



Effects of *Lantana camara* L. leaves extracts and essential oils in the production and protection of tomato (*Solanum lycopersicum* L.) Roma VF

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ABSTRACT

Tomato (*Solanum lycopersicum* L.) is the most commonly consumed vegetable in Nigeria, and synthetic pesticides are frequently used to protect tomatoes against pests and diseases. However, the environment and human health are negatively impacted by their use, prompting consideration of alternative, environmentally safe treatments. *Lantana camara* L. (commonly known as sage, family Verbenaceae), a commonly occurring plant, has shown promise as a natural alternative for controlling tomato pests and may serve as an eco-friendly substitute for synthetic pesticides. Therefore, the potential of extracts of *L. camara* and essential oils (EOs) for the production and protection of the tomato variety “Roma VF” was studied under field conditions in Ibadan, Nigeria. Fresh *L. camara* leaves were collected from plants growing on the University of Ibadan campus, Oyo State and identified at the Herbarium section, Department of Botany, University of Ibadan (UIH 23103). The leaves were air-dried, pulverised and subjected to hydro distillation for EO extraction. The methanol and aqueous extracts of *L. camara* were obtained by maceration in methanol and water, respectively. An in vivo pesticidal bioassay was conducted to determine the biocidal potential of *L. camara* leaves using aqueous extract, methanolic extract, EO and water (as control) via two modes of application (spraying and drenching). The data were analysed using ANOVA and DMRT. The EO treatment gave the best control of the pests and resulted in higher fruit yield (1821 g/plant) compared to the control (512.5 g/plant). Thus, the EO from *L. camara* leaves demonstrated promising biocidal potential and can be effectively used to protect tomatoes against pests for increased fruit yield.

Keywords: Biopesticides, Hydro distillation, Roma VF, Drenching, spraying.

INTRODUCTION

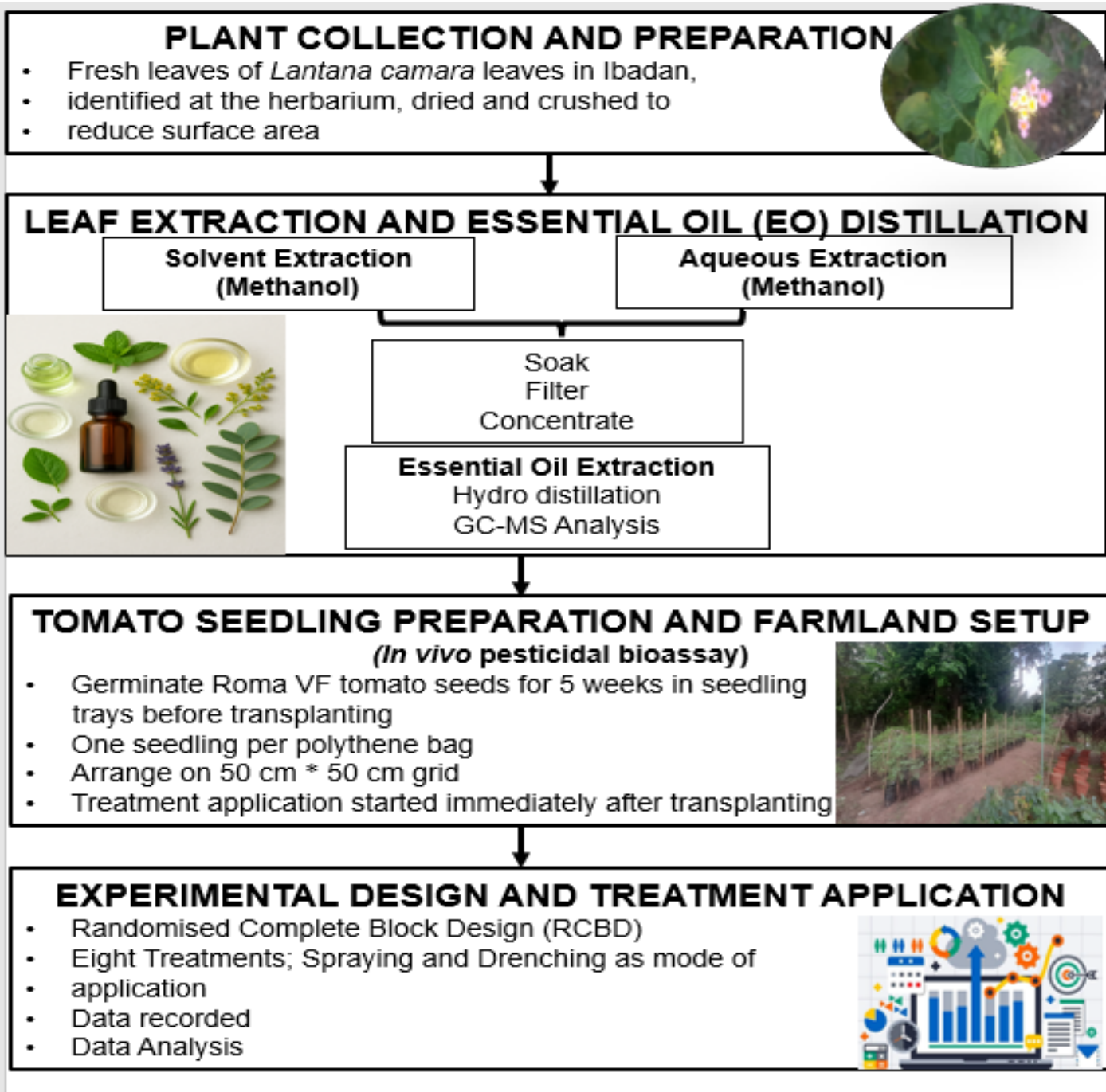
Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated vegetable crops, valued for its nutritional and economic importance (Abdul *et al.*, 2020). In Nigeria and other tomato-growing regions, production is threatened by pests and diseases, particularly late blight caused by *Phytophthora infestans*, which can cause devastating yield losses (Nowicki *et al.*, 2013). Conventional management relies heavily on synthetic pesticides, but their indiscriminate use leads to environmental concerns, increased production costs, and the emergence of resistant strains.

To address these challenges, researchers have increasingly turned to natural products for safer, eco-friendly solutions. Plant extracts and essential oils are rich in diverse bioactive compounds that exhibit antimicrobial, pesticidal, and growth-promoting activities. Several studies have shown their potential to reduce chemical dependence while enhancing plant health and resilience (Kagale *et al.*, 2004).

Lantana camara L., an invasive plant with established ethnomedicinal and pesticidal uses, is particularly rich in secondary metabolites with reported biological activities. Previous studies highlight its potential in crop protection and yield improvement (Sotade *et al.*, 2022). This study therefore evaluates the effects of *L. camara* leaf extracts and essential oils on the growth, yield, and protection of tomato Roma VF, with the aim of developing sustainable alternatives for crop management.

METHODOLOGY

- Experiment conducted at the Department of Crop Protection and Environmental Biology, University of Ibadan.
- Control group received water only.
- Essential oil treatments applied once weekly; solvent extracts applied three times weekly.
- Growth and yield parameters assessed: number of leaves, flower production, damaged leaves, damaged fruits, and fruit yield.
- Data analysed using Microsoft Excel; ANOVA with Duncan Multiple Range Test ($p < 0.05$).



Flowchart of the Research Methodology

METHODOLOGY contd'

Table 1: Treatments and application concentrations

s/N	Mode of application	Extracts/ Essential oil	concentration
1	Spraying	Essential Oil	50 µL
2	Spraying	Aqueous	100 mg/mL
3	Spraying	Aqueous	200 mg/mL
4	Spraying	Methanol	100 mg/mL
5	Spraying	Methanol	200 mg/mL
6	Drenching	Aqueous	200 mg/mL
7	Drenching	Methanolic	200 mg/mL
8	Spraying	Blank – Water	

RESULTS AND DISCUSSION

Weight and Percentage Yield of *L. camara* Extracts and Essential Oils

<i>L. camara</i> leaf	Weight of Plant Material (g)	Yield of Extract (g)/Volume of Oil (ml)	% Yield	Colour of Extract/EO
LCLM	1248.9	52.94	4.24	Deep green
LCLAq	436.02	33.20	7.61	Deep green
LCLEO	156.92	1.4	0.98	Pale yellow

KEYS: LCLM: *L. camara* leaf methanol extract; **LCLA_q:** *L. camara* leaf aqueous extract; **LCLO:** *L. camara* Leaf oil

Plant Growth (Leaves and Flower Production)

EO-sprayed plants produced the highest number of leaves and flowers from the fifth to eighth week after transplanting.

Aqueous and methanolic extracts had minimal impact on leaf and flower production compared to EO treatment.

Enhanced growth is likely due to bioactive compounds in the EO, such as terpenoids and phenolics, which stimulate plant physiological processes (Abo-Elyousr *et al.* 2014).

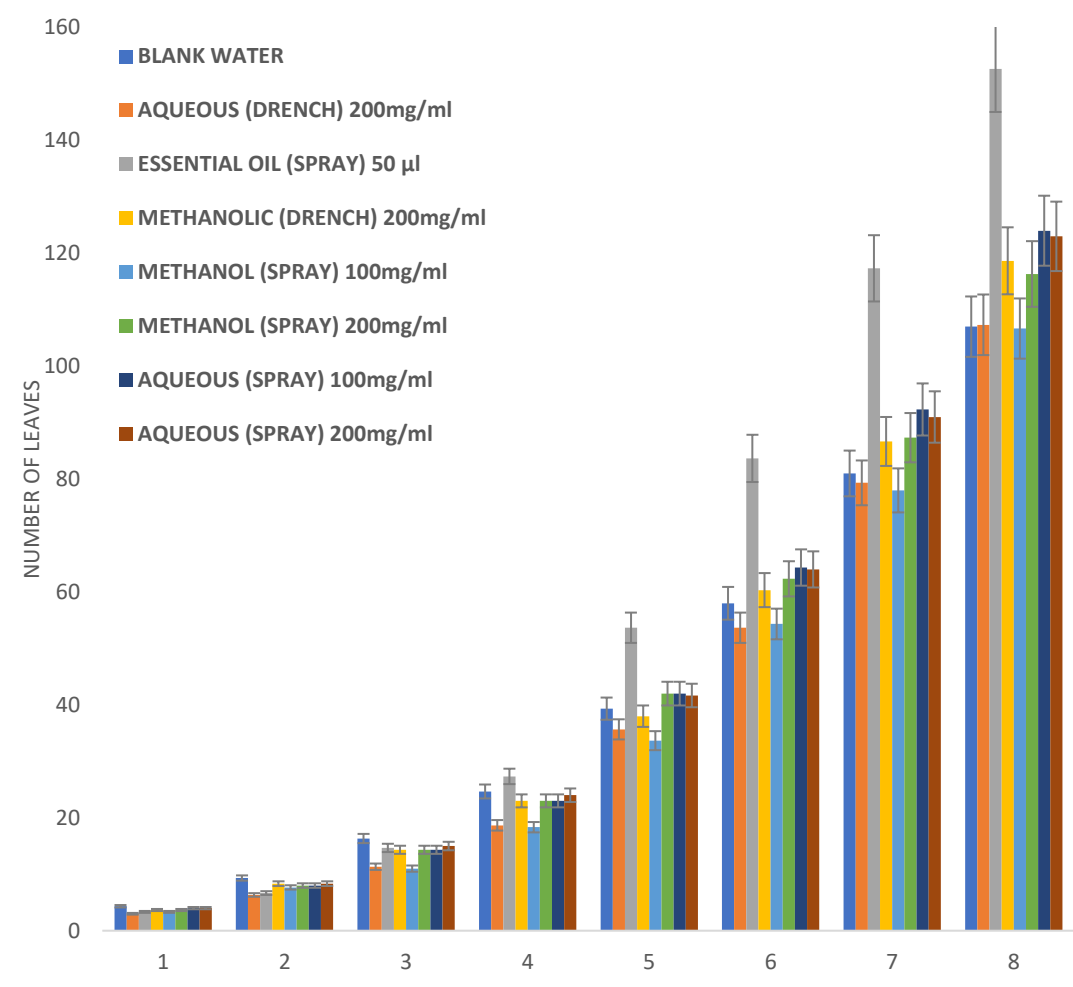


Fig. 1: Number of leaves of tomato in response to leaf extracts of *L. camara*

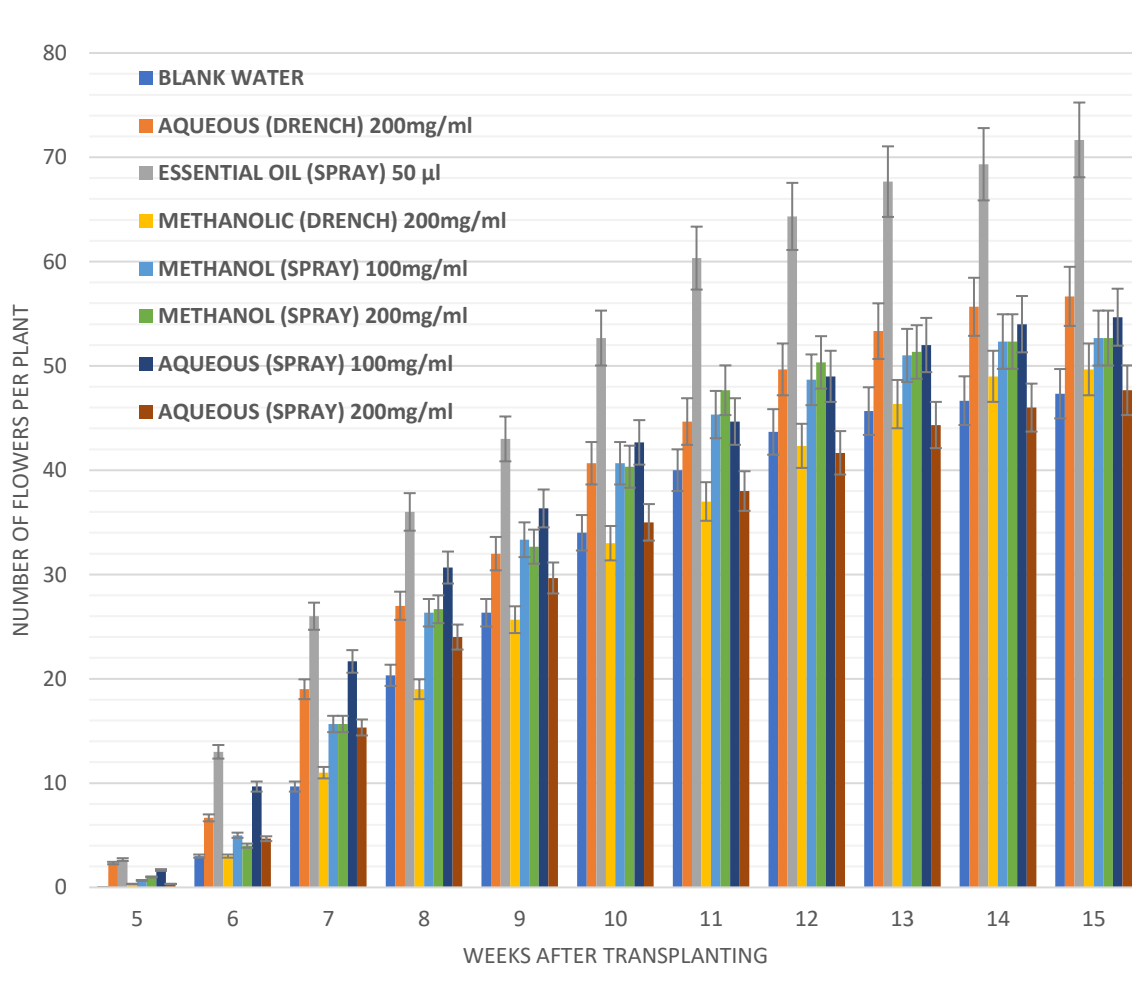


Fig. 2: Flower production of tomato in response to leaf extracts of *L. camara*

Damaged Leaves, fruit damage and fruit yield

- Leaf curling, chlorosis, and perforation were observed across all treatments. Control plants had the highest leaf damage (~70%), while EO-treated plants had minimal damage (0–5%). EO and aqueous drench effectively protected leaves, maintaining photosynthetic efficiency and supporting growth and yield.
- EO treatment minimized fruit damage to ~3.4%, whereas the control had the highest damage (~27.9%). Fruits treated with EO had mostly superficial blemishes, while control fruits exhibited severe lesions and rotting. The EO's volatile compounds likely deterred pests and rodents, preserving fruit quality .
- EO treatment produced the highest fruit yield (1821 g/plant), approximately 3.6 times greater than the control (512.5 g/plant). Other treatments had intermediate yields (740–1245 g/plant). Increased yield is attributed to improved pest control, reduced leaf and fruit damage, and growth-promoting bioactive compounds in the EO. (Nahak & Sahu 2015); Nashwa & Abo-Elyou 2012)

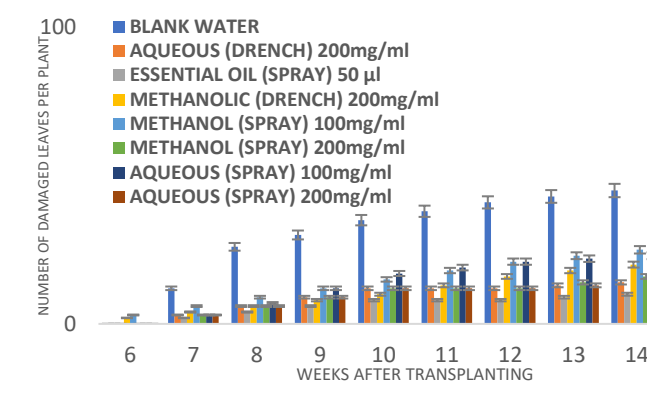


Fig. 1: Leaf damage in Roma VF tomato

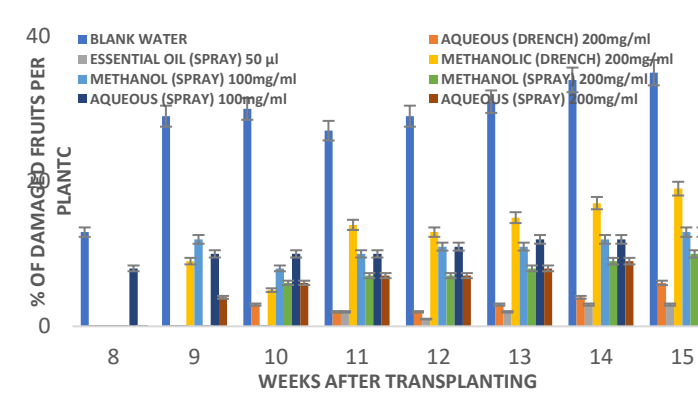


Fig 2: Percentage of damaged fruit in Roma VF tomato

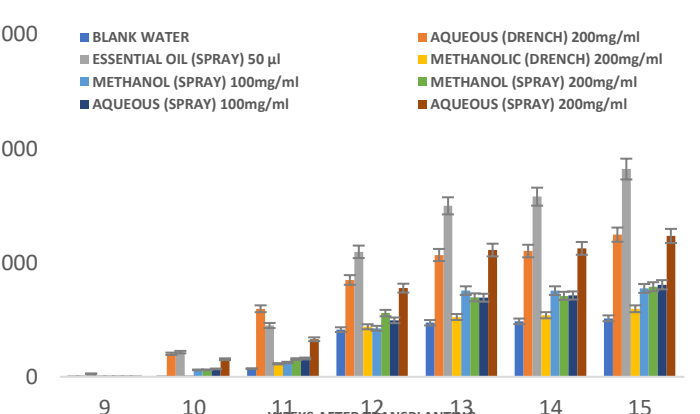


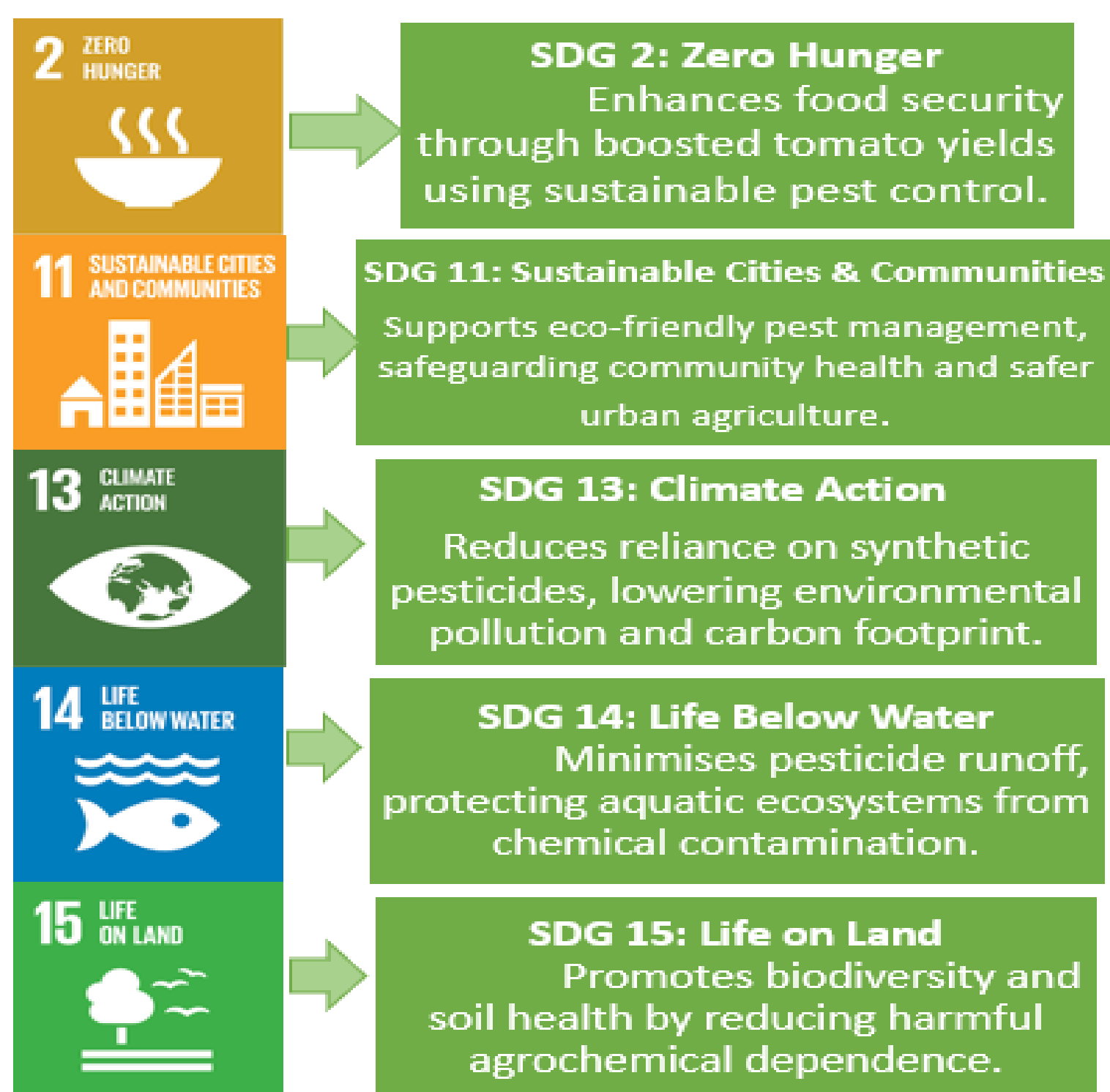
Fig 3: Fruit yield in Roma VF tomato in response to *L. camara* extracts



Fig. 4: Roma VF tomato leaves from the EO-treated (A) and control (B) plants.

CONNECTION TO UN SDG's

This research aligns with multiple United Nations Sustainable Development Goals (SDGs) by demonstrating the potential of *Lantana camara* leaf extracts and essential oils (EOs) as sustainable alternatives to synthetic pesticides in tomato production.



ACKNOWLEDGMENTS

- Department of Chemistry, University of Ibadan
- Department of Crop Protection and Environmental Biology, University of Ibadan

CONCLUSION

Essential oils (EOs) and aqueous extracts of *Lantana camara* leaves effectively suppressed pests and diseases in tomato (*Solanum lycopersicum* L.) production, with EO treatment exhibiting the highest efficacy. EO-treated plants achieved a significantly increased fruit yield (1821 g/plant) compared to the untreated control (512.5 g/plant). Both EO application and soil drenching of aqueous extracts enhanced vegetative growth and fruit production, demonstrating their potential as biopesticides and bio-stimulants in sustainable and organic tomato cultivation. Further research is recommended to optimize EO concentrations, application frequency, and explore efficacy across different tomato cultivars and agroecological zones, supporting broader adoption of *L. camara*-based eco-friendly pest management strategies.

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