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# Biological Control of the Invasive Weed *Parthenium hysterophorous* in East Africa

**Wondi Mersie**  
**Virginia State University**



**VirginiaTech**  
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# *Parthenium hysterophorus* L.

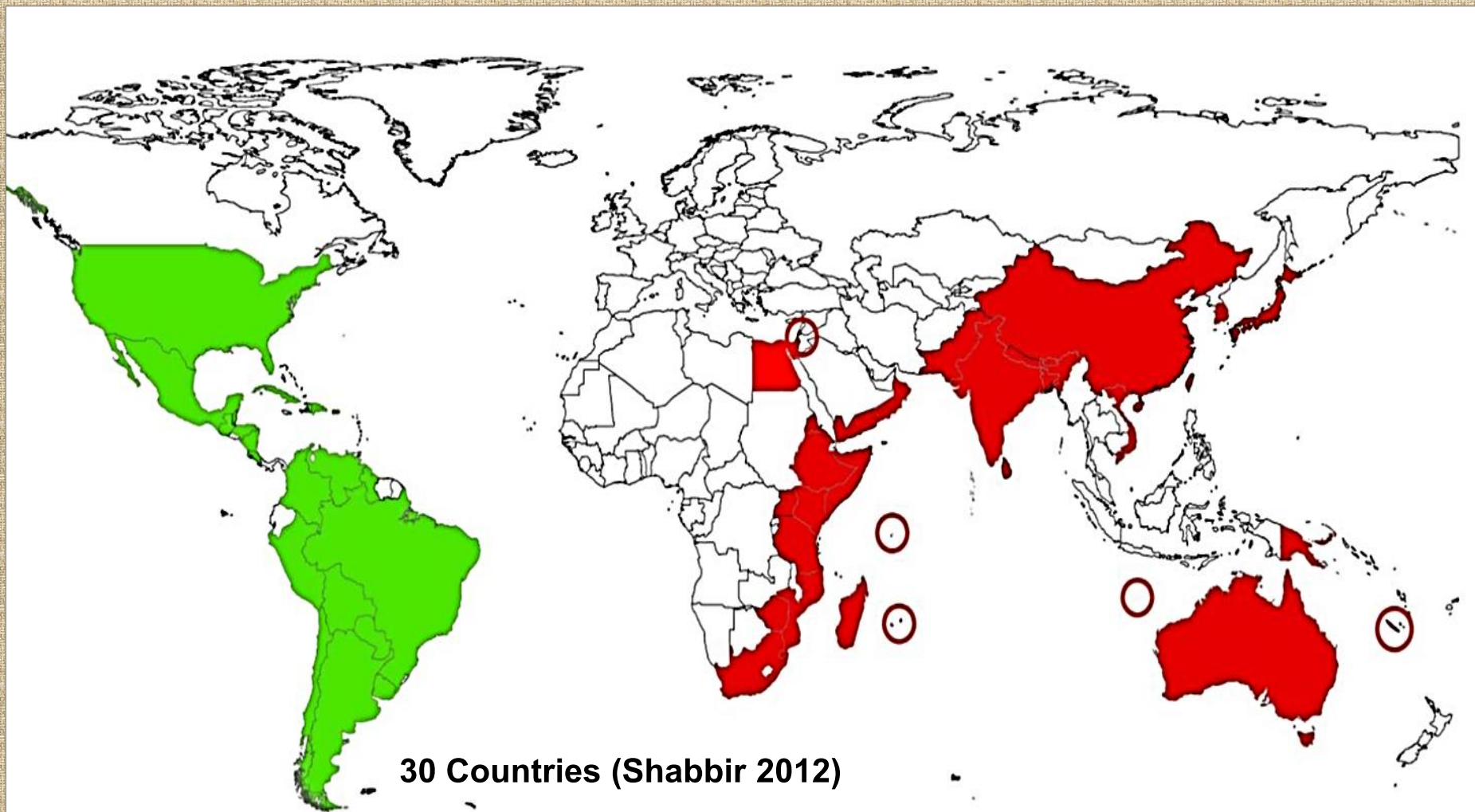




## ***How does it spread?***

- ✓ **Animals, Wind, Water**
- ✓ **Vehicles**
- ✓ **Farm machinery**
- ✓ **Earth moving machinery**
- ✓ **Grain and pasture seeds**

# *Parthenium hysterophorus* Across the Globe



30 Countries (Shabbir 2012)

From presentation by Andrew McConnachie July 2014

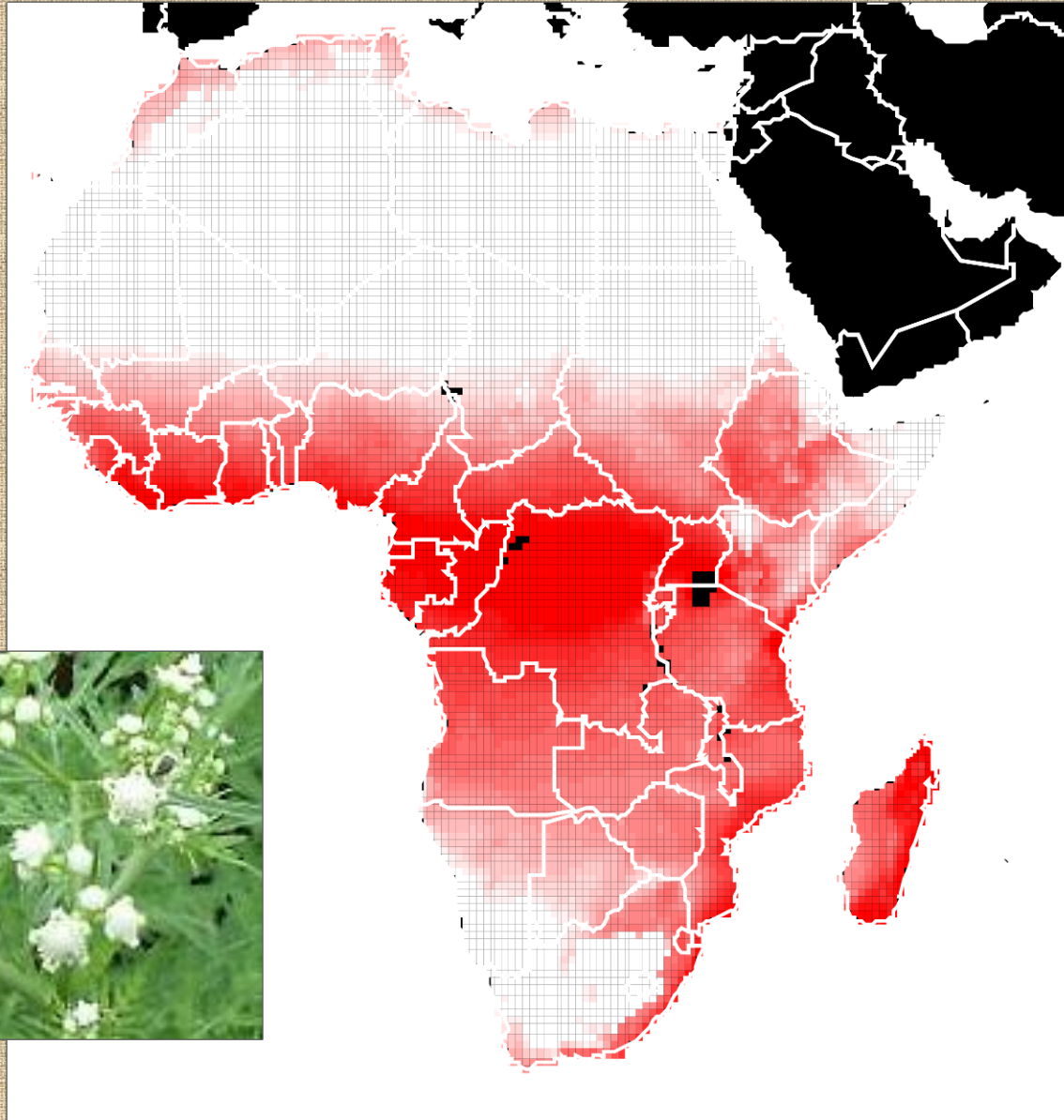
## Parthenium in Africa



Slide from Lorraine Strathie



# Climex Prediction of Parthenium in Africa



Red shading depicts the eco-climatic indices (suitability of each location); the darker the red shading, the more suitable the area is for parthenium.



# Adverse Impacts of Parthenium

In Ethiopia's Oromiffa language,  
the weed is known as  
"Faramasissa," which means,  
"sign your land away."



reduces crop yield



causes human health problems



competes with pasture species; taints meat  
and milk



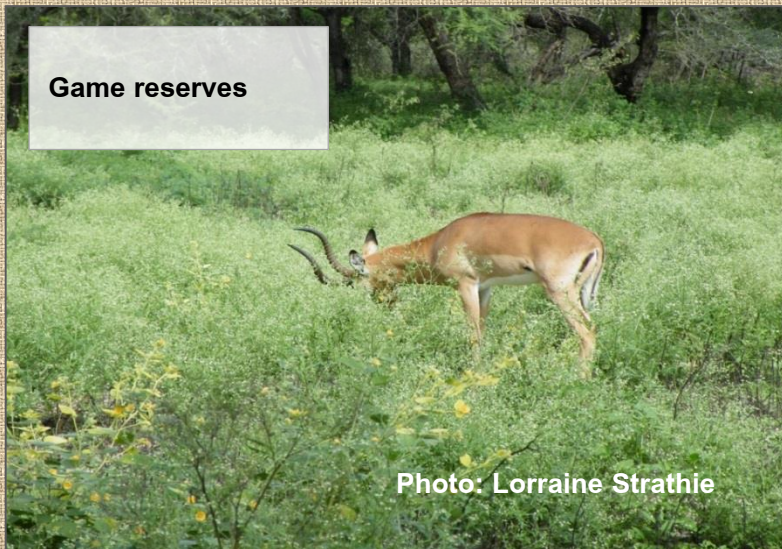
# Adverse Impacts of Parthenium



**Social impact**



**Homestead**



**Game reserves**

Photo: Lorraine Strathie



**Displaces native species**



# **Methods of Parthenium Management**

- ✓ **Hand-weeding**
- ✓ **Chemical**
- ✓ **Biological**

# **Advantages of Biological Control**

- ✓ **Relatively inexpensive**
- ✓ **Self-perpetuating / permanent**
- ✓ **Environmentally friendly**
- ✓ **No cost to the farmer**
- ✓ **No pest resistance problems**



## Agents Introduced to Australia to Control Parthenium

<b><i>Epiblema strenuana</i></b>	<b>Stem-galling moth</b>
<b><i>Zygogramma bicolorata</i></b>	<b>Leaf-feeding beetle</b>
<b><i>Listronotus setosipennis</i></b>	<b>Stem-boring weevil</b>
<b><i>Conotrachelus albocinereus</i></b>	<b>Stem-galling weevil</b>
<b><i>Carmenta ithacae</i></b>	<b>Stem / root crown-boring moth</b>
<b><i>Bucculatrix parthenica</i></b>	<b>Leaf-mining moth</b>
<b><i>Smicronyx lutulentus</i></b>	<b>Seed-feeding weevil</b>
<b><i>Puccinia abrupta</i> var. <i>partheniicola</i></b>	<b>Winter rust fungus (leaves)</b>
<b><i>Puccinia melampodii</i></b>	<b>Summer rust fungus (leaves)</b>

## Agents Introduced to South Africa to Control Parthenium

<i>Zygogramma bicolorata</i>	Leaf-feeding beetle
<i>Listronotus setosipennis</i>	Stem-boring weevil
<i>Carmenta ithacae</i>	Stem / root crown-boring moth
<i>Smicronyx lutulentus</i>	Seed-feeding weevil
<i>Puccinia abrupta</i> var. <i>partheniicola</i>	Winter rust fungus (leaves)
<i>Puccinia melampodii</i>	Summer rust fungus (leaves)



# Established a Quarantine Facility in Ethiopia to Evaluate BC Agents Against Parthenium





# Trained Staff



## International Workshop on Biological Control and Management of *Parthenium hysterophorus*

Ethiopia, July 13-17, 2014

### Venue:

Addis Ababa

July 13 – July 15, 12:00 am

Nexus Hotel

<http://www.nexusaddis.com/>

### Adama

July 15 – July 17, 12:00 am

Kereyu Hill Resort Hotel

<http://kereyuhillresorthotel.com/>

### Objective:

The purpose of this four day workshop is to review the current status of parthenium in the world and discuss management practices that can be used to abate its adverse impacts of this invasive weed. It is hoped that workshop will facilitate collaboration among researchers within Ethiopia, regionally and internationally.

### Background:

The invasive weed parthenium (*Parthenium hysterophorus*) originated in Central America. It has now spread to Africa, Asia, and Australia. In Africa it has invaded Ethiopia in the north and South Africa in the south and countries in between. In all these areas it reduces crop yield adversely affects livestock production by invading pastures, damages biodiversity, and human health. A project funded by USAID through the Integrated Pest Management Innovation Lab (IPM IL) and lead by Virginia State University and Virginia Tech has been developing control practices that abate the adverse impacts of parthenium. This project has evaluated the host range of two bioagents that control parthenium, conducted a detailed survey of parthenium in eastern and south Africa, and trained several individuals on biological control. The workshop will bring together scientists working on parthenium from Africa and other parts of the world to disseminate information on the biology and management of this weed. Workshop participants will also visit a bioagent rearing site, see the release of bioagents that control parthenium, *Zygogramma* and *Listronotus*, and visit farms affected by this weed.



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# ***Zygogramma bicolorata* – Leaf-Feeding Beetle:**

## **Host-range Test on 26 Plant Species in Ethiopia**



- ✓ Eggs laid on leaves
- ✓ Larva pupate within an earthen chamber
- ✓ Egg to adult – 23 days at 27 C
- ✓ Larvae and adults defoliate parthenium plants
- ✓ Diapause in soil during dry periods





# ***Listronotus setosipennis* – Stem-borer:**

## **Host-range Test on 30 Plant Species in Ethiopia**

- ✓ **Adult lays egg on flower**
- ✓ **Larvae tunnel in stems and pupate in soil**
- ✓ **Egg to adult – 23 days at 30 C**
- ✓ **Suitable for dry regions**



From Lorraine Strathie



# Rearing Facilities in Ethiopia





# Rearing and Release Sites in Ethiopia

Rearing & Release

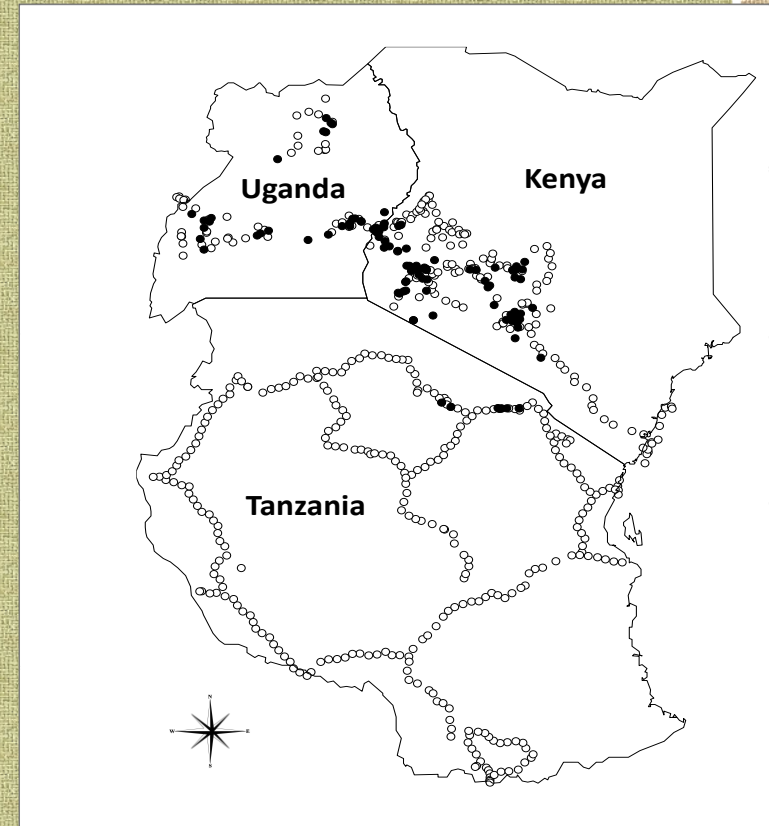
Sites .





# Parthenium Biocontrol Activities in Uganda and Tanzania

- ✓ **Releasing *Zygogramma* in Tanzania**
- ✓ **Seeking permit to introduce *Listronotus* in Tanzania**
- ✓ **Training staff in Uganda**



# Rearing Challenges

- ✓ Labor intensiveness of rearing
- ✓ Staff turnover
- ✓ Pests and predators at rearing sites
- ✓ Providing quality parthenium stock





# Challenges to Releasing Bioagents in East Africa

- ✓ **Lack of policy governing introduction and release of BC agents**
- ✓ **Little or no awareness of BC**
- ✓ **Lack of capacity**
- ✓ **Fear, anxiety and avoidance of insects**



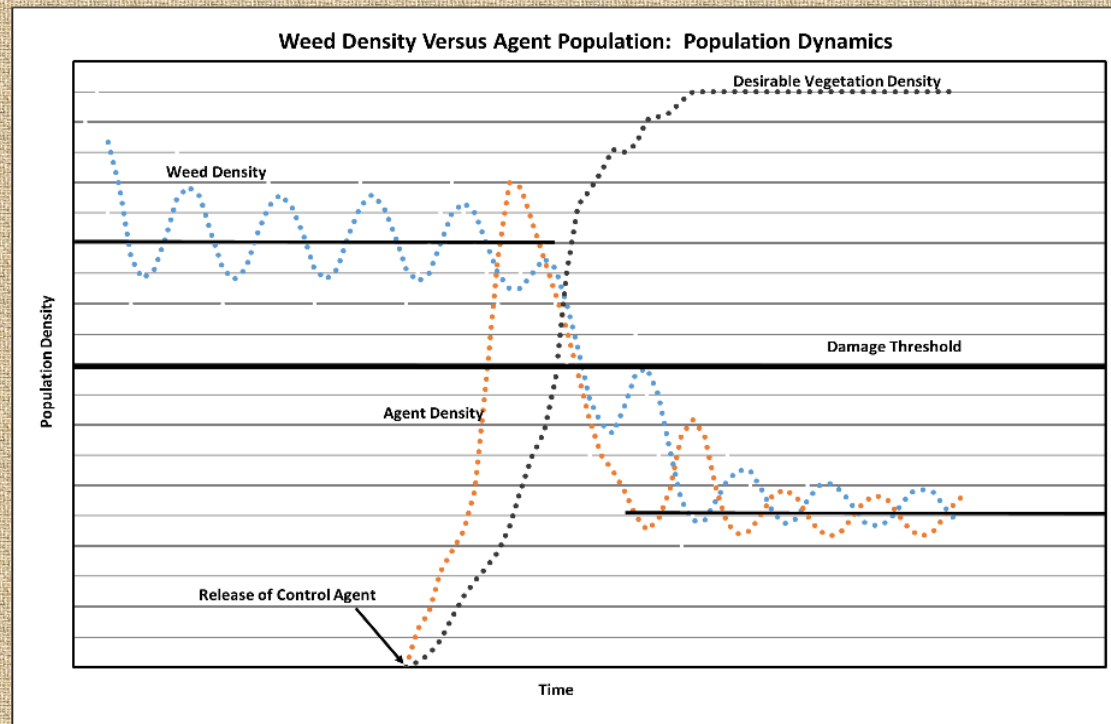
# Establishment Challenges

- ✓ **There is a lag-time between introduction and establishment.**
- ✓ **Zygogramma took 10 years to establish in Australia (Dhileepan 2014).**
- ✓ **In India it took 3 years.**
- ✓ **In South Africa Zygogramma has not established after 2 years.**
- ✓ **There is a positive correlation between release size and establishment success (Quentin Paynter – Weed Biocn. 75, 2016).**



# ***What happens to the agents when the host plant is eradicated?***

**Answer:** The agent never eradicates its host completely but will keep it under control. The agent's population will track with that of its host plant; when the host plant is abundant, the agent's numbers will also increase.



# Engage the Community at Release Sites

- ✓ **Hold discussions with farmers, extension agents and local ag bureaus before releasing bioagents**
- ✓ **Establish demonstration plots to show the specificity of bioagents to parthenium**





# Conclusions

- ✓ **Increase BC awareness**
- ✓ **Assist in developing BC policies**
- ✓ **Scale up rearing of BC agents**
- ✓ **Widespread releases**
- ✓ **Regular monitoring & evaluation**
- ✓ **Redistribution once well-established**
- ✓ **Persistence and patience**



# Acknowledgements



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