**PESTS OF POME FRUITS AND THEIR MANAGEMENT**

**Liyaqat Ayoub, Munazah Yaqoob, Sobiya Zahoor, \*Fazil Fayaz Wani, Rukshanda Hanif, Audil Gull and Ali Anwar**

\*Corresponding Author: fazilfayazwani80@gmail.com

**ABSTRACT**

Pome fruitsconstitute one of the four or five major classes of fruit in terms of world production and are one of the two major groups of temperate fruits. Several insect and mite pests feed on and damage pome trees and their fruits throughout the growing season.Although there are many insect pests that attack pome fruits, some of them are quite harmful and require immediate care for control. Mites, in addition to insect pests, are linked to production and inflict significant financial losses to commercial fruit growers. Insect pests in orchards might be direct pests that eat on fruits, or indirect pests that harm the tree's leaves, trunk, and other parts.These insect pests and mites can cause direct harm to the fruit, rendering it unappealing or inedible, as well as weaken the pome fruit tree by hurting or infecting the leaves, trunk, and branches.High quality fruits in sufficient amounts can only be produced on healthy plants. Thus, one of the most important tasks in crop production is an effective and sustainable management of plant pests.

**INTRODUCTION**

Pome fruits belong to the *Rosaceae* family, and  subfamily*pomoideae*. They are fruits with a thick membrane around a centre of many tiny seeds. The membrane is wrapped in a fleshy layer that may be eaten. Trees are deciduous and have a dormant winter phase that need freezing temperatures in order to break dormancy effectively in the spring. Pome fruits include apples, pears, and quince, which are produced from spring flower through late fall harvest(Knee, 1993).Maggot, codling moth, and other internal fruit eaters are examples of direct pests. Indirect pests include leaf miners, psyllids, aphids, and mites, which do not directly harm fruits. When categorised according to the severity of their infestation, these pests are also referred to as major and minor pests (Atwal and Dhaliwal, 1997). More than 70 insect pests and mites attack apple and pear fruits, often known as Pome fruits, causing significant damage (Abrol, 2015). Damage to pome fruit trees diminishes yield and makes them more vulnerable to winter damage or insect assault. Pest control in pome fruits has long been a difficult task for farmers. Physical treatment of trees and orchards dominated early pest management. Picking and discarding of pest-infested fruits from trees, reducing weeds on the orchard floor, treating harvested fruit, and limiting pest movement in second-hand boxes were all part of this operation. But with advancements in science and technology, newer and newer methods have been discovered to manage the insect pests of pome fruits. Some of the important insect pests of pome fruits include:

**European Red Mite (*Panonychusulmi*):**

European red mite (ERM) is a pest that attacks pome and stone fruit trees, as well as nuts and berries. European red mites lay their eggs in the bark around the base of buds and spurs over the winter. The reddish-orange overwintering eggs are spherical or slightly flattened and have a short stalk on top. Eggs hatched on the underside of leaves during the growth season are yellowish, spherical, and lack a stalk. (Hardman *et al.,* 1985).It was reported in North America for the first time in 1911. It was first observed in India in 1974, in the states of Jammu & Kashmir, Himachal Pradesh, and Uttrakhand. In practically all apple-growing areas, *Panonychusulmi* has established itself as a major pest. (Khajuria and Sharma 1996). In India, *P. ulmi* has been recorded from peach, plum, apple, wheat, fig, hibiscus, tomato, apricot and ivy from Jammu and Kashmir (Kumar and Bhalla, 1993). In arid regions, the European red mite is the most dangerous. Temperature influences the rate of development, which is slower in the spring and fall and faster in the hot summer months. Sexual and parthenogeneticreproductions are also possible. When they're active, they'll be discovered in the foliage, penetrating leaf tissue and sucking up the sap that flows out. European red mites eat apple leaves by putting their mouthparts into individual cells and sucking off the juices, including the chlorophyll. By mid-July, if there is enough feeding, the leaves may take on a bronze look. Serious feeding injury can lead to premature leaf drop, poor fruit colour, lower fruit size and quality, and reduced fruit set the next year, as well as a reduction in the number of fruit buds for the next season's harvest. The European red mite is a pest of many trees, although the apple is the most affected. The bottom leaf surface is more affected than the upper leaf surface. (Kim *et al*., 2008; Marcic, 2007).Pruning and destruction of infested twigs/branches during dormancy to reduce overwintered population as the egg laying is being noticed on these twigs by ERM.Application of dormant oil prior to bloom, scouting the orchard regularly after the petal fall stage through August, application of balanced doses of fertilisers and proper irrigation, and use of reduced risk insecticides to help conserve predatory arthropods that attack ERM are all recommended best management practises for this pest.To control the population of ERM, conservation, mass production, and mass release of predatory mites (*Amblyseiusfallacis*) and lady bird beetles should be undertaken.

**Woolly Apple Aphid (*Eriosomalanigerum*):**

The woolly apple aphid is a tiny, soft-bodied insect that feeds via piercing and sucking. While these aphids are uncommon, when they do occur, they can be a major nuisance to fruit trees. Woolly apple aphids infest tree roots, trunks, limbs, shoots, and, on rare occasions, fruit. The 'woolly' part of the name refers to the waxy secretions that these insects make to protect them from predators. These bark-feeding aphids have masses of white, wool-like waxy coverings covering their bodies, while the aphids themselves are purple. The aphid goes through two stages during the winter: egg stage and immature nymphal stage. Nymphs hibernate on the tree's roots underground. During the summer, after establishing new colonies, the migrants produced many generations. Wound locations on apple tree trunks, limbs, twigs, and roots are colonised by these aphids. Woolly apple aphids feed both above and below ground, but it is belowground aphid root feeding that causes the most harm, especially to young plants (Atwal and Dhaliwal, 1997). Root feeding causes galls to form, which obstruct the flow of nutrients, causing tree stunting, uprooting, and even death. Yellow foliage, especially on young plants, could indicate a woolly apple aphid infestation. Honeydew and sooty mould will be a concern if populations are high, and aphids may enter the calyx end of the fruit. While managing the pest,Chaubatia paste should be used to remove excessive water sprouts and to cover gaps, crevices, and wounds created by pruning. Planting aphid-resistant rootstocks (MM 106 and MM 111) and taking action when aphids infest 10% of pruning scars.*Aphelinusmali* is a parasite that can take over an airborne colony and entirely rule it. In the absence of this parasite, aerial colonies can grow rapidly, and woolly aphids can be discovered in the apple's calyx. Woolly apple aphid outbreaks are most common after the usage of pyrethroids, which kill the aphid's natural enemies. Spraying dormant oils after they've been latent for a while (HMOs). To conserve natural enemies, judicious use of chemical insecticides is required.In certain situations, using an organophosphate plus oil during the delayed dormant phase has resulted in season-long control, or at the very least suppression throughout the summer. When populations grow, an effective pesticide can be used at any time during the season. It's important to plan ahead for a fall epidemic and make sure the pesticide's preharvest interval is followed.Other pesticides (such as IGRs, neonicotinoids, and other innovative modes of action) have largely replaced organophosphates, which have little or no toxicity to the woolly apple aphid but may be similarly deadly to its natural enemies.

**San Jose Scale (*Diaspidiotusperniciosus*)**

San Jose scale is a piercing-sucking pest that attacks apple, peach, plum, and pear trees. It's a sucking pest that feeds by injecting a toxin into the plant, causing discolouration in certain areas. This insect feeds on the twigs, limbs, and fruits of trees. This bug can damage tree limbs or entire trees in as little as 2-3 years if numbers are not regulated. Scale infestation is indicated by purplish-red halos on juvenile bark. This little insect sometimes goes unseen until vast colonies have grown. These small yellow insects roam around on bark and foliage at random before settling down for the long haul. Crawlers will secrete a waxy covering over their bodies a few days after settling down, which will protect them from insecticides. This insect overwinters on the tree as an immature scale, and there are usually two generations every year (Atwal and Dhaliwal, 1997). Timing applications of dormant oil to smother overwintering scales, infested nursery plantations, buds, and graft materials should all be avoided as best management techniques for this pest.During the dormant season, inspect prunings for San Jose scale to make sure it hasn't formed in the tree tops. Scale can also be found on fruit after it has been harvested.In biological control, *Encarsiaperniciosi* and *Aphytisdiaspidis* (San Jose Scale Parasitoids) can be mass produced and dispersed to keep the San Jose Scale population in check.Using pheromone traps and degree day models to track male activity, shade trees like willow, poplar should not be grown in and around fruit orchards. Using insecticides to target crawlers and juvenile scales and pruning badly affected branches during the dormant period and burning them helps to prevent the pest from building up. San Jose scale infestations can be treated by the standard orchard method of delayed dormant spraying, although extensive encrustations often necessitate extra pesticide applications. If the dormant spray fails to provide adequate control, treatments administered immediately after the crawlers emerge are also useful.It is critical to avoid using insecticides indiscriminately in order to protect natural adversaries.

**Codling Moth (*Cydiapomonella*)**

The codling moth is a grey insect with prominent bronze-colored patches on its wings. Under the bark or in leaf litter around the base of apple trees, the codling moth overwinters as a fully formed caterpillar. The codling moth can attack a variety of fruit plants, but apple is its favourite. At night, females lay eggs on or near ripening fruits. The larva (caterpillar) has a brown-colored head capsule and is white to pinkish-white in appearance. The larva is the most dangerous stage of the life cycle, as it only eats fruit. Because it is a direct pest, it causes serious damage to the fruit. Caterpillars feed by burrowing into fruits, ruining the fruit and leaving a path of solid insect faeces known as frass behind. Neonate larvae feed on seed after entering the fruit through the calyx. Fruits that have been infested lose their form and fall early. Apple fruits are rendered unmarketable in 30 to 70% of cases due to both exterior and interior feeding damage by larvae. Every year, this insect produces two or three generations(Atwal and Dhaliwal, 1997).Regular scouting of trees and fruits for damage is one of the best control methods for this insect (including frass on the exterior of fruits), Scrape away loose bark from trunks to prevent Codling moth caterpillars from overwintering. Throughout the season, pheromone traps and degree day models should be used to track adult flight activity and time insecticide applications appropriately. Remove and destroy all fallen fruits that contain caterpillars as soon as possible to aid in insect population control. Although some predators, such as spiders and carabid beetles, may eat codling moth larvae or pupae, natural biological control is ineffective. Releases of the microscopic wasp *Trichogrammaplatneri,* in combination with mating disruption or soft insecticides, have been used successfully to manage codling moth in commercial walnut and pear plantations.The ultimate goal of an insecticide programme is for pesticide residues to be present at egg hatch, so that the tiniest, most sensitive caterpillars are exposed right away as they try to penetrate fruits. Pheromone traps can be used to track adult emergence and mass capture. Spray of insecticides should be done if more than five adults are captured in the trap/week.

**Apple maggot (*Rhagoletispomonella*)**

Apple maggots are microscopic worms that damage and destroy apples and other fruits by tunnelling through them. The mature stage of the fly is roughly the size of a normal house fly. Apple maggots may be found all over the world, and while they favour apples, they will eat just about any fruit they can get their hands on. Plum, cherry, apricot, pear, blueberries, strawberries, and just about any other plant that produces a delicious, full-bodied fruit have all been known to be infested. Females will insert their eggs under the fruit's skin, leaving small dimples and depressions. Apples infested early in the season will mature with bumps. Larval feeding damage is seen as distinct brown tunnels running through the fruit's flesh. Fruit that has been heavily contaminated can turn mushy and drop early. Even modest levels of infection in storage can result in rotten fruit. The harm is similar to that of a codling moth (*Cydiapomonella*). The larvae of the codling moth bore one or two tunnels through the flesh to the core, where they feed on the seeds and inner fruit tissue; faecal pellets are present. Apple maggots have a wedge-shaped body with two small black hooks extending from the pointed 'head' end when feeding. Codling moth larvae have distinctive brown to dark brown heads and six legs; apple maggots have no head capsule or legs, and have a wedge-shaped body with two small black hooks extending from the pointed 'head' end when feeding.Codling moth larvae grow to about 20mm, twice the size of apple maggot larvae (Yee and Goughnour, 2006).To eradicate outside sources of apple maggots, remove any unmanaged, wild, or unsprayed trees within 500 metres of an orchard. Inspect the orchard for symptoms of apple maggot infestation and fallen apples on a regular basis, especially along the edges closest to the backyard or wild host trees. Contact insecticides are necessary for good crop protection because apple maggot must be controlled in the adult stage prior to the deposition of eggs in fruit. Insecticide applications should begin 7 to 10 days after adults are expected to emerge from the soil if an orchard is threatened by apple maggots.

**Rosy Apple Aphid (*Dysaphisplantaginea*)**

The rosy apple aphid *Dysaphisplantaginea* (Passerini) (Homoptera: Aphididae) is one of the most serious pests of apple. These aphids lay their eggs in tree bark fissures, bud axils, and twigs of apple trees to survive the winter. Fruit growers fear this pest because it causes significant damage to the fruits at low densities, so low that visual monitoring is impossible, and because prolonged attack impairs shoot growth and reduces flower formation over the winter (Alford 1984; van Frankenhuyzen 1992). The species overwinters as eggs on its major host plant, just as otherheteroecious aphids. After the silver tip stage of development, the eggs hatch, and newly hatched aphids are dark green in colour, changing to a purple colour as they mature into adults. Rosy apple aphids feed and reproduce on apples until the middle of the summer, when they transfer to new host plants to feed. Furthermore, infested shoots and neighbouring fruitlets slow or stop growing, and damaged branches produce fewer or no blooms the next year. When left untreated, the RAA can wreak a lot of damage in some years and be very harmless in others.Injury symptoms often manifest as tightly curled leaves that turn red and have dry, necrotic patches after the petal fall stage of growth. Because it is difficult to get coverage with pesticides after leaves have curled, this insect is best treated during the 'pink stage' of bud development, before major leaf curl develops.For this pest, the best management practises include applying dormant oil between the green tip and 'alf-inch green growth stages to control newly hatched aphids, and carefully monitoring leaf terminals for live aphid colonies so that action can be taken when a threshold of 5% of apple leaf terminals is reached. Insecticides should be used judiciously to protect natural enemies.

**Plum Curculio (*Conotrachelusnenuphar*)**

Plum curculio is a small'snout' beetle or weevil that feeds by chewing and tearing. The adult and larval stages of this beetle are both harmful, and it is a major pest of pome and stone fruits. (Racette*et al.*, 1992, Vincent *et al*., 1999).Plumcurculio (*Conotrachelusnenuphar*), a true weevil that lays its eggs under the skin of plum, apple, peach, apricot, cherry, and other pome and orchard stone fruits, sets its sights on plum, apple, peach, apricot, cherry, and other pome and orchard stone fruits when spring weather begins to warm with abundant damp showers. The curculio lays eggs behind a flap of flesh, leaving lumps or crescent-shaped scars apparent to the naked eye, causing significant harm to fruit. Fruits that have been burrowed through fall to the ground and perish, whereas scarred fruits show signs of preliminary laying and feeding. As an adult, the plum curculio overwinters in leaf litter in wooded settings. Adults first appear in orchards during bloom, but they become most active after 'petal fall,' when temperatures reach 70 degrees Fahrenheit or above.Adults are most active at night, feeding on buds, flowers, and newly ripened fruit. When adults eat newly ripened fruit, they induce a characteristic form distortion known as 'cat-facing.' Females deposit eggs by chewing 'c-shaped' lesions on fruit, and scarring from these wounds can render produce unmarketable. Fruit is consumed by the larvae, which causes afflicted fruits to fall from trees prematurely. Dropped fruit larvae complete their development and escape the fruit to pupate in the soil.Successful management necessitates careful monitoring of trees and the application of several treatments throughout the year to keep growing trees healthy, as well as proper fertilising, mulching, and watering, so that they can better resist infestation, and monitoring new fruits for the first signs of injury.Adult monitoring with insect beating sheets, which are held or placed on the ground beneath trees to collect insects that fall as branches are shaken or beaten with a stick, insecticide applications at the 'petal fall' or 'first cover' stages of fruit tree development, dormant pruning of fruit trees to create a less favourable environment for plum curculio adults, and removal of uncontrolled or wild fruit trees that may provide additional food and mating sites.

**Japanese Beetle (*Popillia japonica*)**

*Popillia japonica* is a pest of numerous agricultural (Shanovich*et al*. 2019), horticultural, and ornamental plants, including wild and cultivated Rosaceae plants, such as apple (*Malusdomestica*Borkh.) (Rosales: Rosaceae), which are especially favoured host plants (Potter and Held 2002). *Popillia japonica feeds* on apple tree foliage but has been discovered to be incapable of injuring intact fruits.(Pires and Koch 2020). Japanese beetles can cause serious damage to orchard shrubs and trees. Adult scarab beetles feed on the foliage, flowers, and fruits of several tree fruit species; nevertheless, they can eat hundreds of other plant species, whether in the orchard or in the surrounding environment. Because of their wide host range and ability to fly long distances, they are particularly difficult to manage in a focal crop. Adult feeding on the foliage's surface is concentrated between leaf veins, giving it a distinctive skeletonized appearance. Japanese beetles spend the winter as white grubs in the soil before emerging to mate, feed, and lay eggs. Adult activity usually peaks for two to four weeks, after which populations begin to drop, however adults may still be spotted in small numbers. It's worth noting that Japanese beetle grubs aren't harmful to tiny fruit orchards, and adult beetles don't lay eggs on fruit-producing bushes or trees. Each year, a new generation of Japanese beetles emerges. To prevent the attraction of more beetles, best management techniques for this insect include using management strategies at the first sign of beetles (before groups of beetles form), obtaining excellent coverage of trees with pesticides, and tolerating low levels of feeding damage on mature trees.

**The Stem Borer *Aeolesthessarta* (Solsky)**

*Aeolesthessarta* (Solsky) (Coleoptera: Cerambycidae) is a widespread stem borer pest of Apple, cherry, apricot, peach, pear, plum, and mulberry. The adults have dark brown elytra with speckled yellowish pubescence. After mating, the females begin laying eggs in the wounds and crevices of the host trees' dry woody sections. In three years, the life cycle is completed. The newly hatched grubs feed on the bark first, creating zigzag pathways in the process. They dig into the sap wood and feed on it. Although the affected trees may not die for a long time, their vigour and output are harmed. Typically, multiple generations develop on the same tree before it is killed. They feed quickly in the summer, spewing frass from the exit holes. As a result of their feeding, sap flow in that area of the branch or trunk is reduced, eventually resulting in death. The grubs are quite slow in the winter, and well-nourished grubs may just rest in the tunnel without eating. The viability of the trees is lowered as a result of their feeding and the resulting damage to the woody tissue. Parts of the attacked tree begin to die, and the tree eventually becomes unproductive. The frass that comes out of the holes might be used to locate the pest. The beetle should be collected and destroyed. The use of a light trap can aid in the capture of beetles. No insecticide spray will be effective because the pest eats inside the woody parts. Finding the feeding holes, clearing the passage, and injecting poisons are the only ways to control this problem. Wire inserted into the stem can also be used to kill grubs.

**The Apple Root Borer, *Dorystheneshugelii* (Redtenbacher)**

Living and dead roots of apple trees are the major hosts of this borer, but other hosts such as apricot, cherry, peach, pear, walnut, and a few forest trees are also attacked. Due to its underground destructive stage, it is difficult to detect a root borer infestation early on. Infested trees show common signs such as sparse foliage, a shaky, stunted, and weak upright stance, and grow shaky, stunted, and weak as the infestation progresses. Oval longitudinal cuts (2.5-15 cm long) on the stem and branches of afflicted trees that make them vulnerable to secondary pests such as stem borer and diseases such as cankers, resulting in tree death in 3-4 years (Sharma and Khajuria, 1997). Adult beetles emerge, eggs are laid, and grubs feed on roots, all of which are critical stages in the life cycle of the root borer for the spread of infestation and the loss of apple orchards. After the first monsoon downpour, the beetle emerges from the dirt. The grubs eat the roots, girdle them, and consume the internal tissues. As a result, the primary roots are severely injured from the base, and the trees, especially the young ones, die away, while the older ones grow weak and tumble down in strong winds. In order to arrange proper timing of management measures against the target pest, the emergence pattern and time of adult beetle activity must be evaluated in connection to rainfall in order to check the occurrence of this pest. Orchards should not be planted in sandy, dry soil. Inter-culturing in the orchard aids in grub control. Use well-rotted FYM that has been thoroughly mixed with the soil surrounding the tree. Once an infestation has occurred, fumigants should be used to treat the tree basins.

**Blossom Thrips( *Thrips* Sp.)**

Thrips are economically important pests of deciduous fruit trees that cause direct damage to fruit development by ovipositing eggs in floral buds and blooms. (Pearsall and Myers, 2000). A number of thrips viz. *Thripsflavus, T. florum, Haplothripstenuipennis,Franklinielladampfi, Taeniothripsrhopalantennalis* etc. are of significance in temperate fruit orchards (Broughton *et al.,* 2011; Shellhorn*et al.,* 2010). A variety of temperate fruit crops, including apple, pear, peach, plum, and apricot, are infested by these pests. Thrips are little insects with asymmetrical rasping and sucking mouthparts that cause plant damage. Nymphs and adults lacerate floral parts and injure vegetative buds. As a result of the sickly appearance and withering of the affected blooms, fruit set is reduced and the fruits break off prematurely. Flowers are lacerated by both nymphs and adults. Thrips eating on the buds can cause sap to ooze from the wounded places. On infested blossoms, brownish spots appear later at the base of stamens, styles, and petals. Injury can cause the petals to bend and the fruit set to be reduced. Examining samples of buds, tearing them apart, and shaking them onto white paper or a Vaseline-smeared Petri-dish is the traditional way of sampling apple blossoms to check for thrips populations. When calculating a thrips economic threshold, many aspects must be taken into account. Chemical control is one of the most effective and practical methods for controlling apple blossom thrip (ABT) available to orchardists (Ahmad et al., 2019). The thrip population can be reduced by keeping the orchard ground clean and clear of weeds. The most effective application of insecticides for natural enemy conservation can also be an effective approach to manage their population.

**The Pear psylla**

Pear Psylla (*Psyllapyricola*Foerster) is a significant pear pest causing fruit russet, psylla shock, and pear decline (Beers *et al*. 1993). Both nymphs and adults suck the sap and create honeydew, which drips onto the fruits and leaves and forms sooty mould, lowering the quality of the fruit. Pear psylla (*Psyllapyricola* F.) causes tree stunting, premature leaf drop, reduced fruit size, and premature fruit drop at high densities, resulting in significant output losses. (Westigard and Zwick, 1972). These symptoms are known as psylla shock, and they are caused by a toxin found in feeding saliva. *Psyllapyricola* F., an adult pear psylla, acts as a vector for the mycoplasma-like organism that causes pear decline disease and transmits it to the tree while feeding. The sensitive foliage of young shoots and water sprouts is where nymphs and adults get their sap. Honeydew can run onto fruit, leaving dark russet spots or streaks that make the fruit unmarketablem( Hall and Ehler, 1979).In management, among chemical insecticides thiacloprid 21.7 SC @ 0.4 ml/litre has shown effective results in reducing psyllid population followed by imidacloprid 17.8 SL @ 0.4 ml/litre (Nissar*et al*., 2017). Avoid encouraging excessive vigour. Remove suckers from the tree's interior, which kills psylla eggs and nymphs while also increasing spray coverage. Because of the increased risk of fire blight disease and the potential for rinsing insecticide applications from trees, overhead irrigation may help control psylla pressure. However, this is not a common practise due to the increased risk of fire blight disease and the potential for rinsing insecticide applications from trees.

**Green Apple aphid** (*Aphis pomi*)

The aphid feeds on immature apples every now and again, causing them to become deformed. Heavy infection, particularly of young trees, can cause stunting and, in extreme cases, leaf loss, causing significant damage in nurseries, where plants of the sensitive age might become irreversibly damaged. The older the tree, the less it suffers. *Aphis pomi* infests young shoots, causing leaf curling and honeydew production, which causes fruit discolouration. (Oatman and Legner 1961, Madsen et al. 1961, Blommers 1994).The green apple aphid doesn't have a secondary host. It causes leaf curl in apple (*Malus* spp.) and related plants such as pear (*Pyrus*), hawthorn (*Crataegus*), Sorbus, and Cotoneaster by feeding in dense colonies on the young stems and undersides of leaves. Ants frequently visit colonies. Sexual forms emerge in the autumn, and females may lay huge egg masses on twigs after mating. If not repressed, it results in considerable yield reductions. (Hagley, 1989).Aphids are preyed upon by a variety of natural enemies. Lady beetles, green lacewings, brown lacewings, and syrphid fly larvae are among the most significant. Organically acceptable biological controls and sprays of insecticidal soap, approved narrow range oils, and azadirachtin (Neemix) include insecticidal soap, permitted narrow range oils, and azadirachtin (Neemix). A dormant oil spray used later in the day will avoid early harm and should obviate the need for additional applications. Chemical insecticide treatments in the spring may be necessary for young trees with heavy infestations.

**Pin/shot hole borer (*Scolytusnitidus*)**

Adult females inflict damage to pome trees by girdling a shot-hole in the inner bark (the phloem-cambial zone) on twigs, branches, or trunks. Frass often falls to the soil's surface as a result of this activity. The presence of bark beetles can be detected by little emerging holes in the bark. Using the emerging holes to remove the bark often reveals dead and deteriorated inner bark. Galleries can be found beneath the bark, preventing food and water from being blocked. The tree does not show signs in the early stages of the attack, but its growth is slowed. The foliage and fruit output of infested trees are reduced (Hussain *et al.,* 2018).Adults and grubs create galleries and pinholes in the plant's sapwood and hardwood. Perforation of the surface of infested branches occurs, followed by yellowing and wilting of the leaves. A severe infestation may result in the tree's death. Borings on the bark can occasionally indicate holes. During the autumn, management measures include pruning and destroying borer-infested branches. Borer attacks can be reduced by using a well-balanced fertiliser application. Keep clipped branches/twigs and old tree trunks from the previous year in the orchard to catch shot hole borer egg laying adults and destroy them later. A 1:6 mixture of Carbaryl 50 WP and dirt can be used to plaster the holes.

**REFERENCES**

Abrol, D. P. 2015. Pome Fruits. Pollination Biology, Vol. 1, pp. 91-140 DOI 10.1007/978-3-319-21085-8\_4

Ahmad, M., Manto, M. A. Mohu Din, S. and Pathania, S.S. 2019. New Approaches of Management for Apple Blossom Thrip (ABT) in Apple Orchards of Kashmir Valley. Int.J.Curr.Microbiol.App.Sci. 8(01): 1573-1580.

Alford, D. V (1984) A colour atlas of fruit pests. Wolfe, London

Anonymous, 2020. Growing Fruit–Problems of Apples and Pears. <https://www.grimmsgardens.com/growing-fruit-problems-of-apples-and-pears/>

Atwal A.S. and Dhaliwal G.S. (1997).Pests of temperate fruits.In: Agricultural pests of south Asia and their management. Kalayani Publishers,New Delhi pp 274-286

Beers, EH, Brunner, JF, Willet, MJ and Warner, GM (1993) Orchard Pest Management: A Resource Book For The Pacific Northwest, Yakima, WA : A Good Fruit Grower.111 pp

Blommers, L.H.M. 1994. Integrated Pest Management in European Apple Orchards. Ann. Rev. Entomol. 39: 213-241.

Broughton S, Bennington J M A and Cousins D A (2011). Thrips (Thysanoptera) damage to apples and nectarines in Western Australia. Crop Prot 72: 47-56.

Frankenhuyzen A van (1992) Schadelijke en nuttigeinsekten en mijten in fruitgewassen. NederlandseFruittelersOrganisatie, ‘s-Gravenhage, The Netherlands

Hagley, E.A.C. 1989. Release of *Chrysoperlacarnea* Stephens (Neuroptera: Chrysopidae) for control of the green apple aphid, *Aphis pomi* De Geer (Homoptera: Aphididae). Can. Entomol. 121: 309-314.

Hall RW, Ehler LE. Rate of establishment of natural enemies in classical biological control, Bull. Entomol. Soc. Am. 1979; 25:280-282

Hardman, J.M., H.J. Herbert, K.H. Sanford and D. Hamilton, 1985. Effect of populations of the European red mite, Panonychusulmi, on the apple variety red delicious in Nova Scotia. Can. Entomol., 177: 1257-1265.

Hussain, B., Buhroo, A.A., War, A. R. and Sheerwani, A. Insect-Pest Complex and Integrated Pest Management on Apple in Jammu and Kashmir, India. Apple: Production & Value Chain Analysis 261-278. Daya publishing house, New Dehli.

Khajuria, D.R. & Sharma, J.P. 1996. Outbreak of phytophagous mite on apple in Kullu valley. Indian Journal of Plant Protection 24: 134–138.

Kim S.S., S.G. Seo. (2008). Spider mite in apple cultivation farmers EMR and two spotted spider mite may be an important allergens in development of work –related asthma and rhinitis synptoms). Appl. Entomol. Zool., 36: 509-514.

Knee M. (1993) Pome fruits. In: Seymour G.B., Taylor J.E., Tucker G.A. (eds) Biochemistry of Fruit Ripening. Springer, Dordrecht.pp 325-346 https://doi.org/10.1007/978-94-011-1584-1\_11

Kumar, R. and O.P. Bhalla, 1993. An epidemic outbreak of *Panonychusulmi* (Koch) (Acari: Tetranychidae) in apple orchards of Himachal Pradesh, India. Curr. Sci., 64: 709-709.

Madsen, H.F., P.H. Westigard and L.A. Falcon. 1961. Evaluation of insecticides and sampling methods against the apple aphid *Aphis pomi*. J. Econ. Entomol. 54: 892-894.

Marcic D (2007) Sublethal effects of spirodiclofen on life history and life-table parameters of two-spotted spider mite (*Tetranychusurticae*). ExpApplAcarol 42:121–129

MeinazNissar, Sushil Kumar, IrhamRasool, Showkat Dar, G. M. Lone and RafiyaMushtaq , Efficacy of Various Insecticides against Pear Psylla (*Psyllapyricola*Foerster) on Pear in Kashmir, Vegetos 30(Special) 2017

Oatman, E.R. and E.F. Legner. 1961. Bionomics of apple aphid, *Aphis pomi*, on young non bearing apple trees. J. Econ. Entomol. 54: 1034-1037.

Pearsall I A and Myers H J (2000). Effect of Neem on oviposition choice and larval survival of Western Flower thrips, *Frankliniellaoccidentalis* (Thysanoptera: Thripidae). J Econ Entomol 93: 389-395.

Pires, E. M., and R. L. Koch. 2020. Japanese beetle feeding and survival on apple fruits. Biosci. J. 36: 1327–1334. doi:10.14393/BJ-v36n4a2020-50364.

Potter, D. A., and D. W. Held. 2002. Biology and management of the Japanese beetle. Annu. Rev. Entomol. 47: 175–205.

Racette, G., G. Chouinard, C. Vincent, and S. B. Hill. 1992. Ecology and management of plum curculio in apple orchards. Phytoprotection 73: 85-100.

Shanovich, H. N., Dean, A. N., Koch, R. L., and E. W. Hodgson. 2019. Biology and management of Japanese beetle (Coleoptera: Scarabaeidae) in corn and soybean. J. Integr. Pest Manag. 10. doi:10.1093/jipm/pmz009.

Sharma JP, Khajuria DR. Some observations on the bioecology and management of apple root borer, *Dorystheneshugelii*Redtenbacher (Cerambycidae: Coleoptera) in Himachal Pradesh. In: National Seminar on Plant Protection towards Sustainability, 22-24 December, 1997. National Plant Protection Training Institute, Hyderabad-Andhra Pradesh (India) 1997, 3.

Shellhorn N A, Glatz R V and Wood G M. (2010). The risk of exotic and native plants as hosts of four pest species (Thysanoptera: Thripidae). Bull Entomol 23: 1-10.

Vincent, C., G. Chouinard, and S. B. Hill. 1999. Progress in plum curculio management: a review. Agric. Ecosyst. Environ. 73: 167-175.

Westigard, PH and Zwick, RW (1972). The pear psylla in Oregon. Oregon State University, Agricultural Experiment Station Technical Bulletin 122: 22 pp

Yee, WL, and R Goughnour. 2006. New host records for the apple maggot, *Rhagoletispomonella* (Diptera: Tephritidae) in Washington State. Pan-Pacific Entomologist 82(1): 54 – 60.