

Litchi production through smart pest management

Litchi (*Litchi chinensis* Sonn.) is an important subtropical evergreen fruit which is affected by several biotic stresses particularly insect-pests causing reduction in quality production and productivity. Under changing climatic condition, litchi fruit and shoot borer, litchi bugs, loopers, leaf folder, weevils and mites are becoming as major threat to quality litchi production and leading to more than 90% borer infested fruit in unmanaged orchard. Various smart management options viz. application of bio-enhancers, cultural/mechanical practices and safer/newer molecules (IGRs, avermectins, spinosyns, diamides) have been found effective against these pests. Therefore, an attempt has been made to describe major insect-pests associated with litchi along with probable and advanced management options to manage these important pests.

LITCHI (*Litchi chinensis* Sonn) is an evergreen fruit crop and considered as queen of the subtropical fruits due to its attractive deep pink/red colours and flavoured juicy aril. Among biotic constraints, insect-pests are the major one as they attack litchi trees and fruits at different stages of growth. Insect species of major economic importance

in litchi are litchi fruit and shoot borer, leaf roller, looper, bark eating caterpillar, leaf cutting weevils, litchi bugs and litchi mite (Table 1). Various innovative options have been explored to manage these noxious pests and therefore, detailed account of major insect pests of litchi and their smart management options have been enumerated below:

Table 1. Insect-pests associated with litchi

Common name	Scientific name	Order: Family
Major pests		
Litchi fruit and shoot borer	<i>Conopomorpha sinensis</i> Bradley	Lepidoptera: Gracillariidae
Bark eating caterpillar	<i>Indarbela tetraonis</i> Moore	Lepidoptera: Cossidae
Leaf roller	<i>Dudua</i> (= <i>Pleotypeplus</i>) <i>aprobola</i> (Meyrick)	Lepidoptera: Tortricidae
Ash weevil	<i>Mylocerus undecimpustulatus</i> Faust; <i>Lepropus lateralis</i>	Coleoptera: Curculionidae
Red weevil	<i>Apoderus blandus</i> Faust.	Coleoptera: Curculionidae
Litchi looper	<i>Perixera illepidaria</i> Guenée	Lepidoptera: Geometridae
Litchi bugs	<i>Tessaratomia javanica</i> Thunberg; <i>Tessaratomia papillosa</i> (Dury), and <i>T. quadrata</i> Distant	Hemiptera: Pentatomidae
Litchi mite	<i>Acerya litchi</i> Keifer	Acari: Eriophyidae
Minor pests		
Litchi fruit and shoot borer	<i>Conopomorpha litchiella</i> Bradley	Lepidoptera: Gracillariidae
Castor capsule borer	<i>Dichocrocis punctiferalis</i> (Guenée) (= <i>Conogethes punctiferalis</i> (Guenée))	Lepidoptera: Crambidae
Litchi borer	<i>Gatesclarkeana erotias</i> Meyrick	Lepidoptera: Tortricidae
Litchi nut borer	<i>Blastobasis</i> spp.	Lepidoptera: Blastobasidae
Fruit borer	<i>Anarsia</i> sp.	Lepidoptera: Gelechiidae
Leaf roller	<i>Statherotis</i> sp.	Lepidoptera: Tortricidae
Green litchi bug	<i>Chrysocoris stoll</i> Wolff	Hemiptera: Scutelleridae
Bag worm	<i>Eumeta crameri</i> (Westwood)	Lepidoptera: Psychidae

Litchi looper	<i>Thalassodes</i> sp.	Lepidoptera: Geometridae
Lac insect	<i>Kerria lacca</i> Kerr., <i>K. albizziae</i> Green	Homoptera: Lacciferidae
Mango mealy bug	<i>Drosicha mangiferae</i> Green	Hemiptera: Monophlebidae
Fruit sucking moth	<i>Eudocima</i> (= <i>Othreis</i>) <i>maternal</i> (L.)	Lepidoptera: Noctuidae
Thrips	<i>Dolicothrips indicus</i> Hood; <i>Megalurothrips usitatus</i> Bengall; <i>M. distalis</i> Karny	Thysanoptera: Thripidae
Minor but sporadic pests		
Tobacco caterpillar	<i>Spodoptera litura</i> (Fabricius)	Lepidoptera: Noctuidae
Hairy caterpillar	<i>Spilarctia</i> sp.	Lepidoptera: Arctidae

Table 2. Damage symptoms of various insect pests

Name of pests	Symptoms of damages
Litchi fruit and shoot borer (<i>Conopomorpha sinensis</i> Bradley)	- It is one of the major threats to litchi growers, causing severe losses to fruit as well as young shoots, to the tune of 24-48% and 7-70%, respectively. - The adults lay eggs on fruit surface at early stage of fruit (pea size) and newly emerged larvae bore in to soft skin and seed. Whereas at colour break stage, the egg laying is generally done on top of fruits near pedicel. - The newly emerged larvae start boring in to the fruits and reach at pulp-seed junction for feeding. - The infested fruits can be identified by black spot near pedicel with small fruit size. - Infested fruits generally drop down before maturity. - In this way, larvae of this borer cause direct damage to litchi fruits. - During monsoon season, indirect damage causes by larvae through making mines in young leaves and shoots, resulting poor flowering and fruit setting in next season.
Bark eating caterpillars (<i>Indarbela tetraonis</i> Moore and <i>Indarbela quadrinotata</i> Walker)	- This polyphagous species hosts on wide range of plants including longan, rambutan, mango, mulberry aonla, ber, citrus, phalsa, guava, jack-fruit, jamun, loquat, pomegranate and rose attack on litchi trees. - Larvae that hatch out initially feed on the bark and subsequently bore into the trunk. - The fully-grown caterpillars are with dark brown head and dirty brown body. - The tunnel entry remains closed with a frass covering which is drawn out into a sleeve through which the larva moves. - Due to destroying of xylem tissues, results in poor growth and fruiting of the tree. Caterpillars remain within the tunnel inside the stem during day, come out in night and feed upon the bark. - Older and uncared trees are more affected by the pest. Infestation may be noticed by the presence of ribbons of wood chips, frass and silken thread over the bark surface. - Fruiting capacity of tree is adversely affected by the attack of this pest. - Attack of pest weakens the stem, resulting in drying of the branches and finally tree may die itself.
Leaf roller (<i>Dudua aprobola</i> . Meyrick)	- This is also a very serious pest of litchi, causing severe damage to litchi foliage. - The symptoms of leaf damage by the larvae are manifested through rolling of tender leaves and feeding inside. - As a result of larval damage, the infested twigs distort and wither. Leaf damage goes up to 70%. - Litchi trees that have been attacked by this pest results in very poor flowering in subsequent season. - Thus, the crop yield gets reduced considerably. It may attack flowers also.
Litchi looper (<i>Perixera illepidaria</i> Guenée)	- This pest attack on tender leaves in mass and defoliate the new shoots. - In severe attack, it completely defoliates the newly emerged flush. Besides litchi, so many host plants viz., longan, rambutan, mango, and castor have been reported for this pest. - The litchi loopers attack on litchi is normally from August to November with highest population in the month of September-October. - Litchi trees that have been attacked by this pest results in very poor flowering in bearing orchards and retard the growth in young saplings in subsequent season. - When infestation is high, larvae feed voraciously on the lamina of young leaves leaving only the midribs and veins.
Leaf cutting weevils (<i>Mylocerus undecimpustulatus</i> and <i>Apoderus blandus</i>)	- They used to congregate on the tender leaves and nibble irregular holes on the leaves and sometimes consume the entire leaf leaving the midrib only. - Adult of grey weevils has long snout with grey colour, though poor flier but very active feeder on the leaves of litchi. - Adult of <i>A. blandus</i> are bright brownish red in colour. - The ventral side (abdomen) is looking pale brown, and parts of the mouth and claws are brownish red. - The damage of red weevil is more severe at the time of shoot emergence as it prefers newly leaves therefore; newly established orchard/nurseries are more vulnerable for this pest attack.
Litchi stink bug (<i>Tessaratoma javanica</i>)	- This bug is also a regular pest in all the litchi growing areas in India causing huge economic loss. - The infestation of litchi stink bugs observes throughout the year in litchi orchards but its high number of populations observes in summer season and in moderate to low during the rainy and post rainy season. - The peak activity of the bug is from the last week of April to the last week of August after that it disappears from the orchard and undergoes hibernation in adult stages. - Both adults and nymph suck cell sap mostly on tender plant parts such as growing buds, leaf petioles, fruit stalks and tender branches of litchi tree. - In case of severe infestation, drying of growing buds and tender shoots has been observed resulting into poor fruit set.

Name of pests	Symptoms of damages
Litchi mite (<i>Aceria litchi</i>)	- In severe attack it leads to heavy fruit dropping and ultimately total damage to the litchi crop. - The bugs when crowd on the developing fruit, it causes the fruits to fall a couple of week later. Total loss of litchi crop is observed in case of severe litchi bug incidence. - It is a one of the major non-insect pest of litchi which has been reported from all the litchi growing countries of the world. - Normally infestation of litchi mites observed on trees throughout the year, however, severe infestation may be noticed from March to September and population found to be inactive during extreme cold. - There is a direct and positive correlation between the growth of new leaves and the mite infestation in the orchards. - Litchi population was also significantly influenced by temperature and relative humidity. - Dispersal of the erineum mite reported from one orchard to other takes place through old infested litchi leaves or by winds. Both nymphs and adults damage the leaves, newly formed leaf buds, inflorescence and young developing fruits by puncturing and lacerate the tissues with their stout rostrum and suck the cell sap, resulting in no flowering/fruiting. - The damage of mites leads to curling of leaves. At the later stage in curled leaves, chocolate-brown growth on the ventral surface of leaves is usually visible.

Management through cultural practices and bagging of fruits bunches

Application of 4 kg castor and 1 kg neem cake at root zone after the first shower of monsoon have been proved effective in reducing the pest population. The alternate host such as *Kath*, *Jamun* and *Chhota Amaltas* which harboured the pest during off-season must be collected and destroyed in order to minimize the chance of heavy infestation of the pest in subsequent year.

The bagging could be very effective in litchi to reduce pest damage particularly fruit borer. The litchi fruit bunches of cv. Shahi is bagged with white butter paper bag/ Non-woven PP bags (30 gsm) of 500-650 mm × 350-500 mm (L X W) at 40 days after bloom (40 DAB) which was during 3rd fortnight of April. Bagging has been found very effective in reducing fruit borer infestation (71-77%) through creating a physical barrier and modifying fruit micro-environment.

Organic pest management options

Two spraying of neem oil (4 ml/L), first before flowering and second just after fruit setting should be given to avoid insect egg laying. Two sprays with panchgavya (30 ml/L) made up of cow ghee, urine, dung, curd milk along with banana and sugarcane juice should be done at clove stage and colour break stage. Two spray with biodynamic pesticide (50 ml/L) made up with cow urine, cow-dung, chopped leaves of neem/calotropis (madar) decomposed in water should be done at aril (pulp) development stage and about 10 days before expected fruit harvest. Adoption of good orchard management practices like pruning of infested twigs in June, manuring of plants with 4 kg castor-cake and 1 kg neem-cake in the 2nd week of July and prophylactic spray of neem-based formulations (4 ml/L) during new flush emergence (September-October) improve the effectiveness of organic schedule against major pests of litchi.

Table 3. Insecticides recommended for litchi pests

Target pests	Name of insecticide	Dose (ml formulation/ litre of water)
Fruit & shoot borer, looper, leaf folder	Spinetoram 11.7 SC	1.0
	Lufenuron 5 EC	1.2
	Novaluron 10 EC	1.5
	Emamectin benzoate 5% SG	2.0
	Flubendiamide 39.35 SC	0.3
	Spinosad 45 SC	0.35
	Chlorantranilprole 18.5 SC	0.40
	Thiacloprid 21.7 SC	0.7-1.0
	Imidacloprid 17.8 SL	0.7-1.0
	Azadirachtin 1%	3.0-4.0
Fruit & shoot borer, looper, leaf folder, bug	Novaluron 5.25% + Indoxacarb 4.5% SC	1.0
	Trizophos 35% + Deltamethrin 1% EC	2.0
Fruit & shoot borer, looper, leaf folder, bug, weevils	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5%	0.4-0.5
Mite, fruit & shoot borer, looper, leaf folder, bug, weevils	Chlorfenapyr 10 EC	2.5-3.0
Mite	Spiromesifen 22.9 SC	1.5-2.0
	Propargite 57 EC	3.0



Litchi looper damage



Adult litchi stink bug



Leaf roller damage



Ash weevil damage



Bark eating caterpillar



Bark eating caterpillar larva inside



Adult fruit borer



Litchi looper pupa and adult



Litchi bug



Litchi looper damage



Pupae of litchi fruit borer



Red weevil damage

Spraying schedule based on regular monitoring

During monsoon season, major litchi pests as shoot borer, leaf roller and looper can be done through application of two spray of systemic insecticide viz., thiacloprid 21.7 SC or imidacloprid 17.8 SL @ 0.5-0.7 ml/L during September month at 15 days interval on

emerging shoots. However, this spray timing may change in various regions depending upon litchi flushing. Spraying of neem oil (4 ml/L) before flowering may be given to avoid insect egg laying. Alternatively, three spray may be done using any recommended insecticides at different interval during April-May, viz. first spray at clove size

fruit, second spray at cardamom size fruit (after fifteen days of first spray) while third spray at 10 days after second spray (about 15 days before harvest) to regulate pest complex effectively during fruiting season.

Precautions/alertness

Spraying should be done only in sunny days during evening and on outer as well as inner canopy in all the direction on the tree with the help of power sprayer having hollow cone nozzles. Mix sticker @ 0.4 ml/L with insecticide for better results, it also improves effectiveness during rainy season subject to four hours waiting period after spray. Community based approach will be more helpful in pest management programme.

Way forward

The litchi pest management tactics includes understanding the seasonal occurrence, nature of damage, life cycle and associated natural enemies of pests. Applying pest management system in litchi, growers should be smart enough to select the available pest management options to reduce overall pest load and that may be effective, economic and ecologically sound. Newer/safer molecules with selective action, safer to non-target organisms and environmentally sound (IGRs, avermectins, spinosyns, diamides) should be used to manage litchi pests (Table 3). Additionally, insecticidal combinations may be the best alternative to address the problem and to mitigate insecticide resistance. Combining insecticides with different properties such as nature action can be advantageous for containing both chewing and sucking pests simultaneously. Mixtures may enhance the overall target spectra allowing the control of a wide range of pests when they are present on the crop at the same time.

SUMMARY

The infested litchi shoots/fruits and leaves due to fruit and shoots borer, litchi mite, leaf roller, litchi looper and weevils should be removed twice in a year during June and August. Litchi orchard should be ploughed during

summer to kill the eggs and hibernating stages of insects by exposing to sun heat, ants and birds. Larvae of bark eating caterpillar can be easily destroyed by pouring kerosene oil in the hole and plugging with clay. By using light trap, population of moths can be reduced. Light pruning and centre opening of litchi tree provide enough sunshine, resulting reduced pest incidence. Hand picking of the adult weevils and loopers reduces their incidence up to some extent. Adult weevils, bugs and loopers can also be removed from plants by vigorously shaking a branch over an open, inverted umbrella and collected weevils can then be dumped into a container of soapy water/compost pit. Growing of seasonal flowering plants attract parasites and predators, which play major role in pest suppression. Insect Growth Regulators (IGRs) and avermectins formulations can be used to manage lepidopteran pests and novaluron 10 EC @ 1.5 ml/L, flubendiamide 39.35 SC @ 1.5 ml/5L, emamectin benzoate 5% SG @ 2ml/L and spinosad 45 SC @1.75ml/5L have been found very effective against litchi fruit and shoot borer, leaf roller and looper. Three sprays of any one from above mentioned molecules at 10-15 days interval after fruit attaining pea size, keep the infestation below threshold level. In case of favourable weather conditions (rainy and humid conditions), first spray and second spray may be done with thiodiazinon 21.7 SC @ 0.7-1.0 ml/L for better results. Now-a-days, a mixture of thiamethoxam + lambda-cyhalothrin @ 2ml/5 L of water has been found very effective against litchi weevils and bugs. Litchi mite can be effectively managed by three alternative spray of any viz. chlorfenapyr 10 EC (3.0 ml/L), spiromesifen 22.9 SC (2.0 ml/L), propargite 57 EC (3.0 ml/L), two in July at 15 days interval and one in October after needling based pruning.

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Emerging insect-pests in litchi

Litchi stink bug (*Tessaratoma javanica*) and the Flower webber were recorded as emerging insect-pest attaining major pest status of litchi. The other important pests recorded were fruit and shootborer, leaf mite, leaf roller and bark eating caterpillar. Borer complex of litchi was most important as they extensively damaged the developing and matured fruits reducing the yields and marketability.

Panicle blight in litchi

The disease incidence of panicle blight in different orchards varied from 17.43-28.85% while most of the tree had disease severity (PDI) between 10.0-20.0%. The mean disease incidence of fruit blight on trees in farmers' orchard in Muzaffarpur, Bihar varied from 8.4-12.4% (mean 9.8%) in cv. 'Shahi' and 10.2-16.7% (mean 12.6%) in cv. 'China'

Leaf spot disease in litchi

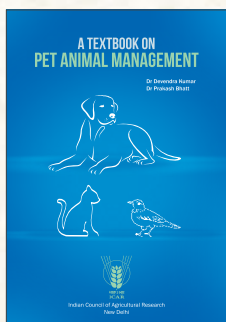
Two different kinds of leaf spot disease were observed in nursery plants and bearing trees of litchi in orchard. The pathogens were identified as *Corynespora litchii* Matsush. and *Pestalotiopsis versicolor* Speg. Difenoconazole 25% EC, Copper Oxychloride 50% WP and Azoxystrobin 23% SC were found very effective in managing disease caused by *A. alternata*.

Source: ICAR Annual Report 2022-23

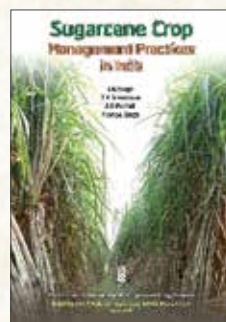
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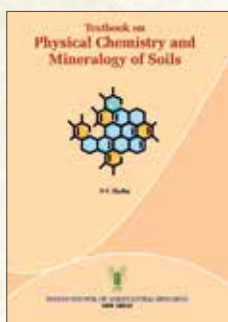
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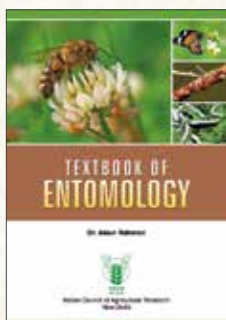
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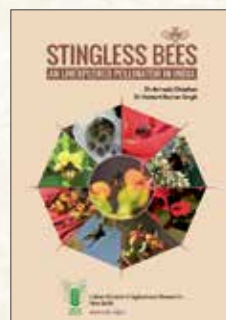
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