Entomologia

INFLUENCE OF FIRE ON THE DIVERSITY OF SCOLYTINAE AND PLATYPODINAE (CURCULIONIDAE) IN *HEVEA BRASILIENSIS* IN SÃO PAULO STATE (BRAZIL)

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Summary: Scolytinae and Platypodinae beetles (Curculionidae) are causing economic damage to rubber trees in the last few years in southern Brazil, and little research on these new pests have been conducted so far. We here report the influence of fire on the population density of these beetles. Most species of Cryphalina were significantly more trapped in the unburnt plantation, while a few Xyleborina and one Platypodinae were found in higher populations in the burnt stand.

Keywords: ethanol-baited trap, *Euplatypus parallelus*, rubber tree, *Xyleborus affinis*, *Xyleborus ferrugineus*

Introduction

In 1972 the Brazilian government created the "Programa de Incentivo à Produção de Borracha Vegetal" (PROBOR), to incentivate the cultivation of rubber trees in different parts of the country. The program had three phases, and in Phase III, created in 1981, the government financed the planting of rubber trees in the southeastern region of Brazil, including the state of São Paulo (Furtado, 2008).

For many years, rubber tree plantations grew with few reports on pests causing economic damage, and the majority of those constituted in leaf and sap feeders (Abreu, 1996). Even though reports on the presence of beetle trunk borers were known already from the beginning of the 20th century (Matta, 1920), for nearly a century these beetles were more of a nuisance than a problem in rubber trees. Starting however mainly in the last few years, they have grown significantly in importance. The severity of their attacks on live trees range from dozens to hundreds of trees attacked and killed per plantation, in association or not with trunk diseases, mainly in the states of São Paulo, Minas Gerais and Mato Grosso do Sul (Flechtmann, unpub.). Probably due to the fairly recent new status of these pests, very little research on them have been reported in the literature.

The effect of fire on tree tissue and physiology in forests has been object of study for a good number of years, and the influence that post fire induces on the beetle borer forest community is also well studied (Fettig et al., 2010). However, even though fire is acknowledged as a potential threat in rubber tree plantations, leading to economic damage (Grist et al. 1998), very little is known on how it influences the beetle borer community in this environment. The objective of this experiment is to evaluate the influence of fire on the Scolytinae and Platypodinae species composition and respective abundance in *Hevea brasiliensis* clone RRIM600 stands.

Material and Methods:

The experimental sites are located in the "Assentamento Celso Furtado", in Castilho, northwestern São Paulo state, Brazil. These are two *Hevea brasiliensis* clone RRIM600 plantations, both implanted in March 1990, and where tapping started in September 2001. One plantation never caught on fire, central coordinates are 20°49'4.47"S 51°33'47.81 and it is 5.8 ha in size. The other plantation, distant ca. 400 m, coordinates 20°49'19.42"S 51°33'50.57"W and 4.2 ha in size, caught on fire twice, in September 2010 and September 2011. Both plantations are completely surrounded by pasture, and tapping started in September 2001.

Scolytinae and Platypodinae beetles are being trapped with a single-vane panel flight intercept trap (modified from Berti Filho & Flechtmann, 1986), baited with 96% ethanol. Traps are placed in the center of each plantation in a single transect of five traps, spaced 25 m apart among each other, and suspended 1.5 m above ground. The collecting frequency is weekly, and the first trapping was in 08.Nov.2014. The experiment should last one year, and we present here results based on 25 weeks of trappings. The determination of the trapped species was 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 sites were compared by PROC GLM and treatment means were separated by Tukey test (SAS Institute 1990).

Results and Discussion

In 25 weeks of collecting, we trapped 33 species of Scolytinae (Table 1; one undetermined species was not included), in five subtribes, accounting for 5487 specimens. In Platypodinae we trapped three species, *Euplatypus parallelus*, *Euplatypus* sp. and *Teloplatypus ratzeburgi*, in 49 specimens. We also collected five Bostrichidae species, *Dinoderus minutus*, *Micrapate brasiliensis*, *Micrapate horni*, *Xylopsocus capucinus* and *Xyloperthella picea*, totalling 242 specimens.

Table 1. Species of Scolytinae (Curculionidae) trapped with ethanol-baited flight intercept traps in burnt and unburnt *Hevea brasiliensis* clone RRIM600 plantations. Assentamento Celso Furtado, Castilho, state São Paulo, Brazil, from November 2014 until April 2015.

sub-tribe	genus	species
Bothrosternina	*Cnesinus*	*Cnesinus dividuus*
Corthylina	*Tricolus*	*Tricolus* sp.
Cryphalina	*Cryptocarenus*	*C. brevicollis*, *C. diadematus*, *C. heveae*, *C. seriatus*, *Cryptocarenus* sp.
	Hypothenemus	*H. areccae*, *H. brunneus*, *H. eruditus*, *H. gossypii*, *H. obscurus*, *H. opacus*, *H. plumeriae*, *H. seriatus*, *H. setosus*, *Hypothenemus* spp. (3)
Dryocoetina	*Coccotrypes*	*Coccotrypes* sp.
Xyleborina	*Ambrosiodmus*	*A. obliquus*, *A. opimus*, *Ambrosiodmus* sp.
	Premnobius	*P. cavipennis*
	Xyleborinus	*X. saginatus*
	Xyleborus	*X. affinis*, *X. biconicus*, *X. ferrugineus*, *X. spinulosus*, *X. volvulus*, *Xyleborus* sp.
	Xylosandrus	*X. laticeps*

We included only the more abundant species in the statistical analyses, which corresponded to 10 Scolytinae, one Platypodinae and two Bostrichidae species. The majority of the analyzed species was significantly more trapped in the unburnt site; these included in Scolytinae the species *C. heveae*, *C. seriatus*, *H. obscurus*, *H. plumeriae*, the sum of all *Hypothenemus*, *A. obliquus*, *A. opimus* and the sum of all Scolytinae, and *D. minutus* and *M. brasiliensis* in Bostrichidae. The Scolytinae species *X. affinis*, *X. ferrugineus* and the Platypodinae *E. parallelus* were statistically more trapped in the burnt site, while *C. dividuus* (Scolytinae) was the only species trapped in similar numbers in both stands (Table 2).

Unfortunately, very few surveys in rubber tree plantations in Brazil are reported in the literature, making comparisons with of our results rather poor. In one of the few comparable experiments, the number of Scolytinae species (33) collected in this on-going experiment is comparable to a 16-month survey conducted by Dall'Oglio & Peres Filho (1997) in five mature rubber tree stands in Mato Grosso, where 30 species were found. However, our sampling effort is less intense and based on only five months of trapping; we expect to collect more species until the completion of the experiment, seven months ahead.

One aspect that is worth stressing is the influence of the surrounding vegetation on the diversity of the species trapped. In another article of ours published in this very meeting (Covre et al., 2015), we trapped a surprising number of 38 species of Scolytinae in a young (up to 2-yr old) plantation, but we showed how the neighboring vegetation influenced, by contributing with beetles immigrating to the rubber tree site. In our current research, the surrounding vegetation is composed by pastures, which should expect to contribute very little (if ever) with immigrating beetles, thus not artificially inflating the species richness. Hence, it is perhaps safe to assume all species trapped here were indeed breeding within the surveyed plantations.

There was a predominance in both number of species (Table 1) and specimens (Table 2) of the subtribe Cryphalina. *Cryptocarenus* and *Hypothenemus* species breed usually in plant material of small diameter, including small vines (mainly *Cryptocarenus*), broken twigs and branches, and seeds (Wood, 2007). Additionally, while the great majority of the Scolytinae and all Platypodinae require plant material with considerable moisture content to develop, *Hypothenemus* beetles are able to colonize and develop in plant material of low moisture content (Wood, 2007). It is common to find broken rubber tree twigs and branches in the soil litter (Podong & Poolsir, 2013; Seephueak et al., 2011), along with some understory in variable densities (Hu et al., 2013). The availability of such breeding material might well explain the predominance of Cryphalina in our plantations.

Table 2. Mean ± SE of Scolytinae, Platypodinae (Curculionidae) and Bostrichidae species attracted to ethanol-baited traps in burnt and unburnt *Hevea brasiliensis* clone RRIM600 plantations. Assentamento Celso Furtado, Castilho, state São Paulo, Brazil, from November 2014 until April 2015. Means back-transformed from $\sqrt{(x + 0.5)}$; means followed by same letters are not significantly different within rows ($P > 0.05$; Tukey test).

species	unburnt	burnt
Scolytinae		
C. dividuus	0.43 ± 0.08 a	0.49 ± 0.08 a
C. heveae	5.46 ± 0.96 a	1.87 ± 0.25 b
C. seriatus	0.99 ± 0.20 a	0.38 ± 0.06 b
H. eruditus	0.12 ± 0.03 a	0.14 ± 0.04 a
H. obscurus	16.48 ± 1.64 a	12.81 ± 1.41 b
H. plumeriae	0.15 ± 0.04 a	0.06 ± 0.02 b
Σ *Hypothenemus*	16.98 ± 1.65 a	13.15 ± 1.42 b
A. obliquus	0.50 ± 0.10 a	0.13 ± 0.04 b
A. opimus	2.46 ± 0.37 a	0.53 ± 0.11 b
X. affinis	0.08 ± 0.02 b	0.40 ± 0.08 a
X. ferrugineus	0.13 ± 0.04 b	0.40 ± 0.07 a
Σ Scolytinae	27.30 ± 2.29 a	17.58 ± 1.52 b
Platypodinae		
E. parallelus	0.10 ± 0.03 b	0.24 ± 0.05 a
Bostrichidae		
D. minutus	0.08 ± 0.02 a	0.02 ± 0.01 b
M. brasiliensis	0.98 ± 0.16 a	0.69 ± 0.10 a

The burnt plantation caught on fire twice, and this fire contributed to reduce the amount of fallen twigs, branches and seeds, on the soil litter. In this case, by reducing the amount of breeding material in the burnt plantation, fire must have been the responsible for a statistically higher number of the vast majority of the analyzed Cryphalina species in the unburnt site (Table 2), where it was more abundant for their development. *Ambrosiodmus obliquus* is known to develop in limbs and small stumps (Wood, 2007), hence following the pattern observed in most Cryphalina. There is not much known about the breeding material of *A. opimus*, other than its type was found in a liana 3-cm in diameter (Wood, 2007). Hence, it might be again that fire could have reduced the amount of breeding material for this species, which would explain higher catches in the unburnt site (Table 2).

Both Bostrichidae species analyzed were also significantly more trapped in the unburnt plantation (Table 2). The great majority of bostrichid beetles usually attack felled timber (Lesne, 1911). Therefore, results indicate these species follow the same pattern described above for Cryphalina.

The only species significantly more trapped in the burnt plantation were *X. affinis*, *X. ferrugineus* and *E. parallelus*. These species are known to attack live rubber trees (Flechtmann, unpub.). Actually, a larger number of Scolytinae and Platypodinae species are able to attack live and standing rubber trees, usually stressed ones (Flechtmann, unpub.). It is known that fire causes damage to tree tissue, and under certain conditions it favors the attacks of Scolytinae beetles (Kelsey & Joseph, 2003), which was reported once in the literature in rubber trees (Sharples, 1936). Hence, it appears that fire might have stressed trees in such way that they became more susceptible to being attacked by these species, which were then more trapped in the burnt plantation.

Conclusion

The majority of the analyzed Cryphalina species were statistically more trapped in the unburnt plantation, and it appears that this was due to the reduction of breeding material, which was burnt with the fires. However, *X. affinis*, *X. ferrugineus* and *E. parallelus*, known to attack live and standing trees, apparently were benefitted with the fires, who probably stressed trees, turning them more susceptible to beetle attack, reflecting in a higher number of trapped species in the burnt plantation.

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