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USE OF EXTRACT OF *ACMELLA OLERACEA* (L.) R.K. JANSEN (ASTERACEAE) - JAMBU AS A NATURAL INSECTICIDE TO CONTROL TERMITES

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Abstract: Many plants have great insecticidal capacity due to their secondary defensive metabolism. This metabolism can act against insect herbivory, replacing artificial insecticides, which are still predominant in Brazil. With the increase in interest in organic products, natural pesticides are gaining more space among consumers, however, these products still require in-depth studies to test their efficiency. The jambu (*Acmella oleracea*) belonging to the Asteraceae family, it is a medicinal herb that owes its anesthetic properties to an antiseptic alkaloid, called spilanthol. The effectiveness of Amazonian plants as a natural insecticide or repellent against insect pests has been explored and tested, whether in the form of extracts, powders, macerates or oils. Therefore, this study aims to evaluate the efficiency of the aqueous extract of *Acmella oleracea* with spilanthol oil as a natural insecticide on termites in urban areas. The experiment was carried out in Belém, Pará, during the months of January and February 2014 with repetition in July 2020 and was carried out in termite infestations in homes in the urban area. The use of jambu extract on termites showed promise, killing 100% of Heterotermes tenuis in about 30 minutes and Nasutitermes sp. within 45 minutes after application.
Keywords: Jambu extract; pest control; social insects.

INTRODUCTION

In the Brazilian flora, in its wide biodiversity, there is a wide variety of plants that present chemical substances derived from their secondary metabolism and that play an important defensive role in the action of herbivorous insects (Isman, 2006). Secondary metabolites are compounds that can act in the defense and protection process of plant species against herbivory, repelling insect attacks due to toxic activity (Raskin et al., 2002). Some species of insects are classified as pests and are responsible for several disorders including the transmission of diseases, which increasingly demands the use of synthetic insecticides, which are still the predominant form of containment (Stefani et al., 2009).

In Brazil, the greatest use of synthetic insecticides is related to agricultural production. However, many problems can occur due to its intensive use, some examples being the presence of toxic residues in food, intoxication of rural producers and consumers, contamination of water and soil and selection of resistant pests (Menezes, 2005).

With the growing interest in organic products, pest control through the use of natural plant extracts has increased. This happens mainly due to consumer demands for the use of substances with lower risks to human health and the environment (Spletozer et al., 2021). Consequently, the demand for healthy food products free from pesticide residues follows this interest, which makes natural products, from plants, a considerable alternative.

The action and effectiveness of Amazonian plants as insecticides or natural repellents on insect pests has been explored and tested, whether in the form of extracts, powders, macerates or oils. Plant metabolites that are effective against insect species may constitute a low-cost alternative for pest control (Santos et al., 2013). Some plant families stand out as natural insecticides because they present some type of action from their essential oils that can repel or cause death of pests, such as: *Piper aduncum*, *Cymbopogon* sp., *Ocimum* sp., *Eucalyptus* sp., *Azadirachta indica*., *Bougainvillea* spp., among the most cited, as they present low risks to the environment.

Jambu (Acmella oleracea (L.) R.K. Jansen), belonging to the Asteraceae family, is a common medicinal herb in the northern

region of Brazil and an important ingredient in Pará cuisine in the preparation of "tacacá" and "pato no tucupi" and even liquor. It is a herbaceous plant, generally creeping with small leaves and yellow flowers. It is popularly known as watercress-do-Pará, cress-do-norte, jambuaçú, buttercup and watercress. The plant owes its anesthetic properties to an antiseptic alkaloid, called spilanthol, which increases salivation and causes slight numbness when its leaves are consumed.

Several biological activities are described in the literature for spilanthol, such as anesthetic, acaricide and anti-wrinkle, which is why it is highlighted in the medicine, food and cosmetics industry (Barbosa et al., 2015). In folk medicine it is used to treat toothache, throat pain and anemia. The economic interest makes jambu the most important native vegetable in the Amazon region, with the largest cultivated area (Rebello & Homma, 2005).

Termites are social insects best known for their pest aspect, both agricultural and urban, and control is generally carried out by chemical substances, being among the insects most attacked by these processes. According to Constantino (2005), there are around 280 species of termites in Brazil, of which only a small portion resist urbanization, which provides a greater number of termite species in urban pests (Constantino, 2002). Some of the problems highlighted have been the attack on homes, furniture, works of art, libraries and construction wood, as pointed out (Costa Filho & Brandão, 2009).

Despite the great threat, studies on new techniques and products for termite control are still incipient in Brazil, and it is necessary to analyze plant species that may present insecticidal action to replace conventional methods. Therefore, this study aimed to evaluate the efficiency of the aqueous extract of *Acmella oleracea* with spilanthol oil as a natural insecticide on termites in urban areas.

MATERIAL AND METHODS

Located on the banks of Guajará Bay and Guamá River, Belém is located in an equatorial zone, with a territorial area of 1,059,466 km2 and 1,303,403 inhabitants (IBGE, 2022. It has an average temperature of 26.4°, with unstable air and average air humidity of 84% (Bastos et al., 2002) Average annual rainfall is 3,000 to 4,000 mm and the city is located in the Af climate zone (Köppen classification) (Alvares et al., 2013).

The experiment was carried out in this municipality, during the months of January and February 2014, with repetition in July 2020, being carried out on termite infestations in residences in the urban area of Belém, Pará. The search for evidence of termite attack was focused on traces left, such as galleries, perforated woodwork, deposition of fecal waste. Figure 1 shows the damage of *Heterotermes tenuis* (Hagen), mainly on papers and in figure 2 you can see traces of the attack by *Nasutitermes* sp. wooden house.

Figure 1. Damage caused by Heterotermes tenuis on paper.

Source: Copyright photography

Figure 2. Traces of galleries of Nasutitermes sp. in residence

Source: Copyright photography

After confirming the attack on pieces, woodwork, furniture and paper, the extract was applied by spraying directly onto the pieces.

The extract was obtained from the maceration of leaves, stems and inflorescences of the plant immersed in distilled water and boiled for 30 minutes. Spilanthol was obtained by fractional distillation of oil from leaves, thin twigs and flower. *Acmella oleracea*, of a plantation from a small farmer in the District of Mosqueiro, Pará.

The extract was applied by spraying on parts attacked by insects. A concentration of 0.5% of the oil was tested, as an economical way and possibility of evaluating mortality.

RESULTS AND DISCUSSION

The most frequent species of termites found causing damage to homes were *Heterotermes tenuis* and *Nasutitermes* sp and in most cases they were found attacking paper and wood. After spraying, the efficiency of the oil-containing extract was positive immediately after application, with 100% insect mortality being achieved.

The use of jambu extract on termites showed to be potentially promising, as when applied to *Heterotermes tenuis* it killed 100% of the insects in around 30 minutes.

For *Nasutitermes* sp., efficacy was also 100% within 45 minutes after application (Figure 3). The efficiency of the oil at a concentration of 0.5% allows it to be used economically and rationally, revealing a future possibility in termite control.

Figure 3. Application of jambu extract to damage caused by termites.
Source: Copyright photography

A wide variety of plants with insecticidal activity can be listed based on popular knowledge, being of great importance for the search for products with biological activity. Plants from the Meliaceae, Rutaceae, Asteraceae, Annonaceae, Labiatae and Canellaceae families are considered the most promising (Jacobson, 1989).

Martinez (2002) highlights that products derived from Meliaceae show promise in controlling various pests. Martius (1998), found that the two species with the greatest repellency or toxicity for termites were papaya (Carica papaya L.) and castor bean (*Ricinus communis* L.) in addition to highlighting that plant extracts represent a good option for controlling these isopters.

Corrêa and Salgado (2011) highlighted that studies carried out in several countries confirmed that some plant oils can not only repel insects, but also have insecticidal action through direct contact or through the respiratory tract. Furthermore, some oils may have fungicidal action against some plant pathogens (Isman, 2000).

An example of an essential oil with insecticidal action is citronella oil, present in some aromatic plants, such as lemongrass (Cymbopogon citratus) and lemon eucalyptus (Eucaliptus citriodora Hook.), being used to manufacture repellents against mosquitoes and black flies. (Menezes, 2005). For Carroll (1994), citronella oil has a deleterious effect and influences the bioactivity and behavior of different arthropods, due to its toxicity.

Neem extract has also been widely used for the manufacture of botanical insecticides as they can cause the death of insects through poisoning and, sometimes, act as repellents. Studies have shown that the combination of neem's active ingredients can be a determining factor in several harmful actions to insects, such as repellency, anti-oviposition, sterility and disturbances in other metabolic processes

(Ferreira et al., 2001).

CONCLUSION

The use of jambu extract on termites showed to be potentially promising, and in view of the good results achieved, tests must continue with other species of termites and other groups of insects. Plant extracts with insecticidal activity represent an important alternative for controlling insect pests.

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