

MANGO FRUIT ORCHARDS INFESTATION: A CASE STUDY ON MANGO FRUITS IN PAKISTAN

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Abstract

A review base case study was conducted on mango fruit production in Pakistan. The aim of the study was to find out the solution and cause of Mango fruit yield reduction in Pakistan. The literature and research investigated that, in Pakistan, two fruit fly species, *Bactocera zonta* and *Bactocera dorsalius* are the major pests and sources of mango fruit orchard infestation. Farmers and field workers prefer to use different toxic chemicals e.g., Diptrax as foliar spray management paratactic, etc but toxic chemicals have no positive results, and fly species produce resistance. The alternative solution is Male Annihilation techniques, Bait Application, and bagging method integrated into the mango orchard resulting in an improvement in mango yields and production.

Keywords; Case study: Fruit fly; Mangoes; Orchards; Infestation

Introduction

Mango (*Mangifera indica* L) is called king fruit and in the tropical region, it is grown about 100 countries of the world (Murtaza et al., 2021a). It has been reported that Mango fruits is the rich sources carbohydrates, protein along with different essential vitamins (A and C), and minerals (Fowomola, 2010). In a study its was accepted that Worldwide Pakistan is the 4th largest in mango fruit production (Memon, 2016). In Pakistan five varieties, Chanusa, Daseri, langara, Sindhri, and Anwar Ratol are well known. The mango fruits are used for different purposes like juices, squashes, pickle etc. Worldwide ranking Pakistan is 4th and 10th largest both in mango production and export to other countries (Memon, 2015). Pakistan is 9-10 tons/ha land of mango tree plantation, low as compared to other mango-

producing countries like China, India, and Mexico (Abbas *et al.*, 2018). One of the basic reason behind the mango fruits yield reduction is due to the pest attack on mango trees, mango bark beetle *Hypocryphalus mangiferae* resulted in the quick decline and effect on mango trees (Masood *et al.*, 2010) while in fruits case Fruit fly attack 75 % losses reported in fruit orchards in Pakistan (Khan *et al.*, 2005). The fruit fly different species 20-90 % losses reported in fruit production in Pakistan (Stonehouse *et al.*, 2002). The fruit fly prefers half-ripe and yellow fruits. when They damage the pulp of fruits and caused early falls. The maggots can be clearly seen in the fruits. therefore, insecticides application were not effective because the toxic chemicals did not reach the inside maggots (Heng *et al.*, 2006).

besides, due to strict rules of quarantine on export and import, due to infestation of the fruit fly in various fruits, the export of infested Mango fruits is restricted and market value of fruits decreases (Riaz and Sarwar, 2013; Riaz and Sarwar, 2014). The researchers adopted various methods to manage the fly's infestation in mango fruits orchards in Pakistan, but we have focused our discussion on review base study on methodology which is safe and friendly to an agroecological zone and future have benefits to the farmer or field workers community.

Fruit Fly Vectored Affecting Mango Fruits Production

Mango fruit fly, *Bactrocera Zonata* and oriental fruit fly, *Bactrocera dorsalis*

The fruit flies belong to the order: Diptera and family Tephritidae, comprises a widely distributed group of agricultural pests. The order Diptera comprised many pest species, infest different types of fruits and vegetables, resulting in huge losses in fruits and vegetables production (Raza *et al.*, 2020). The *Bactrocera zonata* widely distributed in Pakistan, Bangladesh, India, etc in Asia (Sarwar *et al.*, 2019) The population dynamic of fruit fly depend upon on, sun shine, relative humidity and temperature, during July it, s in peak while at April august and December, lowest population recorded in Pakistan. (Khan and Naveed, 2017). when the mango fruits are in not fully ripe the following different safety method must be adopted in Pakistan to control or managed fly infestation in orchards.

Bagging method

The research studies to use the bagging method conducted resulted that Plastic bagging on mango fruits tree gives maximum protection to fruit from the heavy attack of fruit fly species

infestation during summer season, leading to better quality of mango fruits production. The fruits not in fully ripening stage is more better and acceptable for storage and free from pest attack (Abbasi *et al.*, 2014). When the fruit bagging in mango orchard is applied, it is very effective in enhancing the color and weight of the fruits and no need to apply any insecticides. While after the development of fruit about stone size, the mango fruits are not to exposed an external harsh. it is very helpful for the production of high-quality exportable fruit (Karar *et al.*, 2019). The earlier studies proved that if Mango fruit enclosed in Polythene bags have no infestation in fruit orchards and 55 % more infestation found in untreated fruits (Qayyum, 2016). The other factor involved in the increase in export of mango, to used such integrated pest management technique to protected the late varieties from attack of fruit flies, because flies infestation found severely in late grown mango varieties, if we protect the late varieties and more income can be generated. The consumer like to buy high quality fruits free from insect pest attack, these characteristics can be produced by the use of bags in fruit orchards (Karar *et al.*, 2021).

Insecticide Application or Chemical Control

It has been tested extensively various insecticide group including bifenthrin, malathion, methomyl, λ -cyhalothrin and spinosad as a cover spray against control of fruit flies in Pakistan. but research observation show that Mango fruit fly, *Bactrocera zonata* have developed resistance to trichlorfon, malathion, bifenthrin, λ -cyhalothrin and spinosad (Nadeem *et al.*, 2012).

Besides this the Fruit flies species *Bactrocera zonata* and *Bactrocera dorsalis* have developed resistance against some insecticides, also includes Diptrax in Pakistan (Haider and Khan, 2011). The extreme used of toxic chemicals have hazardous effect both human and environment (Edwards *et al.*, 2007). The earlier research outcomes revealed that botanicals used as a oviposition deterrent and repellent (Shah *et al.*, 2016). it can be used as an alternative of synthetic pesticides for the management of *Bactrocera zonata*. (Tephritidae: Diptera) to protect the environment from their hazards. Among all extracts, methanolic extract of peppermint is most effective and it also exhibited no effect on the quality of fruit (Tajdar *et al.*, 2022).

Sanitation or picking of fallen fruit

The research finding show that if the fallen fruits collected in orchard on time, it would stop the life cycle of the maggots to completed, in a study its proved that the infested fruits collected in plastic bags and leave it for sun heat 3-5 days, it will kill the maggots and then dispose of the plastic bags through the garbage system. The Proper disposal is also required to adopted on time in mango orchards (Sarwar, 2015).

Bait Application

In Pakistan two fruit fly species, (*Bactocera zonata* and *Bactocera .dorsalis*) first reported and managed through application of lures in traps in mango fruit orchards (Abbas et al., 2021a; Mohyuddin and Mahmood, 1992).Worldwide different baits, Green Ocimum (leaf extract),Molasses and Piper cubeba crude oil are applied for the management of mango fruit fly and oriental fruit fly (El-Gendy et al., 2020; Parab et al ., 2018).There are recently few published articles to be found in bait application Technique in Mango orchrds fruit fly management in Pakistan as shown in the Table (1). Below

Table.1 List of the baits and Lures used in Mango orchard in Pakistan

Name of Baits and Lures	Fruit fly's species	Author (s)
Protein Hydrolyzate	<i>Bactocera zonata</i> , <i>Bacotera dorsalius</i>	(Abbas et al., 2021b)
GF-120	<i>Bactocera zonata</i>	(Nisar et al ., 2020)
Methyl eugenol	<i>Bactocera zonata</i> , <i>Bacotera dorsalius</i>	(Khan et al ., 2021)
Methyl eugenol	<i>Bactocera zonata</i>	(Murtaza et al., 2021b)
Methyl eugenol	<i>Bactocera zonata</i> , <i>Bacotera dorsalius</i>	Aabdin et al.,2020

Biological control

The earlier research findings show that in baited tarps of different mango varieties in fruit orchards captured the Rhipphoro thrips, mango hoppers, *Amrirtodus atkinsoni*, *Idioscopus clypealis*, cruentatus, fruit fly's species *zonata* and *dorsalis*. The other insect pest captured in traps comprised mango scales, *Aspidiotus destructor*, *Parlotoria pegandei* and mango mealy bugs, *Drosicha stebingi* . while the predators Chrysopalac ciperda, *Mallada boninensis* and

Polynema were identified and recorded (Khan *et al.* ,2020). The alternative techniques for two invasive pest species of fruit fly *Bactrocera zonata* and *dorsalis* researchers describe that natural enemies, parasitoids. reared for *Bactrocera zonata* it different stages. The fruit fly populations reduced by the natural enemies, hymenopteran larval , pupal parasitoids *Aganaspis (Trybliographa) daci* (Weld) and *Dirhinus giffardii* Silvestr reported in a study (Ahmad *et al.*, 2014).The researchers conducted experiments on the virulence of three entomopathogenic fungi, *Verticillium lecanii* *Metarhizium anisopliae*, *Beauveria bassiana* and against *Bactrocera zonata* different laboratory conditions. The results proved that that *B. bassiana* and *M. anisopliae* were more effective in pathogenicity and potentially kill at all stages of *B. zonata* as compared to *V. lecanii* (Murtaza *et al.*, 2022).

Host plant resistance

It has been reported that no variety of mango found to be resistance against powdery mildew disease in Pakistan (Naqvi *et al.*, 2014).The Twenty varieties of mango including, Langra, Chaunsa, Sindhri, etc tested against post-harvest disease of mango (*Lasioidiplodia theobromae*.) resulted Mango varieties, Bagan Pali, Saroli and Saleh Bhai produce resistance against *L. theobromae*, diseases whereas, other varieties were highly susceptible (Khanzada *etal.*, 2015).

Nutritional Deficiency

The study proved that due to nutritional imbalance the mango yield decreases if boron and zinc have applied in mango orchard both as a soil and foliar treatments become the source of increase the Mango fruits quality and quantity improvement (Ahmad *etal.* , 2018).

Conclusion

The better-quality mango production required, soil, climate, and environmental factor. In Pakistan have Human activities such as deforestation and cultivation contribute to the accumulation of carbon dioxide in the environment. (Rehman and Işık, 2022) Pakistan Mango production declined by nearly 60 percent in the ongoing season due to climate change and lack of resources, including closure of canals, electricity loadshedding and diesel shortage, at a very crucial time for the crop. in contrast for better yield and mango production resistance varieties to different insect pest of different fruits are available worldwide, it is necessary to used them in agriculture sector of Pakistan.

Two fruit fly species *Bactrocera zonata* and *dorsalis* are the major cause in yield reduction of mango production in Pakistan. besides use of excessive toxic chemicals, Male Annihilation technique, Bait method and natural enemies must be used.

The mango fruits have infested by different diseases but most common is powdery mildew, orchards growers are required to follow proper sanitation, fallen fruits buried in proper place.

It is clear from research data base that Pakistan has lack of resources, therefore in limited resources the Research Institutes, Nuclear Institute for Food and Agriculture (NIFA), National Institute for Biotechnology & Genetic Engineering (NIBGE) and National Agricultural Research Centre (NARC), Islamabad focused on Resistance varieties, biological control mechanism of Mango production in Pakistan.

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