

Occurrence and management of Apple fruit moth in dry temperate zone

Apple fruit moth/miner, a common pest of apple in Asian, European and American countries, is also found in the dry temperate zone of Himachal Pradesh causing damage to apple. Earlier the pest was reported at an altitude between 2445 to 2900 m above mean sea level, but now it is found up to 3200 m altitude and in yearly isotherms of 0 to 10°C. Its spread to other apple growing areas of the state is unlikely due to unsuitable agro-climatic conditions. Characteristic feature with small entrance holes are marked by the presence of a white crystalline lump made up of oozed out apple juice which later turns sunken, forms discoloured spots and these spots later on turn black. Inter-row cultivation can destroy pupae, and predatory ants (*Myrmica* sp.) are known to feed upon the larvae. Not much work has been done on the management of this pest except chemical control.

APPLE fruit moth [*Argyresthia conjugella* Zeller (Lepidoptera: Argyresthiidae)] is a fruit damaging insect of apple in Kinnaur and Lahaul and Spiti districts (Dry Temperate Zone) of Himachal Pradesh and is also a common pest of apple in Asian, European and American countries. It is reported to be native to India, where its primary hosts are berries of sorb tree (*Sorbus aucuparis* Linn.). Apple fruit moth was first reported from India during 1986 from the tribal district of Kinnaur, Himachal Pradesh. Till its initial survey, it was considered to be localized in Kinnaur district because of its peculiar agro-climatic i.e. annual isotherms $10 \pm 10^\circ\text{C}$ requirements but in later surveys this pest was also recorded from dry temperate zone (Spiti valley) of district Lahaul and Spiti, Himachal Pradesh.

History

During 1960, the fruit moth was wrongly reported as codling moth, *Cydia pomonella* L. and subsequently by other workers due to absence of authenticated adult identification, and because of these reasons Himachal Pradesh was also considered as a codling moth region. Later in 1979, apple fruit moth was identified as tortricid, *Eucosma* sp. as a pest of pines. But during 1986, Khajuria *et al.* succeeded in rearing the adults and the insect was identified as apple fruit moth (*Argyresthia conjugella* Zeller).

Life cycle

Eggs of the apple fruit moth are roughly oval, yellowish or creamy

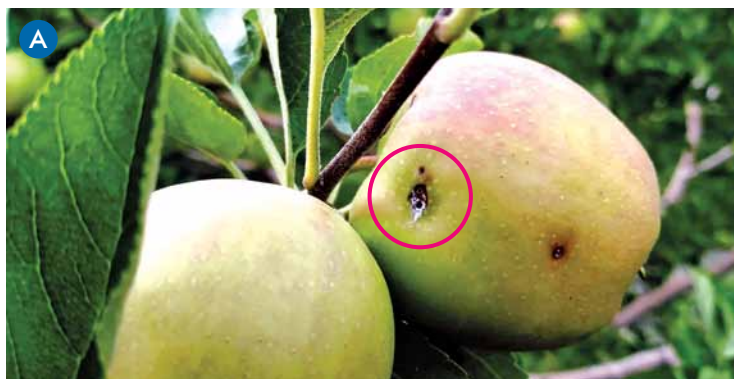
white in colour. Eggs hatch in 11-13 days at temperature of 13°C . After hatching, larvae make small entrance holes which turn sunken, discoloured spots and later on these spots turn black. Entrance hole is marked by the presence of white crystalline lump made up of oozed out apple juice. Initially the colour of newly emerged larva is grayish which later on becomes brick red, pink and sometimes dirty white. Larval duration comprises three larval instars is of 40-90 days, depending upon the temperature.

Mostly the larvae enter from the shady sides of the fruit and form zig zag galleries in all directions towards the seed core. Occasionally, they remain below the skin of the fruit and feed for sometimes and then enter into the seed chamber and feed on the seed till they are reduced to a lump of frass. Thereafter, the larva comes out of the fruit by making straight, outward gallery which ends into small hole outside the fruit. The larva then rests on the fruit and descends down to the ground by spinning a white silken thread. After reaching the ground, it moves about in search of a concealed place for pupation. Pupa

has been reported to be oblong, light brown, but it gradually attains dark-brown colour near adult emergence. Pupation takes place in double span, oblong to spindle shaped, cocoon with outer loose and net like and inner dense white and fusiform covering. Pupation takes place in soil under stone and dead leaves and occasionally inside the fruits. Adult moth is a small frail insect of 5 mm length with 12-14 mm wing expanse having white head with dark purple forewings transverse with diagonal white marks.



Adult of *Argyresthia conjugella* Zeller



Fruit damage: (A) Entrance hole and crystalline lump and (B) Fruit with distorted shape

The apple fruit moth [*Argyresthia conjugella* Zell. (Hyponomeutidae: Argyresthiinae)] in Spiti valley emerges as an adult in late April/May. The female oviposits in May/June on the unripe fruit of rowan or apple, shortly after petal fall. After approximately two weeks, the larva hatches and it immediately eats its way into the fruit. The larva does not leave the fruit until July/August, when it lowers itself down to soil surface through a silken thread. Depending on the climate, the apple fruit moth hibernates on the ground as a larva or a pupa, for a period of 6-8 months.

Appearance

The head and the intermediate body are white-yellow, while the outer body and the wings are grey-brown. It has a white-yellow band at the lower part of the wings. The egg is very small, only 0.5 mm long and 0.3 mm wide and it has a rounded oval shape. The colour is yellow-grey. The larvae are light yellow when hatched. It has 6 eyes on each side of the head and two antennae. It goes through 3-4 juvenile instars before it reaches full size of 6-7 mm. The colour changes from light yellow white, filthy grey to red/orange. The larva of the apple fruit moth makes tunnels in the apple, in search for the seeds. The apples get a bitter taste and rot in advance. Sometimes the larva pupates in the cavity with the seeds, but generally the moth leaves the fruit for pupation. The pupa is shiny yellow-brown, 4-5 mm and it is surrounded by a cocoon that consists of a thin mesh outer covering and a thick inner one. The apple fruit moth can reproduce well in apples, and it means that an orchard with a lot of fruits left on the orchard floor can contribute to the pest population the year after.

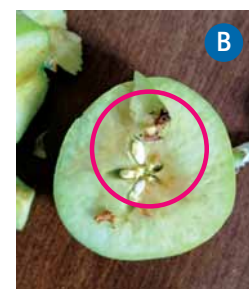
Nature of damage

Small entrance holes turn sunken, form discoloured spots and later on these spots turn black. Thereafter, as a result of larval entrance into the fruit, entrance hole is marked by the presence of a white crystalline lump. When the infested fruits are cut open, there are very small zig zag ingoing galleries due to winding and twisting of the body and by following the longest possible route. This nature of larva is perhaps to delay its entrance into the seed core so that the seed which are in the process of development may attain full growth and size. The galleries get full of light brown frass, terminating outside in a small round hole. The in-going galleries are invariably of brown colour, due to the oxidation of phenols and wet faeces of the larvae.

Sometimes, heavily infested fruits are found distorted in shape, generally in poorly managed orchards in Spiti.

Management practices

- Inter-row cultivation can help destroy pupae and thinning of tree crowns can reduce populations.
- Some predatory ants (*Myrmica* sp.) are known to feed upon the larvae when they drop to the soil for pupation.
- Not much study has been conducted on the management of this pest except chemical control.
- Two spray strategy with good contact insecticide (Chloropyrifos 0.05%, quinalphos 0.05% or deltamethrin 0.03%) at fortnightly interval are effective in suppression of the infestation.
- A two-spray schedule coinciding with egg laying by moths between June to first week of July gives satisfactory control of this pest. The second spray is given after about a fortnight of first spray.



Argyresthia conjugella larva inside fruit

SUMMARY

Apple fruit moth cause damage to apple fruit during early to mid stage of fruit development causing considerable losses in yield. The attack by apple fruit moth larvae at early fruit stage is more serious and they sometimes cause complete crop failure by deforming the fruits, rendering them with no economic value. Insecticides applied to the foliage are usually recommended when apple fruit is in initial development stage.

For further interaction, please write to:

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