Analysis of Sustanable Pest Management In Agriculture

Major Project Report

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UNDER THE SUPERVISION AND GUIDANCE OF

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ABSTRACT

The overreliance on chemical pesticides in agriculture has led to significant environmental and health issues, including soil degradation, water contamination, and adverse effects on non-target organisms, including humans. As an alternative, biopesticides offer a sustainable, eco-friendly approach to pest management. This report explores the use of biopesticides in the summer cultivation of moong (Vigna radiata), assessing their efficacy against pests and their economic viability compared to chemical pesticides.

Moong, a staple legume crop in India, often suffers from pests like pod borers and aphids, which reduce yield. While chemical pesticides are effective, they pose risks such as pest resistance, harm to beneficial insects, and environmental damage. This study evaluates the effectiveness of biopesticides in controlling these pests and enhancing yields.

Recent trends in India show a shift towards biopesticides, driven by awareness of chemical pesticide harms and demand for organic produce. Government initiatives promoting sustainable agriculture have supported this transition, with biopesticides gaining market share and expected to grow faster than chemical pesticides.

Field trials in India demonstrate that biopesticides effectively manage pest populations in moong plantations, with some products matching or surpassing chemical pesticides in efficacy. These trials underscore the potential of biopesticides to improve pest control, promote plant growth, and yield, aligning with integrated pest management strategies to minimize environmental impact.

Keywords

Bio pesticides, Effects of chemical pesticides, Moong plantation in summer, Effect of bio pesticides on moong pest, Trend in biopesticides usage in India, cost analysis.

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ACRONYMS

Agriculture – agr.

Management – Mngmnt

Figure – Fig.

Botanical- bot.

Cost – cst.

Collect – cllct

Suspension Concentrate – SC

Soluble Powder – SP

Emulsifiable Concentrate – EC

Soluble liquid – SL

Wettable Powder – WP

Water-dispersible granules – Wg

NOMECLATURE

NEEM	*Azadiracta indica*
TURMERIC	*Curcuma longa*
GARLIC	*Allium sativum*
TOBACCO	*Nicotiana tabacum*
MOONG	*Vigna radiata*
FLAT BEAN	*Phaseolus vulgaris 'Helda'*
WHITE FLY	*Bemisia tabaci*
ARPHIDS	*Aphis craccivora*
BEAN POD BORER	*Maruca vitrata*
BROWN MORMORATED STING BUG	*Halyomorpha halys*

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CHAPTER 1:

INTRODUCTION

Pesticides are substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Food and Agriculture Organization has defined the term pesticide as any substance or mixture of substances intended for preventing, destroying, or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood, and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport [1].

Types of pesticides

Pesticides are commonly classified into three main categories based on organisms against they are used: -

1. Insecticides: - kill insects which feed on crops, live stocks or valuable products.

2. Herbicides: - kills unwanted that occupies useful spaces.

3. Fungicides: - kills fungus that destroys usefulness of desired product.

The demand of these pesticides are increasing continuously from the starting green revolution and with the increasing demand risk associated with them is also increasing therefore there is a need of better alternative, which is bio pesticides. Bio-pesticides are like the types of pesticides that are derived from plant extracts and have very little or no effect on human health and the environment. According to the Indian Council of Agricultural Sciences (ICAR), biopesticides are natural or manmade substances that control pests in agricultural fields. They are non-toxic, environmentally friendly, and can be sometimes cheaper than other pesticides. Bio- pesticides are derived from microorganisms, plants, or pheromones. Biopesticides are made from naturally occurring substances that control pests by nontoxic mechanisms and in an eco-friendly manner. Biopesticides are an important aspect of sustainable agriculture, providing effective pest control without harming the environment. Some common plants extracts which works as bio pesticides are neem, garlic, tobacco, turmeric etc.

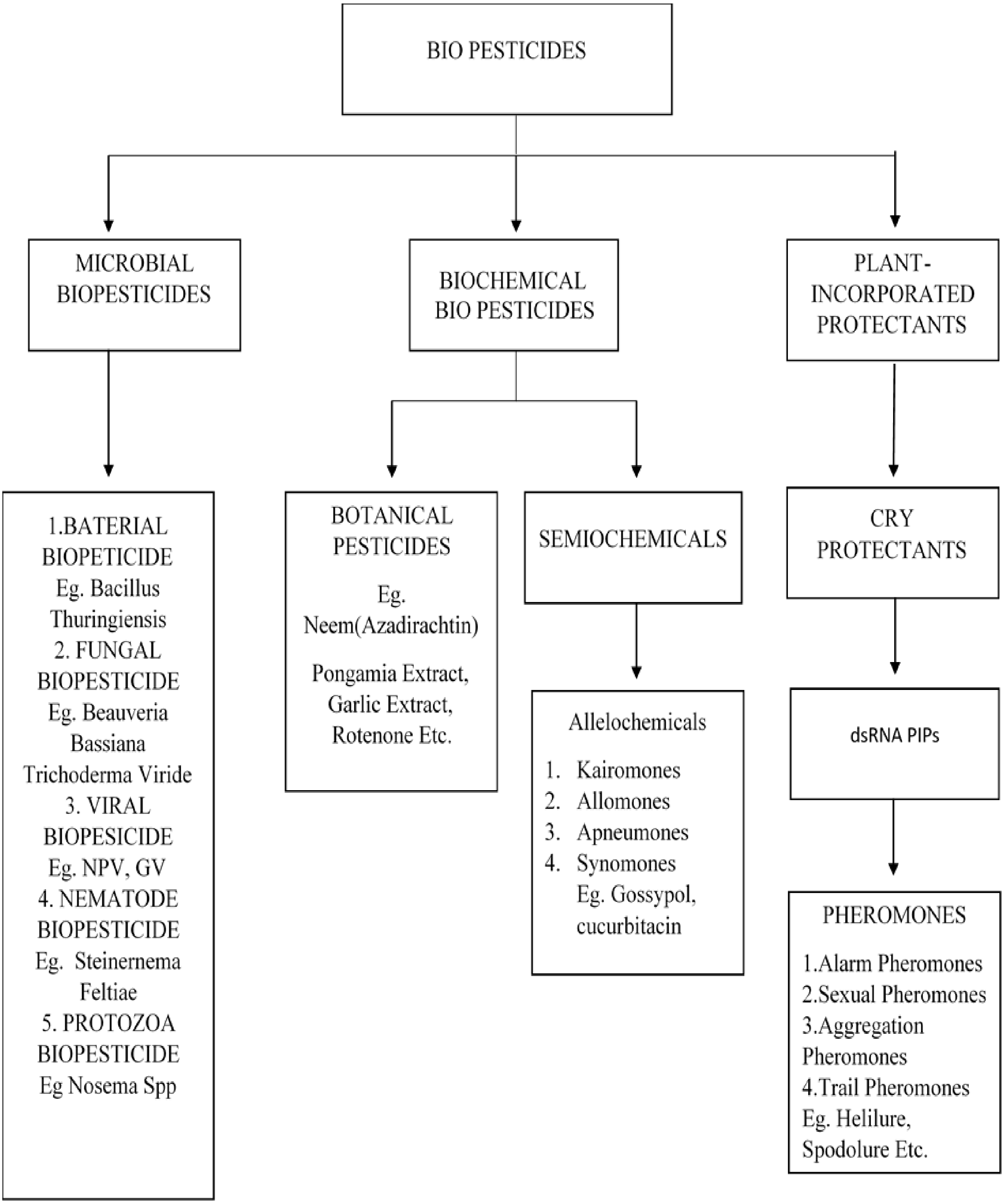

Fig 1.1 Types of Biopesticides

1.1 NEEM

Azadiracta indica known as the Indian neem plant is an evergreen, hard tree that is native to the sub- continent. It can easily be grown in nutrient-poor soil and can survive even in dry harsh conditions. It is known to be friendly with other vegetation but it is disliked by insects! Both leaves and fruit of the new plant are known to have a bitter taste having fungicidal, insecticidal, and nematicidal properties[36]. Recently, the neem plant has gathered much attention it is a potential source of drugs and eco-loving pesticides[32]. Leaves of the neem plant have been used as a substrate for producing vermicompost. The effect of vermicompost application on the growth and yield of the brinjal plant has been studied. It has been revealed that the application of neem vermicompost produces potential effects on plant growth[32].

1.2 TOBACCO

Tobacco is a commodity that is used as the main ingredient for cigarettes. Tobacco commodities and cigarette products have high economic value and are a source of farmers' income, and domestic government revenues and employment. This makes the cigarette industry one of the irreplaceable industries in the country, while the fact that many people want to stop the industry because of the negative effects caused by cigarettes. But if the tobacco industry is stopped, this impacts the lives of tobacco farmers, and the government's income and eliminate one of the employment opportunities chance in Indonesia. On the side of the dangerous effect of raw cigarette material, tobacco has other functions that are not widely known, namely as a biopesticide[13].

1.3 GARLIC

Garlic (Allium sativum), which possesses natural fungicidal and pesticide properties, effectively works to control pests. It serves as an excellent economical, non-toxic biological pesticide for use in agriculture. The natural pesticide (garlic) eliminates a strong aroma that can provide an olfactory camouflage against insects.Thus, masking their normal host-finding or feeding cues. Aphids, ants, termites, white flies, beetles, borers, caterpillars, slugs, and armyworms are some of the pests that can be suitably controlled using garlic[14].

1.4 TURMERIC

Turmeric, also known as Curcuma longa, is a flowering plant that grows natively in the Indian subcontinent and Southeast Asia. It is a spice that shares a genetic relation with ginger and has been utilized in cooking for numerous years. Turmeric is notably recognized for the enhancement it brings in terms of color, flavor, and nutritional value to various dishes and cuisines. apart from that it is a good source of biopesticide.

1.5 MOONG CULTIVATION IN SUMMER

Moong (Vigna radiata), also known as mung bean, is a key legume crop in India, especially valued for its nutritional benefits and soil-enriching properties due to nitrogen fixation. Cultivating moong during the summer season, which spans from March to June, presents unique agronomic challenges and opportunities. The high temperatures and limited rainfall during this period necessitate efficient water management and robust pest control strategies to ensure optimal crop yield and quality.Pest management is a critical aspect of moong cultivation during the summer. Common pests, including pod borers (Helicoverpa armigera), aphids (Aphis craccivora), and whiteflies (Bemisia tabaci), can cause significant yield losses. Traditionally, chemical pesticides have been employed to combat these pests, but their extensive use has led to negative consequences such as pest resistance, environmental pollution, and health hazards for humans and animals.

CHAPTER 2: LITERATURE SURVEY

Biopesticides are major components of integrated pest management and potential alternative to their chemicalcounterparts. Biopesticides represent only 2.89 per cent of theoverall pesticide market in India[25]. In India, sofar only 12 types of biopesticides have been registered underthe insecticidal act, 1968[18]. Biopesticidemarket is growing very rapidly. The growth rate of biopesticidesover the next 10 years has been forecast at 10-15 per cent perannum, in contrast to 2 per cent of chemical pesticides[35]. In India, the annual growth rate of biopesticides isestimated to be 2.5 per cent.

Biopesticides, which include microbial pesticides, biochemicals from natural sources, and genetically modified organisms, offer an eco-friendly alternative to chemical pesticides. Despite their potential benefits to agriculture and public health, the adoption of biopesticides in India remains low, at only 2.5% of the total pesticide market. The global production of biopesticides exceeds 3,000 tons annually and is rapidly increasing. These products are target-specific and safer for non-target organisms, including humans[18].

Chemical pesticides have been widely used in agriculture to control pests, but their adverse effects are increasingly well-documented. These pesticides contribute to environmental pollution, contaminating soil and water sources, and harming non-target organisms, including beneficial insects, birds, and aquatic life[22]. Human health risks associated with chemical pesticides include acute poisoning and chronic illnesses such as cancer, neurological disorders, and reproductive issues[21]. Moreover, the overuse of chemical pesticides can lead to pest resistance, necessitating higher doses and more toxic alternatives[27]. The persistence of chemical residues in food poses additional risks to consumers, prompting a shift towards safer alternatives like biopesticides[29]. This growing awareness underscores the urgent need for sustainable pest management practices.

Biopesticides are a good alternative to the synthetic pesticide. The various properties of different parts of neem (Azadirachta indica) are used as insecticide, antifeedant, hormonal, antifungal, antiallergic, antidermatic, anti-inflammatory, antiscabic larvicidal and spermaticidal activity etc[5]. Azadirachtin, chemically a tetranorterpenoid component of neem acts on the mitotic cells and blocks the microtubule polymerization. Certain activities of genes and proteins are also altered by azadirachtin. As a botanical insecticide azadirachtin is effective against many biological processes. Likewise Nim80 and Neemas are also neem products that produce the insecticidal activity[12]. The neem extract increased shoot height, number of branches, number of leaves, number of buds, number of flowers and number of fruits of tomato plant over controls in different treatments. Neem extract was found effectively in controlling canker (50.32%), early blight (55.12%), wilt (59.45%), leaf spot (55.48%), fruit spot (41.93%), blossom end rot (40.86%) and sun scald (25.61%) in comparison to controls under field condition[10]. Neem extracts are better alternative to chemical pesticides as they are eco-friendly, non-toxic and cost effective.

Turmeric (Curcuma longa) is an effective biopesticide due to its curcumin content, which exhibits antifungal, antibacterial, and insecticidal properties. It can control various pests and pathogens, offering an eco-friendly alternative to chemical pesticides[20]. The fresh juice, the aqueous extracts and the essential oil of the plant are endorsed with fascinating pesticidal properties against certain pests of agricultural importance as well as a perceptible repugnant activity against noxious mosquito species[2]. Turmeric is biodegradable and poses minimal risk to non-target organisms, supporting sustainable agriculture practices. Ongoing research aims to optimize its formulations and application methods to enhance its practical utility in diverse agricultural settings[9]. Garlic (Allium sativum) possesses strong insecticidal and fungicidal properties due to its sulfur compounds, particularly allicin. It effectively controls pests like aphids, termites, and fungi, offering a safe alternative to chemical pesticides. Biodegradable and safe for non-target organisms, garlic supports sustainable agricultural practices. Research focuses on optimizing its use to maximize effectiveness in pest control[9].

Tobacco (Nicotiana tabacum) is recognized for its biopesticidal properties, primarily due to the presence of nicotine, which has strong insecticidal effects. Tobacco extracts are effective against a variety of pests, including aphids, caterpillars, and beetles, providing a natural alternative to chemical pesticides[24]. Biodegradable and less harmful to non-target organisms, tobacco-based biopesticides support sustainable agriculture practices. Despite its potential, the adoption of tobacco as a biopesticide requires further research to optimize application methods and formulations[19].

Green gram or moong beans (Vigna radiata) is a vital legume crop in India. Mungbean accounts for about 12% of the total pulse production in South and Southeast Asia. The nine South and Southeast Asian countries, namely, Bangladesh, Burma, India, Indonesia, Nepal, Pakistan, the

Philippines, Sri Lanka and Thailand, together increased their mungbean production from 1.1 million tin 1976 to 1.8 million tin 1986, registering a growth rate of 4.5%, against a growth rate of only 0.5% for total ·pulses[39]. The cultivation of summer moong faces significant challenges, including high temperatures and limited water availability, which require effective water management and pest control strategies[17]. Typically grown in well-drained soils, moong requires proper irrigation to alleviate heat stress. Common pests such as pod borers, aphids, and whiteflies have traditionally been managed using chemical pesticides[12]. However, the negative impacts of chemical pesticides on the environment and human health have driven the exploration of eco-friendly alternatives like biopesticides. Biopesticides offer a safer approach to pest management, aligning with sustainable agricultural practices[11]. Ongoing research aims to optimize the use of biopesticides for effective pest control in moong cultivation.

Chemical pesticides such as acephate, dimethoate, and monocrotophos have been widely used in agriculture, including the cultivation of moong (Vigna radiata). Despite their effectiveness in controlling pests, these chemicals pose significant risks to human health and the environment.

Acephate, for example, is commonly used to manage a variety of pests in moong fields. However, exposure to acephate can cause symptoms such as nausea, dizziness, and confusion due to its neurotoxic effects, potentially leading to long-term neurological damage with prolonged exposure. In moong cultivation, the presence of acephate residues can be detrimental to both farmers and consumers.

Dimethoate is another pesticide frequently used in moong cultivation to control aphids and other pests. It is known to be highly toxic, causing rapid organophosphate poisoning. Symptoms of exposure include headaches, sweating, muscle twitching, and in severe cases, death. Chronic exposure to dimethoate can result in reproductive harm and long-term neurological issues such as depression and anxiety. The use of dimethoate in moong fields raises concerns about its impact on the health of those involved in the agricultural process and the safety of the food produced.

Monocrotophos, a pesticide known for its acute toxicity, is also employed in the management of pests in moong cultivation. It has been linked to numerous cases of poisoning, causing symptoms such as blurred vision, dizziness, numbness, and severe headaches. In Egypt, a study revealed that farmers exposed to monocrotophos showed a high incidence of chronic pesticide poisoning symptoms. Furthermore, monocrotophos has been associated with a high fatality rate in poisoning incidents, highlighting its danger. The use of monocrotophos in moong farming not only poses a threat to farmers but also to consumers due to potential residue on the crops.

Biopesticides are gaining traction as an effective and sustainable alternative to chemical pesticides for managing major pests of green gram (Vigna radiata), commonly known as mung bean. Several studies highlight the efficacy of biopesticides in controlling key pests such as the pod borer (Helicoverpa armigera), aphids (Aphis craccivora), and whiteflies (Bemisia tabaci).

Pod Borer (Helicoverpa armigera) is one of the most damaging pests of green gram, causing significant yield losses. Biopesticides like Bacillus thuringiensis (Bt) and nuclear polyhedrosis virus (NPV) have been shown to effectively manage pod borer infestations. Bt, a microbial pesticide, produces toxins that are lethal to the larvae of H. armigera, leading to reduced pest populations and less crop damage[12]. NPV, a viral biopesticide, infects and kills the larvae, providing a biological control method that minimizes the need for chemical interventions.

Aphids (Aphis craccivora) are another major pest affecting green gram, known for their ability to transmit plant viruses and cause direct damage through sap-sucking. Neem-based biopesticides, derived from Azadirachta indica, have shown considerable success in controlling aphid populations. Neem oil and neem extracts contain azadirachtin, which disrupts the growth and reproduction of aphids, leading to reduced pest numbers and less plant stress[38].

Whiteflies (Bemisia tabaci) are notorious for their role in transmitting viral diseases and causing sooty mold on plants. Biopesticides such as neem oil and entomopathogenic fungi like Beauveria bassiana have been effective against whiteflies. Neem oil works by repelling and inhibiting the feeding of whiteflies, while B. bassiana infects and kills them through fungal spores, reducing their population[11].

Phosalone and NeemSeed Kernal Extract 10 per cent were equally effective in controlling defoliators on the intercropped green gram (80.55 and68.57 per cent respectively) but varied in the sole crop. The grain yield was 90.32 per cent higher in the carbofuranl phosalone treated agroforestry plots compared to untreated[26].

CHAPTER 3:

PROBLEM STATEMENT

The widespread use of chemical pesticides such as acephate, dimethoate, and monocrotophos in the cultivation of moong (Vigna radiata) and other plants poses significant health risks to farmers and consumers, as well as environmental hazards. These pesticides, while effective in controlling pests, are associated with severe acute and chronic health effects, including neurotoxicity, reproductive harm, and in extreme cases, fatal poisoning. Additionally, their residues on crops can lead to health issues for consumers. Despite their known dangers, the reliance on these chemical pesticides persists due to their immediate efficacy and lack of widespread adoption of safer alternatives. The challenge lies in identifying and promoting sustainable pest management practices, such as the use of biopesticides, that can provide effective pest control without compromising human health or environmental safety. There is an urgent need for comprehensive strategies to educate farmers on the benefits of biopesticides, improve accessibility to these safer alternatives, and implement regulatory measures that encourage the reduction of hazardous chemical pesticide use in moong cultivation.

CHAPTER 4:

METHODOLOGY

Bio-pesticide can be prepared very easily. Even extracts of some work as bio-pesticide. The method adopted is simple extraction of juice from different parts of plant such as leaves, rhizome, root etc.

4.1 PREPRATION

4.1.1 MATERIAL REQUIRED:-

Water, Neem and tobacco leaves, garlic and turmeric, containers, boiling container

and cotton clothe.

4.1.2 STEPS OF PREPARATION

To prepare a blend of bio pesticide following steps and materials are required: -

1. Collect leaves of neem and tobacco, turmeric and garlic.
2. Weigh 750 g of tobacco leaves, 500g of neem leaves, 250g of garlic and 250g of turmeric.
3. Crush the turmeric in fine power and half liter of water and let it rest for 20 minutes.
4. After that filter the solution using cotton cloth in a separate container.
5. Now grind the garlic and squeeze it extract using cotton cloth, around 100-150ml of juice will be extracted from it.
6. Boil the leaves of neem and tobacco plant in 2 liters of water for around 1-2 hrs. (Until half the solution is left).
7. Mix all the solution to in container. The ratio of all the solution may vary in accordance to crops and pest attacks.

Fig 4.1 Manufacturing process

4.2 GENERAL PROPERTITES

4.2.1 CHEMICAL CONTENTMENT OF PLANT EXTRACTS

Extract	Chemical	Effects
	Azadirachtin	It may be creating a reduction in the feeding habit which is putting a halt on molting process; larvae and pupae are facing untimely death, and also a possible cause infertility in the emerging adults. This all depends on the given dose [5]
	Saponins	They have antimicrobial activity, that inhibits molds, and protecting plant from attack of insects[5].

Neem	Nim 80 and azatin	Both neem products have been shown to produce the insecticidal activity or growth effects. At low concentration of azatin the growth rate were reduced while increasing the concentration lead to high mortality rate. Larvae become unable to feed when they were exposed to azatin. It has been shown that azatin acts as direct toxicant instead of inhibiting its growth. On the other hand Nim 80 has showed effectiveness against larval development. [5]
Tobacco	Nicotine	Nicotine, which is believe to be a potential nerve poison, is used as a raw material for various types of insecticides or is a very strong addictive substance. It's highly toxic to some insects and fungal species; such as, the Colorado potato beetle. Moreover, when used correctly, nicotine can help control pests in agricultural settings[6]
Garlic	Allicin	It does possess powerful antimicrobial properties. It can act as a natural pesticide by repelling or even, killing various pests; including various insects and nematodes which can heavily damage crops.[11]

Turmeric	Curcumin	It is the main and most important bioactive compound found in turmeric, it has shown remarkable insecticidal and larvicidal activities against a wide variety of pests. It can effectively disrupt the growth and development of insects and significantly interfere with their feeding habits, making it a potentially promising candidate for use as a biopesticide. Turmeric is truly a versatile and powerful natural remedy that continues to show immense potential in pest control.[11][13]
	Ar-turmerone	It is a natural compound found in turmeric oil. It has been studied for its insecticidal and repellent properties against various pests, including mosquitoes and agricultural pests[11]
	Turmeronol A	It is a diterpene compound isolated from turmeric that has shown insecticidal activity against agricultural pests.[12

Table 4.1 Chemicals present in plant extracts and their action on pests

4.2.2 colours of plant extract

EXTRACT	COLOUR
Garlic	Algae green
Neem	Greenish transparent liquid
Tobacco	Pinkish foam during boiling
Turmeric	Orangish yellow
Final solution	Dusty green with a hint of pink colour

Table 4.2 Colours of different plant extracts

4.3 Moong cultivation in summer

4.3.1 selection of varierty

The time span of zayad is very short. The variety choosen should have duration of about 2 months so that farmers are able to prepare their fields before the starting of rabi season.

Variety	Duration	Average production
IPM 205-7 (VIRAT)	52-55 Days	5-6 Q./acre

PDM 139 (SAMRAT)	60-65 Days	5-6 Q./acre
KM 2342 (AZAD Moong 1)	62-55 Days	4-5 Q./acre
HUM 16 (Malviya Jankalyani)	55-60 Days	5-6 Q./acre
Malviya Janchetna	60-65 Days	5-6 Q./acre
IPM 410-3 (SHIKHA)	60-65 Days	7-8 Q./acre

Table 4.3 Different Varieties of Moong Sutable for summer Season

4.3.2 PEST ATTCKS ON MOONG

POD BORER (*HELICOVERPA ARMIGERA*): The pod borer is a major pest of moong, causing significant damage by boring into pods and feeding on developing seeds, leading to considerable yield loss.

APHIDS (*APHIS CRACCIVORA*): Aphids are small sap-sucking insects that can weaken moong plants by draining vital nutrients, causing stunted growth, and transmitting viral diseases.

WHITEFLIES (*BEMISIA TABACI*): Whiteflies are tiny, winged insects that feed on the underside of moong leaves, excreting honeydew that promotes sooty mold growth and reducing photosynthetic efficiency.

4.3.3 CHEMICAL PESTICIDES USED IN MOONG PLANT

Chemical	Dose	Action	Targeted pest
Asphate 75 sp	200-280g/acre	Organophosphate insecticide with contact and systemic action	Sucking and chewing insects such as leafhoppers, aphids, thrips, flea beetles, corn borers, cabbage worms, diamondback moths, budworms, and bollworms
Dimethoate 30 ec	300-350ml/acre	Organophosphate insecticide that acts through contact, stomach, and systemic modes	Bugs, stem borers, aphids, beetles, weevils etc.
Monocrotophos 36 sl		Organophosphate insecticide that affects the	Aphid, leaf hopper and thrips, gray weevil, bollworms, brown

	600-800 ml/acre	nervous system by inhibiting acetylcholinesterase (ache), an enzyme that's essential for normal nerve impulse transmission	plant hopper, green leaf hopper, leaf roller/foder, pod borer, plume mouth
Thiodicarb 75 wp(banned)	250g/acre	Primarily acts as an ingestion tociant with some complimentry contact action and act by inhibiting cholinesterase enzyme.	Major lepidoptera and coleoptera pests and some hemiptera and diptera

Table 4.4 oprational information about chemical pesticide

Other than these Thiamethoxam 25% Wg(40-50g/acre), Spinosad (75-100ml/acre), Indoxacarb 14.5 sc (250-300 ml/acre) are also common pesticides in moong plant.

4.3.4 pesticide used in organic farming

Targeted pests	pesticide	dosage
Sucking insect	Verticillium lecanii (contact based action, fungal)	2l/acre
Feed incsects (carterpillars)	Boveria bassiana (contact based action, fungal)	400ml/acre

Table 4.5 fungus based organic pesticide

4.4 experiment design

4.4.1 Spray on moong

The plant extract is test on moong plantation in summer season. The extract is tested on different concentration. Usually the pesticides available of similar composition and one which prepared from neem kerenel have optimum dosage of 2ml/l of water, so the base concentrion is taken as 2ml/l and other concentrations are 5ml/l and 10ml/l.

The spraying is done twice during the experiment similar to chemical pesticide spraying.

4.4.2 SPRAY ON FLAT BEANS

This experiment is conducted on a particular plant of flat bean affected by brown mormarated stink bug with an obtimum concentration of pesticide.

4.4.3 CONTROL FIELD AND UNAFFECTED PLANT

The last set of experiment is conducted on control field (untreated field) and healthy unaffected plant without diluting the solution.

4.5 COST ANALYSIS

4.5.1 CHEMICAL PESTICIDES ON MOONG PLANT

Pest	Pesticide	Cost in INR
Bean pod borer maruca testulalis	Broflanlidie 17ml/acre (heavy acttacks)	960(17 ml) BASF Exponus Broflanilide 300 GL SC Insecticide
	Spinosad 75-100 ml/acre (heavy attack)	750(50ml) krishi seva kendra
	Indoxacarb 14.5 sc light attack 250-300 ml/acre	473 (100ml) kite
White fly(Aleyrodidae)	Monocrotophast 36% sl 400-450ml per acre	330/litre, Gujrat kisan fertilizer co.
	Acephat 75% sc 300-400gr/acre	240/250gm Asataf tata
	Dimethoate 30 % ec 600ml/acre	650/l, demat katyayani
Aphid	Thiamethoxam 25% Wg 40-50g/acre	610/500g, triayo iffco

Table 4.6 cost of chemicals pesticides for different pest

4.5.2 ORGANIC PESTICIDES

Pests	pesticide	Cost in INR
Sucking insect	Verticillium lecanii 2l/acre	330/l kattyayani krishi seva kendra
Feed incsects (carterpillars)	Boveria bassiana 400ml/acre	330/l katyayani, kirshi seva kendra

Table 4.7 cost of organic pesticides

4.5.3 MARKET AVAILABLE PLANT BASED BIO-PESTICIDES

Plant Extract	Major Chemical Composition	Cost(INR) / Product
Neem Based	0.03% Azadirachtin	330/L Azasik Sikko
Turmeric Based	5% Curcumin	1250/L Curcumin Extraction RD Suraksha Bio.
	1% Curcumin	620/L Katra Fertilizers And Chemicals Private Limited
Garlic Neem Based	_	200/L Neem Garlic Pesticide
Tobacco	1-2% Nicotine	237/0.9kg Nicotex-D Tobacco Dust Powder

Table 4.8 Plant extract based pesticide available in market

4.5.4 PLANT BASED BIOPESICIDE MANUFACTURING COST

Energy cost - Fire wood burned =10 kg (185 MJ) = 30 Rs

4.5.5 EQUIVALENT COST

SOURCE	CELORIFIC VALUE	COST OF COMBUSTION (INR)
LPG	55mj/Kg – 3-3.5 Kg	200-220 Rs
Coal	23.86 Mj/Kg – 8kg	64 Rs
Natural Gas	50mj/Kg – 3.5 – 4 Kg	320rs
Electric Heater	26 Kwh=93.6 Mj	416 Rs

Table 4.9 Cost of combustion using different source

4.5.6 MATERIAL COST

Neem Leaves – Easily available around the vicinity of village and has no cost for small scale.

Tobacco Leaves – Similar to neem it also has no cost for small scale. Even if not available market price of fresh non-damaged tendu patta is 400/kg but biopesticide don't have such requirement it can be made from leftover or damaged leaves and can be easily available at 1/10 of price of fresh tendu patta.

Garlic – This season it has hit the lowest price of 6rs/kg but currently its mandi rate is 9443.3/quintal in MP (source commodityonline)

Turmeric – Currently it is 148.83 INR/quintal but it has hit the lowest market rate of 55 rs/kg in MP (source commodityonline)

Total cost of manufacturing = 30 + 25(100rs/kg turmeric) + 23.5(94rs/kg garlic = 78.5 INR for 2 liters of solution.

4.5.7 COST COMPARISION

Pesticide Category	Amount Of Spray	Pesticide Cost (INR)	Percentage Saving
Chemical pesticide	200 liters of spray	48+165+960 = 1,173	93.32%
Bio pesticides(organic farming)	200 liters of spray	132+660= 792	90.08%
Plants extract bio pesticides available in market	2ml/l for 200 liter spray	80+237+210+250=777	89.89%
Homemade bio pesticide	10ml/l for 200l spray	78.5	_

Table 4.10 Cost comparision of different pesticides

$$\text{Percentage saving} = \frac{cost\ of\ pesticide\ X - cost\ of\ home\ made\ pesticide}{cost\ of\ pesticide\ X} * 100$$

CHAPTER 5:

OBSERVATION AND RESULT

5.1 OBSERVATION

5.1.1 SPRAY ON SUMMER MOONG

The field test is conducted in parts where ten plants were observed randomly during the whole experiment process. Fours zones are divided in the field such that three zone are sprayed with 2ml, 5ml, and 10ml pesticide dose and last zone is left untreated.

White Fly

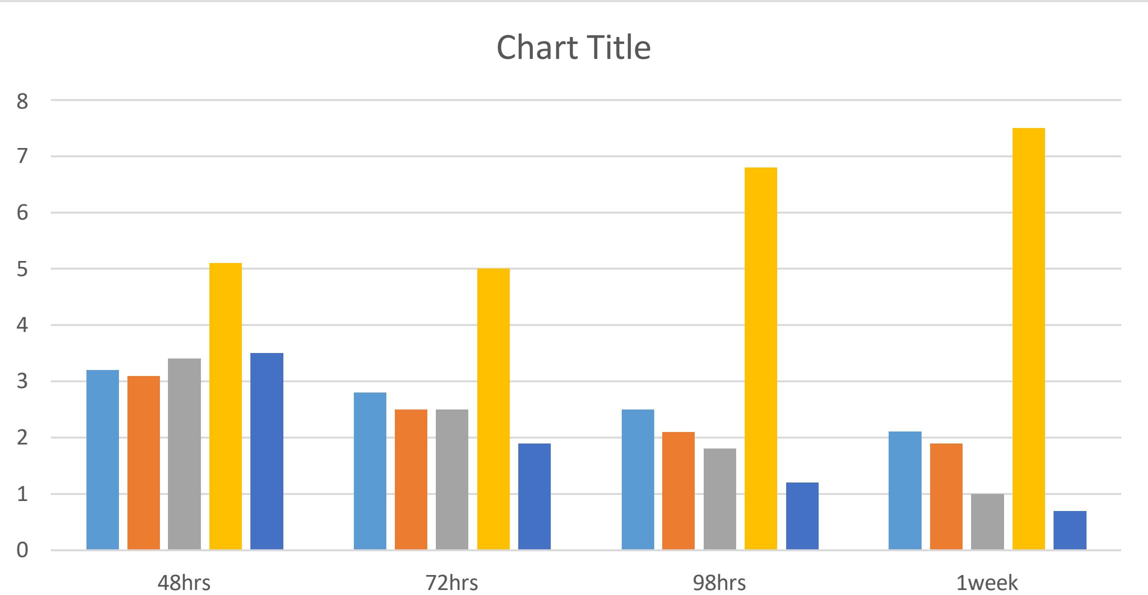

Fig 5.1 Avg. bug population vs time

Application	Pretreatment(Average Bugs In 10 Plants Randomly)	Efficiency
2ml	5.2	59.6%
5ml	5.3	64.15
10ml	5.6	75%
Untreated	5.3	86.78%

Table 5.1 Efficiency of manufactured pesticide against white fly

Arphids

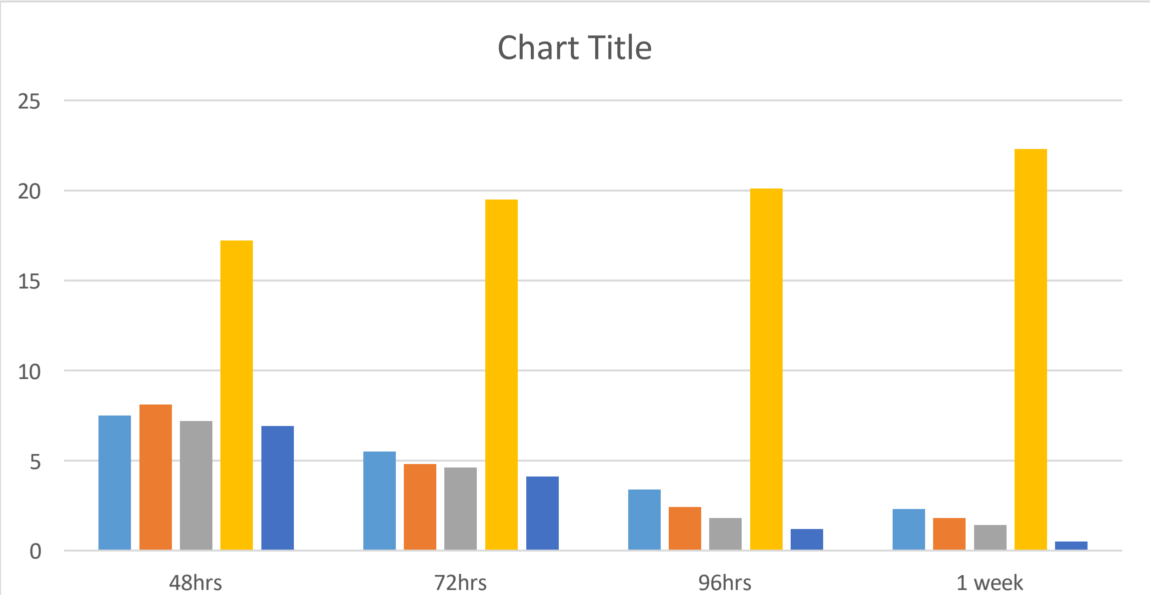

Fig 5.2 Avg. bug population vs time

application	Pretreatment(average bugs in 10 plants randomly)	Efficiency
2ml	15.8	84.31%
5ml	13.2	86.36%
10ml	14.9	90.6%
untreated	14.3	94.4%

Table 5.2 efficiency of manufactured pesticide against arphids

$$\text{Efficiency} = \frac{\text{Pretretment condition} - \text{Condition after 1week}}{\text{Pretretment condition}} * 100$$

Maruca

Maruca vt. Formed coconas inside the flower. Due to the extreme wether condition no major traces of pest were found inside the flower.

5.1.2 SPRAY ON FLAT BEANS

10ml/l of manufactured pesticide is sprayed on single plant of flat bean against brown mormorated sting bug and following observation is obtained

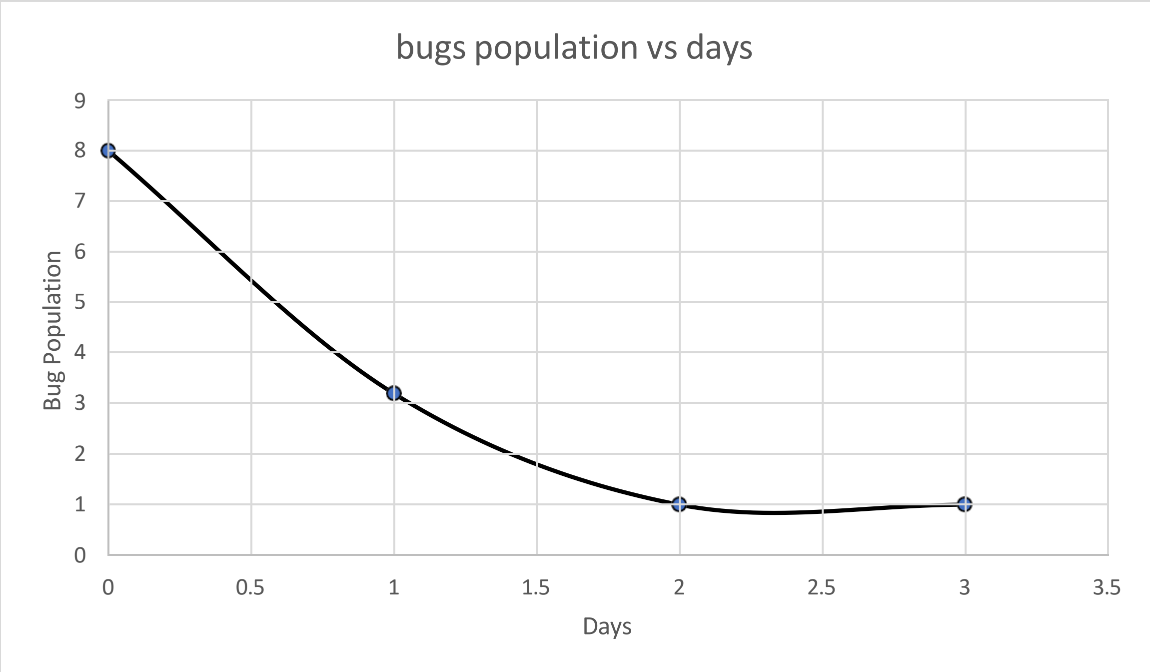

Fig 5.3 Bugs population Vs Days

5.1.3 SPRAY ON UNAFFECTED HEALTHY PLANTS

Concentrated solution of pesticide is sprayed on differents plants to get some idea about its effects. The following points have been observed:-

- After 2-3 hrs of spray the solution on plant surface get dried and formed a thick layer, which is probabily cause due to presence of tobacco extract.
- No ants were obsevered after the spray but they had been observed before the spray
- The presence of bees was unhinded by presence of pesticide but no. of butterflies is reduced.
- The retension time of pesticide is observed around 15 days

5.1.4 RETENSION TIME

Pesticide	Retension Time On Plant
Spinosad	It Breaks Down In 1-2 Days But Have A Killing Effect Upto 4 Weeks
Acephate	10-15 Days
Dimethoate 30 % Ec	7-14 Days
Thiamethoxam 25% Wg	10-21 Days

Boveria Bassiana	It May Stay On Field Upto The Day Of Harvestion Depending On Temperature Condition
Plant Extract	10-15 Days Depending On Concentration And Is Subjected To Rain.

Table 5.3 Retention time of different pesticide
(Source: product specification given their selling website)

5.2 RESULT

The pesticide manufactured is much cheaper as compared to other alternatives. It also shows some positive impacts on non-targeted bugs. It is also seen that sprayed plant get healed faster. The retension time of biopesticide manufactured is lower than most of the chemical pesticide

Fig 5.1 Summer Moong Plant

Fig 5.2 Brown Mormorated Sting Bug On Flat Beans

CHAPTER 6:

CONCLUSSION

This report underscores the growing relevance and potential of biopesticides as sustainable alternatives to chemical pesticides in agriculture, particularly in the cultivation of moong (Vigna radiata). The findings indicate that biopesticides such as neem, garlic, turmeric, and tobacco not only effectively control pests like pod borers, aphids, and whiteflies but also offer significant health and environmental benefits. Chemical pesticides, such as acephate, dimethoate, and monocrotophos, though effective, pose severe risks to human health, including neurological damage and chronic illnesses, as well as environmental hazards like soil and water contamination.

Biopesticides, on the other hand, are biodegradable, non-toxic to humans and non-target organisms, and support sustainable agricultural practices. The use of biopesticides aligns with integrated pest management (IPM) strategies, which promote the use of multiple, synergistic pest control methods. This not only reduces the risk of pest resistance but also minimizes environmental impact. Additionally, the economic analysis shows that while the initial costs of biopesticides may be higher, their long-term benefits include enhanced soil health, reduced application frequency, and eligibility for organic certification.

Overall, the adoption of biopesticides presents a viable path towards sustainable agriculture, improving food safety, reducing toxic exposure for farmers, and mitigating environmental damage. Continued research and field trials are essential to optimize biopesticide formulations and application methods, ensuring their efficacy and economic feasibility for widespread agricultural use.

CHAPTER 7:

RELEVANCE TO THE SOCIETY AND OBJECTIVE

7.1 SOCIAL RELEVANCE

7.1.1 ENVIRONMENTAL RELEVANCE

Reduction In Chemical Residue: The use of biopesticides reduces the risk of harmful chemical residues in soil and water bodies, preventing contamination of local ecosystems and protecting aquatic life.

Soil Health Preservation: Biopesticides contribute to maintaining soil health by avoiding the negative impacts of chemical pesticides, which can disrupt soil microbial communities essential for nutrient cycling and soil fertility.

Mitigation Of Pesticide Resistance: Integrating biopesticides into pest management strategies can help mitigate the development of pesticide resistance in pest populations, ensuring long-term effectiveness and reducing the need for higher doses of harmful chemicals.

Promoting Organic Farming: The project supports the trend towards organic farming and the production of residue-free crops, meeting the growing consumer demand for environmentally friendly and health-conscious agricultural products.

7.1.2 ECONOMIC RELEVANCE

The cost of manufacturing of bio-pesticide is very less as compare to other market available pesticides. These pesticides consume a major chunk of farmer's income. Plant based pesticide allowed them to use the saved money in other necessary investments.

7.1.3 HEALTH RELEVANCE

Farmers' Health: Bio pesticides, derived from natural sources, are typically less toxic than chemical pesticides. This reduces the risk of acute poisoning and long-term health issues for farmers who handle these substances regularly. By minimizing exposure to harmful chemicals, biopesticides help protect farmers from respiratory problems, skin disorders, and other health complications associated with chemical pesticide use.

Food Safety: Bio pesticides contribute to safer food production by leaving minimal to no harmful residues on crops. This enhances the overall safety and quality of food products, ensuring that consumers are not exposed to potentially dangerous chemical residues. The use of biopesticides aligns with the increasing consumer demand for organic and residue-free produce.

Toxic Reduction: The application of biopesticides helps in significantly reducing the environmental and health hazards posed by synthetic chemicals. They break down more quickly in the environment and target specific pests, thereby preserving beneficial insects and maintaining ecological balance. This reduces the cumulative toxic load on the ecosystem, promoting a healthier and more sustainable agricultural practice.

7.2 OBJECTIVE

1. Analyzed the different concentrations dosage of manufactured bio-pesticide
2. Analyzed the cost of manufacturing of pesticides with commercially available pesticide
3. Gained knowledge about moong plantation in summer.
4. Studied the effect of concentrated pesticide sprayed on healthy plant
5. Understood the mechanism of different kinds pesticides action and feeding habbit of moong pests.

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This is to certify that Subhash Thakur of Madhav Institute of Technology & Science, Gwalior, India presented the paper in the 2nd International Student Conference on Multidisciplinary and Current Technical Research (ISCMCTR - 2024), held at Madhav Institute of Technology & Science, Gwalior (M.P.), India, during 20 - 21 April, 2024.

Paper Title: Extracts of Different Plants as a Potential Bio Pesticide and its Effect Against Brown Marmorated Stink Bug

Author(s): Subhash Thakur (Madhav Institute of Technology & Science, Gwalior, India)*

Dr. Manjaree Pandit

Coordinator, ISCMCTR - 2024

Collection work	C.W.
Experiment	Exp.
Research work (litrature)	R.W.
Writting work	W.W
presentation work	P.W.

Day 1, Research work (litrature) 27 Dec, wed.

① Analysing the need of biopestide over chemical pesticide.

② Possibilities & potential of biopesticide

③ Choosing the affordable & economically viable plants for extraction process.
(Neem, garlic, tobacco) &

plants ...
(Neem, garlic, tobacco) &

Day ② Collection, Research 4&5 Jan, Thus & Friday

① ~~Visit to~~ Analysing different method of biopesticide extraction
② College visit.

D③ R.W. 9-10 Jan, Tue, ...

1. Paper reading (Bajwa, Ahmad 2012) on application of neem based pesticide.
2. Paper 2 (Alkazrani) bioefficacy of turmeric & ginger as biopesticide

D.4 W.W. 13 Jan.

1. Presentation preparation for MPR first.
2. Revise all previous work.

D.5 15 Jan

1. Presentation day

D6 18-19 Jan

1. College visit
2. Discussion with mentor on father development.

7 Exp. 24 Jan, Wed

1. Selection of method preparation (water based extraction)

Exp. 28, Sun - 10 Feb sat

Visit to village
collecting neem, garlic, turmeric, & tobacco leaves

~~Exp.~~ 12 Feb Mon

Preparation for MPR Presentation
revisit to previous work

D10 15 Feb Thus

- MPR to presentation
- Getting valuable feedback from mentor about adopted method (extraction, water soluble)

D11 R.W. 20-24 Febru

1. Paper Reading (Kurnia Dewi, 2018) effect of tobacco pesticide on coffee bean protein.
2. P.R. (A.K. CHAKRAVARTHY) on garlic based pesticide

pesticide on Rokkee bean protein.

2. P.R. (A.K. CHAKRAVARTHY) on garlic based pesticide

D.12 Exp. 1 – 5 march

1 Extraction of essence of plants extract

Neem & Tobacco – boiling with water

Turmeric – soaked in water & then filtered.

Garlic – Crushed and squeezed

D.13 ~~Exp~~ 9-10 march

Visit to krishi vigyan kendra
(जीवामृत, नीमास्त्र formulation)

D.14 15 march

MPR 4 Presentation & topic clearance.

D.15 C.W. 20 march – 25 march

Field visit

- spray of pesticide on flat beans & monitoring of changes occurs in plant.
- Plant choosen is affected by brown marmorated stink bug.

D.16 C.W 1 april – 3 april

Data collection and assembling

- Research paper writting
- preparation of ppt

D.17. final analysis & ~~Subtting~~ Submission of the paper 10 april

18 MPR Presentation 15 april

19. Paper presentation 21 april

valuable Feedbacks such as to include cost analysis and ~~other~~ to get other p.o.v.

D.20 25 april

- Mid term evalution

Report submission

PPt presentation

26 April
Spray on Flower plants without diluting

27 April
thick spots are formed on surface of lea
Ants and butterfly are not observed

28 April
Spots developed cracked
still no ants & butterfly

29 April
Bees were observed

30 April
Spray on moong plant
three seperate concentration dosage are prepared
2, 5 & 10 ml & Untreated zone also choosen
Bugs were counted rand. in 10 Plants for each

03 May
No. of Bugs were observed in each zone

05 May
No. of bugs —
It is found that 10 ml con. is obtimum.

10 May
Data is tabulated is graph been plotted
litrature work for comparision with chemical

11 May
Cost analysis is done based on market price

18 May
Report & ppt work.