

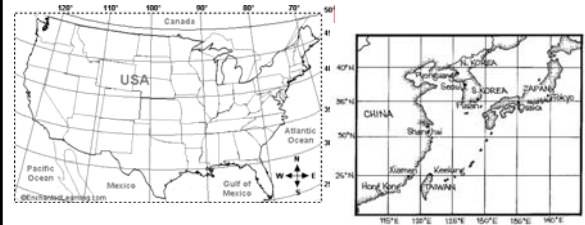
Insights from Asia: South Korea

2011 BMSB Working Group Meeting

[Suck-Dung Namoo Norinjae]
Halyomorpha halys (= *H. mista*)

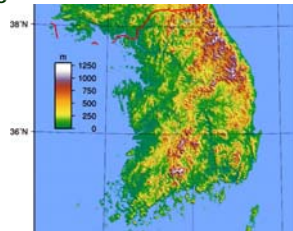
Yong-Lak Park
Entomology @ West Virginia University

U.S. and Far East



Korean Agriculture

Intensive land use
Staple food: rice
Highest yield per acre
Intercropping
Greenhouse



50 million people

Korean Agriculture



Korean Agriculture



Korean Agriculture



BMSB in Korean

Halyomorpha halys (= *H. mista*)
[Suck-Dung Namoo Norinja]
Rotten Tree Stink Bug



Methods of Data Collection


RDA (Rural Development Administration)
 = USDA + University Extension in the U.S.

National Universities
 = Land-Grant University in the U.S.

Pesticide Company
 Registered pesticides for stinks bugs

Articles and reports published in Korea
 Mostly off-line resources written in Korean

Major Korean Stink Bugs



Riptortus clavatus *Piezodorus hybneri* *Dolycoris baccarum* *Claucias subpunctatus* **BSMB** *Plautia stali*

RDA, Korea

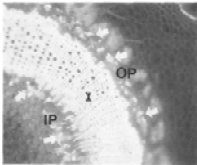

Pest Status of BMSB in Korea

Forest pest of Paulownia



Pest Status of BMSB in Korea



Vector of paulownia witches' broom (PWB)
 Thought that virus was the agent
 Later, MLO (mycoplasma-like organisms)

Bak et al. 1993

Pest Status of BMSB in Korea

PWB transmitted to periwinkle (*Catharanthus roseus*)
 Bak et al. 1993
 By BSMB and *Cyrtopetis tenuis* are vectors

USDA

Pest Status of BMSB in Korea

Major pest on

Soybean
Sweet persimmon
Yuzu
Citrus



Soybean & BMSB in Korea

Life cycle & damage

1-2 generations per year
Generally first observed in late July
No BMSB in R2 stage (full bloom)
Rapid increase in R6 stage (full seed)
Population peak at R8 stage (full maturity)



Soybean & BMSB in Korea

Soybean variety & pesticide test

Son et al. 2000
Tested 40 different soybean varieties
Found that
no BMSB found in two varieties
>12 BMSB found in one variety

Some pesticides provided soybean protection

Fenitrothion
Triazophos
Carbaryl

Persimmon & BMSB in Korea

Persimmon in Korea

The 2nd most harvested fruit after apple in Korea
ca. 280,000 ha
> 10% of growers do intensive pest control



Persimmon & BMSB in Korea

Tannin

Lee et al. 2002
Increases as fruit matures
1.5-3% tannin in a fruit in June and July
Not good as food for BMSB
Fewer BMSB caught in June and July

Soluble tannin

Known to affect development of stink bugs

Sampling BMSB

Black light trap in persimmon

Chung et al. 1995
August was the best
No capture after September

Mercury light trap vs. pheromone in persimmon

Lee et al. 2002
Aggregation pheromone of *Plautia stali*
= Methyl (E, E, Z)-2, 4, 6 Decatrienoate
More BMSBs were attracted to light trap
Pheromone traps caught BMSB one month earlier



Cultural Control of BMSB

Avoid intercropping
 No beans in persimmon orchard
 Reduced chemical control: 3→1 spray

Stink bug screen
 Physical blocking
 Screen after R2 stage of soybean

Chemical Control of BMSB

Field test of pesticide efficacy
 Chung et al. 1995
 Tested 5 chemicals
 deltamethrin, ethofenprox, fenitrothion, fenthion, phenthoate

All worked
 Deltamethrin and fenthion were the best to kill BMSB

Registered Products for Stink Bugs

<p>Persimmon</p> <ul style="list-style-type: none"> Etofenprox Thiamethoxam <p>Apple</p> <ul style="list-style-type: none"> Beta-cyfluthrin Bifenthrin Clothianidin Dinotefuran Etofenprox 	<p>Bean</p> <ul style="list-style-type: none"> Bifenthrin Clothianidin Dinotefuran Etofenprox Fenitrothion Lambda-cyhalothrin Thiamethoxam <p>Tea</p> <ul style="list-style-type: none"> Fenitrothion Thiamethoxam
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Biological Control of BMSB

Really big deal in Korea
 Environment-friendly agriculture
 Well-being boom in Korea
 Acreage increased ca. 90 times in 5 years

Searching for natural enemies of BMSB
 Lim et al. 2007
 Looked for egg parasitoids of BMSB
Trissolcus nigripedius (Hymenoptera: Scelionidae)
 Observed three steps of oviposition
 Drumming
 Oviposition
 Marking

Biological Control of BMSB

Searching for natural enemies of BMSB
 Lim et al. 2007

Found that
T. nigripedius showed all the behaviors
 Drumming, Oviposition, & Marking
 But, no adult *T. nigripedius* emerged

Recent Research of BMSB in Korea

Mating behavior of BSMB

Son and Park, 2009 (conference presentation)

Results

Highest mating frequency in 9pm-6am

Role of presence of absence of antennae

Both sex > male only > female only > none

Recent Research of BMSB in Korea

Mating and oviposition (lab study)

Kang et al. 2010 (conference presentation)

Results

Mating behavior

1. Male antennae touch female abdomen
2. Female erect her abdomen
3. Male turns and mate

Oviposition

- 13-39 egg masses (average of 28.5 eggs per mass)
- 2.5 min to lay one egg
- Total oviposition time was ca. 1 hr 20 min

Recent Research of BMSB in Korea

GC-MS and GC-EAD

Kim et al. 2010 (conference presentation)

Results

Hexane extracts included

- 9 major compounds in both sexes
- More (Z)-2-Decenylacetate in male
- More (E)-2-decenal in female

GC-EAD

- 4-Oxo-(E)-2-hexenal
- Tridecane: strong responses by both male and female
- (Z)-2-Decenylacetate

Recent Research of BMSB in Korea

Catechin: astringent taste

Song et al. 2008

Stink bug may provide better flavor to tea

Plants produce chemical by stink bug damage

Results

Damaged tea leaves contained lower

- Water
- Tannin
- Nitrogen
- Caffeine
- Catechin