Inventum Biologicum: *An International Journal of Biological Research*
2025, Vol. 5, Issue 1, pp. 30-35

Inventum Biologicum

Journal homepage: www.journals.worldbiologica.com/ib

Research paper

Preparation of Organic Repellent for Pest Control in Solanaceae Crops

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ARTICLE INFO

Keywords

Organic substances
Repellent
Pesticides
Eco friendly

DOI
10.5281/ib-1870625

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ABSTRACT

An organic pest repellant is a natural solution for safeguarding plants from destructive pests. It employs substances derived from plants or essential oils to create a protective barrier that either repels or controls pests without causing harm to the environment or human health. This eco-friendly approach encourages a balanced eco system, promotes sustainable agriculture, and reduces the dependency on chemical pesticides. By adopting this method, we can preserve the health of our ecosystems and ensure a stable food supply.

1. Introduction

Organic agriculture (OA) farming aims to achieve sustainable, diversified, and balanced systems, with the purpose of protecting the environment for present and future generations. In the same way, OA provides on the food market, products of a certain nutritional quality, suitable in terms of lower contaminants. The organic product is governed by some well-defined principles, aimed at ensuring environmental and crop sustainability. Being a type of sustainable agriculture the purpose of OA can be expressed by a mini–max function, maximizing production and minimizing the negative agricultural activities on the environment. OA stimulates the activity of useful microorganisms, flora and fauna. Soils under crops are increasingly lifeless and infested with weeds, diseases, as well as pests. This situation is determined by current agricultural practices that excel in monoculture and short crop rotations, of 2–3 years, much delayed and bad quality soil tillage and plant care, burning plant debris ect. Biodiversity management. The soil's biological resources are vital to the economic and social development of all humanity. That is why, it is more and more frequently recognized that biological diversity is universal asset, of inestimable value for future generations. Biological (ecologic, organic) agriculture generally uses a greater number of cultivated species, to explore their

suitability and ecological plasticity. Non-using synthetic herbicides, and instead using milder solutions for weed destruction, ensures the coexistence of weeds together with the crop. Protecting the natural landscape. Elevation diversity, as well as flora and fauna variability, is inseparable to the applied vegetable growing systems, the most aggressive ones being of the intensive type, often causing deterioration. Many cultivation techniques applied in the past decades have had undesired consequences on the environment, contributing to soil erosion, the degradation of the ecological system, contamination of ground water and crops with pesticides and nitrates. Organic agriculture aims to preserve the unaltered environment, using organic fertilizers and also less soluble mineral fertilizers, organic fertilizers, such as composts and green fertilizers, avoiding to use products that can have harmful effects.

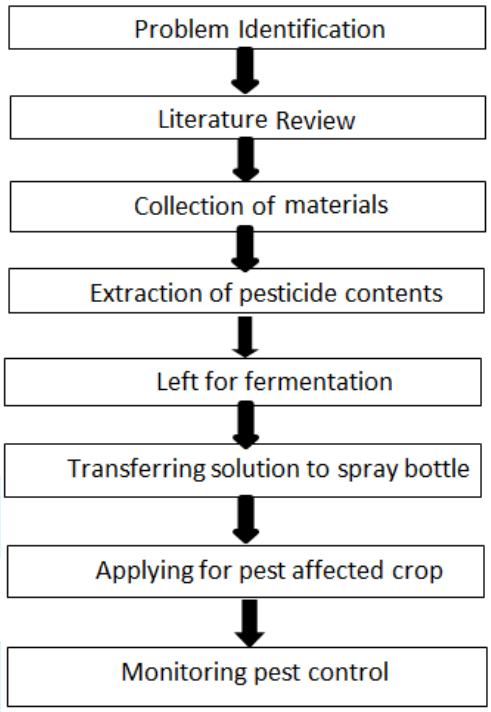
2. Literature Review

J. Smith (2020) entitled as "Comparison of chemical and organic pest repellents in agricultural settings" said that, This study evaluates the effectiveness, safety, environmental impact and cost-effectiveness of chemical and organic pest repellents in various agricultural settings, providing insights into their relative advantages and disadvantages. From this literature, we have learned to prepare cost effective organic pest repellents.

Chris Peterson. (2001) entitled as "Insect repellents" said that, Insect repellents are an alternative to the use of insecticides. They may be applied to the skin to protect an individual from the bites of mosquitoes, mites, ticks and lice or, less commonly, may be used to exclude insects from an area, such as in packaging to prevent infestation of stored products. In our opinion, these latter uses are underexploited at the current time. With increasing problems of insecticide resistance and increasing public concerns regarding pesticide safety, new, safer active ingredients are becoming necessary to replace existing compounds on the market.

Augusto Lopes Souto., (2016) entitled as "Plant derived pesticides as an alternative to pest management and sustainable agricultural production" said that, Pests and diseases are responsible for most of the losses related to agricultural crops, either in the field or in storage. Moreover, due to indiscriminate use of synthetic pesticides over the years, several issues have come along, such as pest resistance and contamination of important planet sources, such as water, air and soil. Natural plant products with bioactivity toward insects include several classes of molecules, for example: terpenes, flavonoids, alkaloids, polyphenols, cyanogenic glucosides, quinones, amides, aldehydes, thiophenes, amino acids, saccharides and polyketides (which is not an exhaustive list of insecticidal substances). In general, those compounds have important ecological activities in nature, such as: antifeedant, attractant, nematicide, fungicide, repellent, insecticide, insect growth regulator and allelopathic agents, acting as a promising source for novel pest control agents or biopesticides.

3. Methodology



3.1 Collection of various materials

Fig. 1 Cow urine

Fig. 2 Yellow chrysanthemum

Fig. 3 Neem leaf

Fig. 4 Lemon

Fig. 5 Pirandai

Fig. 6 Nochi

Fig. 7 Castor

Fig. 8 Umathan

Fig. 9 Seetha leaf

Fig. 10 Eucalyptus leaf

Fig. 11 Collection of materials

3.2 Extraction of pesticide repellent content

We can extract the pesticide content by grinding all the materials. Each material taken the sample of 200 gms for 6 litres of cow urine. After it is transformed into the can and then covered with the cloth.

3.3 Left for fermentation

The prepared organic pest repellent was left for fermentation for 15 days under shade sunlight area.

Fig. 12 Extraction of pesticide repellent content

Fig. 13 Fermentation process

3.4 Transferring solution to the sprayer bottle

The prepared organic pest repellent are filtered with cloth and then 200ml sample of organic pest repellent are mixed with 2 litres of water and then transferred the sample with the sprayer bottle.

Fig. 14 Transfering solution

Fig. 15 Final product

3.5 Applying and monitoring for pest affected crops

After transferring the solution into the sprayer bottle. The prepared organic pest repellent are applied for pest affected crop and monitor in pest control.

Fig. 16 Applying for pest affected crop

Fig. 17 Monitoring pest control

4. Result and Discussion

The organic pest repellent effectively minimized pest infestation without adverse environmental impacts. Results showed a significant decrease in pest populations compared to untreated areas. This repellent's natural composition ensured safety for

beneficial organisms and minimal residue in the ecosystem. Discussion points include its sustainable nature, cost-effectiveness, and potential for broader agricultural applications. Further research may explore optimizing the formulation for specific pests and evaluating long-term effects on soil health and crop yield.

4.1 Test Report

Qualitative phytochemical analysis of given sample

Phytochemicals	Observations	Given sample
Alkaloids Mayer's test Wagner's test	Cream colour Reddish brown solution/ precipitate	+
Flavonoids Lead acetate test H_2SO_4 test	Yellow orange Reddish brown / Orange colour precipitate	++
Steroids Liebermann-Burchard test	Violet to blue or green colour formation	++
Terpenoids Salkowski test	Reddish brown precipitate	++
Arthroquinone Borntrager's test	Pink colour	-
Phenols Ferric chloride test Lead acetate test	Deep blue to Black colour formation White precipitate	+
Saponin	Stable persistent	-
Tannin	Brownish green / Blue black	+
Carbohydrates	Yellow / brownish / blue / green colour	+
Oils & Resins	Filter paper method	-

pH

Parameter	Triplicate Value			Mean ± S. D
	A	B	C	
Ph	6.87	6.84	6.81	6.84 ± 0.03

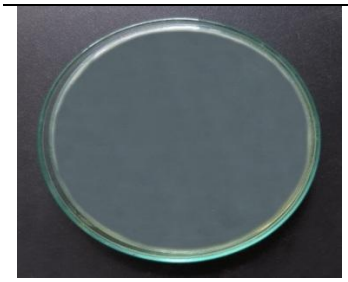
Stability – Stable

Drug Content

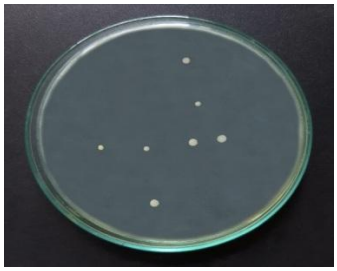
Sample	Triplicate	Drug Content (248 nm)	Drug Content Mean ± S. D
LE	A	23.14	23.46 ± 0.32
	B	23.78	
	C	23.46	

Self-Life

S. No	Hours	No. of Colonies	CFU
1	0	0	0
2	12	7	0.42 X 10^2



0th Hour



12th Hour

Fig. 18 Phytochemical analysis for given samples

4.2 Procedure

4.2.1 PH determination

The determination of the formulated Hydrogel was evaluated by using the pH meter. Small quantity of the hydrogel was taken in the volumetric flask and dissolved in the 100mL of the water and mixed it properly. Each formulation was mixed with the water and pH was determined by taking the at least three readings for the average pH (Baheti, 2019).

4.2.2 Drug Content

To obtain the drug content the formulation (1g) was dissolved in the 20mL of the phosphate buffered saline for minimum 30 min. The resultant mixture was then filtered through a Whatman filter paper. The filtrate was again diluted with the 10mL of buffer; absorbance of the mixture was taken at 215nm buy the UV-VIS spectrophotometer. The record values were taken in the triplicates, average values were determined and noted (Ansaripour and Dehghan, 2020).

4.2.3 Self-life analysis

4.2.3.1 Sample preparation

Obtain representative samples of the plant extract or product containing preservatives. Ensure that the samples are properly labelled and stored according to recommended conditions.

4.2.3.2 Accelerated stability testing (AST)

Conduct accelerated stability testing to simulate the effects of long-term storage under accelerated conditions. Expose samples to elevated temperatures, humidity, and light to accelerate degradation

processes. Monitor samples periodically over a specified period, typically several weeks to months, and assess changes in physical, chemical, and microbial properties compared to baseline measurements. Evaluate parameters such as colour changes, odour, pH shifts, viscosity alterations, microbial growth, and changes in chemical composition (e.g., degradation of active compounds).

4.2.3.3 Cultural Methods

The samples collected from cows were cultured on general purpose media such as blood agar and nutrient agar using a sterile loop inside the biosafety cabinet and around the Bunsen burner. Other selective and differential media such as Mannitol salt agar, MacConkey agar, Eosin methylene blue agar was also used for cultural purposes. Inoculated plates were incubated aerobically at 37°C. After 24 hours of incubation, the plates were removed from the incubation and examined visually. Any growth, pigmentation, haemolysis, and colonial morphology were noted accordingly. CFU/mL = Number of colonies counted / (dilution factor x volume of sample plated for analysis).

4.2.4 Phytochemical Screening

Preliminary phytochemical analysis was carried out for the given sample as per standard methods described by Brain and Turner, 1975).

4.2.5 Detection of Alkaliod

H_2SO_4 test: Extracts were treated with few drops of H_2SO_4. Formation of orange colour indicates the presence of flavonoids.

4.2.6 Detection of Terpeniods

Extract of the hole sample was mixed with 2ml ofchloroform and concentrated H_2so_4 (3ml) was carefully added to form a layer. A reddish-brown coloration of the inner face was indicating the presence of terpenoids.

4.2.7 Detection of Anthroquinones

Borntrager's test: About 0.2g of the extract was boiled with 10% HCl for few minutesin a water bath. It was filtered and allowed to cool. Equal volume of $CHCl_3$ was added to the filtrate. Few drops of 10% NH_3 were added to the mixture and heated. Formation of pink colour indicates the presence anthraquinones.

4.2.8 Detection of Phenols

Ferric chloride test: Extracts were treated with few drops of 5% ferric chloride solution. Formation of bluish black colour indicates the presence of phenol.

4.2.9 Detection of Saponins

About 0.2g of the extract was shaken with 5ml of distilled water. Formation of frothing (appearance of creamy stable persistent of small bubbles) shows the presence of saponins.

4.2.10 Detection of Tannins

A small quantity of extract was mixed with water and heated on water bath. The mixture was filtered and 0.1% ferric chloride was added to the filtrate.A dark green colour formation indicates the presence of tannins.

4.2.11 Detection of Carbohydrates

0.2gm filtrate is boiled on water bath with 0.2ml each of Fehling solutions A and B. A red precipitate indicates the presence of sugar.

4.2.12 Detection of Oils and Resins

Test solution was applied on filter paper. It develops a transparent appearance on the filter paper. It indicates the presence of oils and resins.

5. Conclusion

Organic pest repellents offer a promising alternative to traditional chemical based solutions, providing effective pest control while minimizing environmental impact and potential harm to humans and pets. By harnessing natural substances like plant extracts, essential oils, or biological agents, these repellents target pests without leaving harmful residues or contributing to pesticide resistance. They are also often biodegradable, reducing long-term soil and water contamination. Moreover, organic pest repellents can be part of a holistic approach to pest management, promoting biodiversity by preserving beneficial insects and organisms that maintain ecological balance. Their versatility allows for use in various settings, including agriculture, homes, and gardens, contributing to sustainable practices in food production and pest control. In conclusion, organic pest repellents offer a safe, eco-friendly, and effective solution to pest problems, aligning with the growing demand for environmentally conscious practices in pest management.

Acknowledgements

The authors are highly thankful to Dr. A. Vivekanandhini, Associate Professor and Head, Department of Agriculture Engineering, Paavai Engineering College, Namakkal for providing the basic facilities and for valuable help and support during the study.

Funding Information

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Conflict

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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