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Introduction to alien insect pests on agriculture associated with Indian region and management

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Abstract
Invasive insect pests unknown species accidently introduced. Large number introduce in many species in India. Its control or management very difficult to farmers and other. The Indian agricultural economy is the vulnerable to threat from many bio potential arms mainly invasive insect pests. Causes large loss by invasive species. Invasive insect pests species are exotic, introduced, foreign, non-indigenous or non origin. Invasive pest species have rapidly established and spread in a new area. The number of invasive insect pests species are introduce in India last 20th and 21st century by accidentally and they has greater impact on agriculture. There is a need for interdisciplinary coordinated work among scientists, in identifying invaded organisms and in assessing their ecological problems, environmental concerns in different ecosystems, economic damage and sustainable management by prevention, eradication and control. Invasive species control, uses many phytosenitory certificate, quarantine measurement etc.

Keywords: pests, ecosystems, prevention, phytosenitory certificate

Introduction
Invasive pest species have the potential to develop rapidly and spread in a new area to cause significant crop loss and can adversely affect food security. In India, a total of 25 species of invasive pests are recorded from 1889 to till date. Most of the invasive pests had an outbreak and destroyed the crops because they came into India without their natural enemies. Therefore, exploration should be made in the areas of origin of the pests or efforts should be made to search some effective natural enemies in the invaded area so that the pest population could be curtailed within Economic Threshold Level There is a need for interdisciplinary coordinated work among scientists, in identifying invaded organisms and in assessing their ecological problems, environmental concerns in different ecosystems, economic damage and sustainable management by prevention, eradication and control. Hence, it is necessary to know the recent invasive pests to protect the crops from economic loss.

Common characteristics, colonization and process of invasive species
Invasive pest species have invaded and affected indigenous biota in virtually every ecosystem of the earth. Invasive species can transform the structure and species composition of ecosystems by repressing or excluding origin species, either directly by outcompeting them for resources or indirectly by changing the way nutrients are cycled through the system. The environmental cost is the irretrievable loss of origin species and ecosystem. There are following characters of invasive pests species describe (Rejmanek and Richardson, 2000) [15].

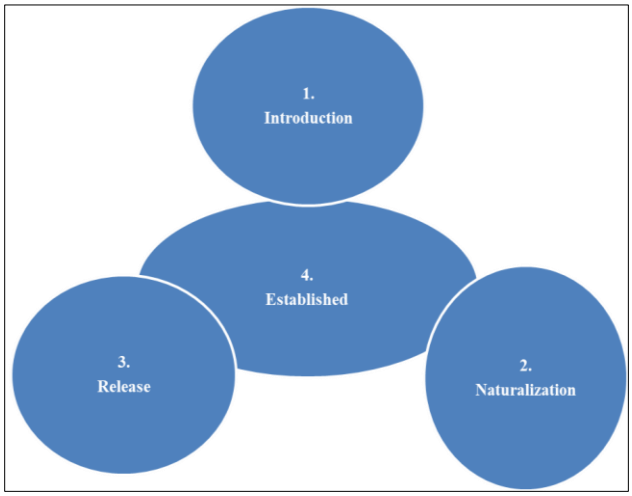

Fig 1: Colonization process

Characteristics of Invasive Species

- It very high and rapid reproduction.
- Fast growth.
- Phenotypic plasticity.
- It more compatibility to survive
- It able to live off of a wide range of food types.
- Strong potential to compete with a origin species.
- Association with humans.
- Ability to move long distances.
- Tolerance of a wide range of environmental conditions.

Effects of Invasive Pest Species on agriculture

The effects of invasive insects pests species is larger threat to agriculture. Without natural enemies or control in the new land they take over the agriculture ecosystem. They can transform the structure and species composition of agriculture ecosystem by excluding origin species by out competing them for resources by changed the behavior are life cycle through the system they cause negative effects on, agro ecosystem/ecosystem, biodiversity, health, economics and decreased produced yield. There are following species which is introduces in Indian and their impact on agro- ecosystem and non-agro ecosystems.

Fall Armyworm, *Spodoptera frugiperda*

The Fall Armyworm, *Spodoptera frugiperda* is a devastating pest of maize that is native to tropical and subtropical regions of the western hemisphere from the United States of America to Argentina. The caterpillars of this moth feed on leaves, stems and reproductive parts of many plant species preferably Gramineae family including maize, millet, sorghum, sugarcane, rice, wheat etc.

It commonly feeds on maize, sorghum, and rice. Frequently it also caused injuries to alfalfa, barley, buckwheat, cotton, clover, oat, millet, peanut, ryegrass, wheat, sugar beet, sudangrass, soybean, sugarcane, timothy, tobacco, cabbage, onion, pasture grasses, tomato, and potato if not well managed. It caused major economic losses on these important cultivated crops. FAW could be one of the most damaging crop pests in America. In Brazil, it also caused yield losses of maize up to 34%. In India, it is reported for the first time on maize from Shivamogga district (Karnataka) during May-June, 2018 (Patidar *et al*., 2021) [12]. Damage symptoms: Epidermal leaf tissues are mostly preferred by the young larvae and make holes in leaves, which is the peculiar damage symptom of FAW. Dead heart is a symptom caused by feeding of young plants through the whorl. Window panes of translucent patches are cause by small FAW in the 1st-2nd instars while large irregular elongated holes on leaves are caused by big FAW in the 3rd-6th instars. The matured larvae present in the whorls of older plants can feed on maize cob or kernels, reducing yield and quality.

Cottony cushion scale, *Icerya purchase* Maskell (Margarodidae: Homoptera)

It is introduced 1921. The is the major host plants are wattle tree *Acacia decurrens*, in more numbers of other commodity plant species (Sharma *et al.,* 2018) [18].

The scale insect in the serious damage to the plants in the Nilgiri and other in South India and has became establishment in the country.

San Jose scale, *Quadraspidiotus perniciosus* (Comstock) (Diaspididae: Homoptera)

It is origin from China and introduced 1911. All surface of the young hosts are infested plants. Attacks are generally on wood but, in severe infestations, leaves and fruits may be penetrated. The major host plants are apple, cherry, plum, pear, peach (Sharma *et al.,* 2018) [18]. In 1933 attained pest status in fruit orchards and plantations of poplars and willows. Infest and causes purple discoloured the fruits. Heavy infestation causes cessation of growth and yield loss.

Apple woolly aphid, *Eriosoma lanigerum* (Hausmann) (Aphididae: Homoptera)

This insect origin from China. During 1920 it is reached a pest status in India (Mishra, 1920) [8]. They are attack of the roots develop galls on roots, the whole plant show sickness. It is damage caused by Adult and nymphs in the plants.

Lantana bug, *Orthezia insignis* Browne (Orthezidae: Homoptera)

Introduced into India, Nilgiri region from Sri Lanka. The major host plants are lantana, Coffee, Jacaranda, Citrus, Sweet potato, Rose etc. It is the mobile scale insect. Adult female large waxy consistancy and species is parthenogenetically. Eggs hatch inside the ovisac and the 1st in star nymphs then move out to feed (Sharma *et al.,* 2018) [18].

Diamond-back moth, *Plutella xylostella* (Linn.) (Plutellidae: Lepidoptera)

Its origin from European countries and introduce in 1941. Its polyphagous pest I deferent host plants on crucifers crops *viz*., cabbage, cauliflower, radish, knoll-khol, turnip, beetroot, mustard. Larvae mining and skeletanizase of the leaves.

Subabul psyllid, *Heteropsylla cubana* Crawford (Psyllidae: Homoptera)

It is origin from Central America and introduce in Chengalpattu district of TN, 1988 and Bangalore during May 1988 (Anonymous, 1989) [2]. Sucks the tender plants parts sap from young shoots, leaves and inflorescences. It is very serious pest in southern Indian states.

Potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae)

It is origin from Italy and introduce in India 1907 (Lefroy, 1907) [7]. It is a serious pest of storage potatoes, tobacco, tomato, brinjal, beat. Damage Caterpillars initially mine the leaves and later make way in veins into petioles and then to stem and sometime tubers in the soil. In storage 30 to 70% tubers are damage.

Coffee berry borer, *Hypothenemus hampei* (Ferrari) (Scolytidae: Coleoptera

It is origin from Northeast Africa and first reported in India from Gudalur in Nilgiris 1990 (Kumar *et al.,* 1990) [4]. Probably introduced accidentally either through coffee brought by refugees from Sri Lanka or through illegally imported coffee seeds (Singh and Ballal, 1991) [21]. Grubs burrow into the stem for 8 to 9 months causes wilting of branches. The berries drop prematurely. 80% loss in yield. Prevalent in TN (Gudalur and Kilkotagiri), Kerala (Wyanad) & KT (Kodagu).

Serpentine leaf miner, *Liriomyza trifolii* (Burges) (Agromyzidae: Diptera)
It is origin from USA (Florida) and first report in India appear in the castor research workers' group meeting held at Hyderabad (Anonymous, 1991) [1]. It is polyphagous pest (Srinivasan *et al*., 1995) [22]. Damage larvae mine the leaves feeding on the mesophyll region. Accelerated leaf drop thus exposing fruits like tomato. Vector of diseases. Reduction in crop yields.

Spiraling whitefly, *Aleurodicus dispersus* Russell (Aleyrodidae: Homoptera)
It is origin from Central America. First reported in Hawaii and introduce in 1994 in India (Palaniswami *et al.*, 1995) [11]. It is highly polyphagous pest affecting wide range in more than 481 plants. Nymphs and adults suck the plant sap from the host. Premature leaf drop. Honeydew is produced which serves as a substrate for dense growth of sooty mould disease in barrier to photosynthesis.

Silvery leaf white fly, *Bemisia argentifolii* Bellows (Aleyrodidae: Homoptera)
It is origin from Greece and introduce a biotype B of *B. tabaci* was first noticed in October 1999 in Kolar district, KT. The host plant of the pest is more than 900. This is the associated with an outbreak of tomato leaf curl virus disease (ToLCVD) which resulted in failure of tomato crop (Ramappa *et al.*, 1998) [14]. Damage piercing and sucking the tender plant part sap from the foliage of the plants. Weakening and early wilting of the plant. Reduces the plant growth development and yield. Leaf chlorosis, leaf withering, premature dropping of leaves.

Sugarcane Woolly Aphid, *Ceratovacuna lanigera* Zehntner (Aphididae: Homoptera)
It is origin from Java and first detected in West Bengal 1958. During 2002, outbreak was noticed in MH and KT (Mote and Puri, 2003) [9]. Both the stages nymphs and adults suck the tender part of the plants from the lower surface of the leaves. Developed sooty mould disease (*Capnodium* sp.) developed the all leaves look in the black. Inhibits photosynthesis reaction. In early growth period plants may die. Crop becomes stunted. Reduction in cane yield (25%) and sucrose content (26.71%). The pest has since then spread to Andhra Pradesh, TN and Kerala in the south, and Uttaranchal and Bihar in the north.

Erythrina Gall Wasp, *Quadrastichus erythrinae* Kim (Eulophidae: Hymenoptera)
It is origin from Singapore and Mauritius and introduce in Thiruvananthapuram, Kerala, April 2005. Enter-Through exchange of plant materials. The major symptom of the pest is gall enlargement and malformation, wilting of leaves, severe defoliation and Death of trees.

Papaya Mealy Bug, *Paracoccus marginatus* Williams and Graner de Willink (Pseudococcidae: Homoptera)
It is origin from Mexico, Guatemala and introduce in Coimbatore in TN 2008. The host range is wide sweet potato, cassava, guava, papaya, brinjal etc. polyphagous. Its symptoms show leaf crinkling. Leaves and fruits are covered with honey dew and sooty mould. Potential economic loss: 65 to 80 %. Present status- It has now spread to Kerala, KT, TR and MH (Munippan *et al.*, 2008) [10].

Coconut Eriophyid Mite, *Aceria guerreronis* Keifer (Eriophyidae: Acarina)
It is origin from Gurerero in Mexico 1965 and introduce in Kerala and TN 1998 (Sathiamma *et al.*, 1998) [16]. Present of this pest is AP, KT, Kerala, TN and Lakshadweep Island. Damage- Suck the sap from tender meristematic tissues.

Spiraling Whitefly, *Aleurodicus rugioperculatus* Martin (Aleyrodidae: Hemiptera)
It is origin from South Florida and introduce in 2016, Pollachi, Coimbatore district, TN. Collected by Dr. K. Selvaraj identify by Dr. R. Sundararaj (Sundararaj and Selvaraj, 2016) [23]. At least 118 host plants include. Damage- Causes on high yielding hybrid varieties of coconut. Population range 18 to 37 nymphs/cm^2 of leaflet. The spiraling whitefly in India polyphagous nature.

South American Tomato Leaf miner (SATLM), *Tuta absoluta* Meyrick (Gelechiidae: Lepidoptera)
It is the origin from Peru in South America. It is the first reported in Pune, MH 2014 by ICAR scientist. It has spread to tomato growing regions of Gujarat, Telangana, and A.P. etc. The specimens were collected, identify and deposit in National Pusa Collection (NPC), Division of Entomology, ICAR-IARI, New Delhi by ICAR IARI scientists. Reported by K. Chandrashekar and P.R. Shashank (Shashank *et al*., 2015) [20]. The major host are tomato, potato, eggplant, etc. its damage symptoms is caused by all the larval instars. The larvae feeds on the mesophyll tissue, forming irregular leaf mines. Larvae also damage fruits by making pinhole symptoms and forming galleries. It can cause up to 90% loss of yield and reduce fruit quality in greenhouses and field conditions. It is observed for the first time of ICAR-IIVR, Varanasi and farmers field of Varanasi and Mirzapur district during 2017.

Use strategies for other invasive species management
1. The utility of genomic approaches for determining invasion mechanisms through analysis of gene expression, gene interactions and genomic rearrangements that is associated with invasion events (Lee, 2002) [6].
2. Three imperatives are evident at this juncture, namely: developing policies with sound biological rationales ensuring the effective biodiversity conservation affect; accelerating the implementation action on the ground urgently; and ensuring the legislative frameworks which are adequate to support the policies (Walton, 2008) [25].
3. India maintains active coordination with FAO and with neighboring countries for surveillance, early detection and use of control measures.

Use sustainable management techniques
1. Use landscape management plans with local communities.
2. Identify the close parallelism between ecologically significant keystone species and the socially/ culturally/ religiously valued keystone species (Ramakrishnan *et al.*, 2001) [13].
3. These community based approaches can best be complemented with technologies such as biological control,

which can provide a long term sustainable component to an overall management plan.

Use legal approaches of pests management

1. Techniques to be developed to make rapid assessment of the status and movement of invaders and of their impacts on ecosystem.
2. Efforts are also continuing to improve the export certification process and standards (Shah, 2008) [17].
3. The new order also rationalizes the structure of certification fees and inspection charges.

Use of eradication and control techniques

1. Mechanical control is highly target- specific.
2. Chemical control is often very effective as a short term.
3. Classical biological control is highly cost-effective, permanent, self sustaining, ecologically safe.
4. The support of all stakeholders must be ensured during the entire program (Doddabassppa *et al.*, 2010)[3].
5. Many exotic sawflies and wood wasps have been reduced to insignificant pest status through introduction of parasitoids, or pathogens as shown from Canada (Langor *et al.*, 2000) [5].
6. India lacks a regional policy although it needs it at a regional and national level.
7. All plants leaving and entering a nursery should be checked for sign of infestation (Verma, 2009) [24].
8. In India, the bio-control agent (*Teleonemia scrupulosa*) released for *Lantana* control failed since it could not cope with the vigorous regrowth of *Lantana* at the onset of monsoon rains or the control agent itself suffered heavy mortality during winter (Sharma, 1998) [19].
9. Thus, the need for concerted research on suitable and environment friendly control measures is clear.

Conclusion

Invasion of insects was the result of globalization and the invasive insect pest caused substantial damage to the origin flora and fauna, and also resulted in the extinction of species. These species, if not accompanied by the natural enemies which keep them in check in their origin range, can multiply in large proportion and cause damage to economically important plant species and crop plants. Hence it is necessary to know the recent invasive insect pests in order to protect the crops from economic loss.

References

1. Anonymous. Annual Progress Rep, Castor Direct. Oil Seeds Rese, Hyderabad, India,1991:121:133.
2. Anonymous. Annual Report, Department of Agricultural Research and Education. Ministry of Agriculture, Government of India, New Delhi, 1989.
3. Doddabasappa BB, Basavarju S, Chakravarthy AK, Nagachaitanya B. Strategies for the management of insect invasive. Karnataka J. Agric. Sci,2010:23(1):19-22.
4. Kumar PKV, Prakasan CB, Vijayalakshmi CK. Coffee berry borer, *Hypothenemus hampei* (Coleoptera:Scolytidae): First record from India. J. Coffee Res,1990:20(2):161-164.
5. Langor DW, Digweed SC, Williams DJM, Spence JR, Saunders C. Establishment and spread of two introduced parasitoids (Ichnemonidae) of the birch leafminer, *Fenusa pusilla* (Lepeletier) (Tenthredinidae). Biocontrol,2000:45:415-423.
6. Lee CE. Evolutionary genetics of invasive species. Trends Ecol. Evol,2002:17:386-391.
7. Lefroy HM. The potato tuber moth. Indian Agric. J,1907:2:294-295.
8. Mishra SC. The American blight or wooly apple aphid *E. Lanigerum* (Hausmann), Agric. J. India,1920:15:627.
9. Mote UN, Puri SN. Present status of sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner, a new pest problem on sugarcane in Maharashtra. Paper presented at brain storming session on sugarcane woolly aphid, 2003.
10. Muniappan R, Shepard BM, Watson GW, Carner GR, Sartiami D, Rauf A *et al*. First report of the papaya mealybug, *Paracoccus marginatus* (Hemiptera: Pseudococcidae), in Indonesia and India. J Agril Urban Ent,2008:25:37-40.
11. Palaniswami MS, Pillai KS, Nair RR, Mohandas C. A new cassava pest in India, Cassava Newslett,1995:19:6-7.
12. Patidar S, Das SB, Paradkar VK, Mishra YK. New Invasive Pest Fall Armyworm, *Spodoptera frugiperda:* Identification and Management. AkiNik Publications, 2021, 45. ISBN: 978-93-90846-48-1. https://doi.org/10.22271/ed.book.1199
13. Ramakrishnan PS, Sankaran KV, Murphy ST. Invasive Alien Plants in India: Developing Sustainable Management Strategies, in Secretariat of the Convention on Biological Diversity (2001). Assessment and management of alien species that threaten ecosystems, habitats and species. Abstracts of keynote addresses and posters presented at the sixth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, held in Montreal, Canada, from 12 to 16 March 2001. Montreal, SCBD, (CBD Technical Paper,2001:1:123.
14. Ramappa HK, Muniyappa V, Colvin J. The contribution of tomato and alternative host plants to tomato leaf curl virus inoculum pressure in different areas of South India. Annals of Applied Biology,1998:133:187-198.
15. Rejmanek M, Richardson DM. What makes some conifers more invasive? Proceedings of the Fourth International Conifer Conference report of the papaya mealybug, *Paracoccus marginatus* (Hemiptera: Pseudococcidae), in Indonesia and India, 2000.
16. Sathiamma B, Nair CPR, Koshy PK. Outbreak of nut infesting eriophyid mite *Eriophyes guerreronis* (K.) in coconut plantations in India. Indian Coconut Journals,1998:29:1.
17. Shah A. (2008). The Plant quarantine order in India. FAO Corporate Document Repository. Identification of risks and management of invasive alien species using the IPCC, 1998.
18. Sharma KR, Jaiswal DK, Babu SR, Saraoj AK. Impact of invasive insect Pests species on agroecosystem in India and their management. Indian Journal of Agriculture and Allied Sciences A Refereed Research Journal, 2018. ISSN 2395-1109- e-ISSN 2455-9709.
19. Sharma OP. How to combat *Lantana* (*Lantana camara* L.) menace? A current perspective. J. Sci. Ind. Res,1998:47:611-616.
20. Shashank PR, Chandrashekahr K, Meshram NM, Shreedevi K. Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae)

an invasive pest from India. Indian Journal of Entomology,2015:77(4):323-329.
21. Singh SP, Ballal CR. Status of coffee berry borer (*Hypothenemus hampei* (Ferr.) (Coleoptera: Scolytidae). Technical Document No. 36. AICRP on Biological Control of crop pests and weeds, Bangalore, 1991, 6.
22. Srinivasan K, VIraktamath CA, Gupta M, Tewari GC. Geographical distribution, host range and parasitoids of serpentine leaf miner, *Liriomyza trifolii* (Burgess) in south India. Pest Mamgt. Hort. Ecosys,1995:1:93-100.
23. Sundararaj R, Selvaraj K. Invasion of rugose spiraling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae): a potential threat to coconut in India Phytoparasitica, 2016. DOI 10.1007/s12600-017-0567-0.
24. Verma SS. Quarantine and surveillance mechanism in India, Paper presented in: the workshop on Insect Invasive species, 21 November, 2009 at National Bureau of Agriculturally Important Insects, Bengaluru, 2009.
25. Walton P. Policy of non-native: An RSPB view. The BOU's 2008 autumn Scientific Meeting held at Peterborough, UK, 2008.