

<http://www.pjbs.org>

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Studies on Population Dynamics of Fruit Flies (Diptera:Tephritidae) in Guava and Nectrin Orchards in Islamabad

Waseem Ahmad Gillani, Tariq Bashir and Mohammad Ilyas

Integrated Pest Management Institute, National Agricultural Research Centre, Islamabad, Pakistan

Abstract: The population dynamics of fruit flies was studied in guava and nectrin orchards at National Agricultural Research Centre, Islamabad, Pakistan, using pheromone traps baited with a mixture of methyl eugenol, sugar and naled. Generally, flies were caught in higher numbers in nectrin orchard than in guava orchard, however, the difference was not statistically significant. The fruit flies were present in the field throughout the year except January. They were caught in the traps in greater numbers from May to August and their population was at the peak in July in both guava (80.66 males/trap/week) and nectrin (168.66 males/trap/week) orchards. Three species, *Dacus zonatus* (Saunders), *Dacus dorsalis* Hendel and *Dacus cucurbitae* Coquillett were caught in the traps. *Dacus zonatus* was the dominant species and its population was significantly higher ($F = 5.73$, $df = 2$, $P = 0.0073$) than other two species. It appears to be a severe pest of these fruits as it was present in the field almost through out the year and in greater numbers in the warmer half of the year. *Dacus cucurbitae* was caught in the traps in very small numbers and this species does not seem to be a serious pest of guava and nectrin under Islamabad ecological conditions.

Key words: *Dacus* spp., *Bactrocera* spp., Tephritidae, fruit flies, population dynamics

Introduction

Fruit flies of family Tephritidae (Order: Diptera) are one of the most serious pests of fruits and vegetables. They cause enormous economic losses in every part of the world where fruits and vegetables are grown. In Indian subcontinent, there are more than 200 known species of fruit flies, however, the species that are considered to be the serious pests of fruits and vegetables are not more than ten. Most of these species are polyphagous, having high rate of fecundity and ability to quickly spread over a wide area that makes them real vexatious pests for fruit and vegetable growers.

In Pakistan, among many species of fruit flies that infest various kinds of fruits and vegetables, *Dacus zonatus* (Saunders) (*Bactrocera zonatus*), *Dacus dorsalis* Hendel (*Bactrocera dorsalis*) and *Dacus cucurbitae* Coquillett (*Bactrocera cucurbitae*) are the most important ones (Marwat, 1986). The *Dacus zonatus* is a serious pest of fruits like guava, peach, mango, citrus, apricot, loquat, nectrin and plum. In case of severe infestation this fly may cause fruit damage up to 50% (Syed *et al.*, 1970). The fruit fly, *Dacus dorsalis* is injurious to various types of fruits specially, mango, guava, jaman, papaya and citrus. Due to its wide occurrence in the subcontinent, it is also known as Oriental fruit fly (Kapoor, 1970). The fruit fly, *Dacus cucurbitae* is an important pest of cucurbit fruits and vegetables (Anonymous, 1978). It is distributed all over Pakistan and feeds on about twenty cucurbitaceous and solanaceous hosts (Syed, 1971).

'Sterile insect technique' (Dominiak *et al.*, 1998) and 'lure and kill method' (Jacobson, 1972) are used to control fruit flies throughout the world. These methods are relatively less damaging to environment and are more sound ecologically. A number of other methods to control these important pests of fruits, such as chemical control (Dashad *et al.*, 1999), cultural control (Makhmoor and Singh, 1999), combinations of insecticides and plant products (Saikia and Dutta, 1997) and culture filtrates of fungi (Purnima *et al.*, 1999) have also been tried. However, for the complete success of these methods or for developing any other strategy for their suppression, the knowledge of population dynamics of fruit flies, is an important prerequisite. Pheromone traps provide an easy and efficient method to monitor the activities of fruit fly populations (Alyokhin *et al.*, 2000) and they also have been successfully used in Pakistan (Marwat and Baloch, 1986). Although pheromone traps attract only adult males of fruit flies but they are good indicators of the total population also, as in nature the normal sex ratio is about 1:1. Bhagat *et al.* (1998) studied the sex ratio of *Dacus*

cucurbitae and reported that during different seasons the population was slightly male- or female-biased but the deviation from 1:1 ratio was not significant.

Present studies were carried out to gather more information about the seasonal fluctuations of various species of fruit flies infesting guava and nectrin orchards. So that it can form the basis of effective Integrated Pest Management strategies against these important pests.

Materials and Methods

The studies were conducted at the guava and nectrin orchards of Fruits and Vegetables Programme, National Agricultural Research Centre, Islamabad. Pheromone traps used to catch the fruit flies were prepared from round-shaped hollow plastic containers (25cm length x 15cm diameter). The lid on each side of the container had a pipe fixed in its center to allow the flies to enter into the trap. The inner diameter of each pipe was 2.5cm and it was protruded into the plastic container for a length of 5cm. In each trap, 4 ml of lure/toxicant mixture was injected into a cotton wick that was suspended in the center of the trap with a wire. The lure/toxicant mixture, composed of 85% methyl eugenol + 10% sugar + 5% Naled (Qureshi *et al.*, 1976), was obtained from Entomology Division, Atomic Energy Agricultural Research Centre, Tandojam, Sindh, Pakistan. Methyl eugenol acts as a sex-attractant for males of fruit flies. Naled is a contact and respiratory acting organophosphorous insecticide that has a rapid and short-term effect. Sugar is added to enhance the attractiveness of the trap. The traps were placed at a rate of 4 traps per acre in guava and nectrin orchards. To increase the efficiency of the traps, they were fixed at a height of one meter above ground (Ali *et al.*, 1999). The traps were kept in place throughout the year from January to December. After every four weeks, the cotton wick was replaced and fresh quantity of the lure/toxicant mixture was injected into it. The trapped flies were removed from the traps and counted after every one week. One-way Analysis of Variance (ANOVA) was used for analyzing the data for month-wise differences in the fruit fly population and for the difference in the population of different species of fruit flies. T-test for two samples was used to compare the fruit fly populations infesting guava and nectrin. Results were considered statistically significant when the probability of their occurrence by chance was less than five percent ($p < 0.05$).

Results and Discussion

The results showed that patterns of fruit fly population

fluctuation in both the guava and nectrin orchards were similar (Fig. 1). The population appeared in February, started increasing in March and reached its maximum in July at both guava (80.66 males/trap/week) and nectrin (168.66 males/trap/week) orchard. Makhmoo and Singh (1998) reported similar results from Indian occupied Kashmir. They stated that peak population (170.66 males/trap/week) of guava fruit fly, *Dacus dorsalis* was observed in July. This peak period of fruit fly population coincides with ripening of guava fruit. After July, the population started declining in both the fruits. In guava, it reached its minimum level (1.20 males/trap/week) in December. While in nectrin, it reached its minimum level (1.20 males/trap/week) in November and it completely disappeared in December. Kabir *et al.* (1997) reported similar results from Bangladesh, who observed that fruit flies were least prevalent in the field in December.

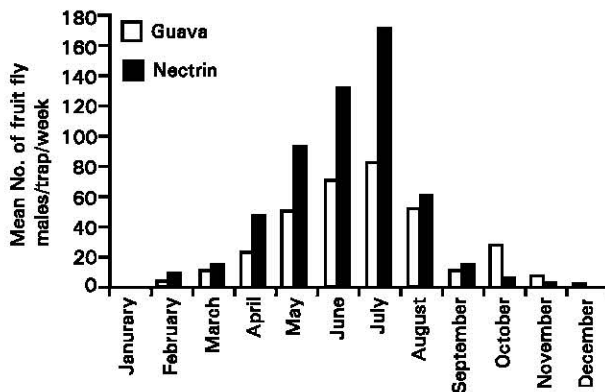


Fig. 1: Seasonal fluctuations of fruit fly population (*Dacus* spp.) in guava and nectrin orchards at NARC, Islamabad

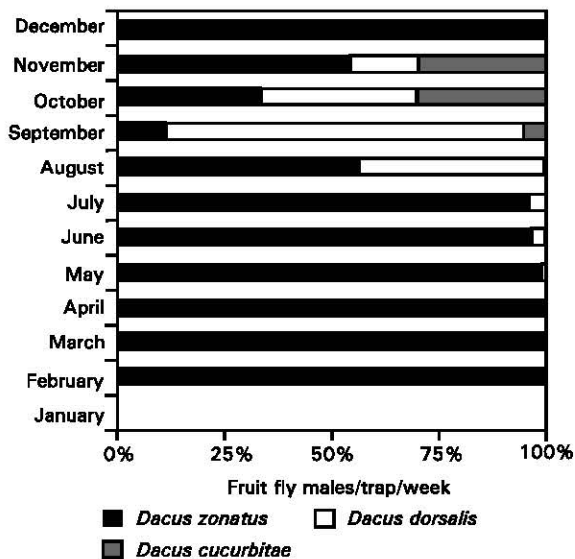


Fig. 2: Proportion of different species in the total population of fruit flies caught in pheromone traps (population trapped in both the orchards i.e. guava and nectrin, is combined)

Statistical analysis showed that in guava orchard the number of male fruit flies caught in pheromone traps in July was significantly higher ($F = 438.96$, $df = 11$, $P < 0.0001$) than rest of the

months. Similarly, in July, fruit flies population was also significantly higher in nectrin orchard ($F = 625.30$, $df = 11$, $P < 0.0001$).

Generally, higher numbers of fruit fly males were caught in pheromone traps in nectrin orchard than in guava orchard (Fig. 1). However, in October, the fruit fly population was relatively higher in guava orchard than in nectrin orchard and it remained like that in November also. This increase in fruit fly population in guava orchard might be due to the presence of guava fruit on plants. In December, the fruit flies disappeared from nectrin orchard while they were still present, although in very small numbers, in guava orchard. Apparently the difference between fruit fly population on guava and nectrin seems quite obvious (Fig. 1), however, the statistical analysis did not show any significant difference between the two populations.

Three species of fruit flies i.e. *Dacus zonatus*, *Dacus dorsalis* and *Dacus cucurbitae* were caught in the pheromone traps placed in guava and nectrin orchards. The *Dacus zonatus* appeared at the end of the February and remained in the field till the beginning of December. It attained its peak in July when its density was 237.5 males/trap/week. The *Dacus dorsalis* appeared in the field in April and attained the peak of its population (48.12 males/trap/week) in August. It remained in the field till November. The *Dacus cucurbitae* appeared in August and disappeared at the end of November. It attained its peak during October (10.12 males/trap/week). Generally, the population densities of *Dacus zonatus* were much higher than the other two species throughout the year (Fig. 2). Statistical analysis showed that the difference between the populations of different species was significant ($F = 5.73$, $df = 2$, $P = 0.0073$).

Dacus zonatus was the dominant species in the field from February till July as it made up more than 95% of the total fruit fly population that was caught in pheromone traps (Fig. 2). In August, decrease in the population of *Dacus zonatus* was started with the onset of increase in the population of *Dacus dorsalis*. The population of *Dacus dorsalis* increased rapidly in this month and reached up to 43.21% of the total population from just 4.74% in the previous month. This increasing trend in the population of *Dacus dorsalis* continued and it became the dominant species in September as its proportion in the total fruit fly population climbed up to 84.31%. However, this dominance was short-lived as its population decreased rapidly in the coming month and the density of all three species became similar in October (*Dacus zonatus*, 32.84%; *Dacus dorsalis*, 36.96%; *Dacus cucurbitae*, 30.21%). It was only in October when *Dacus cucurbitae* was present in the field in reasonable numbers (10.12 males/trap/week). This was also the highest share (30.21%) of this species in the total population in whole year. In November, once again, *Dacus zonatus* has the highest population share (54.12%) followed by *Dacus cucurbitae* (29.41%) and *Dacus dorsalis* (16.47%). In December, the populations of *Dacus dorsalis* and *Dacus cucurbitae* disappeared and only the population of *Dacus zonatus* was present in the field.

The results suggest that *Dacus zonatus* was the most serious pest of guava and nectrin under the ecological conditions of Islamabad. It was present in the field throughout the year except January and in great numbers from April to August. *Dacus dorsalis* was present in the field from April to November but in reasonable numbers only in August and September. *Dacus cucurbitae* was present in the field for a short period from late August to November and in reasonable numbers only in October. This species does not seem to be a serious pest of guava and nectrin under Islamabad ecological conditions.

References

- Ali, I., F. Ullah and S.A. Khan, 1999. Efficacy of various insecticides and trap heights in methyl eugenol traps against fruit flies (*Bactrocera* spp.). *Sarhad J. Agric.*, 15: 589-594.

- Alyokhin, A.V., R.H. Messing and J.J. Duan, 2000. Visual and olfactory stimuli and fruit maturity affect trap captures of oriental fruit flies (Diptera: Tephritidae). *J. Econ. Entomol.*, 93: 644-649.
- Anonymous, 1978. A *Dacus cucurbitae* Coquillett distribution maps of pests. Map No. 64 (revised) Series A. Comm. Well. Inst. Entomol., London.
- Bhagat, K.C., V.K. Koul and R.K. Nehru, 1998. Seasonal variation of sex ratio in *Dacus cucurbitae* Coquillett. *J. Adv. Zool.*, 19: 55-56.
- Dashad, S.S., O.P. Chaudhary and Rakesh, 1999. Chemical control of ber fruit fly. *Crop Res. Hisar.*, 17: 333-335.
- Dominiak, B.C., M. Cagnacci, T. Rafferty and I. Barchia, 1998. Field cage release of sterile Queensland fruit fly (*Bactrocera tryoni* (Froggatt)). *Gen. Appl. Entomol.*, 28: 65-71.
- Jacobson, M., 1972. *Insect Sex Pheromones*. Academic Press, New York, pp. 382.
- Kabir, S.M.H., R. Rahman and M.A.S. Molla, 1997. Biology of *Dacus (Zeugodacus) tau* Walker (Tephritidae: Diptera). *Bangla. J. Zool.*, 25: 115-120.
- Kapoor, V.C., 1970. Indian Tephritidae with their recorded hosts. *Oriental Inst.*, 4: 207-251.
- Makhmoor, H.D. and S.T. Singh, 1998. Effective concentration of methyl eugenol for the control of guava fruit fly, *Dacus dorsalis* Hendel in guava orchard. *Ann. Pl. Prot. Sci.*, 6: 165-169.
- Makhmoor, H.D. and S.T. Singh, 1999. Effect of cultural operations on pupal mortality and adult emergence of guava fruit fly, *Dacus dorsalis* Hendel. *Ann. Pl. Prot. Sci.*, 7: 33-36.
- Marwat, N.K., 1986. Studies on survey, control and management of Tephritidae fruit flies of economic importance in Pakistan. *Ann. Rept., National Fruit Fly Res. Labs. ARS Dera Ismail Khan*.
- Marwat, N.K. and U.K. Baloch, 1986. Methyl eugenol, a male fruit fly sex-attractant. *Pak. J. Agric. Res.*, 7: 234.
- Purnima, S., S.K. Saxena and P. Sinha, 1999. Effect of culture filtrates of three fungi, in different combinations, on the development of the fruit fly, *Dacus cucurbitae* Coq. *Ann. Pl. Prot. Sci.*, 7: 96-99.
- Qureshi, Z.A., A.R. Bughio, Q.H. Siddiqui and Najeebullah, 1976. Efficacy of Methyl eugenol as a male attractant for *Dacus zonatus* (Saunders) Diptera: Tephritidae. *Pak. J. Sci. Ind. Res.*, 19: 22-23.
- Saikia, D.K. and S.K. Dutta, 1997. Efficacy of some insecticides and plant products against fruit fly, *Dacus tau* (Walker) on ridge gourd, *Luffa acutangula* L. *J. Agric. Sci. Soc. North-East India*, 10: 132-135.
- Syed, R.A., 1971. Studies on Trypetids and their natural enemies in West Pakistan. V. *Dacus cucurbitae* Coq. *Tech. Bull. Comm. Well. Inst. Biol. Control*, 14: 53-75.
- Syed, R.A., M.A. Ghani and M. Murtaza, 1970. Studies on Trypetids and their natural enemies in West Pakistan. III. *Dacus zonatus* (Saunders). *Tech. Bull. Comm. Well. Inst. Biol. Control*, 13: 1-16.