



Plant/Insect Interaction and CAP LTER

The Bruchid Beetle/Palo Verde tree insect interaction study was initially started by Dr. Tim Craig at ASU-West and John Wallace at Deer Valley Middle School. Palo Verde trees are native to the desert and are now common in urban desert landscaping. Bruchid beetles lay eggs on the pods, and their larvae feed on the seeds. Urban Palo Verde trees are watered and fertilized, often isolated from other Palo Verde trees, and mixed together with other non-native tree species. All these variables can influence bruchid beetles populations. Through this study, students can compare how beetle populations in urban vs. desert settings respond to these variations.

Comments on the Protocol:

Why collect 30 pods?

This number should be large enough to give you a good random sample, anything smaller might skew the data

Ensuring random pod collection

It's very important to sample the seedpods in an unbiased way. You want your students to collect seedpods that are typical of those at the site. If students pick pods that were particularly interesting to them, such as the largest seedpods, then they would have a biased sample and it would not be useful to compare to the samples from other sites. One way to ensure randomness is to have one student walk around the tree and have **a second student who is not looking at the tree** tell the first student to "collect a pod" (repeat 5 times per tree)

Why collect more than one pod from each tree?

If students collect only a single pod from each tree it might not be typical of the pods on that tree. For example, students might collect the only pod that does not have evidence of bruchid beetles even if there are lots of bruchid beetles feeding on the tree.

Grade Level:

Although originally designed for middle school children, this project can be used by both high school and elementary school children



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Beetles/Seeds

Do you know who is feasting on the seedpods?

Phoenix is an expanding urban area located within the Sonoran Desert. Many trees are uniquely adapted to living here and they are part of food webs that include animals and insects also are adapted to desert living.

One Sonoran Desert plant that has found its way into urban landscapes is the palo verde tree. In the desert, this tree supports a community of animals including bruchid beetles. These insects lay their eggs on palo verde seedpods and the larvae feed on the seeds.

Palo verde seedpods and beetles are connected

The interactions between plants and animals can provide vital information on the health of an ecosystem. Ecologists are interested in determining whether the interactions between urban palo verde trees and bruchid beetles is similar or different than their interactions in undisturbed Sonoran Desert communities.

You can provide important data by investigating the palo verde trees and bruchid beetle populations in your schoolyard.



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Beetles/Seeds Study

What is feasting on those seed pods?

What are they?

Bruchid beetles eat the seeds produced by palo verde trees. Palo verde trees are native to Arizona's Sonoran Desert. They also are common in landscaped areas including parks, schoolyards and backyards.

Female bruchid beetles lay their eggs on palo verde seedpods. After they hatch, beetle larvae eat the seeds, pupate and emerge as adult beetles through little holes they create in the seedpods.

Why study them?

- Plants are at the base of food webs and any change in a plant community can have an impact on all organisms that feed higher up the food web.
- We don't really know whether palo verde trees growing in a city have different seedpod development as compared to those in the Sonoran Desert.
- We also don't know how (or even if!) urbanization of the trees has changed the interaction between bruchid beetles and palo verde trees.
- There might be many reasons that urban trees will grow differently than desert trees. For example, trees in yards and parks may receive more water and fertilizer which could increase the number of seeds produced.

What do they tell us about our urban ecosystem?

Whether or not a seed will be eaten by a beetle depends on many different things. If a female beetle finds a seed, it must lay an egg on it, and then the beetle larvae must be able to eat the seed and survive. All these factors could be different in the city versus the desert. For example, the city seeds might be more or less attractive to the beetle, just as food prepared in different ways might be more or less appealing to you. Even if the beetle likes the seed the larva may not be able to survive feeding on it. For example a particular seed might be too small or too tough to eat.

CAP LTER ecologists are interested in the impact humans have had on native plants growing in cities and the insects that feed upon them. Your investigations might contribute to this understanding.

What Materials Will You Need?

- Bags (paper, plastic)
- Data Sheet
- Pencil
- Magnifying Glass



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Beetle/Seeds

What is feasting on those seedpods?

Bruchid Beetles and Seedpods Protocol

1. Choose a site with blue palo verde (*Parkinsonia florida*) trees. Make sure they are blue palo verde trees and not foothill palo verde (*Parkinsonia microphylla*).
2. Identify your collecting site as either desert or urban. Complete a habitat description data sheet for each site where you are collecting pods. You will need to do this before entering data into the CAP LTER database. **YOU ONLY NEED TO DO THIS ONCE PER COLLECTING SITE.**
3. Collect 30 pods from each site. Pods should be collected directly from the trees.
4. Collect 5 pods from 6 different trees. (If you cannot find 6 trees then collect an equal number of pods from each tree for a total of 30.)

Be sure to collect the 5 pods from **different locations** and **different heights** on the tree.
5. Assign a number to each tree.
6. Put all the pods from one tree in one bag. If you collect 5 pods from 6 trees then you will need 6 bags (one for each tree) and each bag will have five pods. Put a label in the bag with the site and tree number on it.
7. Once inside your classroom, examine each pod, give it a number, and then
 - a) count the number of bruchid beetle emergence holes on the pod.

Bruchid beetle holes are round and 1-2 mm in diameter;
 - b) count the number of seeds each pod contains.
8. Enter all the information on the data sheet.



Site and Habitat Description

Protocol: Bruchid Beetle and Desert Legume

Provide a site description of where you collected Palo Verde Pods. For example, if you are collecting data at seven locations, you will enter seven different sites.

SITE DESCRIPTION

Teacher: _____ **Class:** _____

School: _____

Street Address: _____

City: _____ **Zip code:** _____

Site Name: _____

Create a name to identify the site for which you are collecting data. (e.g. Playground South Corner)

Site ID: _____

Create a 3 – 5 letter and/or number code to identify this site. (e.g. Playground South Corner – PGSC)

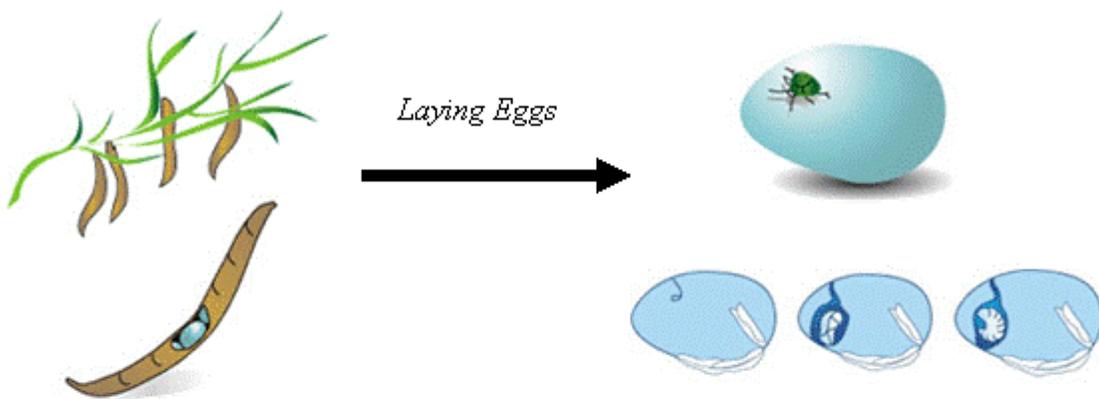
Site Location Write a brief description of where your site is located. (i.e. SW Corner of playground: _____

Description Write a description of your site so that a visitor to your study area would be able to find your site:

Bruchid Beetle Life History

Palo Verde Tree with Seed Pods

Parkinsonia florida, produces seeds that are attacked by three species of bruchid beetle: *Mimosestes amicus*, *Mimosestes ulkei*, and *Stator limbatus*

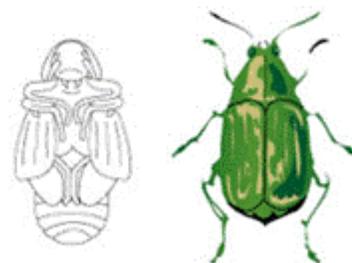


Blue palo verde trees bloom from late March to May and seedpods develop from May to June

Mimosestes amicus and *Mimosestes ulkei* lay eggs on the seedpod and the larvae burrow through the pod and into the seed. *Stator limbatus* enters the seedpod through emergence holes and lays the egg directly on the seed



Larvae take about 34 days to mature



Adult beetles emerge leaving round emergence holes by September/October



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Help! An adult Bruchid Beetle has emerged, which species is it?

Here is a key to the three Bruchid Beetles that feed on Blue Palo Verde seeds:

1a. Beetle is < 3mm in length, has orange "bean-shaped"* markings on the wing covers (elytra)*Stator limbatus*

1b. Beetle is larger than 2.5mm in length, with no orange markings.....Go to 2

2a. Beetle has light (or white) stripe down center of wing covers (elytra) with black border along sides - giving the appearance of a tuxedo.....*Mimosestes ulkei*

2b. Beetle has brown, grey, or golden wing cover (elytra), with no stripe down center of back.....*Mimosestes amicus*

*sometimes this looks crescent-shaped or lobe-shaped