BIOLOGICAL ASPECTS OF *Euplatypus parallelus* (F.) (COLEOPTERA, CURCULIONIDAE, PLATYPODINAE) ATTACKING *Hevea brasiliensis* (Willd. ex A. Juss.) IN SÃO PAULO NORTHWEST, BRAZIL

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Abstract: This is the first report in the literature of several biological aspects of *Euplatypus parallelus* (Curculionidae: Platypodinae), including the description of its gallery system, egg, larval, and pupal stages. There is a generation overlapping, and we investigated the number of young and adult stages inside a gallery. We provided data on the number of beetles than can colonize a tree, and the height on the trunk they can reach while attacking trees. For the first time in Brazil, we list potential natural enemies of *E. parallelus*.

Key words: ambrosia beetles, natural enemies, Para rubber tree, gallery system

Introduction

Hevea brasiliensis, the Para rubber, is native to the Amazon basin (Labroy & Cayla 1913). However, Asian countries respond to over 93% of the world production of rubber, while Brasil contributes with only a little over 1%.

In Brazil, most rubber tree plantations are concentrated in the northeastern and southeastern regions of the country, where trees can grow relatively free of *Microcyclus ulei* (Hennings). The state of São Paulo had an estimate of over 77,000 ha of planted rubber trees in 2008. The yield of natural rubber for this state is of ca. 65,000 tons, which represents 50% of the country's yield. The northwestern region of the state concentrates most of the existing rubber plantations.

Several insect species are associated with Para rubber, and most of these are representatives of termite, cucumber beetle, caterpillar, scale insect, leaf cutting ant, lace bugs and beetle woodborer species. The most important woodborer species associated with rubber trees are Bostrichidae, Cerambycidae and Curculionidae (Scolytinae and Platypodinae).

Curculionidae species associated with Para rubber are commonly known as ambrosia beetles. These beetles have been reported as causing damage to rubber trees ever since the beginning of the 20th century, but these records were sporadic, and in most cases the level of injury was low. Few are the records in the literature of the species of ambrosia beetles associated with rubber tree damage, probably because they are usually small in size (less than 5 mm in length), they have cryptic habits (difficult to be dissected out of tree trunks), and very difficult to identify. Among the few determined species associated with rubber trees found in the literature is *Euplatypus parallelus* (F.) (Platypodinae).

Euplatypus parallelus is native to South America, and it seems to be spread throughout Brazil. Not different than other ambrosia beetle species, it is very polyphagous; it has been reported already on more than 60 different plant tree species, in over 20 distinct families. Despite its abundance and distribution in Brazil, in addition to its importance, little has been reported about this species in the literature this far.

Our objectives were to contribute with some biological data on *E. parallelus*, which is virtually non-existing, and also to list some of the potential natural enemies of this beetle borer species.

Material and Methods

The examined material came from several rubber tree plantations and different cities lying in the northwestern region of the state of São Paulo, Brazil. In most cases we visited the plantations, where attacked trees were cut down, and sections of trunks were brought to the laboratory. In other cases, plantation owners sent us sections of attacked rubber trees.

Data relative to *E. parallelus* gallery systems and number of eggs, larvae, pupae and adults found inside each gallery, came from 20-year old rubber trees of the clone PB 235, and cut in January 2013 (Fazenda Jangada, Sud Menucci/SP, 20°44'50.2"S 50°51'37.2"W). In this case, we carefully dissected tree trunks from the entrance hole until the end of the galleries. Drawings of the galleries were made, and length measurements were taken.

In October 2012 we examined an apparently healthy 24-year old rubber tree clone PR 255 (Fazenda Fanabor, Birigui/SP, 21°06'24.5"S 50°20'12.9"W), who started to be attacked in August of the same year. We cut down the tree and brought the whole 5 m of the trunk to the laboratory. We counted all pinholes, then we dissected the whole trunk and pulled out all beetles found inside.

Results and Discussion

Results pertaining to gallery systems and number of beetles found inside them and presented below were the outcome of the dissection of numerous gallery systems. We computed only galleries where pupal chambers were present.

In most cases, attacks start at the panel region (ca. 1.5 m height above ground), which then extends upwards and downwards as the attack progresses. External signs of attack are pinholes, which are usually associated with frass expelled from the entrance holes. In many occasions 'toothpicks' composed of the same frass are also noticeable (Fig. 1a), especially when there is no rainfall and the wind speed inside the plantation is low, helping preventing these toothpicks from being broken down to loose frass. The length of the toothpicks varied, but it reached a maximum of ca. 2.5 cm in length.

Figure 1. *Euplatypus parallelus* (Curculionidae, Platypodinae) toothpicks (a) and gallery systems (b). *Hevea brasiliensis* clone PR 255, Farm Fanabor, Birigui/SP (Brazil), October 2012.

Males are the pioneer beetles, and once they find a suitable rubber tree, they bore an initial gallery which is 2 mm in diameter, and might be as long as 9 mm. This species is monogynous, as it is the case for most, if not for all Platypodinae. Each male is joined by only a single female, who is then responsible for the gallery construction. The diameter of the gallery bored by the female is also 2 mm.

Galleries may easily reach the heartwood of even rubber trees with a large trunk diameter (Fig. 1b). The internal walls of the galleries are stained in dark color, probably due to the action of the symbiotic fungus the female introduces into the host tree. This stain usually extends a few millimeters beyond the gallery wall.

The gallery system starts usually a few centimeters perpendicular to the trunk axis and towards the heartwood, and then it proceeds mostly at sharp angles either upwards or downwards; sometimes it might instead follow the grain of the wood, before changing the plane of orientation (Fig. 3).

Eggs were found inside galleries in only one occasion, and inside a single gallery system. They are creamy white in color, and with an oval shape. Eggs were found at the end of a gallery branch, and clumped loosely together (Fig. 2a). In one batch there were 74 eggs, and in the other, 22.

Larvae are apodous, curculioniform, and in younger stages the are clearly C-shaped (Fig. 2b), while in the last instar they exhibit a more straight shape. The pronotum is larger than the head, and when larvae are in their more mature stages, they bear dorsally a brownish chain-like pattern; the last abdominal segment is armed by a chitinized plate (Fig. 2b). Larvae of different and overlapping instars were found moving freely inside the parental galleries, and we found a maximum of 71 larvae inside a single gallery. This number is far higher than the only report found in the literature.

Mature larvae pupate in pupal chambers built by themselves, and they always faced their heads toward the parental gallery. These chambers are perpendicular to the parental gallery and parallel to the grain of the wood. Pupal chambers are found usually at the end of a gallery branch, built on both sides (top and bottom) of the tunnel, and parallel to each other (Fig. 2c). Pupal chambers measured ca. 5-6 mm in length, and 2.5 cm in diameter. We examined a total of 924 pupal chamber groups, and the number of chambers per group varied from as little as one to a maximum of 16. The number of pupal chamber groups per gallery system varied from one to five (Fig. 3).

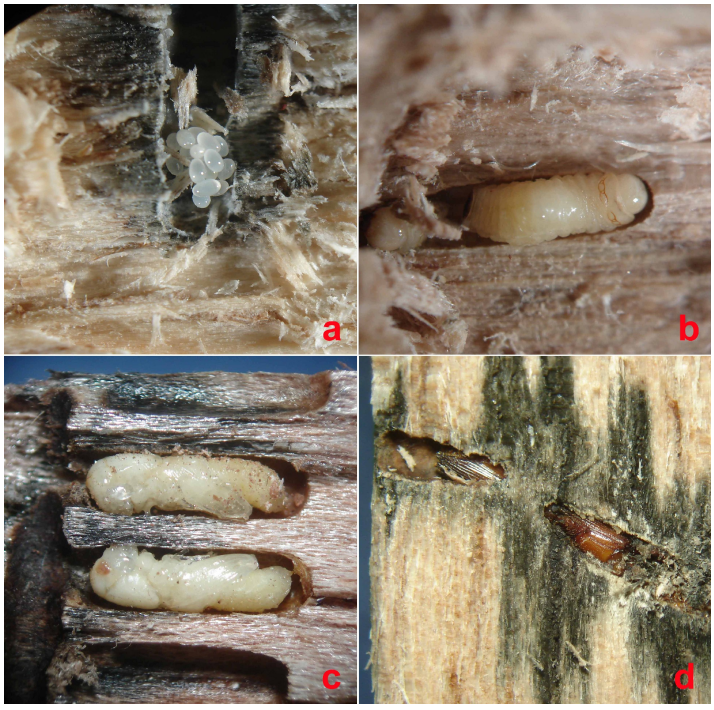

Figure 2. Different stages of *Euplatypus parallelus* (Curculionidae, Platypodinae): eggs (a), mature larva (b), pupae in pupal chambers (c), and male adults (d). *Hevea brasiliensis* clone PB 235, Farm Jangada, Sud Menucci/SP (Brazil), January 2013.

There can be a variable number of adults inside a gallery system, and the maximum we observed were 10. Usually young adults leave the parental gallery, through the entrance hole bored by the parent beetle. However, in the gallery system where the 10 adults were found, while four were callow adults, the other six were however mature adults. This gallery system was very large and complex, and bearing five pupal chamber groups at the time of the dissection (Fig. 3). This combination of factors suggest that if moisture conditions of the host are suitable in providing conditions for the development of young and adult beetles and their symbiotic fungi, the progeny may stay and continue expanding the parental gallery, instead of abandoning it.

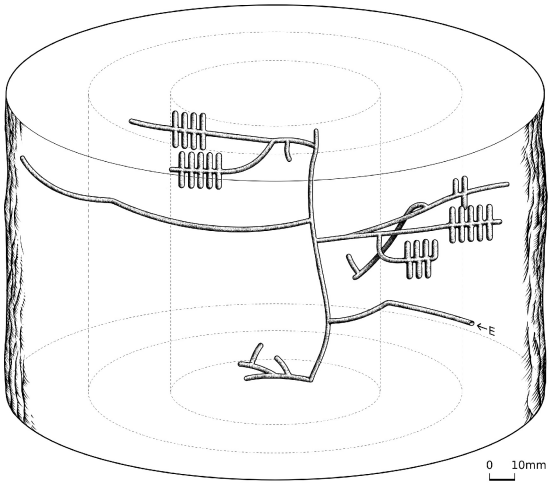

Figure 3. *Euplatypus parallelus* (Curculionidae, Platypodinae) gallery system. *Hevea brasiliensis* clone PB 235, Farm Jangada, Sud Menucci/SP (Brazil), January 2013.

In general, it was common to find a generation overlap, where at least larvae of different developmental instars, pupae and adults were found inside a single gallery system.

We found also a number of associated organisms inside the galleries we dissected. Platypodines are considered to have few natural enemies, but we found inside *E. parallelus* galleries Colydiidae and *Trypanaeus* (Histeridae), which are known

scolytine and platypodine predators, and Mermithidae nematodes, which are arthropod endoparasites. We also found mites in the families Acaridae, Uropodidae, and Ologamasidae, but these are probably not natural enemies of *E. parallelus*.

We dissected also a whole trunk of an attacked clone PR 255 rubber tree. This particular tree was at the edge of the plantation, it had a very well developed canopy, no signs of mechanical injury to the trunk, no evidence of bark or leaf diseases, and a large DBH (30 cm). There was no indication it could be under any kind of stress, and it looked perfectly healthy despite being attacked. However, we still found *E. parallelus* attacking the tree from the bottom up to 4 m above the ground. We counted 806 pinholes along the trunk, and we were able to pull out of the tree 2,387 adults, 1,793 larvae and 352 pupae, adding up to over 4,500 beetles. The sex ratio was 1.3, which is slightly male-biased. Most pinholes and beetles were found between 0.8 m and 1.5 m, which encompasses the panel region. There are a number of references in the literature that state tapping operation might expose the xylem and create an opportunity for beetle borer invasion, which might have been the present case.

Conclusions

Euplatypus parallelus displays generation overlap, and it seems to have a high reproductive potential. We found potential natural enemy species inside their galleries, but considering the number of beetles encountered inside a dissected tree, they might not be able to contain a successful beetle invasion. This species apparently starts its attack at the panel region, then the infestation spreads upwards and downwards, when they are able to colonize the whole tree trunk.

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