

Insect-Pests of Kinnow and Their Control in the Punjab

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KINNOW is getting popular with the orchardists in Punjab for the last few years. In order to raise a profitable crop, it needs regular care particularly insect-pest control from seedlings stage onwards. There are two regular or key pests, and five sporadic serious pests. Four new pest problems have been observed while six pests are of minor occurrence only. Insect pests associated with the Kinnow are listed in Table I.

Key pests

Citrus leaf-miner : During nursery stage, leaf-miner is one of the limiting factors in producing healthy seedlings. The leaf-miner continues to be serious after transplanting. The attack is easily recognisable as distorted leaves on new and water shoots having shiny silvery serpentine mines. As a result the plant looks unattractive and its growth is checked. There is greater need to pay attention on young plants which are more vulnerable to the attack up to 3-4 years. The older plants appear to tolerate the infestation to some extent. Severely infested plants have more incidence of citrus canker. The attack is serious during spring (March-April) and in particular during autumn (September-October) when the damage needs to be checked at all costs.

Citrus psylla : *Citrus psylla* is also active during spring till autumn but the more serious damage is done during flowering and fruit-set stage. The nymphs and adults suck the sap from floral buds, tender shoots and newly emerged leaves. Heavily infested plants are covered by dirty white waxy secretion of the anal gland of the insect which also gets deposited on the ground in the drip area. Infestation devitalise the growing plants, resulting often in excessive flower and fruit shedding, perhaps because of phytotoxemia and the infested twigs die-off tip backward. Often, the dreaded, greening disease is also spread by this insect.

Sporadic serious pests

Citrus white and black flies : The nymphs and adults of both, colonise under the lower surface of old leaves and reduce the vigour of tree by desapping and causing

TABLE I
Insect pests associated with Kinnow in the Punjab

S. No.	Common name	Scientific name
A. Key pests (Regular)		
1.	Citrus leaf-miner	<i>Phyllocnistis citrella</i> Stainton (Phyllocnistidae : Lepidoptera)
2.	Citrus psylla	<i>Diaphorina citri</i> Kuwayama (Psyllidae : Hemiptera)
B. Sporadic serious pests (Recurrent)		
1.	Citrus whitefly	<i>Dioloeurodes citri</i> (Ashmead) (Aleyrodidae : Hemiptera)
2.	Citrus blackfly	<i>Aleyrocanthus woglumi</i> Ashby. (Aleyrodidae : Hemiptera)
3.	Citrus caterpillar	<i>Papilio demoleus</i> Linn. (Papilionidae : Lepidoptera)
4.	Bark eating caterpillar	<i>Indarbela quadrinotata</i> (Walker) (Metarbelidae : Lepidoptera)
5.	Citrus mite	<i>Eutetranychus orientalis</i> Klein (Tetranychidae : Acarina)
C. New pest problems (Sporadic)		
1.	Citrus leaf roller	<i>Psorosticha zizyphi</i> Stainton (Oecophoridae : Lepidoptera)
2.	Fruit sucking moths.	(a) <i>Othresis</i> (= <i>Ophideres</i>) <i>fullonica</i> Linn. (b) <i>O.</i> (= <i>O.</i>) <i>materna</i> Linn. (Noctuidae : Lepidoptera)
3.	California red scale.	<i>Aonidiella aurantii</i> (Mask) (Diaspididae : Homoptera)
4.	Scarlet mite	<i>Brevipalpus phoenicis</i> (Geijk.) (Tenuipalpidae : Acarina)
D. Minor problems		
1.	Citrus fluffy mealy-bug	<i>Nipaecoccus</i> (= <i>Pseudococcus</i>) <i>filamentosus</i> (Cockrell) (Pseudococcidae : Hemiptera)
2.	Mango mealy bug	<i>Drosicha stebbingi</i> (Green) (Monophlebidae : Hemiptera)
3.	Citrus brown aphid	<i>Taxoptera citricida</i> (Kirkaldy) (Aphididae : Hemiptera)
4.	Citrus black aphid	<i>Taxoptera aurantii</i> (Fonscolembe) (Aphididae : Hemiptera)
5.	Hairy caterpillar	<i>Euproctis fraterna</i> Moore (Lymantriidae : Lepidoptera)
6.	Tussock moth	<i>Dasychira mendosa</i> Hubmer (Lymantridae : Lepidoptera)

sooty-mould on the honey-dew secreted by them. The population build up is observed during May-June and September-October.

Citrus caterpillar : The caterpillars of lemon butterfly defoliate the young leaves from margin inwards during spring to autumn and often prove very serious on seedlings and young plants.

Bark-eating caterpillar : The larvae of this caterpillar make profuse webbing on the bark consisting of silken threads, frass and excretal pellets. The nocturnal larvae chew the bark under the cover of their webbing. The damage is more serious in older neglected orchards.

Citrus mite : The leaf-feeding mite assumes serious proportions during dry spell particularly May-June in citrus orchards. There is considerable natural mortality due to rain. The nymphs and adults suck the sap from the upper surface of the leaves which appear dusty and chlorotic before pre-mature fall.

New problems

Citrus leaf-roller : The young leaves of newly planted seedling are rolled up by the caterpillar which remain active from May to October. The caterpillar nibbles the webbed leaves and growing points are eaten up giving a ragged look to the foliage. The plant growth is adversely affected. The attack is more serious during rainy year.

Fruit sucking moth : The incidence of fruit sucking moths has been observed in the sub-mountainous kinnow growing tracts. The harmless larvae develop only on weeds and creepers in the jungle. The large sized moths attack the ripening fruits, piercing them at night. Although the damage is in the form of a small hole in one segment only, yet the fruit falls to the ground after the attack which is not accepted by the customers. Rotting also takes place in the infested fruits. Some times there is total crop failure.

California red scale : The infestation of this scale was observed on the fruits to some extent during September-October but damage is considered to be only minor.

Scarlet mite : A new tenupalpid mite was observed as a serious pest during December-January on the rind of the fruits. The attack was in the form of a characteristic central conspicuous band around the fruit. The infested skin became corky and exhibited numerous red mites. The fruits remain undeveloped and deformed.

Control measures

Care of nursery : In order to protect the nursery plants from sucking and foliage feeding pests, it is advisable to supply Thimet 10 g at the rate of 1 g/square metre nursery bed area, twice during March-April and thrice during September-

October at 3-week intervals. Also spray with Nuvacron 40 SC (1 ml/litre of water) at 10 days interval during peak periods and otherwise at 15 days.

Protection of young plants up to 4 years of planting : Apply Thimet 10 g at the rate of 10 g/plant in planting pit during March-April and twice during September-October at 3-week intervals. Increase the dose for granules by 10 g per year reaching 40 g/plant in the 4th year. Continue spraying the foliage with Nuvacron 40 SC or Rogor 30 EC or Metasystox 25 EC all at 1 ml/litre of water with knapsack sprayer at 15-day intervals during spring and autumn. The young plants are also attacked occasionally by foliage feeding caterpillars such as citrus caterpillar and leaf-roller. Whenever attack is noticed, the control can be achieved by spraying the plants with Nuvacron 40 SC or Ekalux 25 EC or Dursban 200 at the rate of 2 ml/litre water using hand operated knapsack sprayer.

Protection of mature plants : The major problem on mature plants are mainly sucking pests such as citrus psylla, whitefly and mite. Citrus psylla needs to be controlled especially during spring and 1-2 applications are sufficient for complete protection. It is advisable to initiate the spraying on the appearance of visible population of adults which can be seen sitting on both the sides of the leaves. The adulticidal control proves much better than the control of nymphs which normally escape the notice of the orchardist. A careful observer can spot out the infestation by examining patches, colonising on tender twigs, axils and leaves.

Rogor 30 EC or Metasystox 25 EC at the rate of 1 ml/litre water are the most popular insecticides for the control of citrus psylla and whitefly. Nuvacron 40 SC at the rate of 1 ml/litre water is another promising insecticide. All these insecticidal applications are made as high volume spray either with knapsack or foot or rocker sprayers. These treatments also control the mite, if present. The operations are normally considered difficult because of the involvement of haulage of large volumes of water and slow coverage.

In order to overcome the limitation involved in high-volume spraying, recently developed new technique of rotary atomisation with the help of 'FOGAIR' battery-operated rotary-disc ULV sprayer, designed by the author, has been extensively tested with encouraging results. The sprayer weighs only half a kilogram and runs with 8 dry torch cells. Ordinary available liquid insecticides (emulsifiable concentrates) can be sprayed without dilution with water or to reduce the dosage, insecticides are mixed with small quantities of water (1 part insecticides : 4 parts water) and sprayed keeping wind direction in view. About 1 minute is required to spray and 50-60 ml solution is enough to cover one average size tree. The average coverage is 2-4 ha/day by a single operator. This sprayer is highly effective for the control of citrus psylla, whiteflies and mites.

The incidence of bark-eating caterpillars in neglected orchards is a common scene. The control however is quite simple. The webbing should be removed with a soft iron brush and the affected bark may be sprayed with any of the previously recommended insecticides for foliage feeding caterpillars. The holes in the joints can be treated with the help of wash-bottle containing insecticidal solution by inserting the delivery tube into the hole and squeezing the bottle slowly till the liquid drips out. The treated hole may be closed with mud plaster after treatment. Spot spraying only on infested bark with insecticides recommended for foliage feeding caterpillars is also effective. Very small quantities of insecticide (20 ml) and water (15 litres) per acre using manually operated knap-sack is another easy alternative.

Three pests, namely fruit sucking moths, California red scale and scarlet mite, have been causing concern to the fruit growers by injuring the maturing fruits. Very little work has been done on these pests in Punjab. The fruit sucking moths elsewhere are controlled by bagging the fruits which is not a practical proposition for kinnow being a profuse bearer. The moths are also attracted to poison baits (citrus fruit extract 4 litre + Gur 1 kg + Malathion 250 ml + 10 litres of water) and placed in earthen pots normally hung on the bearing tree. It, however, proves only partially effective. California red scale cannot be controlled by chemicals. Only biological control by a black coccinellid predatory beetle (*Chilocorus nigritus* Linn.) which can be introduced on severely infested plants (1-2/fruit) is the only hope for orchardists. The scarlet mite infesting the fruits, if discovered earlier, can be controlled by the pesticides suggested for sucking pests.