

POPULATION DYNAMICS AND MANAGEMENT OF *BACTROCERA* SP. (DIPTERA: TEPHRITIDAE) INFESTING MANGO

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ABSTRACT

Population dynamics and management studies on *Bactrocera* sp. fruit fly infesting mango were carried out in a mango orchard at D.I. Khan, Pakistan. Weekly data on pest incidence were recorded throughout the year, 2004 by installing male sex lure-trap of (methyl eugenol). The mean number of flies captured/month ranged from 6 to 400. Two peaks of flies population were predominant; 1st in June (217) and 2nd during September (397).

Management of the fruit fly on mango via male annihilations, baiting, use of neem oil separately and combination of these revealed significant reduction in fruit infestation when male sex-lures traps were adjoined either by applying bait of protein hydrolysate or by application neem oil. In either case the % reduction in fruit infestation (dropped & harvested) ranged from 89-95% and 76-85% respectively.

INTRODUCTION

Mango, (*Mangifera indica*) is the most important and well-adopted tropical fruit in Pakistan. A large quantity of mango is consumed within the country and considerable share in export present it as the major sources of foreign exchanges earnings of Pakistan.

Recently export of mango from Pakistan is facing phytosanitary embargoes from different countries due to attack of fruit flies, which happened to cause tremendous losses to growers. The pest not only deteriorates its quality but inflicts heavy losses in quantity also due to premature droppage of infested fruits. Two species of Dacine fruit flies; *Bactrocera zonata* (Saunders) and *B. dorsalis* (Hendel) have been found predominant in mango, guava and citrus orchards. The extent of damage caused ranges from 12-35% and in epidemic form the crop is destroyed up to 80% (Abdullah *et al.*, 2002; Latif, 2004).

At present, mango growers mainly depend on synthetic pesticides for the control of almost all important pests of orchards, Management with these hazardous materials causes manifold problems such as pest resurgence, insect resistance to pesticide, secondary pest out-breaks and environmental pollution. In order to find out, alternative to these chemicals, the use of semiochemical and natural compounds may be among the most significant advances in the control of fruit flies. Bait of food-lure in the form of protein hydrolysate attracts gravid females (Latif *et al.*, 1987; Vargas *et al.*, 2001) and plant kairomones, such as methyl eugenol attracts male dacine fruit flies (Marwat and Baloch, 1986; Miranda *et al.*, 2001; Broumus *et al.*, 2002) have been found effective in suppressing flies population and fruit infestation. Neem (*Azadirachta indica*) extracts, repellent / antifeedent have been

extensively used for the control of phytophagous insect pests (Hammad *et al.*, 2001; Singh, 2003; Akol *et al.*, 2003).

Present studies were undertaken with the inference that management of fruit flies may be further improved if semiochemicals and / or biochemical control techniques (alone or in combination) are applied at right time at a pre determined incidence of the pests population.

MATERIAL AND METHODS

Population dynamics:

The studies on population dynamics were carried out in a mango growing area at Paniala, a town 60 Km. towards North East of Dera Ismail Khan, NWFP (Pakistan 2004). Three plastic traps (Steiner type), each impregnated with male sex-lure (methyl eugenol) mixed with 3 % toxicant (Diptrex 80 SP) were installed in mango orchards (8 acre) having *Langra & Chaunsa* varieties. Trap to tarp distance and height from the ground level were 1000 meter and 2.5 meter, respectively. Traps were refreshed at 3-months interval. Weekly data on captured flies were recorded and the means of 4 weeks were worked out into per month population.

Management Techniques:

Comparative studies on management techniques were conducted during the year 2005 in the same locality as mentioned above. The treatments were based on semiochemicals (Sex and food lures) and biopesticide (antifeedent). The design of experiment was according to Randomized Complete Block with 6 treatments, replicated three times. Following techniques and materials were tested alone and in combination in the independent mango orchards.

1. Male Annihilation Technique (MAT)
2. Bait Application Technique (BAT)
3. Neem Application Technique (NAT)
4. MAT + BAT
5. MAT + NAT
6. Untreated check.

MAT was comprised of male sex-lure i.e. toxicant mixed methyl eugenol (International. Pheromones System, Ltd., UK). In plastic traps (Steiner type) installed before fruit setting stage @ 3/acre at 2.5 meter height from the ground level in all treatments except check. BAT consisted of female food-lure, i.e., Protein hydrolysate (International Pheromones System Ltd. UK) mixed with 0.3% Diptrex 80SP (Bayer DAS Pvt., Pakistan) was applied intermittently on 1 square meter leaf area each alternate trees. A liter solution contained 30ml. bait material + 3ml. insecticide in 967ml water. NAT comprised of neem oil which was, applied as cover spray. A liter solution contained 50-ml neem oil + 5-gram detergent (solvent) mixed in 945-ml. water. The application of BAT and NAT were administered twice at 10 days interval before fruit ripening stage. Infestation data were recorded by randomly taking dropped fruits under the 10 trees and 100 fruits from the harvested heap. The criteria to affirm infested fruits were based on exit hole on fruits. The fruits were declared infested which had 2 or more exit holes made by full-grown larvae. Fruits with one hole or which looked deformed were cut and observed if they contained larvae or evidence of larval feeding was counted as infested. Mean of percent infestation & reduction in infestation as affected by treatments was worked out. Mean comparison of each treatment was figured out by applying LSD test at 5% level of significance.

RESULTS

Population Dynamics:

Mean number of flies captured per month (Fig.1) revealed the population fluctuation over the year, ranging from minimum 6 flies during January to maximum 397 flies during September. From January to March capture rate of flies was at the lowest. Population build up started from April (29) and reached to maximum in June (217). Reduction in flies number occurred in July (87) and then started to grow at its highest during August (293) and September (397). Afterward, down trend in flies number was observed which lasted up to December.

Management Techniques:

The data in Table 1 revealed the effect of treatments on fruit infestation. All the treatments showed significant effect in reducing fruit infestation when compared with untreated check. The infestation rate in treated orchards varied from 02.60 to 13.20 % and 0.30 to 3.77% as against 25.37 and 6.87 in check in dropped (DF) and harvested fruits (HF) respectively. However, within the treatments, lowest fruit infestation were recorded in the orchards having combined application of MAT + BAT (2.60 and 0.30 %DF and HF respectively) followed by MAT + NAT (6.0 and 0.90% DF and HF respectively). Mean of percent reduction in infestation over the check (Table-2, Fig.2) were found the maximum in the combined application of MAT either with BAT (89-95%) or with NAT (76-85%).

DISCUSSION

A critical look into the population fluctuation data revealed two peaks of flies population, 1st. in June and 2nd. in September. These peaks may correspond to first and second generation. This study on population fluctuation could not predict fruit infestation or year-to-year variation. However, some useful monitoring information can be inferred from the results and management tactics can be further improved by applying at determined right time of the pest incidence. Population dynamics and natural regulation of fruit flies activities are mainly controlled by the temperature and availability of adult nutrition and its peak incidence greatly effect control measures. (Meats, 1981, Drew *et al.*, 1983).

There are several important examples using olfactory attractants in fruit fly control. *Bactrocera dorsalis* was eradicated from the Mariana Islands by the use of male lure methyl eugenol plus naled. Protein hydrolysate has been used to suppress the population of *Dacus tyroni* in Australia (Prokopy and Roitberg, 1984) and Mediterranean fruit fly, *C. capitata*, oriental fruit fly, *B. dorsalis*, and melon fruit fly, *B. cucurbitae*, in Hawaii (Harris *et al.*, 1971; Broumas, *et al.*, 2002). The results of the present studies on *B. zonata* and *B. dorsalis* infesting mango are in line with the other tephritid fruit flies controlled either by the use of male sex-lures or food bait-lures. Studies undertaken suggest that olfactory receptors responses for plant kairomones in the form of methyl eugenol (citronella oil) and protein hydrolysate (raspberry ketone) may lead to behaviour modification, which may be exploited for its management. Substantial reductions in fruit infestation may be achieved when male and female annihilation techniques (MAT + BAT) are applied prior to the determined peaks of flies population.

Table 1: Mean fruit infestation as affected by treatments in Dropped (DF) and Harvested (HF) Fruits.

Treatments	% Infestation (DF)	% Infestation (HF)
T1. MAT	13.20 B	3.77B
T2. B AT	07.83 C	3.63B
T3. N A T	12.33 B	3.06BC
T4. MAT + BAT	02.60 D	0.30D
T5. MAT + NAT	6.00 CD	0.90CD
T6. Check	25.37A	6.87A
LSD	4.239	2.416

Mean in each column not followed by the same letter are significantly different according to ANOVA and LSD test at $P = 0.05$

Table 2: Mean of % reduction in infestation against check.

Treatments	%Reduction DF	% Reduction in HF
T1. MAT	47.97	45.45
T2. B AT	69.13	47.16
T3. N AT	51.39	55.45
T4. MAT + BAT	89.75	95.63
T5. MAT + NAT	76.35	85.58

Fig.1:Population Dynamics of Mango fruit flies

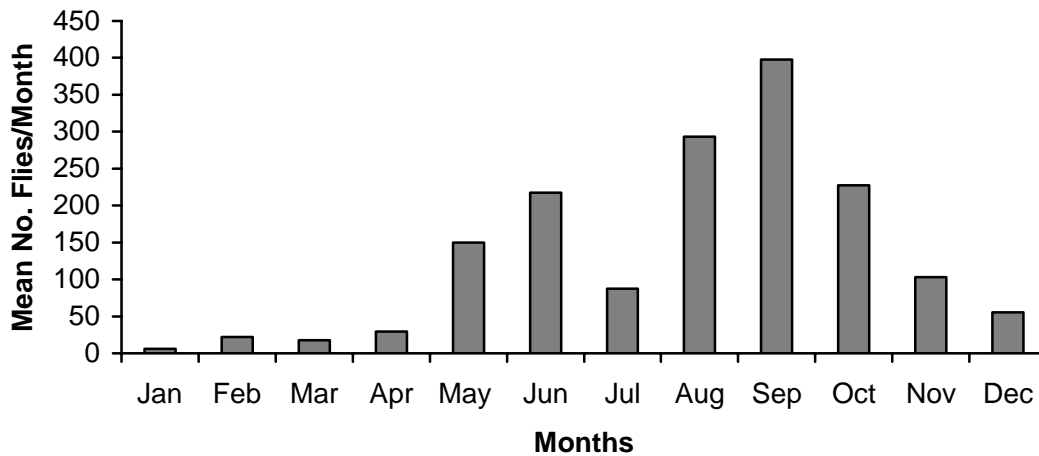
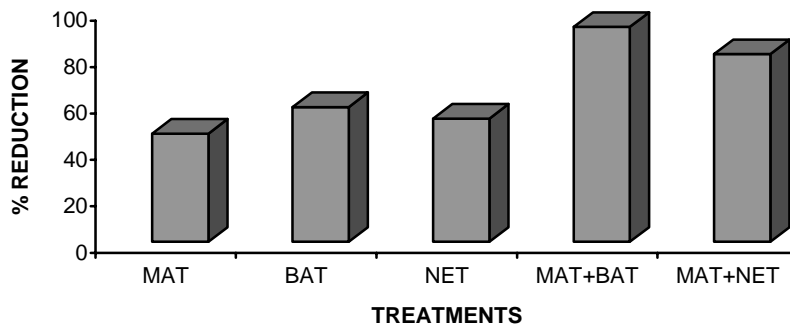


Fig.2: Cumulative Mean%Reduction in Infestation



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