Potential Invasive Pests Workshop

*Diabrotica speciosa*: Important Soil Pest in South America

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## Outline of my talk

- Taxonomic position and biological aspects
- Geographical distribution/Host plants
- Host plant influence on the immature and adult stage
- Economic importance of *D. speciosa* (Brazil)
- Tactics to control *D. speciosa* (larvae and adults)
- Rearing techniques
Taxonomic position

- Order: Coleoptera
- Family: Chrysomelidae
- Subfamily: Galerucinae
- Tribe: Luperini
- Species: *Diabrotica speciosa* (Germar, 1824)

  - Pest very similar to other *Diabrotica* species which occur in the United States
  
  - Clark et al. (2001) => *D. speciosa* and *D. balteata* are sister taxa
Phases of *Diabrotica speciosa* biological cycle
Period of development in each stage

- **Egg** = 8.8 days
- **Larvae I-II-III** = 18 days
- **Pre-pupae/Pupae** = 12 days
- **Adult** = 72.5 days

- **Temp. = 25ºC**

- **Females usually have greater longevity than males**

- **Period of development from egg to adult = 38 days**

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Ministry of Agriculture, Livestock and Food Supply

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Brazilian Government
Sexing according to adults' characteristics:

- **Male**
- **Female**

Sexing according to pupae characteristics:

Female displays a ventral papilla near the end of the abdomen, while in male this structure is absent.
Geographical Distribution

- Occurrence

Map showing the geographical distribution with purple circles indicating occurrence in various countries in South America, including Brazil, Venezuela, Colombia, Ecuador, Peru, Bolivia, Paraguay, Argentina, Chile, Uruguay, and Suriname.
Occurrence in Brazil

Location found
Populational fluctuation

Abundance is influenced by availability of host plants in each region

Dourados, MS - Brazil

The greater abundance occurs when corn is grown in the region.
Host plants of *Diabrotica speciosa*

Polyphagous insect - more than 60 species of plants from 22 families
- Adults => large number of host plants (polyphagous)
- Larvae => small number of host plants (oligophagous)

Main host plants: Corn and potato (larvae) - bean and soybean (adults)

Cucurbitacins (allelochemical) used as feeding stimulant
- Occur especially in cucurbits
- Like other beetles of Luperini tribe
- Can be used for monitoring or controlling adults
Host Influence in the adult stage of *D. speciosa*

The development and reproduction of *D. speciosa* is strongly influenced by the type of food available for larval and adult stages.

**Larval stage**
- Corn "SEEDLINGS"

**Food in the larval stage**
- Bean
- Corn
- Soybean
- Turnip
- Wheat

**Different types of food in the adult stage**

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Bitencourt & Ávila (2007)

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Egg-laying capacity of *Diabrotica speciosa* (Host influence in the adult stage)

![Graph showing egg-laying capacity by host plant.](image)

Bitencourt & Ávila (2007)
Longevity of adults of *Diabrotica speciosa* when fed on different hosts

Bitencourt & Ávila (2007)

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**Host plant**
- Bean
- Soybean
- Turnip
- Wheat
- Corn

**Longevity**
- Bean: 48.4 days
- Soybean: 44.6 days
- Turnip: 45.9 days
- Wheat: 15.4 days
- Corn: 14.3 days
Female survival time of *Diabrotica speciosa* (Host influence in the adult stage)

Adults survival of *Diabrotica speciosa* when fed with different hosts

- Longevity decreased after 8 days feeding on corn leaves
- 28 days after feeding most insects were still alive

Ávila & Parra (2002)
Host influence in the larval stage of *D. speciosa*

Different types of food in the larval stage

- Rooted potato
- Wheat “SEEDLINGS”
- Soybean “SEEDLINGS”
- Corn “SEEDLINGS”
- Bean “SEEDLINGS”

Bean leaves

Food in the adult stage

Bitencourt & Ávila (2007)
Egg-laying capacity of *Diabrotica speciosa* (Host influence in the larval stage)

These results show that the type of food offered at the immature stage influences the oviposition capacity even though with a suitable food in the adult stage.
Longevity of *Diabrotica speciosa* - Temperature influence in the adult stage

Increasing the temperature, the longevity of adults was reduced.

Ávila & Parra (2001)
Egg-laying capacity of *Diabrotica speciosa* - Temperature influence in the adult stage

Total eggs laid by *Diabrotica speciosa* female under different temperatures in the adult stage.

- Higher oviposition at lower temperature
- Explains greatest damage in cold climates compared to warmer regions

Ávila & Parra (2001)
Economic importance of *Diabrotica speciosa*

Both adults and larvae have great economic importance in Brazil

**Adults:**
- They feed on leaves of various plant species of economic importance
- Act as vectors transmitting virus, especially in cucurbits

**Larvae:**
- Because they live underground, can attack roots and tubers
Economic importance of *Diabrotica speciosa*

**Adults damage**

Adults feed on the leaves, thus reducing the productivity of these crops or even the commercial value of fruits.
Economic importance of *Diabrotica speciosa*

**Larvae damage**

- Corn plant falls to the ground and the harvester does not pick up the corn cob anymore

- Especially adventitious roots

- Gooseneck

- This kind of damage reduces the commercial value of the tubers

- View of external and internal damage by larvae in tubers

Photo: F. Fávero
Tactics to control *Diabrotica speciosa* (Adults and larvae)

**Adults:**
- Adults are only controlled with insecticides
- Spraying insecticides in the shoots (Organophosphate)

**Larvae:**
- Insecticides sprayed in the furrow *(more efficient)*
- Application of granular insecticides in the furrow
- Seed treatment is not effective for this type of pest because the damage in the plants occurs about 45 days after plant emergency, when the insecticide does not have residual effect over the insect
Control of *Diabrotica speciosa* larvae

Insecticides are sprayed in the furrow at the time of maize sowing

Chlorpyrifos is considered standard product
Insecticides sprayed in the furrow of corn

Control of rootworm at 45 DAE

Insecticides sprayed in the furrow give good control of larvae

Ávila & Gomez (2001)
Researchers are trying to identify and synthesize this pheromone.

ECOLOGY, BEHAVIOR AND BIONOMICS

Males Are Attracted by Female Traps:
A New Perspective for Management of *Diabrotica speciosa* (Germar) (Coleoptera: Chrysomelidae) Using Sexual Pheromone

Possibility for management of *Diabrotica speciosa* using its sexual pheromone
Rearing techniques of *D. speciosa*

**Rearing in natural diets**

**Substrate**: paper, sand, soil and *vermiculite*

**Suitable substrate** = Keeps the moisture for the maize seedlings to develop and allows the larvae to feed on them.

**Larval development**: corn seedlings, rooted potato

- Cages for adults
- Food for adults (bean leaves)
- Oviposition substrate (black gauze)
- Extraction of eggs in water
- Larval development (corn seedlings)
- Pupal development (vermiculite)
- Adults emerge in vermiculite inside the bottle
Rearing techniques of *D. speciosa*

Rearing in natural diets

Rearing *Diabrotica speciosa* in corn seedlings in vermiculite substrate => more than 75% of viability in the larvae-adult period

Larval development

Inoculation is made in a small container and larvae are transferred to a large one after 10 to 12 days, where the insect completes the cycle
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Thanks for your attention!

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