

## INSECT PEST MANAGEMENT OF TEMPERATE FRUIT CROPS

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### INTRODUCTION

There are many important fruits grown in temperate climates such as apple, peach, pear, plum, apricot, almond, cherry, strawberry, kiwi, walnut etc. Unlike field and vegetable crops, fruit trees are grown over several years in the same habitat and serve as a permanent abode for the multiplication of insect pests. In India, the temperate fruits are confined mostly to the western Himalayan region. Nearly 1000 insect pests and mites have been reported attacking temperate fruit crops throughout the world.

### Apple

In India, over 250 insect pests damage apple with varying infestation levels. Insects like Jan Jose scale and woolly apple aphid have been introduced along with fruit plants and still continue to occur in most apple growing areas as key pests. Rapid increase in area under commercial apple cultivation in NW Himalayan region has also led to establishment of many indigenous pests as major and secondary pests. Nearly 20 insect pests are considered economically important in India and plant protection form the most important operation in the care of apple orchards.

Table: Status of major pests of apple in India

Pest	Distribution
Key Pests	San Jose Scale Most widely spread, Jammu and Kashmir, Himachal Pradesh, Uttarkhand, North-eastern hill states, Sikkim, Tamil Nadu
Woolly apple	Most widely spread, Jammu and Kashmir, aphid Himachal Pradesh, Uttarkhand, North-eastern hill states, Sikkim, Tamil Nadu
<b>Major pests</b>	
Red spider mite	Jammu and Kashmir, Himachal Pradesh, Uttarkhand
Apple leaf roller	Jammu and Kashmir, Himachal Pradesh, Uttarkhand, Assam, Meghalaya, Manipur, Arunachal Pradesh
Blossom thrips	Most widely spread, Jammu and Kashmir, Himachal Pradesh, Uttarkhand, North-eastern hill states, Sikkim, Tamil Nadu
Root borer	Severe in sandy and sandy-loam soil in all apple-growing regions.
Codling moth	Presently confined to Leh and Kargil region of Jammu and Kashmir

Secondary pests	
Defoliating beetles	Serious attack occur in orchards bordered by forests
Leopard moth	Jammu and Kashmir, Himanchal Pradesh and Uttarakhand
Stem borer	Occur in all apple-growing areas on the country
Shoot borer	Occur in all apple-growing areas of the country
Indian gypsy	Damage foliage during may-June in moth Himachal Pradesh, Uttarkhand, Meghalaya, Assam
Tent caterpillar	Himachal Pradesh, Uttarkhand, Meghalaya, Jammu and Kashmir, Assam, Arunachal Pradesh, Manipur
Hairy caterpillars	Occur in all apple-growing areas on the country
Shot hole borer	Occur in all apple-growing areas on the country
Coreid bugs	Occur in all apple-growing areas on the country
Pentatomid bugs	Occur in all apple-growing areas on the country
Apple fruit	Presently restricted to Kinnaur district moth of Himachal Pradesh
Apple fruit	Meghalaya, Assam, Manipur, Arunachal weevil Pradesh

### Key pests

#### 1. San Jose scale: *Quadraspidiotus perniciosus* (Diaspididae: Homoptera)



It is a key pest of apple, pear, peach, almond and plum occurring on almost all temperate fruit growing region of the country.

#### Damage

San Jose scale attacks all plant parts above the ground level. It forms dense colonies on branches, trunks, stems and spurs. Fruits and twigs often surrounded by reddish or pinkish rings. Heavily infested plants look as if sprayed with ash. The young plants, if not checked in time, is killed with in 3 years. Infested fruits show a characteristic red spots having white /grey spots. Active from March to December (3-4 generations)

**Management**

- Pruning and destruction of heavily infested twigs in winter.
- Avoid using bud wood from trees infested with scale.
- The parasitoids, *Encarsia (Prospaltella) perniciosi*, *Aphitis* sp., *Proclia* sp., *Chiloneurus* sp., and predators *Chilocrus bijugus*, *Coccinella septempunctata* exercise fair degree of control.
- Spray dormant trees in winter with 2-3% (4-6 lit/tree) miscible oils (HPTSO/SAVO-OEH/Akrur) from end of February or between late dormancy and green tip stage. Or spray diesel oil emulsion at 4-6% concentration.
- Single application of fenitrothion 50%EC (0.05%), chlorpyrifos 20%EC (0.02%), dimethoate 30%EC (0.03%) at first crawler emergence stage during May. Oil sprays are compatible with insecticides, can be mixed and sprayed for effective control. If necessary spray again in September-October with any one of the above chemicals.
- Avoid summer spray if bio control agents are active and found in good numbers.

**2. Woolly aphid: *Eriosoma lanigerum*  
(Pemphigidae: Homoptera)**



It is a serious pest in most apple growing areas of India.

**Damage**

The purplish aphid is covered with white cottony masses on branches, twigs and main roots below ground; multiplication is very rapid; active from March to December, maximum activity during July-August after rains.

Both nymphs and adults cause damage by sucking cell sap from the aerial and subterranean parts of the plant. The movement of woolly aphid between aerial and subterranean parts occur through 1<sup>st</sup> instar nymphs. Nodule like structures or galls on aerial and underground parts are formed. Ultimately the growth and vigour of the plants are adversely affected. The damage is most serious in nursery plants and young orchards.

**Management**

- Create a physical barrier for migrating aphids about 50cm area around tree trunk should not be disturbed and kept clean following cultural operations.
- Avoid using infested nursery stock for planting.
- Use resistant root stocks like Merton-778, 779, 789, 993, Quince, *Pyrus pashia* and *Cotoneaster braccillaris*.
- The exotic parasitoid, *Aphelinus mali* is an important parasitoid of woolly aphid.
- Incorporation of paradichlorobenzene at 30-110 g/tree in a trench around the tree away from the base may afford control of root infecting aphid.
- Before planting dip the plants in 0.04% chlorpyrifos solution to control and check further spread on the aphid.
- Spray aerial parts of the bearing trees with 0.03% dimethoate 30%EC, or monocrotophos 36%SL during spring (march-April) and again during summer (June-July). For root forms of aphid, give soil application (80-100 mm deep) of phorate 10%G (10-30gm) or carbofuran 3%G (30-50gm) granules at 5cm depth in the root zone of 1-4 year old trees.
- Avoid spray during summer where predators and parasitoids activity is high.

**3. European red mite: *Panonychus ulmi*  
(Tetranychidae: Acarina)**



areas of Himachal Pradesh and Jammu and Kashmir. The economic losses caused by this mite have been estimated to be more than 30%. It attacks apple, pear, peach, apricot, plum and walnut.

**Damage**

Both the young and adults suck the plant sap from leaves and other tender parts. Mite attack cause initial speckling on leaves and at later stage the leaves become brownish-green colour which led to premature leaf fall and weakening of buds. Feeding causes production of unripe, sour, undersized and poorly coloured fruits.

**Management**




- The pruned woods and branches which are mite infested should be destroyed by burning.
- The mite population is regulated by predatory mites such as *Typhlodromous* sp., *Amblyseius* sp., and *Zetzellia* sp., green lace wing *Crysoperla* sp.
- Treat the plants at pink bud stage and one



month later. Combination of orchard spray oil (2%) with lindane 20%EC (0.05%) is recommended to prevent egg hatch.

sulphur 0.25% at pink bud stage and later when the mite population exceeds 15-20/leaf.



- Spray dicofol 18.5%EC (0.05%) or wettable

#### Other major pests of apple

No.	Insect name	Description	Management
1	<b>Root borer, <i>Dorysthenes hugelli</i></b> 	Shining, chestnut-red beetles lay eggs in soil during July-August; grubs feed exclusively on thick roots and other organic matter, their longevity is 3 1/2 years; sandy soil preferred by the pest	Avoid dry sandy soils for apple plantation; remove and destroy grubs from roots of affected trees; Drench the basin of the affected tree with 0.05% chlorpyrifos 20% EC in March and again in July.
2	<b>Tent caterpillar, <i>Malacosoma indica</i></b>	Caterpillars feed gregariously on leaves at night and hide during the day in small tent-like structures of webs; moths lay eggs in bands (strips) around small twigs in May; caterpillars hatch out in the next spring	Remove and destroy egg bands during pruning; destroy web tents mechanically in April-May or give spot treatment with kerosene or spray carbaryl 50%WP (0.05%).
3	<b>Leopard moth, <i>Zeuzera multistrigata</i></b> 	White moths of attractive patterns are seen at dusk during may to july; eggs are laid singly in cracks of barks; pinkish-white young caterpillars bore into branches and stems resulting in drying of shoots with in 1-2 years and of the plant within 3-4 years of infestation.	Kill caterpillars in tunnels by inserting a pointed wire or insert cotton wick soaked in petrol, chloroform or dichlorvas and seal holes with mud. Or insert paradichlorobenzene (0.5g) or aluminium phosphide tablets (1-3Nos each weighing 3gm) and seal the hole with mud.
4	<b>Apple blossom thrips: <i>Taeniothrips rhopalantennalis</i>, <i>T. flavus</i></b>	Minute insects lay eggs in flower buds and nymphs and adults scrape tissues there. So there is no fruit-setting	Spray 0.05% fenitrothion 50%EC, or 0.02% chlorpyrifos 20%EC at early pink bud stage or 7-10 days before flowering.
5	<b>Defoliating and fruit-eating chaffer beetles: <i>Adoretus duvauceli</i>, <i>A. versutus</i>, <i>Anomala dimidiata</i>, <i>A. lineatopennis</i>, <i>A. flavipes</i>, <i>A. rufiventris</i>, <i>Holotrichia longiplennis</i>, <i>Hilyotrogus holosericeous</i>, <i>Lachnosterna coriacea</i>, <i>Melolontha furcicauda</i>, <i>Mimela passerinii</i></b> 	Differently coloured scarab beetles. Lay eggs in soil during rainy season; grubs feed on vegetation under ground till next summer; beetles come out in June and feed on foilage and some species also attack the tender fruits usually during night. The affected fruits lose their market value.	Collect beetles by shaking the infested trees and destroy them. Operate light traps @ 1/Ha to trap beetles from April-September. Spray the trees with 0.2% carbaryl 50%WP twice at 7-day intervals starting as soon as adults appear. Soil application of phorate 10%G (25kg/ha) / quinolphos 5%G (30kg/ha) / chlorpyrifos 10%G (20kg/ha) around the tree to kill grubs.
6	<b>Apple leaf-rollers: <i>Cacoecia sarcosttega</i>, <i>C. ecicyota</i>, <i>C. pomivora</i>, <i>C. termias</i>, <i>C. subsidiaria</i></b>	Polyphagous; larvae feed on the leaves, buds and flowers; after rolling or webbing them together, caterpillars feed within on soft tissues; fruit-setting is adversely affected	Collect and destroy rolled leaves and webbed flowers; spray 0.05% fenitrothion 50%EC or 0.03% endosulfan 35%EC in April

7	<b>Apple leaf-miner</b> , <i>Gracillaria zachrysa</i>	Young caterpillars make several mines on leaf surface; later they leave mines, roll young leaves longitudinally into tubular or cone-shaped pouch and feed within; the maximum damage during summer (April-May) and in autumn (September-October)	Prune heavily the affected parts and burn them; spray neem-cake suspension or 0.05% methyl-O-demeton 25%EC or monocrotophos 36%SL
8	<b>Indian Gypsy moth</b> , <i>Lymantria obfuscata</i> 	See under apricot	See under apricot
9.	<b>Apple stem borer</b> , <i>Apriona cinerea</i> , <i>A. sarta</i> , <i>Batocera rufomaculata</i> 	Ashy-grey, long horned beetles with conspicuous blackish tubercles at the base of elytra. It causes damage to stem and shoots which led to wilting and drying of shoots /plants Clip-off the terminal shoots with unshed cluster of leaves in winter to destroy stem borer.	Clean the hole by inserting a pointed wire or insert cotton wick soaked in petrol, chloroform or dichlorvas 76%SC and seal holes with mud. Or insert paradichlorobenzene (0.5g) or aluminium phosphide tablets (1-3Nos each weighing 3gm) and seal the hole with mud


## Almond


No.	Insect name	Description	Management
1	<b>Almond weevil</b> , <i>Mylocherus laetivirens</i> <b>Other weevils:</b> <i>Mylocherus undecimpus-tulatus</i> , <i>M. discolor</i> , <i>Amblyrhinus poricollis</i>	Beetles with well formed snout often feed either by biting holes in the lamina or by peripheral feeding on marginals; gradually eat up entire leaf leaving only the midrib. Grubs feed on the roots	Collect attacked and fallen fruits and destroy. Spray 0.05% fenitrothion 50%EC
2	<b>Aphids:</b> <i>Brachycaudus helichrysi</i> , <i>Myzus persicae</i> , <i>Pterochlorus persicae</i> 	See under peach	Same as in the case of peach
3	<b>Almond beetle</b> , <i>Mimastra cyanura</i> <b>Others:</b> <i>Altica</i> sp., <i>Haplosoma</i> sp., <i>Merista</i> sp., <i>Monolepta</i> sp. 	Small beetles are seen with black spots at the anal end of elytra. Adults appear in swarms during May, defoliate the trees, causing huge losses; peak activity reaches during July-August	Same as for controlling almond weevils
4	<b>San Jose Scale</b> , <i>Quadraspidiotus perniciosus</i>	Minor pest of almonds (see under apple)	Same as in the case of apple

## Apricot

No.	Insect name	Description	Management
1	<b>Indian Gypsy moth,</b> <i>Lymantria obfuscata</i>	Round, greyish-brown eggs are laid in clusters during June-July under the bark on tree trunks and are covered with yellowish-brown hairs; these hatch after 8-9 months; larvae feed gregariously at night and defoliate the trees completely	Collect and destroy egg masses, as these are very conspicuous; Caterpillars come down to the basin of trees at night. Place gunny bags soaked with either chlorpyrifos 20%EC (0.02%) or fenitrothion 505EC (0.05%)
2	<b>Apricot chalcid,</b> <i>Eurytoma samsonowi</i>	Adults emerge from dry fruits in the end of February; lay eggs inside young fruits; grubs feed on the developing seeds, fruit growth is arrested and fruits fall prematurely; pupation takes place inside the seeds; maximum activity in April-May	Collect and destroy all dropped fruits
3	<b>Apricot weevil,</b> <i>Emperorhinus defoliator</i>	Adults defoliate the trees during summer	Same to those of almond weevil
4	<b>Grey weevils:</b> <i>Myllocerus discolor</i> , <i>M. undecimpustulatus</i> , <i>M. laetivirens</i>	Symptoms similar to those of almond. Adults defoliate trees during summer	Same to those of almond weevil
5	<b>Apricot chafer beetles:</b> <i>Anomala polita</i> , <i>A. lineatopennis</i> etc.	See under apple	Same to those of apple
6	<b>Peach borer,</b> <i>Sphenoptera lafertei</i>	See under peach	Same as in the case of peach
7	<b>Leaf-rollers:</b> <i>Cacoecia epicyrta</i> , <i>C. sarcostega</i>	Black headed green caterpillars fold leaves April-May onwards. Attack on fruit also is seen.	Spray carbaryl 50%WP (0.05%) or malathion 50%EC (0.05%) about two weeks before harvesting
8	<b>Scale insects:</b> <i>Eulecanium coryli</i> , <i>Parlatoria oleae</i> , <i>O. perniciosus</i> , <i>Parlatoria oleae</i> , <i>Quadraspidiotus perniciosus</i>	See under Apple	Same to those of apple

## Peach

No.	Insect name	Description	Management
1	<b>Peach leaf curling aphid,</b> <i>Brachycaudus helichrysi</i> 	Smooth green looking aphids suck sap from growing leaves which lead to crinkling and curling. Growing buds become weak and result in poor setting and fruits fall-off prematurely	Spray 7-10 days before flowering (pink bud stage) methyl demeton 255EC (0.025%) or Dimethoate 30%EC (0.03%) or Monocrotophos 36\$SL (0.04%) or Fenitrothion 50%EC (0.05%) or Formothion 25%EC (0.038%) @ 4-8 Litres/tree. Spray with imidacloprid 17.8%EC 0.006% also very effective.
2	<b>Blossom thrips:</b> <i>Thrips rhopalantennalis</i> , <i>T. flavus</i> , <i>T. florum</i> , <i>Haplothrips</i> sp., <i>Tenuipennis</i> sp., <i>Frankiniella dampfi</i>	See under apple	Same as in apple. Pre-bloom spray recommended for peach leaf curl aphid is also effective.
3	<b>Peach Fruit fly Bactrocera</b> <i>Zonatus</i> <b>Oriental fruit fly</b> <i>Bactrocera (Dacus) dorsalis</i>	The adult is stout, brown to dark brown in colour with ferruginous thorax; measures 7 mm in length and	During April-May when adult flies start appearing on leaves, spray the bait consisting of 0.1% malathion 505EC + 10g

	<p>14 mm across the wings; females has tapering abdomen which ends in a pointed ovipositor. They lay eggs inside fruits; maggots feed on pulp; fruit becomes soft, ferments and drops. The incidence reduces yield and quality of the fruit</p>	<p>sugar/ gur (in one litre of water) on the foliage of trees or install bait stations in the orchard by mixing 25 g gur in 10 ml malathion and sufficient quantity of water for making slurry. Encourage early maturing varieties like "Worlds Earliest" and "white giant" in infested localities. Do not delay harvesting of fruits. Collect and destroy the fallen fruits</p>
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#### Pear

No.	Insect name	Description	Management
1	<b>Stem borer</b> , <i>Sahyadrassus malabaricus</i>	The larvae bores into the basal part of the stem.	Syringing petrol or kerosene or chlorpyrifos 20%EC 0.05% into the tree trunk.
2	<b>Aphid</b> , <i>Lachnus krishnii</i>	See under peach	Same to those of peach
3	<b>Scale insects:</b> <i>Parlatoria oleae</i> , <i>O. perniciosus</i> , <i>Parlatoria oleae</i> , <i>Quadraspidotus perniciosus</i>	See under Apple	Same to those of apple

#### Plum

No.	Insect name	Description	Management
1	<b>Plum Weevil</b> , <i>Amblyrrhinus pricollis</i> <b>Other weevils:</b> <i>Myloccerus tactivirens</i> , <i>M. sabulosus</i> , <i>M. undecimpustulatus</i>	Adult beetles feed on the epidermis of fresh and tender leaves leaving behind only the network of veins, affected leaves dry up and fall serious damage on young plantation	Same to those of almond weevil



#### Cherry

No.	Insect name	Description	Management
1	<b>Flat-headed borer</b> , <i>Sphenoptera Lafertei</i>	Small coppery black adult beetles feed on foliage; generally attack stems and branches exposed to the sun. The plants become weak or die in severe infestation.	Spray the main trunk with methyl parathion 50%EC (0.1%) or swab the main trunk and limbs with methyl parathion 50%EC (0.1%). Remove the dead bark and apply waterproof paints on hard wood. Cover the exposed part of the tree with grass/gunny bags with methyl parathion 50%EC (0.2%).
2	<b>Root borer</b> , <i>Dorysthenus hugelli</i>	See under apple	Same to those of apple
3	<b>Stem borers:</b> <i>Aeolesthes Holosericea</i> , <i>Apriona cinerea</i> , <i>B. rufomaculata</i>	See under apple	Same to those of apple
4	<b>Plum scale</b> , <i>Eulecanium tiliae</i>	See under apple	Same to those of apple

#### Persimmon

No.	Insect name	Description	Management
1	<b>Leaf roller</b> , <i>Hyplocala rostrata</i>	Dark, violaceous grey and orange moth lay eggs on leaves in early-July. Insects remain active through-out the rainy season. Caterpillars fold leaves, feed inside and pupate within the leaf folds	Spray endosulfan 35%EC (0.05%) or Malathion 50%EC (0.05%) in mid-July and again in mid-August.

## Strawberry

No.	Insect name	Description	Management
1	<b>Fruit borer</b> , <i>Helicoverpa armigera</i> 	The moth has V shaped speck on the light brown forewings and a dark border on the hindwings. The larva is greenish with dark grey lines on the body. Larva damages the leaves and fruits	Install <i>H. armigera</i> pheromone trap @10/ha for monitoring adults. Spray neem formulation 0.3%EC (3ml/lit) or HaNPV 250LE (1ml/lit) or <i>Bacillus thuringiensis</i> (Bt) (1-2gm/lit)
2	<b>Defoliator</b> , <i>Spodoptera litura</i> 	The moth has wavy white markings on the forewings and white hindwings. The larvae hide during day time in the soil and active during night feeding on the leaves.	Collection and destruction of egg masses and gregarious young larvae. Install <i>S. litura</i> pheromone trap @10/ha for monitoring adults.
3	<b>Defoliating chaffer beetles</b>	Adults are variously coloured cause defoliation. Grubs are root feeders.	Spray SINPV 250LE (1ml/lit) Same as that of apple
4	<b>Hairy caterpillars</b>	Defoliate plants during June-July	Spray endosulfan (0.05%) or malathion (0.05) on the appearance of caterpillars, Do not spray endosulfan on fruits. Harvest berries 7-10 days after malathion spray.

## Walnut

No.	Insect name	Description	Management
1	<b>Walnut weevil</b> , <i>Aclidodes perrectirostris</i>	Weevils with prominent snout. Excavate circular feeding holes on the fruit surface. Grubs bore into the fruits and reduce the kernels into a black mass, attacked fruits drop prematurely with grubs inside	Fallen fruits should be collected and destroyed. This method is efficient only if tree owners carry out this operation of collection and destruction of infested fruits on campaign basis

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