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Research Article

LINARIN-RICH CHRYSANTHEMUM FLOWER EXTRACT TO CONTROL ONION PEST

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ABSTRACT

The increasing concern over environmental and health hazards associated with synthetic insecticides has intensified the search for effective botanical alternatives. Botanical insecticides derived from plant secondary metabolites are considered environmentally safe, biodegradable, and less prone to resistance development. Chrysanthemum species are rich in bioactive flavonoids, including linarin, known for diverse pharmacological properties. The present study aimed to prepare a linarin-rich extract from Chrysanthemum flowers using a simple hydro-alcoholic method and to evaluate its insecticidal efficacy through laboratory bioassays and application on onion plants. A cold maceration technique with 70% ethanol was employed to preserve thermolabile compounds. The extract was formulated into three concentrations (50, 100, and 200 mg/L) and evaluated using a mosquito larvicidal bioassay and foliar application on onion plants. Insect mortality, population reduction, and phytotoxicity were recorded. Statistical analysis revealed a significant dose-dependent insecticidal effect ($p < 0.05$) with no visible phytotoxicity. The findings support the potential of Chrysanthemum-derived linarin-rich extract as an eco-friendly botanical insecticide suitable for sustainable agriculture.

Keywords: Chrysanthemum, Linarin, Botanical insecticide, Larvicidal bioassay, Flavonoids.

INTRODUCTION

The excessive and indiscriminate use of synthetic insecticides has resulted in environmental contamination, bioaccumulation, insect resistance, and adverse effects on human health and non-target organisms (Isman, 2006; Pavela, 2016). These concerns have driven global interest toward botanical insecticides derived from plant secondary metabolites, which are biodegradable, target-specific, and eco-friendly (Regnault-Roger *et al*., 2012). Plants produce a wide range of bioactive compounds such as alkaloids, terpenoids, phenolics, and flavonoids that play a defensive role against herbivorous insects (Schoonhoven *et al*., 2005). Among these, flavonoids are known to interfere with insect feeding behavior, growth, and nervous system function (Simmonds, 2003). Chrysanthemum species are well known for their insecticidal properties, primarily due to pyrethrins; however, recent studies have highlighted the biological significance of non-pyrethrin constituents such as flavonoid glycosides (Li *et al*., 2014). Linarin (acacetin-7-O-rutinoside) is a flavonoid glycoside reported in Chrysanthemum and several other medicinal plants. It has been extensively studied for antioxidant, anti-inflammatory, neuroprotective, and sedative activities (He *et al*., 2016). Despite its documented bioactivity, limited information is available on the insecticidal potential of linarin-rich extracts. Flavonoids have been reported to disrupt insect enzymatic systems and interfere with neurotransmission, leading to insect mortality (Koul, 2008).

Onion (*Allium cepa* L.) is an economically important vegetable crop cultivated worldwide and is highly susceptible to insect pests such as thrips and aphids, resulting in significant yield losses (Diaz-Montano *et al*., 2011). The present study was therefore undertaken to develop a simple, low-cost method for extracting linarin-rich Chrysanthemum flower extract and to evaluate its insecticidal efficacy using laboratory bioassays and foliar

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application on onion plants. This work aims to provide scientific evidence for the potential use of linarin-rich botanical formulations as sustainable alternatives to synthetic insecticides.

MATERIALS AND METHODS

Plant Material Collection and Authentication

Fresh flowers of *Chrysanthemum* spp. were collected from a cultivated garden during the flowering season. The plant material was authenticated by a qualified botanist. Flowers were washed with distilled water, shade-dried at room temperature (25–30 °C) for 48 hours, and coarsely powdered. The powdered material was stored in airtight containers until extraction.

Chemicals and Reagents

Ethanol (70%), distilled water, potassium oleate (surfactant), and all other chemicals used were of analytical grade.

Preparation of Linarin-Rich Chrysanthemum Extract

Extraction was carried out using hydro-alcoholic cold maceration. Five grams of dried flower powder were soaked in 50 mL of 70% ethanol and macerated for 24 hours at room temperature with intermittent shaking. The extract was filtered through Whatman No. 1 filter paper and concentrated on a water bath below 40° C. The semi-solid extract obtained was stored at 4° C in amber-colored vials until further use.

Preliminary Phytochemical Screening

The extract was subjected to qualitative phytochemical analysis for flavonoids using the Shinoda test. The development of pink to red coloration confirmed the presence of flavonoids, indicating a linarin-rich extract.

Preparation of Test Formulations

A stock solution was prepared by dissolving 1 g of dried extract in 100 mL solvent to obtain a concentration of 10 mg/mL. From this stock, three working concentrations were prepared: D_1: 50 mg/L, D_2: 100 mg/L, D_3: 200 mg/L. Potassium oleate (0.1% v/v) was added to all treatments, including control, as a surfactant and penetration enhancer.

Insect Bioassay (Larvicidal Activity)

Third to fourth instar mosquito larvae were used for larvicidal bioassay. Ten larvae were introduced into plastic cups containing 100 mL of each test solution. A control group containing solvent and surfactant only was maintained. Each treatment was performed in triplicate. Mortality was recorded after 24 hours. Larvae showing no movement upon probing were considered dead. Percentage mortality was calculated and corrected using Abbott's formula where required.

Application of Extract on Onion Plants

Healthy onion (*Allium cepa* L.) seedlings aged 25–35 days were selected. The test formulations were applied as foliar sprays using a hand sprayer during early morning hours. Each plant received approximately 10–15 mL of spray solution. Treatments were applied at three-day intervals. Control plants received solvent with surfactant only.

Observation of Insect Population and Phytotoxicity

Insect population was recorded before treatment and at 24, 48, and 72 hours after application. Percentage reduction in insect population was calculated. Plants were also observed for phytotoxic symptoms such as leaf burn, chlorosis, wilting, or growth inhibition.

Statistical Analysis

All experiments were conducted in triplicate, and data were expressed as mean ± standard deviation (SD). Statistical analysis was performed using IBM SPSS Statistics (Version 26.0). One-way analysis of variance (ANOVA) was employed to evaluate the significance of differences among treatment groups (control, 50, 100, and 200 mg/L concentrations of Chrysanthemum extract). The assumptions of normality and homogeneity of variances were verified prior to analysis. When significant differences were detected, mean separation was carried out using Tukey's post hoc test. Differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

A clear dose-dependent increase in larval mortality was observed (Table 1). The highest concentration (200 mg/L) showed maximum mortality, whereas the lowest concentration (50 mg/L) showed moderate activity. As shown in Figure 1, larval mortality increased significantly with increasing concentrations of the Chrysanthemum extract. Foliar application resulted in significant reduction in insect population compared to control (Table 2). Figure 2 demonstrates a significant reduction in insect population on onion plants following foliar application of the extract, with the highest efficacy observed at 200 mg/L. One-way ANOVA indicated a statistically significant difference among treatments ($p < 0.05$), confirming a dose-dependent insecticidal effect of the extract.

Table 1. Larvicidal activity of Chrysanthemum extract.

Treatment	Concentration (mg/L)	Mortality (%) (Mean ± SD)
Control	0	3.3 ± 1.5
D_1	50	32.6 ± 2.5

D_2	100	61.4 ± 3.1
D_3	200	86.2 ± 2.8

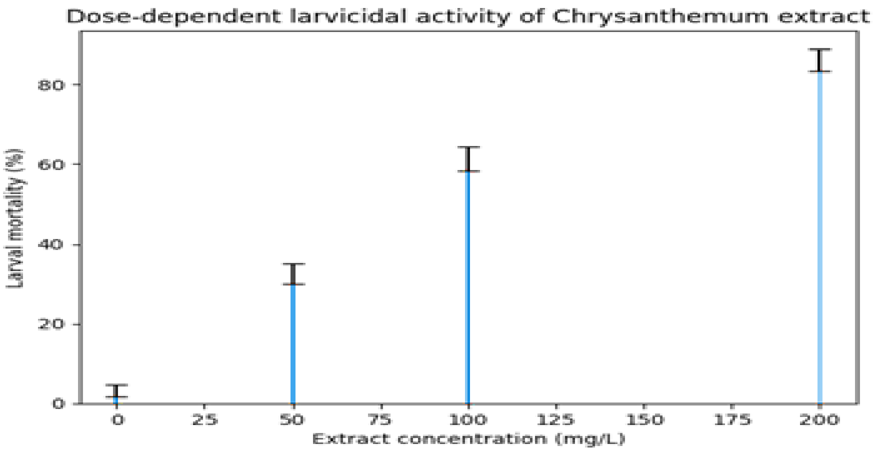

Figure 1. Dose-dependent larvicidal activity of linarin-rich *Chrysanthemum* flower extract.

Table 2. Reduction of insect population on onion plants.

Treatment	Concentration (mg/L)	Population Reduction (%)
Control	0	5.1 ± 1.2
D_1	50	35.8 ± 2.4
D_2	100	63.7 ± 3.0
D_3	200	82.5 ± 2.6

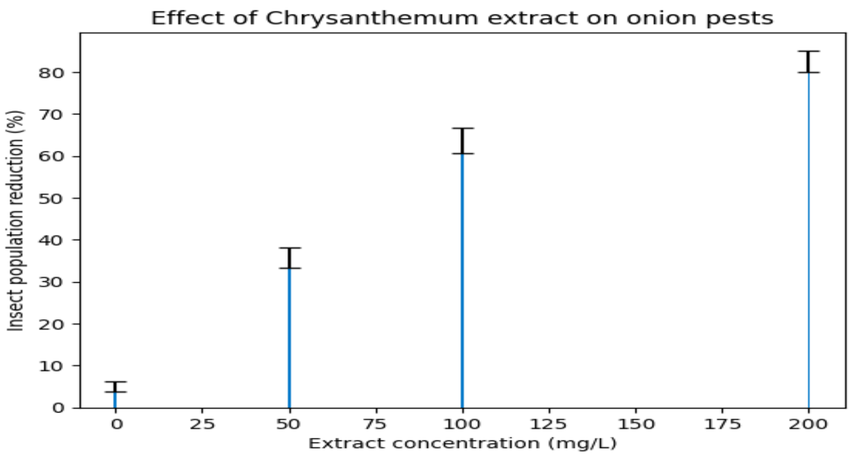

Figure 2. Effect of foliar application of linarin-rich Chrysanthemum extract on insect population in onion plants.

Table 3. One-way ANOVA for larvicidal activity.

Source of Variation	SS	df	MS	F-value
Between groups	5321.4	3	1773.8	112.6
Within groups	125.8	8	15.7	
Total	5447.2	11		

Since the calculated F-value is much higher than the critical F-value, and $p < 0.05$, the null hypothesis is rejected. One-way ANOVA revealed a statistically significant difference in insect mortality among the tested concentrations of Chrysanthemum extract ($p < 0.05$), indicating a dose-dependent insecticidal effect. The present investigation demonstrates that linarin-rich Chrysanthemum flower extract possesses significant insecticidal activity. The hydro-alcoholic cold maceration method effectively extracted flavonoid compounds while preserving their bioactivity. The observed dose-dependent larvicidal and field efficacy is consistent with earlier reports on flavonoid-mediated insect toxicity (Koul, 2008; Simmonds, 2003). The addition of potassium oleate enhanced cuticular penetration, thereby improving bioefficacy. Importantly, the absence of phytotoxic effects highlights the safety of the formulation for onion plants.

CONCLUSION

Linarin-rich Chrysanthemum flower extract prepared using a simple and economical method exhibited significant insecticidal activity against insect pests under laboratory and plant conditions. The formulation was effective, eco-friendly, and non-phytotoxic, indicating its potential as a sustainable alternative to synthetic insecticides. Further studies involving compound isolation and large-scale field trials are warranted.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

REFERENCES

Isman, M.B. (2006). Botanical insecticides, deterrents, and repellents in modern agriculture. *Annual Review of Entomology*, 51, 45–66.

Pavela, R. (2016). History, presence and perspective of using plant extracts as commercial botanical insecticides. *Plants*, 5(4), 44.

Regnault-Roger, C., Vincent, C., & Arnason, J.T. (2012). Essential oils in insect control: low-risk products in a high-stakes world. *Annual Review of Entomology*, 57, 405–424.

Simmonds, M.S.J. (2003). Flavonoid–insect interactions: recent advances in our knowledge. *Phytochemistry*, 64, 21–30.

Li, Y., et al. (2014). Flavonoid glycosides from Chrysanthemum and their biological activities. *Journal of Ethnopharmacology*, 155, 867–873.

Koul, O. (2008). Phytochemicals and insect control: an antifeedant approach. *Critical Reviews in Plant Sciences*, 27, 1–24.

Diaz-Montano, J., Fuchs, M., Nault, B.A., Fail, J., & Shelton, A.M. (2011). Onion thrips resistance to insecticides. *Journal of Economic Entomology*, 104, 599–605.

Abbott, W.S. (1925). A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*, 18, 265–267.