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Evaluation of *Glycosmis pentaphylla* (Dodampana) plant extract as a source of insect repellent in radish (*Raphanus sativus*)

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Abstract
Various synthetic agrochemicals, are inherent to the current agricultural technology development mode. They are primarily responsible for several environmental and health problems in the world. Continuous use of synthetic pesticides develops resistance against some pests and is not a sustainable option to control pests. Therefore, the interest on organic applications is increasing and a need for the possible alternatives for agro chemical usage in agriculture is developing. Hence. a herbal plant of *Glycosmis peritaphylla*, known as "Dodampana" has been experimentally investigated at the research field at UCIARS, Weligatta, Hambantota, Sri Lanka with the objective of evaluating the *Glycosmis pentaphylla* leaf extract as an insect repellent for a vegetable crop of Radish. There were four treatments with four replications, comprised of 60 radish plants per each. The treatments were the Dodampana leaf extract, Neem oil mixture, a recommended commercial pesticide containing the active ingredient of abamectin and water as the control. Growth parameters (Number of leaves per plant, Length of leaf (cm), Yield in (kg) and Pest incidence (Number of pest attacked plants, Number of damage leaves by pests, Number of pests identified in experiment unit) were recorded and statistically analyzed using SAS 9.1 statistical software. It was revealed that, there was a significantly higher yield in G*lycosmis pentaphylla* leaf extract added radish plants compared with control. The values are comparable in G*lycosmis pentaphylla* leaf extract added plants and Chemical pesticide applied plants. Further, there was a significant reduction of number of pest attacked plants and number of damaged leaves in *Dodampana* leaf extract added plants compared with control. There was no significant difference in number of pest attacked plants and number of damaged leaves in *Glycosmis peritaphylla* leaf extract added plants and chemical pesticide applied plants. Therefore, *Glycosmis peritaphylla* leaf extract could be used as an alternative for chemical pesticide application for Radish.

Keywords: insect repellent, G*lycosmis pentaphylla*, *Raphanus sativus*

Introduction
The root vegetable species radish (*Raphanus sativus* L.) belongs to the Brassicaceae family. It is most likely to have originated in the Mediterranean-Caspian Sea region (Crisp, 1995) [1]. Tender tuberous roots and fresh succulent leaves are the most cheap and appetizing portions of the radish crop. Radish eating provides a long list of health advantages, including aiding digestion, blood pressure control, and immune enhancement. It can also be used as a trap crop or cover crop. Among the many pests and diseases that affect the radish crop, insect pests are the most prevalent.

Many wide spectrum pesticides are used extensively and indiscriminately by farmers to control this renowned pest. Pesticides made from synthetic materials have been utilized for more than six decades. Pesticides may have environmental consequences despite their good impact on agricultural output (Devine and Furlong 2007) [4]. Pesticides can have unintended consequences for non-target species not just during application, but also through residues in the soil, water, and harvested product (Croft and Brown 1975; Inglesfield 1989; De Snoo and De Wit 1998; Langhof *et al*. 2003, 2005; Mansfield *et al*. 2006; Devine and Furlong 2007) [2, 5, 3, 7].

Chemical pesticide use has risen dramatically in recent years, notably in India. Synthetic chemicals have gained a lot of attention and have been shown to improve food security, but their widespread and indiscriminate use has resulted in the development of insect resistance, human health risks, environmental harm, adverse effects on non-target organisms, and the extinction of natural enemies. As a result, finding environmentally benign alternatives to synthetic pesticides for pest management is critical. Because botanical pesticides are safe to humans, beneficial insects, and other non-target creatures, hence they can be useful alternatives to chemical insecticides.

The Rutaceae family includes *Glycosmis pentaphylla*. There are roughly 11 species in the genus Glycosmis of the Rutaceae family. *Glycosmis pentaphylla* is a tiny (1.5–5.0 m) shrub or tree found in tropical woods at low altitudes from India, Malaysia, and Southern China to the Philippine Islands (Wang *et al*., 2006) [12]. It has long been used to treat fever, liver problems, and a variety of other ailments. The stems are commonly used as a toothbrush to clean teeth (Quader *et al*., 1999) [10]. Hydrophobic alkaloids, such as those found in the quinolone,

quinazoline, acridone, and carbazole kinds of leaves, roots, and stems bark, were the focus of phytochemical studies on this species (Quader *et al*., 1999) [10]. It is thought that *Glycosmis pentaphylla* leaf extract can be utilized in plants to suppress pests and enhance growth. With these considerations in mind, a study was conducted to see how effective *Glycosmis pentaphylla* leaf extract is as an insect repellent and growth booster in vegetable growing.

Materials and Methods

Experimental Location

A field experiment was conducted at the research field of University of Colombo Institute for Agro-Technology and Rural Sciences, Weligatta, Hambantota, Sri Lanka which is belongs agro-ecological zone of DL5 (Low country Dry zone). The crop was maintained following the recommended cultural practices by the Department of Agriculture. All plots were equally maintained throughout the experimental period.

Preparation of Leaf Extract of *Glycosmis pentaphylla*

Mature leaves of *Glycosmis pentaphylla* plant were collected randomly from Melsiripura, Sri Lanka. A taxonomist was used to identify plants before collection. The leaves were washed, sun dried and subjected to crushing, then weighed, packed and labeled. *Glycosmis pentaphylla* dried leaf powder (100 g) was mixed with 1000 ml of distilled water to prepare the concentrated solution.

Preparation of Neem oil mixture

Neem oil (15 ml) was added in to 1000 ml water to prepare the solution and soap water was added as a surfactant (Khattak *et al*., 2006)

Preparation of Pesticide Solution

Pesticide solution prepared at recommended rate

Treatments

Treatment 1 – 10% *Glycosmis pentaphylla* leaf extract
Treatment 2 – 1.5% Neem oil mixture
Treatment 3 – Recommended pesticide (Abemactin 0.6%)
Treatment 4 – Control

Application of different treatments

Prior experiment was conducted to identify best concentration of *Glycosmis pentaphylla* for application. From this experiment it has identified that 10% *Glycosmis pentaphylla* leaf extract is best among other concentrations of 5% and 15%.

Radish plants were treated with of 10% *Glycosmis pentaphylla*, 1.5% Neem oil mixture, Abamectin 0.6% and control plants were kept without use of any substances. Abamectin (commercially available chemical pesticide) was used to compare the effectiveness of *Glycosmis pentaphylla leaf extract*. Starting ten days after transplanting and continuing every five days until harvest, several treatments were uniformly sprayed during the evening hours of the day. Plant growth data (Number of leaves per plant, leaf length and yield) and pest incidence (Number of pests attacked plants, number of damaged leaves and Number of pest identified in a unit area and type of pest) were recorded. Data collection began two weeks after radish seeds were planted and was done every four days. The experiment made use of a randomized complete block design (RCBD) with four repetitions.Statistical Analysis

The SAS 9.1 statistical program was used to properly tabulate the acquired data and then analyze it using the ANOVA process. The means were separated using Duncan Multiple Rang Test at 0.05 significance level and ranking was indicated by alphabets.

Results and Discussion

Number of leaves, leaf length and fresh weight of plant

It was found that, there were no significant differences between the treatments on number of leaves, leaf length and fresh weight of plant.

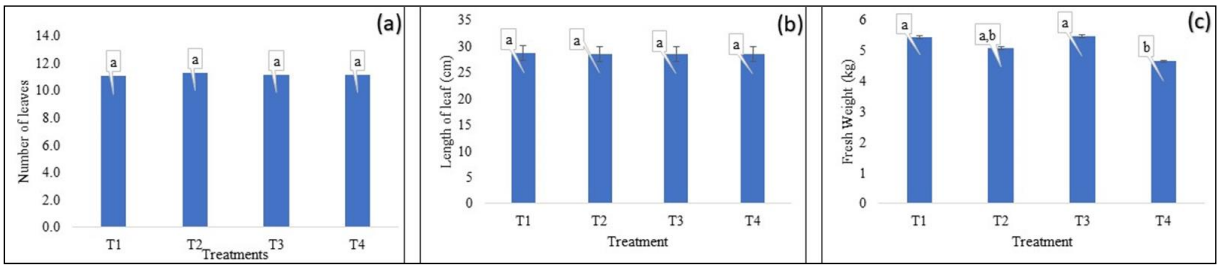

Fig 1: Effects of different treatments on number of leaves, leaf length and fresh weight of the Raddish plants

Number of pest attacked plants

It was revealed that, there were significant differences among the treatments on number of pest attacked plants. Higher number of pest attacked plants were observed in control. It was followed by the application of Dodampana and neem oil mixture. Lower number of pest attacked plants were recorded in the treatment where commercial pesticide applied. Neem, also known as the Indian lilac, is an evergreen, fast-growing plant with tremendous antifeedant characteristics due to its efficacy in suppressing the feeding sensation in insects at concentrations as low as 1 part per million (Schmutterer, 1990). (Isman *et al*., 1991) [6]. The seeds of this tree contain 40% oil, with azadirachtin as the principal active component, which is responsible for neem's insecticidal properties (Isman *et al*., 1991) [6].

Number of damaged leaves

There were significant differences among the treatments on number of damaged leaves. Higher number of leaves were observed in treatments where water was applied and maintained as the control. Application of other materials showed comparatively lower not significant values in damaged leaves. Application of Dodampana has capability to reduce the leaf damages in Radish as compared to commercial pesticide and neem oil mixture. Sajith and Harilal (2015) [11] reported that, there is a ffect of the leaf extracts *Glycosmis pentaphylla on pests* with varying concentrations.

Number of pests

There were significant differences among the treatments on number of pests. Higher number of pests were observed in the treatment where water was applied as the treatment. It was followed by the treatments Dodampana leaf extract and neem oil mixture. Lowest number of pests were observed in the treatment where commercial pesticide applied. It was revealed that, Dodampana has a potential to use as a biopesticide to reduce the pest population in radish cultivations. It can be successfully used to replace the commercial pesticides. Koul *et al* (2000), on the other hand, found that *H. armigera* larvae fed azadirachtin-treated leaves had a dose-dependent effect on growth. Young larvae given 4 ppm azadirachtin treated leaf gained weight at first, while older larvae fed 4 ppm azadirachtin leaf grew at a 75 percent slower rate than control larvae (Koul, 1985). Murugan and Babu (1998) [9] made similar discoveries on the development and feeding physiology of *H. armigera* larvae fed *Glycosmis pentaphylla* extract. Murugan *et al*. (1998) [8] also discovered that *Glycosmis pentaphylla* has a pesticidal effect on larval growth. Plant leaf extracts of *G. pentaphylla* include bioactive compounds that are effective and eco-friendly larvicides and adulticidal vector control agents.

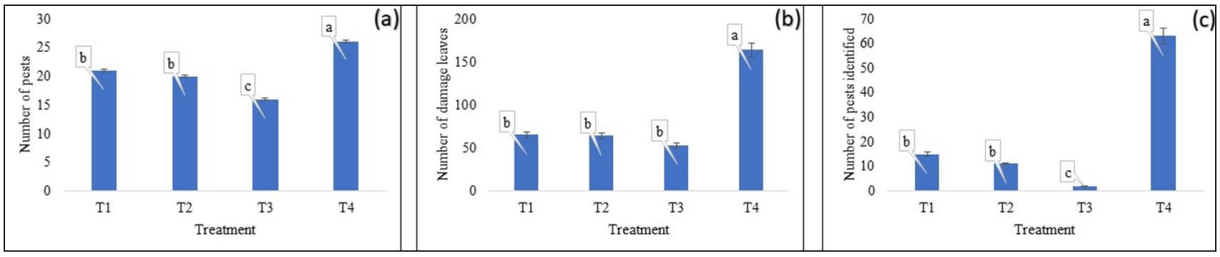

Fig 2: Effects of different treatments on no. of pest attacked plants, no. of damaged leaves and no, of pest identified

Conclusion

G*lycosmis pentaphylla* leaf extract added radish experimental units showed significantly lower number of Pest attacked plants, lower number of damage leaves and lower number of identified pests compared with control where nothing was added. With the above results it can be considered that G*lycosmis pentaphylla leaf extract* can be used as an alternative for chemical pesticide application for Radish.

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