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# First report of *Hypsipyla grandella* (Lepidoptera: Pyralidae) on African mahogany *Khaya ivorensis*

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ABSTRACT: The mahogany shoot borer *Hypsipyla grandella* Zeller is an important economic pest in all American tropical forests, because it prevents monoculture of valuable timber trees species like mahogany and cedar. The shoot borer damages several tree structures, especially the apical shoots, impairing the formation of the commercial stem. This pest can attack the plants during the year and one larva per plant is enough to cause significant damage. In infested areas, the attack can reach up to 100 % of the trees. The Australian cedar and African mahogany have been cultivated in Brazil for timber production, because they are considered resistant to *H. grandella* (Lepidoptera: Pyralidae) attack. However, in this work we report for the first time the *H. grandella* attack to African mahogany *Khaya ivorensis*.
Keywords: Meliaceae, mahogany shoot borer, resistance, forest pest

## Introduction

The forest species of Meliaceae family, native to Tropical America, is largely explored due to the high commercial value of its timber. In Brazil, there are six genera and about 100 species, highlighting *Carapa*, *Cedrela* and *Swietenia*. However, mahogany monoculture, along with other American Meliaceae, is impaired due to mahogany shoot borer *Hypsipyla grandella* (Zeller) attack (Lunz et al., 2009; Paul and Weber, 2013). This shoot borer is a Lepidopteran that co-evolved with some Meliaceae species. It attacks preferably *Swietenia*, *Cedrela* and *Carapa* (Navarro and Hernández, 2004).

Mahogany shoot borer occurs in South America (except Chile), Central America and South Florida and it follows the Meliaceae distribution pattern of which they feed (Griffiths, 2001; Horak, 2000). This borer may attack several plant structures and its main damage involves the perforation of young branches, especially the apical shoot, causing tree bifurcation, significantly reducing the economic value of the timber. This results in the reduction of plant growth and timber production (Newton et al., 1993, 1999). The attacks are frequent since the initial phases of plant development, when the plants are more susceptible to infestation (Ennion, 2003). Attacks can reach 70 % of the plants in the first 12 months after planting and up to 100 % at 24 months (Paul and Weber, 2013). This prevents the monoculture establishment of native Meliaceae.

The monoculture of exotic species like *Khaya* spp. and *Toona ciliata* M. Roem in Brazil poses as an alternative to native Meliaceae for being resistant to *H. grandella* (Lunz et al., 2009; Perez et al., 2010), due to absence of co-evolution of these species (Agostinho et al., 1994). It is estimated that there are 400 producers that cultivate about 15 thousand hectares of *Khaya ivorensis* A. Chev., in the states of Minas Gerais, Pará, Mato Grosso, Goiás and Paraná. African Mahogany has been on the market in the United States of America for a long time, but its use dramatically increased after 2003 when *Swietenia macrophylla* King was listed in CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). Currently, *K. invorensis* is the species of the African mahogany most important in the international market (Stephens, 2010). Then, this work aimed to report the *H. grandella* attack to African mahogany *Khaya ivorensis*.

## Materials and Methods

In June 2015, apical shoots of *Khaya ivorensis* were detected with holes, feces and exudations, characteristic of mahogany shoot borer, on a commercial crop of 25 ha, in Patos de Minas, Minas Gerais state, Brazil (18°34′44″ S, 46°31′05″ W, 824 m above sea level). The plants were 3 years old and 3 % of them were attacked. The region is under the Cerrado domain and has plain relief. The predominant soil is the Oxisol. The climate is tropical with dry season. The average annual temperature is 22.8 °C and average annual rainfall is 1445 mm.

Five branches were taken to Lavras (21°13′36″ S, 44°58′27″ W, 927 m above sea level), Minas Gerais State, for analysis. The apical shoots collected had 3-10 cm in diameter with 24 borer holes. The branches were kept in cages until pupae formation.

## Results and Discussion

Six pupae were formed, four which were female, with two presenting atrophied wings. *H. grandella* larvae feed on leaves of *Khaya senegalensis* (Desr.) A. Juss. in laboratory conditions, but the adults emerge with abnormal wings and affected reproductive performance (Perez et al., 2010). The taxonomist Victor O. Becker (Uiraçu Institute, Camacan, BA) identified the adults as *Hypsipyla*

*grandella* using Heinrich illustrations (Heinrich, 1956) and by comparison with species voucher of Becker Collection. This is the first report of *H. grandella* attacking *K. ivorensis* in Brazil.

In spite of the incentives for planting exotic species of Meliaceae as an escape strategy to *H. grandella* attack, in order to meet the high demand for hardwood, this report puts on alert all producers of these crops. This pest is present in the field throughout the year (Taveras et al., 2004) and is a constant threat in the first years after planting (Wightman, 2008) when the plants are more susceptible (Ennion, 2003). Once the plantation is invaded by insects, almost all trees are damaged (Paul and Weber, 2013), and the damage threshold corresponds to one caterpillar per plant (Hilje and Cornelius, 2001). Brazil has the largest natural reserve of tropical native mahogany (*Swietenia macrophylla*), which is the main host of *H. grandella*. Thus, the shoot borer is present in almost all regions where *Khaya* sp. and *Toona ciliata* are cultivated.

Few control strategies have been studied; however, no efficient control measures for mahogany shoot borer have been achieved (Lunz et al., 2009). Studies have pointed out that some culture practices may reduce the damages such as pruning the affected branches and lateral shading (Hilje and Cornelius, 2001; Opuni-Frimpong et al., 2008); mosaic planting with other arboreal species such as *Cassia siamea* Lam., *Eucalyptus* spp. (Hilje and Cornelius, 2001) and other shrubby crop species (Paul and Weber, 2013); avoidance of shallow soils, with high acidity and deficient drainage (Hilje and Cornelius, 2001).

Several natural enemies of *H. grandella* have been registered (Grijpma, 1972, 1973; Hilje and Cornelius, 2001; Nickle, 1981; Pinto et al., 2014; Taveras et al., 2004; Zaché et al., 2013). Nevertheless, these natural enemies cannot control effectively the populations of *H. grandella* in monocultures (Hilje and Cornelius, 2001; Taveras et al., 2004).

Very likely, the increase in the selection pressure, exerted by extensive resistant monocultures may contribute to the reduction of resistance of *Khaya ivorensis* by *H. grandella*, because this pest has the ability to attack this plant. This fact has been reported in *Hypsipyla robusta* attacking the American mahogany *Switenia macrophyla* cultivated in Africa and Australia (Newton et al., 1993; Cunningham et al., 2005), *Diabrotica virgifera virgifera* LeConte migrating from corn to soybean (Meloche and Hermans, 2004), and *Euschistus heros* migrating from soybean to cotton (Azambuja et al., 2013). Further research must be encouraged concerning monitoring, pest control techniques, selection of new resistant materials and resistance management strategies, such as the use of structured refuge with susceptible materials.

## References

Agostinho, S.M.; Silva, M.F.G.F.; Fernandes, J.B.; Vieira, P.C.; Pinheiro, A.L.; Vilelas, E.F. 1994. Limonoids from Toona data and speculations on their chemosystematic and ecological significance. Biochemical Systematics and Ecology 22: 323-328.

Azambuja, R.; Degrande, P.E.; Pereira, F.F. 2013. Comparative biology of *Euschistus heros* (F.) (Hemiptera: Pentatomidae) feeding on cotton and soybean reproductive structures. Neotropical Entomology 42: 359-365.

Cunningham, S.A.; Floyd, R.B.; Griffiths, M.W.; Wylie, F.R. 2005. Patterns of host use by the shoot-borer *Hypsipyla robusta* (Pyralidae: Lepidoptera) comparing five Meliaceae tree species in Asia and Australia. Forest Ecology and Management 205: 351-357.

Ennion, R.C. 2003. Evaluation of four Taungya permanent big-leaf mahogany plots, aged 36 to 38 years, in Belize. p. 362-374. In: Lugo, A.E.; Colón, J.C.F.; Alayón, M., eds. Big-leaf mahogany: genetics, ecology, and management. Springer, New York, NY, USA.

Griffiths, M.V. 2001. The Biology and ecology of hypsipyla shoot borers. p. 74-80. In: Floyd, R.B.; Hauxwell, C., eds. Hypsipyla shoot borers in Meliaceae. ACIAR, Canberra, Australia.

Grijpma, P. 1972. Studies on shoot borer *Hypsipyla grandella* (Zeller) (Lep, Pyralidae). Observations on egg parasite *Trichogramma semifumatum* (Perkins) (Hym-Trichogrammatidae). Turrialba 22: 398-402.

Grijpma, P. 1973. Studies on shoot borer *Hypsipyla grandella* (Zeller) (Lep, Pyralidae): records of 2 parasites new to Costa-Rica. Turrialba 23: 235-236.

Heinrich, C. 1956. American moths of the subfamily Phycitinae. Bulletin of the United States National Museum 207: 1-581.

Hilje, L.; Cornelius, J. 2001. *Hypsipyla grandella* is uncontrollable as forest pest? = ¿Es inmanejable Hypsipyla grandella como plaga forestal? Manejo Integrado de Plagas 61: 1-4. Available at: http://www.sidalc.net/REPDOC/A2133E/A2133E.PDF [Accessed Sept 10, 2015] (in Spanish).

Horak, M. 2000. Taxonomy of *Hypsipyla* shootborers pests of mahogany red cedar an relatives. Australian National Insect Collect 16: 4-6.

Lunz, A.M.; Thomazini, M.J.; Moraes, M.C.B.; Neves, E.J.M.; Batista, T.F.C.; Degenhardt, J.; Souza, L.A.; Ohashi, O.S. 2009. *Hypsipyla grandella* in Mahogany (*Swietenia macrophyla*): current situation and perpesctives. Pesquisa Florestal Brasileira 59: 45-55 (in Portuguese, with abstract in English).

Meloche, F.; Hermans, P. 2004. Eastward expansion and discovery of the soybean biotype of western corn rootworm (*Diabrotica virgifera virgifera* LeConte) in Canada. Canadian Journal of Plant Science 84: 305-309.

Navarro, C.; Hernández, G. 2004. Progeny test analysis and population differentiation of mesoamerican mahogany (*Swietenia macrophylla*). Agronomía Costarricense 28: 37-51.

Newton, A.C.; Baker, P.; Ramnarine, C.; Mesrn, J.F.; Leakey, R.R.B. 1993. The mahogany shoot borer: prospects for control. Forest Ecology and Management 57: 301-328.

Newton, A.C.; Watt, A.D.; Lopez, F.; Cornelius, J.P.; Mesén, J.F.; Corea, E.A. 1999. Genetic variation in host susceptibility to attack by the mahogany shoot borer, *Hypsipyla grandella* (Zeller). Agricultural and Forest Entomology 1: 11-18.

Nickle, W.R. 1981. Mermithid parasites of agricultural pest insects. Journal of Nematology 13: 262-266.

Opuni-Frimpong, E.; Karnosky, D.F.; Storer, A.J.; Cobbinah, J.R. 2008. Silvicultural systems for plantation mahogany in Africa: influences of canopy shade on tree growth and pest damage. Forest Ecology and Management 255: 328-333.

Paul, C.; Weber, M. 2013. Intercropping *Cedrela odorata* with shrubby crop species to reduce infestation with *Hypsipyla grandella* and improve the quality of timber. International Scholarly Research Notices Forestry 2013: 1-10.

Perez, J.; Eigenbrode, S.D.; Hilje, L.; Tripepi, R.R.; Aguilar, M.E.; Mesen, F. 2010. Use of grafiting to prevent *Hypsipyla grandella* (Zeller) (Lepidoptera: Pyralidade) damage to new world Meliaceae especies. Neotroprical Entomology 39: 618-625.

Pinto, A.A.; Teles, B.R.; Penteado-Dias, A.M. 2014. First report of *Phanerotoma bennetti* Muesebeck (Hymenoptera, Braconidae, Cheloninae) parasitizing *Hypsipyla grandella* (Zeller) and *Hypsipyla ferrealis* Hampson (Lepidoptera, Pyralidae) in crabwood in Brazil. Brazilian Journal of Biology 74: 264-265.

Stephens, K. 2010. Mahogany: which one is the real thing? Available at: http://www.woodworkerssource.com/blog/wood-conversations/mahogany/ [Accessed Aug 10, 2016]

Taveras, R.; Hilje, L.; Hanson, P.; Mexzón, R.; Carballo, M.; Navarro, C. 2004. Population trends and damage patterns of *Hypsipyla grandella* (Lepidoptera: Pyralidae) in a mahogany stand, in Turrialba, Costa Rica. Agricultural and Forest Entomology 6: 89-98.

Wightman, K.E.; Ward, S.E.; Haggar, J.P.; Santiago, B.R.; Cornelius, J.P. 2008. Performance and genetic variation of big-leaf mahogany (*Swietenia macrophylla* King) in provenance and progeny trials in the Yucatan Peninsula of Mexico. Forest Ecology and Management 255: 346-355.

Zaché, B.; Costa, R.R.; Zanuncio, J.C.; Wilcken, C.F. 2013. *Palmistichus elaeisis* (Hymenoptera: Eulophidae) parasitizing pupae of *Hypsipyla grandella* (Lepidoptera: Pyralidae). Florida Entomologist 96: 1207-1208.