Natural Enemies of Important Insect Pests of Field Crops and Utilization as Biological Control Agents in Thailand

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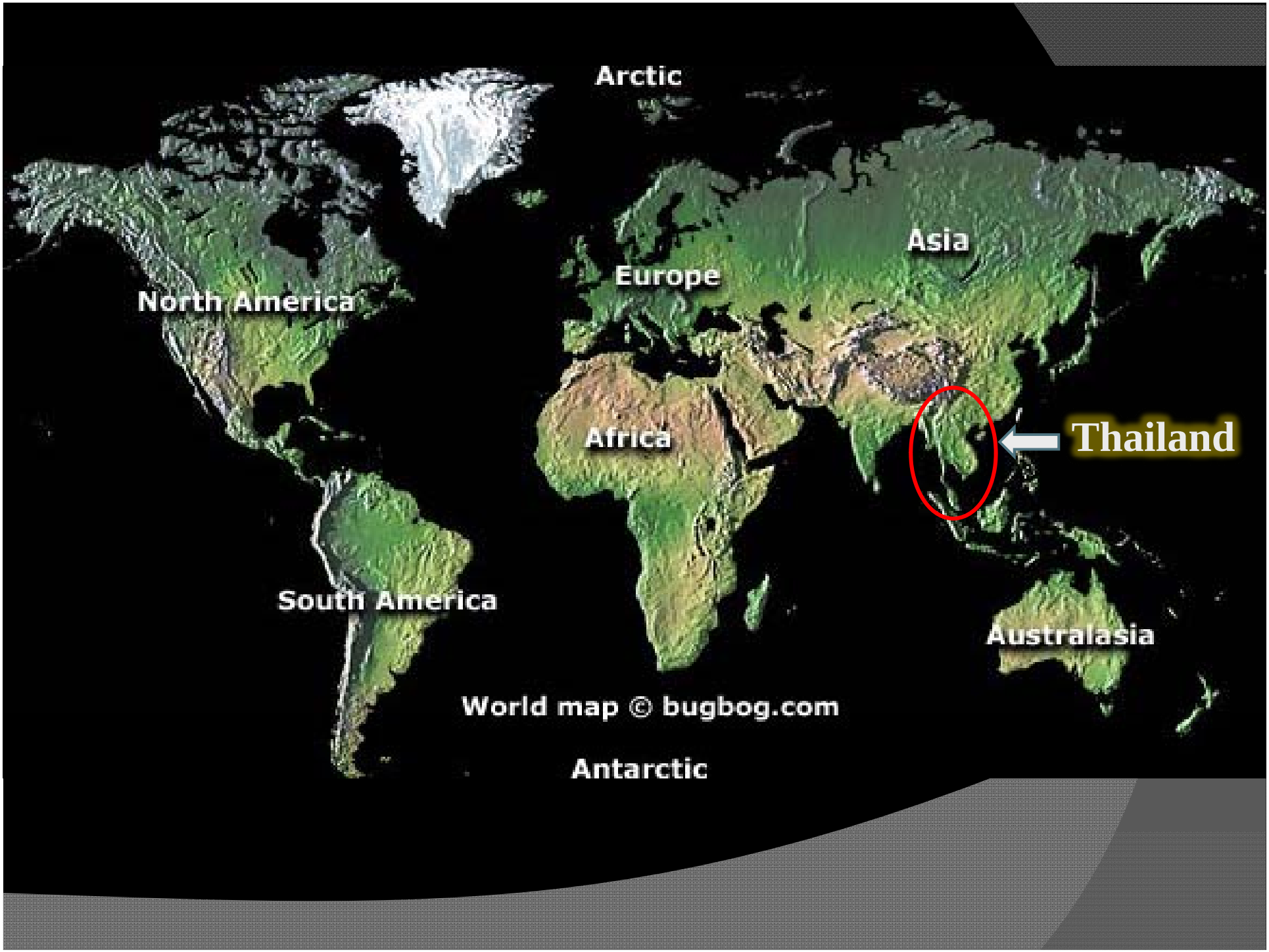
The purposes of this paper

- To present some current activities of the insect pests of economic field crops and their natural enemies.
- To manifest the impact of the successful implementation of effective natural enemies for biological control of insect pests in field crops in Thailand.


Arctic
North America
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Asia
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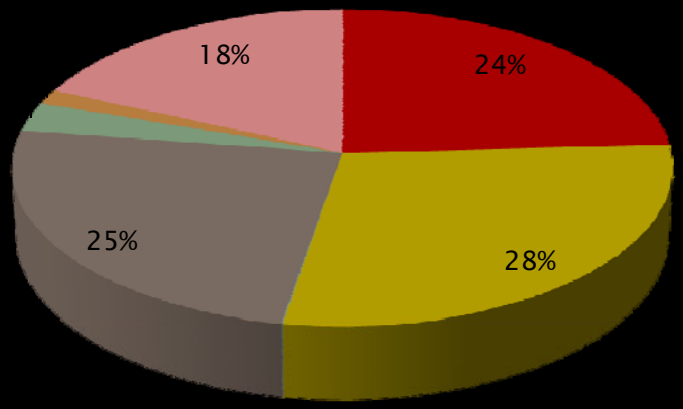
Antarctic

Introduction

Important field crops in Thailand



- Sugarcane
- Cassava
- Cotton
- Corn
- Soybean
- Coffee
- Other

Insect pests and important natural enemies

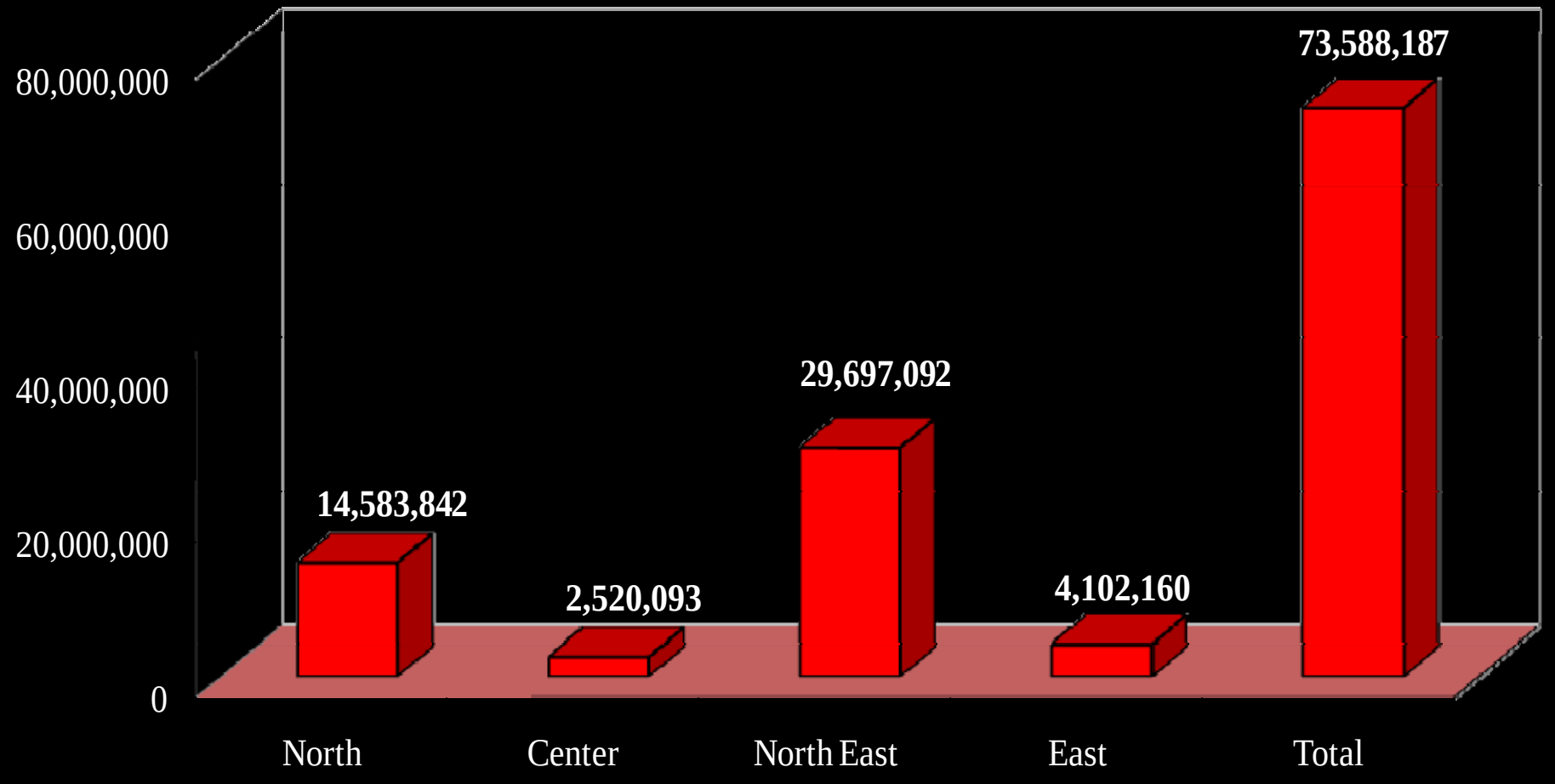
	No. species		
Field crops	Pests	Key pests	natural enemies of key pests
Sugarcane (*Saccharum officinarum* L.)	192	9	52
Cassava, *Manihot esculenta* (L.) Crantz	42	5	10
Corn, *Zea mays* L.	69	6	49
Soy bean, *Glycine max* L.	16	2	18
Cotton, *Gossypium* spp.	39	4	34

Plants: Pests	**Parasitic Insect/Predatory Insect/Spider and Entomopathogenic Fungus**	
Sugarcane (*Saccharum officinarum* L.)	**<u>Parasitic Insect:</u>**	
Chilo infuscatellus	*Bracon chinensis*	(Hymenoptera: Braconidae)
Chilo sacchariphagus	*Cotesia flavipes***	(Hymenoptera: Braconidae)
Chilo tumidicostalis	*Telenomus beneficiens*	(Hymenoptera: Scelionidae)
Scirpophaga excerptalis	*Telenomus rowani*	(Hymenoptera: Scelionidae)
(Lepidoptera: Pyralidae)	*Elasmus zehneri*	(Hymenoptera: Encyrtidae)
Sesamia inferens	*Tetrastichus schoenobii*	(Hymenoptera: Eulophidae)
(Lepidoptera: Noctuidae)	*Tetrastichus ayyari*	(Hymenoptera: Eulophidae)
	*Trichogramma chilotreae**	(Hymenoptera: Trichogrammatidae)
	Trichogramma confusum	(Hymenoptera: Trichogrammatidae)
	Trichogramma australicum	(Hymenoptera: Trichogrammatidae)
	Temelucha philippinensis	(Hymenoptera: Ichneumonidae)
	Xanthopimpla stemmator	(Hymenoptera: Ichneumonidae)

The strategy for utilization of natural enemies for biological control in Thailand has been intensively investigated by National Biological Control Reserch Center (NBCRC) and their cooperative networks since 1978. The basic ground works including the explorations of natural enemies and the evaluation of their control potential and effectiveness as biological control agents. Through these extensive examinations, those inherent natural enemies were then identified and summarized by Charernsom and Suasaard (1994).

The utilization of natural enemies for augmentative biological control of insect pests in Thailand was initially summarized by Napompeth (1989, 1990a, 1990b, 1992) and subsequently updated by Suasa-ard (2000).


Sugarcane
Saccharum officianarium L.



Sugarcane production in Thailand 2007-2008 (tons)

The most serious insect pests of sugarcane plantations in Thailand

- Sugarcane moth borers
  - *Chilo tumidicostalis*
  - *Chilo sacchariphagus*
  - *Chilo infuscatellus*
  - *Sesamia inferens*
  - *Scirpophaga excerptalis*

Infestation area

Damage stalks

Longhorn stem borer, *Dorysthenes buqueti*

Infestation of *Lepidiota stigma*

Important Natural Enemies

Trichogramma chilotreae

Telenomus rowani

Cotesia flavipes

Sugarcane moth borers

Tetrastichius ayyari

Tachinid fly

Xamthopimpla stemmator

Natural enemies of *Dorysthenes buqueti*

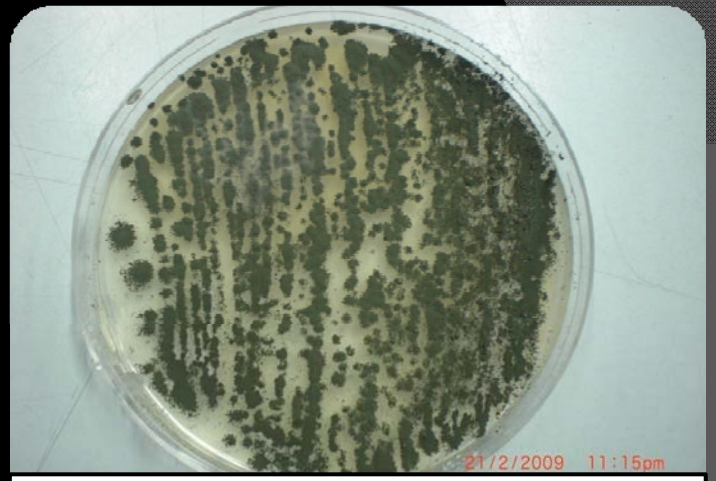
Metarhizium anisopliae

White egret

Human

White grub, *Lepidiota stigma*

Natural enemies



Metarhizium anisopliae

Food for Human

Sugarcane whitefly

Natural enemies

***Amitus* sp.**

Cheilomenes* *sexmaculata

Encarsia ochai

Coccinella ***transversalis***

***Azotus* sp.**

Sugarcane scale

Aulacaspis tegalensis

Natural enemies

Cheilomenes sexmaculata

Mallada basalis

Coccinella transversalis

Sugarcane pink mealybug
Saccharicoccus sacchari

Coccinella transversalis

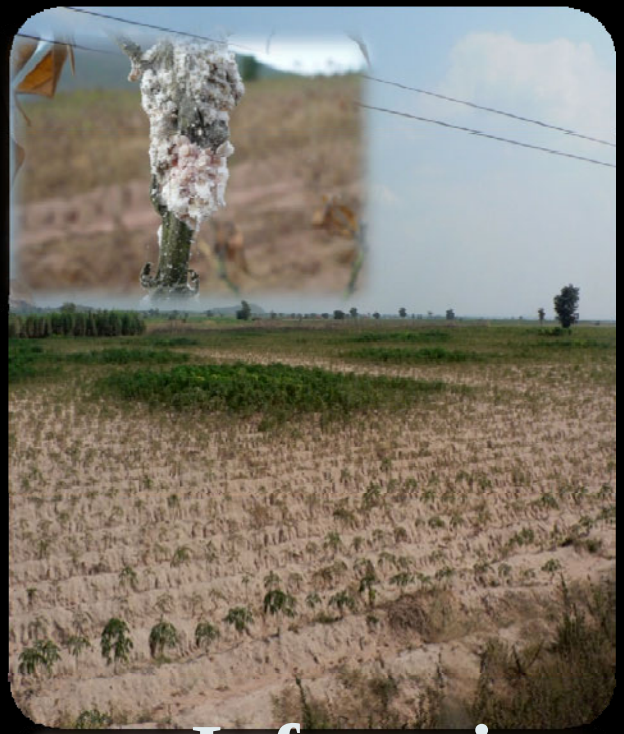
Natural enemies

Proreus simulans

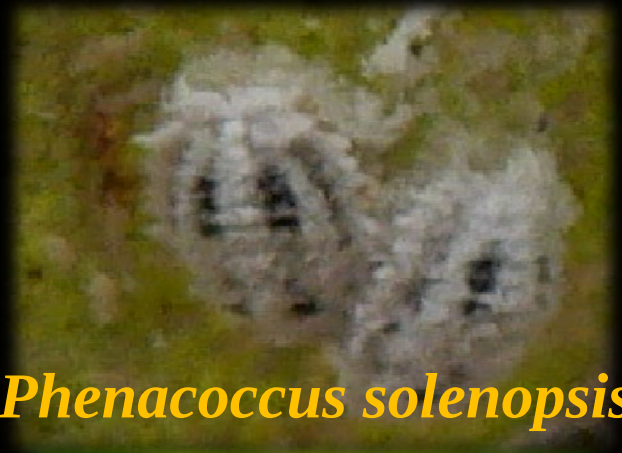
***Chrysopa* sp.**

Cassava

Manihot esculenta (L.)



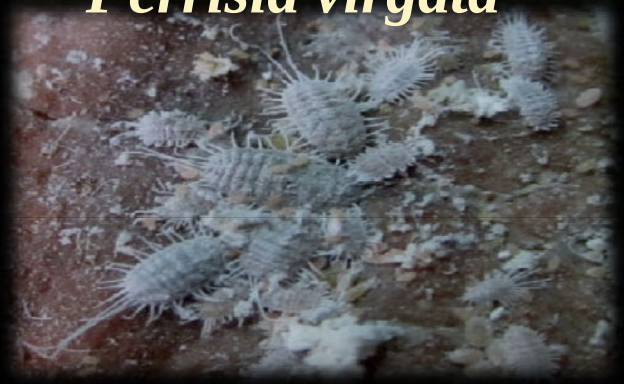
Infestation of mealybugs complex



Phenacoccus solenopsis

Ferrisia virgata

Phenacoccus madeirensis



Pseudococcus jackbeardsleyi

Phenacoccus manihoti

Native natural enemies

Plesiochrysa ramburi

Micraspis discolor

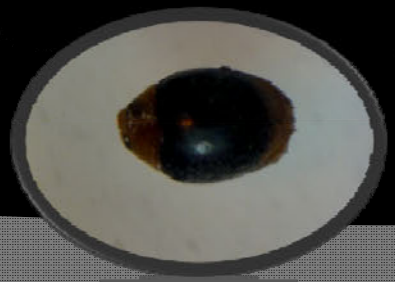
Cheilomenes sexmaculata

Mallada basalis

Nephus sp.

Brumoides sp.

Unidentified coccinellid



Native parasite of Thailand

***Allotropa* sp.**

***Leptomastrix* sp.**

***Arphenophagus* sp.**

Unidentified encyrtid

Corn

Zea mays (L.)

Mallada basalis

Trichogramma **sp.**

Natural enemies of corn borer

Proreus simulans

Ostrinia furnacalis

Telenomus rowani

Paederus fuscipes

Natural enemies of corn borer
Helicoverpa armigera

Eocanthecona furcellata

Sycanus collaris

Natural enemies of *Frankliniella williamsi*

Wollastoniella rotunda

Orius maxidentex

Amblyseius sp.

Franklinothrip vespiformis

Utilization of effectively native natural enemies as biological control agents in sugarcane fields

Cotesia flavipes

Sommartya *et al*. (2007) reported that all entomopathogenic fungi infecting *D. buquti* larvae collected from sugarcane fields throughout Thailand were identified as *Metarhizium anisopliae* var. *anisopliae*. It has been considered the most effective natural enemy to control *D.buqueti*; and infects all stages of *D.buqueti* and kills 100% of infected larvae in the laboratory within 14 days after inoculation with a suspension of $1x10^7$ spores per ml.

Methodology

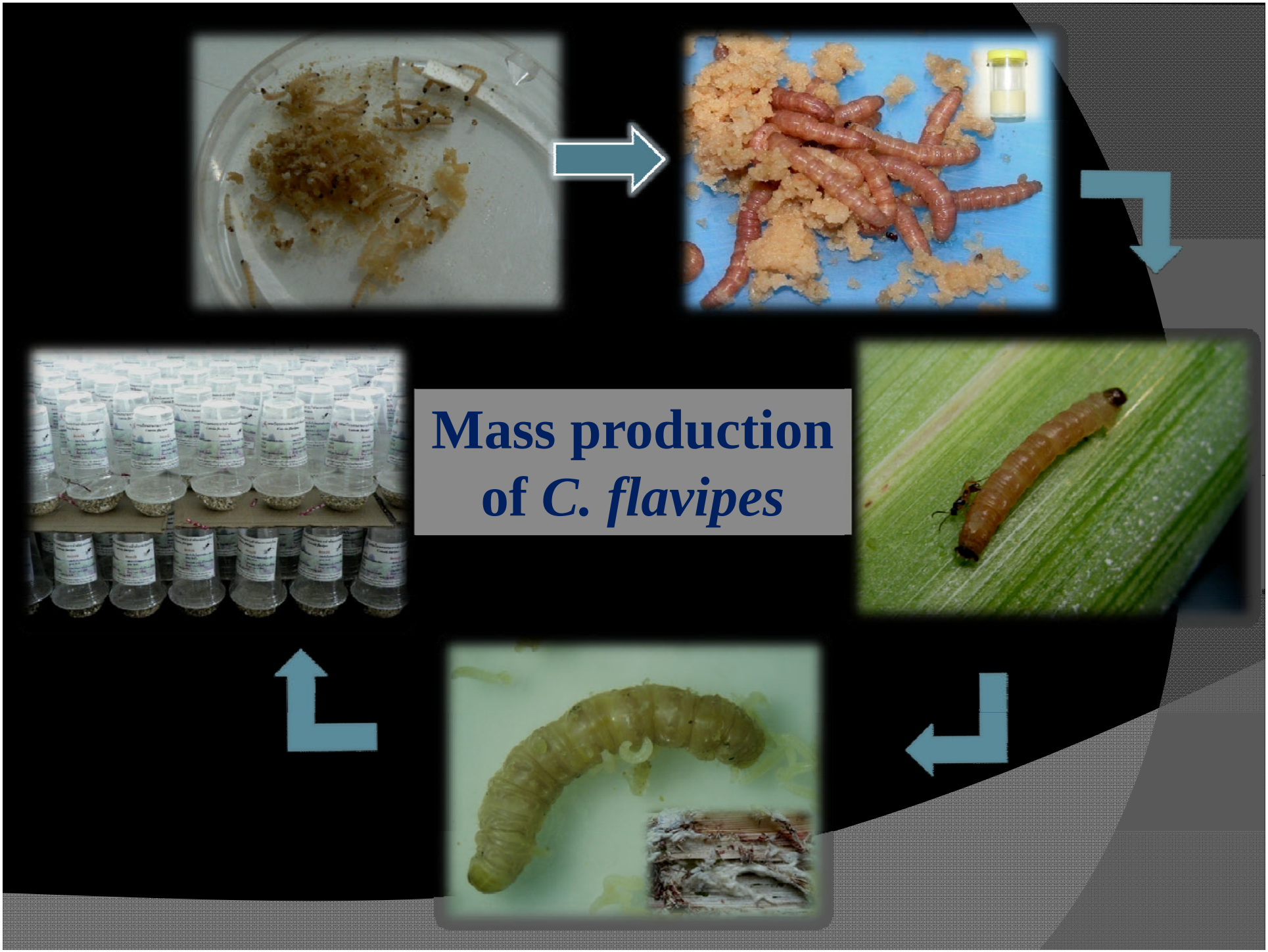
- Education for utilization
- Mass production of Natural enemies
- Utilization in the field
- Field assessment

Education for utilization

- Introduction of pests and natural enemies of sugarcane
- Benefit of biological control
- Application of natural enemies
- Assessment of the project

Demonstration plots

- Six demonstration plots in farmer fields
- Four acres per plot
- Field days


Mass production
of C. flavipes

Mass Production of *M. anisopliae*

pure culture

Mass production of *M. anisopliae*

Mass production of *M. anisopliae* was carried out by colonisation of cooked rice at the National Biological Control Research Center (NBCRC) Central Regional Center, Kamphaeng Saen, Nakhon Pathom. About 3000 kg of fresh culture on cooked rice were produced monthly for application and evaluation in the fields.

Field application and evaluation

Field application and evaluation were done in Nakhon Pathom, Kanchanaburi and Suphanburi provinced in the Central Region of Thailand

Application of *M. anisopliae* in the field

Result of *C. flavipes* released fields

Success of *C. flavipes* for control sugarcane moth borers was confirmed in 1995-1997 **and 1999-2000**

Impact of the project: farmers satisfaction

Additional impacts of the success of the project can be made evident from the questionnaires. There were 621 sugarcane farmers collaborated with the project and were asked to give their response to the questionnaires for the assessment of the project.

- 80% had the perception in solving insect pest problems by natural enemy applications
- 88% of the farmers gained more knowledge and apprehension in biological control of sugarcane insect pests

Utilization of native natural enemies as biological control agents in cassava fields

Plesiochrysa ramburi
(Neuroptera: Chrysopidae)

Mallada basalis
(Neuroptera: Chrysopidae)

Methodology

- **Education for utilization**
- **Mass production of *M. basalis* & *P. ramburi***
- **Field release natural enermies**
- **Field assessment**

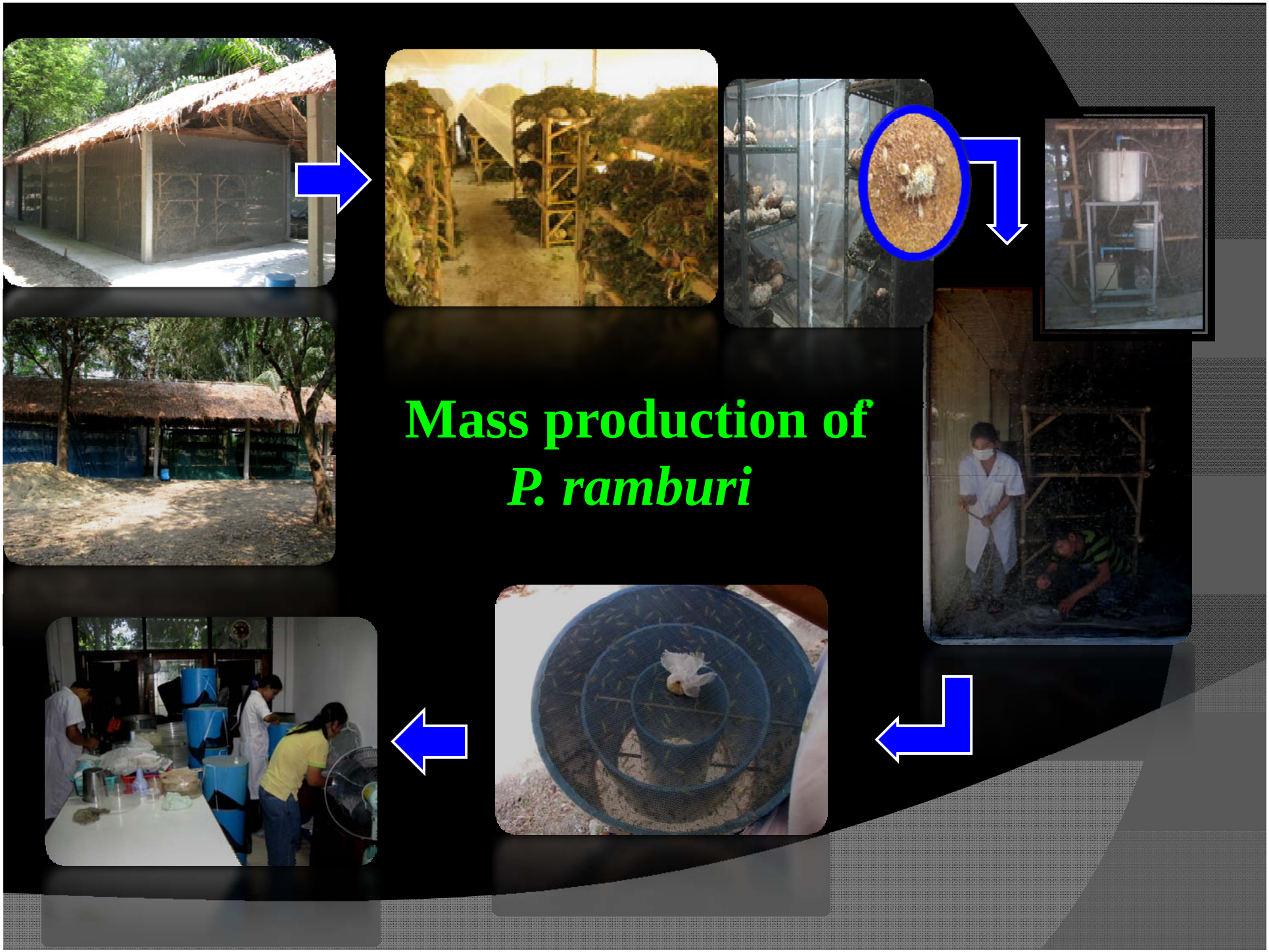
Education for utilization

- Introduction of pests and natural enemies of cassava
- Benefit of biological control
- Application of natural enemies
- Assessment of the project

Small group training in the farm

- Introduction of natural enemy species
- Mass rearing
- Method of release
- Augmentation
- Conservation


Mass production
of M.basalis


Mass production of
P. ramburi

Package and transportation of natural enemies

Field release


Field evaluatio




CONCLUSIONS

- More than 110 species of natural enemies including insects predators, parasitic insects and pathogens associated with economic insect pests of sugarcane, cassava, and corn. These natural enemies are considerable regulation factors for the control insect pests in term of natural biological control agents. Among these *C. flavipes*; the green muscadine fungus, *M. anisopliae* and the green lacewings: *P. ramburi* and *M. basalis* have been utilized for augmentative biological control of sugarcane moth borers complex, sugarcane longhorn stem borer and the cassava mealybugs complex. The results from the utilization of these natural enemies gave most satisfaction control. Tt is very challenging for future research to control important insect pest of field crops in Thailand.

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WELCOME


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