 1973, poor bloom and poor pollinating weather during bloom made the effort worthless.

CONCLUSION

The data presented here demonstrate a serious problem to attract honey bees to the 'Magness' pear variety. Several factors apparently contribute to this demonstrated unattractiveness. Examinations of the behavior of honey bees working 'Magness' and pollenizer varieties demonstrated a very mobile bee moving about a great deal on 'Magness' and a more deliberate behavior on the more attractive blooms of the pollenizer varieties. This mobile activity undoubtedly resulted in their moving from the 'Magness' to the more attractive pollenizer and competitive bloom in a short time. With the absence of pollen in the 'Magness' variety, fewer pollen collectors visited 'Magness' bloom. The nectar of 'Magness' and pollenizer varieties is apparently not very competitive either and thus few bees visit the blossoms for this purpose. Bees present on 'Magness' are very mobile and do not exhibit the usual deliberate working pattern necessary for pollination.

Literature Cited

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Book Review

E. I. DuPONT, BOTANISTE, THE BEGINNING OF A TRADITION. The University Press of Virginia, Charlottesville, Virginia 22903. Cloth, $7.50; paper, $3.95. 10 chapters, 133 pages, ill. By Norman B. Wilkinson.

The famed Longwood gardens of Pennsylvania and the Winterthur gardens of Delaware are prime examples of horticulture and gardening pursuits established by the duPont family. This book, written by the Director of Research at the Hagley museum, portrays the family background, beginning in 1799 with Eleuthere Iréneé du Pont, and continues through his descendants.