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BIOLOGY

Fungus gnats (Diptera: Sciaridae) damage the desert rose (*Adenium obesum* Forssk. Roem. & Schult) crop in Jataí – Goiás, Brazil

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ABSTRACT: Recent rise in desert rose production, the expanded cultivation of this species may promote infestation by certain insects and mites. One such insect, the fungus gnats (*Bradysia* sp), also known as fungus flies, have been damaging numerous ornamental plant species. This study reported the incidence of fungus gnats infesting desert rose plants in the municipality of Jataí - GO, Brazil. Throughout 2022, we evaluated 48 desert rose plants for parasitic occurrences through direct observation. Sticky traps were used to record adult insects. Damage to plant organs has been documented and the presence of parasites at various stages of development with digital photographs. The incidence of fungal gnats is confirmed by observing adult insects and larvae in the plant substrate and roots. Of the 48 plants evaluated, 39 showed signs of infestation. Symptoms of a fungus gnat attack on desert rose include small necrotic lesions on new roots, progressive root rot, and a withered caudex resembling dehydration. The fungus gnats attack can cause the desert rose caudex to wilt, reducing its size and losing part of its shape, fact that can compromise the commercialization of this crop.
Key words: *Bradysia* sp, fungus fly, ornamental plants.

Fungus gnats (Diptera: Sciaridae) causam danos na cultura da rosa do deserto (*Adenium obesum* Forssk. Roem. & Schult) em Jataí – Goiás, Brasil

RESUMO: Com o recente aumento na produção de rosas do deserto, o cultivo expandido desta espécie pode promover a infestação por certos insetos e ácaros. Um desses insetos, os mosquitos do fungo (*Bradysia*sp), também conhecidos como moscas do fungo, têm danificado inúmeras espécies de plantas ornamentais. Este estudo tem como objetivo relatar a incidência de mosquitos e fungos infestando roseiras do deserto no município de Jataí - GO, Brasil. Ao longo de 2022, avaliamos 48 plantas de rosa do deserto quanto a ocorrências parasitárias por meio de observação direta. Armadilhas adesivas foram usadas para registrar insetos adultos. Danos aos órgãos das plantas foram documentados e a presença de parasitas em vários estágios de desenvolvimento com fotografias digitais. Confirma-se a incidência de mosquitos fúngicos observando insetos adultos e larvas no substrato vegetal e nas raízes. Das 48 plantas avaliadas, 39 apresentaram sinais de infestação. Os sintomas de um ataque de mosquito fungo na rosa do deserto incluem pequenas lesões necróticas em novas raízes, podridão radicular progressiva e um caudex murcho semelhante a desidratação. O ataque dos mosquitos do fungo pode causar o murchamento do caudex da rosa do deserto, reduzindo seu tamanho e perdendo parte de sua forma, fato que pode comprometer a comercialização desta cultura.
Palavras-chave: *Bradysia* sp, mosca-dos-fungos, planta ornamental.

The desert rosebelongs to the succulent plant species of the Apocynaceae family. It originated from South Africa and the Arabian Peninsula and has since been introduced and naturalized in various parts of the globe (SANTOS et al., 2020). This shrub species, capable of growing up to 5 meters in height, thrives in arid regions. It is known for its vibrant flowers that exhibit a range of colors (ANACLETO & BUENO, 2021). Its unique thick caudex and root system allows for the accumulation of water and nutrients, ensuring its survival in harsh, arid conditions (SANTOS et al., 2015). The desert rose is widely utilized for ornamental purposes across the world, mainly due to its low maintenance, drought resistance, and eye-catching flowers that possess unique shapes and colors (SANTOS et al., 2020). In Brazil, the desert rose has been steadily gaining prominence within the production chain, with an increasing demand from florists and landscapers who value its ornamental appeal for both indoor and outdoor decoration (VARELLA et al., 2015).

However, the introduction of the desert rose in various countries has led to new records of parasitic infestations, such as those caused by

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caterpillars, mealybugs, and aphids (MILLER et al., 2014). Specifically, in Brazil, infestations from mealybugs like *Hemiberlesia rapax* Comstock (Hemiptera: Diaspididae) and *Parasaissetia nigra* (Hemiptera: Coccidae) have been reported in this crop (TIAGO NETO et al., 2017). Nevertheless, reports of parasite attacks on the desert rose in Brazil are minimal, indicating a potential need for additional investigations with this specific focus. Caterpillars, mealybugs, and aphids are known pests that inflict damage on a variety of ornamental plant species (MURUGESAN et al., 2024). Additionally, the fungus gnats are reported to cause significant harm, leading to substantial economic losses (BROADLEY et al., 2018). They are regarded as the primary pest within greenhouse production systems due to their direct and indirect effects (DUARTE et al., 2022).

The fungus gnat, also referred to as the fungus fly, falls under the Class Insecta, Order Diptera, Family Sciaridae, and Genus *Bradysia* (CLOYD, 2015). It boasts a wide geographical distribution, predominately appearing in humid, shaded environments (LEITE et al., 2007). The species *Bradysia matogrossensis* (Lane) is the most commonly identified species in Brazil (CASTILHO et al., 2009). The life cycle of fungus gnats includes four stages: egg, larva (across four instars), pupa, and adult. The adults colonize the soil, where the females lay between 100 and 200 eggs in damp substrate over approximately a 7-day lifespan. With temperatures around 23 °C, the eggs hatch in about three days. The larvae develop into pupae over an average of 10 days and, about 4 days later, the adults emerge. Depending on the temperature, a new generation of fungus gnats can be produced every 17 days, with higher temperatures accelerating their development (BETHKE & DREISTADT, 2013; YE et al., 2017). Fungus gnat larvae feed on the fungi that grow in decomposing organic matter within the substrate and the roots and stems. This feeding behavior leads to both direct and indirect damage to a variety of crops. The direct damage comes from the feeding larvae, while the indirect damage stems from the adults spreading phytopathogen propagules (DUARTE et al., 2022). Additionally, they reduce the attacked root system's efficiency in water and nutrient absorption (BETHKE & DREISTADT, 2013), as the larvae inhibit the circulation of sap from the xylem and phloem of the plants by migrating into their roots (YE et al., 2017).

Fungus gnats have been causing harm to many ornamental plant species, such as violets, chrysanthemums, cyclamens, begonia, verbena, geraniums, parrot beaks, ferns, cacti, young orchids, and areca palms, among others (MEAD & FASULO, 2001). Literature lacks reports on the occurrence of this insect within desert rose cultivation. Hence, this study reported the occurrence of fungus gnats in desert rose plants grown in Jataí, Goiás, and to described the damage caused by larval activity.

The desert rose individuals (n=48) selected for this study are herbaceous, with an average height of 37.22 cm, and have been under cultivation for approximately one and a half years. They are located in an experimental area of a commercial nursery, which features a 150-micron diffuser plastic film for superior coverage and a side screen that allows for 30% light transmission (sombrite 70%). This nursery is situated in Jataí, Goiás (17º55'32'' S and 51º42'32'' W), at an altitude of 670 m. The desert rose seedlings were propagated sexually and planted in black polyethylene gourd pots with a diameter of 21 cm and a capacity of 2 L. The substrate used for planting was Ouro Negro®, a commercial substrate suitable for desert rose cultivation. The plants were watered every other day, with each plant receiving 1 liter of water.

The regional climate is of the Aw type, tropical mesothermal, which exhibits two distinct climatic seasons: a rainy season between October and April and a dry period from May to September, according to the Koppen classification. The average temperature is 23.3 °C, and the average annual rainfall is 1541 mm (GOMES et al., 2021).

Throughout 2022, leaves, stems, and roots were evaluated monthly for parasite occurrence through direct observation. Adhesive traps were employed to record adult insects. Damage to plant organs and the presence of parasites at various developmental stages were documented using a digital camera. Insects at different developmental stages were collected in 70% alcohol and photographed under a Leica® M165C stereomicroscope equipped with a Leica® DFC295 digital camera.

We reported fungus gnat individuals colonizing the soil and roots of the desert rose in both larval and adult stages (Figure 1-A-B-C). Over a 15-day period, approximately 500 adult insects were captured in the sticky traps. In the necrotic lesions, at least two insect larvae were found per lesion. No larvae were observed on healthy plants. The initial report was recorded in March 2022, which coincided with the month of highest relative humidity at 80.47% (INMET, 2022). Of the 48 plants evaluated, 81.25% displayed symptoms. During this period, the substrate retained high humidity, potentially promoting the growth of fungi in the soil's organic matter; thereby,

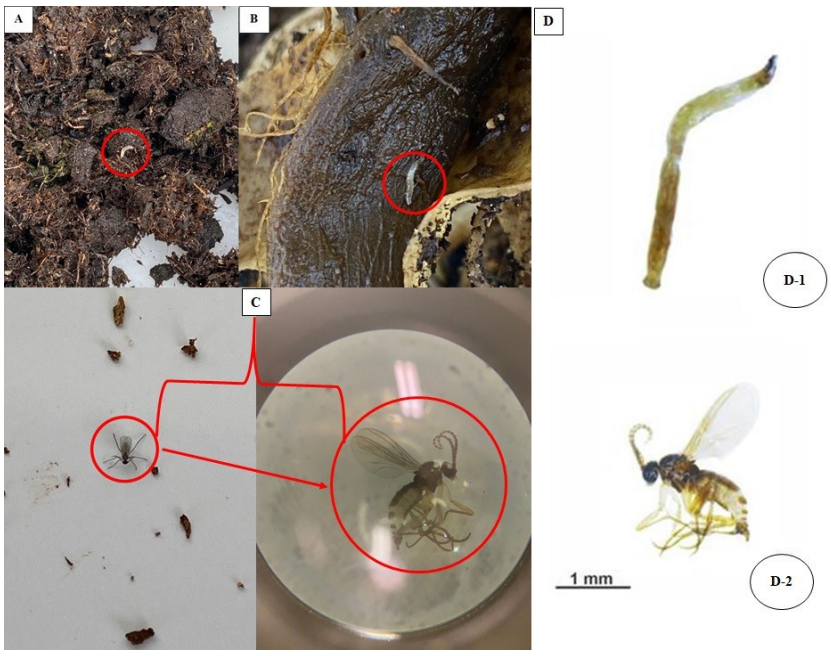

Figure 1 - Larval Stage of Fungus Gnats (Red Circle). A- General View of the Larva Occurring in the Substrate; B- Close-up View of the Larva on the Roots of the Desert Rose.C- Adult Fungus Gnat. D- Different Developmental Stages of Fungus Gnats Found Damaging Desert Rose. D-1 - Larva; D-2 - Adult.

creating a favorable environment for the development of fungus gnats.

The larvae feature a small, shiny black head along with a smooth, cylindrical, and elongated body that is white in color and semi-transparent. This transparency makes the contents of their digestive tract visible (YE et al., 2017) (Figure 1 D-1). They lack legs and, when fully developed, measure an average size of 6 mm (YE et al., 2017). Adult fungus gnats are small and delicate in appearance, resembling mosquitoes, with an approximate size of 3 mm. They have a dark brown body, thin legs, and segmented antennae longer than their heads. Their eyes are rounded and prominent, forming a bridge above the insertion point of the antennae. Their wings range in color from light gray to darker shades and feature ribs marked in a Y shape (YE et al., 2017) (Figure 1 D-2). They are often found around plants and near the substrate surface. Compared to a housefly, their flight is slower and covers shorter distances (MENZEL et al., 2020).

The initial symptoms of a fungus gnat infestation were the emergence of necrotic lesions on new roots (Figure 2A and B), which progressed to the region of the caudex (Figure 2 C). In more advanced stages, this necrosis extended to the vascular system (Figure 2B), leading to the rotting of the caudex (Figure 2D) and ultimately, the plant's death (Figure 2F). Necrotic lesions with subsequent progression occurred in 69.24% of the symptomatic plants. This can be attributed to the fungus gnat larvae, present in the substrate, which feed on the plant's roots. This feeding behavior allows for an entry point for fungi and bacteria, leading to diseases such as *Pythium*, *Botrytis*, *Verticillium*, and *Fusarium*, which are primarily responsible for plant death (CLOYD, 2015). The fungus gnat attack can trigger the wilting of the caudex of the desert rose, causing a reduction in its size and a loss of its distinctive shape. This symptom was present in 30.76% of the attacked plants (Figure 2F). In the cultivation of the desert rose, a well-developed and exuberant caudex is one of the most sought-after characteristics by the consumer market (COLOMBO et al., 2018). The reduction in size and loss of its unique shape can potentially compromise the marketability of this crop.

This wilting may be associated with the larvae's migration into the roots, inhibiting or reducing the circulation of sap in the plant's xylem and phloem (YE et al., 2017). Thus, a fungus gnat

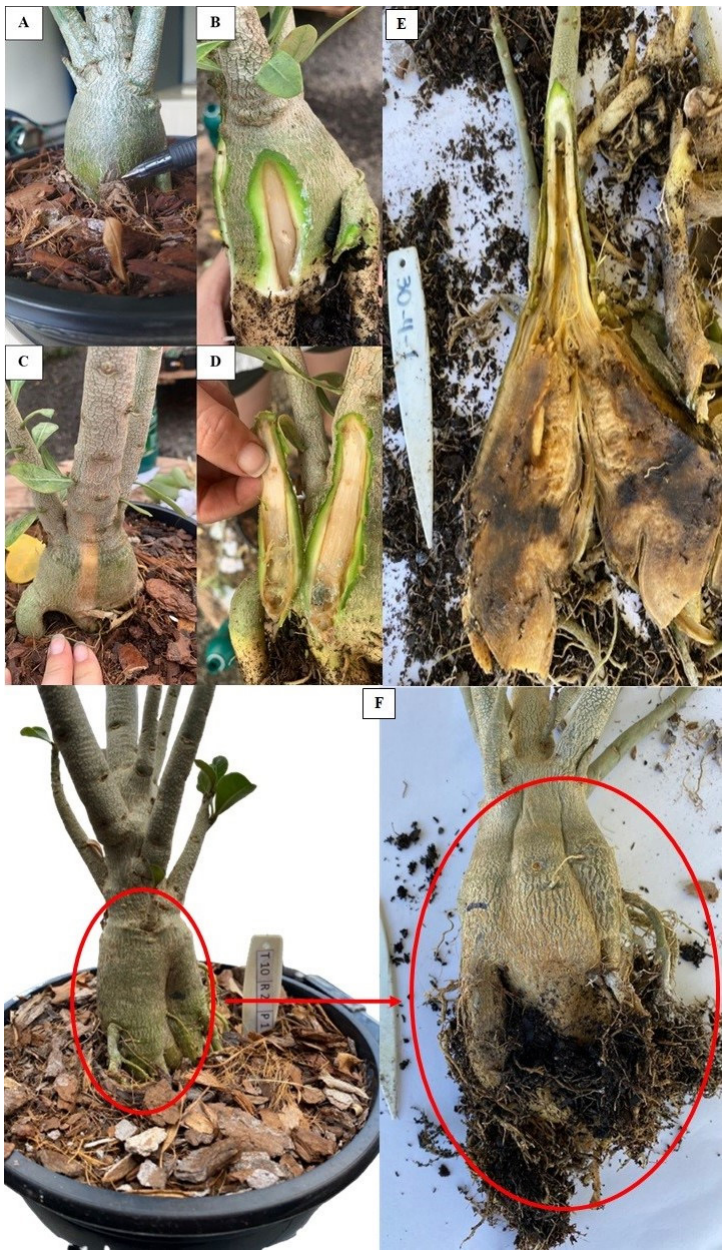

Figure 2 - Symptoms of Fungus Gnat Attack on Desert Rose. A- Damaged Young Roots; B- Necrosis of the Vascular System; C- Progression of Lesion Along the Caudex; D- Progression to Rot and Plant Death. E- Necrosed Desert Rose Seedlings Following Fungus Gnat Attack. F- Desert Rose Seedlings with Dehydration Symptoms Caused by Fungus Gnat Attack.

infestation in the desert rose can result in significant economic damage and disrupt the commercial production of seedlings, since the presence of this insect damages the plant's caudex, making it unfit for commercialization.

This study is the first to report the infestation of fungus gnats in desert rose cultivation, resulting in severe symptoms. These include small necrotic lesions on new roots, progressive root rot, and a withered caudex resembling dehydration. The fungus

gnats attack can cause the desert rose caudex to wilt, reducing its size and losing part of its shape, fact that can compromise the commercialization of this crop.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

All authors contributed equally to the conception and writing of the manuscript. All authors critically revised the manuscript and approved the final version.

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