21st Century Invaders: Insect Pests Endangering Horticultural Crops

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ABSTRACT

In recent years, the introduction and spread of invasive insect pests have posed significant threats to agriculture, ecosystems and biodiversity worldwide. The introduced pests from one region to another which are destroying crops very disruptively and these introduced pests are known invasive pests. These pests, often transported through global trade and travel, can rapidly establish and outcompete native species, leading to severe crop losses and ecological imbalances. Effective management strategies including early detection, biological control and sustainable practices are crucial for minimizing their impact. Additionally, protecting natural ecosystems and mitigating climate change can reduce the risk of future invasions.

INTRODUCTION

India is one of the world's largest producers of fruits, vegetables, spices, flowers, plantation crops and medicinal plants. This sector plays a key role in improving farmers' livelihoods, ensuring nutritional security, boosting export potential and creating employment opportunities, particularly for small and marginal farmers. Nowadays the farmers are facing severe problem in Horticultural field due to pests by direct and

indirect losses and thrive into the environment that made a severe damage and rapidly destroying crops. These invasive pests are one of the major and most rapidly growing threats to agricultural biodiversity, livelihood, human and animal health, results in a huge economic loss. Additionally, these invasive pests damage the farmers field by a major cause in crop loss, by quality degradation, by increase in the costs of production, by market restrictions and makes a food security risk.

Invasive insect pests are non-native or exotic organisms that occur outside their natural adapted habitat and dispersal potential. However, some of the invasive insect pests become invasive when they are introduced deliberately or unintentionally outside their natural habitats into new areas where they express the capability to establish, invade and outcompete native species. According to the International Union for Conservation of Nature and Natural Resources (IUCN) invasive insect pest is one which becomes established in natural or seminatural ecosystems or habitat and threatens native biological diversity. Alien species is a species introduced by humans- either intentionally or accidentally outside of its present distribution, however not all alien species have negative impacts only between 5% and 20% of alien species become problematic. The globalization has increased international agricultural trade and movement of seeds and planting materials has enhanced the risk of introduction of invasive insect pests into India. These insect pests can multiply in large proportion and cause damage to economically important plant species and crop plants.

Some of the major invasive insect pests affecting horticultural crops are:

1. Rugose Spiralling Whitefly (RSW)

Aleurodicus rugioperculetus: Aleyrodoidea: Hemiptera

- *A. rugioperculatus* was originally described from Belize and belongs to the native species-group of Aleurodicus. It is naturally distributed in Belize, Guatemala, Mexico and subsequently, it has spread to 22 other countries in Central and South America, including Florida, USA.
- In India first time reported on coconut from Pollachi, Tamil Nadu during August, 2016. Later the massive outbreak was noticed in Karnataka, Andhra Pradesh, Telangana, Maharashtra, *etc*...
- The life cycle of RSW spams for 30-40 days. Eggs are laid in spiral shaped on lower surface of the leaves that hatch into crawlers and settle to feed.
- Nymphs and adults suck the sap from lower surface of the leaves produce large number of honeydew excretion which promotes the development of black colour sooty mould fungus that reduces the photosynthesis and lead quality. Heavy infestation leads to leaves to turn yellow, wilt and drop prematurely
- Host range: Coconut, Sapota, Mango, Banana, Custard Apple, Guava, Curry leaf tree, Papaya, White wax Jambu, Indian Almond (Pradhan *et al*., 2021).

2. South-East Asian thrips

Thrips parvispinus (Thripidae: Thysanoptera)

- *T. parvispinus* has been documented from Thailand to Australia. It is reported on papaya in Hawaii, Gardenia sp. in Greece, vegetable crops like Capsicum, green beans, potato and brinjal from other countries.
- Occurrence of this species in India has been first reported on papaya from Bengaluru. This thrips poses a growing concern for various Horticultural crops and ornamental

plants across the region. Recently an outbreak has been reported from southern states especially on chilli crops causing 50-80 per cent damage.

- *T. parvispinus* completes a life cycle in 13–14 days. Female thrips insert their eggs into the leaves and larvae hatch after four to five days. *T. parvispinus* nymphs harm plants by rasping and sucking sap, primarily on the undersides of leaves while adults target flowers and leaves. Severe infestations cause leaf discoloration, distorted lamina with necrotic patches, flower drop, stunted growth and reduced fruit production.

- Host range: Chilli, capsicum, mango, cotton, drumstick, cucumber, bottle gourd, bitter gourd, beans, marigold, chrysanthemum, watermelon, coccinea, brinjal *etc*… (Prasannakumar *et al*., 2021).

3. South American tomato leaf miner

Tuta absoluta (Meyrick) Gelechiidae: Lepidoptera

- Since 1960s this moth has become one of the key pests of tomato in South America. In Europe, it was reported in Spain during 2006. Later it was recorded in Morocco, Tunisia, France, Italy, Netherland, Albania, Portugal, Bulgaria, Cyprus, Germany, Israel, Hungary, Greece, Bahrain, Iraq, Japan, Jordan, Kuwait, Qatar, Saudi Arabia, Syria, Turkey, Yemen, Ukraine

- In India, it was first reported in 2014 on tomato followed by reports on potato at Bengaluru (Karnataka) and later from Pune, Maharashtra.

- *T. absoluta* had a lifecycle consisting of egg, larva, pupa and adult. Egg hatches in 4-6 days and larva passes through 4 instars, which is the most damaging stage feeding on leaves, stems and fruits, which will live up to 10-13 days. The pupation takes place either in the soil or larval galleries which develops into adult and live up to 20-25 days and lay the eggs to repeat the cycle (Halder *et al*., 2017).

- Larva bores into internal tissues. Formation of irregular patches and serpentine mines can be seen on the leaves. This damage the photosynthesis process causing leaf drying and eventually death of the plant can be seen. Larva also attack on the fruits, bores into small holes, making tunnels inside filled with black frass, making fruits unmarketable and vulnerable to secondary infections.

- Host Range: Tomato is the main host plant but it also attacks potato, eggplant, peppers, pepinodulce and wild Solanaceae such as *L. hirsutum*, *S. americanium*, *S. hirsutum*, *S. nigrum*, *Datura stramonium* and *Nicotiana glauaecte*, sweet pepper, tobacco, bean, cape gooseberry, green bean and Malva sp.

4. Cassava Mealy Bug

***Phenacoccus manihoti* (Pseudococcidae: Hemiptera)**

- Origin: South America. Introduced from South America to Africa in 1970 and then in Asia, Thailand (2008) on cassava.

- In India first reported from Kerala in April 2020 and then in Tamil Nadu. In India, Southern India was at most risk of infestation.

- The life cycle of CMB consisting of egg, nymph and adult. Female lay 300-600 eggs in cottony scales which hatch into nymphs that feed on plant sap for 14-20 days before maturing. Adult female reproducing without males live for 30-60 days causing significant damage to cassava crops.

- Nymphs and adults suck sap from young shoots, leaves and stems causing chlorosis,

leaf deformation and early drying. Produce large amount of honeydew excretion which promotes the development of black colour sooty mould fungus reduces photosynthesis process and leaf quality.

- Host range: In India, which survive in the field between cassava crops. It has also been reported in other hosts like Capsicum spp. Citrus, Ipomoea batatas (sweetpotato), *Glycine max* (soyabean), *Manihot glaziovii* (ceara rubber), Cyperus (flat sedge) *etc*… in other countries (Chakupurakal *et al*., 1994).

Table 1: Notable Invasive Insect Pests of the 21st Century Affecting Horticultural Crops in India

Sl. No	Common Name	Scientific Name	Entry to India (Place)	Native
01	Eucalyptus gall wasp /Blue gum chalcid	*Leptocybe invasa* (Hymenoptera: Eulophidae)	2001-Karnataka /Tamil Nadu	Australia
02	Erythrina gall wasp	*Quadrastichus erythrinae* (Hymenoptera: Eulophidae)	2006-Kerala	Tanzania, East Africa
03	Papaya mealy bug	*Paracoccus marginatus* (Hemiptera: Pseudococcidae)	2007-Coimbatore, Tamil Nadu	Mexico
04	Jack Beardsley mealybug (Banana)	*Pseudococcus jackbeardsleyi* (Hemiptera: Pseudococcidae)	2012-Karnataka	America
05	Madeira mealybug (Hibiscus)	*Phenacoccus madeirensis* (Hemiptera: Pseudococcidae)	2012-Karnataka	Neotropical
06	Coconut Spindle infesting leaf beetle	*Wallacea* sp. (Coleoptera: Chrysomelidae)	2014/2015-Andaman Islands	Australia
07	Nesting whitefly (Coconut)	*Paraleyrodes minei* (Hemiptera: Aleyrodidae)	2018-Kerala	Syria
08	Bondar's Nesting Whitefly (Coconut)	*Paraleyrodes bondari* (Hemiptera: Aleyrodidae)	2018-Kerala	Central America
09	Woolly Whitefly	*Aleurothrixus floccosus* (Hemiptera: Aleyrodidae)	2019- Kerala	Neotropical
10	Neotropical Whitefly (Coconut)	*Aleurotrachelus atratus* (Hemiptera: Aleyrodidae)	2019-Mandya/ Bangalore	Brazil
11	Apple leaf miner	*Leucoptera malifoliella* (Lepidoptera: Lyonetiidae)	2020- Kashmir Valley	Europe and Asia
12	Mango soft scale	*Fistulococcus pokfulamensis* (Hemiptera: Coccidae)	2022- Karnataka	Hong Kong

Rugose spiraling whitefly

South American tomato leaf miner

South East Asi Thrips

Cassava mealy bug

CONCLUSION

The rapid spread of invasive insect pests presents significant challenges to agriculture and biodiversity worldwide. Effective management strategies including early detection, biological control and sustainable practices are crucial for minimizing their impact. Fighting against invasive insect pests requires teamwork and prompt action. Early detection and effective pest control methods can help minimize their impact. International cooperation and information sharing are essential to prevent their spread. Additionally,

protecting natural ecosystems and mitigating climate change can reduce the risk of future invasions. A strategic and well-managed approach ensures crop security and environmental sustainability, helping to safeguard global agricultural systems.

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