

***The allergic reaction caused by the bite of the Brazilian ant
Dinoponera quadricaps***
*A reação alérgica causada pela picada da formiga brasileira Dinoponera
quadricaps*

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Abstract: Ants are insects with a high potential to cause injuries in humans. In this study, we documented the first case report resulting from a sting by the *Dinoponera quadricaps* ant in Brazil. *Dinoponera quadricaps* stings can result in a range of injuries, including pain at the sting site and systemic symptoms such as fever, tremors, and cardiac arrhythmias. In this particular case, a 22-year-old man experienced swelling, redness, and a loss of tactile sensitivity at the sting site, followed by systemic symptoms such as edema, skin rashes, and shortness of breath. Medical treatment with antihistamines and corticosteroids led to a significant improvement. This case highlights the medical significance of the queenless ant *D. quadricaps*.

Keywords: Neotropical, hymenopteran, *brejo de altitude*, tropical medicine

Resumo: As formigas são insetos com alto potencial para causar lesões em humanos. Neste estudo, documentamos o primeiro relato de caso resultante da picada da formiga *Dinoponera quadricaps* no Brasil. As picadas de *Dinoponera quadricaps* podem resultar em uma série de lesões, incluindo dor no local da picada e sintomas sistêmicos, como febre, tremores e arritmias cardíacas. Neste caso em particular, um homem de 22 anos experimentou inchaço, vermelhidão e perda de sensibilidade tátil no local da picada, seguido de sintomas sistêmicos, como edema, erupções cutâneas e falta de ar. O tratamento médico com antihistamínicos e corticosteroides levou a uma melhora significativa. Este caso destaca a importância médica da formiga sem rainha *D. quadricaps*.

Palavras chaves: Neotropical, himenóptero, *brejo de altitude*, medicina tropical.

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INTRODUCTION

Ants are insects belonging to the family Formicidae Latreille, 1809, considered one of the most common groups within the order Hymenoptera (HÖLLDOBLER and EDWARD, 1990). These invertebrates are widely distributed worldwide, exhibiting high species richness and abundance (MARINHO et al., 2002; CEOLIN MARIANO, et al., 2019), and accounting for a quarter of the insect biomass in tropical ecosystems (SCHULTZ, 2000). Therefore, they are excellent examples of organisms well adapted to adverse regions and unfavourable conditions, such as urban ecosystems (BRAGANÇA and LIMA, 2010; BRASSARD et al., 2021; GUIMARÃES, et al., 2023).

In tropical regions, ants occupy various positions in the food chain (O'DONNELL et al., 2007; SOUA, et al., 2016). For example, within the ant group, the subfamily Ponerinae Lepeletier de Saint-Fargeau, 1835 is particularly notable for its distinctive characteristics, such as its relatively large size and diversified diet, which includes other ants as well as larger arthropods like millipedes, spiders, and scorpions (HÖLLDOBLER and EDWARD, 1990; ORIVEL et al., 2000; HADDAD et al., 2005; SANTOS et al., 2017; CORREIA et al., 2022). Their modified ovipositor, located at the terminal region of the abdomen, functions as a sort of tubular sting that injects venom directly into their prey, enabling a more varied diet (STEEN et al., 2005). These ants have the ability to deliver painful stings that can result in a diverse range of injuries to the victim, from the pain of the sting itself to systemic manifestations such as fever, sweating, tremors, nausea, vomiting, lymphadenopathy, and cardiac arrhythmias (HADDAD et al., 1996; COSTA et al., 2018; SHARMA e UPADHYAY et al., 2021; AGARWAL et al., 2022).

According to HADDAD et al., (2005), within the Ponerinae group, the genus *Dinoponera* Roger, 1861 encompasses ants that hold medical relevance, such as the giant ant *D. gigantea*. *Dinoponera* ants can be found in the Neotropical region and are common in various biomes in Brazil (KEMPF, 1971). For example, in the northeastern region of Brazil, the species *D. quadriceps* Kempf, 1971 (Figure 1) can be found, especially in the Caatinga and Atlantic Forest ecosystems (KEMPF, 1971; PAIVA and BRANDÃO, 1995; ARAÚJO and RODRIGUES, 2006). This ant has the ability to inject venom through its ovipositor (COLOGNA et al., 2013), allowing it to capture live prey during foraging (ARAÚJO and RODRIGUES, 2006; MEDEIROS et al., 2014; DIET, 2015). Therefore, the aim of this study is to report the first case of human injury caused by *D. quadriceps* and its implications, including the medical treatment administered.



Figure 1. *Dinoponera quadriceps* individual in a lateral view.

CASE REPORT

This study complies with the requirements of the Ethics Committee for Research with Human Subjects (CEP) of the Lauro Wanderley Hospital at the Universidade Federal da Paraíba. It is registered and approved under Ordinance No. 0172/16 and CAAE: 55981916.3.0000.5188.

The patient in this case was a 22-year-old adult male (first author) with no history of comorbidities or hypersensitivity to insect bites. During a nighttime walk (at 6:30 PM on February 4, 2023) in the Pau Ferro Forest (an Atlantic Forest enclave in a ‘brejo de altitude’ on the outskirts of the city of Areia, Paraíba, Brazil), he was stung on the thumb of his right hand by a *D. quadriceps* ant while sitting in the forest. According to the patient, immediately after the sting, he experienced significant pain at the site, and within approximately the first 10 minutes, the sting site exhibited swelling, redness, and tactile paresthesia. Within 30 minutes, the local manifestations of pain and numbness persisted. However, the initial condition

progressed to systemic symptoms, including nausea, tachycardia, mild salivation, intense headache, and generalized itching. Subsequently, rashes were observed, followed by diffuse welts all over the body, still accompanied by itching and paresthesia (Figure 2).

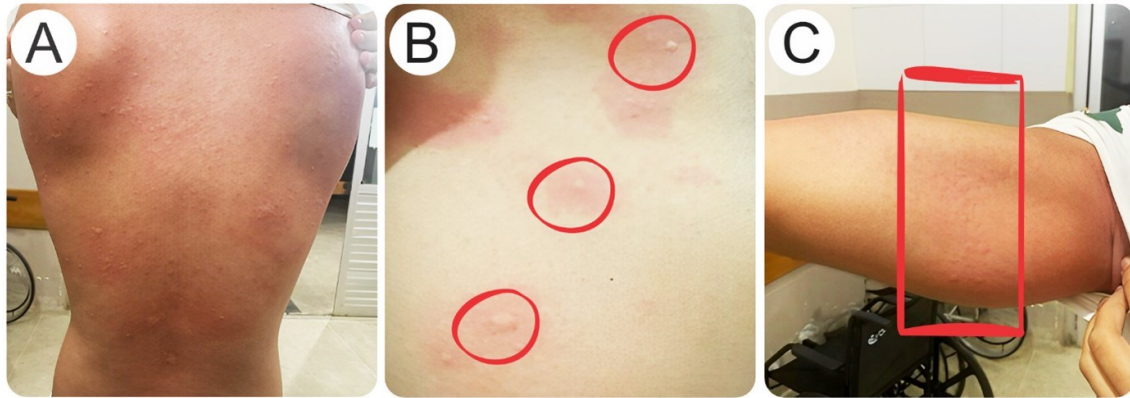


Figure 2. Rash and diffuse welts. Typical of dermal allergic reactions distributed on the victim's body.

A - back, B - abdomen, C - right arm and armpit.

One hour after the incident, there was an increase in edema, itching, and burning sensations, followed by shortness of breath. The worsening of the case led to the victim seeking hospital care. Hospital medical care was provided at the Dr. Hercilio Rodrigues Hospital in the city of Areia, Paraíba, starting at 8:07 PM. The main complaint was envenomation by hymenoptera (Formicidae) and the systemic symptoms described here. On arrival, the patient presented with a diffuse allergic reaction characterized by skin rash, erythema, and burning sensation, with a prognosis of possible anaphylactic shock following contact with *D. quadricaps*.

The patient was treated with an antihistamine (Promethazine) and corticosteroids (Dexamethasone) via intramuscular injection, with the indication for the use of adrenaline if the condition worsened, which did not occur. After the treatment of the allergic reaction, there was a significant improvement. Itching ceased, edema, skin rash, burning sensation, and shortness of breath were alleviated, and the patient was discharged from the hospital without significant systemic symptoms. Following discharge and throughout the night at his residence, the patient complained of slight burning sensations and mild hyperthermia followed by sweating. According to the patient, these symptoms gradually subsided after a warm bath. The next day, all symptoms had disappeared. However, the sting site remained sensitive to touch and pressure, persisting for 4 days.

DISCUSSION

Dinoponera quadriceps is a species of ant with venom composition rich in proteins and described by some authors as dinoponeratoxin (COLOGNA et al., 2013; CEOLIN MARIANO et al., 2019). Although the venom of this species has shown antinociceptive effects in mice, reducing the transmission of painful stimuli (SOUSA et al., 2012; MONTEIRO et al., 2022) insects like these can also potentially cause harmful effects in their prey and victims through their venom (STEEN et al., 2005).

For example, HADDAD et al., (2005) described the symptoms caused by an incident with *D. gigantea*, in which the victim initially presented with simple symptoms such as edema, erythema, and excruciating pain at the site, which progressed to systemic effects, resulting in cold sweats, nausea, vomiting, discomfort, tachycardia, and axillary lymphadenopathy. Therefore, we see that there is potential for ants to cause injuries in humans, necessitating a deeper understanding of the injury mechanisms and possible clinical interventions in case of accidents. Thus, this study reports the first diagnosis of an allergic reaction caused by the sting.

The presented symptoms resembled a strophulus, a type of allergic reaction to common insects in children but can be manifested in adults as well. Ants with potential systemic implications for human health have a global distribution (ASCUNCE et al., 2011; OLIVEIRA and PORRAS, 2021). From the same family as *Dinoponera* sp., *Paraponera* sp. have a broad record of their toxins' action, which present more severe symptoms such as deep pain, tachycardia, fever, chills, tremors, and nausea. Urticarial reactions can persist for up to 30 hours (CARDOSO et al., 2003).

Therefore, it is crucial to deepen the understanding of injury mechanisms and possible clinical interventions for new clinically relevant ants. As some species of *Dinoponera* are considered medically important ants, causing more intense clinical pain and percussion (HADDAD et al., 2005; OLIVEIRA and PORRAS, 2021), *D. quadriceps* has also shown to have implications for human health. Considering that the occasional sting caused allergic reactions requiring medical intervention with the use of antihistamines (Promethazine) and corticosteroids (Dexamethasone), this is an extremely important fact, as part of the child and adult population is allergic to the Hymenoptera group (NIEDOSZYTKO et al., 2012; VALISETTY et al., 2014). For example, occasional accidents with wasps have caused

consequences such as thrombocytopenia, a direct effect of the venom on the patient's platelets (VIKRANT et al., 2005).

CONCLUSION

In conclusion, understanding the potential harm that ants like *D. quadricaps* can cause is essential for the development of effective clinical interventions and to prevent further harm. The case of a young adult male who experienced an allergic reaction to the venom of *D. quadricaps* highlights the need for caution when interacting with these insects. As more research is conducted, we can gain a more accurate understanding of the injury mechanisms caused by these ants and develop more targeted treatments to mitigate their effects on humans. Ultimately, it is crucial to continue studying medically important insects like *D. quadricaps* to ensure the safety and well-being of humans and other living organisms.

DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

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