Scientific Note

First occurrence of *Spodoptera cosmioides* (Walker, 1858) (Lepidoptera: Noctuidae) on eucalyptus seedlings after field transplantation in Rio Grande do Sul State, Brazil

Norton Borges Junior¹ , Ervandil C. Costa² , Dayanna N. Machado² , Leandra Pedron² , Jaridel Boscardin³ , João A. C. Vivian¹

¹CMPC, Guaíba, RS, Brazil. ²Programa de Pós-Graduação em Engenharia Florestal, Universidade Federal de Santa Maria, Santa Maria, RS, Brazil. ³Instituto de Ciências Agrárias, Universidade Federal de Uberlândia, Monte Carmelo, MG, Brazil.

Corresponding author: norton.borges@cmpcrs.com.br

Edited by: Daniell R. R. Fernandes

Received: August 20, 2020. Accepted: September 09, 2020. Published: September 17, 2020.

Abstract. This study reports the first occurrence of *Spodoptera cosmioides* (Walker, 1858) (Lepidoptera: Noctuidae) larvae causing defoliation in transplanted seedlings in a clonal plantation of *Eucalyptus urophylla* S.T. Blake (Myrtaceae), in Butiá municipality, Rio Grande do Sul State (30°9'45" S; 51°59'42" W). The *S. cosmioides* caterpillars are polyphagous, including eucalyptus among their host plants. It was observed that the caterpillar infestation damaged 80% of the seedlings, while the defoliation varied from 13% to 24% per plant. This is the first record of *S. cosmioides* caterpillars causing injuries in a new plantation of *E. urophylla*.

Keywords: armyworm, defoliating caterpillar, forest entomology, pest management.

Plantations of *Eucalyptus* L'Héritier have an important role in the Brazilian economy, occupying 5.7 million hectares. It represents 72.4% of the total area planted with tree species in Brazil, highlighting the states of Minas Gerais (24%), São Paulo (17%), Mato Grosso do Sul (16%), Bahia (11%), Paraná (5%) and Rio Grande do Sul (5%) (IBÁ 2019). When planted as homogeneous populations, the agricultural and forest crops provide favorable conditions for the occurrence of harmful insects, due to the ecosystem simplification (Altieri & Letourneau 1982; Garlet et al. 2013).

In general, there are many pest insects found in the eucalyptus crop and the defoliating insect species deserve emphasis. *Eupseudosoma aberrans* Schaus, 1905 *Eupseudosoma involuta* (Sepp, [1855]) (Erebidae: Arctiinae); *Apatelodes cerrita* Draudt, 1929 (Bombycidae); *Glena unipennaria* (Guenée, 1857), *Iridopsis subferaria* (Walker, 1860), *Oxydia vesulia* (Cramer, 1779), *Stenalcidia grosica* Schaus, 1901, and *Thyrinteina arnobia* (Stoll, 1782) (Geometridae); *Sarsina violascens* (Herrich-Schaeffer, 1856) (Lymantriidae); *Cecrita varona* (Schaus, 1901), *Nystalea nyseus* (Cramer, 1775), and *Psorocampa denticulata* Schaus, 1901 (Notodontidae), and *Euselasia eucerus* (Hewitson, 1872) (Riodinidae) can be highlighted among the main native Lepidoptera species recorded in *Eucalyptus urophylla* S. T. Blake plantations in Brazil (Pereira et al. 2001; Zanuncio et al. 2009; 2014). Also, Kowalczuck et al. (2012) cited 26 Lepidoptera species associated with *E. urophylla*.

Santos et al. (1980) recorded *Spodoptera latifascia* (Walker, 1856) (Lepidoptera: Noctuidae) caterpillars attacking eucalyptus seedlings in a nursery in the Federal District, Brazil. Nowadays, it is known that the species was, actually, *Spodoptera cosmioides* (Walker, 1858) (Silvain & Lalanne-Cassou 1997). *S. cosmioides* is a polyphagous species, which larvae feeds on a large number of cultivated and spontaneous plants, damaging several crops of economic interest (Silva et al. 1968). This species has been registered in 126 host species belonging to 40 botanical families such as Solanaceae, Fabaceae, Asteraceae, and Poaceae (Specht & Roque-Specht 2016).

In Rio Grande do Sul State, the occurrence of some insect pests were reported in eucalyptus seedlings settled at the field. *Diloboderus abderus* (Sturm, 1826) (Coleoptera: Melolonthidae) was reported

damaging the plant root collar of clonal seedlings of *E. grandis* Hill ex Maiden x *E. urophylla* S. T. Blake (Garlet et al. 2009) and *Heilipodus dorsosulcatus* (Boheman, 1843) (Coleoptera: Curculionidae) damaging the apical portion of the seedlings of *E. saligna* Smith and hybrid clones of *E. urophylla* x *E. grandis* (Garlet et al. 2011).

The present work reports, for the first time, the occurrence and damage of *S. cosmioides* larvae in field transplanted *E. urophylla* seedlings in a commercial plantation in Rio Grande do Sul State, Southern Brazil.

The attack by *S. cosmioides* larvae was verified in a one-month-old commercial plantation of *E. urophylla* (AEC 0144 clone) in Cambará garden forest (30°9'45" S; 51°59'42" W), at a parcel identified as 009A (25.4 ha), belonging to the company CMPC, at Butiá municipality, Rio Grande do Sul. Planting was performed on November 3, 2015, using a spacing of 3.0m x 2.5m, with a density of 1,334 plants/ha. A survey of the attack intensity was performed in the studied area by evaluating five randomly distributed 100-plant parcels.

The caterpillars (Fig. 1A) were collected with the aid of tweezers, packed in plastic containers with small holes, and transported to the laboratory of Universidade Federal de Santa Maria (UFSM), Santa Maria, Rio Grande do Sul, for raising and later identification. The 20 collected specimens were kept in plastic pots covered with voile, where they remained in a controlled environment (temperature of 25°C ± 1°C, air relative humidity of 70% ± 5%, and 12-hour photoperiod) until the adult emergence (Fig. 1B). The caterpillars fed only eucalyptus leaves in the laboratory and completed the life cycle until the adult phase of the insect, evidencing that the eucalyptus is a potential host for the pest.

In this area of attack, the eucalyptus plantation has been carried out for more than 30 years, while its surrounding areas are used for agriculture and livestock. The first attack was recorded on December 1, 2015 (Figs. 1C, 1D). The feeding was performed only with eucalyptus leaves until the pupal stage. The species was identified as *S. cosmioides* by a specialist in the area. The voucher specimens are deposited in the collection of the Forest Entomology Laboratory of the UFSM.

Figure 1: *Spodoptera cosmioides*: (A) Caterpillar; (B) Adult female; (C) Larvae damaging *eucalyptus* seedlings in the field. (D) Sprouting of seedling after the injury caused by the larvae.

In addition to *S. cosmioides* (Santos et al. 1980; Specht & Roque-Specht 2016), several species of *Spodoptera* such as *S. albula* (Walker, 1857) (Montezano et al. 2013), *S. eridania* (Stoll, 1781) (Montezano et al. 2014), *S. frugiperda* (J.E. Smith, 1797) (Montezano et al. 2018) and *S. ornithogalli* (Guenée, 1852) (Brito et al. 2019) have already been found in nurseries. The present study stands out by reporting and characterizing the damages caused by the species *S. cosmioides*, which occurs in transplanted seedlings of *E. urophylla* in the field. 80% of the *E. urophylla* seedlings transplanted in the field (i.e. 400 plants) presented injuries. The results indicate that there was a high infestation of *S. cosmioides* in the *E. urophylla* plantation, with up to three individuals per plant.

The fact that this caterpillar is polyphagous and feeds on several hosts, and that the area planted in nearby agricultural areas may have attracted the adults of *S. cosmioides* to oviposit in the eucalyptus plantation. As a consequence, after the eclosion, the larvae damaged the plants. It was observed that the larvae of *S. cosmioides* caused defoliation at the border or inside of leaves of eucalyptus plants. Defoliation occurred on both new and old leaves (Figs. 1C, 1D).

The severity of damage was estimated by the percentage of defoliation of each plant. In 500 evaluated plants, the average severity was 13% defoliation, with maximum defoliation rate reaching 24%. According to Tang et al. (2006), the defoliation causes water loss around the injury, decreasing the foliar photosynthetic area even more, besides reducing the foliar area for performing the photosynthesis and reducing the accumulation of photoassimilates.

The reduction in the foliar area by caterpillars may compromise the seedling settling and development soon after planting, especially for species as *S. cosmioides* that presents great potential for defoliation (Santos et al. 2010). *S. cosmioides* has a high capacity for leaf consumption. In a study comparing the potential leaf consumption between different Lepidoptera pests in soy crops, *S. cosmioides* consumed twice the leaf area consumed by *Anticarsia gemmatilis* Hübner, 1818, *Pseudoplusia includens* (Walker, 1857), *S. eridania* or *S. frugiperda* (Lepidoptera: Noctuidae) (Bueno et al. 2011).

Given the defoliation capacity and the population density of *S. cosmioides*, the occurrence of this species in *E. urophylla* is a new and relevant fact for eucalyptus cultivation in Rio Grande do Sul State and in Brazil. Concerning the high infestation mentioned, the reproductive capacity of the species stands out, in which females of *S. cosmioides*, under ideal laboratory conditions, can generate more than five thousand larvae, resulting in an estimated biotic potential of about five sextillions individuals/female/year (Specht & Roque-Specht 2019). It is possible to obtain from 9.6 to 11.7 annual insect generations in ideal temperature ranges, between 25°C e 28°C (Bavaresco et al. 2002).

Thus, as a basis for implementing adequate pest management, plantation monitoring must be constant, mainly in the initial phase. *S. cosmioides* is a potential pest insect for eucalyptus crop, stressing *E. urophylla*, which was identified in the present study as host species. Hence, given the polyphagous characteristic of *S. cosmioides*, constant monitoring is advisable, as well as the performance of studies involving measures to prevent the attack of the pest. The use of chemical or mechanical weeding in eucalyptus crop areas may be used to eliminate invasive plants characterized as potential hosts of *S. cosmioides*.

There are no registered products for controlling *S. cosmioides* in the eucalyptus culture (AGROFIT 2020). Therefore, testing biological insecticides based on pathogenic fungi, such as *Beauveria bassiana* (Bals.) Vuill. and *Metharizium anisopliae* (Metsch.), as well as virus entomopathogenic *Baculovirus*, (i.e., all pathogens that act in the natural biological control of caterpillars in the complex *Spodoptera*; Teodoro et al. 2013) is recommended. Such biological insecticides meet the requirements of forest certification, which has encouraged the implementation of more sustainable techniques and decisions in the management of pests in forest plantations in Brazil (Lemes et al. 2017).

Acknowledgments

To researcher Ph.D. Clérison Régis Perini, of the Pest Integrated Management Laboratory (LabMIP) of Universidade Federal de Santa Maria, for identifying the species. To the reviewers of Entomological Communications, for their valuable contributions.

Authors' contributions

Conceptualization: Borges Júnior, N.; Costa, E. C.; Bioassays development: Machado, D. N.; Pedron, L. Writing and editing: Borges Júnior, N.; Costa, E. C.; Machado, D. N.; Pedron, L.; Boscardin, J.; Vivian, J.; Reference analysis: Borges Júnior, N.; Costa, E. C., Boscardin, J. All authors read and approved the final version.

References

- AGROFIT (2020) Sistema de Agrotóxicos Fitossanitário. Ministério da Agricultura, Pecuária e Abastecimento. http://agrofit.agricultura.gov.br/agrofit_cons/principal_agrofit_cons. Access on: 27.viii.2020.
- Altieri, M. A.; Letourneau, D. K. (1982) Vegetation management and biological control in agroecosystems. *Crop Protection*, 1(4): 405-430. doi: 10.1016/0261-2194(82)90023-0
- Bavaresco, A.; Garcia, M. S.; Grützmacher, A. D.; Foresti, J.; Ringenberg, R. (2002) Biologia e exigências térmicas de *Spodoptera cosmioides* (Walk.) (Lepidoptera: Noctuidae). *Neotropical Entomology*, 31(1): 49-54. doi: 10.1590/S1519-566X2002000100007
- Brito, R.; Specht, A.; Gonçalves, G. L.; Moreira, G. R. P.; Carneiro, E.; Santos, F. L.; Roques-Specht, V. F.; Mielke, O. H. H.; Casagrande, M. M. (2019) *Spodoptera marima*: a new synonym of *Spodoptera ornithogalli* (Lepidoptera: Noctuidae), with notes on adult morphology, host plant use and genetic variation along its geographic range. *Neotropical Entomology*, 48(3): 433-448. doi: 10.1007/s13744-018-0654-z
- Bueno, R. C. O.; Bueno, A. F.; Moscardi, F.; Parra, J. R.; Hoffmann-Campo, C. B. (2011) Lepidopteran larva consumption of soybean foliage: basis for developing multiple-species economic thresholds for pest management decisions. *Pest Management Science*, 67: 160-164. doi: 10.1002/ps.2047
- Garlet, J.; Costa, E. C.; Boscardin, J.; Deponti, G.; Shwengber, C. R.; Machado, L. M. (2013) *Leptocybe invasa* em *Eucalyptus* sp. no estado do Rio Grande do Sul, Brasil. *Ciência Rural*, 43(12): 2175-2177. doi: 10.1590/S0103-84782013001200009
- Garlet, J.; Costa, E. C.; Magistrali, I. C.; Boscardin, J.; Borges Junior, N. (2011) First report of *Heilipodus dorsosulcatus* (Boheman, 1843) (Coleoptera: Curculionidae) in a plantation of *Eucalyptus* L'Héritier in Brazil. *The Coleopterists Bulletin*, 65(3): 243-245. doi: 10.1649/072.065.0306

- Garlet, J.; Zauza, E. A. V.; Ferreira, F.; Salvadori, J. R. (2009) Danos provocados por coró-das-pastagens em plantas de eucalipto. *Ciência Rural*, 39(2): 575-576. doi: [10.1590/S0103-84782008005000079](https://doi.org/10.1590/S0103-84782008005000079)
- IBÁ (2009) Indústria Brasileira de Árvores - Relatório 2019. <https://iba.org/datafiles/publicacoes/relatorios/iba-relatorioanual2019.pdf>. Access on: 18.viii.2020.
- Kowalczyk, M.; Carneiro, E.; Casagrande, M. M.; Mielke, O. H. H. (2012) The Lepidoptera associated with forestry crop species in Brazil: a historical approach. *Neotropical Entomology*, 41(5): 345-354. doi: [10.1007/s13744-012-0056-6](https://doi.org/10.1007/s13744-012-0056-6)
- Lemes, P. G.; Zanuncio, J. C.; Serrão, J. E.; Lawson, S. A. (2017) Forest Stewardship Council (FSC) pesticide policy and integrated pest management in certified tropical plantations. *Environmental Science and Pollution Research*, 24: 1283-1295. doi: [10.1007/s11356-016-7729-3](https://doi.org/10.1007/s11356-016-7729-3)
- Montezano, D. G.; Specht, A.; Bortolin, T. M.; Fronza, E.; Sosa-Gómez, D. R.; Roque-Specht, V. F.; Pezzi, P. P.; Luz, P. C.; Barros, N. M. (2013) Immature stages of *Spodoptera albula* (Walker) (Lepidoptera: Noctuidae): Developmental parameters and host plants. *Anais da Academia Brasileira de Ciências*, 85(1): 271-284. doi: [10.1590/S0001-37652013000100013](https://doi.org/10.1590/S0001-37652013000100013)
- Montezano, D. G.; Specht, A.; Sosa-Gómez, D. R.; Roque-Specht, V. F.; Barros, N. M. (2014) Immature stages of the armyworm, *Spodoptera eridania*: developmental parameters and host plants. *Journal of Insect Science*, 14(238): 1-11. doi: [10.1093/jisesa/ieu100](https://doi.org/10.1093/jisesa/ieu100). PMID:25373148
- Montezano, D.G.; Specht, A.; Sosa-Gomez, D. R.; Roque-Specht, V. F.; Sousa-Silva, J. C.; Paula-Moraes, S. V.; Peterson, J. A.; Hunt, T. E. (2018) Host plants of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas. *African Entomology*, 26(2): 286-300. doi: [10.4001/003.026.0286](https://doi.org/10.4001/003.026.0286)
- Pereira, J. M. M.; Zanuncio, T. V.; Zanuncio, J. C.; Pallini, A. (2001) Lepidoptera pests collected in *Eucalyptus urophylla* (Myrtaceae) plantations during five years in Três Marias, State of Minas Gerais, Brazil. *Revista de Biologia Tropical*, 49(3-4): 1073-1082.
- Santos, G. P.; Cosenza, G. W.; Albino, J. C. (1980) Biologia de *Spodoptera latifascia* (Walker, 1856) (Lepidoptera: Noctuidae) sobre folhas de eucalipto. *Revista Brasileira de Entomologia*, 24(2): 153-155.
- Santos, K. B.; Meneguim, A. M.; Santos, W. S.; Neves, P. M. O. J.; Santos, R. B. (2010) Caracterização dos danos de *Spodoptera eridania* (Cramer) e *Spodoptera cosmioidea* (Walker) (Lepidoptera: Noctuidae) a estruturas de algodoeiro. *Neotropical Entomology*, 39(4): 626-631. doi: [10.1590/S1519-566X2010000400025](https://doi.org/10.1590/S1519-566X2010000400025)
- Silva, A. G. A.; Gonçalves, C. R.; Galvão, D. M.; Gonçalves, A. J. L.; Gomes, J.; Silva, M. N.; Simoni, L. (1968) Quarto catálogo dos insetos que vivem nas plantas do Brasil, seus parasitos e predadores. Rio de Janeiro, Ministério da Agricultura, Tomo 1, Parte II. 622 p.
- Silvain, J. F.; Lalanne-Cassou, B. (1997) Distinction entre *Spodoptera latifascia* (Walker) et *Spodoptera cosmioidea* (Walker), bona species (Lepidoptera: Noctuidae). *Revue Française d'Entomologie*, 19(3-4): 95-97.
- Specht, A.; Roque-Specht, V. F. (2016) Immature stages of *Spodoptera cosmioidea* (Lepidoptera: Noctuidae): developmental parameters and host plants. *Zoologia*, 33(4): 1-10. doi: [10.1590/S1984-4689zool-20160053](https://doi.org/10.1590/S1984-4689zool-20160053)
- Specht, A.; Roque-Specht, V. F. (2019) Biotic potential and reproductive parameters of *Spodoptera cosmioidea* (Walker) (Lepidoptera: Noctuidae) in the laboratory. *Brazilian Journal of Biology*, 79(3): 488-494. doi: [10.1590/1519-6984.184595](https://doi.org/10.1590/1519-6984.184595)
- Tang, J. Y.; Zielinski, R. E.; Zanger, A. R.; Crofts, A. R.; Berenbaum, M. R.; Delucia, E. H. (2006) The differential effects of herbivory by first and fourth instars of *Trichoplusia ni* (Lepidoptera: Noctuidae) on photosynthesis in *Arabidopsis thaliana*. *Journal of Experimental Botany*, 57(3): 527-536. doi: [10.1093/jxb/erj032](https://doi.org/10.1093/jxb/erj032)
- Teodoro, A. V.; Procópio, S. O.; Bueno, A. F.; Negrisoni Junior, A. S.; Carvalho, H. W. L.; Negrisoni, C. R. C. B.; Brito, L. F.; Guzzo, E. C. (2013) *Spodoptera cosmioidea* (Walker) e *Spodoptera eridania* (Cramer) (Lepidoptera: Noctuidae): novas pragas de cultivos da Região Nordeste. Comunicado Técnico No 131. Aracaju, SE: Embrapa Tabuleiros Costeiros.
- Zanuncio, J. C.; Lemes, P. G.; Santos, G. P.; Soares, M. A.; Wilcken, C. F.; Serrão, J. E. (2014) Population dynamics of Lepidoptera pests in *Eucalyptus urophylla* plantations in the Brazilian Amazonia. *Forests*, 5(1): 72-87. doi: [10.3390/f5010072](https://doi.org/10.3390/f5010072)
- Zanuncio, J. C.; Torres, J. B.; Sedyama, C. A. Z.; Pereira, F. F.; Pastori, P. L.; Wermelinger, E. D.; Ramalho, F. S. (2009) Mortality of the defoliator *Euselasia eucerus* (Lepidoptera: Riodinidae) by biotic factors in an *Eucalyptus urophylla* plantation in Minas Gerais State, Brazil. *Anais da Academia Brasileira de Ciências*, 81(1): 61-66. doi: [10.1590/S0001-37652009000100008](https://doi.org/10.1590/S0001-37652009000100008)