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EFFICACY OF *CARICA PAPAYA* AND *ALOE BARBADENSIS* LEAF EXTRACTS AGAINST MUSTARD APHIDS (*LIPAPHIS ERYSIMI* KALT.)

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ABSTRACT

Carica papaya and *Aloe barbadensis* leaf extracts in different solvents like alcohol, acetone, acetic acid and water assessed for the insecticidal activity to mustard aphid (*Lipaphis erysimi* Kalt.). The laboratory assay with different concentrations (100, 200, 400 and 800 ppm) showed significant mortality in mustard aphids. The *C. papaya* leaves extract @ 400 ppm showed mortality of insects in acetic acid, alcohol, water and acetone extracts by 100, 25, 20 and 4% after 24 h, with LC_{50} values of 32.5, 1397.2, 1120.0 and 7770.5 ppm, respectively. The *A. barbadensis* leaves extracts @ 800 ppm also showed mortality of insects in Acetic acid followed by water, alcohol and acetone extracts 100, 44, 28 and 12 % with LC_{50} values of 116.2, 1062.4, 1541.9 and 2614.9 ppm, respectively. The study suggests some insecticidal attributes in acetic acid extract fraction of *C. papaya*.

Key words: *Carica papaya, Aloe barbadensis,* leaf extract, Mustard aphid, *Lipaphis erysimi*

INTRODUCTION

Mustard aphid (*Lipaphis erysimi* Kalt.) is important sucking plant pest. However, harms increase with their ability to transmit plant pathogenic microbes. Aphids are soft-bodied, pear-shaped insects generally less than 1/8 inch long. Most aphids are wingless females but males are winged. Aphids have two short cornicles or tubes at the end of their bodies. The predominant reproduction mode of aphids is parthenogenesis. These insects are commonly found on the stems or undersides of young leaves in small colonies and on inflorescence, and cause heavy losses to the crop (Buss, 2010; Farooq, 2007).

Although, synthetic insecticides are utilized as an important part of pest management for many years, the disadvantages and environmental risks of using them have become apparent. As a result, many people are looking for less hazardous alternatives to conventional synthetic insecticides (Cox-Foster *et al*., 2007). Rapid breakdown and fast action make botanicals more selective to certain plant-feeding pests and less harmful to beneficial insects (Buss and Brown, 2009; McIntyre *et al*., 1989). Present work explored the leaf extract of papaya (*Carica papaya* L.) and Aloe (*A. barbadensis* Mill.) for their insecticidal potential under laboratory conditions.

MATERIALS AND METHODS

Carica papaya and *Aloe barbadensis* leaves were collected from the field located at the back yard of the Department of Agriculture & Agribusiness Management, University of Karachi. The leaves were washed thoroughly with sterile water and placed in a tray for about 15 days for air-drying. The leaves were then ground in mortar and pestle to fine powder.

Four different solvents *viz*., alcohol, acetone, acetic acid and water were used for extraction from the dried leaf powder. Five g leaf powder was added to 100 ml of each solvent and left for 15 days to dissolve completely. The suspension was then filtered through sterilized filter paper; the filtrate was retained whereas, the residue was discarded. The filtrate was kept in vent chamber at 25 °C till the solvent was dried. Known quantity of the dried extracted matter left after evaporation of the solvent was dissolved in the respective solvent to get solutions having 100, 200, 400 and 800 ppm concentrations. One ml of each concentration absorbed on 2x2 cm filter paper kept in the bioassay chambers, and the solvent allowed evaporating. Filter paper pieces treated with respective pure solvent served as control.

Mustard aphids collected from local fields situated at University of Karachi moved onto potted mustard plant in a screen-house for rearing. Five aphids were transferred with a brush to each bioassay chamber containing different treatments (Fig. 1). There were five replicates for each treatment. The bioassay chambers incubated at room temperature and number of living and dead insects observed after 24 h of application. Percent mortality was calculated by using Abbott's formula, as Abbott's Corrected percent mortality=1- n in T after Treatment/ n in C after TreatmentX100. Where; the n=Insect population; T=Treatment; C=control (Abbott, 1925).

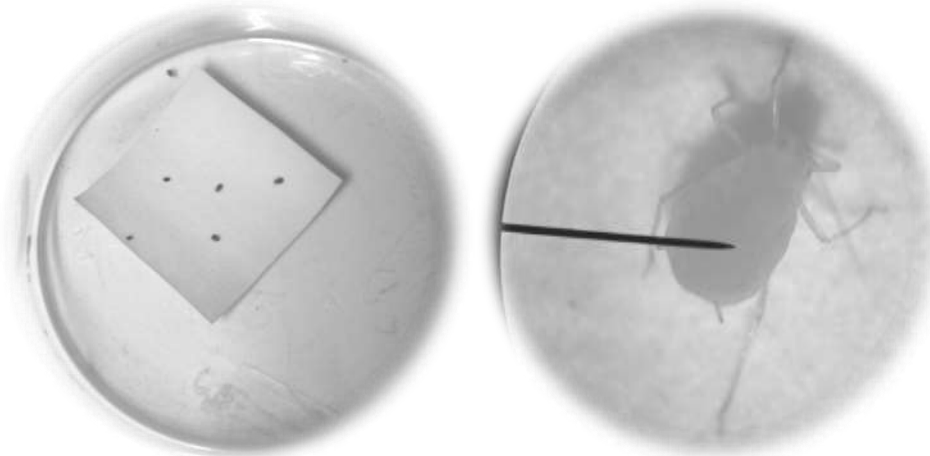

Fig. 1. The aphid population inside the bioassay chamber containing extract-impregnated filter paper (left) and a mustard aphid cadaver after 24 h of treatment with *C. papaya* acetic acid fraction of extract.

RESULTS

Four different *A. barbadensis* extracts showed different results at different concentrations. The acetic acid extract showed 100% mortality @ 800 and 400 ppm while 36% and 52% of mortality observed @ 200 and 100 ppm after 24 h. In water extract, the insect mortality was 28, 16, 16 and 8% @ 800, 400, 200, 100 ppm, respectively. Alcohol extract showed lower effect on the mortality rate that was 0, 4, 20 and 24%, while acetone showed the least effect and only 0, 0, 12 and 12% mortality observed in 100, 200, 400 and 800 ppm treatments, respectively (Fig. 2). The median lethal dose analysis through dose-time mortality probit analysis showed that amongst four *A. barbadensis* extracts, the acetic acid was highly effective with LC_{50} 116.4 ppm followed by water (1062.4 ppm), alcohol (1541.9 ppm) and acetone (26214.4 ppm) after 24 h (Table 1; Fig. 4).

Table 1. LC_{50} values of different fractions of *A. barbadensis* extract observed after 24 h after application on aphid inside bioassay chambers.

Extract fractions	LC_{50} (ppm)	Estimate-Intercept	Z-Intercept	Sig.	Chi^2
Alcohol	1541.9	1.9-6.1	28.8-33.7	0.00	
Acetic acid	116.4	1.9-3.9	28.8-25.0	0.00	245.3
Acetone	2614.9	1.9-6.5	28.8-35.1	0.00	(df=75)
Water	1062.4	1.9-5.7	28.8-33.0	0.00	

Table 2. LC_{50} values of different fractions of *C. papaya* extract observed after 24 h after application on aphid inside bioassay chambers.

Extract fractions	LC_{50} (ppm)	Estimate-Intercept	Z-Intercept	Sig.	Chi^2
Alcohol	1397.2	1.3-4.2	22.6-27.3	0.030	
Acetic acid	32.5	1.3-5.2	22.6-31.2	0.004	3038.60
Acetone	7770.5	1.3-2.0	22.6+14.4	0.001	(df=75)
Water	1120.0	1.3+4.1	22.6+26.6	0.02	

Acetic acid extract of *C. papaya* leaves showed 100, 100, 80 and 68% mortality in 800, 400, 200, 100 ppm treatments, respectively. Extracts in other solvents showed lower insect toxicity as 44, 28 and 12% mortalities were observed in 800 ppm treatments of water, alcohol and acetone extracts, respectively. Acetone extract was least effective and gave 0, 0, 4 and 12% mortality in 100, 200, 400 and 800 ppm treatments, respectively (Fig. 3). The

LC_{50} values showed that acetic acid extract of *C. papaya* was more effective against test insect with 32.5 ppm followed by water (1120 ppm), alcohol (1397 ppm), and acetone (7770 ppm) (Table 2; Fig. 3&5).

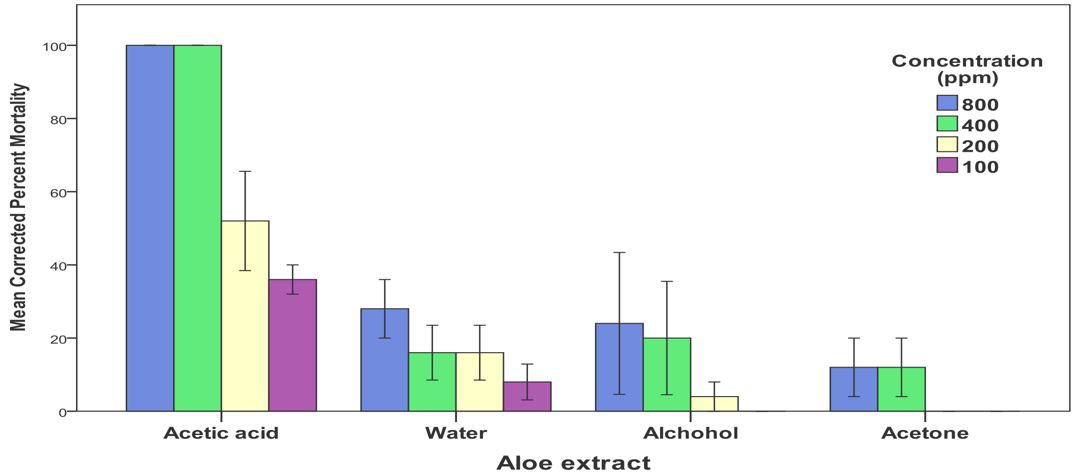

Fig. 2. The percent mortality caused by *A. barbadensis* leaf extract fractions in different concentrations (ppm) to aphids inside bioassay chambers after 24 h.

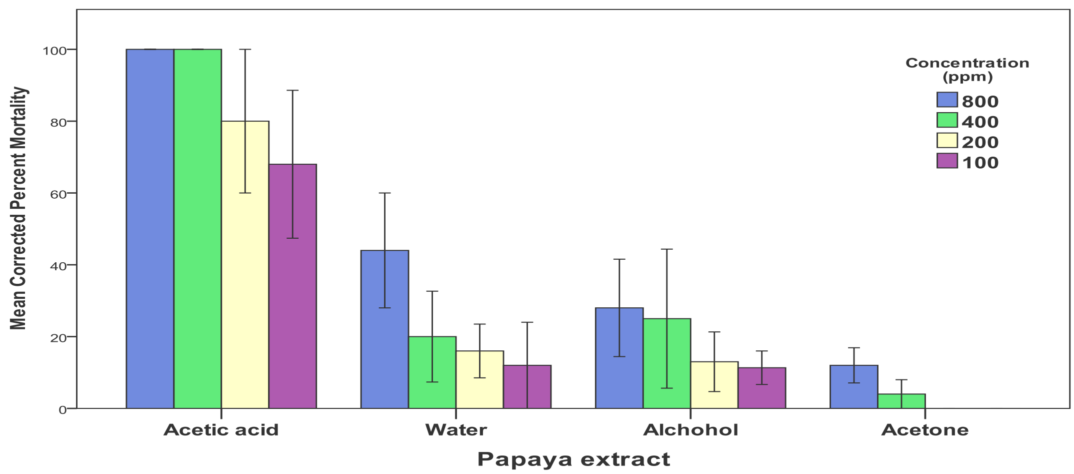

Fig. 3. The percent mortality caused by *C. papaya* leaf extract fractions in different concentrations (ppm) to aphids inside bioassay chambers after 24 h.

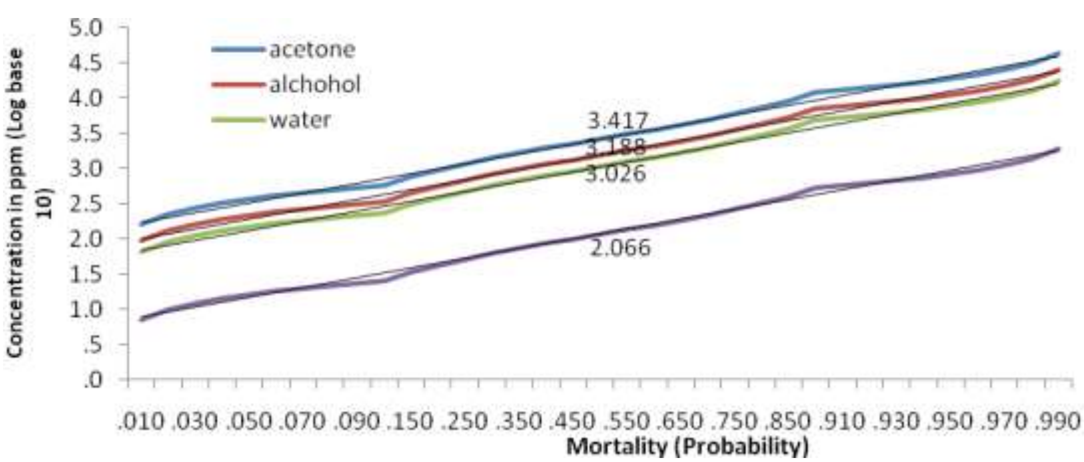

Fig. 4. The LC_{50} values of *A. barbadensis* extract in different fractions after 24 h of mustard aphids inside bioassay chamber.

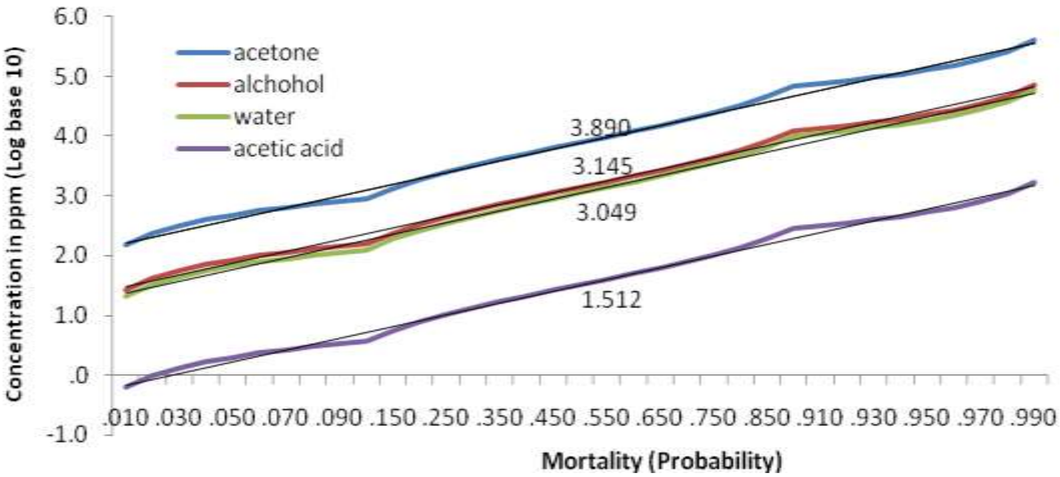

Fig. 5. The LC_{50} values of *C. papaya* extract in different fractions after 24 h on mustard aphids inside bioassay chamber.

DISCUSSION

The botanical insecticides such as neem, garlic, tobacco, hot pepper extracts are low in cost, locally available, and very effective for the control of insect pests (Sohail *et al*., 2012*)*.Results of the present studies appear to be the first report on insecticidal activity of *C. papaya* and *A. barbadensis* leaves against mustard aphid. Variation in efficacy of extracts in different solvents indicates a variation in nature and polarity of the compounds that dissolved in different solvents.

C. papaya is known for its insecticidal uses and compound isolations. Its leaf extract reduced population of *A. gossypii* (cotton aphid), *E. vittella* (spotted bollworm), *P. puncticollis* (flea beetle) and *B. tabaci* (white fly) when sprayed on okra plant @ 15 ml/L (Zobayer and Hasan, 2013). Muzemu *et al.*, (2013) reported that the papaya leaf powder mixed in maize grains @ 5, 15 and 20 g per 200 g grains induced 15, 32, 47% mortality of weevil (*Sitophilus zeamais* Motsch.), respectively. Latex of *C. papaya* seeds contains a large amount of cysteine proteases, namely "papain", that is responsible for strong toxicity against some insect pests (Konno *et al*., 2003). *C. papaya* seed contain insecticidal compounds against fall armyworm that also confirms the presence of bioactive compounds (Gutierrez *et al.*, 2011).

A. barbadensis has medicinal properties and used for many purpose (Saks and Golan, 1995). Subramaniam *et al*. (2012) reported that *A. barbadensis* extract in petroleum ether solvent had variable LC_{50} values (68.6-300 ppm) against different life stages of *Aedes aegypti* laravae. *A. barbadensis* crude extract produced 80% death of mosquito (*Culex salinarius*) larvae, a vector for West Nile virus in mammals and birds, when used @ 200 ppm (Verma *et al.*, 2013). Sarwar (2013) reported insecticidal properties of aqueous extract of *A. barbadensis* against (*Myzus persicae* Sulzer) under field conditions.

The present study suggests that acetic acid soluble fractions in *C. papaya* and *A. barbadensis* leaf have greater insecticidal properties as compared to fractions soluble in other solvents. This study also confirms earlier report on the insecticidal potential of *C. papaya* and *A. barbadensis*. Further characterization of the extract fractions and compound identification is needed for pesticide development from both *A. barbadensis* and *C. papaya*.

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