

SURVEY AND SURVEILLANCE OF INSECT PESTS AND THEIR NATURAL ENEMIES IN ACID LIME ECOSYSTEMS OF SOUTH COASTAL ANDHRA PRADESH

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ABSTRACT : Acid lime is one of the commercial horticultural crops grown widely in the South coastal region of Andhra Pradesh. Roving and fixed plot surveys were carried out during 2006-07 to assess the major insect pests and their natural enemies occurring on acid lime, *Citrus aurantifolia* Swingle in Nellore district of this region. The results revealed that twelve species of insects and mites and six species of natural enemies occurred in acid lime ecosystem. The citrus leaf miner, *Phyllocnistis citrella* Stainton and rust mite, *Phyllocoptruta oleivora* Ashmead were in severe form whereas citrus butterfly, *Papilio demoleus* Linn. and leaf roller, *Psorosticha zizyphi* Stainton showed moderate infestation. Rest all were at low levels and their infestations varied among different areas of Nellore district.

Keywords: *Citrus aurantifolia*, coastal Andhra, insect pests, natural enemies, surveillance

INTRODUCTION

Acid lime, *Citrus aurantifolia* Swingle, is the important tropical fruit crop of citrus group after mandarins and sweet oranges. It is cultivated in almost all the states, with Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka, Gujarat and Himachal Pradesh being major producing states. It is widely grown in the south coastal region of Andhra Pradesh. In India, 250 species of insects and mites have been reported infesting different species of citrus (Wadhi and Batra, 1964). Acid lime is infested by several insect and mite pests which cause severe damage resulting in the reduction of yield both qualitatively and

quantitatively. Citrus butterfly, leaf miner, blackfly, whitefly, psylla, snow scales etc. are the major pests that cause severe damage to the acid lime crop. Majority of the insect pests occur at the new flush stage and damage the new growth thereby hampering the plant development. Lemon butterfly, *Papilio* sp. is an important defoliator of acid lime and several epidemic outbreaks occurred in the Maharashtra region. Its maximum activity was observed during August – September and March in Vidarbha region (Jadhav, 1999). Citrus leaf miner, *Phyllocnistis citrella* (Stainton) is also the most widely distributed pest found ubiquitous in citrus growing areas. The pest activity coincides with the new flushes

(Muñoz *et al.*, 2008). The larva mines into the leaf lamina tissues and leaves out silvery lines which become the predisposing factor for canker incidence later. The infested leaves get reduced in size and folds inwards thus reducing the photosynthetic activity of the plant (Bermudez *et al.*, 2004). Citrus leaf miner infestations of 97.14 per cent were observed in Manabi and it was estimated that number of fruits reduced to 45 per cent and yield decreased up to 48 per cent in *Citrus aurantifolia* (Valerezo and Canarte, 1998). Both the nymphs and adults of psylla, *Diaphorina citri* K. suck sap from leaves and tender shoots. Heavy deblossoming may occur and leaves show chlorotic symptoms. Leaves become distorted and curled. Infested twigs die off from tip backward. Psylla is vector of greening disease and one of the major causes of citrus decline in certain parts of India. Though acid lime is widely grown in Nellore district of Andhra Pradesh, there have been no studies on the incidence and abundance of insect pests and their seasonal cycles, which are essential to plan management strategies. The present study has aimed at understanding the various insect and mite pests associated with acid lime in Nellore district and identification of key pests to be managed which in turn helps in timing the ideal and suitable management strategies.

MATERIALS AND METHODS

Roving surveys were carried out at fortnightly intervals in the acid lime orchards of Venkatagiri, Dakkili, Chejarla, Gudur and Pellakur mandals of Nellore district for insect pests and their natural enemies. Population/damage levels of different pests were graded and recorded as per the percentage damage inflicted (Table 1). Two villages were selected in each mandal and in each village three orchards were surveyed for insect and mite pests. Fixed plot survey was carried out at the citrus farm of Citrus Research Station, Petlur, Venkatagiri, Nellore dt., A. P. *In situ* sampling was done on ten randomly selected trees, which were marked and tagged for long term

observations. On these trees, observations were recorded from 20 terminal shoots per tree, five in each direction *viz.*, East, South, West and North. Thus, a total of 200 (20 x 10) terminal shoots were sampled at fortnightly intervals. Population counts/damage levels were recorded for different pests. The natural enemies of the insect pests were also monitored and documented. The insect pests were collected and mounted for further studies.

Table 1. Scoring of population/damage levels of major acid lime insect pests

Pest	Negligible	Low	Mode	Severe	Very severe
Leaf miner	<1 %	1-5 %	6-15 %	16-30 %	> 30 %
Butterfly	< 1 %	1-5 %	6-10 %	11-15 %	> 15 %
Rust mite	< 1%	1-10 %	11-30 %	31-40 %	> 50 %

RESULTS AND DISCUSSION

A periodical survey for major pests of acid lime conducted at fortnightly intervals revealed that twelve insect and mite pests and six species of natural enemies occurred in acid lime ecosystem. The insect and mite pest fauna recorded in acid lime ecosystem included citrus butterfly, *Papilio demoleus* Linn. (Lepidoptera : Papilionidae), citrus leaf miner, *Phyllocnistis citrella* Stainton (Lepidoptera:Gracillariidae), leaf roller, *Psorosticha zizyphi* (Stainton) (Lepidoptera : Oecophoridae), black fly, *Alurocanthus woglumi* Ashby (Hemiptera:Aleyrodidae), snow scales, *Unaspis citri* (Comstock) (Hemiptera : Diaspididae), psylla, *Diaphorina citri* Kuwayama (Hemiptera : Psyllidae), green mite, *Schizotetranychus hindustanicus* (Hirst.) (Acari : Tetranychidae), rust mite, *Phyllocoptruta oliivora* (Ashmead) (Acari : Eriophyidae), *Mylocerus discolor* B. (Coleoptera : Curculionidae), mealybug, *Planococcus citri* (Risso) (Hemiptera : Pseudococcidae), thrips, *Scirtothrips dorsalis* Hood (Thysanoptera : Thripidae) and aphids, *Toxoptera citricida* (Kirkaldy) (Hemiptera : Aphididae).

Survey of natural enemies showed the occurrence of five predator species viz., *Cheilomenes sexmaculata* F., *Scymnus* sp., *Brumus suturalis* F., *Coccinella transversalis* F. (Coleoptera : Coccinellidae), *Chrysopid* sp. (Neuroptera : Chrysopidae) and one parasitoid, *Distatrix papilionis* (Viereck) (Hymenoptera : Braconidae) on citrus butterfly larvae in the acid lime ecosystem.

The incidence of citrus butterfly and leafminer was severe during the months of November, December, January, February & March and moderate during April, June and nil during May. The leafminer infestation was high again during July – August. This is in conformity with the findings of Jadhav (1999) in Maharashtra which indicated that the leaf miner activity was peak during February – March, June – July and October – November. The incidence has been reported as high as 87.41 per cent during *Ambia* flush. The leaf roller incidence was severe from

December to February and low during March and negligible during rest of the months. Severe infestation of snow scales incidence was observed from February to April. Black fly incidence was low to moderate during January & February. Rust mite incidence was severe in months of April, May and June while green leaf mite incidence was severe during April & May. Thrips infestation was found to be moderate from February to April and infestation was high in acid lime nurseries compared to main crop. Rest of the insect pests was at low level both in main orchards and nurseries (Table 2).

The intensity of insect and mite pests prevailed in acid lime orchards at different mandals of Nellore district is presented in Table 3 and the results showed that leaf miner and rust mite were the major pests of acid lime where the incidence was severe in all the mandals surveyed. Citrus butterfly, snow scales and green mite infestation was moderate to severe.

Table 2. Insect and mite pests and their severity of attack in acid lime

S. No.	Common name	Scientific name	Severity of attack	Peak infestation period
1.	Lemon butterfly	<i>Papilio demoleus</i> L.	Moderate	November - March
2.	Leaf miner	<i>Phyllocnistis citrella</i> Stainton	Severe	November - March
3.	Leaf roller	<i>Psorosticha zizyphi</i> (Stainton)	Moderate	December - February
4.	Black fly	<i>Aleurocanthus woughlumi</i> Ashby	Low	-
5.	Snow scales	<i>Unaspis citri</i> (Comstock)	Moderate to severe	February - April
6.	Psylla	<i>Diaphorina citri</i> Kuwayama	Low	-
7.	Green mite	<i>Schizotetranychus hindustanicus</i> (Hirst.)	Moderate to severe	April - May
8.	Rust mite	<i>Phyllocoptruta oliivora</i> (Ashmead)	Severe	April - June
9.	Ash weevil	<i>Myloccerus discolor</i> B.	Low	-
10.	Mealy bug	<i>Planococcus citri</i> (Risso)	Low	-
11.	Thrips	<i>Scirtothrips dorsalis</i> Hood	Low to moderate	February - April
12.	Aphids	<i>Toxoptera citricida</i> (Kirkaldy)	Low	

Table 3. Intensity of pest incidence in acid lime orchards surveyed in different mandals of Nellore district

Pest	Venkatagiri	Gudur	Dakkili	Chejarla	Pellakur
Citrus butterfly	Moderate	Moderate	Severe	Severe	Moderate
Leaf miner	Severe	Severe	Severe	Severe	Severe
Black fly	Low	Moderate	Low	Low	Nil
Psylla	Low	Low	Nil	Nil	Nil
Snow scales	Severe	Moderate	Moderate	Severe	Severe
Green mite	Severe	Severe	Severe	Moderate	Moderate
Rust mite	Severe	Severe	Severe	Severe	Severe

The psylla and black fly infestation was very less to nil in most of the places during the period surveyed. Of all the mandals surveyed, Pellakur recorded comparatively low level of infestations, which can be attributed to the management practices followed by the growers.

The survey will help in yielding the seasonal incidence and population dynamics of major pests with which suitable management practices can be recommended and timely control measures can be adopted. As most of the major pests *viz.*, citrus butterfly, leafminer, leaf roller, psylla and thrips attack the tender leaves, a prophylactic spray at the new flush stage of the crop will protect from the pests. Flushing can also be limited by reducing fertilization and irrigation to the minimum required for normal plant growth. Similarly during hot weather, mites flare up can be managed with the right choice of control measures. The snow scales infest the bark and branches and with the onset of infestation, mechanical practices like rubbing it with gunny bags followed by spraying with a systemic insecticide will curb the attack. Invertebrate pests have to be graded according to the damage intensity and take up the management measures. The green mite which was present in moderate to severe form, can be ignored as it doesn't have much impact on economic produce as is the case with rust mite.

Another most important aspect is conservation of the natural enemies especially in perennial ecosystems. Integrated pest management programme involves conservation of natural enemies that provide partial or complete control of various insect pests. The survey showed that there are about four carnivorous ladybird beetles, one general predator found coexisting in the acid lime ecosystem. The presence of these bioagents would have been regulating the coccids and pseudococcids below economic thresholds in acid lime ecosystem and hence the less occurrence of this pests. The larval parasitoid of citrus butterfly was also abundant in less chemical intensive areas. The biological control forms the more viable component of integrated pest management systems. Hence, measures have to be taken while selecting the broad spectrum insecticides and also have to decide the level of infestation and strategize the control measures. The biocontrol agents when not sufficient in numbers to effect the pest control can be integrated with the chemical means compatible with the natural enemy activity. Horticultural mineral oils found to be less disruptive to the natural enemies (Liang *et al.*, 2010), which can be one of the options in controlling the sucking pests. The continuous survey and surveillance will help in timely protection of the crop by preventing the pests from reaching the economic injury levels.

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