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FIRST REPORT AND POPULATION CHANGES OF *BRADYSIA DIFFORMIS* (DIPTERA: SCIARIDAE) ON *EUCALYPTUS* NURSERIES IN BRAZILALEXANDRE SANTOS¹, RONALD ZANETTI¹, ROOSEVELT P. ALMADO², JOSÉ E. SERRÃO³ AND JOSÉ C. ZANUNCIO^{4,*}¹Departamento de Entomologia, Universidade Federal de Lavras, Caixa Postal 3037, 37200-000, Lavras, Minas Gerais, Brasil²ArcelorMittal BioFlorestas Ltda, Avenida Carandaí 1115, 10º andar, 30130-060, Belo Horizonte, MG, Brasil³Departamento de Biologia Geral, Universidade Federal de Viçosa, 36570-000, Viçosa, Minas Gerais, Brasil⁴Departamento de Biologia Animal, Universidade Federal de Viçosa, 36570-000, Viçosa, Minas Gerais, Brasil

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ABSTRACT

The clonal propagation of *Eucalyptus* in plastic tube containers with growing media substrate without direct contact of seedlings with soil floor in nurseries, changed the status of insects such as fungus gnats (Diptera: Sciaridae), especially the genus *Bradysia*. This study monitored populations of adults within a *Eucalyptus* spp. tree nursery in the municipality of Bom Despacho, Minas Gerais State, Brazil. Adult samples were collected monthly, during seven months with 58 yellow sticker card traps, including 21 in a mini garden, 16 in a greenhouse, and 21 in a shaded house. All individuals collected were identified as *Bradysia difformis* Frey, 1948 (= *Bradysia paupera* Tuomikoski, 1960) (Diptera: Sciaridae). The population dynamics of *B. difformis* were not correlated with environmental variables (temperature and relative humidity), but varied between the three sectors of the nursery. This work is the first report associated with the population dynamics of *B. difformis* of nursery seedlings of *Eucalyptus* spp. in Brazil.

Key Words: fungus gnats, nursery, Diptera, forest seedlings

RESUMO

A propagação clonal de *Eucalyptus* em casa de vegetação, em tubetes plásticos com substrato e sem o contato direto das mudas com o solo, mudou o status de insetos como as moscas-do-viveiro (Diptera: Sciaridae), especialmente o gênero *Bradysia*. Este estudo monitorou adultos deste gênero em viveiro de plantas de *Eucalyptus*, no município de Bom Despacho, Minas Gerais, Brasil. Adultos foram amostrados, durante sete meses com 58 armadilhas amarelas de cola, incluindo 21 em mini-jardim clonal, 16 em casa de vegetação, e 21 em casa de sombra. Todos os indivíduos coletados foram identificados como *Bradysia difformis* Frey, 1948 (= *Bradysia paupera* Tuomikoski, 1960) (Diptera: Sciaridae). A dinâmica populacional de *B. difformis* não se correlacionou com as variáveis climáticas (temperatura e umidade relativa), mas variou entre os três setores do viveiro. Este trabalho é a primeiro relato de ocorrência associada com a dinâmica populacional de *B. difformis* em viveiro de mudas de *Eucalyptus* spp. no Brasil.

Palavras chave: moscas-do-fungo, viveiro de plantas, Diptera, mudas florestais

Clonal propagation of *Eucalyptus* in plastic tubes with growing media substrate in nurseries may provide favorable environmental conditions which allow insect species to become pests (Berti Filho & Wilcken 1993) including fungus gnats. Fungus gnats (*Bradysia* spp.) (Diptera: Sciaridae) are the main group of insect pests in nurseries and commercial greenhouses of many countries (Cloyd & Zaborski 2004).

Adults of *B. difformis* are dark brown to black, 1.8-2.1 mm long, with a large number of dark bristles on the body, thorax and abdomen, dark brown

to clear yellow lateral areas, with elongated and grayish thin legs and wings (Menzel et al. 2003). Adults live about 2 to three days and females lay 30 to 70 eggs beneath the soil growing media substrate. The larvae have four instars with a life-cycle of 21 days (Harris et al. 1995) depending on the temperature, substrate and host plant (Bravo et al. 1993). The fungus gnat *B. difformis* is often found in greenhouses where it can become a pest.

In Brazil, larvae of *Bradysia coprophila* Lintner (Diptera: Sciaridae) damage *Eucalyptus* spp. seedlings in nurseries (Zanuncio et al. 1996),

where they feed on fungi and roots, causing damage that reduces crop biomass and water absorption (Vaughan et al. 2011) primarily in moist substrates with high organic matter content (Dreistadt 2001). This can compromise growth and development of *Eucalyptus* cuttings by causing a loss of vigor, and yellowing of its leaves (Berti Filho & Wilcken 1993) and make plants susceptible to attack by pathogens (Gardiner et al. 1990). Larvae of this insect feed on living plant matter, especially roots (Werner Mohrig, pers. commun.). *Bradysia difformis* like *B. coprophila* feeds on roots of *Eucalyptus* and *Pinus* in nursery seedlings in South Africa (Hurley et al. 2007).

Gnats of the genus *Bradysia* can spread pathogens both directly or indirectly (Gillespie & Menzies 1993; Shamshad et al. 2009) such as *Verticillium albo-atrum* Reinke & Berthold in alfalfa (Kalb & Millar 1986), *Botrytis cinerea* Persoon ex Fries and *Colletotrichum fragariae* Brooks in strawberry (Radin et al. 2009), *B. cinerea* and *Fusarium* spp. in conifer seedlings (James et al. 1995) and *Pythium aphanidermatum* (Edson) Fitzp. in cucumber (Jarvis et al. 1993).

The objective of this study was to monitor populations of the genus *Bradysia* in a *Eucalyptus* spp. nursery to improve fungus gnats information in commercial seedlings production in Bom Despacho, Minas Gerais State, Brazil.

MATERIALS AND METHODS

This work was developed in a *Eucalyptus* seedling production unit, that produces eight million *Eucalyptus* seedlings/year, in the Municipality of Bom Despacho (S 19° 44' 11" W 45° 15' 08" at an altitude of 769 m asl), Minas Gerais State, Brazil.

Adults samples were collected monthly with 58 card-type yellow sticker traps suspended 10 cm from the top of *Eucalyptus* seedlings. Twenty-one traps were distributed in an area of 4,900 m² of a clonal mini garden (MJC) sector with three traps systematically distributed between hydroponics channels; 16 in 2,675 m² in greenhouses complex (CV) sector with 2 traps systematically distributed in the center of each vegetation house) and 21 in a 5,922 m² area of the shaded area (CS) sector with 2 traps systematically sampled per vegetation. Traps were monitored during seven months in CS-shade house, the CV-greenhouse and MJC-mini clonal garden.

The traps were removed each month and sent to the Laboratory of Forest Entomology of the Federal University of Lavras in Lavras, Minas Gerais State, Brazil where the fungus gnat adults per trap and nursery sector (CS, CV and MJC) were counted with the help of a stereoscopic microscope (40x).

Traps were not collected at the CV in July and August because this area was cleaned and seedlings were removed of the greenhouses. Adults

were removed from the traps with a brush and liquid petrolatum in the first month of monitoring and sent to Prof. Dr. Werner Mohrig for identification.

Temperature data (°C) and %RH were obtained with digital thermometer-hygrometer monitors in CS, CV and MJC sectors of the seedling production unit and correlated with the number of fungus gnats per sector of the nursery (Pearson, $P \leq 0.05$).

Generalized linear models (GLM), using the appropriate distribution of errors for the number of insects as response variable (Crawley 2005), were constructed to test the effect of CS, CV and MJC sectors of the nursery and month on population number of *B. difformis* and the means per sector compared by analysis of contrast models ($P \leq 0.05$) (Ferry et al. 2009). Statistical analysis was performed with the program R (R Development Core Team 2008) and the package Multicomp (Hothorn et al. 2008).

RESULTS

All insects collected were identified as *Bradysia difformis* Frey, 1948 (= *Bradysia pauper* Tuomikoski, 1960) (Diptera: Sciaridae). The average number of individuals of *B. difformis* was not correlated with temperature and relative humidity in the clonal mini garden (Temperature (°C): 26.6 ± 0.24 , $r = 0.4716$, $P = 0.2854$, RH (%): 53.1 ± 0.84 , $r = -0.0695$, $P = 0.8823$), greenhouse (Temperature (°C): 29.3 ± 0.27 , $r = -0.7695$, $P = 0.1281$, RH (%): 80.7 ± 0.76 , $r = 0.6304$, $P = 0.2542$) and the shaded area (Temperature (°C): 26.5 ± 0.24 , $r = 0.6269$, $P = 0.1319$, RH (%): 53.1 ± 0.84 , $r = -0.1687$, $P = 0.7176$) sectors.

The numbers of *B. difformis* captured varied between the 3 sectors in each month evaluated. Nine to 83 gnats per trap were collected in the CS, CV and MJC sectors of the nursery and the MJC generally had the lowest number of fungus flies (Fig. 1). The GLM analysis using contrasts showed differences in the number of adults of *B. difformis* in each sector of the nursery but without similarity between populations of these gnats per sector in any month evaluated (Fig. 1).

DISCUSSION

The temperature and relative humidity affected the population dynamics of *B. difformis*; and the numbers of *Bradysia* adults which was positively correlated with temperature and humidity (Prishchepa & Kondratenko 2008). Contrary in this study, the abundance of *B. difformis* was not correlated with temperature and relative humidity, probably because the environmental variables were evaluated in a shorter time period (seven months).

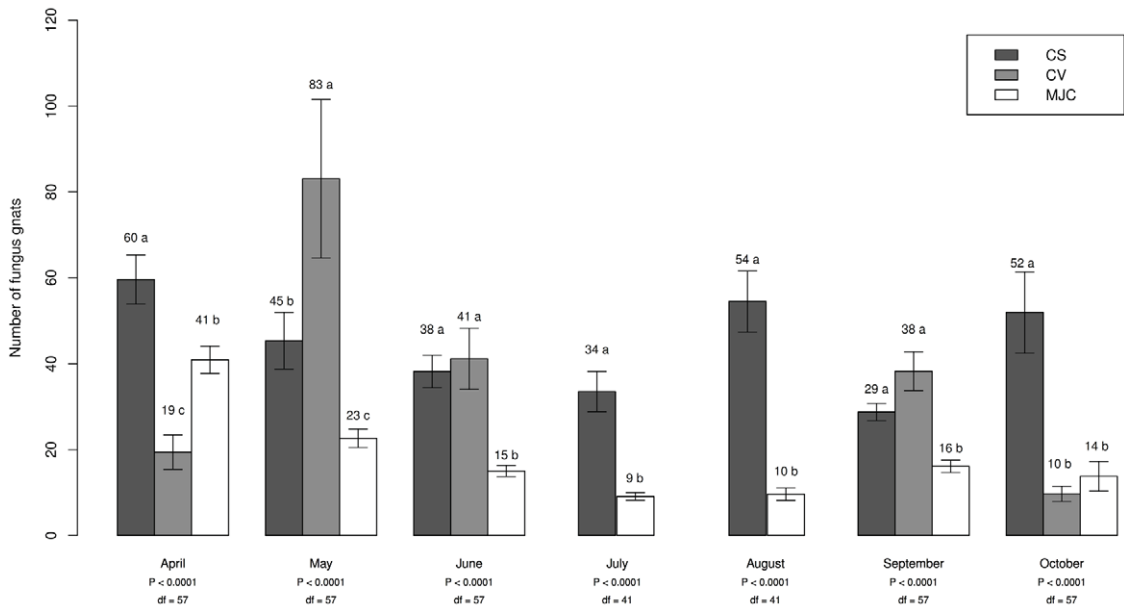


Fig. 1. Number (mean \pm standard error) of *Bradysia difformis* adults collected with yellow sticker traps per sector of production of *Eucalyptus* spp. seedlings April to October 2005 in Bom Despacho, Minas Gerais State, Brazil ($P \leq 0.05$). CS is the shade house, CV is the greenhouse, and MJC is the clonal mini garden.

Bradysia difformis is expected to have higher frequency numbers in CV and CS sectors, compared to the MJC, due to the substrate of this sector which consists only of sand and this species is found normally in substrate with organic matter (Dreistadt 2001), despites similarity in environmental conditions. The constant moist growing media substrate for propagating *Eucalyptus* seedlings combined with an average temperature of 27.5 °C in nursery areas may provide ideal conditions for growth and development of the fungus gnat independent of production and seasonal environmental conditions since the optimum temperature for adult emergence of species of this group is above 20 °C (Lee et al. 1998).

CONCLUSIONS

This is the first report of *B. difformis* monitored in one commercial nursery with *Eucalyptus* spp. seedlings in Brazil. The abundance of this insect was not correlated with environmental conditions, probably because these variables were evaluated in a shorter time in this study. However, the number of individuals of this insect varied between different sectors of the *Eucalyptus* nursery.

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