Hexapoda (*Insecta indica*)

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International and National Tools and Obligations against Invasive Alien Insect Species: Indian Scenario

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ABSTRACT: Invasive alien insect species upholds excessive dimensions to disturb and upset the ecological equilibrium by invading into the new areas/habitation. It is noticed when an aggressive species invade/encroach in new ecosystem, it may not have local natural enemy system/predator and these hostile species therefore spread rapidly and take precedence on indigenous flora and fauna. International market has opened the windows for global trade in agricultural produce, which has facilitated the global movement (pathway) of alien species and high rate of introduction of invasive species into non-native ecosystems. Different international and national agencies are playing significant role in safe trade of agricultural products to regulate and so prevent the introduction and spread of exotic/alien species and are devoted to avert the movement of alien species across the countries.

Key words: Invasive Alien Species (IAS), trade, international tools, national obligations

Introduction

The liberal progression in trade sector of import and export of agricultural and horticultural products plays a potentially significant role in dispersing Invasive Alien Species (IAS) beyond the borders of their native abodes. The expansion of trade of agriculture produce has gradually amplified in recent era and noteworthy contribution is recorded to uplift the global economy with negotiation of multilateral and regional trade agreements; including World Trade Agreements in 1994. Contrarily, the

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trade across national borders in agricultural goods has opened a window and so provide pathways for Invasive Alien Species (IAS) to be introduced, spread and colonize into new areas/environments where they are not normally found and thereafter, can pose serious adverse consequences for their new environment. Trade is regarded as the prime means (or "pathway") by which alien species can be introduced into new habitat accidentally or deliberately.

In recent epochs, the world has almost crossed the threshold level of expending the geographical areas of pests and arrived in a new period of biological invasions on putting biodiversity in alarming stage. Intentional and unintentional movement of alien species beyond their natural geographical barriers has augmented due to enhanced trade, transport, travel and tourism.

"Alien" species are those that are introduced into new habitats; they are considered "invasive" if they flourish in such a way which threatens biodiversity, wildlife including agricultural and native species. The threats include competition for food among the species, the spread of disease or the spread of predators. Species that are in balance in one environment in their natural habitat can become invasive if they are introduced (accidental or intentional) into another habitation. Invasive species are non-native or exotic that occurs outside their natural adapted habitat and exhibit high dispersal potential to suppress the natural/native species of that area where they get introduced and thereafter on getting congenial environment these alien species become invasive. Once the alien species invaded in new region it's typically hard to eradicate and protect the ecosystem.

The definitions of the commonly used terms are given below:

1. Alien species:

It is defined as "a species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce (CBD).

2. Invasive species:

It is described as "animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem and species (IUCN)

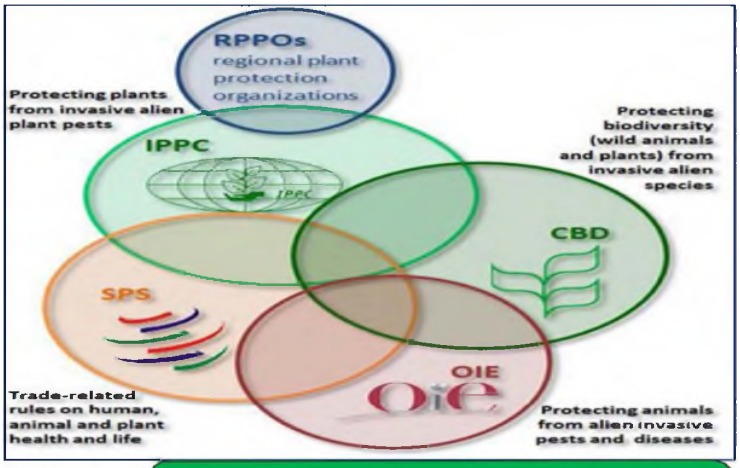
3. Invasive alien species:

It is defined as "an alien species whose introduction and /or spread threaten biological diversity". It is also called as alien invasive species (CBD)

INTERNATIONAL TOOLS AND OBLIGATIONS ON INVASIVE ALIEN SPECIES

Numerous international mechanisms are in place to deal with different aspects of the problem of IAS. There are a number of legislations for invasive species and are entitled to deal with the issues related to these species

1. Convention on Biological Diversity (CBD), adopted in 1992 Is the prime international convention, which is highly committed to take action on invasive alien species (IAS) with all participation of its contracting parties. The aims of the convention are the conservation and sustainable use of biological diversity and the impartial sharing of benefits arising out of the judicious utilization of



International mandate on IAS, Source: Lopian, 2005 [3]

such genetic resources. Article 8(h) of the CBD requires contracting parties/countries to play effective role in planning and implementation of the action plans to prevent the introduction, control or eradication of alien species which threaten ecosystems, habitats or native species.

.Convention Protocols:

• **The Cartagena Protocol on Biosafety,** adopted on 29th January, 2000 and accountable for safe trade (handling, transportation and utilization) of Living Modified Organisms (LMOs) which are of great concern and may reveal potential to threat the human health. The Cartagena Protocol on Biosafety, negotiated under the CBD's auspices, addresses the international movement of living modified organisms (LMOs) with the aim of minimizing the chance that such organisms might present an invasive threat to the environment. This protocol provides a platform where the endorsement has to be made of providing all the necessary information before the import of LMOs by the country. The Protocol comprise of total 40 articles to ensure the protection during trans boundary movement (handling and transport) and judicious use of LMOs which may affect (directly or indirectly) human health, environment, or wholesome biological diversity (Gupta *et. al*, 2008 and CBD).

• **The Nagoya Protocol on Access and Benefit-sharing** entered in force on 12th October, 2014, an international agreement which provide a platform to share/ exchange of information on benefits of adequate utilization of genetic resources.

2. WTO- SPS Agreement- With the establishment of the World Trade Organization the agreement on the Application of Sanitary and Phytosanitary Measures (the "SPS Agreement") entered into force in year 1995. The agreement concerns the implementation of food safety and animal and plant health regulations. The Agreement on the application of Sanitary and Phytosanitary measures (SPS Agreement) is the WTO agreement that most directly relates to prevention efforts, although other WTO agreements, including the General Agreement on Tariffs and Trade (GATT), the Agreement on

Technical Barriers to Trade (TBT Agreement), and the General Agreement on Trade in Services (GATS) also affect these efforts (Burgiel, *et al.* 2006). The WTO- SPS Agreement superseded the GATT, TBT & GATS as the umbrella organization for international trade and institutes the basic international framework structure, requirements and legal obligations for how countries can regulate imports of agricultural commodities that may be facilitating the pathway for introduction and spread of alien species posing threat to public health, animals or plant life.

3. International Plant Protection Convention (IPPC)-The International Plant Protection Convention came into force in 1952 and is one of the "Three Sisters" recognized by the World Trade Organization's (WTO) Sanitary and Phytosanitary Measures (SPS) Agreement, along with the Codex Alimentarius Commission for food safety standards and the World Organization for Animal Health (OIE) for animal health standards. The IPPC also covers provisions applicable to invasive alien species when the species concerned are pests of plants or plant products. The IPPC objective is to prevent the spread and introduction of pests of plants and plant products, meanwhile also to promote appropriate phytosanitary measures for their control during facilitation of safe trade. The convention has provided International Phytosanitary Measures (ISPMs) to regulate the safe trade and to avoid introduction of any quarantine pests. ISPMs, which are embraced by the governing body for the IPPC, provide guidance to the signatory countries to meet their IPPC obligations (as of July 2021, there are 45 adopted ISPMs (ISPM 30 being revoked), 29 Diagnostic Protocols and 39 Phytosanitary Treatments). ISPMs are intended to harmonize phytosanitary measures applied in international trade. The IPPC definition of a quarantine pest covers much, but not all, of what is considered as an invasive alien species under the CBD. Both definitions refer to any organism that is injurious to plants and that has an environmental impact (Tanaka & Larson, 2006). Sometimes IPPC aim perceived as limited to the protection of agricultural and forestry plants but it's not factual. The IPPC covers all plants, including those found in natural and semi- natural habitats and is not only confined to the safety of crop plants but much committed at work for the welfare of whole biodiversity.

Three IPPC recommendations related to IAS legislation

- All the contracting/signatory countries and National Plant Protection Organizations (NPPOs) will indorse the protection of wild flora and biodiversity form pests by implementing the reviving the plant protection laws and policies.

- All the contracting/signatory countries and NPPOs will actively play a part in promotional activities of IPPC guidelines and will showcase positive approach towards national strategies & regulations connected to the threats posed to biodiversity by invasive alien species.

- All the contracting/signatory countries and NPPOs will strengthen the National strategic structure for implementation and utilization of International Standards of Phytosanitary Measures (ISPMs) to safeguard the biodiversity from invasive alien species *(IPPC, 2005b)*

4. Regional Plant Protection Organizations (RPPOs) are the integral part of international framework that is focused on IAS and universal spread of pests and their introduction into endangered areas. RPPOs function as regional coordinating bodies and contribute in different undertakings

related to plant health and trade of agricultural commodities to attain the goals of the IPPC. Till date there are ten RPPOs (Asia and Pacific Plant Protection Commission (APPPC), Caribbean Agricultural Health and Food Safety Agency (CAHFSA, Comunidad Andina (CAN), Comite de Sanidad Vegetal del Cono Sur (COSAVE) European and Mediterranean Plant Protection Organization (EPPO),Inter-African Phytosanitary Council (IAPSC), Near East Plant Protection Organization (NEPPO), North American Plant Protection Organization (NAPPO), Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) and Pacific Plant Protection Organization (PPPO), who works to secure the plant health and biodiversity of their respective regions by monitoring NPPOs activities to implement and promote the IPPC guidelines/activities/international standards of phytosanitary measures and cooperating with other regions to endorse coherent phytosanitary measures for environmental protection.

5. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), entered in force on 1st July, 1975. The Parties to the CITES first and foremost addresses trade in endangered species of wild animals and plants. CITES management authorities are dedicated for providing consultations among Parties' on how to evade or better regulate the transfer of endangered species that may be invasive to the importing party as well on priority the convention ensures the international trade will not pose any threat for the survival of the species. CITES doesn't supersede the national laws nevertheless, it offers an international platform to be adopted by the contraction parties by ensuring the implementation of CITES along with the national legislations.

6. International Union for Conservation of Nature (IUCN) established in 1948 and provides the Red List of Threatened Species (or IUCN Red list) in 1964 which has been emerged out as massive comprehensive information source on the global conservation status of animal, fungi and plant species. It is an abundant store house and effective tool to provide information on various aspects of species like, range, population size, habitat, ecology, use and/or trade, threats and conservation actions required for conservation of nature. Furthermore, in compliance with principles of international law and obligations, the exporting countries have a general accountability to ensure that activities within or beyond the limits of their national jurisdiction would not harm the environment of their and other States in either the way.

INDIAN NATIONAL TOOLS AND OBLIGATIONS ON INVASIVE ALIEN SPECIES

1. National Plant Protection Organization (NPPO), The NPPOs are representatives of the Contracting Parties to the IPPC and authorized for various activities to prevent the entry, introduction and establishment of exotic pests/quarantine in its respective country. NPPOs play crucial role in reporting the occurrence, outbreak and spread of pests, inspecting consignments of plant and plant products and other regulated items, managing treatments related to plant health (either disinfections or disinfestations) of consignments, surveillance and maintenance of pest free areas (PFA) and areas of low pest prevalence (ALPP),issuance of phytosanitary certificates to fulfill the phytosanitary requirements of importing country and conducts pest risk analysis for import of new commodities. Pest Risk Analysis plays a crucial role to prevent its introduction (Tanaka & Larson, 2006).

Directorate of Plant Protection Quarantine & Storage (DPPQ&S), Faridabad, Haryana, the NPPO of India signify its obligation by executing starring role in plant protection by recommending the government of India as well the state governments on emerging issues in trade, pest management, plant quarantine, regulations of pesticides, locust warning etc. and implementation of international standards of phytosanitary measures allied to trade of plant /plants products in India.

2. National Biodiversity Authority under section 8, established in 2003 to implement India's Biological Diversity Act (2002). This is a statutory body and focus on various issues of conservation, sustainable use of resources and equitable sharing of benefits arising out of the use of biological resources. The headquarter of NBA is located in Chennai, Tamil Nadu is supporting the local and State level committees as per their line of mandate. This Act has given the provision to regulate the use/trade in GMOs and establishment of Biodiversity Management Committees (BMC) at local level, State Biodiversity Boards (SBB) at state level, and a National Biodiversity Authority (NBA) at national level. State Biodiversity Boards (SBBs) mainly emphasis on advising the state governments as per the guidelines of government of India on matters related to the conservation of biological diversity to sustain its components and equi-distribution of benefits outcomes of biological resources and associated indigenous knowledge. The local level Biodiversity Management Committees (BMCs) are responsible for promoting conservation, suitable use and documentation of biological diversity. NBA provides funding/finance for adaptive researches on managing invasive species as well on priority basis facilitate capacity building programmes for managing invasive alien species by providing cooperation at different levels.

3. Different Indian legislations related to Invasive Species:

a. Destructive Insect & Pests Act, 1914 (and amendments), subject to prevent the introduction of any destructive pest (insect, fungus or, other pest), to the crops into the country (India). DIP Act, 1914 has endured several amendments; Plant, Fruits and Seeds Order, 1984 (PFS Order) revised in 1989, New Policy on Seed Development (1988) and thereafter Plant Quarantine (Regulation of Import into India) Order, 2003.

b. Plant Quarantine (Regulation of Import into India) Order, 2003, regulates import of plant/plant products and other regulated articles into India. As per the import regulations to prevent the entry, establishment and spread of exotic pests/quarantine pests in India and the provisions of sub-section (1) of Section 3 of the *Destructive Insects and Pests Act, 1914 (2 of 1914), the government of India* has acquainted a mandatory Pest Risk Analysis (PRA) to be carried out for the import of any new agricultural product or an already imported product being imported from a new country/origin. The risk analysis is carried out to predict the possibility of a consignment carrying a potential pest entering the country may along (pathway) and associated with the imported product. By following the international norms PQ Order, 2003 make sure to incorporate the additional declaration required to be endorsed into Phytosanitary Certificate (PSC) and special conditions of import of plant and plant products.

c. Environment Protection Act, 1986, has empowered the Central government to take steps for protection of environment from hazardous pollutants and chemicals to handle the issues by setting

authorized official body. Introduction of Amendment in 1989 has widened the scope of this act by taking initiatives for usage, import, export (transportation & handling) and storage of living organisms /GMOs in view of environment protects from exotic pests and health of the plants (nature).

d. The Biological Diversity Act, 2002, has given a provision for conservation of bio diversity, sustainable use of its components. This Act provides three statutory, autonomous bodies, Biodiversity Management Committees (BMC), State Biodiversity Boards (SBB) and National Biodiversity Authority (NBA) to execute their roles to take corrective measures to protect and ensure the conservation of biological diversity and traditional knowledge. The National Biodiversity Authority is authorized to issue approval for export of biological material from the country under this Act.

4. Other Agencies: To prevent the introduction of invasive species and for their management and control measures other agencies are also involved:

a. Ministry of Environment Forests and Climate Change (MoEFCC), core objective to implement policies & programmes for protection of environment, conservation of forests & natural resources as well welfare of animals and wildlife. Change in climate has triggered the competition for food and shelter (habitation), extinction of species and increases the risk of invasion of new pests. MOEFCC emphasises adaptive research and capacity building for environment protection, restoration and conservation.

b. National Bureau of Plant Genetic Resources (NBPGR), a nodal organization authorized to issue Import Permit, Phytosanitary Certificate and related quarantine activities for transboundary exchange of germplasm and transgenic material. The trade of plant and plant material for research purpose is routed through the quarantine check (inspection, testing, and phytosanitary treatment) for quarantine pests (nematodes, pathogens -fungi, bacteria and viruses and weeds) at NBPGR. NBPGR ensures the safe exchange of germplasm among the countries, pest free conservation of germplasm (in Gene-Bank) and contribute in policy issues related to quarantine aspects and international standards.

INVASIVE ALIEN SPECIES IN INDIA

On look back to history of invasion of pests, we find numbers of alien species were introduced and among them many have become invasive alien species and immensely contributed to destruction of ecosystem and environment.

Invasive Alien Insects: Major introduced Invasive alien species of insects in India are listed in Table 1.

FUTURE MANAGEMENT PERSPECTIVES OF INVASIVE SPECIES

A coherent cooperation among existing national, regional and international organizations is must needed to manage the invasive species. All the countries should assess, monitor and manage species that may be invasive and that directly or indirectly affect plants or plant products, or that are diseases of animals, in accordance with the relevant IPPC provisions and standards, guidelines and recommendations. Countries should use existing phytosanitary control and quarantine systems and

procedures to prevent the introduction of IAS, in line with their obligations under the SPS Agreement, also in order to minimize trade repercussions. Plant health authorities and other relevant stakeholders, as appropriate, should be engaged in policy and strategy formulation related to IAS at an early stage. Phytosanitary requirements/treatment of imported commodities, including through fumigation, immersion, spraying, heat and cold treatment and pressure to be endorsed as specified in import permit. Public information through different modules/modes and early warning/ pest alerts, drive to predict endangered areas for an invasive species, and can also forecast potential of new invasive species for a region/ country. The National Plant Protection Organizations (NPPOs) should take initiative to prevent the entry and spread of alien pests by continuous surveillance activities, phytosanitary inspection, lab testing and detection & diagnosis of the exotic pest at the point of entry (airports, seaports, land frontiers, inland containers, etc.). Effective implementation of quarantine regulation/import regulation/phytosanitary measures and with the effective quarantine system the responsibility has to be enduring by NPPO, Central Government, State/ Union Territory, Research Institutes, Agricultural Universities, Private/ Public sectors, Farmers and Public. To overcome the destructive consequences of these notorious tiny entities, on plants, human, animals, environment an emergency plant pest incursion management system is much needed. Governments should come forward to structure public awareness, system approach for environment risk and transport-related agreements are in dire need to develop. The standard operating procedures (SOPs), robust phytosanitary support system, capacity building and phytosanitary related adapted research has wide scope to win the battle against these intruders. Single organization or agency cannot be successful in managing invasive alien species; there is a dire need of coordinated efforts required between the organizations at global level. The pathway of introduction, ecological characteristics and ecological/economic impacts should be studied properly to monitor the Invasive Alien Species.

Annexure 1

Table 1. Major Invasive Alien Species Introduced in India (Insects)*

S. No.	Common Name	*Scientific Name*
1.	Soft green scale	*Coccus viridis* (Green)
2.	Woolly apple aphid	*Eriosoma lanigerum* Hausm.
3.	San Jose scale	*Quadraspidiotus* perniciosus (Comstock) Cockerell
4.	Lantana bug	*Insignorthezia insignis* (Browne)
5.	Cottony cushion scale	*Icerya purchasi* Maskell
6.	Potato tuber moth	*Phthorimaea operculella* Zeller
7.	Diamond back moth	*Plutella xylostella* (Linnaeus)
8.	Sugarcane woolly aphid	*Ceratovacuna lanigera* Zehntner
9.	Pine woolly aphid	*Pineus pini* sensu lato
10.	Litter beetle	*Luprops tristis* (Fabricius)
11.	Subabul psyllid	*Heteropsylla* cubana D.L. Crawford
12.	Serpentine leaf miner	*Liriomyza trifolii* Burgess
13.	Coffee berry borer	*Hypothenemus hampei* Ferrari
14.	Spiralling whitefly	*Aleurodicus disperses* Russell
15.	Coconut eriophyid mite	*Aceria guerreronis* Keifer
16.	Silver leaf whitefly	*Bemisia tabaci* (Gennadius, 1889) -biotype B
17.	Defoliating tortoise beetle	*Trachynela tincticollis*
18.	Erythrina gall wasp	*Quadrastichus erythrinae* Kim
19.	Cotton mealy bug	*Phenococcus solenopsis* Tinsley
20.	Lotus lily midge	*Stenochironomus nelumbus* Tok et Kur
21.	Eucalyptus gall wasp	*Leptocybe invasa* Fisher & La Salle
22.	Erythrina gall wasp	*Quadrastichus erythrinae* Kim
23.	Papaya mealybug	*Paracoccus marginatus* Williams & Granara de Willink, 1992
24.	Madeira mealybug Green	*Phenococcus madeirensis* Green, 1923
25.	Solanum mealybug	*Phenacoccus solani* Ferris
26.	Tomato pinworm	*Tuta absoluta* (Meyrick)
27.	Rugose spiralling whitefly	*Aleurodicus rugioperculatus* Martin
28.	Western flower thrips	*Frankliniella occidentalis* (Pergande, 1895)
29.	Stem borer or longhorn	*Aristobia reticulator* (Voet)
30.	Peach black aphid	*Pterochloroides persicae* (Cholodkovsky)
31.	Fall armyworm	*Spodoptera frugiperda* J.E. Smith
32.	Bondar's Nesting Whitefly	*Paraleyrodes bondari* Peracchi
33.	Nesting whitefly	*Paraleyrodes minei* Iaccarino
34.	Palm infesting whitefly	*Aleurotrachelus atratus* Hempel
35.	Woolly whitefly	*Aleurothrixus floccosus* (Maskell, 1895)
36.	Cassava mealybug	*Phenacoccus manihoti* Matile Ferrero

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