

FIRST RECORD OF A NATIVE HETEROPTERAN PREYING ON THE INTRODUCED EUCALYPTUS PEST, *THAUMASTOCORIS PEREGRINUS* (HEMIPTERA: THAUMASTOCORIDAE), IN BRAZIL

GABRIELY K. SOUZA¹, TIAGO G. PIKART¹, FILIPE C. PIKART², JOSÉ EDUARDO SERRÃO³, CARLOS F. WILCKEN³
AND JOSÉ C. ZANUNCIO¹

¹Departamento de Entomologia, Universidade Federal de Viçosa, 36570-000 Viçosa, Minas Gerais State, Brazil

²Centro de Ciências Agroveterinárias, Universidade do Estado de Santa Catarina, 88520-000 Lages, Santa Catarina State, Brazil

³Departamento de Biologia Geral, Universidade Federal de Viçosa, 36570-000 Viçosa, nas Minas Gerais State, Brazil

⁴Departamento de Produção Vegetal, Faculdade de Ciências Agrônômicas, Universidade Estadual Paulista, 18603-970 Botucatu, São Paulo State, Brazil

The bronze bug, *Thaumastocoris peregrinus* Carpintero & Dellape, 2006 (Hemiptera: Thaumastocoridae), is a threat to commercial plantations of *Eucalyptus* (Myrtales: Myrtaceae) in Argentina, Australia, Brazil, Chile, Kenya, South Africa, Uruguay and Zimbabwe (Carpintero & Dellape 2006; Martínez & Bianchi 2010; Nadel et al. 2010; Noack et al. 2011). *Thaumastocoris peregrinus* is a typically gregarious sucking insect with nymphs and adults of different generations overlapping throughout the year (Noack & Rose 2007; Wilcken et al. 2010). Adults are about 3 mm long, with a flattened light brown body (Noack et al. 2011). Females lay about 60 black eggs usually in clusters on leaves, branches and at the base of host plant trunks (Jacobs & Nesar 2005; Noack & Rose 2007).

The high reproductive capacity of *T. peregrinus* facilitates rapid colonization and infestation. The pest initially causes silvering of the leaves, which subsequently shift to brown and red coloration, and this makes the trees look bronzed (Jacobs & Nesar 2005). These canopy coloration changes allow identification of the presence of *T. peregrinus* before leaf drop and plant death occurs.

The mechanism that induces plant death is not known, but the symptoms of feeding by nymphs and adults of *T. peregrinus* on eucalyptus leaves are similar to those of *Cardiaspina* psyllids (Hemiptera: Psyllidae) (Woodburn & Lewis 1973; Crawford & Wilkens 1996). The psyllids insert their stylets through the apertures of stomata to reach food supply causing cell degeneration of the mesophyll tissue that resembles the process of leaf senescence (Crawford & Wilkens 1996).

The use of the systemic insecticide imidacloprid injected into the trunk has been shown effective to control *T. peregrinus* in field tests (Noack et al. 2009), but chemical control in forest plantations is questionable due to potentially adverse environmental impacts and high costs (Zanuncio et al. 1994). Thus, biological control, such as the introduction or enhancement of populations of

predators, parasitoids and pathogens, is important (Silva 2000). Pest control with natural enemies is growing in popularity; and heteropteran predators are important agents of biological control in integrated pest management programs (Molina-Rugama et al. 1997; Lemos et al. 2003).

Here, we report the occurrence of the predatory stinkbug, *Supputius cincticeps* Stal, 1860 (Hemiptera: Pentatomidae), nymphs feeding on *T. peregrinus* nymphs and adults in Lages, Santa Catarina State, Brazil. Nymphs and eggs of *S. cincticeps*, and nymphs and adults of *T. peregrinus* were found on *Eucalyptus viminalis* Labill (Myrtales: Myrtaceae) trees at the Centro de Ciências Agroveterinárias of the Universidade do Estado de Santa Catarina (CAV-UDESC) (Fig. 1) in the urban perimeter of Lages, Santa Catarina State, Brazil (27°47'S, 50°18'W) in January and February 2011. There were high densities of eggs, nymphs and adults of *T. peregrinus* on the eucalypts. The infested trees exhibited silver colored leaves (Fig. 1), but defoliation was not high. Damage by *Gonipterus scutellatus* Gyllenhal, 1833 (Coleoptera: Curculionidae) weevils to *E. viminalis* leaves was also observed (Fig. 2), indicating the coexistence of the bronze bug with other eucalyptus pests, causing multifaceted and potentially more severe damage.

Adults of *T. peregrinus* were collected, stored in 70% alcohol and observed under stereomicroscope to confirm species identification (Carpintero & Dellape 2006). Second and fourth instars *S. cincticeps* were collected and kept individually in Petri dishes (diam 9.0 × 1.2 cm) with nymphs of *T. peregrinus ad libitum* during 4 d for feeding behavior observation. Petri dishes were observed during five minutes at intervals of 60 min from 9 AM to 6 PM, and the number of *T. peregrinus* nymphs predated was counted. Subsequently the *S. cincticeps* nymphs were brought to the Laboratory of Biological Control of Insects (LCBI) of the Universidade Federal de Viçosa (UFV) where they were fed on pupae of *Tenebrio molitor* L.



Fig. 1. *Supputius cincticeps* on *Eucalyptus viminalis* leaf (shown at the center point). The leaf presents characteristic symptoms (silvering) of feeding by *Thaumastocoris peregrinus*. A nymph of egg clusters of *Thaumastocoris peregrinus* are shown by the white and black arrows, respectively.

(Coleoptera: Tenebrionidae) to obtain adults for taxonomic identification. Some of the predator nymphs were maintained with *T. peregrinus* nymphs *ad libitum* as their sole food source to ascertain if they could complete the life cycle feeding on this prey. The average consumption of *T. peregrinus* nymphs per *S. cincticeps* nymph was 10.26 ± 1.58 per day. Third instar larvae of the predator *Chrysoperla externa* (Hagen, 1861) (Neuroptera: Chrysopidae) showed a similar capacity, consuming 10.43 ± 0.51 *T. peregrinus* nymphs per day in laboratory (Barbosa et al. 2010). Predatory stink-



Fig. 2. *Eucalyptus viminalis* leaves showing damage caused by *Gonipterus scutellatus* (white arrows) and *Thaumastocoris peregrinus* (bronzed aspect of the leaves). An egg cluster of *T. peregrinus* is located at the tip of the black arrow.

bug, such as *Podisus* spp. and *S. cincticeps*, usually attack/kill more prey at higher prey densities than are needed to supply their food requirements (De Clercq & Degheele 1994, Vivan et al. 2002). This behavior tends to enable the predator to find the prey more easily (Holling 1966); and the gregariousness of *T. peregrinus* may facilitate the foraging behavior of *S. cincticeps*. Moreover, we observed that *S. cincticeps* reached the adult stage when it fed only on *T. peregrinus* nymphs, which suggests a potential novel host shift that could reduce populations of this prey.

Thaumastocoris peregrinus was first reported as a pest in 2002 on eucalypts in urban areas of Sydney, Australia (Noack & Rose 2007). In subsequent years, this pest spread to other countries, including Brazil, where it has been detected in Rio Grande do Sul, São Paulo, Minas Gerais, Espírito Santo, Rio de Janeiro, Mato Grosso do Sul and Paraná States (Wilcken et al. 2010), and in the western region of Santa Catarina (Savaris et al. 2011). Lages is located in the center of a major forest hub, and is a connection point between the Federal Highway BR-116, that connects Santa Catarina State to neighboring states Rio Grande do Sul and Paraná, with the Federal Highway BR-282 that crosses this state. This connection of federal highways supports the hypothesis that the transport of timber and eucalypt seedlings along these highways is a major mode of spread of *T. peregrinus* (Wilcken et al. 2010). Furthermore, it illustrates the vulnerability of South America to exotic pests, and the need to invest in plant health checks and quarantine, especially at ports and airports (Wilcken et al. 2010).

Thaumastocoris peregrinus was recently introduced into Brazil, and there are no effective strategies for its control in commercial plantations. The wasp, *Cleruchooides noackae* Lin & Huber, 2007 (Hymenoptera: Mymaridae), has been observed parasitizing eggs of the bronze bug in Australia (Lin et al. 2007) and the systemic insecticide imidacloprid was tested on trees in urban areas to control this pest (Noack et al. 2009). *Supputius cincticeps* is a generalist predator that naturally controls defoliating insects in *Eucalyptus* plantations in Brazil (Zanuncio et al. 1993, 1994). Moreover, this predator is easily reared in the laboratory and has potential for biological control programs (Zanuncio et al. 2004, 2005). Thus, additional studies on the biology, mass rearing and handling, and predation of *S. cincticeps* on *T. peregrinus*, both in the laboratory and field, should be undertaken with the goal of using this natural enemy in biological control programs of the bronze bug.

SUMMARY

Thaumastocoris peregrinus (Hemiptera: Thaumastocoridae) is a threat to commercial

plantations of *Eucalyptus* species in South Africa, Argentina, Australia, Brazil, Chile, Kenya, Uruguay and Zimbabwe, and there are no effective strategies for its control. We report here for the first time, the occurrence of the predatory stink bug *Supputius cincticeps* (Hemiptera: Pentatomidae) nymphs feeding on *T. peregrinus* nymphs and adults. *Supputius cincticeps* is a native generalist predator that is easily reared in the laboratory and may be utilized as a biological control agent. Thus, studies on the biology and predatory capacity of *S. cincticeps* on *T. peregrinus* should be conducted to use this natural enemy in biological control programs targeting *T. peregrinus*.

Key Words: eucalyptus, biological control, Heteroptera, *Supputius cincticeps*

RESUMO

Thaumastocoris peregrinus (Hemiptera: Thaumastocoridae) é uma ameaça a plantios comerciais de *Eucalyptus* na África do Sul, Argentina, Austrália, Brasil, Chile, Quênia, Uruguai e Zimbábue e não existem estratégias efetivas para o controle desse inseto. Este trabalho registra, pela primeira vez, a ocorrência de ninfas do percevejo predador *Supputius cincticeps* (Hemiptera: Pentatomidae) predando ninfas e adultos de *T. peregrinus*. *Supputius cincticeps* é um predador generalista nativo facilmente criado em laboratório e pode ser utilizado como um agente de controle biológico. Dessa forma, estudos como a biologia e a capacidade predatória de *S. cincticeps* em *T. peregrinus* devem ser desenvolvidos visando à utilização desse inimigo natural em programas de controle biológico de *T. peregrinus*.

Palavras-chave: eucalipto, controle biológico, Heteroptera, *Supputius cincticeps*

ACKNOWLEDGMENTS

We express heartfelt thanks to "Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)", "Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)" and "Fundação de Amparo à pesquisa do Estado de Minas Gerais (FAPEMIG)" for financial support. We thank Asia Science for English editing and correction of this manuscript.

REFERENCES CITED

- BARBOSA, L. R., SANTOS, F., BARDDAL, H. P. O., MACHADO, B. O., WILCKEN, C. F., AND SOLIMAN, E. P. 2010. Predação de *Thaumastocoris peregrinus* por *Chrysoperla externa*. EMBRAPA FLORESTAS, Colombo, Paraná. Comun. Técn. No. 257.
- CARPINTERO, D. L., AND DELLAPÉ, P. M. 2006. A new species of *Thaumastocoris* Kirkaldy from Argentina (Heteroptera: Thaumastocoridae: Thaumastocorinae). Zootaxa 1228: 61-68.
- CRAWFORD, S. A., AND WILKENS, S. 1996. Ultrastructural aspects of damage to leaves of *Eucalyptus camaldulensis* by the psyllid *Cardiaspina retator*. Micron 27: 359-366.
- DE CLERCQ, P., AND DEGHEELE, D. 1994. Laboratory measurement of predation by *Podisus maculiventris* and *Podisus sagitta* (Heteroptera: Pentatomidae) on beet armyworm (Lepidoptera: Noctuidae). J. Econ. Entomol. 87: 76-83.
- HOLLING, C. S. 1966. The functional response of invertebrate predators to prey density. Mem. Entomol. Soc. Canada 48: 5-86.
- JACOBS, D. H., AND NESER, S. 2005. *Thaumastocoris australicus* Kirkaldy (Heteroptera: Thaumastocoridae): a new insect arrival in South Africa, damaging to Eucalyptus trees. South African J. Sci. 101: 233-236.
- LEMOES, W. P., RAMALHO, F. S., SERRÃO, J. E., AND ZANUNCIO, J. C. 2003. Effects of diet on development of *Podisus nigrispinus* (Dallas) (Het., Pentatomidae), a predator of the cotton leafworm. J. Appl. Entomol. 127: 389-395.
- LIN, N. Q., HUBER, J. T., AND LASALLE, J. 2007. The Australian genera of Myrmaridae (Hymenoptera: Chalcidoidea). Zootaxa 1596: 1-111.
- MARTÍNEZ, G., AND BIANCHI, M. 2010. Primer registro para Uruguay de la chinche del eucalipto, *Thaumastocoris peregrinus* Carpintero y Dellapé, 2006 (Heteroptera: Thaumastocoridae). Agrociencia 14: 15-18.
- MOLINA-RUGAMA, A. J., ZANUNCIO, J. C., TORRES, J. B., AND ZANUNCIO, T. V. 1997. Longevidad y fecundidad de *Podisus nigrispinus* (Heteroptera: Pentatomidae) alimentado con *Musca domestica* (Diptera: Muscidae) y frijol. Rev. Biol. Trop. 45: 1125-1130.
- NADEL, R. L., SLIPPERS, B., SCHOLES, M. C., LAWSON, S. A., NOACK, A. E., WILCKEN, C. F., BOUVET, J. P., AND WINGFIELD, M. J. 2010. DNA bar-coding reveals source and patterns of *Thaumastocoris peregrinus* invasions in South Africa and South America. Biol. Invas. 12: 1067-1077.
- NOACK, A. E., AND ROSE, H. A. 2007. Life-history of *Thaumastocoris peregrinus* and *Thaumastocoris* sp. in the laboratory with some observations on behaviour. Gen. Appl. Entomol. 36: 27-33.
- NOACK, A. E., KAAPRO, J., BARTIMOTE-AUFFLICK, K., MANSFIELD, S., AND ROSE, H. A. 2009. Efficacy of Imidacloprid in the control of *Thaumastocoris peregrinus* on *Eucalyptus scoparia* in Sydney, Australia. Arboric. Urban For. 35: 192-196.
- NOACK, A. E., CASSIS, G., AND ROSE, H. A. 2011. Systematic revision of *Thaumastocoris* Kirkaldy (Hemiptera: Heteroptera: Thaumastocoridae). Zootaxa 3121: 1-60.
- SAVARIS, M., LAMPERT, S., PEREIRA, P. R. V. S., AND SALVADORI, J. R. 2011. Primeiro registro de *Thaumastocoris peregrinus* para o estado de Santa Catarina, e novas áreas de ocorrência para o Rio Grande do Sul, Brasil. Cienc. Rural 41: 1874-1876.
- SILVA, C. A. D. 2000. Microorganismos entomopatogênicos associados a insetos e ácaros do algodoeiro. EMBRAPA-CNPQ, Campina Grande, Paraíba. Doc. No. 77.
- VIVAN, L. M., TORRES, J. B., VEIGA, A. F. S. L., AND ZANUNCIO, J. C. 2002. Comportamento de predação e conversão alimentar de *Podisus nigrispinus* sobre a traça-do-tomateiro. Pesq. Agropec. Bras. 37: 581-587.
- WILCKEN, C. F., SOLIMAN, E. P., NOGUEIRA DE SÁ, L. A., BARBOSA, L. R., DIAS, T. K. R., FERREIRA FILHO, P. J., AND OLIVEIRA, R. J. R. 2010. Bronze bug *Thaumastocoris peregrinus* Carpintero & Dellapé (Hemiptera:

- Thaumastocoridae) on *Eucalyptus* in Brazil and its distribution. J. Plant Prot. Res. 50: 184-188.
- WOODBURN, T. L., AND LEWIS, E. E. 1973. A comparative histological study of the effects of feeding by nymphs of four psyllid species on the leaves of eucalypts. J. Aust. Entomol. Soc. 12: 134-138.
- ZANUNCIO, J. C., NASCIMENTO, E. C., GARCIA, J. F., AND ZANUNCIO, T. V. 1994. Major lepidopterous defoliators of eucalyptus, in the Southeast Brazil. Forest Ecol. Manag. 65: 53-63.
- ZANUNCIO, J. C., LACERDA, M. C., ZANUNCIO JR., J. S., ZANUNCIO, T. V., SILVA, A. M. C., AND ESPINDULA, M. C. 2004. Fertility table and rate of population growth of the predator *Supputius cincticeps* (Heteroptera: Pentatomidae) on one plant of *Eucalyptus cloeziana* in the field. Ann. Appl. Biol. 144: 357-361.
- ZANUNCIO, J. C., BESERRA, E. B., MOLINA-RUGAMA, A. J., ZANUNCIO, T. V., PINON, T. B. M., AND MAFFIA, V. P. 2005. Reproduction and longevity of *Supputius cincticeps* (Het.: Pentatomidae) fed with larvae of *Zophobas confusa*, *Tenebrio molitor* (Col.: Tenebrionidae) or *Musca domestica* (Dip.: Muscidae). Braz. Arch. Biol. Techn. 48: 771-777.
- ZANUNCIO, T. V., ZANUNCIO, J. C., NASCIMENTO, E. C., AND VILELA, E. F. 1993. Descrição das ninfas do predador *Supputius cincticeps* Stål (Heteroptera: Pentatomidae). An. Soc. Entomol. Bras. 22: 221-229.