# **Biocontrol Technical Workshop Series 2022**

# **Session 6: Botanical Pesticides**



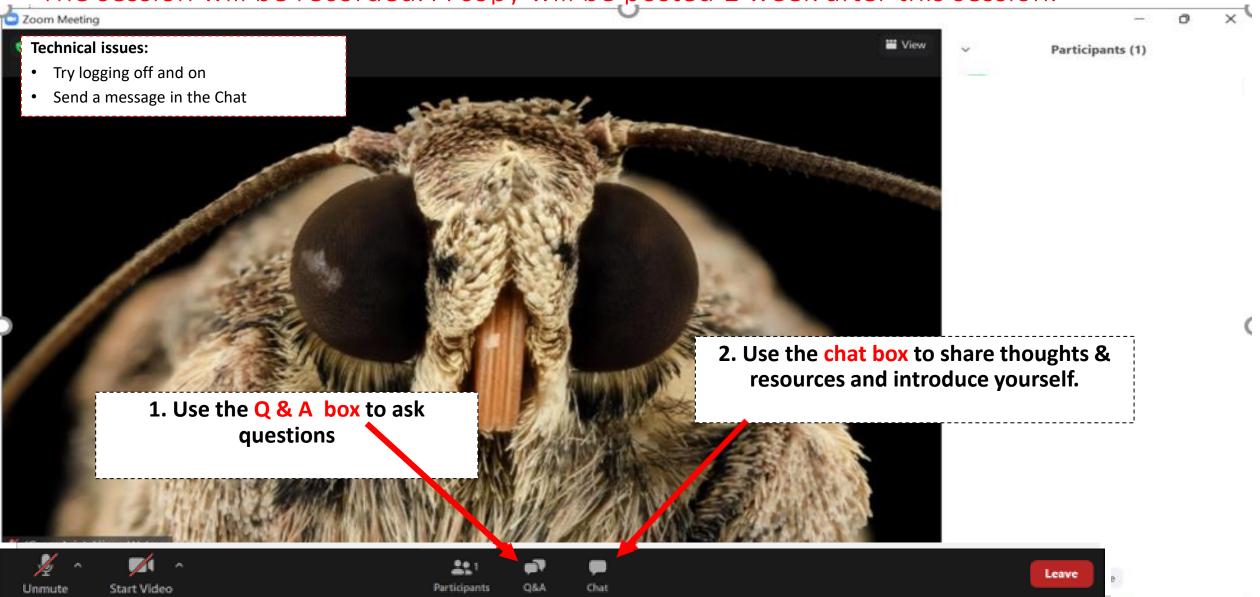
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23 November 2022

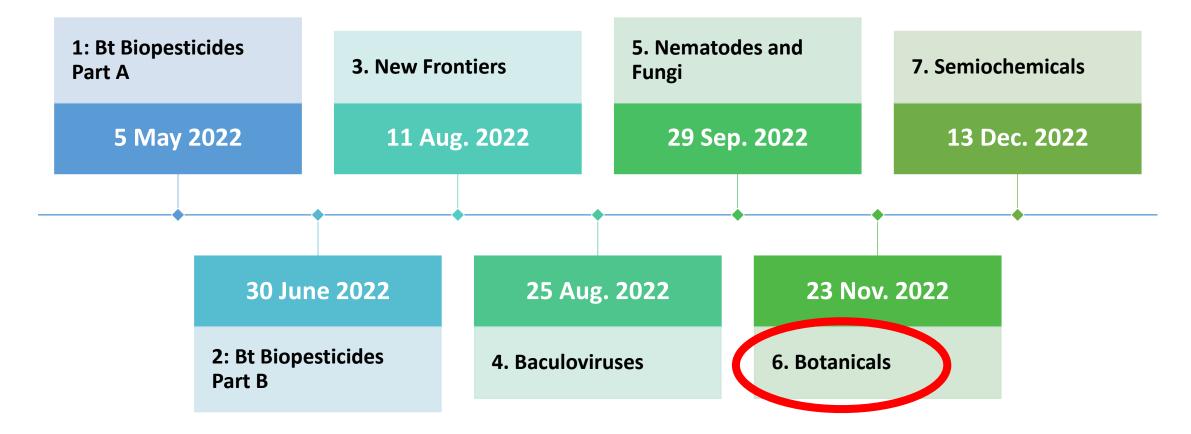




#### The session will be recorded. A copy will be posted 1 week after this session.



# **Biocontrol Workshop Schedule**



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# Speakers

**Botanical insecticides: the disconnect between theory and practice** Dr Murray Isman, Professor of Entomology/ Toxicology, University of British Columbia

Status of botanical pesticides in Viet Nam Dao Bach Khoa, Head of Division of Pesticide, Weed and Environment, PPRI, Vietnam

**Prospects of botanical compounds and pesticides for FAW control** 

Patrick Maada Ngegba, Researcher, South China Agricultural University

#### POLL (anonymous)

1. Have you worked with or researched botanicals for plant health and protection purposes?

#### 2. Choose the statement that <u>best</u> suits your view:

**Statement 1:** We need to spend more time on discovering new botanical insecticides

### OR

Statement 2: We need to spend more time on developing botanical insecticides from a targeted number of plants already known to be suitable for producing botanical insecticides.



# Botanical insecticides: the disconnect between theory and practice

## Murray B. Isman

Faculty of Land and Food Systems

University of British Columbia, Vancouver, CANADA

ASEAN FAW Action Plan Biocontrol Workshop Series 6: Botanicals 23 November 2022











Terrestrial plants are a rich source of novel chemistry; the majority of these plant "secondary" substances likely evolved as defenses against herbivores and pathogens









There are perhaps 100,000 or more "secondary plant metabolites"; many serve as natural chemical defenses for the plants producing them. *Thousands* (or more) have some <u>demonstrated bioactivity in</u> <u>insects</u> (at least in laboratory tests)

Bioactivities can be behavioral (repellence, feeding deterrence, oviposition deterrence) or physiological (acute toxicity, developmental disruption, growth inhibition)

Why are there so few botanical insecticides in actual use?







# **Long-established Botanical Insecticides**

- Pyrethrum (Tanacetum cinerariaefolium)
- Rotenone (Derris elliptica, Lonchocarpus spp.)
- Nicotine (Nicotiana and Anabasis species)

NB the use of rotenone and nicotine for insect control has been largely discontinued in most industrialized countries

# **Recently Introduced Botanical Insecticides**

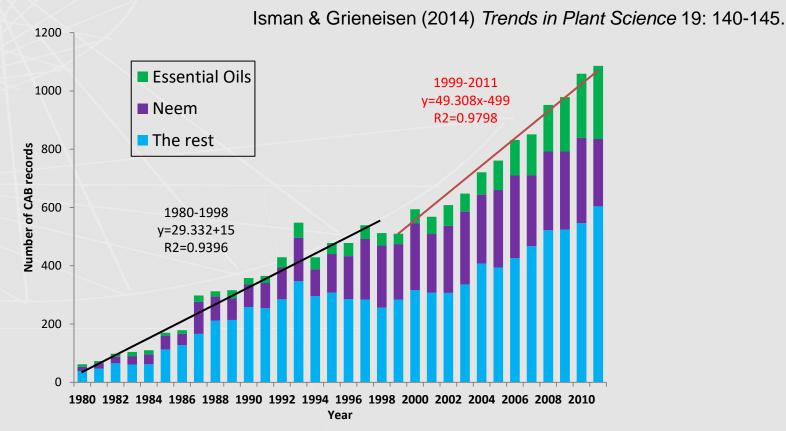
- Neem (Azadirachta indica)
- Essential oils (various including Eugenia, Cymbopogon, Thymus, Cinnamomum, Citrus)







### Growth in Journal Papers on Botanical Insecticides: 1980-2011



Note: 1. in 2011, more papers on essential oils (251) than on neem (231)

- 2. overall, twice as many papers on neem (4,997) than essential oils (2,180)
- 3. over half of all papers on essential oils (1,111) published in 2007-2011







# The problem statement

- Published research on botanical insecticides is heavily skewed (>80%) toward the *discovery* end of the R&D spectrum (e.g., "extract or oil of plant species X kills or repels pest species Y <u>under laboratory conditions</u>")
- In the absence of much applied research, this wealth of knowledge is NOT being translated to practice (i.e., put in the hands of farmers)







Challenges for the <u>commercial</u> development of new botanical insecticides

- Resource availability/sustainability
  - Wild-crafting vs. propagation/cultivation
- Stability, standardization and quality control
  - Chemical characterization; formulation
- Regulatory approval (toxicology)
  - Data requirements, data waivers, exemptions







### **Botanical insecticides commercialized since 2000**

Common name	Plant species	Active ingredient(s)	Country of manufacture	Commerical product(s)
Matrine	Sophora flavescens	Matrine and related quinolizidine alkaloids	PR China	Matrine 0.3% EC
Black false hellebore	Veratrum nigrum	Cevadine-type alkaloids	PR China, USA	Veratrine 0.5% SL, Veratran D
Staff vine	Celastrus angulatus	Celangulin and related sesquiterpenes	PR China, USA	Celastrus 1% EW, Celan-X SL
Annona, sweetsop	Annona squamosa	Annonin and related acetogenins	India	Anosom, Biorakshak
Karanjin	Derris indica (syn. Pongamia glabra)	Karanjin (a furanoflavonol)	India	Biocawach
Hot pepper	Capsicum annuum	Capsicum oleoresin, capsaicin	Colombia, USA	EcofloraAgro, Captiva
Butterfly pea	Clitoria ternatea	cyclotides	Australia	Sero-X







# Matrine 0.3% EC PR China Veratrine 0.5% SL



Sophora flavescens



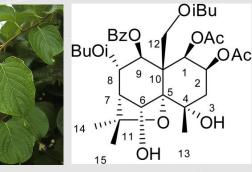
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#### Celan-X SL

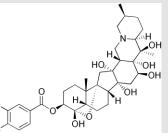




#### Celastrus angulatus



Veratrum nigrum





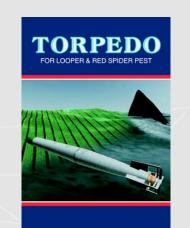






Annona squamosa and A. reticulata (1% squamosin)

$$\begin{array}{c} 0\\ 0\\ H_{3}C \end{array} \xrightarrow{(CH_{2})_{12}} H \xrightarrow{(CH_{2})$$



India





Sophora

Stemona







Millettia



Land and Food Systems



## Plant essential oils as active ingredients of some commercial botanical insecticides

Common name	Plant species	Major constituent(s)	Country of manufacture	Commercial product(s)
Rosemary	Salvia rosmarinus (syn. Rosmarinus officinalis)	1,8-cineole (=eucalyptol), camphor	USA	Ecotrol, TetraCURB
Thyme	Thymus vulgaris	Thymol, carvacrol	USA, Italy	Avenger Plus, Promax, Api Life VAR
Orange	Citrus sinensis	<i>d</i> -limonene	RSA, USA	Prev-AM, XT-2000
"Chenopodium"	Synthetic blend of terpenes based on <i>Chenopodium</i>	$\alpha$ -terpinene, <i>p</i> -cymene, <i>d</i> -limonene	USA	Requiem EC
Mint	Mentha spp.	Menthol, carvone	USA	EcoSMART









Active ingredients: 10% Rosemary oil 2% Peppermint oil

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ACTIVE INGREDIENTS		AKTIEWE BESTANDELE		
Borax Inorganic compound	10 g/ê	Boraks Anorganiese verbinding		
Orange oil	50 g/ê	Lemoenolie		
MANUFACTURER / REGISTR	ATION HOLDER			
Oro Agri SA (Pty) REG. Nº 2001/027414/07	Ltd.			_
PIST P.O. Box 475	Somerset Mall • 7137	3082	000	AGRI
EMAIL	info sa@oroagri.com			

Active ingredient: 5% orange oil



Active ingredients: 16.75% monoterpenes



Active ingredients: 7.6% Capsicum oleoresin extract 23.4% Garlic oil 55.0% Canola oil



Active ingredients:Cinnamon oil1.25%Oil of Oregano0.25%Peppermint oil1.00%Clove oil0.50%Neem oil4.00%Olive oil21.00%Soybean oil2.00%







# **Control of tomato pests using botanical insecticides - 2017**

Visalia, California, August 2017

Treatment	Sweetpotato whitefly nymphs/5 leaves	Green peach aphids/5 leaves	Beet armyworms/plo t
Ecotec (0.25%)	4.75 a	8.25 a	1.75 a
Pyganic (0.13%)(pyrethri ns)	4.25 a	7.75 a	1.25 a
Untreated control	22.75 b	50.25 b	9.0 b

Insect counts taken 1 week after 2<sup>nd</sup> application;

data courtesy of Brandt Consolidated



Myzus persicae



Bemisia tabaci



Spodoptera exigua

BRANDT







# France - control of western flower thrips on cucumber - 2018

Treatment (L/ha x applications)	Thrips larvae/shoot (@ 3 weeks)
KeyPlex 063 (5.0 x 4)	138
Oikos (azadirachtin)(1.5 x 4)	180
Decis (deltamethrin)(0.83 x 3)	125
Untreated control	960



Western flower thrips Frankliniella occidentalis









# A question of scale...



Commodity-based mechanized agriculture (domestic and for export) versus smallholder food production for local consumption











- Choose a select number of plants from among the many already known to be suitable for producing botanical insecticides
- Focus more research/development on:
  - Methods for propagation and cultivation
  - Simple methods for extraction
  - Simple methods to validate bioactivity
  - Field trials/demonstrations to optimize efficacy







#### PLANT POWER

Thirteen herbs controlled under the Hazardous Substances Act are being widely used by farmers as substitutes for chemicals.

 Neem / Against cotton leafhoppers, cabbage moth, onion cutworm, bean pod borer.
 Citronella grass / Against rice diseases, seed-gall nematode.
 Turmeric / Fungicide.

Plants / Properties

against rice weevils. Ginger/ Insecticide Chinese ginger /

Against snails, and bacteria and nematode-caused diseases.

African marigold / Against nematodecaused diseases.

Siam weed or Bitter bush / Against cabbage moth, common cutworm, cowpea weevil, aphid, plant diseases.

8 Tea seed cake / Against golden apple snails.

 Chilli / Against spider mite, whitefly, rats, aphid, cabbage moth.
 Chinese celery / Against rice blast

disease. (1) Ringworm bush / Scare off birds.

12 Glory lily /

Insecticide.

Insecticide, against plant diseases, cabbage moth.

Source: Department of Agriculture POSTgraphics

# Some plant extracts used for crop protection

<u>Thailand</u>

## **Brazil**

Azadirachta indica (Neem) Derris spp. (timbó)(Rotenone) Chrysanthemum cinerariaefolium (Piretro)(Pyrethrum) Piper nigrum (Pimenta do reino)(Black pepper) Allium sativum (Alho)(Garlic) Allamanda nobilis (Alamanda) Melia azedarach (Cinamomo)(Chinaberry) Pongamia glabra (Karanja) Capsicum frutescens (Pimenta Malagueta)(Hot pepper) Artemisia absynthium (Artemisia)(Absynthe) Bixa orellana (Annato)



Land and Food Systems



## Well known insecticidal plants – Asia, Americas

Sophora flavescens (MB Isman)



Piper retrofractum (Berbagi Sedikit Informasi)



*Tagetes minuta* (H. Tolosa, Flora Bonaerense)



*Eucalyptus globulus* (Forest & Kim Starr, Wikipedia)



Annona squamosa (I. Maguire, Pine Island Nursery)







# Well known insecticidal plants in Africa

Tephrosia vogelii (MB Isman)



Lippia javanica (PlantzAfrica.com)



BC

THE UNIVERSITY OF BRITISH COLUMBIA



Ocimum gratissimum (Onlyfoods.net)



#### Tithonia diversifolia

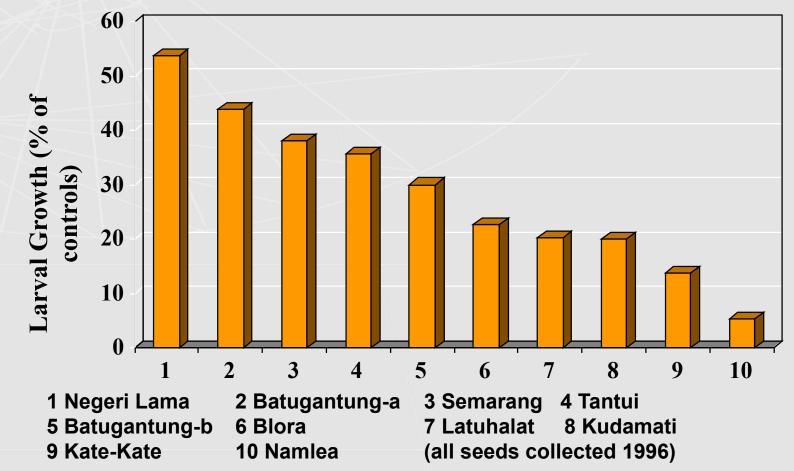
(PlantzAfrica.com)





# Geographic variation in potency of Annona squamosa seed extracts to Spodoptera litura

(Leatemia & Isman, *Phytoparasitica 32: 30-37, 2004*)





Land	and	Food	Sys	tems
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## **Problem: Chemical variation in plants** Solution: Blending to achieve consistency

Cocoa: beans to chocolate

Coffee: beans to beverage

Wine: grapes to beverage



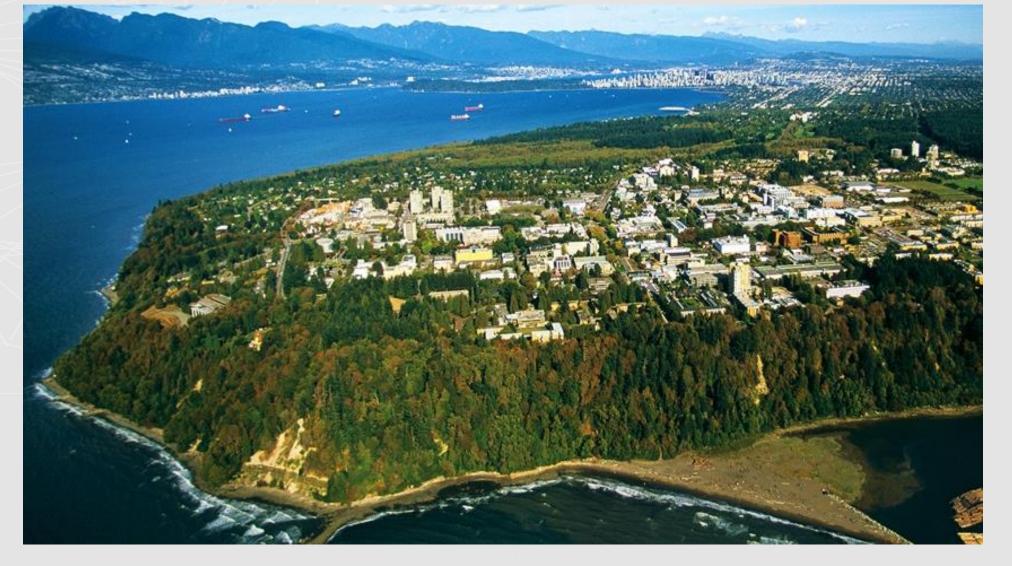


# **Summary**

- a vast (and growing) scientific literature indicates that hundreds (possibly thousands) of terrestrial plants contain natural constituents that are toxic or deterrent to insects
- In contrast, only a handful of botanical insecticides have been commercialized in the past 20 years, because the barriers to commercialization are primarily technical, financial and legal rather than biological
- The disconnect between the theory (research) and practice (utilization) for botanical insecticides is a result of too much research on "discovery" and too little research on "application"
- More focus should be placed on the practical utilization of insecticidal plants that are already well known globally







### murray.isman@ubc.ca











# Prospects of botanical compounds and pesticides as sustainable management strategies against *Spodoptera frugiperda*



Speaker : Patrick Maada Ngegba PhD in Pesticide Science (In view) M. Agriculture in Crop Protection B.Sc (Hons) Crop Protection

2022 BIOCONTROL WORKSHOP SERIES Workshop 6 23/11/2022



## PRESENTATION OUTLINE

1. Current status of FAW

2. Prospects of botanical pesticides in management FAW

3. Some commercial botanical pesticides

4. Impact of botanical pesticides on FAW and its yield potential

5. Challenges of botanical pesticides usage

6. Conclusions and Recommendations

# **Current status**

Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) is an economically important agricultural pest that poses a serious threat to food security globally (Hui-ru et al., 2021; Qi et al., 2021)

It is native to tropical and subtropical regions of the Americas, and has rapidly spread to most parts of the world (Lira *et al.*, 2020; Wang et al., 2020)

Highly polyphagous and has a wide host range of 353 plant species from 76 families, including maize (Zea mays L.), sorghum (Sorghum bicolor (L.) Moench), cotton (Gossypium sp. L.), and rice (Oryza sativa L.) (Montezano et al., 2018; Guo et al., 2020; Lv et al., 2021)

A serious transboundary pest, can fly long distances, and breeds prolifically under suitable environmental conditions (Baudron et al., 2019)



Photo credit: Desiree Van Heerden from Sygenta

# **Current status**

• Globally, the application of synthetic pesticides is the most widely utilized control measure against *S. frugiperda* (Arias *et al.*, 2019; Tambo *et al.*, 2019)

• Commonly used insecticides include carbamate organophosphates, pyrethroids, and diamides (Gutiérrez-Moreno et al., 2019; Boaventura et al., 2020).

• Chemical pesticides pose adverse health risks to farmers and consumers, can build up resistance, cause toxicity to beneficial insects and natural enemies, and lead to environmental contamination (Day et al., 2017).

• How might botanical pesticides help in farmers manage FAW and what are the benefits and challenges

# **Prospects of botanical pesticides in management of FAW**

- Botanical pesticides
  - efficacy
  - biodegradability
  - varied modes of action
  - low toxicity
  - easy usage
  - affordability
  - availability
  - minimal adverse effects on agroecosystems
  - human health (Shu et al., 2019; Jia et al., 2020)

# **Prospects of botanical pesticides in management of FAW**

Botanical pesticides induce behavioral and physiological effects such as:

- repellence
- oviposition
- feeding deterrence
- acute toxicity
- developmental disruption
- growth suppression

#### Some plants utilized as botanical insecticides and their effects on *S. frugiperda*

Scientific Name (s)	Common Name (s)	Part used	Effect on Life Cycle	Study Area	Reference
Dysphania ambrosioides	Jesuit's tea, Mexican-tea	Leaf, Seed	High mortality, pupal weight loss	Laboratory/greenhou se/field	(Trindade et al., 2015; Sisay et al., 2019)
Tagetes erecta	African marigold	Leaf	Antifeedant, larval and pupal mortality, weight reduction	Laboratory	(Salinas-Sánchez et al., 2012)
Cymbopogon winterrianus	Citronella (Java Type)	Leaf	Alteration to the biochemical profile of larval, impaired reproduction	Laboratory/Greenhou se	(Silva et al. 2015)

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#### Some plants utilized as botanical insecticides and their effects on *S. frugiperda* Cont'd

Scientific Name (s)	Common Name (s)	Part used	Effect on Life Cycle	Study Area	Reference
Carica papaya	Pawpaw	Seed	Reduced larval weight, prolonged pupation emergence time, high mortality	Laboratory/Greenhouse	(Perez-Gutierrez et al., 2011; Figueroa- Brito et al. 2013)
Euphorbia pulcherrima	Poinsettia	Leaf	Larval mortality, larval or pupal weight loss, prolonged larval stage, reduced egg viability	Laboratory	(Almeida et al. 2017)
Moringa oleifera	Moringa, Horse radish tree		Antifeedant activity, high mortality	Laboratory	(Kamel 2010)

#### Some plants utilized as botanical insecticides and their effects on *S. frugiperda* Cont'd



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Scientific Name (s)	Common Name (s)	Part used	Effect on Life Cycle	Study Area	Reference
Jatropha gossypiifolia	Bellyache bush, Cotton-leaf physic nut	Leaf	Antifeedant	Laboratory	(Bullangpoti et al., 2012)
Azadirachta indica	Neem	Seed	Growth inhibition, antifeedant, larval mortality, low oviposition, prolonged development rate.	Laboratory/ greenhouse/field	(Sisay et al., 2019)
Argemone ochroleuca	Pale Mexican prickly poppy	Leaf, seed, flower	Larval mortality, antifeedant, delayed larval growth	Laboratory	(Martínez et al., 2017)

#### Some plants utilized as botanical insecticides and their effects on *S. frugiperda* Cont'd

Scientific Name (s)	Common Name (s)	Part used	Effect on Life Cycle	Study Area	Reference
Cymbopogon flexuosus	Cochin grass, Malabar grass	Leaf	Insecticidal activity	Laboratory	(Oliveira et al., 2018)
Lantana camara	Lantana	Seed	Larval mortality	Laboratory/ greenhouse/field	(Sisay et al., 2019)
Ocimum basilicum	Ho-ra-pa, Sweet-basil, basil	Leaf	Induced toxicity, nonpreference, knockdown	Laboratory/ greenhouse/field	(Phambala et al., 2020)



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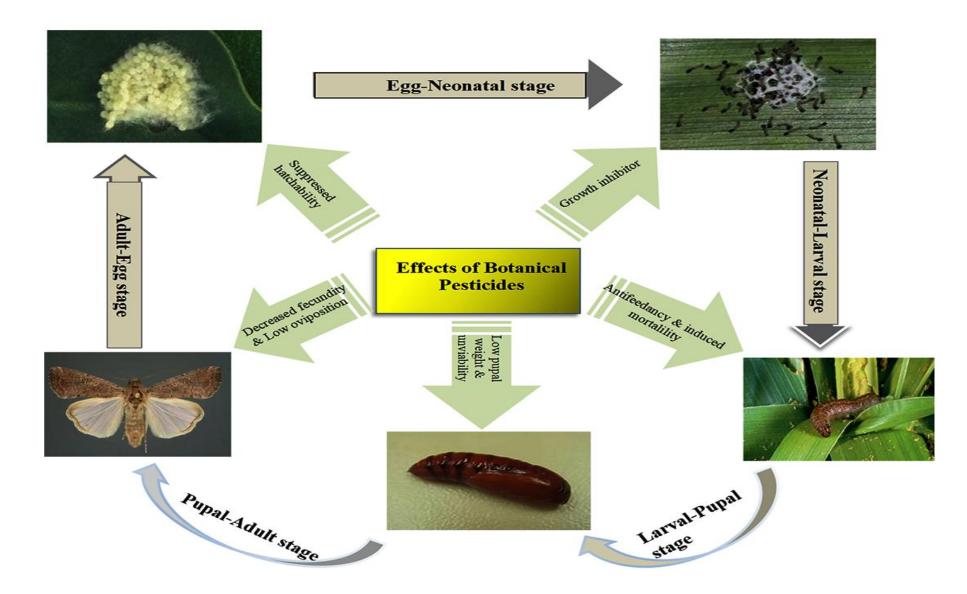


Illustration of effects of botanical pesticides on the life stages of *S. frugiperda* (Ngegba et al., 2022).

# **Some commercial botanical pesticides**

Scientific Name (s)	<b>Product common Name (s)</b>	Trade Name
<i>Cymbopogon nardus, C.citratus, Cymbopogon flexuosus (D.C)</i>	Lemongrass essential oil	GreenMatch EX™
Azadirachta indica	Neem	Ecozin, Azatrol EC, Agroneem, Trilogy™
<i>Cassia tora</i> (L.), <i>Cassia</i> <i>obtusifolia (</i> L.)	Cinnamaldehyde	Vertigo™, Cinnacure™
<i>Syzygium aromaticum</i> (L.) <i>Eugenia caryophyllus</i> (Spreng)	<b>Clove essential oil</b>	Matran EC, Burnout II, Biooganic Lawn.
Tanacetum cinerariaefolium (Trevisan) Schultz-Bip.	Pyrethrum	Pyganic, DiatectSeed.

# **Some commercial botanical pesticides**

Scientific Name (s)	<b>Product common Name (s)</b>	Trade Name
Derris spp., Lonchocarpus spp., and Tephrosia spp	Rotenone	Bonide, Rotenone
Ryania spp. (Ryania speciose Vahl)	Ryania	Natur-Gro R-50, Natur-Gro Triple Plus, Ryan 50.
Schoenocaulon spp. (S. officinale)	Sabadilla	Veratran, RedDevil, Natural Guard.
Thymus vulgaris L. Thymus spp	Thyme essential oil	Proud 3, OrganicYard Insect Killer, Promax™



# Impact of botanical pesticides on FAW and yield potential

Neem extracts inhibited *S. frugiperda* infestation and recorded highest maize yield of 4.9 t ha<sup>-1</sup>, followed by cypermethrin + Chinaberry with 4.7 t ha<sup>-1</sup> and a garlic yield of 4.3 t ha<sup>-1</sup> respectively (Siazemo and Simfukwe, 2020).

Extracts from West African black pepper at different concentrations induced *S. frugiperda* mortality and decreased the larval population (Tanyi et al., 2020).

Reducing plant damage at both the vegetative and reproductive stages and leading to more crop growth and photosynthesis that accounted for maize yields ranging from 2.2 to 6.3 t ha<sup>-1</sup> compared to control (Tanyi et al., 2020).

## Impact of botanical pesticides on FAW and its yield potential cont'd

Some botanical extracts suppressed *S. frugiperda* damage in maize fields, and azadirachtin had the highest grain yield of 2,580 kg-ha<sup>-1</sup>, followed by neem seed kernel with 2,446 kg ha<sup>-1</sup> (Dhobi et al., 2020)

Green chili induced the lowest grain yield (2,051 kg ha<sup>-1</sup>) compared to *Lantana* camara (2,089 kg ha-1) and tobacco decoction 2,198 kg ha<sup>-1</sup> (Dhobi et al., 2020).

## Challenges of botanical pesticides usage

Botanical pesticide effectiveness in the field is extremely contingent on prevailing environmental and weather conditions as they are **easily degradable** (Isman and Grieneisen, 2014; Campos et al., 2018).

It is often **challenging to standardize botanical pesticide dosages** due to variance growth habitations, varietal differences, harvest duration, extraction methods, and storage conditions (Shiberu and Getu, 2016).

Appropriate formulation is very challenging because multiple bioactive constituents are evident in one plant species that differ in chemical properties (Kumar and Singh, 2015).

# Challenges of botanical pesticides usage Cont'l

Botanical pesticides commercialization has major challenges, such as

(a) limited supply of botanical raw materials

(b) poor standardization and quality control of the required active ingredients

(c) issues with regulatory approval, i.e., costly toxicological evaluation of the candidate botanical pesticide (Isman and Paluch, 2011; Fischer et al., 2013)

## **Conclusions and Recommendations**

Significant concerns related to human health, environmental safety, and negative impacts on beneficiary organisms from the use of conventional chemical pesticides along with increasing global demand for pesticide residue-free products can help drive increasing demand for botanical pesticides as sustainable alternatives in managing *S. frugiperda*.

Botanical pesticides can cause low egg viability, reductions in larval growth, prolong development periods, increase mortality, and lower fertility and fecundity of adults of *S. frugiperda*, providing benefits related to environmental safety and food safe for human consumption.

Considering the benefits of botanical pesticides in helping to control FAW we recommend...

Recommendations to enhance the utilization of botanical pesticides to manage *S. frugiperda* (Ngegba et al., 2022)



# Acknowledgements

I want to sincerely thank and appreciate my supervisor Professor (Dr.) Guohua Zhong, Dean of Plant Protection, South China Agriculture University, Guangzhou, China for his mentorship and funding to this project

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I am particularly grateful to the organizers for singling out our work to be shared with the wilder stakeholders in the agricultural sector.

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Journal of Economic Entomology, XX(XX), 2022, 1–12 https://doi.org/10.1093/jee/toac157 Review



Review

#### Prospects of Botanical Compounds and Pesticides as Sustainable Management Strategies Against *Spodoptera frugiperda*

Patrick Maada Ngegba,<sup>1,2,9</sup> Gaofeng Cui,<sup>1,2,0</sup> Muhammad Zaryab Khalid,<sup>1,2,0</sup> Yun Li,<sup>1,2,0</sup> and Guohua Zhong<sup>1,2,4,0</sup>

<sup>1</sup>Key Laboratory of Integrated Pest Management on Grops in South China, Ministry of Agriculture and Rural Affairs, South China Agricultural University, Guangzhou, 510642, China, "Key Laboratory of Natural Pesticide & Chemical Biology, Ministry of Education, South China Agricultural University, Guangzhou, 510642, China, "Sierra Leone Agricultural Research Institute, P.M.B 1313 Tower Hill, Freetown, 47235, Sierra Leone, and "Corresponding author, e-mail: guohuazhong@scau.edu.cn

#### Subject Editor: Dominic Reisig

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#### Abstract

Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) (fall armyworm) is an extremely destructive insect pest that causes crop losses, especially cereal production across the world. Its management is challenged by its high migratory ability, polyhagous nature, high fecundity level, and short life cycle. It has become a serious threat across the globe that requires proactive and coordinated regional and global interventions. Although synthetic insecticides have been widely utilized to control the pest, there are numerous inherent challenges associated with the overreliance and overues of these chemicals, e.g., toxicity to humans, destruction of natural pest enemies and pollinators, environmental and food contamination, pest resurgence, secondary pest outbreaks, and resistance development. Plant-derived pesticides such as Azadimetha indigrach taindigra. *Euclayptus globulus, Jatropha curcas, Lantana camara, Phytolacca dodecandra, and Piper guineense* have been evaluated under laboratory, greenhouse, and field conditions to control *S. frugiperda*. We are certain that the substantial potential of these plants under field conditions could be enhanced and promoted together with existing plant-based products, the review highlights challenges and prospects that will help refocus and increase research attention on the development and application of botanical pesticides under field conditions to increase the commercialization and adoption rate of this technology across the globe.

Key words: Spodoptera frugiperda, botanical pesticide, challenge and prospect, commercialization, adoption

Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) is an economically important agricultural pest that poses a serious threat to food security globally (Dumas et al. 2015, Zacarias 2020, Hui-ru et al. 2021, Qi et al. 2021). Moreover, it is native to tropical and subtropical regions of the Americas, and this deleterious pest has rapidly spread to most parts of the world since 2015 (Baloch et al. 2020, Lira et al. 2020, Wang et al. 2020). S. frugiperda was first detected outside its native range in Central and West Africa (Benin, Nigeria, Sao Tome and Principe, and Togo) in 2016 and caused immense devastation to maize in several countries (Goergen et al. 2016, FAO 2018). In less than three years, it spread to s44 African countries (Hedmann et al. 2019), as well as several Asian countries (Source et al. 2019).

(Guo et al. 2018, Shylesha et al. 2018, CABI 2019). The first report of the invasion of S. frugiperda into China was in January 2019 in Yunnan Province (Guo et al. 2019, Zhang et al. 2019). Then, it rapidly spread to 26 provinces across the country and became extremely destructive to maize and other crops (Jiang et al. 2019). The average corn yield losses due to infestation by S. fruggiperda range from 20% to 50% in Africa, South Asia, and Southeast Asia (Day et al. 2017, FAO 2018). In Central Mexico, crops have experienced considerable yield losses estimated at 17.7 million tons (Jaraleño-Teniente et al. 2020).

Spodoptera frugiperda is highly polyphagous and has a wide host range of 353 plant species from 76 families, including maize

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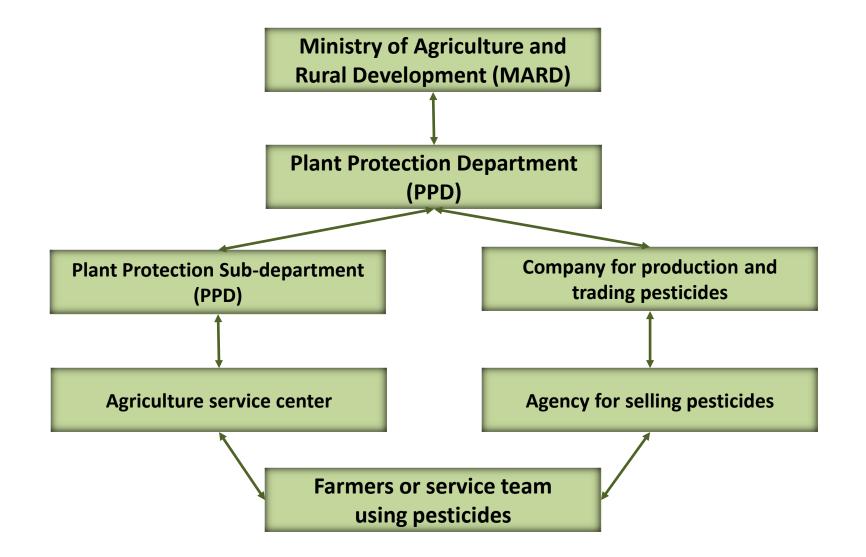
VIETNAM ACADEMY OF AGRICULTURE SCIENCE PLANT PROTECTION RESEARCH INSTITUTE



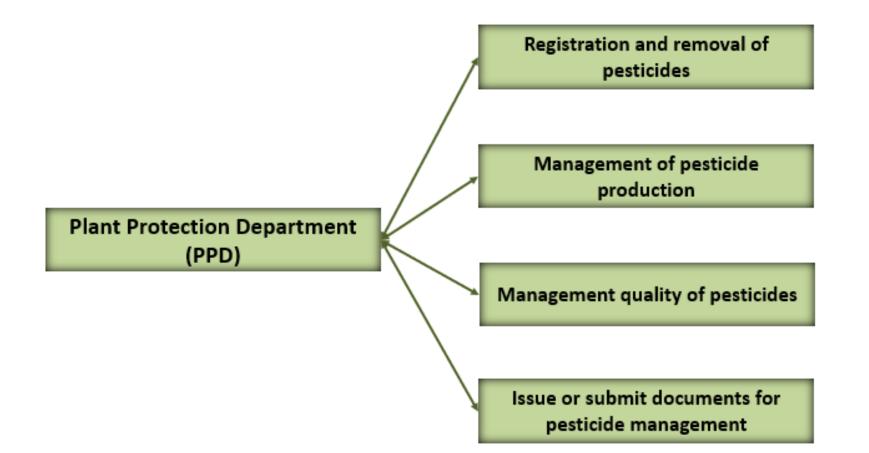
# CURRENT STATUS OF USING BOTANICAL PESTICIDES IN VIETNAM

Dr. Dao Bach Khoa Hanoi-2022

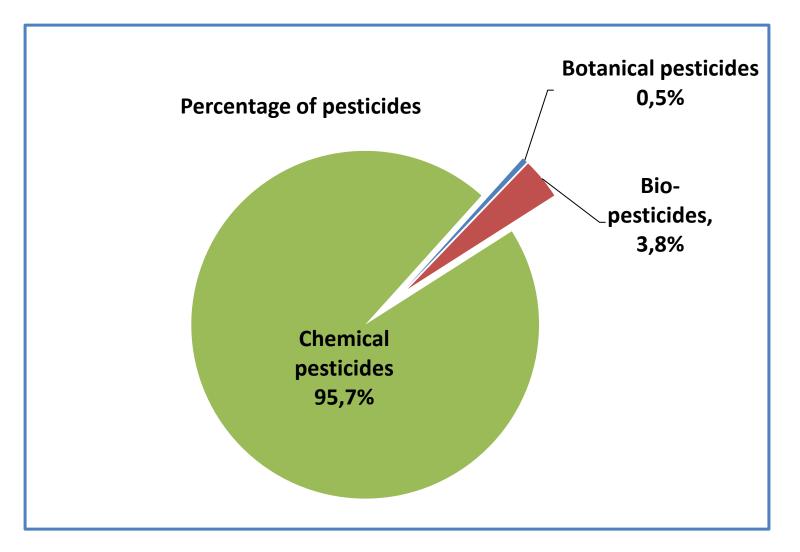
### Vietnam: System for management and use of pesticides



# Vietnam: System for management, production and use of pesticides



## **Comparison of botanical pesticides with bio-pesticides and chemical pesticides**



Active Ingredient	Trade name	BCA_CONCENTRATION	Registered Pest
nical Azadirachtin	Agiaza 0.03 EC, 4.5EC	0.03EC, 4.5EC	diamond back moth, Thrips, Aphid, Red spider mite, Bollworm, Green aphids
	Altivi	0.3EC	diamond back moth, Red spider mite, Sheath borer, Green aphids
	A-Z annong	0.03EC, 0.15EC, 0.3EC, 0.6EC, 0.9EC	diamond back moth, Thrips, BPH, Aphid, Red spider mite, Green aphids, Rice Leafroller
	Aza	0.15EC	diamond back moth
	Boaza	0.3EC, 0.6EC	diamond back moth
	Cittioke	0.6EC, 0.9EC	diamond back moth, Thrips, BPH, Rice Leafroller
	Goldgun	0.3EC, 0.6EC, 0.9EC	diamond back moth, Thrips, BPH, Aphid, Red spider mite, Green aphids, Rice Leafroller
	Hoaneem	0.03EC, 0.15EC, 0.3EC	diamond back moth, Red spider mite, Rice Leafroller, Leafminer
		0.3EC	diamond back moth, Aphid, Red spider mite, Green aphids, Rice Leafroller
	Jasper	0.3EC	
	Kozomi	0.15EC, 0.3EC, 1EC	diamond back moth, BPH, Aphid, Red spider mite, Bollworm, Green aphids, Rice Leafroller
	Minup	0.3EC, 0.6EC, 0.9EC	diamond back moth, Thrips, BPH, Red spider mite, Green aphids
	Misec	1.0EC	diamond back moth
	Mothian	0.35EC	diamond back moth, Aphid, Red spider mite, Bollworm
	Neem Nim Xoan Xanh		
	green	0.15EC, 0.3EC	diamond back moth
	Sarkozy	0.3EC, 1EC, 1WP	diamond back moth, Thrips, Red spider mite, Sheath borer, Green aphids, Rice Leafroller, Leafminer
	Sokotin	0.3EC	diamond back moth, BPH, Red spider mite, Green aphids, Rice Leafroller
	Super Fitoc	3EC, 5EC, 10EC	diamond back moth, Thrips, BPH, Aphid, Red spider mite, Green aphids
	Trutat	0.32EC	diamond back moth, Aphid, Red spider mite, Bollworm, Rice Leafroller
	Vineem	1500EC	Thrips, Aphid, Red spider mite, Green aphids
	Dau nim xoan xanh		
	xanh	0.15EC	Leafminer, Mealybug, aphid, Diamond Back moth
Celastrus angulatas	Emnus	1EC	diamond back moth, Thrips, Cutworm, Silk worms (Vietn.) syn. Diamondback moth Green aphids, Rice Leafroller
Celastrus angulatus	Agilatus 1EC	1EC	diamond back moth, Thrips, Cutworm, Red spider mite, Bollworm, Rice Leafroller
Citrus oil	MAP Green	3SL, 6SL, 8SL, 10SL	diamond back moth, Thrips, Red spider mite, Mold, Rot, Anthracnose, Rice Leafroller
		83SL:Corn oil30% + Cottonseed oil30% +	
Corn oil + Cottonseed oil + Garlic oil	GC - 3	Garlic oil23%	Powdery mildew
Esters of botanic oil	Subain	99SL	Surfactant
Eucalyptol	Pesta	2SL: Eucalyptol (min 70%)	diamond back moth, Cutworm, BPH, Rice Leafroller
Garlic juice	Bralic - Toi Toi	1.25SL, 10SL	Mealybugs

Ajsuper       SSL, SL, LC, LWP       diamod back moth, Thrips, Red spider mite, Sheath borer, Green aphids         Aphophis       SEC, LBEC       diamod back moth, Thrips, GLNJORM, BPH, MealyNugs, Rice Leafroller         Hard SC       SEC, DSL       diamod back moth, Aphid, Green aphids         Fina SC       SEC, OSL       diamod back moth, Aphid, Green aphids         Kobsuper       SI       Galec, OSL       diamod back moth, PH, Rice Leafroller         Kobsuper       SI       Galec, OSL       diamod back moth, PH, Rice Leafroller         Marigold       OSEC, OSL       diamod back moth, PH, Rice Leafroller       diamod back moth, PH, Rice Ladroller mite, Sollworm, Mold, Green aphids, Rot         Solopi OSL       OSEC, OSL       diamod back moth, Thrips, Red spider mite, Bollworm, Kold, Green aphids, Rot         Solopi OSL       OSEC, OSL       diamod back moth, Thrips, Red spider mite, Bollworm, Mold, Green aphids, Rot         Solopi OSL       Solopi OSL       diamod back moth, Thrips, Red spider mite, Bollworm, Green aphids         Solopi OSL       Solopi OSL       diamod back moth, Thrips, Red spider mite, Bollworm, Green aphids, Rot         Solopi OSL       Solopi OSL       Solopi OSL       diamod back moth, Thrips, Red spider mite, Bollworm, Green aphids, Rot         Solopi OSL       Solopi OSL       Solopi OSL       Sol	Matrine (gentian extract)	Agri-one 1SL	1SL	diamond back moth, Thrips, Aphid, Red spider mite
AsinO.SEC. 0.SSLdiamond back moth, AphiaEma SECSECdiamond back moth, AphiaEma SECSECdiamond back moth, Thrips, Cutworm, BPH, Mealyabugs, Rice LeafrollerFail0.238E(2, 0.SSLdiamond back moth, Thrips, Red spider mite, BollwormKobisuperISLThrips, Red spider mite, BollwormKobisuper0.26SL0.26SLdiamond back moth, Thrips, Red spider mite, Bollworm, Mold, Green aphids, RotSakumec0.36E(2, 0.SSLdiamond back moth, Thrips, Red spider mite, Bollworm, Green aphids, RotSokupi 0.36SL, 0.SSLdiamond back moth, Worm, rice bug, LeafolderVoraceSEC, 10EC, 16ECdiamond back moth, Worm, rice bug, LeafolderPolyphenols extracted from Gieditisa,Sokupi 0.36SL, 0.SSLdiamond back moth, Cutworm, BPH, Rice LeafrollerPolyphenols extracted from Gieditisa,ISLcrewth stimulationPolyphenols extracted from SideitisaISLcrewth stimulationPolyphenols extracted from SideitisaISLcrewth stimulationPolyphenols extracted from SideitisaISLcrewth stimulationPolyphenols extracted from SideitisaISENAphidPolyphenols extracted from SideitisaSideiticaSideiticaPolyphenols extracted from SideitisaSideiticaSideiticaPolyphenols extracted from SideiticaISENAphidPolyphenols extracted from SideiticaSideiticaSideiticaPolyphenols extracted from SideiticaSideiticaSideiticaPolyphenols extracted from SideiticaSideiticaSideitica<		Ajisuper	0.5SL, 1SL, 1EC, 1WP	diamond back moth, Thrips, Red spider mite, Sheath borer, Green aphids
Image: Provide a serie of the serie of t		Aphophis	5EC, 10EC	diamond back moth, Thrips, BPH, Aphid, Green aphids
Famile   6288C,0.3SL   diamond back moth, BPH, Rice Leafroller     Kobisuper   1SL   Thrips, Red spider mite, Bollworm     V 265L   0.26SL   Aphild, Damond back moth, Thrips, Red spider mite, Bollworm, Mold, Green aphilds, Rot     Sakumec   0.36SL   diamond back moth, Thrips, Red spider mite, Bollworm, Mold, Green aphilds     Sokunec   0.36SL   diamond back moth, Thrips, Red spider mite, Bollworm, Green aphilds     Sokune   0.36SL   diamond back moth, Thrips, Red spider mite, Bollworm, Green aphilds     Sokune   0.36SL   diamond back moth, Thrips, Red spider mite, Green aphilds     Oligo-alginate   Sckunec   0.36SL   diamond back moth, Thrips, Cutworm, BPH, Rice Leafroller     Polyphenols extracted from Gieldita;   Formation   Sckunec   Sckunec     Polyphenols extracted from Solpora   ISL   Growth stimulation     Indica L   Lacasoto   SP   Sckunec     Japonica L-Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Solpora   ISC   Growth stimulation     Japonica L-Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Solpora   ISC   Scyce   diamond back moth, Thrips, SPH, Aphid, Sheath borer, Green aphids     Japonica L-Schott   Lacasoto   SP   Growth stimulation  <		Asin	0.5EC, 0.5SL	diamond back moth, Aphid
Result   Kobisuper   Stand   Thrips, Red spider mite, Boilworm     V 026SL   0.26SL   Aphid, Diamond back moth, Thrips, Red spider mite, Soliworm, Mold, Green aphids, Rot     Skumec   0.36SC, 0.5SL   diamond back moth, Thrips, Red spider mite, Golworm, Mold, Green aphids     Skonec   0.36SL   diamond back moth, Thrips, Red spider mite, Golworm, Mold, Green aphids     Skonec   0.36SL   Diamond back moth, Thrips, Red spider mite, Golworm, Green aphids     Olgo-alginate   Notac   Giomond back moth, Thrips, Cutworm, BPH, Red spider mite, Golworm, Green aphids     Polyphenois extracted from Gioffisia   Notac   Giomond back moth, Thrips, Cutworm, BPH, Red spider mite, Golworm, Green aphids     Polyphenois extracted from Manffer   Notar   Giomond back moth, Thrips, Cutworm, BPH, Red spider mite, Golworm     Polyphenois extracted from Solword   Anisaf SH-01   SL   Stand     Polyphenois extracted from Solword   Hastword   Giomond back moth, Thrips, BPH, Aphid, Sheath bore, Green aphids     Polyphenois extracted from Solword   Natox   Stand   Giomond back moth, Thrips, BPH, Aphid, Sheath bore, Green aphids, Red spider mite, Green aphids     Polyphenois extracted from Solword   Natox   Stand   Giomond back moth, Thrips, Sheh, Aphid, Sheath bore, Green aphids     Polyphenois extracted from Solword   Natox   Stand   Giomond back moth, Thrips, Sheh, Aphid, Red spider mite, Green aphids		Ema 5EC	5EC	diamond back moth, Thrips, Cutworm, BPH, Mealybugs, Rice Leafroller
Image: Provide the section of the sectin of the section of the s		Faini	0.288EC, 0.3SL	diamond back moth, BPH, Rice Leafroller
Image: Provide a strate of the strate of		Kobisuper	1SL	Thrips, Red spider mite, Bollworm
sakumec   Sakumec   0.36EC, 0.5SL   diamond back moth, Thrips, Red spider mite, Green aphids     Sokone   0.36SL   Diamond back moth, Worm, incise Usu, leafolder     Vota   SEC, 10EC, 16EC   diamond back moth, Worm, incise Usu, leafolder     Oligo-alginate   Wota   SEC, 10EC, 16EC   diamond back moth, Yorm, incise Usu, leafolder     Polyphenols extracted from Gleditisi,   Anisaf SH-01   SL   Growth stimulation     Polyphenols extracted from Sophora   Incise Stracted from Sophora   Incise Stracted from Sophora     japonica L Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Sophora   Incise Stracted from Sophora   Incise Stracted from Sophora     japonica L Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Sophora   Incise Stracted from Sophora   Incise Stracted from Sophora     japonica L Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Sophora   Incise Stracted from Sophora   Incise Stracted from Sophora     japonica L Schott   Lacasoto   SP   Growth stimulation     Polyphenols extracted from Sophora   Incise Stracted from Sophora   Incise Stracted from Sophora     japonica L Schott   Lacasoto   SP   Growth stimulation     Incise Stracted from Sophora		Ly 0.26SL	0.26SL	Aphid, Diamond back moth
Sokone   0.36SL   Giamond back moth, BPH, Red spider mite, Bollworm, Green aphids     Sokup   Diamond back moth, Norm, rice bug, leafolder     Votac   65C, 1DEC, 16EC   Giamond back moth, Thrips, Cutworm, BPH, Rice Leafroller     Oligo-alginate   MA Maral   10SL, 10WP   Growth stimulation     Polyphenois extracted from Gielek   Ainslaf Sh-01   SL   Jamond back moth, Thrips, Cutworm, BPH, Rice Leafroller     Siegesbeckk, Bidens and Parthenium   Ainslaf Sh-01   SL   Growth stimulation     Polyphenois extracted from Mangifer   F   F   F     Japonica L, Schott   Jaston   SP   Growth stimulation     Polyphenois extracted from Sopher   Hativac   SP   Growth stimulation     Polyphenois extracted from Sopher   Lassoto   SP   Growth stimulation     Japonica L, Schott   Lassoto   SP   Growth stimulation     Pyrethrins   Mativex   LSEV   Aphid     Mativex   JSEV   Giamond back moth, Thrips, BPH, Aphid, Sheath borer, Green aphids, Rice Leafroller     Japonia L, Schott   Linater   SE   SE     Japonen   Nixtop   JSEV   Giamond back moth, Thrips, Subj, Aphid, Red spider mite, Green aphids, Rice Leafroller     Japonen   Linater   SE   SE   SE     Japonen		Marigold	0.36SL	diamond back moth, Thrips, Red spider mite, Bollworm, Mold, Green aphids, Rot
Skapi 0.36SL 0.5SLDiamond back moth, morn, rice bug, leafolderOligo-alginateMA Maral5C, 10EC, 16ECdiamond back moth, Thrips, Cutworm, BPH, Rice LeafrollerPolyphenols extracted from Gleditsia, Bigesbeckia, bildens and PartheniumAnlaralSS, 10WPPolyphenols extracted from Gleditsia, Bigesbeckia, bildens and PartheniumAnlara SH-01SS, 10WPPolyphenols extracted from MangiferaHastin SH-01SS, 10WPPolyphenols extracted from MangiferaPastinulationGrowth stimulationPolyphenols extracted from SophoraIppoten L. SchottLacasotoSSGrowth stimulationPorthrinsBogy14EC, SOECGrowth stimulationMativexJoSGrowth stimulationSIIppoten ServerNatavesJoSdiamond back moth, Afed spider miteIppoten ServerNixatop16C, SSECGrowth stimulationPyrethrinsBogy16C, SSECGrowth StimulationIppoten ServerNixatop16C, SSECGrowth StimulationIppotentSSEC10EC, SSECGrowth StimulationIppotentStore16C, SSECGrowth StimulationIppotentStore16SGrowth StimulationIppotentStore16SGrowth StimulationIppotentStore16SGrowth StimulationIppotentStore16SGrowth StimulationIppotentLassottoStoreApliteIppotentStore16SGrowth StimulationIppotent <td></td> <td>Sakumec</td> <td>0.36EC, 0.5SL</td> <td>diamond back moth, Thrips, Red spider mite, Green aphids</td>		Sakumec	0.36EC, 0.5SL	diamond back moth, Thrips, Red spider mite, Green aphids
VotacKC1 DEC, 16ECdiamond back moth, Thrips, Cutworm, BPH, Rice LeafrollerPolypenols extractedMA Maral10SL, 10WPGrowth stimulationPolypenols extracted from Gleditisis,Anisaf SH-01Sl.diamond back moth, Cutworm, CutwormPolyphenols extracted from MangiferAnisminaSl.diamond back moth, CutwormPolyphenols extracted from SophorPolyphenols extracted from SophorGrowth stimulationPolyphenols extracted from SophorBopyAlec, SoECGrowth stimulationPortentrinsBopyAlec, SoECGrowth stimulationNatorSoEQSoECAphidPortentrinsBopySiEC, SSECdiamond back moth, Reie Sapider mitePortentrinsBopySiEC, SSECdiamond back moth, Reie BarilenNatorSoEC, SSECdiamond back moth, Reie BarilenNatorSiEC, SSECdiamond back moth, Reie BarilenNatorSiEC, SSECdiamond back moth, Thrips, Aphid, Steath spider mite, Bollworm, GreenNatorSiEC, SSECSoEC, SOWPdiamond back moth, Thrips, Aphid, Red spider mite, Bollworm, GreenNatorSiEC, SSEC, SOWPSinond back moth, Thrips, Aphid, Red spider mite, Green aphids, LeafmerNatorSiEC, SSEC, SOWPMainond back moth, Thrips, Aphid, Red spider mite, Bollworm, Rice Leafroller,NatorSiEC, SSEC, SOWPMainond back moth, Thrips, Aphid, Red spider mite, Bollworm, Rice Leafroller,NatorSiEC, SSEC, SOWPMainond back moth, SPEN, Aphid, Red spider mite, Bollworm, Rice Leafroller,NatorSiEC, SSEC, SOWP <td></td> <td>Sokonec</td> <td>0.36SL</td> <td>diamond back moth, BPH, Red spider mite, Bollworm, Green aphids</td>		Sokonec	0.36SL	diamond back moth, BPH, Red spider mite, Bollworm, Green aphids
Oligo-alginateM.A.Maral10SL, 10WPGrowth stimulationPolyphenols extracted from Gledita, Siegesbeckia, Bidens and PartheniumAnisaf SH-01ZSLPolyphenols extracted from MangfferaFlastimulaSLPolyphenols extracted from MangfferaFlastimulaGrowth stimulationPolyphenols extracted from SophoraFlastimulaSLjaponica L. SchottLacasoto4SPGrowth stimulationPyrethrinsBopy14EC, 50ECdiamond back moth, Red spider miteNixatopNixatop3.OCSdiamond back moth, Red spider mite, Green aphids, Rice LeafrollerNixatopNixatopSUP, SSL, SGRdiamond back moth, Aphid, Red spider mite, Green aphids, Rice LeafrollerNixatopSWP, SSL, SGRdiamond back moth, Aphid, Red spider mite, Green aphids, Rice LeafrollerNewfatocSWPSSL, SSL, SSRdiamond back moth, Aphid, Red spider mite, Green aphids, Rice LeafrollerNewfatocSWP, SSL, SGRdiamond back moth, Aphid, Red spider mite, Green aphidsNewfatocSVP, SSL, SSR, SSRdiamond back moth, Thrips, Cutworm, Aphid, Red spider mite, Green aphidsRotenoneLimater-SECdiamond back moth, Thrips, Aphid, Red spider mite, Green aphidsNewfatocSUP, SSL, 75SL, 75WPdiamond back moth, Thrips, Aphid, Red spider mite, Green aphidsNewfatocSECSUPdiamond back moth, Thrips, Aphid, Red spider mite, Green aphidsNewfatoSECSUPSECdiamond back moth, Thrips, Aphid, Red spider mite, Green aphidsNewfatoSECSUPSEC <t< td=""><td></td><td>Sokupi 0.36SL, 0.5SL</td><td></td><td>Diamond back moth, worm, rice bug, leafolder</td></t<>		Sokupi 0.36SL, 0.5SL		Diamond back moth, worm, rice bug, leafolder
Polyphenols extracted from Gleditsia, Siegesbeckia, Bidens and Parthenium     Aisaf SH-01     2SL     diamond back moth, Cutworm       Polyphenols extracted from Mangifer indica L     Plastimula     1SL     Growth stimulation       Polyphenols extracted from Sophora japonica L. Schott     Lacasoto     SP     Growth stimulation       Pyrethrins     Bopy     14EC, 50EC     diamond back moth, Red spider mite       Mativex     1.5EW     Aphid       Nixatop     3OCS     diamond back moth, Red spider mite, Green aphids, Rice Leafroller       Dibaroten     Bin 10EC, 25EC     10EC, 25EC     diamond back moth, Rice Leafroller       Dibaroten     SWP, SSL, 5GR     diamond back moth, Rice Leafroller       Dibaroten     SWP, SSL, 5GR     diamond back moth, Thrips, Cutworm, Aphid, Red spider mite, Green aphids       Ketenone     Limater     7.5EC     aphids       Nixoto     SOWP, SOSL, 7SSL, 7SWP     Thrips, BPH, Aphid, Red spider mite, Green aphids, Leafminer       Rinuo     SOEC, SOWP     diamond back moth, Thrips, Aphid, Red spider mite, Green aphids       Roteide 2SL     QSL     SEC     diamond back moth, Thrips, Aphid, Red spider mite, Green aphids       Limater     7.5EC     aphids     diamond back moth, Thrips, Aphid, Red spider		Wotac	5EC, 10EC, 16EC	diamond back moth, Thrips, Cutworm, BPH, Rice Leafroller
Siegesbeckia, Bidens and PartheniumAnisaf SH-012SLdiamond back moth, CutwormPolyphenols extracted from Mangifer indica LHastimulaSLGrowth stimulationPolypenols extracted from Sophorjaponica L. SchottLacasoto450Growth stimulationPyrethrinsBopy14EC, SDECdiamond back moth, Red spider miteNataop.5EW-AphidNatop.5EWdiamond back moth, Arping, BPH, Aphid, Sheath borer, Green aphids, Rice LeafrollerNatop.5EW00C, SECdiamond back moth, Arping, BPH, Aphid, Sheath borer, Green aphids, Rice LeafrollerNatop.5EW00F, SSL, SGRdiamond back moth, Arping, Red spider mite, Green aphids, Rice LeafrollerNatop.5W.5EVdiamond back moth, Aphid, Red spider mite, Green aphids, Rice LeafrollerNatop.5EW.5EVdiamond back moth, Aphid, Red spider mite, Green aphids, Rice LeafrollerNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV.5EVNatop.5EV.5EV<	Oligo-alginate	M.A Maral	10SL, 10WP	Growth stimulation
Polyphenols extracted from Mangifera     Plastimula     1SL     Growth stimulation       Polyphenols extracted from Sophora     Japonica L. Schott     Lacasoto     4SP     Growth stimulation       Pyrethrins     Bopy     14EC, 50EC     diamond back moth, Red spider mite       Nixatop     JSEW     Aphid       Nixatop     3.0CS     diamond back moth, Rei Leafroller       Ibiaroten     Bin 10EC, 25EC     diamond back moth, Rice Leafroller       Dibaroten     SWP     diamond back moth, Rice Leafroller       Dibaroten     SWP     diamond back moth, Thrips, Cutworm, Aphid, Red spider mite, Green aphids       Imater     7.5EC     aphid3       Newfatoc     SOWP, 50SL, 75SL, 75WP     Thrips, BPH, Aphid, Red spider mite, Green aphid3       Imater     7.5EC     diamond back moth, Thrips, Aphid, Red spider mite, Green aphid3       Newfatoc     SOWP, 50SL, 75SL, 75WP     Thrips, BPH, Aphid, Red spider mite, Green aphid3       Rinup     SOEC, SOWP     diamond back moth, Thrips, Aphid, Red spider mite, Green aphid3       Rinup     SEC     diamond back moth, Thrips, Aphid, Red spider mite, Green aphid3       Soponin     Minup 15 GR     SEC     diamond back moth, Thrips, Aphid, Red spider mite, Bollworm, Rice Leafroller, Leafminer			201	
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Trusach     2.5EC     Leafminer       Vironone     2EC     diamond back moth, Thrips, Aphid, Red spider mite, Bollworm, Rice Leafroller, Leafminer       Saponin     Abuna 15 GR     15GR     Snail, Slug       Dibonin super     5WP, 15WP     Snail, Slug       Map Lisa 230 SL     230SL     diamond back moth		Rinup	50EC, 50WP	diamond back moth, Thrips, Aphid, Red spider mite, Green aphids
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		Dibonin super	5WP, 15WP	Snail, Slug
Oc tieu Snail, Slug		Map Lisa 230 SL	230SL	diamond back moth
		Oc tieu		Snail, Slug

Product

Product				
Mix	Azadirachtin + Matrine	Biomax	1EC:Azadirachtin 0.6% + Matrine 0.4%	diamond back moth, BPH, Rice Leafroller
		Golmec	9EC, 15EC, 20EC:Azadirachtin 5(7.5/10)g/L+Matrine 4(7.5/10)g/L	diamond back moth, Cutworm, Rice Leafroller, Rice borer
		Lambada 5EC	5EC:Azadirachtin 3 g/l + Matrine 2 g/l	diamond back moth, Cutworm, Rice Leafroller
	Botanic oil + potash	Thuốc sâu sinh học Thiên Nông 1 SL	1 SL	diamond back moth
	Cafein + Nicotine Sulfate + Azadirachtin	Tob	1.25GR, 1.88GR	Snail
		105	Chaeto.sp1.5x10^6 cfu/ml+	Shan
	Chaetomium sp. + Trichoderma sp.	Mocabi SL	Trichod.sp1.2x10^4 cfu/ml	Root rot, Wilt, Rot
			20WP, 50WP:Chitosan 19g/kg (49g/kg) +	
	Chitosan + Polyoxin	Starone	Polyoxin 1g/kg (1g/kg)	Rot, Blast
	Chitosan 2% + Oligo - Alginate 10%	2S Sea & See 12WP, 12SL	12WP, 12SL	Black rot
			70SL:Cottonseed oil 40%+clove oil 20%+garlic	
	Cottonseed oil + clove oil + Garlic oil	GC - Mite	oil10%	Mealybugs, Rice Leafroller
	Cucuminoid + Gingerol	Stifano	5SL: Cucuminoid 5% + Gingerol 0.5%	Late blight, Root rot, Wilt, Leaf spot, Rot, Bacterial spot, downy mildew, Leaf blight
	Matrine + Oxymatrine	Disrex	0.6SL:Matrine 0.5% + Oxymatrine 0.1%	diamond back moth
	Pyrethrins + Rotenone	Biosun	3EW:Pyrethrins 2.5% + Rotenone 0.5%	diamond back moth, Thrips, Red spider mite, Green aphids
	Rotenone + Saponin	Dibonin	5WP, 5SL, 5GR: Rotenone 2.5% + Saponin 2.5%	diamond back moth, Aphid, Red spider mite, Green aphids
		Ritenon	150BR, 150GR: Rotenone 2g/kg + Saponin 148g/kg	Nematode
		Sitto-nin	15EC, 15BR:Rotenone 50g/kg (g/l) + Saponin 2.5% 145g/kg (g/l)	Nematode
	Saponin + Cafein + Azadirachtin	Dietoc	5.6GR:Saponin 5%+ Cafein 0.5% + Azadirachtin 0.1%	Snail
		Ovadan	37GR:Saponin 30 g/kg + Cafein 6g/kg + Azadirachtin 1g/kg	Snail
	Saponozit + saponic acid	TP - Than Dien 78SL	78SL:Saponozit 46% + Saponin acid 32%	Thrips, Red spider mite, Mealybugs
	Polyoxin complex	Polyoxin AL	(blank)	Leaf spot

Product

- F	roduct				
ľ	Vix	Azadirachtin + Matrine	Biomax	1EC:Azadirachtin 0.6% + Matrine 0.4%	diamond back moth, BPH, Rice Leafroller
				9EC, 15EC, 20EC:Azadirachtin	
			Golmec	5(7.5/10)g/L+Matrine 4(7.5/10)g/L	diamond back moth, Cutworm, Rice Leafroller, Rice borer
			Lambada 5EC	5EC:Azadirachtin 3 g/l + Matrine 2 g/l	diamond back moth, Cutworm, Rice Leafroller
			Thuốc sâu sinh học		
		Botanic oil + potash	Thiên Nông 1 SL	1 SL	diamond back moth
		Cafein + Nicotine Sulfate + Azadirachtin	Tob	1.25GR, 1.88GR	Snail
				Chaeto.sp1.5x10^6 cfu/ml+	
		Chaetomium sp. + Trichoderma sp.	Mocabi SL	Trichod.sp1.2x10^4 cfu/ml	Root rot, Wilt, Rot
				20WP, 50WP:Chitosan 19g/kg (49g/kg) +	
		Chitosan + Polyoxin	Starone	Polyoxin 1g/kg (1g/kg)	Rot, Blast
			2S Sea & See 12WP,		
		Chitosan 2% + Oligo - Alginate 10%	12SL	12WP, 12SL	Black rot
		Cottonseed oil + clove oil + Garlic oil	GC - Mite	70SL:Cottonseed oil 40%+clove oil 20%+garlic	
				oil10%	Mealybugs, Rice Leafroller
		Cucuminoid + Gingerol	Stifano	5SL: Cucuminoid 5% + Gingerol 0.5%	Late blight, Root rot, Wilt, Leaf spot, Rot, Bacterial spot, downy mildew, Leaf blight
		Matrine + Oxymatrine	Disrex	0.6SL:Matrine 0.5% + Oxymatrine 0.1%	diamond back moth
		Pyrethrins + Rotenone	Biosun	3EW:Pyrethrins 2.5% + Rotenone 0.5%	diamond back moth, Thrips, Red spider mite, Green aphids
				5WP, 5SL, 5GR: Rotenone 2.5% + Saponin	
		Rotenone + Saponin	Dibonin	2.5%	diamond back moth, Aphid, Red spider mite, Green aphids
				150BR, 150GR: Rotenone 2g/kg + Saponin	
			Ritenon	148g/kg	Nematode
			Citta nin	15EC, 15BR:Rotenone 50g/kg (g/l) + Saponin	Nematodo
			Sitto-nin	2.5% 145g/kg (g/l)	Nematode
		Saponin + Cafein + Azadirachtin	Dietoc	5.6GR:Saponin 5%+ Cafein 0.5% + Azadirachtin 0.1%	Snail
			Dictor	37GR:Saponin 30 g/kg + Cafein 6g/kg +	Undin
			Ovadan	Azadirachtin 1g/kg	Snail
		Saponozit + saponic acid	TP - Than Dien 78SL	78SL:Saponozit 46% + Saponin acid 32%	Thrips, Red spider mite, Mealybugs
		Polyoxin complex	Polyoxin AL	(blank)	Leaf spot

# Advantages in the production and use of botanical pesticides in Vietnam

- Diversity of topography and tropical monsoon climate permit many plants to grow that are good materials for botanical pesticide production.
- Government supports research and development of botanical pesticides in particular, and bio-pesticides in general.
- Consumers are gradually understanding and receptive to organic agriculture products.

# Disadvantages in the production and using botanical pesticides in Vietnam

- Biological efficacy and economic efficiency are lower to compare with chemical pesticides.
- Botanical pesticides are normally difficult storage and using.
- It is very difficult to change farmer's habits about using chemical pesticides.
- It is very difficult to register new botanical pesticides in the list.



VIETNAM ACADEMY OF AGRICULTURE SCIENCE PLANT PROTECTION RESEARCH INSTITUTE



# **THANK YOU**

Dr. Dao Bach Khoa



# **Biocontrol Technical Workshop Series 2022**

# **Session 6: Botanical Pesticides**



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23 November 2022







# ASEAN Action Plan on Fall Armyworm www.aseanfawaction.org



Australian Government

**Department of Foreign Affairs and Trade** 





