Entomologia

INFLUENCE OF TAPPING ON THE ABUNDANCE OF SCOLYTINAE AND PLATYPODINAE (CURCULIONIDAE) IN *HEVEA BRASILIENSIS* IN NORTHWESTERN SÃO PAULO STATE, BRAZIL

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Event: Presented at the IV Congresso Brasileiro de Heveicultura - 24 to 26 June 2015, São José do Rio Preto/SP.

Summary: Several factors may contribute to stress a rubber tree, hence turning it more prone to attack by beetle trunk borers, Scolytinae and Platypodinae (Curculionidae). One 'standard' stressing factor is man-induced, the tapping activity. We were interested in learning how the tapping activity influences the abundance of these beetles in a *Hevea brasiliensis* clone RRIM 600 plantation, by trapping them in pre-tapping and tapping periods. For the vast majority of the species, there were no statistically significant differences in abundance between periods. We believe this was due to the fact that perhaps considering this was still the first tapping year, stress was still mild on trees, not reaching a level where beetles would benefit from it and attack trees.

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

Introduction

Scolytinae and Platypodinae (Curculionidae) are well known pests of various tree species planted by man, from reforestations to fruit orchards. Several are the factors that predispose trees to beetle attack, but generally speaking, any factor or combination of factors that would induce a potential host tree to become stressed have a direct influence on a successful beetle attack and tree colonization (Wood, 2007).

Brazil has been intensively implementing *Hevea brasiliensis* plantations over the last few decades, and most of these plantations are located in areas outside the natural distribution of these species. Most of these new plantations are located in southeastern Brazil, and are also called "escape areas", as a reference to a climatic region which is significantly dryer than where rubber trees grow naturally, and hence less prone to diseases (Furtado, 2008).

While lessening the problems with diseases, one has to keep in mind these rubber trees grown in "escape areas" are developing in a region with a significantly smaller amount of rainfall and days of rain, as compared to the native Amazon region (Gonçalves et al., 1991). Hence, it is safe to assume rubber trees in southeastern Brazil are in a constant status of water stress, which causes a negative influence on tree growth (Rao et al., 1990). Rubber trees are grown for latex extraction, which is done by a man-made wounding process called tapping (Thomas et al., 1995). As any wounding process, tapping stresses rubber trees, impacting negatively several tree physiological processes (Kunjet et al., 2013).

In Brazil, problems with insect pests on plantations of *Hevea brasiliensis* were sporadic and restricted to few species (Abreu, 1996) until the beginning of the 21st century. However, in the last few years we have been observing an abundance in reports of growers complaining of rubber tree death caused be Scolytinae and Platypodinae beetles, in association or not with tree trunk diseases, most of them in northwestern São Paulo state, Brazil (Flechtmann, unpub.).

The main objective of this research is to study the influence of the tapping activity, starting from the first tapping year, on the abundance of Scolytinae and Platypodinae beetles in a plantation of *H. brasiliensis* clone RRIM 600, in northwestern São Paulo.

Material and Methods:

The experiment is being developed at Sítio Boa Sorte, in Três Fronteiras, northwestern São Paulo state, Brazil. The rubber tree plantation is a 5.3 ha *Hevea brasiliensis* clone RRIM 600, planted in a somewhat steep landscape between February and April 2006. The local altitude is 437 m a.s.l., and central coordinates are 20°12'33.58"S 50°51'51.67"W. Tapping started in September 2014.

Scolytinae and Platypodinae beetles are being trapped with a single-vane panel intercept trap (modified from Berti Filho &

Flechtmann, 1986), baited with 96% ethanol. There are five traps, 1.5 m above ground and spaced 25 m among each other in a single transect in the middle of the plantation. Trapping frequency is weekly; the first trapping was in July 20, 2013, and we are here presenting results of 81 weeks of trappings, where 20 weeks out of those included the period when tapping started.

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 periods were compared by PROC GLM and treatment means were separated by Tukey test (SAS Institute 1990).

Results and Discussion

We trapped 42 species of Scolytinae (Table 1; one undetermined species was not included), in five subtribes, totalling a little over 3100 specimens. In Platypodinae we trapped three species, *Euplatypus parallelus*, *Euplatypus* sp. and *Teloplatypus ratzeburgi* (19 specimens), and 7 Bostrichidae species, *Bostrichopsis uncinata*, *Dinoderus minutus*, *Micrapate brasiliensis*, *Micrapate horni*, *Rhyzopertha dominica*, *Xylopsocus capucinus* and *Xyloperthella picea* (277 specimens).

Table 1. Species of Scolytinae (Curculionidae) trapped with ethanol-baited flight intercept traps in a *Hevea brasiliensis* clone RRIM600 plantation in pre- and tapping periods. Sítio Boa Sorte, Três Fronteiras, state São Paulo, Brazil, from July 2013 until January 2015.

sub-tribe	genus	species
Bothrosternina	*Cnesinus*	*Cnesinus* sp.
Corthylina	*Microcorthylus*	*M. minimus*
	Monarthrum	*Monarthrum* sp.
	Pityophthorus	*Pityophthorus* sp.
Cryphalina	*Cryptocarenus*	*C. brevicollis*, *C. diadematus*, *C. heveae*, *C. seriatus*
	Hypothenemus	*H. abhorrens*, *H. areccae*, *H. brunneus*, *H. crudiae*, *H. eruditus*, *H. gossypii*, *H. javanus*, *H. obscurus*, *H. opacus*, *H. plumeriae*, *H. seriatus*, *H. setosus*, *Hypothenemus* spp. (2)
Dryocoetina	*Coccotrypes*	*Coccotrypes* sp.
Xyleborina	*Ambrosiodmus*	*A. obliquus*, *A. opimus*, *Ambrosiodmus* spp. (2)
	Coptoborus	*Coptoborus* sp.
	Dryocoetoides	*Dryocoetoides* sp.
	Premnobius	*P. ambitiosus*, *P. cavipennis*
	Xyleborinus	*X. saginatus*, *Xyleborinus* sp.
	Xyleborus	*X. affinis*, *X. biconicus*, *X. ferrugineus*, *X. spinulosus*, *X. volvulus*, *Xyleborus* spp. (3)

We compared the trapping abundance between pre- and tapping periods for the most abundant species. In Scolytinae 14 species were included, while in Platypodinae and Bostrichidae one and two species were added, respectively. Of the 17 species analyzed, for the greatest majority of them there were no statistically significant differences between periods. Only for the Scolytinae species *C. diadematus*, *X. reconditus* and *X. affinis* differences were present, with catches significantly higher in the pre-tapping period (Table 2).

The Scolytinae species richness found might be considered high, considering we are dealing with a monoculture, where also the understory is usually diffuse, and composed mainly by grasses and small vines. Results of experiments in rubber stands with similar objectives apparently center in just one article (Dall'Oglio & Peres Filho, 1997), where 30 Scolytinae species were trapped, and with a higher sampling effort, in the state of Mato Grosso, Brazil.

Most species were from the sub-tribe Cryphalina, genera *Cryptocarenus* and *Hypothenemus* (Table 1), which were also the most abundant species (Table 2). In another two articles submitted to this very same rubber tree meeting (Covre et al., 2015; Pinheiro & Flechtmann, 2015), where we surveyed different rubber tree plantations, all in northwestern São Paulo, we observed the same results. Rubber trees shed a reasonable number of twigs and branches, which usually compose part of the litter in these plantations, and the majority of *Cryptocarenus* and *Hypothenemus* beetles develop well in this breeding material (Wood, 2007).

Additionally, *Hypothenemus* species are able to breed in plant material of low moisture content (Wood, 2007); hence, they find very suitable conditions to develop in rubber tree plantations.

Tapping is an activity that stresses rubber trees in various ways (Kunjet et al., 2013), and we were expecting to see an increase in the abundance of some Scolytinae and Platypodinae species, while for other species we would predict there would be no variation in beetle numbers. Hence, for Scolytinae species known not to attack live and standing trees (the subject of wounding by tapping), such as the Bothrosternina, Corthylina, Cryphalina and Dryocoetina (Wood, 2007) trapped in this experiment, as well as all Bostrichidae species, which usually attack felled or dry woody material (Lesne, 1911), we would not expect to be an increase in abundance due to tapping. Conversely, we were forecasting an increase in abundance for some *Euplatypus*, *Tesserocerus* (Platypodinae) and *Xyleborus* species, because they are known to attack and breed in live and standing rubber trees (Flechtmann, unpub.).

Table 2. Mean ± SE of Scolytinae, Platypodinae (Curculionidae) and Bostrichidae species attracted to ethanol-baited traps in a *Hevea brasiliensis* clone RRIM600 plantation in pre- and tapping periods. Sítio Boa Sorte, Três Fronteiras, state São Paulo, Brazil, from July 2013 until January 2015. Means back-transformed from √(x + 0.5); means followed by same letters are not significantly different within rows (P > 0.05; Tukey test).

species	pre-tapping	tapping
Scolytinae		
Cnesinus sp.	0.22 ± 0.08 a	0.04 ± 0.02 a
C. heveae	0.90 ± 0.12 a	0.62 ± 0.12 a
C. diadematus	0.11 ± 0.02 a	0.03 ± 0.02 b
C. seriatus	0.05 ± 0.01 a	0.07 ± 0.03 a
H. brunneus	0.08 ± 0.03 a	0.00 ± 0.00 a
H. eruditus	0.18 ± 0.04 a	0.10 ± 0.03 a
H. javanus	0.06 ± 0.02 a	0.00 ± 0.00 a
H. obscurus	3.55 ± 0.34 a	4.09 ± 0.61 a
H. setosus	0.14 ± 0.03 a	0.09 ± 0.04 a
Σ *Hypothenemus*	4.14 ± 0.37 a	4.53 ± 0.62 a
A. obliquus	0.18 ± 0.03 a	0.10 ± 0.04 a
A. opimus	0.36 ± 0.04 a	0.30 ± 0.08 a
X. reconditus	0.14 ± 0.03 a	0.03 ± 0.02 b
X. affinis	0.12 ± 0.03 a	0.01 ± 0.01 b
X. ferrugineus	0.03 ± 0.01 a	0.07 ± 0.03 a
Σ Scolytinae	8.60 ± 0.47 a	7.79 ± 0.77 a
Platypodinae		
E. parallelus	0.03 ± 0.01 a	0.02 ± 0.02 a
Σ Platypodinae	0.06 ± 0.02 a	0.03 ± 0.02 a
Bostrichidae		
D. minutus	0.07 ± 0.02 a	0.05 ± 0.03 a
X. capucinus	0.39 ± 0.05 a	0.52 ± 0.11 a
X. picea	0.18 ± 0.04 a	0.23 ± 0.05 a
Σ Bostrichidae	0.32 ± 0.05 a	0.33 ± 0.05 a

Overall, there was no statistically significant increase in abundance for the vast majority of species that do not breed in live rubber trees, as expected. However, we found no significant increase in abundance for the species known for their ability to develop in standing trees (Table 2). What probably must be happening here is that, since we compared the abundance of a period prior to tapping to the very first year tapping was carried out, it might be that whatever stress was caused to trees, it was still mild, not enough to contribute to favor a beetle attack to them. It is also possible that weather conditions in the tapping period were not favorable for beetle development, reflecting in low catches. Three species were more trapped in the pre-tapped period though, which was unexpected. The likely explanation is that the factors that influenced in these results were not related to the tapping activity.

Conclusion

The Scolytinae species richness of the plantation can be considered as high, but it is biased towards Cryphalina species, able to thrive in small and even dry plant material, abundant in the rubber tree plantation litter. There was no apparent influence of tapping on the abundance of the species, but this is probably due to the fact that we analyzed data corresponding to the first year of tapping, when the stress of this activity on trees must be still small, not enough to affect the population density. We expect though that, with the progression of the tapping activity over the years, stress will build up a level where beetles would be able to overcome tree resistance and start to attack them, increasing in population density.

Acknowledgments

The authors would like to thank Evair Pedrão for allowing us to use their plantation for our research, and also thank Francisco Marival da Silva for assistance in the field collections when needed.

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