

Article

Alternance of overpopulation of urban insect pests in areas of Cerrado in the north of Minas Gerais, Brazil

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Abstract

In the present study, we report for the first time the alternance of insect overpopulation pests in urban environment for the north of Minas Gerais, Brazil. The observations were made from November 2017 to November 2018 in the city of Montes Claros and six other towns. During the period of one-year the overpopulation of three species was recorded: *Tropidacris collaris* (Orthoptera: Romaleidae), *Gryllus assimilis* (Orthoptera: Gryllidae) and *Arthrostictus speciosus* (Drury, 1829) (Coleoptera: Carabidae). Considerations about the factors leading to overpopulation of these species in urban areas are also presented.

Keywords biological control; habitat modification; phytophagous pests; urbanization.

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1 Introduction

Insects can increase their abundance in a relatively short time interval, which can trigger a phenomenon of overpopulation (Dhang, 2014). The sudden increase in number of individuals within populations can result that some insect species become pests in urban environments, causing major economic and public health problems (Dhang, 2014; Robinson, 1996). Grasshoppers and other herbivorous pests can cause serious economic problems by consuming crops and ornamental plants (Lockwood and Lockwood, 2008).

Several cities in the North region of Minas Gerais, Brazil, have experienced, in recent years, many episodes of insect overpopulation, which could be classified as urban pests. In the present study, we report for the first time the alternance of insect overpopulation for the north of Minas Gerais. This region is situated in a transition area between two large Brazilian biomes, the Cerrado and the Caatinga, having a climate characterized by a strongly seasonal rainfall regime, type aw of Köppen (Espírito-Santo et al., 2009).

2 Study Area and Methodology

We report the overpopulation event which occurred at the municipality of Montes Claros (16°44'06"S, 43°51'43"W) and six other municipalities (Bocaiúva, Janaúba, Janaúria, Jequitaí, Mirabela, and Pirapora) occurring within a radius of at most 200 km from Montes Claros. The climate of region is hot and dry (classified as of Köppen), characterized by well-defined rainy periods and with an average temperature of 23°C and average annual precipitation of 1,000 mm. The observations were made from November 2017 to November 2018. Photographic records were obtained at different localities and some insects were collected by active sampling and brought to the Laboratory of Zoology of the Universidade Estadual de Montes Claros for specific identification and biometric measurement.

3 Results and Discussion

During the period of one-year the overpopulations of three species were recorded: *Tropidacris collaris* (Stoll, 1813) (Orthoptera: Romaleidae), *Gryllus assimilis* (FABRICIUS, 1775) (Orthoptera: Gryllidae) and *Arthrostictus speciosus* (Drury, 1829) (Coleoptera: Carabidae) (Fig. 1). In total were collected 42 specimens of *T. collaris* which had an average body size of 68.56 mm \pm 6.05 mm (mean \pm SD). We also analyzed 10 specimens of *G. assimilis*, which measures approximately 25 mm of body length, and nine specimens of *A. speciosus*, with approximately 20 mm of body length.

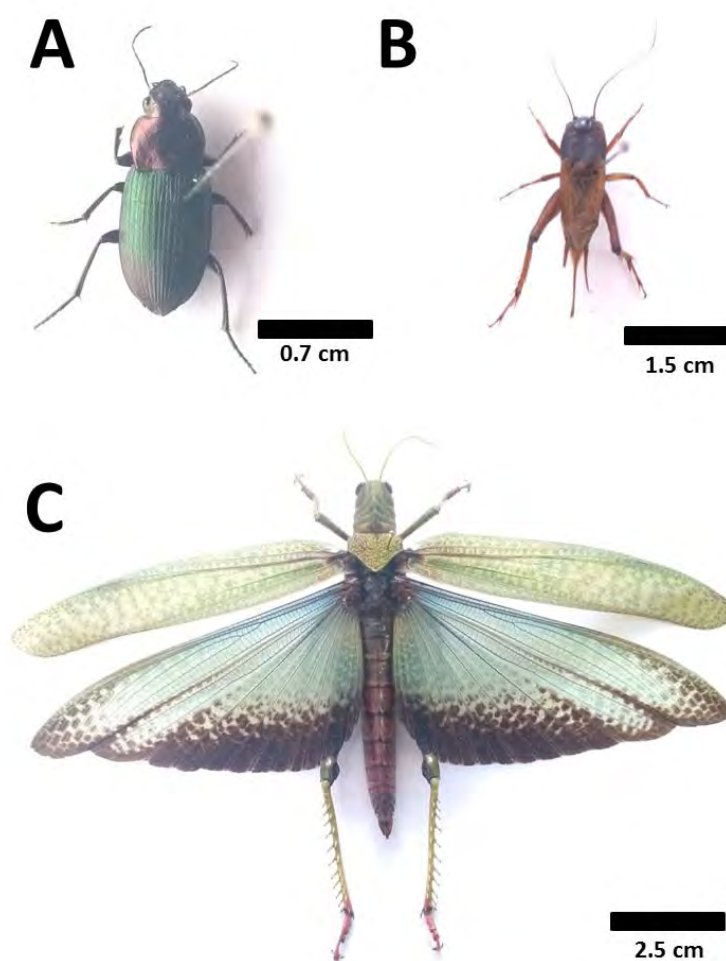


Fig. 1 Pest insect species recorded in urban environments in the North of Minas Gerais, Brazil: *Arthrostictus speciosus* (Drury, 1829) (Coleoptera: Carabidae) (A), *Gryllus assimilis* (Fabricius, 1775) (Orthoptera: Gryllidae) (B), and *Tropidacris collaris* (Stoll, 1813) (Orthoptera: Romaleidae) (C). Source: Araújo (2018).

The species *T. collaris* is a large South American grasshopper; it is common in both forests and dry areas of South America from Colombia to Argentina (Carbonell, 1986). Previous reports have recorded the species as a pest in parts of northern Argentina (Pelizza et al., 2012). The *G. assimilis*, commonly known as field cricket, occurs West Indies and parts of the southern United States, Mexico, and South America. Crickets of this species are considered pests in vegetable (Melo et al., 1980). Already *A. speciosus* is a species of distribution in the New World and it usually occur in dark and humid places, can sometimes become pests (Magalhães et al., 2015). All species have been previously reported for the region of Montes Claros.

The grasshopper *T. collaris* had its peak abundance between the periods of November to December of 2017 (Fig. 2A), which corresponds to the period of higher incidence of rainfall in the region. The black cricket *G. assimilis* was more abundant at the end of the rainy season, between the months of April and May of 2018 (Fig. 2B). The highest abundance of the beetle *A. speciosus* occurred between the months of October and November of 2018, which corresponds to the beginning of the rainy season, with a peak density of 1.000 individuals/m² in some localities (Fig. 2C).



Fig. 2 Couple of grasshoppers (*Tropidacris collaris*) in an area close to city of Jequitaiá (A), specimens of black cricket (*Gryllus assimilis*) invading homes in the city of Montes Claros (B), and infestation of beetles (*Arthrostictus speciosus*) in the city of Januária (C). Source: (A) Araújo (2018), (B) Martins (2018), and (C) Oliveira (2018).

The overpopulation events reported above are responsible for an increasing nuisance to the human population within the affected area. Grasshoppers and black crickets, for example, were reported eating ornamental plants and other vegetables on the studied localities. We must also mention the inconvenient invasion of homes and other buildings, especially at night, when these species are attracted by the artificial light from the residences. The beetles, in addition of being home intruders, also have a relevant medical importance, because when they feel threatened or disturbed they release an acid through their pygidial glands (Habermehl, 1981), which can cause irritation and even some skin burn.

The causes responsible for the overpopulations of these insects still need to be better clarified, but they must be related to the high reproductive potential of the species, favorable climatic conditions such as the rainy season, increase in primary production from October to May, proximity to areas of natural vegetation and reduction of natural enemies. As females of these species are able to place a fairly large amount of eggs, the combination of favorable climatic factors, such as high temperatures and a concentrated rainfall regime (seasonal climate), can be pivotal factors for the overpopulation of the species mentioned above (Price et al., 2011; Speight et al., 2008).

In addition, the cities at the North of Minas Gerais are surrounded by natural or semi-natural vegetation of the Cerrado and Caatinga savannas (Espírito-Santo et al., 2009), so that the high rates of reproduction on natural or semi-natural areas, associated to the high primary production during the rainy season are crucial for maintaining large native populations which can invade the neighboring urban environments. The suppression of natural vegetation and the use of pesticides can also lead to insect migration from rural to urban areas (Robinson, 1996). Additionally, most of the potential predators of these insects, such as birds, lizards and frogs, are known to be susceptible to anthropization (Dirzo et al., 2014); therefore, we expect a low efficiency of natural predators in controlling these pest insects within urban environments (Karp et al., 2013).

4 Conclusions

This is the first systematic report of the alternation of overpopulations for these insects in the region, although there are informal reports of the occurrence of similar phenomena in the recent past (1990s and 2000s). This phenomenon can be explained by natural causes, such as climatic factors that lead to insect proliferation, as well as the proximity of urban areas to wild areas. On the other hand, it is not possible to rule out the possibility of anthropogenic factors potentiating the occurrence of these overpopulations, for example, the suppression of natural vegetation and the use of pesticides, which can lead insects to migrate to urban areas, and also the reduction of natural predators of these insects, which tend to be rare in cities.

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