

Arthropod Containment in Plant Research

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What we do at USDA ARS BIIRU -

- To develop biological control programs against invasive (**non-native**) agriculture and forest **pests**
 - Research involves both the plant-feeding insects and their natural enemies (predators & **parasitoids**)



The Goal of Insect Containment at USDA ARS BIIRU-Quarantine Facility

- Prevent “accidental introduction” of “unwanted” non-native insects from damaging our agriculture and forestry



Outlines

- **Why do we need to contain insects in plant research?**
- **How can we most effectively contain insects in plant research?**
- **Quarantine containment facility and standard operation procedures**

Why Do We Need To Contain Insects in Plant Research

- Non-native insects can become serious invasive pests in a newly introduced region **because disassociation with co-evolved natural enemies**
- Non-native insects used in plant research should be contained prior to regulatory approval for environmental releases



Non-native, plant-feeding insects can become devastating pests in agriculture and forestry



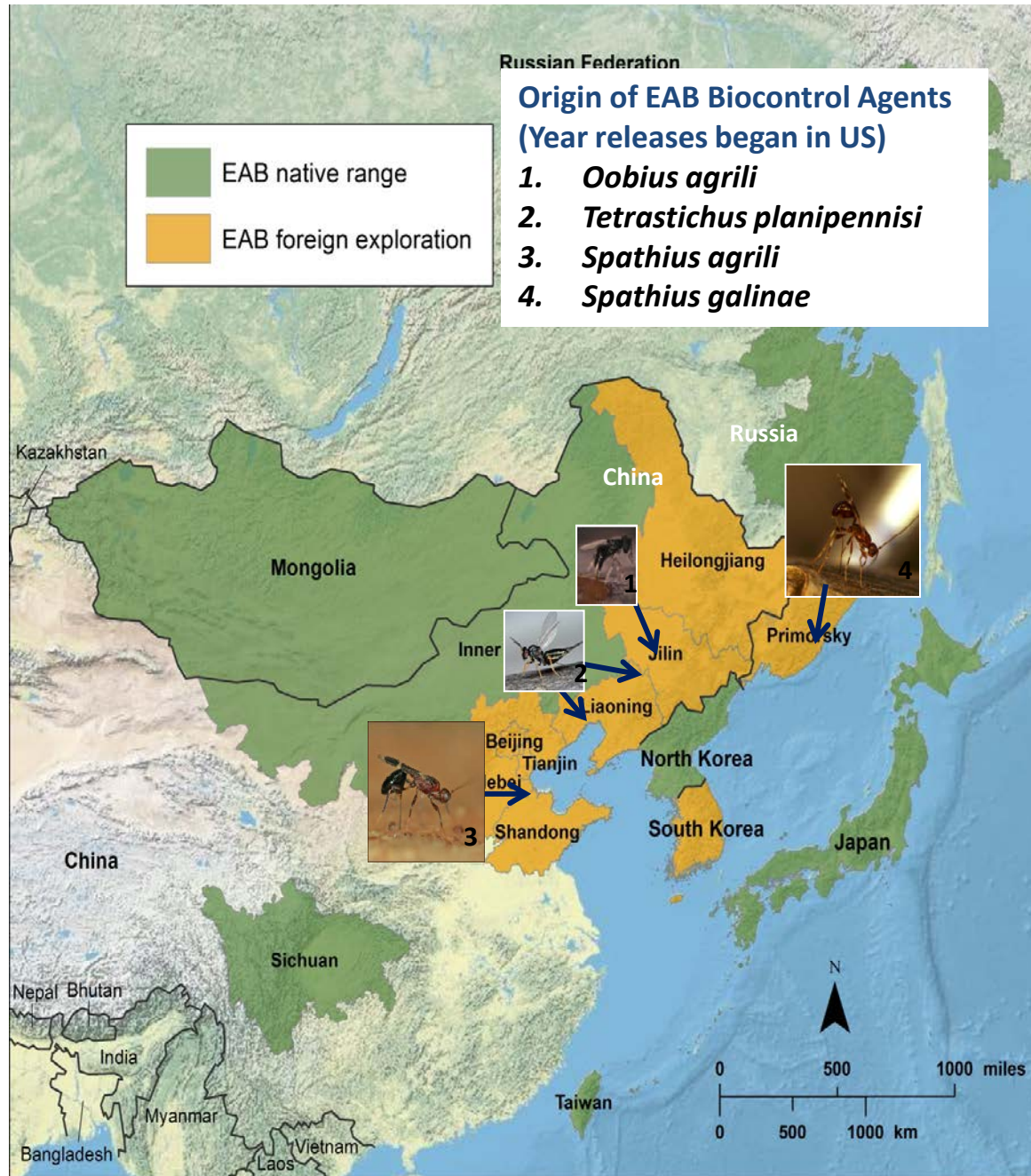
Emerald Ash Borer



Detected in Michigan in 2002

- **31 States in the U.S.**
- **Killed millions of ash trees**

Native Range of EAB & Origin of EAB-Parasitoids



Prevent “accidental introduction” of weed biocontrol agents – phytophagous insects



**Cactus moth used as biocontrol agent in SA
But caused serious damage to NA cactus**

Prevent “accidental introduction” of insect predators & parasitoids



- Multicolored Asian ladybird beetle
 - introduced to US for Biocontrol of aphids & scales in 1978
 - An invasive predator replacing North American native ladybugs
 - Nuisance household pests

Why do we need to contain arthropods in plant research?

- **Ecological imperatives** to prevent the damage by invasive pests
- **Regulatory requirement** –
 - [Plant Protection Act of 2000](#), amended 2004
- **Research needs** –
 - E.g., studying the biology/ecology and **host specificity** of non-native arthropod natural enemies: phytophagous insects, predatory and parasitic insects

How Do We Most Effectively Contain Insects in Plant Research?



How can we most effectively contain arthropods in plant research?

- Understanding the biology, behavior, and life-history of the concerned arthropod species
- Cost-benefit analyses for bio-safety and containment measures

The diversity of arthropods makes “one size-fit-all measures” impossible

- Arthropod body sizes varied from **0.5 mm** to **100 mm**
- Feeding biology/living habitats vary with developmental stages (egg, larvae, pupae, adults)
- Unique behavior to adapt to or overcome adverse environments (winters/summers/food shortages)

Examples of Emerald Ash Borer & Natural Enemy Containment

The beetle lays eggs under loose ash bark or bark crevices



The parasitic wasp lays its egg inside the emerald ash borer egg



Quarantine facility and plant related procedures

(Jay Bancroft)

Plants are key to the research in a dozen quarantine labs in the USA

- Plants of interest to people have insect pests that are adapted in very specific ways to exploit their hosts.
- The coevolution makes for great diversity of 'noxious' plants and arthropods.



Four categories for containment involving plants

- Lab Diets – best reliability, high cost
- Pre-cleaning “wild” plant food for insects



Chamber grown plants

good reliability, high cost



Greenhouse

Growing plants locally - inside or outside
containment



Our lab works on arthropod pests that
often eat many kinds of plants
(polyphagus)



Our lab specifically works on entomophagus biocontrol



Staff Training

Specializations for plants

- Trainees learn plant specific procedures for egress, research tasks, waste disposal.
- Learn Special Conditions on each permit that they work under.

This Package Contains
LIVING REGULATED ORGANISMS
*DO NOT OPEN EXCEPT IN THE PRESENCE OF AN APHIS
INSPECTOR OR DESIGNATED REPRESENTATIVE OF USDA.*


DELIVER TO
U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

Label # 25

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Los Angeles Plant Inspection Station
(Hawthorne)
USDA APHIS PPQ (310-725-1910)
11840 South La Cienega Blvd
Hawthorne, CA 90250
usa

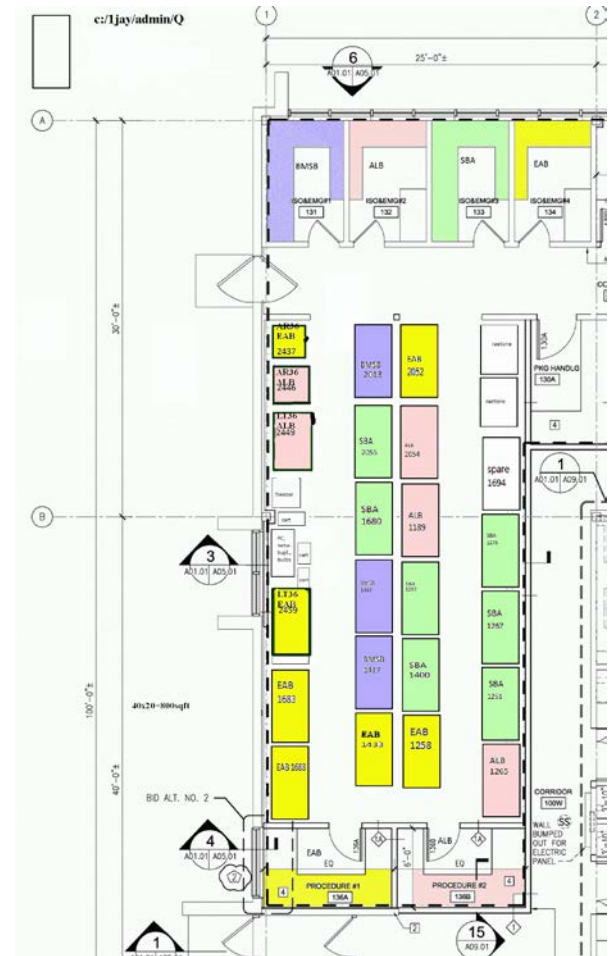
PPQ FORM 599 (SEP 2006) PERMIT NO. P526P-10-01043



Aspects Physical Biosecurity

all have relations to plants

- Control of HVAC humidity, environmental chambers monitored by building automation.
- Improvements: electrical backup generator ('12), air curtain, sticky mats ('14), added manipulation room ('15), chillers ('16), boiler & autoclave ('17).



Physical Controls

- Sanitation is key. Insect control is very disruptive to research



Waste liquid is treated with bleach and solids are autoclaved per standards set out by APHIS-PPQ



Thanks

Short orientation video

quarantinevideo2.wmv 90 sec

