EFFECT OF HONEY BEE POLLINATION ON THE FRUIT SETTING AND YIELD OF LOQUAT

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Abstract

The panicles covered, with polythene bags bore few fruits resulting in the lowest yield of 21 grams per pancile with least minimum fruit setting of 3.57%. The highest yield of 708 grams was obtained from panicles left open to honey bees pollination under natural condition with fruit setting of 82.93 percent; whereas the panicles left open under natural conditions without honey bee visitation yielded 252 grams per panicle with fruit setting of 46.15 percent.

Introduction

The loquat, *Eriobotrya japanica* (Thunb) Lindl (Fam. Rosaceae) also called Japanese plum, is not widely grown commercially for its fruit in Pakistan but to a limited extent in Haripur and Peshawar in view of its early fruit arrival in the market when there is no fresh stone fruit available. Its woolly inflorescence, as indicated by its technical name "Eriobotrya", contains a copious quantity of nectar in the open cavity around the ovary, below the base of the anthers. Mc Gregor (1976) has listed 53 crops dependent upon or benefited by insect pollination in USA. Parker (1983) reported that there are approximately ninty-five crop species, grown in the USA, dependent upon or benefiting from insect pollination. Howard (1975) reported that more than 80 percent of all pollination required for setting of fruit and seed crops is accomplished through honey bees. He found that the honey bee is best adapted to act as a carrier of pollen. The body and legs are covered with heavy, branched hairs which catch and hold the pollen grains. In particular the hind legs of the honey bees contain pollen baskets, somewhat concave spaces fringed with long curved hairs. Honey bees are "flower constant", that is, visiting only one kind of flowering plant at a time either for nectar or pollen collection. He also reported that blue berry flowers must be pollinated by bees or there will be no fruit set at all.

Latif *et al*, (1960) reported that *Apis indica* (*cerana*) were able to increase the yield of *Brassica* crops (toria) by about 100 percent. Shahid and Mohammad (1976) obtained much lower yield from the rays plants covered with polythene bags than the plants left open under natural conditions. Butcher (1957 a and 1957 b) observed that no fruit was set on a tree (lychee) which was caged to exclude insect pollination, proving the lychee plants require insect pollination.

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Mc Gregor (1976) reported that the "pollination requirements seem to vary with cultivars of loquat, but all are benefited by, and some require, cross pollination." He also found that honey bees visit the flowers freely and are usually the primary visitors. They are satisfactory pollinating agents and one bee is adequate for 100 flowers. Crescimanno (1958) reported that even individual cultivars vary widely from year to year in the amount of fruit set through self-pollination. He found that bagged blossom set only 0.0, 16.5, and 1.3 percent, whereas, open blossoms set 4.2, 12.0 and 21.7 percent; and crossed flowers set 60 and 55 percent of the blossoms during different years. High temperature appears to be detrimental to fruit setting which could be the result of a decreased period of stigma receptivity of pollen viability associated with inadequate pollinator activity. Mortensen and Bullard (1968) reported that cross pollination was beneficial to all cultivars of loquat and necessary in some. Kennard and Winters (1960) also reported that the flowers are self-incompatible, so several loquat plants should be planted close together to assure corss pollination. Mohammad (1935) reported that only 37 percent of bagged flowers were able to form pods themselves as against 100 percent in cross pollinated by hand in *Brassica* crops.

Period of receptivity in loquat flowers is not well known. Singh (1963) found that pollen remains viable for 35 to 45 days at room temperature, 22 months at $0^{o}C$ and 26 months in a deep freezer.

Keeping in view the most important economic role of honey bees to the loquat growers experiments were carried out to evaluate the role of honey bees in loquat pollination.

Materials and Methods

The study was conducted in two orchards at Garhi Qamaruddin, 3 kilometers apart, near Peshawar during 1983-84. The parameters of study were:

T_1 = Pollination by Honey bees.

T_2 = Pollination by non-apis bees only.

T_3 = Self-pollination as check.

Loquat trees of about 16 years age and of equal size, grown at 3.6 x 7 meters spacing were selected at random keeping one tree for each treatment replicated four times under randomized complete block design. On the marked trees five panicles were tagged on every tree for observation. One panicle on top and one each on all 4 sides i.e. east, west, north and south of the tree were selected on each tree. The tagged panicles on trees in the self pollination treatment were covered over by polythene bags to keep them free from insect pollination.

Five honey bee colonies were placed in the orchard at Garhi Qamaruddin for pollination. To avoid honey bee pollination 4 trees of about the same age and size were selected in another orchard 3 kilometers away from the honey bee colonies.

The bags were removed after the fruit setting and number of fruits was counted on each tagged panicle. On maturity, number of fruits from each panicle was counted, removed and weighed, separately.

Results and Discussion

The data on fruit setting and fruit yield from the loquat trees was collected and compiled in to the following table:

Fruit setting of fruit yield of Loquat in various pollinations.

Pollination	No. of Buds	Fruits Formed	% Fruits Formed	No. of Ripe Fruits	Ripe Fruit weight (g) per Panicle	% decrease in fruit yield
Honey Bee Pollination	82	68	82.93	59	708	–
Non-apis bee Pollination	78	36	46.15	28	252	64.41
Self pollination check	84	3	3.57	2	21	97.03

It may be seen from the table that 82.93%, 46.15% and 3.57% formation occurred in the honey bee pollinated, Non-apis bee pollinated and self pollinated tree of loquat, respectively. The difference in fruit setting in three types of pollinations indicates that the tree is completely dependent on insect pollinators as only 3.57% fruit formation took place when the insect pollinator were excluded. In the natural pollination also the fruit setting was only half as compared to the honey bee polination. These results clearly express the dire need of insect pollinators and that too in plenty so that each and every opening flower bud is visited by the insects otherwise pollination and fruit setting in loquat will be adversely affected. These inferences support the view expressed by Kennard and Winters (1960).

The data on the formation and ripening of fruits given in the above table also indicate that insect pollination helps in increase of fruit yield. If the insect pollination is excluded 97.03% loss in fruit yield occurs. Even in natural pollination without the honey bees a loss of 64.41% occurrs in case of non-apis bee pollination simply because the non-apis bees are not found in numbers enough to visit and pollinate each and every flower bud. To fill up the gap placing of honey bee colonies near the orchards is every essential for good fruit yield. This view has also been expressed by Crescimanno (1958), Mortenson and Bullard (1968) and McGregor (1976).

Suggestions and Recommendations

On the bases of the above pollination study it can safely be recommended that:

1. Honey bee colonies be placed in or around fruit orchards to maximize fruit production. In loquat 3 times more yield can be had through honey bee pollination.

2. Farmers particularly vegetable and fruit growers may be encouraged to keep their own honey bee colonies for pollination as well as honey production.

3. Those farmers who cannot afford to maintain the honey bee colonies and their frequent migration to catch honey flow may be provided with honey bee pollination service on rental basis by the Agriculture Extension Service and Agriculture University.

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