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Original Article

The beetle *Costalimaita ferruginea* (Coleoptera: Chysomelidae) in *Eucalyptus* plantations in transition area of Amazon and Cerrado Biomes

T. K. R. Dias[a], E. M. Pires[a], A. P. Souza[b], A. A. Tanaka[b], E. B. Monteiro[b] and C. F. Wilcken[c]*

[a]Instituto de Ciências Naturais Humanas e Sociais, Universidade Federal de Mato Grosso – UFMT, Campus de Sinop, Av. Alexandre Ferronato, 1200, Distrito Industrial, CEP 78557-267, Sinop, MT, Brazil

[b]Instituto de Ciências Agrárias e Ambientais, Universidade Federal de Mato Grosso – UFMT, Campus de Sinop, Av. Alexandre Ferronato, 1200, Distrito Industrial, CEP 78557-267, Sinop, MT, Brazil

[c]Departamento de Produção Vegetal, Faculdade de Ciências Agronômicas – FCA, Universidade Estadual Paulista "Júlio de Mesquita Filho" – UNESP, Rua José Barbosa de Barros, 1780, CEP 18610-307, Botucatu, SP, Brazil

*e-mail: evaldo.pires@gmail.com

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(With 4 figures)

Abstract

Costalimaita ferruginea (Coleoptera: Chrysomelidae) attacks *Eucalyptus* plants causing severe damage through netting of the leaves. Recently, this Coleoptera has been reported attacking Myrtaceae in Mato Grosso State and, studies about the occurrence of this beetle in commercial plantations of eucalypts has been the subject of researchers through monitoring programmes in the forest protection area. With the beginning of the rainy season, adults were observed causing damage in eucalypt plantations in four cities that are part of the transition region of Amazon and Cerrado Biomes. The spots where these insects were observed are located in Feliz Natal, Lucas do Rio Verde, Sorriso and Vera. The purpose of this study was to report the new occurrences and to characterize the attack period of the beetle *C. ferruginea* in *Eucalyptus* plantations in Middle-North region of Mato Grosso State, region of Biomes Transition.

Keywords: damage, defoliator, new distribution, yellow beetle.

O besouro *Costalimaita ferruginea* (Coleoptera: Chysomelidae) em plantios de *Eucalyptus* em áreas de transição dos Biomas Amazon e Cerrado

Resumo

Costalimaita ferruginea (Coleoptera: Chrysomelidae) ataca plantas de *Eucalyptus* provocando intensos danos através do rendilhamento das folhas. Recentemente, esse Coleoptera tem sido relado atacando Myrtaceae no Estado de Mato Grosso e, estudos sobre a ocorrência desse besouro em plantios comerciais de eucaliptos tem sido alvo de pesquisadores através de programas de monitoramento na área de proteção florestal. Com o início do período chuvoso, adultos foram observados causando danos em plantios de eucalipto em quatro municípios que fazem parte da região de transição dos Biomas Amazônia e Cerrado. Os pontos onde foram observados esses insetos estão localizados em Feliz Natal, Lucas do Rio Verde, Sorriso e Vera. O objetivo deste trabalho foi relatar as novas ocorrências e caracterizar o período de ataque do besouro *C. ferruginea* em plantios de *Eucalyptus* na região Médio-Norte do Estado de Mato Grosso, região de transição de Biomas.

Palavras-chave: danos, desfolhador, nova distribuição, besouro amarelo.

1. Introduction

In Mato Grosso State, intensive silviculture with cultivation of *Eucalyptus* sp. is in its initial stage with around 59,980 ha and there are just a few registered pest insects causing damage (Shimizu et al., 2007; ABRAF, 2013). Among the leaf beetles, *C. ferruginea,* popularly known as "yellow beetle", stands out for its voracity and biotic potential (Santos et al., 2009; Zanuncio et al., 1993).

This species is considered a serious phytosanitary problem in Brazil, it has been accounted in Acre (Santos et al., 2016), Bahia (Mafia et al., 2014), Espírito Santo (Mafia et al., 2014), Goiás (Santos et al., 2003), Maranhão (Chagas and Coelho, 1974), Mato Grosso do Sul (Berti-Filho et al., 1980; Kassab et al., 2011), Minas Gerais (Freitas et al., 2002; Mafia et al., 2014; Pires et al., 2014; Santos et al., 2009),

Pará (Maués and Couturier, 2002; Pinto et al., 2004; Lunz and Azevedo, 2014), Rio Grande do Norte (Mendes, 2004), Rio Grande do Sul e Paraná (Santos et al., 2009), Roraima (Marsaro-Júnior and Perreira, 2007), São Paulo (Mariconi, 1956; Junqueira, 1962), in Vale do Jari, between the States of Amapá and Pará (Lunz and Azevedo, 2014).

Besides these accounts, the Entomology Collection "Pe. Jesus S. Moure" of the Department of Zoology from Federal University of Paraná (DZUP) has some specimens deposited which collection records were in Ceará State and Pernambuco State (Information provided by Professor Germano H. Rosado Neto – UFPR). In Mato Grosso State, *Costalimaita* sp. was observed causing damage in seedling nursery in Sinop City (Pires et al., 2013).

The "yellow beetle" is considered small, measuring 5 to 6 mm long, it is bright yellowish-brown, its ventral region is orange, elytra with 15 to 18 longitudinal carinae and with small circular dots in relation to the end of the wing. Its adult life causes damage because they mainly feed on young leaves located in the upper third of the trees' crown, however, high population attack all the crown, reducing chlorophyllic parenchyma, giving the leaves a net-like appearance and drilling them, compromising the development and even may lead to death of the plants (Mendes et al., 1998; Santos et al., 2009). Their immature forms develop in the soil, where the larvae feed on the roots of grasses (Gould and Raga, 2002).

The information about the "yellow beetle" distribution in Mato Grosso is incipiente. Thus, the objective of this study was to broaden the reports of occurrence of *C. ferruginea* attacking commercial plantations of eucalyptus in the Middle-North of Mato Grosso State, transition region of Amazon Biome and Cerrado Biome.

2. Material and Methods

Samples were collected in commercial plantations of *Eucalyptus grandis x Eucalyptus urophylla* during the period from January 2014 to January 2016 in the cities of Feliz Natal, Lucas do Rio Verde, Sorriso and Vera. In Feliz Natal (12º 20' 67" S, 55º 01' 06" W) and Vera (12º 19" 63" S, 55º 19' 01" W) the plantations were located in the border of the Highway MT 225; in Sorriso (12º 51' 98" S, 55º 52' 93" W) and Lucas do Rio Verde (12º 51' 22" S, 55º 52' 33" W) they were located in the border of Highway BR 163, in Mato Grosso State (Figure 1).

The areas were monitored with yellow sticky traps (10 × 12 cm), trademark BIOTRAP® and, light traps model "Luíz de Queiroz", with UV fluorescente lamp (black light), 15 watts, powered by 12-volt battery. All the sampled material was taken to the Laboratory of Energy and Pests from Agricultural and Environmental Sciences Institute of Federal University of Mato Grosso for screening, identification, and fixation of specimens.

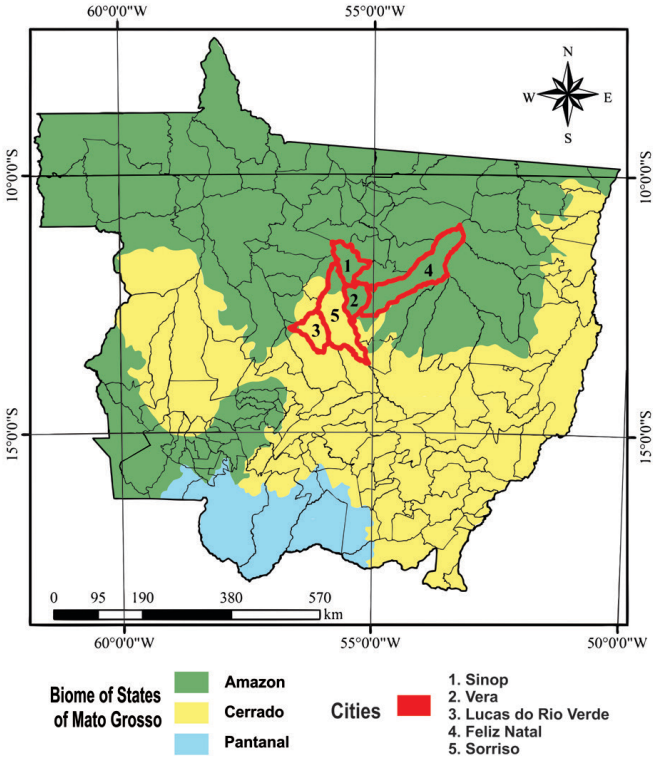

Figure 1. Map of the State of Mato Grosso, Brazil and its biomes. Emphasis on the cities where occurrence of *Costalimaita ferruginea* (Coleoptera: Chrysomelidae) were reported. (1) Sinop, (2) Vera, (3) Lucas do Rio Verde, (4) Feliz Natal, (5) Sorriso.

Collected leaves in the field were conducted to the laboratory, 40 apical, middle and basal leaves were sampled, in three-year-old plantations bordered by native forested fragment, eucalyptus plantation and crops (soybeans) in Feliz Natal City, to obtain the real leaf area and consumed, with the aid of the photoelectric meter Li-Cor Li-300.

3. Results

The presence of *C. ferruginea* was found in all sampled areas and both ways of collection were effective in monitoring. In 2014, plants and leaves were observed with similar damage caused by *C. ferruginea.* With the beginning of the rainy season in the region (October, November) occurred the emergence of adults and the registration of damage only in samples carried out in Feliz Natal, MT (Figure 2). Compartments with plants of hybrid *Eucalyptus grandis* × *Eucalyptus urophylla*, bordered by native forested fragment and crop (soybean), were more affected by Chrysomelidae (Figure 2A, B). The photosynthetic area of plants was reduced, with perforated and net-like leaves. The consumption of leaf area was observed between 0 – 20% and more intense between 80-100% in eucalyptus leaves (Figure 3).

Eucalyptus plants bordered by native forested fragment showed higher percentage of leaf consumption in all thirds sampled due to the attack of C. *ferruginea*, however, higher percentages were recorded in the apical third, where most of the leaves showed consumption between 21 to 40%,

Figure 2. (A) *Costalimaita ferruginea* (Coleoptera: Chrysomelidae); (B, C). Damage on *E. grandis* x *E. urophylla.* Vera / Feliz Natal, Mato Grosso, Brazil.

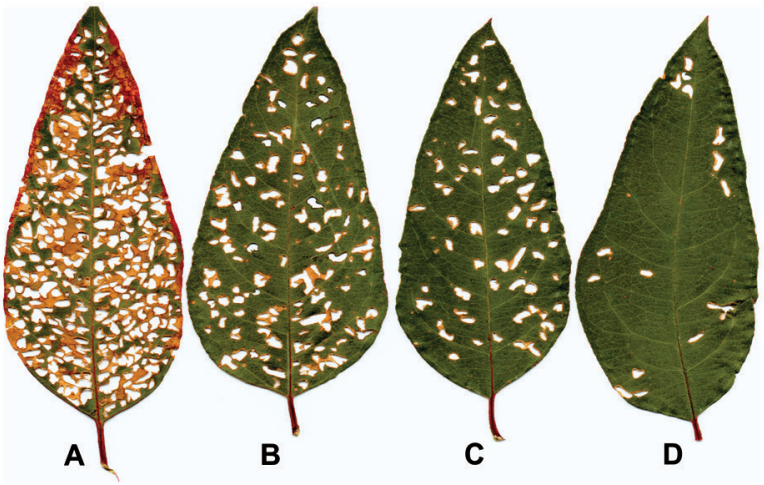

Figure 3. Leaves damage by *Costalimaita ferruginea*. (A) 81 a 100%, (B) 41 a 60%, (C) 21 a 40%, (D) 0 a 21%.

Table 1. Leaf consumption of *Costalimaita ferruginea* (Coleoptera: Chrysomelidae) on *Eucalyptus grandis* × *Eucalyptus urophylla*.

	Consumption percentage		
Position	**Apical**	**Middle**	**Basal**
E.F	24.02 Aa	20.2 Aa	21.46 Aa
E.E	23.04Aa	19.39Aab	15.49 Bb
E.L	14.35 Bab	13.27 Bb	17.65 ABa

Averages followed by the same letter in the column and lowercase latter in line do not differ by Tukey test at 5 (%) probability. E. F. *Eucalyptus* plantation bordered by native forested fragment. E.E. *Eucalyptus* plantation bordered by eucalyptus. E. L. *Eucalyptus* plantation bordered by crops.

according to the range by Montes et al. (2012). Plants bordered by crops, and during sampling period with soybean crops, obtained lower percentage of leaf consumption in the apical and middle thirds, lower than plants bordered by native forested fragment and eucalyptus plantations, despite that, the basal third showed no significant difference to other positions evaluated. The leaves of the basal third of eucalyptus plantations were less consumed (Table 1).

In 2015, in the same period with the onset of rains, the presence of this beetle was also recorded in other monitored localities, in the cities of Vera, Sorriso and Lucas do Rio Verde (Figure 2). Compartments of the same hybrid showed defoliation signs and burned leaves. In Vera City, one-year-old plants were the most attacked ones, with 3/4 or more of their destroyed crown and apical parts due to *C. ferruginea* attack in accordance with attack intensity levels recommended by Mazanec (1966). In other locations the plants were also attacked, but with less intensity, possibly due to the age of the plants that were between two and four years old. Light traps enabled the collection of beetles in January of 2015 and 2016 in all sampled locations.

4. Discussion

Leaves in all thirds of the plants were attacked, with predominant attack on young leaves. It is Worth mentioning that in periods of higher temperature range, the beetles take shelter in the abaxial part of the leaves. Attacks with similar characteristics were recorded by Pires et al. (2013), preference for young leaves in apical and lateral parts with insects sheltered under leaves and lower feeding activity in the hottest periods of the day.

The pattern of damage inflicted on the leaves described by Anjos et al. (1990), netting, occurred in all sampled locations and years (Figure 1B, C), varying only the intensity of the attack on plants, and this characteristic is an indicative of the occurrence of defoliating Chrysomelidae in the area (Mendes, 2004).

Part of the development cycle of *C. ferrugínea* occurs on the ground, its immature stage, feeding on roots (Mendes et al., 1998; Montes et al., 2012). Possibly, the proximity of eucalyptus planted areas to native forested fragment enables the development of a greater number of larvae of the coleopteran, generating larger amount of adults, due to the absence or reduced anthropic interference on the ground in this fragment, reducing the exposure of larvae to predators, parasitoids and even climate factors, such as high temperature during soil preparation period for the implantation of soybean cultivation in Amazon-Cerrado region, between the months of August and September (Souza et al., 2012).

This proximity also allows the provision of food resources for this phytophagous due to constant regrowth of plants and formation of new roots inside the native forested fragment. Favero et al. (2011) reports greater abundance and diversity of Chrysomelidae in forested fragments in an advanced stage of restoration when compared to fragments in the early stages of restoration, this fact is attributed to the diversity of food source for phytophagous insects.

Young leaves of the apical third were preferred (Table 1), and the reduction of leaf area in this third may cause major economic losses, to the detriment of the reduction in mature leaves (Anjos and Majer, 2003). The preference for younger leaves is directly linked to nutritional quality, high nitrogen levels and lower levels of essential oils which provide high levels of defoliation (Ohmart et al., 1985; Baker at al., 2002). In Southeast Brazil, *E. camaldulensis, E. urophylla*, *E. grandis,* and hybrids *E. grandis x E. urophylla* ("urograndis") show leaves with higher percentage of damage between 21 and 100% of leaf area consumed by *C. ferruginea* (Montes et al., 2012).

The period of occurrence of "yellow beetle" in Middle-North region of Mato Grosso with standard Amazon-Cerrado transition vegetation, is similar to that found in the Southeast region of the country, during the rainy season, as evidenced by Mendes et al. (1998), Freitas et al. (2002), Montes et al. (2012) and Pires et al. (2014). However, the rainy season in Mato Grosso region with water excess is between October and April, with annual accumulated precipitation of 1974.47 mm (Souza et al., 2012, 2013). This difference of over 30 days of rainy period, when compared to brazilian Southeast, October to March, (Alves et al., 2005; Minuzzi et al., 2007), favors the beetle cicle, promoting the development of the larva over time due to moisture in the soil (Figure 4).

Despite all areas had been monitored for two years, only in the city of Feliz Natal was confirmed the presence of the beetle, 36 insects, during the first year, possibly due to the transportation of seedlings infected with larvae in the substrate, contributing to the distribution of *C. ferruginea* or even the proximity to areas of forested fragments and, or farming, considering the preference of this beetle in

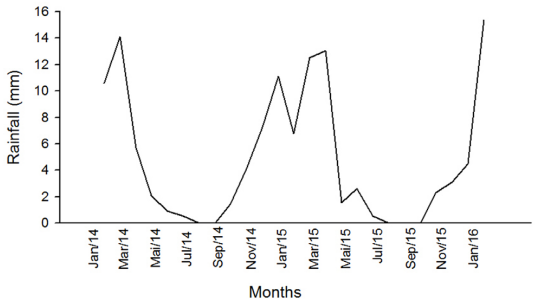

Figure 4. Rainfall in Middle-North of Mato Grosso, Brazil between 2014 and 2016.

grass roots, behavior reported by Gould and Raga (2002), since this region of Mato Grosso is a major grain producer in Brazil, soybean-corn succession and pasture used in cattle-raising.

Little is known about *C. ferruginea* behavior, especially as the scenery changes, but, like other beetles, this is sensitive to environmental changes, in a special way in biomes transition areas (Andresen, 2001; Rodrigues et al., 2013).

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