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# SCOLYTINAE AND PLATYPODINAE (CURCULIONIDAE) IN *HEVEA BRASILIENSIS*: FROM IMPLANTATION TO CLEARCUTTING

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**Summary:** Rubber tree plantations in Brazil were practically free of serious problems with insect pests until the beginning of the 21st century. However, Scolytinae and Platypodinae beetle borers have been inflicting serious losses in several plantations in southeastern Brazil in the last years. Our objective is to survey for these beetles starting from the implantation of a stand until its clear cutting. We present here results for the first two years of the plantation. A total of 38 Scolytinae species were trapped, where there was a predominance of *Cryptocarenus* and *Hypothenemus* species. No Platypodinae specimens were trapped during the analyzed period. For the majority of the most abundant species, there was no statistically significant difference in abundance between years.

**Keywords:** *Cryptocarenus*, ethanol-baited trap, *Hypothenemus*, rubber tree

## Introduction

The rubber tree, *Hevea brasiliensis* (Willd. ex A.Juss.) is native to the Amazon region (Labroy & Cayla, 1913). However, in an attempt to escape the high incidence of diseases in its native range, the Brazilian government encouraged growers to start plantations in the states of São Paulo and Minas Gerais (Furtado, 2008).

Until roughly the end of the first decade of the 21st century, damage inflicted to this culture by insect pests were sporadic. The most common intermittent pests were usually within the families Sphingidae, Aleyrodidae, Formicidae and Tingidae (Abreu, 1996). Damage by beetle borers, mainly Platypodinae and Scolytinae (Curculionidae) were already reported in the literature ever since the beginning of the 20th century (Matta, 1920) in its native range, but were infrequent. Over the years thereafter, reports were found in the literature at irregular time periods. The most relevant were for the states of Pará (Rodrigues, 1977), Bahia (Bernardes, 1981) and Minas Gerais (Silva & Anjos, 1988). However, in the last few years we are receiving a wealth of complaints from rubber tree growers throughout northwestern São Paulo, southern Minas Gerais and Mato Grosso do Sul, of trees being killed by an association of beetle borers and tree trunk diseases.

There are very few recent studies on beetle borers associated with rubber tree plantations in Brazil, most of them under the coordination of one of us (CAHF). A rubber tree plantation is expected to be commercially exploited during three to four decades, while latex extraction starts only from 6th-7th year of age of trees. There is no report in the literature on how the beetle borer species community changes over the years, and when they start to grow in economic importance.

The main objective of this ambitious experiment is to learn how the biodiversity and abundance of Scolytinae and Platypodinae vary in a rubber tree plantation from its implantation until the end of its economic life period, decades ahead.

## Material and Methods:

The site is a *Hevea brasiliensis* clone RRIM600, planted in March 2013, in an area of 4.7 ha. The rubber tree stand is located in Sítio Lagoa Azul, in Três Fronteiras, state of São Paulo, Brazil, with central coordinates 20°15'29.65"S 50°54'52.39"W, and elevation of 374 m a.s.l.. The plantation is surrounded mainly by citrus orchards, eucalypt plantation, a fragment of native vegetation, and an older rubber tree plantation, planted in 2009 (Figure 1). Once a year average tree diameter and height are measured.

We are using a single-vane panel flight intercept trap (modified from Berti Filho & Flechtmann, 1986), baited with 96% ethanol, and placed 1.5 m above ground, to capture the targeted beetle species, Scolytinae and Platypodinae (Curculionidae). Trapping frequency is weekly, and traps are 25 m apart from each other in a single transect placed in the middle of the plantation. Traps were deployed on July 13, 2013, and results are based on trappings up until December 27, 2014, corresponding to the first two years of collections, totaling 75 trapping weeks.


Figure 1. Experimental *Hevea brasiliensis* RRIM600 plantation. Sítio Lagoa Azul, Três Fronteiras, state of São Paulo, Brazil.

Species were determined based on Wood (2007), and voucher specimens were deposited in the Museum of Entomology of UNESP (MEFEIS), Ilha Solteira, SP, Brazil.

Beetle catches were transformed into $\sqrt{(x + 0.5)}$ to remove heteroscedasticity (Phillips, 1990), and catches between years were compared by PROC GLM and treatment means were separated by Tukey test (SAS Institute, 1990).

**Results and Discussion**

Trees were on average 0.30 m high during planting, and after one year they reached already 5.80 m in height. Tree diameter increased from 0.43 cm to 30.92 cm during the same time interval, respectively.

Over 2300 Scolytinae specimens were trapped in 75 weeks of trappings. The number of species collected was of 38, with a predominance within the genus *Hypothenemus* (Table 1). Bostrichidae specimens were also trapped, within the species *Bostrichopsis uncinata*, *Micrapate brasiliensis*, *Micrapate horni*, *Xylopsocus capucinus* and *Xyloperthella picea*. No Platypodinae specimens were trapped during the analyzed period.

Table 1. Species of Scolytinae trapped with ethanol-baited flight intercept traps in a *Hevea brasiliensis* clone RRIM600 plantation. Sítio Lagoa Azul, Três Fronteiras, state of São Paulo, Brazil, from July 2013 until December 2014.

| sub-tribe | genus | species |
|---|---|---|
| Bothrosternina | *Cnesinus* | *Cnesinus* spp. (2) |
| | *Araptus* | *Araptus* spp. (3) |
| Corthylina | *Corthylus* | *C. theobromae*, *Corthylus* sp. |
| | *Pityophthorus* | *Pityophthorus* sp. |
| | *Tricolus* | *Tricolus* sp. |
| Cryphalina | *Cryptocarenus* | *C. brevicollis*, *C. diadematus*, *C. heveae*, *C. seriatus* |
| | *Hypothenemus* | *H. crudiae*, *H. eruditus*, *H. gossypii*, *H. javanus*, *H. obscurus*, *H. plumeriae*, *H. seriatus*, *Hypothenemus* spp. (5) |
| | *Scolytogenes* | *S. jalapae* |
| | *Trischidias* | *T. atoma* |
| Hylesinina | *Phloeoborus* | *P. rudis* |
| Xyleborina | *Ambrosiodmus* | *A. obliquus*, *A. opimus* |
| | *Premnobius* | *P. ambitiosus*, *P. cavipennis* |
| | *Xyleborus* | *X. affinis*, *X. ferrugineus*, *X. spinulosus*, *Xyleborus* spp. (2) |
| | *Xylosandrus* | *X. curtulus* |

Only the nine more abundant trapped Scolytinae species were included in the statistical analyses. *C. heveae* and *S. jalapae* were significantly more trapped in year 1, *A. opimus*, *H. obscurus* and *P. cavipennis* were statistically more trapped in year 2, while there were no statistically significant differences between years for the remainder of the analyzed species (Table 2).

Table 2. Mean ± SE of Scolytinae species attracted to ethanol-baited traps in a *Hevea brasiliensis* clone RRIM600 plantation. Sítio Lagoa Azul, Três Fronteiras, state of São Paulo, Brazil, from July 2013 until December 2014. Means back-transformed from √(x + 0.5); means followed by same letters are not significantly different within rows (P > 0.05; Tukey test).

| species | year 1 (2013-2014) | year 2 (2014-2015) |
|---|---|---|
| *C. diadematus* | 0.28 ± 0.06 a | 0.18 ± 0.04 a |
| *C. heveae* | 0.34 ± 0.06 a | 0.21 ± 0.04 b |
| *H. brunneus* | 0.27 ± 0.07 a | 0.18 ± 0.03 a |
| *H. eruditus* | 1.09 ± 0.20 a | 0.96 ± 0.12 a |
| *H. javanus* | 0.13 ± 0.03 a | 0.12 ± 0.04 a |
| *H. obscurus* | 0.57 ± 0.13 b | 1.02 ± 0.13 a |
| *S. jalapae* | 0.36 ± 0.08 a | 0.04 ± 0.01 b |
| *A. opimus* | 0.87 ± 0.13 b | 2.76 ± 0.27 a |
| *P. cavipennis* | 0.05 ± 0.13 b | 0.51 ± 0.10 a |

If we analyze the total number of Scolytinae species trapped, and considering the trappings were done in (1) a monoculture, (2) a young plantation and (3) with a low number of traps, we might surmise that 38 is a high number of species. To our knowledge, in the only similar and comparable experiment found in the literature, Dall'Oglio & Peres Filho (1997), surveying for 16 months in five mature rubber tree stands in the state of Mato Grosso with ethanol-baited traps, collected a smaller number of Scolytinae, 30 species. Surprisingly, in an unpublished work, Fazolin (1991) found no Scolytinae beetles in a 5-year long survey with a light trap in a rubber tree plantation five years old in Rio Branco, state of Acre.

Taking into account that the rubber trees so far are very young (up to two years old) and they appear to be in a healthy state, with no evidence of beetle boring activity, it would be safe to assume the beetles trapped are not developing yet in the rubber trees. The stand however harbors a number of vines and small shrubs, and one has to bear in mind the plantation is surrounded by tree stands of different cultures, including even a native forest fragment (Fig. 1). Therefore, it would be a safe assumption to consider that part of the species found were developing in the weedy vegetation present in the plantation, while others had the surrounding vegetation as their origin. In another article of ours (Castilho & Flechtmann, 2015) being published in this same meeting, we are presenting results from a survey in two 25-year old RRIM600 stands with only pasture as the surrounding vegetation. In this case we found less Scolytinae species than being here reported, and similar to Dall'Oglio & Peres Filho (1997), which might be a hint of the influence of the surrounding vegetation in our survey.

The majority of the species trapped develop usually in small diameter plant material and seeds (Wood, 2007), including all Cryphalina, part of the Corthylina (*Araptus* and *Pityophthorus*) and the Bothrosternina that were trapped (Table 1). Hence, these could well have bred in plant material found in both the rubber tree plantation and surrounding vegetation. Additionally, *Cryptocarenus* and *Hypothenemus* species are considered to be very common in disturbed areas, and the young rubber tree plantation can fit this classification (Wood, 2007).

The Hylesinina and Xyleborina species trapped (Table 1) however, usually develop in plant material of larger diameter, such as branches and trunks of trees and shrubs (Wood, 2007), except perhaps for *X. curtulus*, which usually develops in cut branches and small twigs (Wood, 2007). Thus, there is a good probability these species were not developing in the experimental site, but immigrated from the neighboring vegetation.

The influence of the surrounding vegetation might have been the responsible for the lack of statistically significant differences in abundance between years for the majority of the species. Species significantly more trapped in year 1 were *C. heveae* and *S. jalapae* (Table 2). *Scolytogenes* beetles bore into small stems of vines, which might have been more abundant in the plantation while trees were smaller, allowing for more sunlight for vine growth. *Cryptocarenus heveae*, a species native to Brazil, was actually described from twigs of rubber trees in Africa (Wood, 2007), but breeds in any plant material of small diameter, and chances are most specimens originated from the neighboring vegetation.

*Ambrosiodmus opimus*, *P. cavipennis* and *H. obscurus* were trapped in significantly higher numbers in year 2 (Table 2). The first two species breeds in larger diameter plant material (Wood, 2007), hence it must have originated from the neighboring vegetation, and its varying trapping numbers must not have been directly related to the age of rubber trees. *Hypothenemus obscurus* however, to the best of our knowledge, is always found in rubber tree plantations, where it is usually one of the

prevalent *Hypothenemus* species in mature plantations. During the first year, *H. eruditus* was the most abundant species, but for year 2 *H. obscurus* was already numerically the most abundant species within *Hypothenemus* (Table 2). However, the percentage of *H. obscurus* within the genus (data not shown) increased in a statistically significant rate ($F_{1,373} = 5.88$, $\alpha = 0.0158$).

**Conclusion**

We collected a high number of Scolytinae species in the young rubber tree plantation. However, results suggest that there was a high influence of the neighboring vegetation in the trappings. Opportunistic species of the genera *Cryptocarenus* and *Hypothenemus*, which thrive in disturbed environments, predominated. The majority of these breed species in plant material of small diameter, and part of these do not require much humidity to develop, such as *Hypothenemus*, in contrast to the majority of other scolytines. We expect though, as the canopy closes the plantation concomitant with the continuing growth of the trees over the years, that shade and the build-up of more breeding material for the development of scolytines will result in a change in the species community, and lessening the influence of the surrounding vegetation.

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