

PRODUCTION OF QUALITY AND COSMETIC VALUED MANGOES AND MANAGEMENT OF FRUIT FLY (TEPHRITIDAE: DIPTERA)

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ABSTRACT

Mango (*Mangifera indica* L) is delicious fruit, full of carbohydrates, vitamins A and C, minerals and dietary fibers. Major problem, in trade of mango fruit among countries, is attack of many species of fruit flies (Tephritidae: Diptera). Due to this major problem, most countries have imposed sanctions on import of mangoes with contamination of fruit fly eggs and / or larvae. An easy way to control the pest under discussion is the use of chemical pesticides which leads to other relevant problems like health hazards linked with persistency of chemicals and onset of resistance in the pest. In present study, fourteen cultivars of commercial mango cultivars were tested against fruit fly attack and found that early maturing varieties like Dusehri, Malda, Langra and Chaunsa, had no to less attack of fruit fly which was mainly because of less fly population build up in early months. Covering or wrapping fruits with paper or cloth bags is another technique by which chemical and fruit fly free mangoes can be harvested. In that experiment, six types of bags were tested and found that bags of Korean -1 type remained at top and fruits in those bags had shiny and healthy appearance with no fruit fly. On the other hand, the fruits without bagging had more than 55 % damage done by the fly. Results found in the current work reveal that there are methods to control pests without losing quality and health of fruits.

Keywords: Fruit flies, Tephritidae, Mango Cultivars, Fruit bagging, Cosmetic value

INTRODUCTION

Mango (*Mangifera indica* L) is a delicious fruit full of dietary fibers, carbohydrates, vitamins (A, and C), minerals (Fe, K and Ca) and to some extent with protein (Fowomola, 2010). It has many varieties in the world which may differ in colour, taste, aroma and flavor depends upon the climatic zones, soil types and people's choice. Beside the consumption of mango as ripened fruit, it can also be used by value addition such as pickles, jams, mango leathers, squashes and juices etc. Various insects like bees, flies, hoppers, midges, bugs, beetles, mealy bugs, and fruit flies visit mango plant to fulfill various needs like nectar, food and shelter. Among these, some damage the leaves, inflorescence, roots, shoots and fruits. Fruit fly is most notorious and destructive insect pest of mango (Chowdhury, 2015). He also pointed out that the fruit fly species *Bactrocera zonata* (Saunders) is the major pest damaging mango fruits. These fruit flies are included in insect

Family Tephritidae. These insects have long, sharp and pointed ovipositor by which it lays eggs on ripening fruit. The female fly punctures fruit skin to lay her eggs and latex exudes from the fruits thus the process of deterioration starts. After some days, depending upon climatic conditions, larvae emerge from the eggs (Dekker and Messing, 2016). These immature are creamy white in colour and legless having pointed mouthparts and called maggots. These maggots feed on pulp of the fruit resultantly deteriorate the shape and taste of the fruit. After some days, on turning into pupae, these immature fall down to ground for pupation thus leaving the fruit. The attacked fruit is now the house of bacteria, fungi and deterioration increases with rotting. Rotten fruit is for no use and fall down the ground. In this way, the fruit fly damages the mango fruit in both qualitatively and quantitatively. Pakistan is 4th largest mango producing nation (Memon, 2015) and among top ten exporting countries in the world. Mango importing countries imposed quarantine sanctions to prevent

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entry of mango shipments without fruit fly free certificate. Pakistan can earn more foreign exchequer if this notorious pest of the fruit can be controlled and pest free export be possible to the world. Although mango produces in all provinces in the country but major areas lie in Southern Punjab and Sindh. Among growers, a large sect comprises on small farmers who bear huge loss due to fruit fly attack to their produce. To control the fruit flies, many techniques are being utilized including chemical sprays, mechanical/physical methods, pheromone traps and baits. As an easy job, pesticide chemicals are used in large scales to control various insect pests including the tephritids, resultant development of resistance in pests against the chemicals (Hsu and Feng, 2006). So, every new chemical pesticide loses its effectiveness against fruit flies due to resistance. Beside the problem of resistance, use of chemical insecticides also leads to various types of health hazards in humans (Kamel and Hoppin, 2004). Pheromones and food baits are also used to attract the pests. Pheromone traps are used to attract male and food baits are commonly used to trap both male and female fruit flies (Khan *et al.*, 2015). Bagging the fruit and whole tree can be an effective approach to control the fruit fly infestation but this method is not in practice by Pakistani mango growers. So, one of objectives of the study is to test this technique.

Other benefits of bagging may include the avoidance of fruits from attack of birds and production of toxin and fruit fly free fruits. It is therefore necessary for pest managers to integrate various control methods against fruit flies so that population of the pest can be remain under check. In this way, it is possible to increase quantity and quality of the mango fruit for consumption in country as well as for export.

In consideration these facts in view, present study was designed in which pest avoidance and mechanical (fruit bagging) control techniques were tested on different commercial mango cultivars in Multan, known as “the mango city” in the country. Population dynamics of various species of fruit flies and host resistance of cultivars against the pest were also studied.

The data so collected shall be utilized in strategic plans of fruit fly control in pest management campaigns at public as well as private level.

MATERIALS AND METHODS

The study was conducted in Mouza Buch Mubarak, Nawab Pur Road, Tehsil and District Multan in fruiting seasons of mango in 2015 and 2016. Four orchards were selected for the project. A brief methodology for each component has been given below:

Screening of Mango varieties against Fruit Flies

Fourteen cultivars (CVs) of Mango were selected, grouped into three categories according to their time of maturity i.e. Early (CVs. Dusehri, Malda and Langra), Medium (CVs Chaunsa, Fajri, and Sensation) and Late varieties (CVs Sanglakhi, Ratul-12, Mehmood Khan Wala, Desi, Kala Chaunsa, White Chaunsa, Dai Wala and Sobay Wali Ting) and, checked for susceptibility / tolerance against fruit fly. For data collection, five plants of each variety were selected, out of which 20 fruits were checked from each tree. The damage and number of larvae were observed from sampled fruits.

Hanging fruits were chosen by random method for data recording. Data were recorded after every 3 days.

Species of Fruit Flies recorded on mango fruits, their fecundity and sex ratio

Infested fruits were collected from different orchards and placed them in insect rearing cages of size of 1.5 x 1.5 ft. A layer of sand was laid on the bottom surface of the cage to provide pupation place for larvae of the pest. At time of adult emergence data was recorded every day to check the number of emerged adults, their species and sex ratios. The data was noted till the emergence of all larvae into adults. Ten mango cultivars were selected for this component and the names are mentioned in Table 1.

Effect of Different types of bagging on mango against fruit flies

More susceptible mango cultivar Ratol-12 was selected for this component. Three trees of the variety were selected and tagged by date. Bags used for the study were of six types i.e. Korean-1, Korean-2, American, Chinese, Tara Vera (a type of local cloth) and Muslin cloth, and ten bags from each type were chosen to pack the fruits. Fruits were bagged one month before harvesting and the remaining un-bagged were considered as the control, available for fruit fly infestation. The process of packing in bags was adopted as given by Sarwar 2015. Data was taken weekly. At time of harvesting, each bag was treated separately to check for the quality and cosmetics of the fruit. The detail of bags used is given in Table 2.

RESULTS AND DISCUSSION

Screening of Mango varieties against Fruit Flies

Regarding the screening of Mango cultivars against fruit fly attack, it was observed that there was no attack of the pest on early varieties like Dusehri, Malda and Langra. Medium attack was observed on Medium maturing varieties. Among Late maturing varieties, Kala Chaunsa and Dai Wala were attacked moderately whereas rest had heavily attacked. In last week of July, maximum attack was observed on Sanglakhi, Ratole – 12, Mehmood Khan Wala, Sobay Wali Ting and Desi. The results under discussion (Figure 1) are contradictory with those presented in Mexico (Aluja *et al.*, 2014), where Sensation was found among most susceptible varieties. This might be due to variation in population in early and late season. Early season varieties have low population of fruit flies attack where as medium and late season varieties have more attack respectively due multiplication of fruit flies generation and more chances to attack on fruits. The reason can be the difference of climatic conditions.

Species of Fruit Flies recorded on mango fruits, their fecundity and sex ratio

Among two recorded species of fruit fly in the study, populations of *Bactrocera zonata* and *Bactrocera dorsalis* were recorded i.e. 81.36% and 18.65%, respectively. Male to female sex ratio observed in *B. zonata* and *B. dorsalis* as 1:1.04 and 1:1.44, respectively. Maximum number of fruit fly larvae were recorded from Sanglakhi and minimum were observed from White Chaunsa which shows that CV.

Table 1

Specifications of bags used.

| Treatment | Specification | Colour | Size (mm) |
|---------------------------|----------------------|--|-----------|
| T1 Korean - 1 | Double layered paper | inner layer red glazy; outer layer brown with inner side black | 160 x 100 |
| T2 Korean - 2 | Double layered paper | Brown | 160 x 100 |
| T3 American | Hard paper | Brown | 152 x 101 |
| T4 Chinese | Kraft Paper | Yellow | 160 x 240 |
| T5 Tera Vera | Mix Cloth | White | 203 x 152 |
| T6 Muslin Cloth | Cotton Cloth | White | 203 x 152 |
| T7 Control (Without bags) | | | |

Table 2

Number of larvae per fruit in different Mango cultivars.

| Cultivar | Cage 1 | Cage 2 | Cage 3 | Avg. |
|-------------------|--------|--------|--------|-------|
| Mehmood Khan Wala | 9.00 | 12.20 | 5.80 | 9.00 |
| Dai Wala | 10.60 | 10.20 | 12.50 | 11.10 |
| Sanglakhi | 14.10 | 16.30 | 15.50 | 15.30 |
| Chaunsa | 3.90 | 2.90 | 3.40 | 3.40 |
| Kala Chaunsa | 4.80 | 5.00 | 6.10 | 5.30 |
| Sobay Wali Ting | 12.50 | 15.00 | 11.50 | 13.00 |
| Sensation | 5.00 | 3.90 | 3.40 | 4.10 |
| White Chaunsa | 2.50 | 2.70 | 1.70 | 2.30 |
| Fajri | 4.90 | 5.10 | 3.20 | 4.40 |
| Ratole - 12 | 7.10 | 6.30 | 6.70 | 6.70 |

Table 3

Cosmetic value of Mango Fruits after use of various types of bags.

| Treatments | Cosmetics Value of fruit |
|--------------------------|--------------------------|
| T1 Korean – 1 | Very Good , Shiny |
| T2 Korean – 2 | Good |
| T3 American | Normal |
| T4 Chinese | Normal |
| T5 Tera Vera | Normal |
| T6 Muslin Cloth | Normal |
| T7 Control (without bag) | Very Poor |

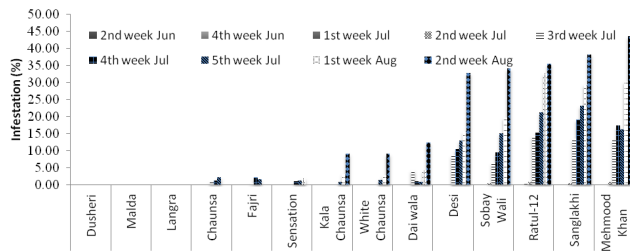


Fig. 1

Temporal infestation (percentage) of fruit flies on Mango Cultivars.

Sanglaxhi is most suitable as a food source for development of fruit fly larvae. The detail of average number of larvae emerged from infested fruits of various cultivars under study is given in Table 2.

Effect of Different types of bagging on mango against fruit flies

The results of this component reveal that no infestation of the fruit fly under study was found on fruits enclosed in bags, whereas the un-bagged fruits had infestation more than 55 % as shown in the Figure 2. Besides the production of undamaged mangoes, the cosmetic value was also very good to normal in bagged fruits as compared to poor in control, as given in Table 2. Among other benefits of bagging fruits were free from dust and bird attack and there was no sunburn. The results obtained in present study were in coincidence with those presented in a previous one (Sarwar, 2015).

CONCLUSIONS

Tephritid flies are most destructive and quarantine pests of fruits and vegetables especially in mangoes. At this era of population increase, the trade of food stuff among nations of the world is being increased day by day. This global trade fetches foreign exchequer for the countries like Pakistan whose economy is based generally on agriculture. Due to pest attack especially fruit flies, the desire to boost the export of fruits especially mango from the country will remain merely a daydream. Control of fruit flies with pesticides is facing problem of contamination and most countries do not allow entry of such fruits in their borders with residues of chemicals. Therefore methods to control fruit flies other than synthetic pesticides should be incorporated in control programs. So fruit fly resistant mango cultivars / early fruit bearing commercial varieties should be screened out and current study presented an initial work towards this approach. Likewise, exclusion of fruits from infestation of fruit fly is another chemical free approach. Now, there is to work more on those aspects and others to control pests by avoiding chemicals so that fresh and healthy horticultural products can be produced resultantly more export and more foreign income can be earned for the country as well as for the poor farming community. Fruit bagging is one of the best ways to avoid fruit

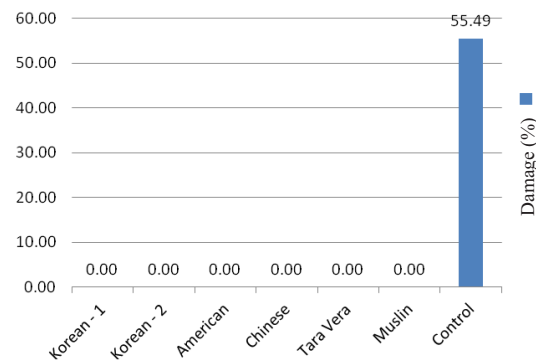


Fig. 2

Infestation of Fruit Fly (%) on mango fruits with various types of bags.

fly attack for production of export quality fruits of mango.

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