Identification and impact of *Atractomerus pitangae*: a new pest on Rio Grande Cherry seeds (*Eugenia involucrata*)

Identificação e impacto de *Atractomerus pitangae*: uma nova praga em Cereja do Rio Grande (*Eugenia involucrata*)

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Abstract

This study aimed to identify the insects which consumes *Eugenia involucrata* seeds and to evaluate the potential for damage to the seeds as well as the food substrate consumed by the attack. To obtain the data, a collection of fruits was carried out at the Forestry Research Center (FEPAGRO / Florestas) in the municipality of Santa Maria, RS, being conducted at the UFSM crop protection department. After seed processing were separated into healthy seeds and damaged seeds (those that contained an emergence hole for the insect). As for the analyzed seeds, there were a total of 3287 seeds, of which 1998 were healthy (60.08%), 1289 damaged seeds (39.2%) and a loss of substrate consumed of 7.65 g per seed, corresponding to a damage level of 39.98% of the food mass. It was found a high rate of predation in the seeds, which became unsuitable for the propagation of the plant. In this study, *Atractomerus pitangae*, associated with the predation of *Eugenia involucrata* seeds, was registered for the first time in southern Brazil.

Keywords: Seed Processing. Damage in Seeds. Coleoptera.

Resumo

Este estudo teve como objetivo identificar os insetos que consomem as sementes de Eugenia involucrata e avaliar o potencial de danos às sementes, bem como ao substrato alimentar consumido pelo ataque. Para obter os dados, foi realizada uma coleta de frutos no Centro de Pesquisa Florestal (FEPAGRO / Florestas) no município de Santa Maria, RS, conduzida no departamento de proteção de cultivos da UFSM. As sementes, após o processamento, foram separadas em sementes saudáveis e sementes danificadas (aquelas que continham um orifício de emergência para o inseto). Quanto às sementes analisadas, foram um total de 3287 sementes, das quais 1998 estavam saudáveis (60,08%), 1289 sementes danificadas (39,2%) e uma perda de substrato consumido de 7,65 g por semente, correspondendo a um nível de dano de 39,98% da massa de alimentos. Foi encontrada uma alta taxa de predação nas sementes, tornando-as inadequadas para a propagação da planta. Neste estudo, Atractomerus pitangae, associado à predação de sementes de Eugenia involucrata, foi registrado pela primeira vez no sul do Brasil.

Introduction

Native fruit species represent great economic potential, especially for family farmers, due to the possibility of producing differentiated fruits, since the consumer market is always looking for new products (Degenhardt et al., 2007). In this search, foods that have nutraceutical properties, such as those considered small fruits are quite interesting, as they have been shown to have an antioxidant effect, attributed to anthocyanin, the pigment that gives fruits red, purple and blue colors.

*Eugenia involucrata* commonly known ascerejeira, cerejeira-do-mato, cerejeira-da-terra, cerejeira-do-rio-grande (Lorenzi, 2002), is one of these small fruits, belonging to the family of Myrtaceae, native species that occur from Minas Gerais to Rio Grande do Sul (Donadio et al., 2002). It is a small tree, which blooms from September to November, with full maturation of the fruits from October to December.

Although this species seems promising in the small fruit market, one of the biggest obstacles concerns difficulties in its propagation process, which represents an obstacle to its economic, ecological and silvicultural use (Degenhardt et al., 2007). Many species of *Eugenia*, despite their ecological importance and the potential for commercial exploitation, have low occurrence density, a fact that makes it difficult to obtain seeds in considerable quantities, to the point of allowing the production of seedlings on a large scale, either for commercial use, with the planting of fruit production orchards, or for use in plant restocking programs (Silva et al., 2005).

There are some reports on the propagation of *E. involucrata*, through cutting and seeds, the second form being the most recommended (Sanhotene, 1989). However, it has been verified that the damage caused by insects in fruits and seeds of forest species has become more and more frequent, as a consequence of massive anthropization. With the attack, the predated seeds lose their germinative power, since their cotyledons are consumed by the larvae of these insects, being this one of the most critical stages of the life cycle of the plants after dispersal (Fenner, 1985).

The main form of propagation of forest species is through seeds, however some have interactions with insects that develop inside reproductive structures, affecting the quality of the seed destined for the perpetuation of the species (Kuniyoshi, 1983). There is the presence of insects in reproductive structures of many forest species, although there are no studies such as the occurrence and predation of insects that are associated with *E. involucrata* fruits and seeds. The seed predator insects before their dispersion (pre-dispersion) have, possibly,
greater influence on the structure between the plant and its disperser, through at least two mechanisms: reduction of the number of seeds available for dispersion (Janzen, 1970) and decrease of dispersers due to the low density of fruits to be dispersed. The damage caused by these insects can compromise the obtaining of seeds to be used in the propagation of these species, causing loss of vigor and reduced germination (Santos et al., 1997), contributing to the infection by fungi and other pathogenic agents (Soave and Wetzel, 1987; Santos et al., 1989). In this sense, this investigation aims to register a new pest that promotes the predation of *Eugenia involucrata* seeds and evaluate the potential for damage to them as well as the food substrate consumed at the time of its attack.

**Material and Methods**

Seed collections for the development of the study were carried out at the State Agricultural Research Foundation / Floresta (FEPAGRO / Floresta) located in the Boca do Monte District in the municipality of Santa Maria, RS (Figure 1)

The region's climate, according to the Köppen classification, is of the humid subtropical (“Cfa”) type, with the average temperature of the coldest month between -3 °C and 18 °C, and the average temperature of the warmest month exceeding 22 °C. The average annual precipitation is 1,770 mm, without droughts (Moreno, 1961). The soil of the study area is classified as Sandy Dystrophic Red Argisol (Ultisol), originating from sandstones and siltstones of the São Pedro Mapping Unit, with gently undulating relief. This Unit is characterized by presenting medium-deep, non-hydromorphic, well-drained soils, with a reddish Bt (B textural) horizon, with a frank sandy surface, acids and poor in organic matter (Streck et al., 2008).
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As for obtaining plant material, the fruits of *Eugenia involucrata* were collected from parent plants on 10/21/2013 at the FEPAGRO / Florestas unit, Santa Maria, RS. After the collection, cleaning, pulping of the fruits was carried out manually, under running water in a sieve and put to dry in the shade, receiving batch number 53/2013. After, the Germination (74%), Humidity (41%), Purity (99.18%) and Thousand seed weight (286.55g) were measured. Tests were subsequently sent to the Entomology Laboratory of the Department of Phytosanitary Defense (DFS) from the Federal University of Santa Maria (UFSM).

Regarding the identification of specimens, the emergence of insects was observed daily, where the seeds remained conditioned until the emergence of adult insects, which occurred in 30 days. After emergence, eight adult specimens were removed from the containers, previously prepared and sent to the specialist in coleoptera Prof. Dr. Germano Henrique Rosado Neto from the Zoology Department of the Federal University of Paraná (DZUP) for identification.

Seed damage assessment was conducted at the Entomology Laboratory belonging to the Department of Phytosanitary Defense (DFS) of the Federal University of Santa Maria (UFSM). According to Brasil (1992), seeds that are damaged by insects are those that contain eggs, larvae, caterpillars, pupae, adult insects and those that have an exit hole for the insect, whether damaged by a single species of insect or by several. Seed infestation can occur in the

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**Figure 1. Location of the study area.**
Fonte; The authors. 2023.

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A total of 3287 seeds were placed in 18 x 16 x 16 cm polystyrene containers, free of high luminosity, covered with a voile mesh to prevent the exit, and consequently the capture of adult insects. The seeds were quantified and classified in healthy categories and attacked by insects. Each seed was evaluated using a magnifying glass adapted to the bench and an incision was made with a scalpel, with the aid of forceps in order to check external and internal signs of damage from the presence of the insect. During the evaluation period, the containers remained at a temperature of 25 °C. To quantify healthy and damaged seeds, healthy seeds were considered as those that did not show signs of perforation or orifice and damaged seeds as those that showed signs of perforation and orifice, each seed was analyzed individually. Subsequently, five lots of 100 healthy seeds and five lots of 100 damaged seeds were separated. The percentage of seed loss was calculated in relation to the predation rate equation $T_p\% = Sh \times 100 / N$. The hatched seeds were not analyzed. The substrate consumption (mass, seed husk) was obtained by the difference in weight between healthy seeds and predated seeds. For this purpose, five batches of seeds were separated, one represented by healthy seeds and the other by attacked seeds, weighed individually in a precision scale of 0.0001g (AND model HR-200).

Finally, the percentage loss of each seed class was calculated. As for the exploratory data analysis, the seed lots, healthy and predated, from the same collection period, were analyzed, and the results obtained were submitted to statistical analysis by the Tukey test at the level of 5% probability, with the help of the statistical program SAS Agri (Canteri et al., 2001) and the Graphpad Prism 6 Trial version software (Graphpad Software, 2015). The other results were presented using descriptive statistics.

Results and Discussions

After the emergence of adult insects and in the absence of information about it, the insect was examined and cataloged as belonging to the genus Atractomerus Duponchel & Chevrolat, 1849, of the species Atractomerus pitangae (Marshall, 1925) (Coleoptera: Curculionidae: Curculioninae), possessing the synonym nomenclature of Anthonomus pitangae Marshall, 1925 and/or Anthonomus bruchi Hustache, 1939, Anthonomus obliquatus Hustache, 1940. These were included in the DZUP collection of the Department of Zoology.
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According to the total analyzed seeds (3287), healthy seeds (60.8%) and 1289 damaged seeds were quantified in 1998, with a loss of 39.2%. Predators that feed on seeds before their dispersion (pre-dispersion) have, possibly, greater influence on the structure between the plant and its disperser, through at least two mechanisms: reduction of the number of seeds available for dispersion (Janzen, 1970) and decrease in dispersers due to the low density of fruits to be dispersed.

To assess the potential damage of the insect in seeds, we made the assessment taking into account the calculation of the substrate consumption (mass, husk), where from the average weight of healthy and damaged seeds, respectively, of 22.25 and 14.43. The average result of the substrate consumed was 7.65 g, corresponding to a loss of 39.98% of the food mass consumed. This reduction is extremely important since with this consumption made by the larva, it makes the attacked seed unviable, which may justify one of the great difficulties in the process of obtaining E. involucrata seedlings.

Cerejeira seeds, as well as other forest species, mainly from the Leguminosae family, can be severely damaged by insects of the order Coleoptera (Bruchidae, Curculionidae, Antrhibidae and Cerambycidae), Lepidoptera (Pyralidae) and Diptera (Tephritidae) (Crauley, 1992; Gallo et al., 2002). In this study, for the first time in southern Brazil, A. pitangae was associated with the predation of E. involucrata seeds. The cereja-do-mato, therefore, presents itself as another challenge for researchers and a future opportunity for farmers (Degenhardt et al., 2007).

Having compiled the data of several authors, it is possible to say that they are also predators associated with the species Eugenia uniflora L. According to Lima (1956), he
mentions the presence of A. pitangae known as the broca-da-pitangeira. Picolotto et al., (2011) reported the attack of A. pitangae in a study of the initial development of E. uniflora, from fruit seeds at different stages of maturation, consequently reducing the percentage of seedling emergence.

Regarding the damage caused to the seeds, it was observed that the post-embryonic phase of the insect occurred inside the seeds, which possibly when this young form emerges may feed on other neighboring seeds. Several authors found only one larva per seed, (Santos et al., 2001), larva of beetle of the family Curculionidae, in seeds of Syagrus romanzoffiana, (Silva et al., 2007) in Piptadenia peregrina were attacked by Rhyssomatus sp. (Coleoptera: Curculionidae), (Araldi et al., 2008) occurrence of Pentobuchus germaini (Coleoptera: Bruchidae) associated in Parkinsonia aculeata seeds, (Boscardini et al., 2012) found only one larvae of Pygiopachymerus lineola in Cassia fistula seeds.

The results of the analysis showed a high rate of predation, possibly these seeds will not be viable for the propagation of the plant. Considering the existence of other factors that prevent its germination, such as pathogenic agents (fungi) and unfavorable conditions of the environment (climatic variations) (Ferreira, 1989). The high rates of predation observed in this study suggest that the seeds of the species E. involucrata are highly sought after by A. pitangae during the period of fruiting and seed dispersal.

According to Rego et al. (2006), in the same inflorescence, flowers were observed in several phenological phases. According to these authors, the cerejeira-do-mato presents three annual and seasonal blooms, two of which are intense in the months of August and September, and another of lesser intensity in the month of October. In the region of Pelotas, RS, flowering is faster than for other fruit Mirtaceae in the region, starting in the second week of October and ending between the end of October and the beginning of November. While flowering and fruiting comprise three months for each phenophase in the Colombo region (Franzon, 2004; Rego et al., 2006).

The average fruit development time from anthesis to maturation is 43 days, under the conditions of Pelotas (Franzon, 2004) and 36 days for the Colombo region (Rego et al, 2006). The need for studies during several phenological stages of fruiting is highlighted, in addition to seed germination tests, in order to better understand the influence of predation by A. pitangae on the reproductive capacity of E. involucrata.

In this sense, it is inferred that this attack may occur in places with different collection periods, even at any stage of maturation, which may be damage of greater or lesser intensity. The losses indicated in the results caused the destruction of fruits and seeds during the entire
fructification period in the parent trees, which attests that these pests are limiting the crop even in the field.

**Conclusions**

*Atractomerus pitangae* was identified as a causative agent of damage to *E. involucrata* seeds, causing a reduction of approximately 40% of the seed mass.

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