INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES

(p-ISSN: 2348-5213: e-ISSN: 2348-5221)

www.ijcrcps.com Coden: IJCROO (USA)

Research Article

CONTROL OF PYRETHRUM AGAINST THE TOMATO DISEASE CMV CAUSED BY APHIDS

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Abstract

Tomatoes are the important crop in India and it is being attacked by a group of sucking pest during its various stages. This crop is damaged by about 30 species of insects of various species like aphids, whitefly, leafhopper and thrips etc. At present many pesticides/insecticides are being used for the control of aphids in plants and crops. Undoubtedly pesticides kill aphids but also give many harmful impacts on the plants as well as on the environment also. Insecticides are dispersed ubiquitously in the environment and posed a serious problem to the ecosystem, due to their toxicity and ability to accumulate in the biota. So, the need of the hour is to make an ecofriendly insecticide which reduce the number of insects of the plant but do not harm the environment. Soap based pesticides have improved efficacy against insect pest. The environmentally friendly soap based pesticides have improved residuality, short and long term efficacy against both immature and adult pests and improved safety for both humans and plants. An economically viable product is synthesised by using ,integrated pest management strategy., a soap based insecticide (potassium laurate and potassium myristate) and pyrethrum of various concentrations against a tomato plant disease named cucumber mosaic virus (CMV), caused by aphids. On comparing the efficacy of both eco-friendly mixture it ,is, concluded that the mixture of potassium laurate and pyrethrum is more effective as compared to the mixture of potassium myristate and pyrethrum against the tomato disease named CMV caused by aphids.

Keywords: Pyrethrum, pyrethroid ,aphids, cucumber mosaic virus etc.

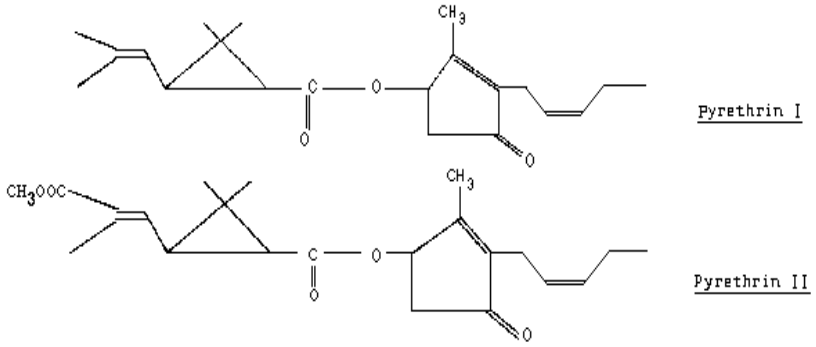
Introduction

Tomato is an important crop in India and also a popular source of vitamins and minerals in human diet [1] .It is being attacked by a group of sucking pest during its various growth stages. This crop is damaged by about 30 species of insects of various species like aphids, whitefly, leafhopper and thrips etc. Aphids are generally found in temperate regions. They suck the sap and juice from plant, and plant are often stunted, have short internodes and may have extremely distorted and malformed leaves known as fearn leaf. Disease will occur on the edges of fields in these conditions. But if the fall and/or spring is warm and less moist, aphids reproduce rapidly and subsequently spread the virus at a much higher rate [2].

CMV (cucumber mosaic virus) is a viral disease which is caused by aphids. CMV is transmitted by more than 60 species of aphid. CMV is a plant pathogenic virus in the family Bromoviridae .The symptoms of CMV are leaf mosaic or mottling, yellowing, rings pots, stunting, and leaf, flower and fruit distortion.CMV shows symptoms on leaves known as the "Shoestring" effect for most host species. This effect causes young leaves to appear narrow and the entire plant to be stunted.

Pyrethrum is a natural insecticide made from the dried flower heads of *Chrysanthemum cinerariifolium* and pyrethrins are the active compounds from the pyrethrum flower. Pyrethroids are synthesized pyrethrins. Study has been done [3] for the management of tomato plant diseases by pyrethroid in past. Pyrethrins are a pair of natural organic compounds that have potent insecticidal activity. Pyrethrins are neurotoxins that attack the nervous systems of all insects. When present in amounts not fatal to insects, they still appear to have an insect repellent effect. They are non-persistent, being biodegradable, and break down on exposure to light or oxygen.

The chemical structure of pyrethrin were determined by Hermann Staudinger and Lavoslav Ruzicka in 1924 [4]. Pyrethrin I and pyrethrin II are structurally related esters with a cyclopropane core. (fig.1)



Structure of Pyrethrin (Fig: 1)

In terms of their biosynthesis, pyrethrins are classified as terpenoids, being derived from dimethylallyl pyrophosphate, which combine by the action of the enzyme chrysanthemyl diphosphate synthase [5]. (fig.1.1)

Material and methodology

Pyrethrum is extracted from Chrysanthemum. Chrysanthemum flowers were harvested, dried, crushed and conserved in a freezer [6] .Pyrethrum are extracted with Kerosene method [7].

Potassium laurate was prepared by refluxing equivalent amount of corresponding fatty acids and aqueous solution of potassium hydroxide for 6-8 hours on a water bath (equation -1). Potassium laurate was purified by recrystallization with benzene- methanol mixture and dried under reduced pressure. The purity of potassium laurate checked by the determination of their melting point (120 ^{0} C).

$$\underset{\text{(Lauric Acid)}}{C_{11}H_{23}COOH} + \underset{\text{(Pot. Hydroxide)}}{KOH} \dashrightarrow \underset{\text{(Pot.Laurate)}}{C_{11}H_{23}COOK} + \underset{\text{(Water)}}{H_2O}$$

Equation for soap preparation

The conductivity measurements of the solution of potassium laurate in distilled water was made with "BIOCRAFT" direct reading conductometer and a dipping type glass conductivity cell with platinised electrodes at a room temperature and the CMC (criticle micelli concentration) of potassium laurate is 0.0045 dm^3/l on plotting specific conductance Vs concentration at various concentrations.

Many samples of various concentration having different p^H have been prepared by mixing potassium laurate of concentration (LCMC) and pyrethrum of different dilution (%), and then sprayed on tomato plant to check the efficacy of this insecticidal spray on weekly and bi- weekly interval.

Potassium myristate was prepared by refluxing equivalent amounts of corresponding fatty acid and aqueous solution of potassium hydroxide for 6-8 hours on a water bath. The potassium myristate was purified by re-crystallization with methanol under reduced pressure. The purity of potassium myristate was checked by the determination of their melting points.

The purity of the soaps was confirmed by elemental analysis and determination of their melting points. The melting points of purified soaps was: 91^0 C

$$\underset{\text{(Myristic Acid)}}{C_{13}H_{27}COOH} + \underset{\text{(Pot. Hydroxide)}}{KOH} \dashrightarrow \underset{\text{(Pot. Mrystate)}}{C_{13}H_{27}COOK} + \underset{\text{(Water)}}{H_2O}$$

Equation for soap preparation

The CMC (criticle micelli concentration) of potassium myristate is 0.005 dm^3/l on plotting specific conductance Vs concentration at various concentrations.

Soap based solutions (potassium laurate and pyrethrum, potassium myristate and pyrethrum) having different concentrations having different p^H values being sprayed weekly and bi-weekly on tomato plants, which grows in various rows (1-26). All the agronomic requirements were followed as when required.

There were 26 rows having two tomato plants in each row. The first row having two plants found healthy but the remaining rows were afflicted with the disease CMV either on leaf or fruits or on stem (photo :1).

Photo:1 Aphids on plant leaf

Photo:2 Infected leaf of plant

Photo:3 Infected fruit

Photo:4 Healthy Fruit and Plant after application

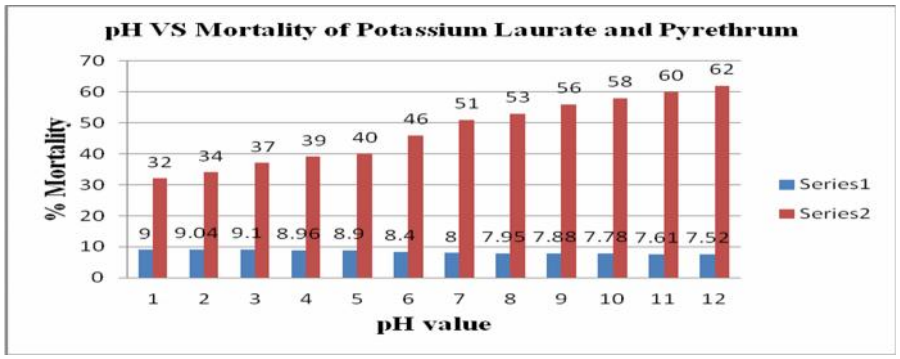
The leaf turns yellowish (photo : 2) and stunting and fruit became distorted (photo:3). These symptoms on leaves known as the “shoestrig” effect. Which was the first initial sign of the CMV of tomato caused by aphids. We have two plants in each row and each plant simultaneously subjected by two different insecticidal sprays of potassium laurate and pyrethrum and potassium myristate and pyrethrum (%) of various p^H values (9.00-7.52) on bi-weekly in the beginning when the symptoms started appearing and converted into weekly application, when the plants (leaf, fruit and stem) started growing healthy. Two mixtures of potassium laurate and pyrethrum and potassium myristate and pyrethrum of p^H values 9.00 has been sprayed on second row and similarly the liquid spray of decreasing p^H have been sprayed in each rows. The impact and the efficacy of the mixture of both of sprays i. e. potassium laurate and pyrethrum and potassium myristate and pyrethrum on tomato plant for CMV disease of tomato having given in table -1 and (photo:5).

Conclusion

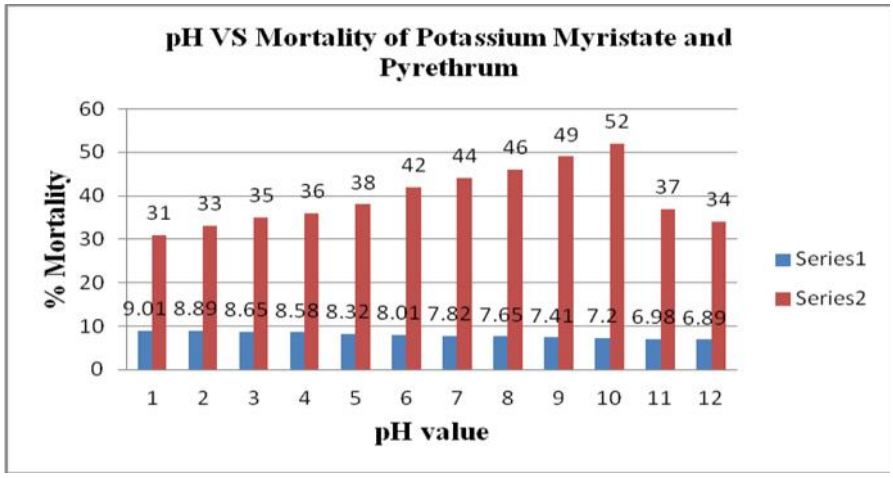
In our experiment, on the comparative study of both of these insecticidal solutions of (potassium laurate and pyrethrum) and (potassium myristate and pyrethrum), we conclude that, the liquid spray of soap based insecticide contains potassium laurate and pyrethrum having p^H 7.52 is found to be more effective because the % mortality of this solution was more (graph: 1) , (graph: 1.2) among all the solutions of potassium laurate and pyrethrum and potassium myristate and pyrethrum of same concentrations. Other solutions of potassium myristate having p^H value 7.20 was also effective (graph : 1.1) but they were less effective because their % mortality were lower than the solution of potassium laurate and pyrethrum of same concentration for the control of disease cucumber mosaic virus of tomato transmitted by aphids on tomato plants.

Table 1 : Impact of mixture of potassium laurate (cmc 4.50 × 10^{-3} dm/l) and pyrethrum and potassium myristate (cmc 5.00 × 10^{-3} dm/l) and pyrethrum on tomato plant

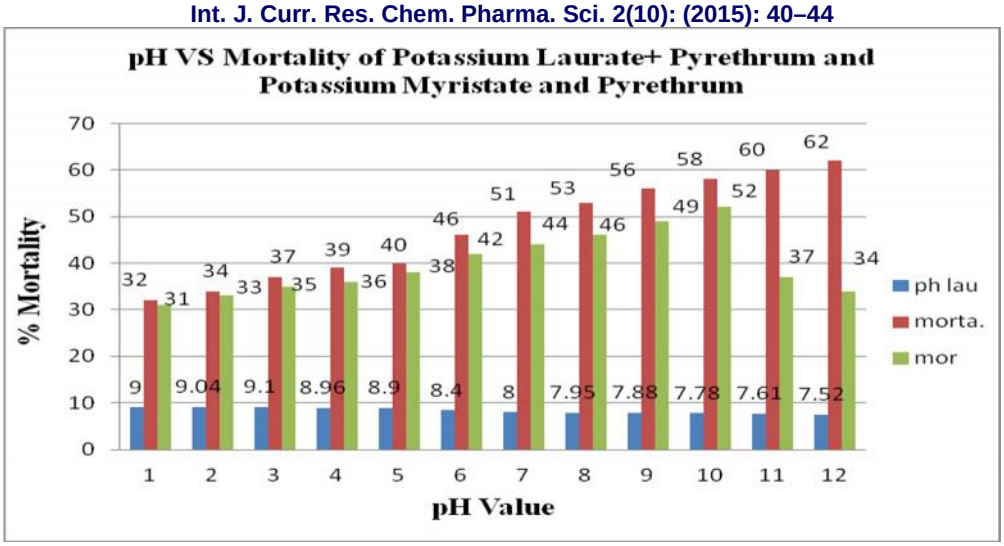
S. No.	Number Of Rows	Concentration of Pyrethrum (%)	pH Value Of Spray (potassium laurate and pyrethrum)	% Mortality	pH Value Of Spray (potassium myristate and pyrethrum)	% Mortality
1.	First plant (healthy)	--------	--------	-------	---------	------
2.	Second plant	1	9.00	32	9.00	31
3.	Third plant	2	9.04	34	9.04	33
4.	Forth plant	3	9.10	37	9.10	35
5.	Fifth plant	4	8.96	39	8.96	36
6.	Sixth plant	5	8.90	40	8.90	38
7.	Seventh plant	6	8.40	46	8.40	42
8.	Eight plant	7	8.00	51	8.00	44
9.	Ninth plant	8	7.95	53	7.95	46
10	Tenth plant	9	7.88	56	7.88	49
11.	Eleventh plant	10	7.78	58	7.78	52
12.	Twelfth plant	11	7.61	60	7.61	37
13.	Thirteen plant	12	7.52	62	7.52	34



Graph 1 : pH VS Mortality of potassium Laurate and Pyrethrum



Graph 1.1 : pH VS Mortality of potassium Myristate and Pyrethrum



Graph 1.2 :Comparative Study of pH VS Mortality of Potassium Laurate +Pyrethrum and Potassium Myristate + Pyrethrum

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