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ORIGINAL ARTICLE

Insecticidal and Anthelmintic Effects Of Plant Extracts With Different Solvents on *Tribolium castaneum*, *Planococcus Citri*, *Sitophilus Oryzae a*nd *Pheretima posthuman*

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ABSTRACT
The present work reports an experimental investigation of the Insecticidal and Anthelmintic effects of Eichhornia crassipes, Tamarindus indica, Carica papaya, Cassia uniflora, and Moringa oleifera leaf extracts and their efficacy with different solvents. The plant leaves were collected from different places of Mysore and Hubli district of Karnataka state, India. Leaf material was surface washed followed by shade dried to prepare plant powder. Plant powder was soaked in different solvents (Ethanol, Acetone, Petroleum ether, and Water) to prepare the crude extract. The insecticidal activity was conducted on Tribolium castaneum, Planococcus citri, Sitophilus oryzae, and the anthelmintic activity on Earthworm. The highest result was seen with 100% mortality in ethanol extract of Tamarindus indica for Tribolium castaneum, ethanol extract of Moringa oleifera for Planococcuscitri, acetone extract of Carica papaya for Sitophilus oryzae, ethanol extract of Eichhornia crassipes for Pheretima posthuma. The blend of few plants extract with water and petroleum ether solvent had negative results. Comparing with the solvent extracts, plant extracts with ethanol and acetone was more potent than Water and Petroleum ether. The novelty of the current work was to find swiftly possible natural substitutes for synthetic pesticides, thereby avoiding the hazardous effect on the environment and improving the region's economy.
Keywords: *Carica papaya, Tamarindus indica,* ethanol, Acetone, eco-friendly, Pesticides

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INTRODUCTION

A pesticide is any compound or formulation used to control pests which contains active ingredients and other substances to aid its delivery to target organisms and hence minimize pests. The major types of pesticides are herbicides, fungicides, rodenticides, molluscicides, soil bacteriostants, disinfectants, and living organisms with pesticidal activity. Pesticides are widely used in agriculture and have a tremendous impact on the production of food and fibres. They are important to the economy in terms of agricultural production, structure preservation and control of disease vectors. Biopesticides are often effective in very small quantities and decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides (25). One of the most important global problems is protecting crops from insects. Less than 0.5% of the total number of the known insect species are considered pests, and only a few of these can be a serious menace to people. Herbivorous insects are said to be responsible for destroying one-fifth of the world's total crop production annually. Particularly in the tropics and sub-tropics, where the climate provides a highly favourable environment for a wide range of insects. Insects inflict their damage on stored products mainly by direct feeding. Some species feed on the endosperm causing loss of weight and quality, while other species feed on the germ, resulting in poor seed germination and less viability (9). Helminthic infestations are now being recognized as a cause of chronic ill health and sluggishness amongst the children. More than half of the population in the world suffers from worm infestations of one or the other. Helminthes also affect domestic animals and livestock causing considerable economic loss (20).Global agriculture is currently challenged to provide increasing supplies of food for a growing population due to the changing trends of insect attacks and climatic conditions. There is overwhelming evidence that the use of chemical pesticides has created many other serious problems like ecological backlashes in pest species, environmental pollution and degradation, threat to biodiversity conservation, loss of beneficial fauna (predators, parasites, pollinators etc.)and human beings (10).Human health and environment are greatly affected by extensive use of synthetic insecticide, which is why the alternative way of pesticides, such as botanical pesticide consumption increase with the passage of time to control of insect pests (4).Plants and some microorganisms produce many natural chemicals that they use for their own defence against insects and disease organisms (19). Plants with bioactive compounds have been used to manage different crop pests and human infections with notable success. Management of pests using plant-based products was practiced over time until technology took over and synthetic pesticides were developed. The current global trend is towards consumption of food produced using safe and preferably natural plant protection products (14). Chemical pesticides will hinder the nitrogen fixation in the soil, so the growth and development of the plant is reduced. Insects will cause major harm to animals and plants, they cause severe health disease in animals, in plants they directly injure by feeding leaves, burrows in stems or roots. Worms can destroy young and tender plants. Also, when they are present in large numbers, they destroy grasslands by making too many burrows in the soil. Hence, the present study is undertaken to test the efficacy of plant extracts against anthelmintic and insecticides.

MATERIAL AND METHODS

Plant materials

Plants materials like *Eichhornia crassipes* (Mart). Solms, *Tamarindus indica* L., *Carica papaya* L., *Cassia uniflora* Mill., and *Moringa oleifera*Lam., were collected from Mysuru and Hubli districts of Karnataka, India. Authentic Identification was done using standard manuals and flora (5, 6, 15, 27).

Extraction of Plant Material

The leaves of the collected plants were washed with distilled water, cleaned leaves were allowed for drying in a shady area for 15 days and powdered separately. The crude extract was prepared by adding 5g of each plant extract in the beakers containing 50ml of acetone, ethanol, petroleum ether and water respectively, kept it in the room temperature for 24hrs with occasional shaking (8). The solvent extract was filtered using Whatman filter paper (22).

Collection of insects:

Test organisms like *Triboliumc astaneum*(Herbst)*, Planococcus citri*(Risso), *Sitophilus oryzae*(L.), *Pheretima posthuman* infested on plants and grains were collected from Mysuru and Hubli districts of Karnataka, India.

Insecticidal and Anthelmintic activity

Crude extracts of the processed plants were treated on the whatman filter paper, and allowed to dry completely. The insects and earthworms were produced into the pre-treated Whatman filter paper petri plate and observed. Both paralyzed and death timings were noted from the individual plant solvent extract. When the moment of insects is ceased then the insect is said to be dead (18). Chemical insecticides and Albendazole drug (20mg/ml) were granted as positive and solvents as negative controls (13).

RESULTS AND DISCUSSION

The synthetic pesticides had caused maximum damage to the environment as well as human health. So, there is a great need to develop alternative safe control agents. The agents like plant extracts with active compounds shows the insecticidal activity. Ethanol, acetone, petroleum ether and water leaf extracts of *Eichhorniacrassipes, Tamarindus indica, Carica papaya, Cassia uniflora* and *Moringa oliefera* were studied for their Anthelmintic and Insecticidal properties. Ethanol and acetone plant extract showed the highest susceptibility than the water and petroleum ether extract.To assess the anti-insecticidal activity of the plant extracts mortality of the insects were counted. In *Tribolium castaneum* which was collected from stored grains, all the plant extracts showed positive results, ethanol and acetone solvent extracts showed 100% mortality whereas petroleum ether and water solvent extracts showed different mortality for each plant extract (Table 1). The highest result was achieved in *Carica papaya* ethanol extract. Ethanol and acetone showed better result as compared to the positive control i.e., Paralyze- 48:20 and Death- 54:15, whereas negative control showed more than 2hrs to paralyze and death was not occurred (Figure 1).

Similar results was seen in the ethanol *Moringa oleifera* extract had highest result with 36% mortality (16). The *Tamarindus indica* water extract showed 73.33% mortality (17), *Moringa oleifera Petroleum ether* extract showed 32.65% mortality (4) and that *Allium sativum* and *Zingiber officinale* had the highest insecticidal activity against *Tribolium castaneum* (1).
In *Planococcuscitri* which was collected from *Hibiscus rosa- sinensis* plant. All the plant extracts showed positive results, ethanol and acetone solvent extracts showed 100% mortality whereas petroleum ether and water solvent extracts showed different mortality for each plant extract (Table 2). The highest result was achieved in *Moringaoleifera*ethanol extract. Ethanol and acetone showed better result as compared to the positive control i.e., Paralyze- 50:15 and Death- 58:25, whereas negative control took more than 2hrs to paralyze and death was not occurred (Figure 2). Petroleum ether *Citrus aurantium* extract showed 97.01% and intermediate results in Acetone *Lantana salvifolia* extract (7). Highest mortality i.e., 94.44±2.59% and 86.66±3.6% was showed in Pepper and Eucalyptus extract respectively (2). Ethanol *Moringa oleifera* extract revealed the highest efficacy with 100% mortality. Effective results was obtained on *Planococcuscitri* in *Pterocladiacapilaceae* water and ethanol extract with 60±0.5% and 67.1±11% mortality respectively (3).
In *Sitophilousoryzae* which was collected from stored grain, all the plant extracts showed positive results in ethanol and acetone solvent extract with 100% mortality whereas some plant extract showed negative results in petroleum ether and water solvent extract. The highest result was achieved in *Carica papaya* acetone extract (Table 3). Ethanol and acetone showed better result as compared to the positive control i.e., Paralyze- 45:36 and Death- 58:28, whereas negative control showed more than 3hrs to paralyze and death was not occurred (Figure 3). 61.2% mortality rate was obtained using ethanol bakain drupes (*Melia azdarach*) extract (24). Insecticidal activity was studied on *Sitophilus oryzae* using *Macaranga postulate* in Ethanol, Acetone, Petroleum ether, Distilled water and proved that Ethanol *Macaranga postulate* extract had showed the highest mortality rate (21). Highest mortality was showed in ethanol *Clerodendru minerme* L. extract with 86.66±5.76% and ethanol *Cassia tora* extract with 43.33±3.46% (26). Mortality rate in *Piper nigrum* Petroleum ether extract was 99.56% and concluded the mortality increased with increase in concentration (11).
Anthelmintic activity was performed using *Pheretima posthuma* which was collected from vermicompost pit. Anthelmintic activity was done using *Eichhornia crassipes, Moringa oleifera and Carica papaya* by Ethanol, Acetone and Petroleum ether solvents against *Pheretima posthuma.* Ethanol and acetone plant solvent extract showed positive results with 100% mortality whereas *Eichhornia crassipes* ethanol extract had showed negative result (Table 4). The highest was achieved in *Eichhornia crassipes* ethanol extract. *Eichhorniacrassipes*achieved highest result ie,paralyzed at 25 sec and Death occurs at 28 sec in crude extract whereas similar results was achieved as the paralyzed and death results at 4.11±1.8min and 40.64±10min at 100mg/ml using ethanol *Eichhorniacrassipes* root extract (12). In Ethanol *Carica papaya Pheretima posthuma* paralyzed at 35sec and Death occurs at 52sec in crude extract whereas similar results was observed paralyzed and death timing as 10.66±0.33min and 12±34.43min respectively at 5% concentration of Ethanol *Carica papaya* extract (23).

Table 1- Insecticidal activity of *Tribolium castaneum*

SL. NO	PLANTS USED		ETHANOL (min)	ACETONE (min)	PETROLEUM ETHER (min)	WATER (min)
01	*Eichhorniacrassipes*(Mart). Solms	Paralyze	5:40	10:50	50:08	52:27
		Death	8:54	13:45	55:18	56:55
		Mortality	**100%**	**100%**	**33%**	**12.5%**
02	*Tamarindusindica*L.	Paralyze	4:25	4:50	42:35	38:17
		Death	7:40	7:40	46:38	42:23
		Mortality	**100%**	**100%**	**63%**	**75%**
03	*Moringaolifera*Lam.	Paralyze	5:20	6:35	44:20	48:52
		Death	8:13	9:10	49:23	53:31
		Mortality	**100%**	**100%**	**83%**	**62%**
04	*Cassia uniflora*Mill.	Paralyze	5:40	11:33	51:35	51:29
		Death	8:50	14:25	55:27	55:30
		Mortality	**100%**	**100%**	**16%**	**37%**
05	*Carica papaya* L.	Paralyze	4:12	5:13	38:17	35:19
		Death	7:30	8:50	42:40	40:25
		Mortality	**100%**	**100%**	**100%**	**100%**

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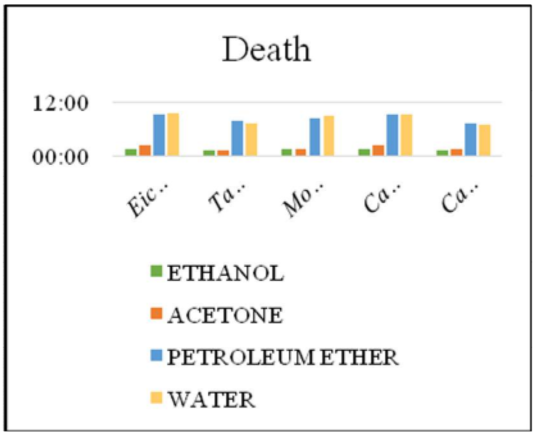
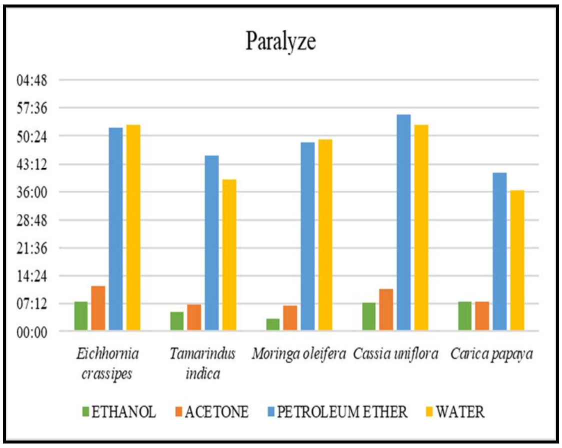


Figure 1: Insecticidal activity of *Tribolium castaneum* showing Paralyzed and Death rate.

Table 2- Insecticidal activity of *Planococcuscitri*

SL. NO	PLANTS USED		ETHANOL (min)	ACETONE (min)	PETROLEUM ETHER (min)	WATER (min)
01	*Eichhorniacrassipes*(Mart). Solms	Paralyze	7:47	11:42	52:23	53:18
		Death	9:10	13:35	54:15	55:02
		Mortality	**100%**	**100%**	**40%**	**37%**
02	*Tamarindusindica*L.	Paralyze	5:08	7:02	45:18	39:15
		Death	8:52	9:43	48:28	43:50
		Mortality	**100%**	**100%**	**80%**	**75%**
03	*Moringaolieferа*Lam.	Paralyze	3:17	6:42	48:50	49:26
		Death	4:20	8:52	51:13	54:30
		Mortality	**100%**	**100%**	**60%**	**50%**
04	*Cassia uniflora*Mill.	Paralyze	7:32	11:03	55:50	53:21
		Death	10:02	13:27	58:03	56:25
		Mortality	**100%**	**100%**	**20%**	**12.5%**
05	*Carica papaya* L.	Paralyze	7:42	7:53	40:58	36:23
		Death	9:32	10:18	44:50	39:12
		Mortality	**100%**	**100%**	**100%**	**87%**



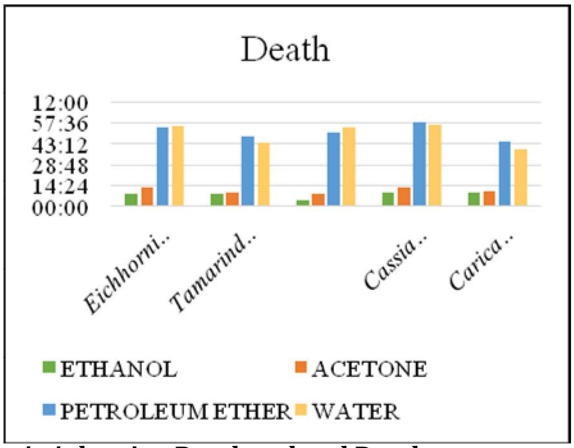
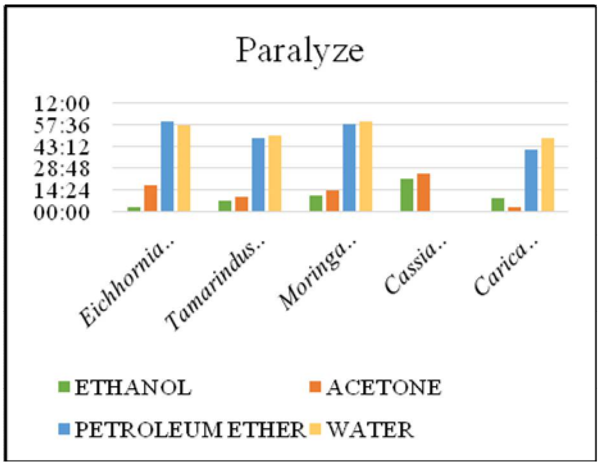


Figure 2-Insecticidal activity of *Planococcuscitri* showing Paralyzed and Death rate.

Table 3-Insecticidal activity of *Sitophilous oryzae*

SL. NO	PLANTS USED		ETHANOL (min)	ACETONE (min)	PETROLEUM ETHER (min)	WATER (min)
01	*Eichhornia crassipes*(Mart). Solms	Paralyze	2:48	16:48	59:36	56:26
		Death	5:25	22:25	--	--
		Mortality	**100%**	**100%**	**-ve**	**-ve**
02	*Tamarindus indica*L	Paralyze	6:48	8:58	48:25	49:53
		Death	8:52	16:54	59:25	56:32
		Mortality	**100%**	**100%**	**37%**	**37%**
03	*Moringaolliefera*Lam.	Paralyze	10:33	13:54	57:42	59:26
		Death	17:52	21:33	--	--
		Mortality	**100%**	**100%**	**-ve**	**-ve**
04	*Cassia uniflora*Mill.	Paralyze	21:14	24:15	--	--
		Death	33:15	49:25	--	--
		Mortality	**100%**	**100%**	**-ve**	**-ve**
05	*Carica papaya* L.	Paralyze	8:25	2:50	40:17	48:23
		Death	14:22	4:54	46:40	57:42
		Mortality	**100%**	**100%**	**12.5%**	**12.5%**



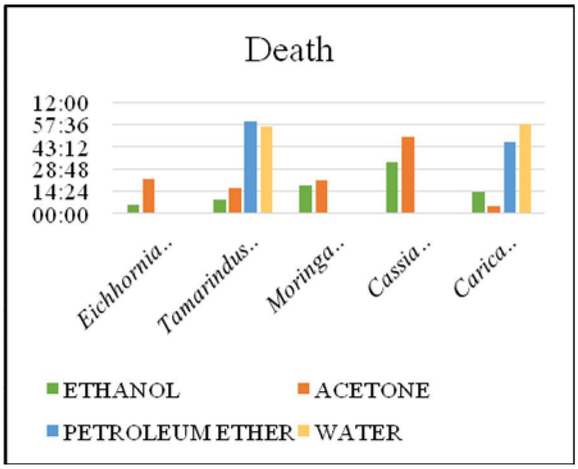
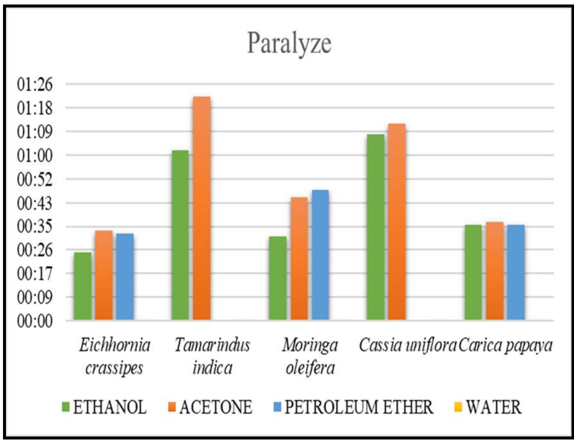


Figure 3- Insecticidal activity of *Sitophilous oryzae* showing Paralyzed and Death rate.

Table 4- Anthemintic activity of *Pheretimaposthuman*

SL. NO	PLANTS USED		ETHANOL (min)	ACETONE (min)	PETROLEUM ETHER (min)	WATER (min)
01	*Eichhornia crassipes* (Mart). Solms	Paralyze	0:25	0:33	0:32	--
		Death	0:28	0:41	--	--
		Mortality	**100%**	**100%**	**-ve**	**-ve**
02	*Tamarindus indica*L	Paralyze	1:02	1:22	--	--
		Death	1:11	1:24	--	--
		Mortality	**85%**	**87%**	**-ve**	**-ve**
03	*Moringa oliefera*Lam.	Paralyze	0:31	0:45	0:48	--
		Death	0:48	0:50	0:51	--
		Mortality	**100%**	**100%**	**100%**	**-ve**
04	*Cassia uniflora*Mill.	Paralyze	1:08	1:12	--	--
		Death	1:15	1:26	--	--
		Mortality	**90%**	**89%**	**-ve**	**-ve**
05	*Carica papaya* L	Paralyze	0:35	0:36	0:35	--
		Death	0:52	0:52	0:52	--
		Mortality	**100%**	**100%**	**100%**	**-ve**



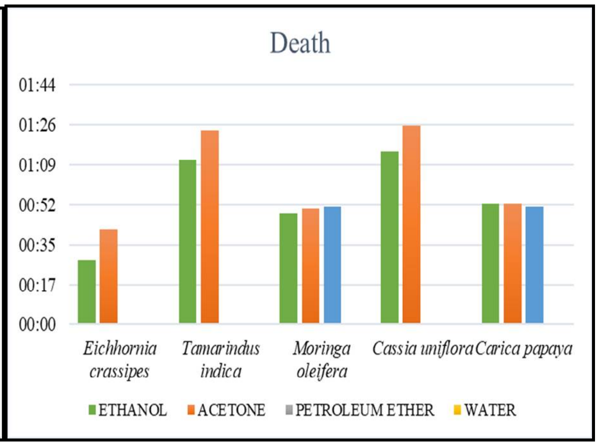


Figure 4-Anthemintic activity of *Pheretima posthuma* showing Paralyzed and Death rate.

CONCLUSION

The increasing concern of consumers about the problems associated with synthetic chemicals for pest control and food safety has led growers to find new eco-friendly methods to replace the current chemical-based practices. Biopesticides can break down quickly in sunlight and in the soil, the faster a chemical breaks down the sooner soil can return to a healthy state. Most biopesticides are also safe to use around people and pest. Based on high mortality and highest death period, it is concluded that the application of natural-based plant extracts gives quick and promising results. Ethanol and Acetone plant extracts are most suitable for the preparation of biopesticide as compared to Water and Petroleum ether plant extract.

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