MACROBIALS IN INDIA

AN OVERVIEW

23 OCTOBER 2018, BASEL

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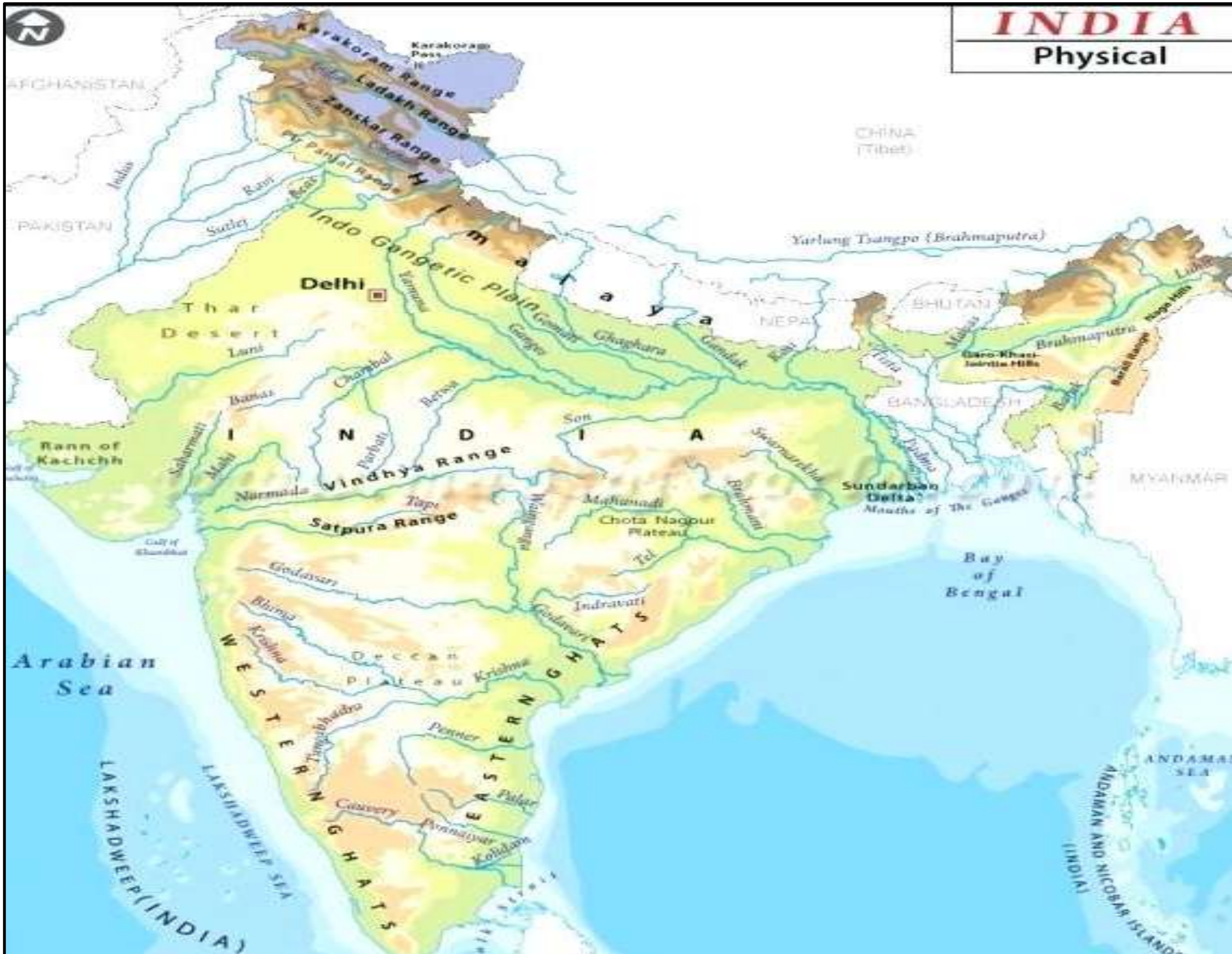
ABIM
Annual Biocontrol Industry Meeting

PRINCIPLES OF BIOLOGICAL CONTROL - BHAGVAD GITA (ANCIENT INDIAN SCRIPTURE)

jivo jivasya jivanam

One living entity is food for another in the struggle for existence.


INDIA
Physical
Karakoram Pass
Karakoram Range
Ladakh Range
Zanskar Range
Pir Panjal Range
AFGHANISTAN
PAKISTAN
CHINA
(Tibet)
Indus
Ravi
Beas
Sutlej
Himalaya
Indo Gangetic Plain
Delhi
Thar Desert
Luni
Yamuna
Ganga
Gomati
Ghaghara
Gandak
Kosi
NEPAL
BHUTAN
Yarlung Tsangpo (Brahmaputra)
Brahmaputra
Garo-Khasi-Jaintia Hills
Naga Hills
Barail Range
Tista
BANGLADESH
Chambal
Banas
Betwa
Son
Rann of Kachchh
Sabarmati
Mahi
Parbati
INDIA
Vindhya Range
Narmada
Tapi
Satpura Range
Wainganga
Mahanadi
Chota Nagpur Plateau
Brahmani
Swarnarekha
Padma
Sundarban Delta
Mouths of the Ganges
MYANMAR
Bay of Bengal
Godavari
Tel
Indravati
Bhima
Krishna
Deccan Plateau
Arabian Sea
WESTERN GHATS
EASTERN GHATS
Tungabhadra
Penner
Palar
Cauvery
Ponnaiyar
Kollidam
LAKSHADWEEP (INDIA)
LAKSHADWEEP SEA
ANDAMAN SEA
ANDAMAN AND NICOBAR ISLANDS (INDIA)

INDIAN BIOLOGICALS – MARKET & SEGMENTS

Biological Products – Segment	Mill $
BIOSTIMULANTS :	
Mineral/ Natural/ Plant (Seaweeds, Humics, Aminos, Chelates, etc.)	290
Microbial/ Biological Nutrient Elicitors/ Enhancers	90
BIOCONTROLS :	
Plant Extracts : Neem, Pyrethrum, Karanjin, Garlic, etc. (Agriculture)	30
Plant Extracts : Pine, Citronella, Lemongrass, etc. (Home/Garden)	30
SemioChemicals : Pheromones for Agriculture and Storage	25
Microbials (Bacteria, Fungus, Virus, VAM, etc.)	120
Macrobials (Wasps, Nematodes, Beetles, Mites, Bees, etc.)	3-5
TOTAL VALUE (2016-17)	**600**

Source : Industry Estimates

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National Bureau of Agricultural Insect Resources (NBAIR) – Risk Assessor

Located in Bangalore, in the same premises where The Commonwealth Institute of Biological Control (CIBC), Indian Station, established in 1957.

NBAIR's Activities are Divided into Three Divisions.

- **Germplasm Collection and Characterisation**
- **Genomic Resources**
- **Germplasm, Conservation and Utilisation**

Germplasm Collection and Characterisation - Mandate	Genomic Resources - Mandate	Germplasm, Conservation and Utilisation - Mandate
Augmentation of collections and maintenance of a national repository.	Whole genome sequencing of some important insects and entomopathogenic nematodes.	Utilization of agriculturally important arthropods for the management of insect pests.
Biosystematic studies on insects, spiders and mites using traditional & molecular approaches and DNA barcoding.	Gene and allele mining for the selection of genes of specific interest and their utilization.	Development of protocols and designs for the establishment of state of art mass production units for beneficials.
Generation of checklists, catalogues, illustrated field identification guides and digitization of collections, networking of institutions and individuals working on biosystematics & identification services.	RNAi technology for IPM.	Introduction of beneficial quarantine and post-release monitoring. Studies on virus-vector dynamics.
Classical biological control, biosecurity, threat perception & action-plan for alien pests.	Genome sequence repository for useful genes.	Effect of climate change.
	Endosymbionts and determination of their functional role.	Role of pollinators in crop productivity.
	Use of bioinformatics tools and development of genomic databases.	Role of semio-chemicals for insect pest management.

Macrobials for Release–Assessed & Approved by NBAIR

Parasitoid	Delivery Mode	Target Insects	Release Rate/ ha	Release Frequency
Trichogramma Species (11)	Parasitised egg cards	Borers on Cotton, Maize, Okra, Paddy, Sugarcane, Cabbage Cauliflower & Tomato	50,000 to 150,000 (crop specific)	1 release at 10 day intervals; 4 to 8 releases (crop specific)
Telenomus remus (Nixon)	Parasitised egg cards	Tobacco caterpillar	100,000	1 release at 10 day intervals; 3 to 4 releases (crop specific)
Goniozus nephantidis (Muesebeck)	Cocoons	Coconut black-headed caterpillar	10 adults per palm	1 release every 3 to 4 weeks (crop specific)
Chelonus blackburnii (Cameron)	Adults	Potato tuber moth	50,000 2 adults/kg/ potatoes in warehouses	2 weekly releases 3 to 4 fortnightly releases

Macrobials for Release – Assessed & Approved by NBAIR

Predators	Supply Stage	Target pest	Release Rate/ Ha	Release Frequency
Cryptolaemus montrouzieri Mulsant (E)	Adults / Grubs	Mealy bugs	10 beetles or 50 grubs /infested plant or tree or 5000 beetles/ha	1 to 2 releases based on pest intensity
Scymnus coccivora (Ramakrishna Ayyar)	Adults	Mealy bugs on citrus, grapes and other fruits	600 – 2500 adults/ha	One or more releases based on pest intensity
Chilocorus nigrita (Fabricius)	Adults / Eggs	Sugarcane scale insect Citrus scale	1500 beetles/ha; or 10 egg pads (with 40 eggs per pad) in 100 spots/ha (40,000 eggs/ha)10 adults/tree	One or more releases based on pest intensity
Cheilomenes sexmaculata Fabricius	Adults / Eggs	Aphids on Legumes and Oilseeds	5000 larvae or 500 adults per ha	Two releases; first release to coincide with the appearance of aphids
Coccinella septempunctata Linnaeus	Adults / Eggs	Aphids on Legumes and Oilseeds	5000 larvae or 500 adults per ha	Two releases; first release to coincide with the appearance of aphids
Brumoides suturalis (Fabricius)	Adults	Aphids and white flies	-	-
Curinus coeruleus Mulsant (E)	Adults	Subabul psyllid	20 Adults per tree	Two releases during July and October
Chrysoperla carnea (Stephens)	Eggs / First instar larvae	Sucking pests on cotton, groundnut, tobacco, sunflower, & some fruits	10,000 first instar larvae/ha	Twice during the season with an interval of 15 days On fruit crops, 10 – 20 larvae per infested tree

Commercial Import of Macrobials-Risk Assessed & Approved by NBAIR

Scientific Name of Macrobial	Pollinator/Predator /Parasite	Purpose/Host Insect
Amblyseius swirskii	Predatory Mite	Thrips, Whitefly
Neoseiulus californicus	Predatory Mite	Spider Mites
Phytoseiulus persimilis	Predatory Mite	Spider Mites
Aphidius colemani	Parasitic Wasp	Aphids
Aphidius ervi	Parasitic Wasp	Aphids
Diglyphus isaea	Parasitic Wasp	Leaf Miners
Anagyrus pseudococci	Parasitic Wasp	Mealybugs
Cryptolaemus montrouzieri	Predatory Beetle	Mealybugs
Orius laevigatus	Predatory Bug	Thrips

Native Host Insects for Release-Risk Assessed & Approved by NBAIR

Host Insect	Supply Stage	Purpose
Corcyra cephalonica (Stainton)	Eggs	Research/ Bio-Agent Production
Sitotroga cerealella (Olivier)	Eggs	Research/ Bio-Agent Production
Helicoverpa amigera (Hubner)	Eggs, 1st instar larvae & pupae	Research/ Bio-Agent Production
Spodoptera litura (Fabricius)	Eggs, 1st instar larvae & pupae	Research/ Bio-Agent Production
Plutella xylostella (Linn.)	Pupae	Research/ Bio-Agent Production
Callosobruchus spp.	Adults	Research/ Bio-Agent Production
Mealybug Maconellicoccus hirsutus	Ovisacs/ Crawlers	Research/ Bio-Agent Production
Mealy bug Ferrisia virgata (Cockerell)	Gravid females/ Crawlers	Research/ Bio-Agent Production
Scale Hemiberlesia lataniae (Signoret)	Infested pumpkin	Research/ Bio-Agent Production

MACROBIALS IN INDIA - CHALLENGES

INDIGENOUS MACROBIALS

- Macrobials (Insect Bio Control Agents) – Systemic Approach is needed
- Every Chain Link is Critical
- Risk Assessment is done by NBAIR
- Insectaries – only Govt. Institutions/ Universities/ Agencies
- Macrobials (IBCAs) are delicate
- Fragmented and Small Land Holdings
- Spray Drift of Chemical Insecticides
- Limited Acreage of Covered Agriculture
- Adverse conditions in Transport & Handling has Negative Impact on Efficacy
- Limited Shelf life (Days)
- Most widely accepted Macrobial is Trichogramma (Delivery is Eggs on Cards)
- Partnership of Beneficials & Bumblebees – Must for Natural Pollination Advantage

IMPORTING MACROBIALS TO INDIA – PROCEDURE

- Each Macrobial Separate Application - PQ Form 12 (Fee = USD 14)
- Submission of Data/ Information Prior to Import
- Each Application Evaluated by Expert Committee
- On Approval, Import Permit (Form PQ 13) issued - Validity 2 years
- List of Handling Airports as per Import Permit
- On Arrival at Airport, Quarantine & Customs Clearance Required

IMPORTING MACROBIALS TO INDIA– DATA REQUIREMENT

Exporting Country's Responsibilities (Data Submission) :

- Environmental Risk Studies
- Impact on Target and Non-Target Organisms
- Data on Hyper-Parasitoids, Hyper-Parasites
- Status of Containment/ Quarantine Facilities
- Status of Mass Rearing Technology/ Facilities
- Monitoring Data on Survival of Released Bio-Control Agents
- Remedial Action/ Procedure in Case of Accidents/ incidents
- Research on Related Quarantine Procedures

IMPORTING MACROBIALS TO INDIA – DATA EVALUATION

Challenges for Expert/ Technical Committee

- Dossier Preparation for each Macrobial (IBCA)
- Pest Details (Identification, Distribution, Importance and Known Natural Enemies)
- IBCA Details (Identification, Biology, Host Specificity, Hazards to Non-Targets, Contaminants and Elimination Procedures)
- Plant, Human and Animal Health Safety
- Evaluation for Release in different climatic zones, cropping cycles/ patterns and target / non-target pest species
- Protocol for Introduction, Multiplication and Studies/Release

MACROBIALS IN INDIA - CHALLENGES

COMMERCIAL IMPORT OF MACROBIALS

- Risk Assessor : NBAIR – ICAR.
- Regulator: Directorate of Plant Protection, Quarantine & Storage, Ministry of Agriculture, Govt. of India
- Macrobials Approved for Import are Limited
- Streamlining of Procedures/ Criteria needed
- Rationalisation of Tariffs & Inspection Fees
- Logistics & Supply Chain Issues (Arrival to End-Use)
- Homogenising Regulations and Import Permit Conditions

BIOLOGICALS IN INDIA – ONE STOP SOURCE

- HIGHLY TALENTED RESOURCE POOL.
- BIOLGICALS - PUBLIC/GOVT. BODIES – PROVEN/ TESTED.
- EFFICACY IN VARIED CLIMATIC CONDITIONS – TROPICAL RAINFOREST, TROPICAL SAVANNAH, ARID, SEMI-ARID, TEMPERATE, MOUNTAIN.
- AVAILABILITY OF ALL TYPES OF CROPS – FIELD, GREENHOUSE, ORCHARDS.
- ADEQUATE CAPACITY : EXTRACTION, LIQUID FERMENTATION, CHEMISTRY
- DESIRED CAPACITY : SOLID FERMENTATION, INSECTARIES, FORMULATION.
- EASILY AVAILABILE SOLID CARRIER MATERIALS.
- EASY AVAILABLITY OF OILS AS INERT CARRIERS.
- FAVOURABLE EXCHANGE RATE

- **CONDUCIVE CLIMATE – HUMID/TEMPERATURE(Everything Grows!)**
- **CAPTIVE MARKET - 195 Million Ha.**

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Thank You

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