ISSN–0974–0759 | ●●● Popular Article ●●● |Visit us : *www.researchjournal.co.in*|

# Integrated pests and pollinators management (IPPM) strategies for onion seed production

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**Introduction:** Globally, India is one of the major producer and exporter of onion. It ranks first in area and second in production. However, our productivity is still low (14.21 t $ha^{-1}$) relative to the world average (19.47 t $ha^{-1}$). It is partly due to the losses incurred by pests and lack of supply of quality seeds for cultivation. Onion is highly cross-pollinated crop and the flowers are protandrous, self pollination is largely absent. The process of cross-pollination in onion relies primarily on upon insects forage visits. In the lack of insect pollinators, few seeds set are likely. Under natural conditions, onion umbels are visited by variety of insect species and their ecosystem services are important in order to accomplish quality seed production. The safety of existing pollinating insects and the introduction of pollination management strategies are critical. At the other hand, use of synthetic insecticides to combat pest such as like *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) and its transmitting diseases poses a significant threat to the pollinators health in onion seed production system. Therefore,' a holistic approach for the management pests and pollinators must be implemented in order to monitor, suppress the pests and conserve the pollinators. In this context, to make awareness of seed growers, in this chapter we have provided list of pests and pollinator insects (Table 1 and 2), their challenges, scope of integrated pest as well as pollinator's management. The information and strategies provided with this chapter would be very much useful for seed growers to adopt sustainable approach in pest and pollination management.

**Fig. 1 : Onion umbel**

**Table 1 : Insect pests of onion seed production system**

| Sr. No. | Common Name | Scientific Name | Damaging stage | Nature of feeding | Damage symptom |
|---|---|---|---|---|---|
| 1. | Onion thrips | *Thrips tabaci* Lindeman | Larvae and adults | Onion stalk and Umbel | Silvery patches/streaks on leaves/ stalk and distorted flowers/umbel |
| 2. | Tobacco caterpillar | *Spodoptera litura* Fabricius | Larvae | Onion stalk and Umbel | Defoliation/bore holes on the umbel stalk, umbels |
| 3. | Beet army worm | *Spodoptera exigua* Hubner | Larvae | Onion stalk and Umbel | Defoliation, papery batches of damaged plants/bore holes on the umbel stalk, umbels |
| 4. | Head borer | *Helicoverpa armigera* Hubner | Larvae | Onion stalk and Umbel | Defoliation/bore holes with fecal on the umbel stalk, umbels and broken umbel stalks |
| 5. | Red spider mite | *Tetranychus cinnabarinus* (Boisduval) | Nymphs and adults | Onion stalk and Umbel | Spider like webbing on top of umbel |

**Integrated strategies for pests and pollinators management:** The use of synthetic insecticides in onion is impotant because they are an integral component in Onion thrips, *Thrips tabaci*, IPM. Thrips is a key pest of seed onion at all times and vectors of deadly onion disease, Irish Yellow Spot Virus. In addition to this, miner pests such as Tobacco caterpillar, *Spodoptera litura*, Beet army worm, *S. exigua*, Head borer, *Helicoverpa armigera* and Red spider mite, *Tetranychus chinnaberinus* also become critical as they occurs as sporadic and are capable of causing significant damage to onion foliage and umbels. The following are the vital strategies for pests and pollinator management in onion seed production system.

**Seed bulb dipping:** Before planting the onion seed at main field dip the entire bulbs in a solution of 0.025 per cent carbosulfan for 2 hours prior to planting in the main field. This method would help to protect the freshly sprouted leaves in early stage of crop. It would prolong the thrips infestation and significantly reduce the population load in standing crop upto 30 days of planting.

**Safer application of insecticides:** Since, bees are primary pollinators of onion, sustaining the bee health is essential to maintaining the abundance of dominant pollinators and ensuring successful pollination. Therefore, spray shedule to be implemented as window strategy. Application of reccomended dose of insecticides *viz*., profenophos (@ 1 ml/lit), fibronil (@ 1 ml/lit), carbosulfan (@ 2 ml/lit) must be performed with intense before the begning of umbel initiation and not after flower opening. Temporal isolation, preferably late evening spraying is reccomended as the foragers are absent during this time so that one can avoid immediate exposure of bees to this poisionous chemicals.

**Habitat manipulation for bee activity:** The neighbouring crops of onion seed crop should be non be appealing to bees. Inviting timely bee visits and increasing rate of visits is suggessted by planting of bee attracting crops such as mustard, fennel, coriander in and around of onion field is suggested. The planting mustard as border/intercrop after two weeks of onion bubling demonstrates maximum, far atrractive to bees and facilitates more bees visits. This approach is works like atrract and divert of insect foragers in time and could increase 0.60-fold more visitation than the sole onion planted. However, these attractive crops should be cut down/ harvested and no more trap crop stand is adviced when the start of the umbel initiation is underway.

**Good agronomy practices:** Balanced use of ferilizers and the maintainance of good irrigation management are necessary to ensure adequate nector production in flowers. Too wet and dry fields will results into low amount of nector production, which is not ideal for visits to bees. The irrigation at intervals of 10-12 days will be optimum to ensure a good visitation pace.

**Managed pollination:** An important practice required to achive good pollination rate. For open-pollinated varieties, systemically placing of bee hives of *Apis mellifera* or *Apis cerana* @ 4-6 hives/acre will increase the bees activity and the success rate of pollination. Hives are to be placed when 10 per cent of the flowers are opened. Stingless bee *Tetragonula* spp. can also been supplemented but requires more hives (almost double) than the *Apis* species colonies. Hives are to be kept in and around the field, provided proper shade at the top. Always good to keep hives entrance directed towards field interior to ensures that bees are working within onion field rather than foraging elsewhere. Colony with good strength, free of diseases and mites is recomended. In order to ensure

**Table 2 : Insect pollinators of onion seed production system**

| Order | Family | Common Name | Scientific Name | Forage source |
|---|---|---|---|---|
| Hymenoptera | Apidae | Rock bee | *Apis dorsata* Fab. | Pollen, Nectar |
| | | India bee | *Apis cerena* Fab. | Pollen, Nectar |
| | | Italian bee | *Apis mellifera* Fab. | Pollen, Nectar |
| | | Small bee | *Apis florea* L. | Pollen, Nectar |
| | | Stingless bee | *Tetragonula* sp. | Pollen, Nectar |
| | | Carbender bee | *Xylocopa* sp. | Pollen, Nectar |
| | Vespidae | Wasp | *Vespa* sp. | Nectar |
| Lepidoptera | Pieridae | Yellow butterfly | *Pieris rapae* L. | Nectar |
| | Danaidae | Calotropis butterfly | *Danais chrysippus* (L) | Nectar |
| Diptera | Syrphidae | Syrphids | *Eristalis* sp. | Nectar |
| | Muscidae | Housefly | *Musca domestica* L. | Nectar |

the health of the bee hives, regular inspection of the colony is necessary.

**Conclusion:** Quality seed production in onion is primary driven by insect pollinators, their foraging visits and bees are the major pollinating agents in onion. Amount of forage visitation, time of visitation, type of visit and visiting insects determine quantity of pollination and efficiency. However, use of chemical pesticides against onion thrips, *Thrips tabaci*, less diversity in and around the area of field and man-made influences such as urbanization may have negative impacts on insect pollination service. It is therefore crucial to adopt sustainable way of approach to retain and conserve the existing insect pollinators in onion seed production ecosystem.

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***Received :*** *27.03.2020* ***Revised :*** *21.04.2020* ***Accepted :*** *22.05.2020*