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The toxic impact of the extract of the *Dieffenbachia picta* leaves on the ratio of death in the termites' workers *Microcerotermes diversus* (silvestri) [Isoptera: Termitidae]

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ABSTRACT

Effects of the extract obtained from the *Dieffinbachia picta* leaves were examined on the termite workers of *Microcerotermes diversus* using four treatments (T) including 25%, 50%, 75% and 100% by spraying. The results showed mortality rate in the termite workers at different periods of time. $T_{100\%}$ recorded the highest mortality rates (8%, 8.67% and 9%) after 24, 48 and 72 hours respectively, while the minimum mortality in the insect workers was recorded at $T_{25\%}$ as 1.7%, 2.3% and 3.7% after 24, 48 and 72 hours respectively. According to results of the present study, there is a possible advantage of the toxic properties of *D. picta* leaves as an alternative and effective plant pesticides for combating the termite of *M. diversus*.

key words: *Microcerotermes*, Isoptera, plant toxicity, Calcium oxalate, *Dieffenbachia picta.*
Article type: Short Communication.

INTRODUCTION

Dieffenbachia plant, related to the Araceae family, is a tropical plant often found at the building entrances, offices and in companies of decoration. The plant was named by the Austrian botanist Heinrich schott to honor his head gardener Josep Dieffenbachia. *Dieffenbachia picta* is a very toxic ornamental plant that children should be kept away from (Al. Mohna 2015). However, the plant is characterized by the beauty of its leaves and its ability to withst and low levels of light and high air dryness (Croat 2004). This plant includes 56 species, among them, *Dieffenbachia picta*, spreads in central and South America. It is amonocotyledon, of herbaceous nature, an erect - thick stem, large oval-shaped leaves with long necks. Its leaves are colored with blackish green or yellowish green (Schvartsman 1992) and its flowers appear in floral buds known as spath or spadix in white arranged or a thick and short erect-axis. The female flowers place at the base of the axis, while the male are found at the top and pollinated by insects (Corazza 1988).

Since the early of the 17th century, this plant was famous by its toxicity (Onwugutu 2003; Jiri *et al.* 2005; Belssin *et al.* 2009; Oloyede 2011). The toxic properties are represented by containing the cells and tissues of this plant flowers (calcium oxalates) in needle- shape called Rhaphides that appeared at masticating some parts of this plant swelling in the mucous membrane into the mouth and tongue. It becomes red and produce severe burning in the mouth and collect large amounts of saliva and difficulty swallowing. However, eating large mass of them will lead to the loss of the ability to speak for several days, hence from this issue, their nomination by the dumb chocolate, since it was rumoured that the plant was used in the past to torture the witnesses and prevent them from speaking (Al. Mohna 2015).

The plant stems and leaves also contain aleic acids, carboxic acids, carbonilates and benzene compounds (Oloyede 2011) as well as perinoides, flavonoids, phenol, alkaloids, resins and saponin (Oloyede *et al.* 2012). They also contain tannins, lead acetate and terpenes (Alizza *et al.* 2018; Al-Hilali *et al*. 2021), so these materials were extracted from analysing the organism tissues (Markgren 2011) and according to the modern trends in the use of

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the biocontrol in killing the harmful insects, including microcerotermes in our current study. The termites is considered as one of the most important insects in economy in the tropical, subtropical and temperate regions. Given the fact that the termite's insect is defined by the special kind, i.e., *Microcerotermes diversus* (silvestri), hence it is a harmful insect in all Iraqi governorates due to the increasing economic losses caused in the old and modern buildings, field crops and fruit trees (Al-Alawy 1987). So, this study targeted using *Dieffenbachia picta* as a planticide to fight the termite instead of the chemical pesticides due to its activity in killing the insect workers because of its highly toxic compounds (N = 80) including hexane, phenols, benzene and insect-deadly carboxylic acids (Oloyede 2011).

MATERIALS AND METHODS

Gathering the plant samples 1

Dieffenbachia picta is obtained from one of the Samarra Nurseries, Iraq. They were free of any injuries. After isolating and washing with water to remove the dusts and dirties, the process of cutting them into very small parts with sharp knives was performed followed by sterile process and placing them in an electric mixer with 200 mL distilled water and mixing them well until it turned into juice. Then the samples were filtered using sterile gauze pad once and then again using filtration paper in two stages until the extract became clear, Thereafter, the samples were reserved as sterile in sealed bottles and ready to use, so this solution was considered as the stock extract (100%; Alwan 2017).

Microcerotermes diversus Gathering samples ٢

These samples were gathered from the stems and branches of trees infected by Termite from one of groves in al-Mutasam region within the area of Samarra district. These samples were placed in plastic bags and wetted with an amount of water, then transferred to the laboratory to complete the experimental stages. The 120 samples of the Termite's workers were used and divided into 4 groups, each group had 30 samples.

The termite's workers were treated with prepared concentrations where each 10 workers were placed in a plastic petri dish, 5.5 cm in diameter, containing a filter sheet. Then, these insects were treated with the extract by spraying using a plastic sprayer and from a distance of 30 cm through three repeating sprays for each concentration prepared of the following concentrations: 25%, 50% ,75% and 100%. The control samples were transformed to the petri dishes containing the filtration papers wetted with 0.5 mL of only sterile distilled water (Krutmuang 2005). Thereafter, the treated and non-treated dishes were reserved at a room temperature (25 ^{o}C), continued wetting the control sample with distilled water as needed, then the mortality rates in the termite's workers were recorded within three periods of times (24, 48 and 72 hours) of treatment.

Statistic analyses

The data were analysed statistically using One-Way ANOVA applied by SPSS programme. The mathematic averages of the treatments were compared using Duncan's multiple range test at a probability level of $p<0.05$ (Al Rawy *et al.* 1982).

RESULTS AND DISCUSSION

According to the results in Table 1 and as a test for the toxic properties of *Dieffenbachia picta*, some significant differences were observed in the *M. diversus* mortality rate, which then multiplied by increasing the extract concentration and the duration of exposure, hence the relation was direct. The minimum mortality levels were found at the concentration of 25 %, hence, the killed insects reached 1.7 %, 2.3 % and 3.7% after 24, 48 and 72 hours respectively. At the concentration of 50%, the mortality rates of these insects reached 4.67 %, 6.67 % and 7.33% after 24, 48 and 72 hours respectively. At the concentration of 75%, the mortality rates reached 6.67 %, 8% and 8.67% after 24, 48 and 72 hours respectively. The maximum at 100% of the plant leave extract reached 8%, 8. 67% and 9% after 24, 48 and 72 hours respectively. The control samples did not encountered any mortality in termite workers, so the results of the current study are in line with those of Al farajy's (2008), because the relation was direct between the extract concentration, the duration of treatment and increased mortality rate. The reason for the mortality rate is the presence of contact poisons in the extract of *D. Picta* leaves once treating the termite's workers by the spraying method. This extract caused a kinematic analysis at the beginning of the treatment and then decomposition and tearing the wall of the insect body as well as swelling in the head section and breaking down in bronchia and antenna. All these damages were caused by the nervous break down leading

to damage the neural tissue of this insect. The present results are in accordance with those of Oloyede (2011), who reported that the *D. Picta* stem and leaves contained the effective compounds with a toxic impact representing by benzene compounds, carbonilates, oleic acids and carboxilic acids, which leads to damage insect and its developmental stages. The present study is compatible with the results of Sha'ban & Al- Malah (1993) who reported that the exposure of the termite workers to the plant extract leads to passing it through the cuticle layer and penetrating to the flexible regions in the insect body, such as the chemoreceptors or penetrating through the spiracles and the bronchia leading to their breaking down. This is similar to the study of penderson *et al.* (1976) who reported that the mortality of these insects was happened due to chelating the toxic materials with the lipid materials of this insect and hence, starting their effects by inhibiting the oxidative phosphorylation in Mitochondria (Taniguchi *et. al.* 1979) or inhibiting the enzymes such as proteinase (Rees & Beck 1976; Stipanovic 1983). The calcium oxalates known as Raphides crystals in the *D. Picta* leaves are toxic compounds which lead to the breaking down of the organism tissues. This is verified by observing the treatment of the workers of *M. diversus* by appearing their effects on the neural receptors causing the continuous trembles followed by the nervous paralysis and then their mortality, which is in accordance with that of Al- Adil & Abid (1979) and Shaban & Almalah (1993).

Table 1. The effect of four concentrations of *Dieffenbachia picta* leaves on the termites workers of *Microcerotermes diversus* after the different periods of time.

Concentration / **Time**	**24 h**	**48 h**	**72 h**	**Average of con.**
Con. 25%	1.70 d	2.30 cd	3.70 bcd	2.57 b
Con. 05%	4.67 abcd	6.67 abc	7.33 ab	6.22 a
Con. 75%	6.67 abc	8.00 ab	8.67 a	7.78 a
Con. 100%	8.00 ab	8.67 a	9.00 a	8.56 a
Average time	5.26 a	6.41 a	7.18 a	

*The similar letters signify there are no significant differences among them. The different letter signify there are significant differences among them.

The chemical indication of the aqueous extract of the plant leaves illustrated the presence of many alkaloids, which are among the compounds used in pesticides, and in the current study, we observed the killing effects of these compounds (Gote & Giberanan 2012). The chemical detection also recorded the presence of the lead acetate compounds in the plant leaf extract as well as terpenes and tannins, which kills these insects and some other organisms (Alizza *et al.* 2018). Notably, these substances in plant bodies, specifically in leaves, stems, flowers and even fruits, exhibited the plant defences against the herbivores and insects. So, *D. picta* can be regarded as one of the active elements of biocontrol in the fighting the termites when treating in spraying methods.

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