

## Pollination of Kiwifruit in Himachal Pradesh

J.K. Gupta, B.S. Rana and H.K. Sharma

Department of Entomology and Apiculture, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, India

Kiwifruit (*Actinidia chinensis*), also known as Chinese gooseberry, is functionally dioecious and, therefore, requires interplanting of male plants with females in the ratio 1: 9 for fruit production. Flowers are visited by pollinators only for pollen as there is little nectar and so are not particularly attractive to bees. It has been suggested that bees can be stimulated to collect pollen by feeding colonies with sugar syrup (Goodwin, 1997). The cultivation of this exotic fruit has been a great success under mid-hill conditions of Himachal Pradesh in areas at 600–1700 m and is now being extended to other Himalayan regions of the country. The present studies were undertaken to discover the pollinator complex and to study the effect of using bee colonies for pollination on fruit set and quality of fruit.

### Materials and Methods

The present studies were undertaken in the kiwi (var. Allison) orchard of Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (1275 m) during April to November 1996. Pollinators visiting flowers were counted and identified. One colony of *Apis mellifera* and four colonies of *A. cerana* were placed in one corner of the orchard when about 5% of the crop had

bloomed. Kiwi vines at 8, 12, 25 and 55 m away from bee colonies were marked. Floral buds on two branches of each vine were counted for three types of pollination: open pollination, hand pollination and caged pollination. Data on fruit set were recorded in July 1996. Observations on the visits of insect pollinators during different day hours were recorded. Ten fruits were harvested in November and the weight of each fruit from each mode of pollination was recorded. Kiwifruit have thousands of seeds so for comparison fruits were cut into transverse and longitudinal sections and the number of seeds revealed were counted.

### Results and Discussion

Six species of insect pollinators visited the kiwi bloom: *A. mellifera*, *A. cerana*, *A. dorsata*, *Eristalis* sp., *Episyrphus* sp. and *Orthellia* sp. However, *A. dorsata* was the predominant visitor constituting 40.5% of total. *Apis mellifera* and *A. cerana* constituted only 7.87% and 4.42% respectively despite placement of five colonies in the orchard. This indicated that hive bees preferred other flora. This is contrary to the findings of Barbattini *et al.* (1994) who reported that *Apis mellifera* was the most important pollinator of this crop. The dipteran flies, *Episyrphus* and *Orthellia*,

**Table 1.** Percentage fruit set in kiwi at various distances from bee colonies at Nauni during 1996

Distance (m)	Average fruit set (%)	Range
8	81.03 ± 3.86	66.67-92.59
12	93.35 ± 2.48	82.00-96.67
25	92.85 ± 0.85	91.43-96.42
55	96.05 ± 1.08	93.10-97.50

Average fruit set (%) = 90.82 ± 2.89

represented 27.07% and 13.85% of the insect visitors. However, as pointed out by Macfarlane (1995), flies carry only 10% of the pollen that bees can carry on their bodies, so the role of flies in kiwi pollination remains limited.

Average fruit set at various distances from bee colonies kept in the orchard was 81.03% at 8 m, 93.35% at 12 m, 92.85% at 25 m, and 96.05% 55 m (Table 1). This indicates that placement of colonies did not influence fruit set. The heavy fruit set obtained was due to wild pollinators and wind pollination. Wind is known to play an important role in kiwi pollination since pollen produced by male flowers is dry. Ferguson and Pusch (1991) have reported that pistillate flowers of kiwi capture viable pollen even without insect visitation and postulated that air currents were the vector and electrostatic charges and acoustics were implicated in kiwi pollination. However, Costa *et al.* (1993) found that although wind pollination can result in 81-98% fruit set, the fruits weigh less from such pollination. In the present study, fruit set from hand pollination was

100% and caged pollination (indicating wind pollination) was 40-50%.

Fruits collected from hand-pollinated vines were heavier (61.63 ± 1.46 g) than those from open pollination (47.41 ± 2.4 g) and caged pollination (15.17 ± 0.68 g). Qualitatively also, the placement of bee colonies did not influence the weight of fruit. There was no trend in the weight of fruits harvested at 8-55 m. The number of seeds was not significantly different in fruits taken from hand- and open-pollinated blooms. There were few seeds in fruits from caged treatments. The results suggest that under Solan conditions, hand pollination is more effective than open pollination using bee colonies in quality-kiwifruit production.

## References

- Barbattini, R., Greatti, M., Zaandigiacomo, P., Costa, G., Testolin, R. and Vizzotto, G. 1994. Insect pollinators of kiwifruit and their role in crop pollination. In *Atti XVII Cong. nazionale Italiano di Entomologica*, Udine, Italy. 13-18 Giugno. 1994.
- Costa, A., Testolin, R. and Vizzotto, G. 1993. Kiwi fruit pollination: Unbiased estimate of vine and bee combination. *N.Z.J. Crop and Hort. Sci.* 21: 189-195.
- Ferguson, A.M. and W.M. Pusch. 1991. Development of mechanical dry pollen application to kiwi fruit. *Acta Hort.* 297: 299-305.
- Goodwin, R.M. 1997. Feeding sugar syrup to honeybee colonies to improve pollination: a review. *Bee World*, 78: 56-62.
- Macfarlane, R.P. 1995. Applied pollination in temperate areas. In: *Pollination of Plants in the Tropics*, FAO Agr. Serv. Bulletin, 118: 20-33.