

Innovative approaches for insect pest management in floriculture

In context of insect pest challenges, Integrated Pest Management (IPM) techniques that emphasize the use of biocontrol agents, bio-pesticides, and organic pesticides offer promising solutions to combat resistant pest populations. Moreover, adopting holistic approaches, such as trap crops, banker plants, and pollinator-friendly practices, can help maintain the ecological integrity of floriculture systems and promote sustainable crop production. This article offers an in-depth look at the nature of damage and management of major pests affecting important flower crops.

THE floriculture sector is experiencing rapid global growth, including significant expansion in India, driven by high commercial and aesthetic demand. The cultivated area under flower crops in India has nearly tripled, from 1.06 lakh ha in 2001-02 to 3.39 lakh ha in 2018-19. States like Maharashtra, Karnataka, Andhra Pradesh, Haryana, Tamil Nadu, Rajasthan, and West Bengal have emerged as major floriculture centres in a country. However, the sector faces significant biotic stress issues from pests like lepidopteran borers, defoliators, aphids, thrips, midges, whiteflies, mealybugs, scales, and mites, leading to considerable economic losses. Due to the high market sensitivity to the visual appeal of flowers, floriculture heavily relies on pesticides for rapid pest control. The absence of direct involvement in the food chain has led to the neglect of issues such as pesticide residues on flowers and associated health risks. Additionally, in India, a lack of proper pesticide recommendations for flower crops by the Central Insecticides Board & Registration Committee (CIB&RC), India further exacerbates the indiscriminate use of harmful chemicals by the farmers. This overreliance on broad-spectrum pesticides, often advised by sellers, undermines the health of pollinators and natural enemies within the agroecosystem, crucial for maintaining ecological balance.

Pesticide misuse, including fixed spray schedules irrespective of pest population densities, contributes to pesticide resistance in pests and disrupts the ecosystem services provided by non-target organisms like pollinators and biocontrol agents. These organisms are particularly vulnerable to pesticides, and their decline can result in pest resurgence and secondary outbreaks, leading to a vicious cycle where farmers increase pesticide dosages, further endangering human health and biodiversity. In light of these challenges, Integrated Pest Management (IPM) techniques that emphasize the use of biocontrol agents, bio-pesticides, and organic pesticides offer

promising solutions to combat resistant pest populations. Moreover, adopting holistic approaches, such as trap crops, banker plants, and pollinator-friendly practices, can help maintain the ecological integrity of floriculture systems and promote sustainable crop production. This article provides information on the nature of damage and management of major pests affecting important flower crops.

Pests of important flower crops and their management

Tuberose (*Agave amica*)

More than 10 pest species are known to damage various parts of the tuberose plant. Among these, the blossom midge (*Contarinia maculipennis*) and mealybugs (*Ferrisia virgata* and *Dysmicoccus* sp.) are considered highly destructive pests of tuberose in several states across India. Blossom midge maggots feed on the internal contents of flower buds causing deformities in buds and



Tuberose midge (*Contarinia maculipennis*) damage



Tuberose mealybug (*Ferrisia virgata*) damage

florets, which significantly reduces the market value of the produce. Mealybugs extract sap from stems, leaves, and the underground parts of plants, leading to stunted growth, drooping, and eventually the death of the plants. Following management practices have been suggested to combat the damage caused by major pests of the tuberose:

- Washing the bulbs with silicon (organo-trisiloxane) surfactants @ 0.2 mL/L water and shade-dried before planting to prevent initial source of mealybug infestation in the field.
- Regular collection and destruction (at 20-25 days interval) of midge infested buds and mealybug infested leaves.
- Avoid flood irrigation and prefer drip irrigation. It will ensure sufficient moisture at root zone to reduce mealybug colonies and it will also keep the soil between the two rows dry to reduce pupation rates of midges.
- Frequent racking up/harrowing the soil between tuberose at 20-25 days interval to disrupt the life cycle of midges and mealybugs.
- Fix yellow sticky traps @ 100/ha for mass trapping of sucking pests as well as midges.
- Encourage parasitoids and predator populations in the field to enhance natural biological control of pests.
- Spray NSKE 5% @ 5 mL/L water for three times at 20 days interval during flowering for midge and mealybugs.
- If mealybug infestation starts, spray towards the basal region with alternate spray of Fish Oil Rosin Soap (FORS) 25% @ 3 mL/L water and silicon (organo-trisiloxane) surfactants @ 0.4 mL/L water (or as per label of the product) at 15 day interval until the control of mealybugs.
- Chemical control package consisting of spray towards the basal region twice with Thiamethoxam 12.6% + Lambda-cyhalothrin 9.5% ZC @ 0.5 mL/L at 15 days interval have been found effective in field trials at ICAR-DFR, Pune.

Rose (*Rosa* spp.)

Several pest species are known to infest rose plants during different growth stages. Amongst, thrips (*Thrips* sp.), aphids (*Macrosiphum rosae*), red spider mites and bud borer (*Helicoverpa armigera*) are common pests of roses in India. Thrips (nymphs and adults) primarily damage flowers by feeding, reducing the aesthetic value of rose blooms. Severe infestations may prevent buds from opening, while feeding causes silvery or bleached spots on petals that turn brown and dry. Both nymphs and adult aphids damage rose plants by extracting plant sap, especially from tender plant parts and flower buds, leading to distorted or stunted growth. Caterpillars of *H. armigera* feed on the internal contents of rose buds, leading to direct economic losses. Mites feed by sucking the sap from rose leaves, which can result in stippling, bronzing, yellowing, or reddening. Affected leaves may also curl and eventually drop off. Following management strategies are suggested for management of major pests of roses:

- Deep ploughing of the field to kill the hibernating stages of insect pests.

- Collection and destruction of egg masses of leaf caterpillars and hairy caterpillars on lower side of leaves.
- Install light traps to attract adult moths of budborer and leaf caterpillar.
- Use yellow sticky traps @ 100/ha for mass trapping of aphids and white flies, and blue sticky traps @ 100/ha for thrips.
- Use pesticides judiciously and only when necessary, adhering to the labelled guidelines. Additionally, rotate pesticides from different chemical classes to prevent the development of resistance.
- Recommended chemical pesticides for rose thrips include spray of Dimethoate 30% EC @ 0.6 mL/L water.
- Recommended chemical pesticides for rose mites include sprays of Bifenazate 50% WP @ 0.25 g/L or Bifenazate 22.60% SC @ 0.25 mL/L or Flufenoxuron 10% DC @ 1 mL/L or Hexythiazox 5.45% w/w EC @ 1 mL/L or Milbemectin 1% EC @ 0.45 mL/L water.
- Follow updated recommendations and guidelines from the Central Insecticides Board & Registration Committee (CIB&RC), Faridabad, for pesticide use in flower crops.



Rose thrips damage



Rose aphid damage

Jasmine (*Jasminum* sp.)

Jasmine budborer complex consisting of lepidopteran borers and blossom midges cause economic losses to jasmine. Among budborers, *Hendecasis duplifascialis* and *Contarinia* sp. are major pests that cause huge economic losses across India. The caterpillars of the budborer, *H. duplifascialis*, feed on the inner contents of jasmine buds, and occasionally on the inner petals. Affected buds turn purple and fall from the plant. The caterpillars' excreta are often visible on the exterior of the infested buds. The maggots of the blossom midge, *Contarinia* sp., feed on the inner parts of flower buds, causing them to turn purple, become deformed, and eventually drop off before blooming.

Following management practices have been suggested to manage the damage caused by bud borers in jasmine:

- Regular collection and destruction of damaged buds.
- Encourage drip irrigation facility. Besides saving



Budborer (*Hendecasis duplifascialis*) damage



Blossom midge (*Contarinia* sp.) damage

water, drip irrigation maintains enough soil moisture only at root zone and keep the space in between rows dry, which affects the pupation process of many pests.

- Mulching or weed mats in between plant rows create barriers for several bud feeders to complete pupation.
- Frequent racking up/harrowing the soil between plants at 20-25 days interval to disrupt the life cycle of midges, thrips and lepidopteran borers.
- Fix yellow sticky traps @ 100/ha for mass trapping of sucking pests.
- Soil application of *Metarhizium anisopliae* 1.5 WP @ 5 Kg/ha through FYM.
- Alternate sprays of Azadirachtin 1EC @ 1 mL/L water followed by Bt var k 8WP @ 2 g/L water for three times at 15-20 days interval during flowering helps to reduce budborer and midges on jasmine.
- Three spray of NSKE 5% @ 5 mL/L water and Spinetoram 12% SC @ 0.9 mL/litre water at 15-20 days interval during flowering also found effective against budborers and thrips in field trials at ICAR DFR, Pune.



Cotton aphid, *A. gossypii*



Chrysanthemum aphid, *M. sanborni*



H. armigera feeding on flower buds of chrysanthemum



S. litura feeding on flower buds of chrysanthemum

Chrysanthemum (*Chrysanthemum morifolium*)

More than 15 pests are known to cause damage to chrysanthemum plant parts. Among them, thrips (*Thrips* sp.) and aphids (*Aphis gossypii* and *Macrosiphoniella sanborni*) cause damage to flowers and other plant parts. Three pests, viz. *Helicoverpa armigera*, *Spodoptera litura* and *Spilartia obliqua* cause damage to leaves as well as flower buds.

Following management practices have been suggested to reduce the damage caused by these pest complex in chrysanthemum:

- Regular collection and destruction (at 15 days interval) of *Spodoptera* and BHC egg masses as well as gregarious larvae during vegetative stages.
- Fix DFR sticky traps @ 100/ha for sucking pests.
- Encourage natural enemies in the field and avoid use of synthetic pesticides considering pest: defender ratio in the field.
- Avoid excess use of nitrogen, as it makes plants susceptible to sucking pests.
- Regular harvesting of flowers to minimize pest load in the field.
- Foliar sprays of commercial formulations of NPVs of *S. litura* and *H. armigera* @ 500 LE/ha for effective management of budborers and leaf eating caterpillars.
- Two sprays at a 15 days interval of neem oil-based formulation of Azadirachtin 1 EC @ 0.1% mixed with organo-trisiloxane surfactant @ 0.025% for aphids, budborers and thrips during vegetative and bud formation stage.
- In case of severe infestation, apply two sprays at a 15 days interval of Spinetoram 12 SC @ 0.9 mL/L followed by Flonicamid 50 WG @ 0.4 g/L water during vegetative and bud formation stage.

CONCLUSION

The rapid growth of the floriculture sector in India presents both opportunities and challenges. While the increased area under flower cultivation reflects a strong market demand, significant pest pressures threaten the economic viability of this industry. The reliance on broad-spectrum pesticides, often driven by a lack of appropriate recommendations and practices, has led to detrimental effects on pollinators and the overall ecosystem, contributing to resistance and health risks. To address these issues, adopting IPM strategies that prioritize ecological health and utilize biocontrol agents, bio-pesticides, and organic solutions is essential. Implementing holistic practices, such as cultural practices and pollinator-friendly methods, can enhance sustainability in floriculture. Ultimately, a shift toward more responsible pest management practices will not only safeguard the floriculture sector but also promote biodiversity and environmental health.

For further interaction, please write to:

Dr Dnyaneshwar Madhukar Firake (Senior Scientist), ICAR-Directorate of Floricultural Research, Pune, Maharashtra 411 036.
*Corresponding author email: dfirake@gmail.com