



Contribution about the occurrence of *Pachymerus bridwelli* (Prevet) (Coleoptera: Chrysomelidae) in diaspores of pindo palm (*Butia odorata*) (Barb.Rodr.) Noblick & Lorenzi

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ABSTRACT

Several studies have demonstrated the importance of Pindo palm in Rio Grande do Sul and Brazil, mainly through preservation but also due to the economic potential of using its fruit. In collections of Pindo palm fruit carried out in some regions of Rio Grande do Sul, the presence of beetle larvae inside of seeds was observed. This study aimed at identifying the species and evaluating the level of infestation of this insect in Pindo palm endocarps. Endocarps were kept in observation in the laboratory to verify the emergence of adults. The number of endocarps with the presence of the exit hole of the adult insect was registered. Afterwards, the endocarps were broken, and the number of adult insects, larvae and intact seeds was registered. The insect that occurred in the Pindo palm trees was identified for the first time in the country, at the species level, as *Pachymerus bridwelli* (Prevett, 1966). Infestation occurred in 75.1% of the endocarps. Among the damaged ones, the occurrence of only one larva was verified in 75.7%. However, it was also possible to verify the presence of two larvae (22.1%) and up to three larvae (2.2%) per endocarp. The loss of seeds reached 53.4%.

Keywords: Arecaceae; bruchine; insect; propagation; seeds.

INTRODUCTION

Studies on Pindo palm, *Butia odorata* (Barb. Rodr.) Noblick (Arecaceae) have been carried out, aimed at populational characterization (Schwartz *et al.*, 2010), ethnobotanic studies (Büttow *et al.*, 2009), propagation (Schlindwein *et al.*, 2013) and economic utilization of the fruit (Tonietto *et al.*, 2009), showing the importance of this species to Rio Grande do Sul and to Brazil.

Building orchards for economic purposes depends on the supply of quality seedlings which allow greater uniformity of the plants, which is achieved through asexual multiplication (Hoffmann *et al.*, 2005). Despite the studies of somatic embryogenesis in palms like the oil palm (*Elaeis guineensis* Jacq) (Silva *et al.*, 2012), coconut (*Cocos nucifera* L.) (Gomes *et al.*, 2004) and açai palm (*Euterpe oleraceae* Mart.) (Scherwinski-Pereira *et al.*, 2012), the seedlings production of most palms occurs via sexual

reproduction (Lorenzi *et al.*, 2010), being the sanity of seeds an important factor to the success of the propagation. Besides dormancy, which affects the germination of palm seeds like the Pindo palm (*Butia* spp.) (Fior *et al.*, 2011; Schlindwein *et al.*, 2013), seed infestation by insects interferes directly with the quality of fruit and reduces its reproductive capacity.

The occurrence of insects in Pindo palm seeds was reported by Pevett (1966), describing a genus of Pachymerini (Coleoptera: Chrysomelidae: Bruchinae) in Uruguayan populations. Link & Costa (1982) and Link & Naibo (1995) and reported the occurrence of larvae of *Butiobruchus* sp (Coleoptera: Chrysomelidae: Bruchinae) in Pindo palm seeds. Martín *et al.* (2009), collecting Pindo palm fruit in some places in Uruguay, verified the occurrence of *Pachymerus* aff *nucleorum* and of larvae of an insect from the Curculionidae family. Eloy *et al.* (2017)

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observed and identified as *Pachymerus nucleorum* the commonly called “larva do coquinho” on *Butia odorata*.

Johnson *et al.* (1995) reported that, among the many threats to the health and life of seeds, bruchid beetles are the most frequent. According to the authors, these beetles lay their eggs on seeds or fruits, and their larvae feed inside the seeds, usually destroying them. Examples of these damages were reported by Garcia *et al.* (1979) in *Siagrus oleraceae* (Arecaceae) and by Grenha *et al.* (2008) in *Allagoptera arenaria* (Arecaceae), both damaged by *Pachymerus nucleorum* (Coleoptera: Chrysomelidae: Bruchinae).

Between 2006 and 2009, Pindo palm fruit were collected in some places of the State of Rio Grande do Sul, aiming at seed germination studies and *in vitro* culture of embryos. The endocarps of these fruits were kept either in a storage chamber or in a laboratory environment and revealed an insect inside of Pindo palm seeds. The purpose of this study was to identify and to evaluate the infestation level of this bruchid in endocarps of Pindo palm.

MATERIAL AND METHODS

In February of 2009, a batch of 181 endocarps of Pindo palm, *B. odorata*, collected in the city of São Lourenço do Sul, in the state of Rio Grande do Sul, Brazil, was stored in a plastic bag and kept in laboratory environment, without any light or temperature control. In the beginning of December 2009, larvae, pupas and adults of an insect were observed inside the endocarps. The endocarps were kept in observation, in the same environment, to verify the emergence of adult insects. From December 15th on the emergence of the first adult insect in the batch of endocarps was observed. After 20 days there was no emergence of other adult insects.

Then, the number of endocarps that had the exit hole of the adult insect was registered and labeled “damaged” (Figure 1). The endocarps which did not have an exit hole of insects were named “without apparent damage” (WAD). All endocarps were broken with a bench vise to verify the presence of larvae, pupas or adult insects inside them. The endocarps that did not show any damage, with all their seeds intact, were considered “without damage”. From these endocarps (45), the average number of seeds by endocarp and the frequency of endocarps with one, two or three seeds were obtained.

Upon observation of 181 endocarps, the number of adult insects, larvae and intact seeds was counted. Other 52 endocarps were stored for 24 months in a laboratory, without any light or temperature control, to verify the emergence of adults and the time the insects stayed inside the endocarps.

Lots collected from other municipalities in the state (Arambaré, Cachoeira do Sul and Viamão), stored in

dry camber showed the presence of the insect. A sample from each municipality, including of São Lourenço do Sul, was sent to the Laboratório de Sistemática e Bioecologia de Coleoptera of the Departamento de Zoologia at the Universidade Federal do Paraná (UFPR), for identification. The specimens were placed in the collection of the Departamento de Zoologia at UFPR and two specimens were donated to the Museu de Ciências Naturais of the Fundação Zoobotânica of Rio Grande do Sul.

RESULTS AND DISCUSSION

The species was identified as *Pachymerus bridwelli* in all samples collected. This species had already been identified and cited by Prevett (1966) feeding on the seeds of *Butia capitata* (Martius) Beccari. It was identified, for the first time in this country, in the species level, in Pindo palms *Butia odorata*. Reviewing papers on insects infesting of palm seeds, Johnson *et al.* (1995) also reported the occurrence of *P. bridwelli* in *B. capitata*. In other taxonomic review of bruchids in palm trees, Nilsson & Johnson (1993) considered *Butiobruchus* synonymous with the genus *Pachymerus* Thunberg, 1805. Thus, it is highly probable that the genus mentioned by Link & Costa (1982) and Link & Naibo (1995) is the same cited by Nilsson & Johnson (1993). It is also possible that this was the same bruchid observed by Martín *et al.* (2009) in the fruits collected from Pindo palm trees in Uruguay, identified as *Pachymerus* aff. *nucleorum*. Upon external evaluation of the 181 endocarps it was observed that in 41 of them there was at least one hole, measuring between 5.5 and 6 mm in diameter, through which the adult insect of *P. bridwelli* came out. There were three endocarps with two holes, indicating the possibility of more than one larva completing its cycle inside the endocarp in the same season. Four endocarps showed a little perforation besides the one made by the bruchids, possibly made by *Revena plaumannii* Bondar 1943, an insect often present in Pindo palm fruits (Figure 1) and mentioned for the first time in *B. odorata* by Tonietto & Schlindwein (2016).

After the external observation of each endocarp, all of them were opened, including the 41 perforated by the bruchids, to verify the presence of larvae and seeds. The values obtained are shown in Table 1.

Out of the 181 endocarps, 136 had the bruchids inside and 45 were intact. The values obtained (Table 1) showed that even the endocarps without apparent damage can have larvae inside, corroborating Link & Naibo (1995), who observed in their study of *Butiobruchus* sp, that a superficial examination can overlook the infestation by the insect, and that it is necessary to open the endocarps to evaluate the infestation.

The most frequent occurrence was one larva per endocarp, in 75.7% (103) of them, followed by two larvae,

in 22.1% (30) and, more rarely, three larvae, in 2.2% (3). There were 17 cases in which an adult insect emerged and a larva stayed inside the endocarp. In only three cases the emergence of two adults in the same endocarp was verified. No dead larvae or any trace of damaged larvae were found. The space inside the endocarps was filled by the insect on its various stages, or by seeds.

The level of predation of the endocarps was 75.14%. These values are close to the ones reported by Link & Naibo (1995) for *Butiobruchus* sp., reporting infestation values between 48.7 and 82.5% of attacked endocarps, depending on the year. The level of predation observed is also within the limits found by Garcia *et al.* (1980) for *P. nucleorum* on *Siagrus oleracea* (Arecaceae), which varied from 42.0 to 54.5% depending on the municipality where the fruit were collected. Grenha *et al.* (2008), comparing two areas during two years, observed 61.7% and 69,6% of maximum predation by *P. nucleorum* on *Allagoptera arenaria* (Arecaceae), depending on the month of evaluation. Scherer & Romanowski (2005),

studying levels of predation of *Megacerus baeri* (Coleoptera: Chrysomelidae: Bruchinae) in *Ipomoea imperati* (Convolvulaceae), observed a predation percentage of 67.6%, considering it high.

The importance of an insect that eats the seeds of a plant depends on some characteristics of the plant, such as propagation mode, number of fruit and seeds per fruit, ecological and agronomic importance, importance of the seed for the development of the fruit, seed longevity, natural regeneration and extinction risk, among others. Garcia *et al.* (1980) mention that the seeds of carnauba, dende, licuri, babassu, among others, of high commercial and industrial value, were devalued due to the occurrence of *P. nucleorum*. They also reported that the predation of *Syagrus oleracea* seeds by *P. nucleorum* was a serious threat to the reproduction of that species. Link & Naibo (1995) considered that the attack of *Butiobruchus* sp did not prevent the survival of the Pindo palm. According to the authors, the hole made by *Butiobruchus* sp. would allow the water to go into the endocarp, facilitating



Figure 1: Endocarps of Pindo palm with holes made by an adult *Pachymerus bredwelli* (larger diameter) and by a larva of *Revena plaumanni* (smaller diameter).

Table 1: Data of Pindo palm endocarp predation by *Pachymerus bredwelli*. Porto Alegre, RS, Brazil, 2009-2010

Number of endocarps		Frequency /endocarp		
		1 insect	2 insects	3 insects
Damaged	41	21	17(34*)	3(9)
WAD*	140	82	13(26)	0
Total of endocarps	181	Total of insects 172		

*Without Apparent Damage, * between parenthesis and the total number of insects per category.

germination, since its attack would harm only one or two seeds.

In the infestation of Pindo palm endocarps by *P. bridwelli*, 172 individuals were counted, 44 adults and 128 at larval stage. A total of 150 seeds were not damaged. Thus, as each insect eats only one seed while growing, the total number of seeds in the studied lot was 322. Such values resulted in a seed predation of 53.4%. The reduction on the propagation capacity of the diaspores because of predation is minimized, in some cases, due to the production, by the Pindo palm, of endocarps with more than one seed, reaching up to three per endocarp. However, over half of the 45 intact endocarps from the evaluated lot had only one seed. 26 endocarps had one seed (57.8%), 11 had two seeds (24.4%) and 8 had three seeds (17.8%). Moreover, the Pindo palm seeds need a long time to germinate and specific conditions to overcome their dormancy (Carpenter, 1988; Schlindwein *et al.*, 2013).

The factors stated above indicate that the predation which occurred in the studied endocarps is a factor that can contribute to the pressure on the reproductive capacity of this palm and, consequently, to its natural regeneration. In addition, they create difficulties during the management of the seeds for purposes of propagation and seedlings production, especially in selection and plant breeding programs.

The emergence of the adult insects occurred between the middle and the end of December. This period is coincident with the bloom of Pindo palms, which take place in the spring and in the beginning of the summer (Reitz *et al.*, 1983). The plant can produce many bunches achieving an average between 2.85 and 5.67, depending on the plant and the crop (Schwartz *et al.*, 2010) and between 1.8 and 3.1 depending on the region (Schlindwein *et al.*, 2017).

Thus, both the inflorescences and fruits are available during the period of emergence of the adult insect, indicating that the oviposition occurs in the female flower or in the early development period of the fruit. This inference is corroborated by Martín *et al.* (2009), who observed the emergence of *Pachymerus* aff *nucleorum* adult insects synchronously with the beginning of the blooming of Pindo palm populations in Uruguay. The same case was also verified by Grenha *et al.* (2008) for *P. nucleorum* ovipositing on *A. arenaria*. According to Johnson *et al.* (1995) the general life cycle of bruchids is: the adult lays an egg on a fruit or seed, and the first stage larva bores through the fruit and /or seed coat and enters the seed. Yus *et al.* (2007) quote that the bruchids have hypermetamorphosis, where the larvae show at least two distinct shapes, as a mobile and another apodal or less mobile stage. In the study of pindo palm was not possible look at larvae in the first instars, it being necessary more observations to verify the occurrence this phenomenon.

The identification of the emergence period of adult insects and of the oviposition of *P. bridwelli* is essential for the management of this insect, mainly when seeds are the object of interest. It is important to highlight that this insect does not damage the fruit pulp because the larva stays inside the endocarp throughout its life cycle (Figure 2), different from *Revena plaumanni*, which goes out of the endocarp when the fruit falls on the ground or is harvested, damaging the pulp and making fruit storage difficult.

The presence of *P. bridwelli* is only noticed after the emergence of the adult, which, in the case of this study, occurred ten months after fruit harvest.

In the 52 endocarps kept under observation for 24 months, 15 adults developed and 25 larvae stayed alive in the second year of observation, showing that the same

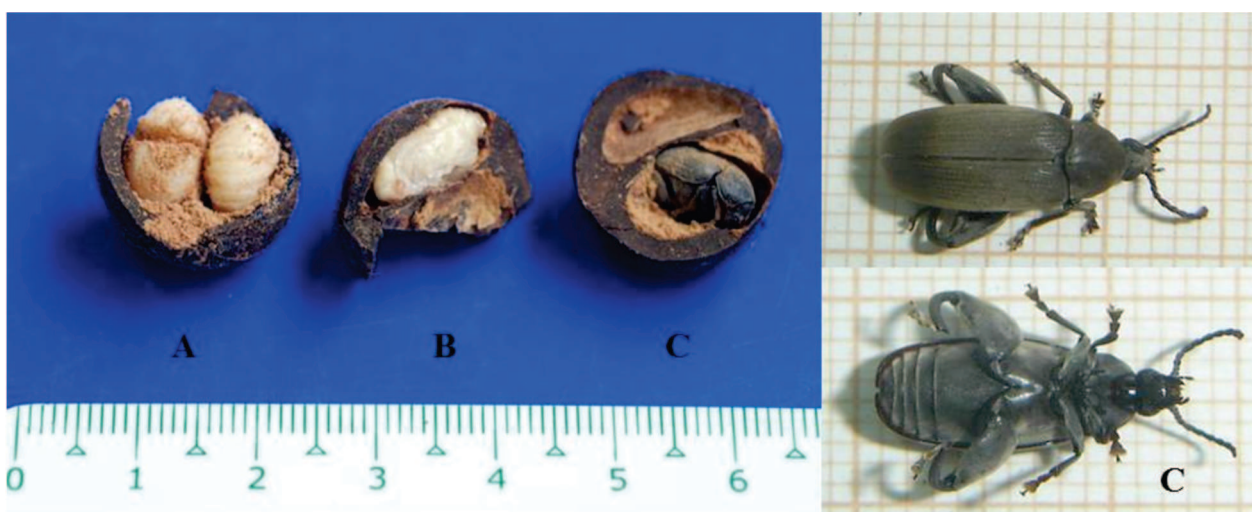


Figure 2: Stages of *Pachymerus bridwelli* in endocarps of *Butia odorata*: A) Larvae, B) Pupa, C) Adult.

generation of individuals can remain viable in the environment for at least two years.

Besides the identification of the insects in the lot of seeds from São Lourenço do Sul, insects found in stored seed lots from Arambaré, Viamão and Cachoeira do Sul were also identified as *P. bridwelli*, showing that the insect is spread in the areas of occurrence of *B. odorata* in the state of Rio Grande do Sul.

From of the information obtained in this paper we conclude that other studies about the mechanisms of infestation of *B. odorata* by these insects are necessary, as well as the factors involved in this process. This way, it will be possible to predict ways to manage the areas of Pindo palm that allow the balance of these populations, guaranteeing the economic viability and the regeneration of natural areas.

CONCLUSION

The species found infesting the endocarps of *Butia odorata* was identified as *Pachymerus bridwelli* (Prevet, 1966), for all areas sampled, and the insect can stay inside the endocarp for at least two years;

The predation of endocarps is over 75% and, of seeds, is over 50%, causing losses in the plantlet production or seed utilization processes.

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