

Studies on Citrus Crop Insect-Pests Management with Adhesive Cages under Integrated Pest Management Programme

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ABSTRACT: *Papilio demoleus*, *Citrus psylla*, are major insect of citrus crops which causes severe loss to the growers. Application of adhesive cages or insect traps is the primary control measures. These measures require basic knowledge of the agro ecosystem and vigilant care of the crop. This method differs from the chemical and biological measures as the control involves reduction of the insect population without killing them by chemicals, predators and microbes. Its help in maintaining the sound ecosystem of the region. Experiments were laid out in R.B.D. and two types of poison bait were formulated.

(i) Water 100 ml + Gur 5g + citronella oil 1 ml + malathion (50EC) 1 ml.

(ii) Water 100 ml + Gur 5g + citronella oil 1 ml + Dipel 0.5 ml.

Prepared adhesive cages were hanged in the orchards throughout the years and found that maximum numbers of citrus butterfly 12.302, 13.331 adhered to the cages in the month of August and may 2005 and 2006, respectively, which were followed by 11.989, 7.933 and 7.223 per cage in September, may and October months during 2005 and 12.583, 10.212, 7.87 and 7.640 per cage in September, July, May and October months during 2006, respectively. Both formulations revealed statistically at par results during both years of investigations.

KEYWORDS: Citrus, Insect-pest, Trape

I. INTRODUCTION

Citrus is one of the most important fruits and is grown in more than 52 countries around the world. Brazil and China are



the largest producers of citrus worldwide producing about 45million tons (MT) of citrus fruit together, followed by

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USA, India, Mexico and Spain with a production of 10.7, 8.6, 7.2 and 5.5 MT, respectively Insects are found in all types of environment and they occupy little more than two thirds of the known species of animals in the world. Insects affect human beings in a number of ways. Many of them fed on all kinds of plants including crop plants, forest trees, medicinal plants and weeds. They also infest the food and other stored products in godowns, bins, storage structures and packages causing huge amount of loss to the stored food and also deterioration of food quality. Insects inflict injury to plants and stored products either directly or indirectly in their attempts to secure food. Insects that cause less than 5 % damage are not considered as pests. The insects which cause damage between 5 - 10% are called minor pests and those that cause damage above 10% are considered as major pests.

Introduction of high yielding varieties, expansion in irrigation facilities and indiscriminate use of increased rates of agrochemicals such as fertilizers and pesticides in recent years with a view to increase productivity has resulted in heavy crop losses due to insect pests in certain crops. This situation has risen mainly due to elimination of natural enemies, resurgence of pests, development of insecticide resistance and out-break of secondary pests.

Integrated Pest Management (IPM) is a program of prevention, monitoring, and control which offers the opportunity to eliminate or drastically reduce the use of pesticides, and to minimize the toxicity of and exposure to any products which are used. IPM does this by utilizing a variety of methods and techniques, including cultural, biological and structural strategies to control a multitude of pest problems. IPM is a term that is used loosely with many different definitions and methods of implementation. IPM can mean virtually anything the practitioner wants it to mean. Beware of chemical dependent programs masquerading as IPM. Those who argue that IPM requires the ability to spray pesticides immediately after identifying a pest problem are not describing IPM. Conventional pest control tends to ignore the causes of pest infestations and instead rely on routine, scheduled pesticide applications. Pesticides are often temporary fixes, ineffective over the long term.

Non-toxic and least toxic control products are a major growth area and new materials and devices are increasingly available in the marketplace.

The Six IPM Program Essentials

1. **Monitoring.** This includes regular site inspections and trapping to determine the types and infestation levels of pests at each site.
2. **Record-Keeping.** A record-keeping system is essential to establish trends and patterns in pest outbreaks. Information recorded at every inspection or treatment should include pest identification, population size, distribution, recommendations for future prevention, and complete information on the treatment action.
3. **Action Levels.** Pests are virtually never eradicated. An action level is the population size which requires remedial action for human health, economic, or aesthetic reasons.
4. **Prevention.** Preventive measures must be incorporated into the existing structures and designs for new structures. Prevention is and should be the primary means of pest control in an IPM program.
5. **Tactics Criteria.** Under IPM, chemicals should be used only as a last resort only, but when used, the least-toxic materials should be chosen, and applied to minimize exposure to humans and all non-target organisms.
6. **Evaluation.** A regular evaluation program is essential to determine the success of the pest management strategies.

Citrus crops namely sweet orange, acid lime, karna khatta, kinnow etc. are cultivated in commercial scale and give a good dividend to the growers. A large number of insect-pests have been recorded in citrus orchards and about more than fifty species were found to major damage to reduce the production (Singh and Pandey, 1993). Insect traps and adhesive cages are the ordinary farm practices through which the outburst or migration of the insect-pests can be prevented at beginning itself. It is a simple device by which the insect can be captured, killed and the population of the pest can be reduced with safe environment.

II. MATERIAL AND METHODS

Experiments were laid out in C.S.A. University of Agriculture and Technology, Kanpur during 2005 and 2006 in R.B.D. Following two types of poison were formulated to test against the adults of citrus butterfly and citrus psylla.

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1. Water 100 ml, Gur 5g, Citronella oil 1 ml, Malathion (50EC) 1 ml.
 2. Water 100 ml, Gur 5g, Citronella oil 1 ml, Dipel 0.5 ml.
- 50 ml of the formulated solution of poison bait was kept in petridish of 5 cm diameter replicating five times. Each petridish was enclosed with a small wire netting was recorded after 12 hours. A control treatment was also run simultaneously.

Citrus psylla

Diaphorina citri(Kuway) (Hemiptera: Psyllidae)

Citrus psylla has become a very serious pest in all citrus growing areas of India. It attacks all parts of the plant above ground. It is a known vector of the disease 'citrus greening'. The insect excretes honey which accumulates on the plant leaves and twigs. Sooty molds develop on the honey and the plant becomes black interfering with photosynthesis of the plant thus indirectly affecting plant yield. Insect feeds on plant sap and under high populations plant start dying.

Papilionemoleus L.

It attacks Citrus spp. unlike most swallow tail butterflies it does not have a prominent tail. The butterfly is a pest and invasive species from the Old World which has spread to the Caribbean and Central America. In India it has become a pest of major importance overtime. The larvae feed on leaves eating from the edge right up to midrib. Seedlings and young plants are completely defoliated. Depending upon season a generation takes about weeks to four months. There are 5-6 overlapping generations a year. It overwinters as pupa.

III. RESULTS AND DISCUSSION

Prepared adhesive cages were hanged in the citrus orchards throughout the years. Different insects were found stucked to the adhesive cages during throughout the period of the investigations and results were summarized in table-1. Maximum number of insects was found stucked 12.302 and 13.331 in citrus butterfly, which was found adhered in August during 2005 and 2006, respectively. Minimum number 7.577 and 6.926 citrus psylla which was found in March 2005 and 2006, respectively. Hare and Luck (1994), Hatting (1994) and Gupta (1997) also found similar findings in different insect on citrus and other crops. El-Sayed and Darwish (1990) used various combinations of trap and attractants against insects of citrus. They found that international stick Traps (IPST) were more effective then Jackson Trap (JT). Nascimento *et al.* (1986) and Tandon *et al.* (1988) conducted experiments and also suggested the trapping methods for controlling the citrus insects under IPM programme.

Integrated pest management: Biological control alone is not good enough in controlling fruit flies to tolerable limits. This has to be supplemented with other control measures impact. In view of extremely low tolerance levels of fruit losses and to ensure fruit production in pesticide free environment, strategies for controlling fruit flies are changing worldwide from relying on one control measure to integrated pest management(IPM).

Maximum number of citrus butterfly were followed by 11.989, 7.933 and 7.223 per cage in September, May and October months during 2005 and 12.583, 10.212, 7.817 and 7.640 per cage in September, July, May and October months during 2006, respectively. Similar results were found by Garijo and Garcia (1994).

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Table 1: Number of Insects adhered to the adhesive cages.

Months	No. of <i>P. demoleus</i> larvae		No. of <i>P. citri</i> larvae	
	2005	2006	2005	2006
March	2.121 (3.910)	1.911 (3.152)	2.842 (7.577)	2.725 (6.926)
April	2.037 (3.649)	1.858 (2.952)	3.020 (8.620)	3.178 (9.599)
May	2.904 (7.933)	2.884 (7.817)	3.888 (14.617)	4.042 (18.878)
June	2.264 (4.626)	2.263 (4.621)	3.673 (12.991)	3.803 (13.963)
July	2.968 (4.772)	3.273 (10.212)	3.574 (12.273)	3.521 (11.897)
August	3.578 (12.302)	3.719 (13.331)	3.624 (12.633)	3.628 (12.662)
September	3.534 (11.989)	3.617 (12.583)	3.504 (11.778)	5.508 (29.838)
October	2.779 (7.223)	2.853 (7.640)	2.865 (7.708)	2.843 (7.583)
November	2.338 (4.966)	2.1113 (3.965)	-	-
S.E. +	0.186	0.050	0.315	0.712
C.D. at 5%	0.395	0.106	0.676	1.527

Note: Figures in Parenthesis of transformed back values

IV. CONCLUSION

Insect pests on citrus in India have rich natural enemy complexes and mostly are under natural control. The white flies are well under natural control and need no measures to be applied against them. Some of the pests such as mealy bug *Drosichastebbinji*, fruit flies *Bactrocera* spp., butterfly, leaf miner, scale insects *Aoinidiella* spp. and citrus psylla need to be addressed on priority. All these pests too have good natural enemies complexes, however some of the agricultural practices impact on natural enemies that need to be identified. There is need to develop techniques which encourage natural control. Parasitoids associated with fruit flies are their main mortality factors, therefore, biological control through augmentation and conservation of parasitoids integrated with other non pesticide measures need to be tested with holistic approach in citrus, guava and mango on area wide basis. This conclusion is further supported by the fact that fruit flies are flying insects, and there are frequent chances of their incursions from one orchard to the other orchard. As such there is no hard line for fixing size of the area size for application of this approach, however, a minimum area of 500 ha may be considered practicable. Many of the natural enemies exported to USA from Pakistan and other countries have established there and are giving substantial control of the citrus pests. On analogy of the same, some of the parasitoids have been identified in the paper for introduction in Pakistan to improve the existing natural enemy fauna of the pests. Citrus is a perennial crop therefore all negative approaches of applying insecticides should be avoided.

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