

## **Predation of agrillo seed (*Rhus trilobata*) in the highlands region of Jalisco**

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### **Abstract**

Seed, a basic reproductive unit for the great majority of plant species, is a nutritional source in the first instance for the establishment of a new generation, however some herbivores take advantage of this state of fragility and alimentary concentration to develop its biological cycle to the interior of fruits like in agrillo (*Rhus trilobata*), a perennial shrub of the Anacardiaceae family, of which in recent years the presence of an insect of the order hymenoptera, parasitizing the seed has been reported, so the objective of the present work was to study the herbivory between the insect and the seed of agrillo for which, fruits collected and diagnosed with the presence of the aggressor by means of an X-ray equipment, were incubated in laboratory for the identification of the insect, which turned out to be of the Genus *Eurytoma*. Likewise, some patterns of behavior of the aggressor agent were identified, which are discussed.

### **Herbivory, *Eurytoma*, seed**

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## Introduction

The seed as the basic unit of reproduction of most plant species is a concentrated food source, in the first instance for the establishment of a new generation; this condition has been exploited by certain herbivores which parasitize the seed of several species among which is the fruit of the agrillo (*Rhus trilobata*, Anacardiaceae), a species appreciated in the highlands of Jalisco, particularly in the municipality of Arandas, place where its inhabitants have been collecting it for decades for the production of refreshing drinks, ice cream and confectionery; however, it is reported potential use of gardening, restoration of degraded ecosystems, traditional herbalism and the production of plant pigments or active ingredients.

## Justification

The growing demand for products made from agrillo together with the loss of their natural habitat as a result of the change in land use in the Jalisco highlands, has led to interest in their domestication, conservation and chemical characterization.

## Problem

In the municipality of Arandas, Jalisco, in the year of 2016 a herbivore was reported parasitizing the seed of the agrillo. Wasp larvae and pupae (genus hymenoptera), were discovered by means of an X-ray equipment, which caused 38% on seed quality.

## Hypotesis

It is possible to identify the aggressor seed aggressor agent by artificial incubation of the parasitized fruits.

## Objectives

### General objective

Estudiar la herbivoría entre el insecto reportado y la semilla de agrillo.

### Specific objectives

- Identify the insect that parasitizes the seed of agrillo, reported in previous studies.
- Study the behavior patterns of the aggressor insect.
- Estimate the damages caused at the seed level by the herbivore.

## Theoretical framework

The guidelines were established to identify the herbivore aggressor of seeds of agrillo. Plants established in the open field were parasitized by the aggressor agent naturally. The mature fruits were collected and incubated to obtain the adult phase of the insect, then proceeded to its identification.

## Research Methodology

The work was carried out in the Orthodox Seeds Laboratory of the National Center for Genetic Resources (CNRG) of INIFAP, from agricultural plants established in the ARRG arboretum, in Tepatitlán de Morelos, Jalisco (Fig. 1a). The harvest of the fruits was carried out in the month of May 2017.

The collected fruits were examined for the detection of the different stages of development of the insect, by means of an X-ray machine, Faxitron brand model MX20. The biological cycle of the insect was divided into: egg, larva and pupa, likewise, for those fruits without the presence of the insect, but with the evident perforation at the seed coat level, those that remained intact were considered as damaged seeds and undamaged seeds.

Percentages were calculated for each category and subsequently, the fruits were incubated in a bioclimatic chamber with conditions of 25 ° C constant and 16 light for 8 of darkness for the capture and identification of the insect in adult stage (Fig. 1b).

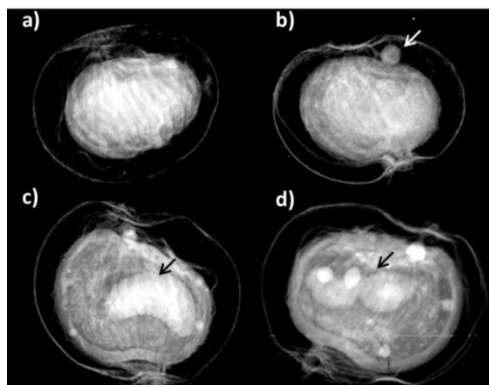


**Figure 1** Photographs of: a) Agrillo plants established in the CNRG arboretum, and b) incubation of the fruits of agrillo.

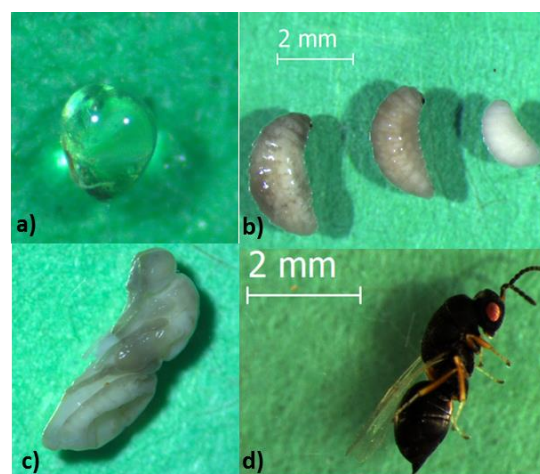
### Theoretical Methods

Figure 2 shows graphically the categories considered for the evaluation by X-rays: a) fruit without damage, b) fruit with egg, which is deposited near the peduncle (base of the fruit) in the mesocarp region by means of the ovipositor apparatus of the females, c) developing larva, d) pupal stage.

Likewise, in Fig. 3, photographic images of the stages are presented: a) egg, b) larva, c) pupa and d) adult female.



**Figure 2** Radiographic images of agrillo fruits: a) fruit without damage, b) fruit with egg, c) fruit with larva and d) fruit with pupa.



**Figure 3** Photographs of the biological cycle of the herbivore identified in agrillo seeds: a) egg, b) larva, c) pupa and d) adult female.

### Results

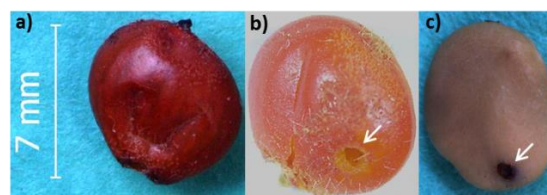
After making the diagnosis with the X-ray equipment and incubating the different immature stages of the herbivore, it was found that the insect that parasitizes the fruits of the agrillo and specifically the seed, corresponds to the genus *Eurytoma* (Figure 3d). This genus belongs to the family Eurytomidae which exhibits a wide range of food habits, however, most of the larvae of this family are endophytes, of which stand out: seed borers, galls formers or even insect parasitoids. Phytophagous. In the case of the agrillo, the fruit is parasitized in the maturation phase. The egg is deposited in the mesocarp region by means of the ovipositor apparatus of the females, regularly near the base of the fruit or peduncle (Fig. 2b), inside the mesocarp the egg hatches and the larva migrates to the interior of the seed in which develops and completes its metamorphosis while consuming the seed completely.

The results obtained from this evaluation are presented in Table 1, which shows that the highest values were for the seed free of damage with 54.52%, as well as for the empty seed with 21.29%, these two values seem logical for wait, considering that the harvest of the fruit begins in late March and early April, which is why the percentage of empty seeds was increased, which means that the insect completed its metamorphosis together with the complete consumption of the seed, which it is revealed by the X-ray image (Fig. 2d) and the perforation when leaving (Fig. 4b).

Stadium	Percentage (%)
Egg	4.83
Larva	15.63
Pupa	3.73
Seed with damage (empty)	21.29
Seed free of damage	54.52

**Table 1** Percentages of the different stages of the herbivore *Eurytoma* sp. in seed of agrillo, detected by means of X-rays.

It is important to point out that a little more than 50% of the seeds did not suffer damage, so the percentage of regeneration for the species could not be strongly affected by the herbivore; likewise, only the presence of one larva per fruit was found in cases where the presence of immature stages was detected, which could be an indication of the high specialization in the herbivory that occurs between parasite and host, since the seed of agrillo is small and could only reach to complete the development and metamorphosis of one insect per fruit at a time, for which the emission of certain hormones has been reported as an indication that a fruit has been previously parasitized.



**Figure 4** Photographic images of: a) fruit of a healthy tree, b) Fruit of a tree with the typical perforation once the insect completes its metamorphosis and migrates as an adult, c) seed damaged by the herbivore.

In this sense, it has been established that seed predators can have important and often variable effects on the population dynamics of plants and, together with other biotic and / or abiotic factors, on the evolution of traits or characters of a species.

### Conclusions

The herbivorous insect that parasitizes the seed of an agrillo is of the genus *Eurytoma*.

Only the presence of one larva per fruit (seed) indicative of the high specialization that exists between host-parasite was detected.

More than 50% of seeds were not damaged, so the herbivore could have a minimal effect on the preservation of the species.

### References

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