



Turning Problems into Opportunities for CSIs: Biological Control of Transboundary Agricultural Pests

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Session-IV: Technology Transfer for Cottage and Small Industries – Opportunities and Challenges

Regional Workshop on Planning and Managing Technology Transfer for Inclusive Development
KNOWLEDGE FOR LIFE





Invasive and its menace

- Arrive in new area : Alien non native
- Usually due to human intervention
- Intended introductions
 - Agriculture, Fish Farming , ornamentals, pets
- Unintentional introductions
 - Commodity shipments
 - Personal luggage
 - Timber and other packaging
 - Military
 - In soil
 - Contaminants in seed
- Combination of natural spread/human aid

Spodoptera frugiperda: taking world by storm

The Fall Armyworm – once arrived, will not be eradicated

- Natural dispersal
- Polyphagous – over 300 plant species



Fall Armyworm spread 2016 - present



2016



2017



2018




current





News : Economy & Forex

MOAF Ministry of Agriculture and Forests of Bhut : Advisory note on fall armyworm

08/17/2018 | 09:01pm EDT



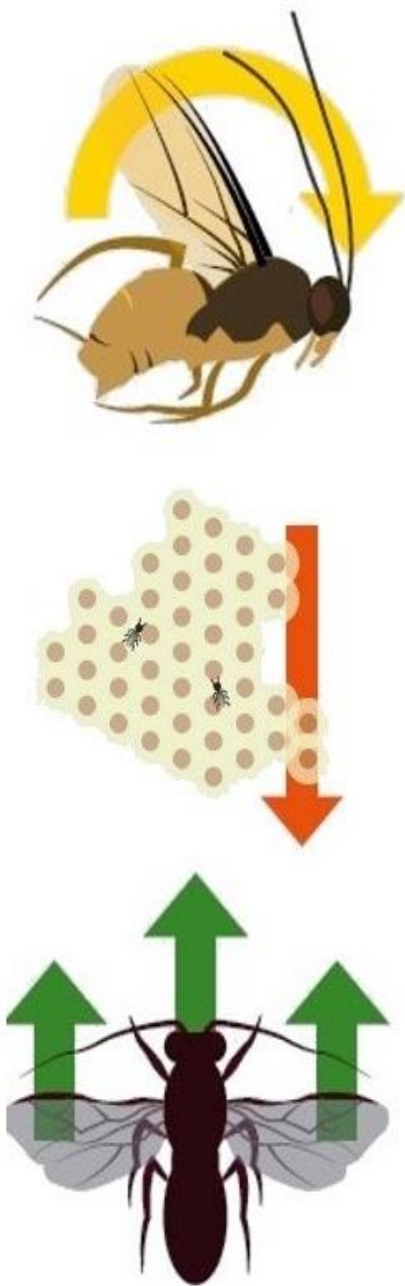



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Three categories of biological control

- **Classical biological control by introduction**

- Introduction of a natural enemy of exotic origin to control a pest, usually also exotic, aiming at a permanent control of the pest
- Inoculative (inoculation at the beginning of the season of a small number of biocontrol agents that will reproduce), or

- **Biological control by augmentation**

- Augmentation of the density of natural enemies by regular releases
 - Inundative (mass releases for single and immediate control)

- **Biological control by conservation**

- Methods favouring the efficiency of natural enemies already present in the system

All three methods are presently being recommended for FAW in Asia

Surveys for natural enemies: Augmentation of biological control



- Augmentation: regular releases of parasitoids
- Most promising agent: egg parasitoid *Trichogramma* spp., *Telenomus remus*
 - Already used in Latin America
 - Found occurring in Africa and Asia
- Safe application to plants : Point release
- Self searching capacity
- 3 spaced out consecutive release
- New releases based on Moth movement (indicated by trap catch)
- *Trichogramma* spp. Collected from FAW eggs > 50% parasitism (ICAR-NBAIR, India)

The screenshot displays the journal's interface. At the top, there are navigation links for 'Home', 'About', 'Information & Guidelines', 'Insects', and 'Alert'. Below this is a search bar with fields for 'Title / Keyword', 'Author / Affiliation', 'Article Type', and 'Search'. The main content area shows the article title: 'Telenomus remus, a Candidate Parasitoid for the Biological Control of Spodoptera frugiperda in Africa, is already Present on the Continent'. The authors listed are Marc Kenis, Hannalee du Plessis, Johnnie Van den Berg, Malick Niango Ba, Georg Goergen, Kofu Eric Kwadjo, Ibrahim Baosa, Tadele Teteza, Alan Buddie, Giovanni Cafa, Lisa Clifford, Ivan Rwomushana, and Andrew Polaszek. The article is from Volume 10, Issue 4, published in 2019. The journal logo 'insects' is visible in the top left corner of the page.

Local production of natural enemies: Trichogramma & Bt



- Cuba
- Colombia
- Nicaragua
- Honduras
- Brazil

- South-South Cooperation (Brazil): Low-cost, rural enterprises & employment



Enabling Environment

- Human and institutional capacity of local partners (PPQS, PPD, PPC)
- Local governments assurance on continuation of delivering and spreading the action's benefits on a larger scale.
- Establish an intra-regional knowledge and exchange platform established –
- Strengthen south-south partnership and to facilitate the transfer and knowledge
- Transfer of biologically-based plant protection technology.



Monitoring Participatory actions

- Regional Platform to monitor participatory planning and implementation
 - Fostered participatory tools and methods,
 - Project cycle management for small projects
 - in depth understanding of national maize production systems,
 - local occurrence and population dynamics of pest and natural enemies : Local NE survey
 - Distribution of nucleus culture to regional stations
 - Regional stations provide to farmers for on farm production
 - the ability to jointly develop need-based and farmer friendly solutions



Method

- Transfer of technology for production of egg parasitoids : customized local context
- Facilities able to produce Trichogramma egg cards in standard quality :
 - to reach a higher production capacity and thus the economic break-even point
- Knowledge production technology : anchored institutional



Steps in mass production of Trichogramma in cottage industry

- Procurement of nucleus culture from regional stations
- Maintenance of host culture
 - *Corcyra cephalonica*
- Parasitisation of host eggs
 - By nucleus culture
- Preparation of Tricho cards
- Packaging and Distribution



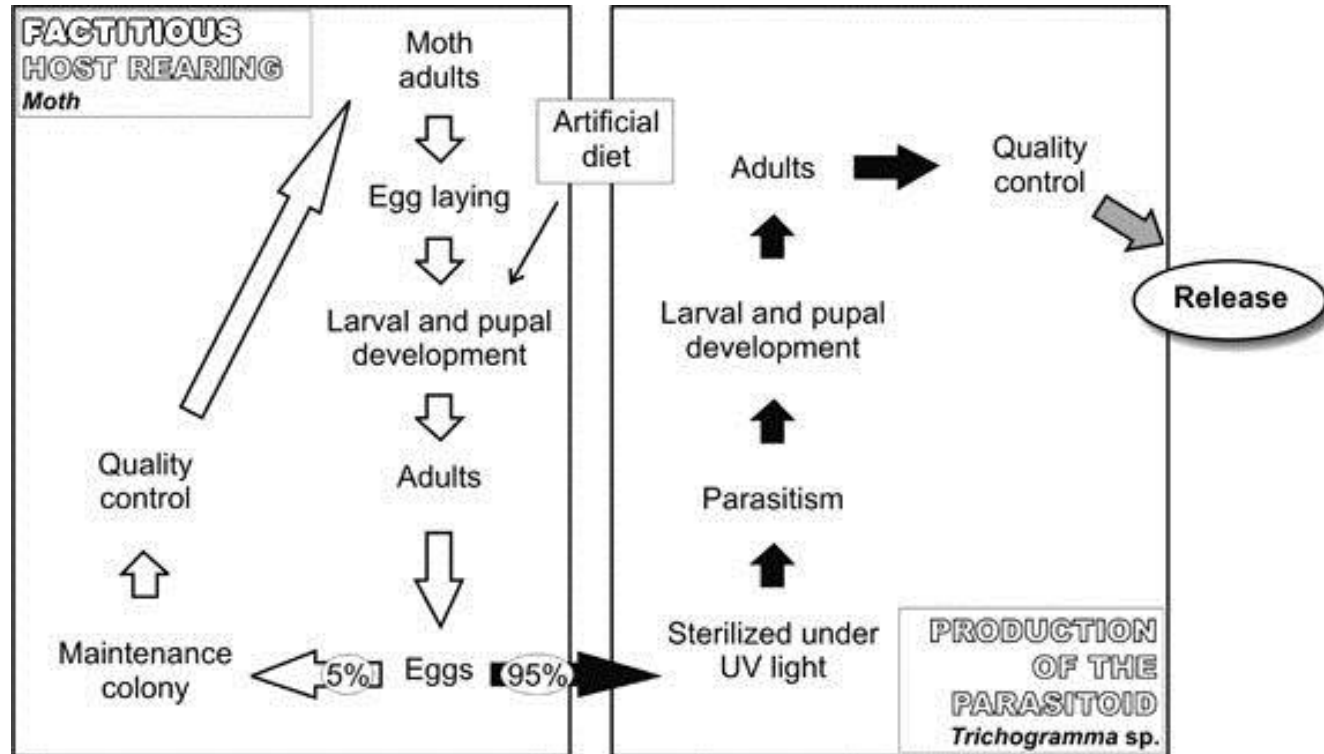
Host Culture: *Corcyra cephalonica*

- *Corcyra cephalonica* commonly called as rice meal moth
- Easier and cheaper to produce natural enemies on different stages of *Corcyra*
- Need on farm produce like bajra kernel
- Need simple equipments for production like bucket, drums, sieves, brushes etc
- Adult moths can be collected from warehouses and used for culture
- 100 pairs of adults produce 1.5 cc of eggs in 4 days.
- From each basin an average of 2500 moths are collected.
- Hence from each basin 18.00 – 20.00 cc of eggs can be obtained in 90 days.
- Simple data to be documented

Production of Biocontrol agent : Trichogramma

- *Trichogramma* is cosmopolitan in distribution and present in all terrestrial habitats
- *Trichogramma* parasitizes eggs of pest of agricultural importance including FAW
- Procurement of *Corcyra* eggs and nucleus culture
- Sterilisation of eggs with simple UV light
- Preparation of card with eggs glued
- Polythene ovipositional cages
- the life cycle is completed in 8 to 10 days,

Production Cycle and Product release





Packaging and Marketing

- Simple
- Coinciding with the pest monitoring
- Production predictable
- Consistent
- Local Production –supply chain
- Wastage low
- Low manpower
- Low production cost
- Poor quality of mass reared *Trichogramma* can result in control failures
- Two basic models
 - Combined Host culture and Parasitoid
 - Nucleus Host an parasitoid culture



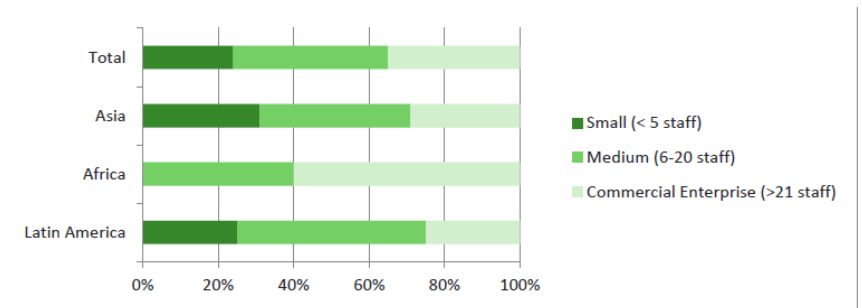
Sources

- http://agritech.tnau.ac.in/crop_protection/crop_prot_bio_mass_parasitoids1.html
- ICAR-NBAIR technology
 - **Multiple insecticide tolerant strain of egg parasitoid, *Trichogramma chilonis***
 - **High temperature tolerant strain of egg parasitoid *Trichogramma chilonis***

Challenges and Limitations

Reason for starting the business	Asia
<i>Personal mission based on potential opportunity</i>	57%
<i>Incentives based on policy and grants given by national government</i>	20%
<i>As part of national project funding initiative</i>	23%
<i>As part of international project funding initiative</i>	9%
<i>As part of a Cooperative or Community</i>	17%

Business ownership:	Asia
<i>Individually owned enterprise</i>	37%
<i>Wholly public sector (100% subsidized)</i>	26%
<i>Private company (limited company, family owned, etc.)</i>	11%
<i>Individual farmer-based enterprise</i>	6%
<i>Cooperative or Community based company</i>	11%
<i>Public-private partnership</i>	9%
<i>Non-profit foundation</i>	0%



- The most important challenges
 - involve the logistics of transporting and
 - storing live organisms and
 - their need for special care in order to survive.

CABI facilitation : Case Studies

Box 2 Managing the transition – example 1

Six Trichogramma facilities were established in Yunnan province, China, by two EU-funded projects in 2014-15. Research institutes provided strong technical support during project implementation. When the projects finished in 2016, the facilities were taken over by local grass-roots farmer organisations set up during the project, and by village committees. One facility, located in the Plant Protection and Quarantine Station of Denghong (PPQS-DH), remained in the institution, operated from its own funds.

Box 4 Managing the transition – example 3

In Laos and Myanmar two Trichogramma rearing facilities, serving maize farmers, were established with EU funding, which came to an end in mid 2016. After the project local community groups were established to support the ownership and management of the facilities by the community.

By the end of 2017 both facilities were still operating with the active involvement of the community groups. However, only the Laos facility was still producing egg cards, the Myanmar facility was by then only rearing stock. The community group supporting the Laos facility was mostly made up of District level government extension officers, suggesting the importance of ongoing government involvement to ensure the success of the facility.

The facilities had also launched other entrepreneurial activities (e.g. maize processing and marketing) to improve their financial sustainability after the end of the EU project. These entrepreneurial activities proved successful in generating additional income for the facilities and their community groups. However, proceeds were re-invested in the income generating activities, rather than in the facilities' Biological Control functions as was originally envisaged.



Economics for Small Cottage Industry

- 1,000 acres of crops are under trichogramma protection.
- Approximately five cc of trichogramma eggs are required per acre.
- Hanging the cards in the fields has shown to reduce the cost for insecticides by 30 per cent.
- In a year the SHG generates around 4,000 cc of trichogramma eggs,
- which in turn gives the members an income of Rs 60,000.

Warrier, S. Gopikrishna. Eco-savvy women's self-help groups. Buisness line Thursday, Jun 06, 2002



Way Forward

- Consistency in Demand
- Intensify the production units for proper coverage
- Planning the production with farmers
- Support through public institutions
- Motivation through proper linkages



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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC