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Short Communication

First record of *Atherigona reversura* Villeneuve (Diptera: Muscidae) feeding on Bermudagrass (*Cynodon dactylon* cv. Jiggs, Poaceae) in Brazil: morphological and molecular tools for identification

Leandro do Prado Ribeiro[a], Alexandre Carlos Menezes Netto[b], Felipe Jochims[a], Kirstern Lica Follman Haseyama[c], Claudio J.B. de Carvalho[d,*]

[a] *Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina, Centro de Pesquisa para Agricultura Familiar, Chapecó, SC, Brazil*
[b] *Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina, Estação Experimental de Videira, Videira, SC, Brazil*
[c] *Universidade Federal de Minas Gerais, Departamento de Zoologia, Belo Horizonte, MG, Brazil*
[d] *Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, PR, Brazil*

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ABSTRACT

Bermudagrass (*Cynodon dactylon* cv. Jiggs) is an important food source for dairy cattle in the semi-intensive milk production systems most often used in southern Brazil. Although many insect pests are associated with feed grasses, we report here the first occurrence of the fly *Atherigona* (*Atherigona*) *reversura* Villeneuve, 1936 (Diptera: Muscidae) feeding on bermudagrass in Brazil. This potential pest was observed in April 2015 in three localities (Abelardo Luz, Palmitos, and Videira) in western Santa Catarina, in southern Brazil. The infested plants had senescent and necrotic terminal leaves that reduced plant growth. New growth had to sprout new tillers from basal nodes, which resulted in a reduced plant growth rate. We also provide a morphological identification key (with figures) for *A.* (*Atherigona*) *reversura* and *A.* (*Acritochaeta*) *orientalis* Schiner, 1868. A molecular identification based on COI is also provided to better differentiate species.

Dairy farming has increased recently in Brazil due to changing market demands (Muniz et al., 2013). Southern Brazil is among the most important milk producing regions and has the greatest increase in production (Síntese Anual da Agricultura de Santa Catarina 2014–2015). Although cattle diets are often supplemented (especially with corn silage and hay), most farmers use pastures as the main source of feed. Thus, management of cultivated pasture is important to ensure constant forage supply and to maintain high levels of productivity while keeping costs low.

In tropical and subtropical regions, *Cynodon* grasses (bermudagrass) are very productive (over 20 t ha^{-1}), adaptable to regional soil conditions, pest and disease tolerant, and therefore of great forage potential (Oliveira et al., 2000; Rodrigues et al., 2006b). During the last 20 years, bermudagrass became the most important pasture grass for milk production in southern Brazil, used in more than 80% of milk farms (Fernandes, 2012). To date, few insect pests, including spittlebugs (Hemiptera: Cercopidae) (Lohmann et al., 2010; Chiaradia et al., 2013), caterpillars (Lepidoptera: Noctuidae) (Assunção-Albuquerque et al., 2010), and grass bug (Hemiptera: Miridae) (Chiaradia and Poletto, 2012) were problems for perennial grasses in southern Brazil.

We report, for the first time in Brazil, herbivory and damage by *Atherigona* (*Atherigona*) *reversura* Villeneuve, 1936 (Insecta, Diptera: Muscidae) on bermudagrass *Cynodon dactylon* cv. Jiggs. This is also the first record of the species in South America. *Atherigona* (*Atherigona*) *reversura* larvae were found infesting bermudagrass in April 2015 in three localities: Abelardo Luz (26°39′22″ S; 52°12′17″ W), Palmitos (27°7′56″ S; 53°6′9″ W), and Videira (27°1′23″ S; 51°11′53″ W) in the western region of the state of Santa Catarina in southern Brazil. These larvae caused the death of apical leaves of infected tillers by feeding apically starting at the terminal node and which damages vascular tissue (Fig. 1). Once larvae begin feeding, senescence and necrosis of the upper part of tillers occurs, mostly due to the death of the two newest leaves. Feeding this way causes a reduction in plant growth because regrowth must begin through new tillers originating at basal nodes, or the apical node prior to the damage. Thus, feeding by the fly larvae causes a reduction in establishment into new areas as well as biomass production in areas already established.

* Corresponding author.
E-mail: cjbcarva@ufpr.br (C.J.B. de Carvalho).

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Fig. 1. (A) *Cynodon dactylon* cv. Jiggs showing plant damage. *Atherigona* (*Atherigona*) *reversura*: (B) larvae; (C) puparium; (D) adult. Scale bars = 1 mm.

Known elsewhere as the bermudagrass stem maggot (BSM), *A.* (*Atherigona*) *reversura* was first discovered in the New World in southern USA state of Georgia in July 2010 where it was infesting bermudagrass hayfields, pastures and turf and is now found throughout the southeastern United States (Grzywacz et al., 2013). Although the extent of damage varies among cultivars (Ikeda et al., 1991), BSM causes an average decrease of ~8% in total dry biomass of bermudagrass cultivars in the USA (Baxter et al., 2014). Thus, due to this potential problem, *A.* (*Atherigona*) *reversura* should be monitored to assess its establishment and behavior as a potential pest of pastures in Brazil. Additional study is also necessary to quantify damage by the fly larvae to bermudagrass quality and yield, to develop integrated management.

In the laboratory, under controlled conditions (26 ± 2 °C, RH: 70 ± 10% and photoperiod: 14L:10D hours), larvae were reared and the resulting adults were identified as *A.* (*Atherigona*) *reversura* using the revision of Pont and Magpayo (1995). Adrian C. Pont (Oxford University Museum of Natural History – UMO) also confirmed the species identification by figures and photographs we sent to him. Voucher specimens were deposited at the Coleção Entomológica da Epagri/Cepaf, in Chapecó, and in the Coleção Entomológica Pe. Jesus Santiago Moure, in the Department of Zoology of the Universidade Federal do Paraná, Curitiba (DZUP).

We also used molecular data to confirm identity and to provide another tool to aid in the identification of this pest. Thus, we provide a partial COI sequence of *A.* (*A.*) *reversura* and compared it to *Atherigona* sequences available at GenBank (Table 1). Our objective in comparing the sequences was to use additional evidence that the species we were dealing was not any other with known sequences. We also intended to verify if COI data was enough to differentiate *Atherigona* (*Atherigona*) *reversura* from other species of the genus, especially *Atherigona* (*Acritochaeta*) *orientalis*. We highlight this analysis is not an inference of the phylogenetic relationships of the genus, which is very speciose. We also examined the *Atherigona* (*Acritochaeta*) *orientalis* voucher that provided the sequence KP161673 to verify its identity. We amplified the COI gene using Folmer et al. (1994) primers (LCO-1490f and HCO-2198r), the region chosen by DNA Barcoding project as the standard

Table 1
List of *Atherigona* species used in this study with GenBank number.

Species	GenBank number
Atherigona (*Atherigona*) *nigritibiella* Fan & Liu, 1982	EU627708
Atherigona (*Acritochaeta*) *orientalis* Schiner, 1868	EU627707
Atherigona (*Acritochaeta*) *orientalis* Schiner, 1868	KP161673
Atherigona (*Atherigona*) *oryzae* Malloch, 1925	KP161674
Atherigona (*Atherigona*) *reversura* Villeneuve, 1936	KT906365
Atherigona (*Atherigona*) *seticauda* Malloch, 1926	KJ510607
Atherigona (*Atherigona*) *theodori* Hennig, 1963	KJ510608
Atherigona (*Atherigona*) *varia* (Meigen, 1826)	KJ510609
Cyrtoneuropsis veniseta (Stein, 1904)	KJ510614
Cyrtoneuropsis veniseta (Stein, 1904)	KP161656