



# Effect of leaf extracts of *Azadirachta indica* (Neem), *Eucalyptus saligna* (Eucalyptus), *Murraya koenigii* (Curry leaf) on *Chrysanthemum* Aphid, *Macrosiphoniella sanbornii*, Gillette

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## ABSTRACT

Chrysanthemum is one of the major ornamental flowers used in the horticulture sector, having higher demand and high cut flower production. But due to insect pest damage the productivity and quality is being decreasing day by day. Aphids are the major pest in Chrysanthemum plant causing a great economic loss to the producers and farmers. To find a sustainable and ecofriendly solution to this problem alternative options can be implemented to control Aphids. The results of the current experiment conducted showed that all the treatments were significantly different in causing pest mortality over control. *Azadirachta indica* i.e., Neem leaf extract, *Eucalyptus saligna* leaf extract was found to be most effective in the pest mortality. *Murraya koenigii* i.e., Curry leaf extract was the least effective extract that caused the pest mortality. Neem leaf extract showed more than 90% pest mortality respectively.

**Keywords:** Chrysanthemum, Plant leaf extract, Pest mortality, *Macrosiphoniella sanbornii*.

## INTRODUCTION

Chrysanthemum ranks second to rose among top ten cut flowers in the world trade of flower crops preferred particularly for its range of shapes and size of flower, brilliant colour tones and long lasting flower life (Brahma, 2002). Floriculture is one of the major commercial agricultural sectors in India. Due to increasing demand of beautiful flowers not only for ornamental use but also for cosmetic, medicinal and health products.

Chrysanthemum (*Dendranthema grandiflora* Borkh) gets its name from the Greek words Chryos – Golden, Anthos – flower, it belongs to the family Asteraceae. Chrysanthemum was cultivated in China as early as 15<sup>th</sup> century BC. The plants were used as herbs and the roots and leaves were eaten. The plant migrated to Japan several centuries later and thrived in the temperate climate of Asia. Presently 2000 varieties are grown around the world and in India about 1000 varieties are grown (Datta and Bhattacharjee, 2001). Chrysanthemum is both a source of beautification and possess high medicinal characteristics (Shahrajabian et al., 2019). The flower is commonly called as “Queen of east”, Guldaudi in India. Chrysanthemum is affected by pests such as Aphids, Caterpillars, mites, whiteflies, thrips and leaf miners. Amongst these, *M. sanbornii* *Macrosiphoniella sanbornii* (Gillette), is one of the key pests of the crop and is wide spread on cultivated Chrysanthemum throughout the world. These greenish-black nymphs and brownish adults once called “blackflies”, mainly feed on young leaves, developing flower buds and becomes very abundant. Aphids are ‘stealthy’ pests, adapted to suck plant juices. They have short generation times and an extremely high rate of

parthenogenetic reproduction which leads to a rapid increase in the population density and subsequent elevated consumption levels of phloem sap, might lead to depletion of nutrients leaving severe impact on host plant (Gill *et al.*, 2013). While use of good agricultural practises and integrated pest management (IPM) are being increasingly advocated in specially protected cultivation (Mishra *et al.*, 2019). Hence, to dispose the use of chemical insecticides various botanicals such as leaf extract, essential oil or dry leaf powder are used as insecticides which are eco-friendly in nature. The leaf extract can be prepared by several methods. One of the most widely used process is by soaking certain amount (gm) of leaves in a given quantity of water. Another method is to blend the leaves and extract the juice by the help of muslin cloth. *Macrosiphonella sanbornii* was sourced from the garden. The plant leaf extract was tested against *M. sanbornii* with a motto to find out their impact against *M. sanbornii*.

## MATERIALS AND METHODS

In order to determine the effect of different leaf extract on the *M. sanbornii*, pot experiment was conducted in a laboratory based environmental setup during the month of March. The experiment was conducted with three treatments. The plants treated were as follows:

**TEST1:** *Azadirachta indica* leaf extract.

**TEST2:** *Eucalyptus saligna* leaf extract

**TEST3:** *Murraya koenigii* leaf extract.

**TEST4:** Control (water)

Pot used was of plastic material and was 7cm in width and 16cm in height. A Chrysanthemum plant was sourced from a garden. 40 stem cuttings of the chrysanthemum plant were planted into 40 pots and was taken care for few days until the experiment was carried out. The size of the plants planted was of 16cm each. Three treatments and one control each with four replications were tested against *M. sanbornii*. For control, plants were treated only with water.

First instar of Aphids was collected from a garden with the help of zero sized brush. The aphids were infested on the tip of plant and were covered with the help of plastic transparent bottles covered with muslin cloth at the top. The experiment was carried out for 72 hours (3 days). Spraying of the leaf extract was done at a particular time and was observed for 72 hours at regular intervals and the mortality of the number of aphids were observed.

In total 20 Aphids were introduced on the tip of the chrysanthemum plant. The aphids took around 2.5 days to build colony of around 30 aphids. The plant leaf extract was prepared one day before spraying and was left overnight without disturbing. On the very next day the extract was poured into an empty spray bottle and then it was sprayed.

## Statistical analysis

The mortality of the aphids after spraying the extract were expressed by making a table which shows the value of both the mean mortality of the aphids after spraying the treatments and the average percentage of the mortality of the aphids after spraying the treatments. The table was made with the help of Excel spreadsheet. With this table a clear picture is demonstrated which showed that the effectiveness of the treatment on the aphids. The highest mean mortality and the average percentage mortality was observed in the treatment *Azadirachta Indica* (neem leaf extract). Data were submitted to one way analysis of variance using SPSS software. The significance of ANOVA was  $p < .001$

## PREPARATION OF THE EXTRACT

Extract was prepared by taking 150gm of freshly plucked leaves from the Neem Tree (*Azadirachta indica*), Eucalyptus Tree (*Eucalyptus saligna*) and Curry leaf (*Murraya koenigii*) blended in 0.5 litres of water separately. The extract was filtered with the help of muslin cloth and stored overnight.

### TEST 1

The *Azadirachta indica* leaf extract was prepared by sourcing 150gm of neem leaves from a garden. The leaves were cleaned properly with the help of water and then blending the leaves in 0.5 litres of water. After that filtered with the help of muslin cloth. The extract was kept overnight and then transferred to a spraying bottle.

### TEST 2

The *Eucalyptus saligna* leaf extract was prepared by sourcing 150gm of Eucalyptus leaves from a garden. The leaves were washed properly and then was blended in 0.5 litres of water. The extract was filtered with the help of muslin cloth and then kept undisturbed for one night. The next day the extract was poured into the spraying bottle.

### TEST 3

The *Murraya koenigii* leaf extract was prepared by plucking around 150gm of curry leaves from a garden. Washed and blended the leaves and then filtered using a muslin cloth. The extract was kept overnight and the very next day was poured in a spraying bottle.

## OBSERVATIONS

Table 1- Showing Mortality (Mean  $\pm$  S.E) and average %mortality after exposure to *Azadirachta indica* leaf extract on aphids

Plant extract	Conc.	Mean $\pm$ S.E.			Average mortality percentage		
		DAY1	DAY2	DAY3	DAY1	DAY2	DAY3
<i>Azadirachta indica</i>	10ml	4.5 $\pm$ 0.64	7.5 $\pm$ 0.64	9.25 $\pm$ 0.47	22.5%	37.5%	46.25%
	20ml	11.5 $\pm$ 0.64	13.25 $\pm$ 0.85	15.25 $\pm$ 0.47	57.5%	66.25%	76.25%
	30ml	18.5 $\pm$ 0.64	22.75 $\pm$ 0.85	26.25 $\pm$ 0.94	90.5%	92.5%	98.2%

Graph 1- The graph shows the mortality of the aphids after spraying the *Azadirachta indica* leaf extracts

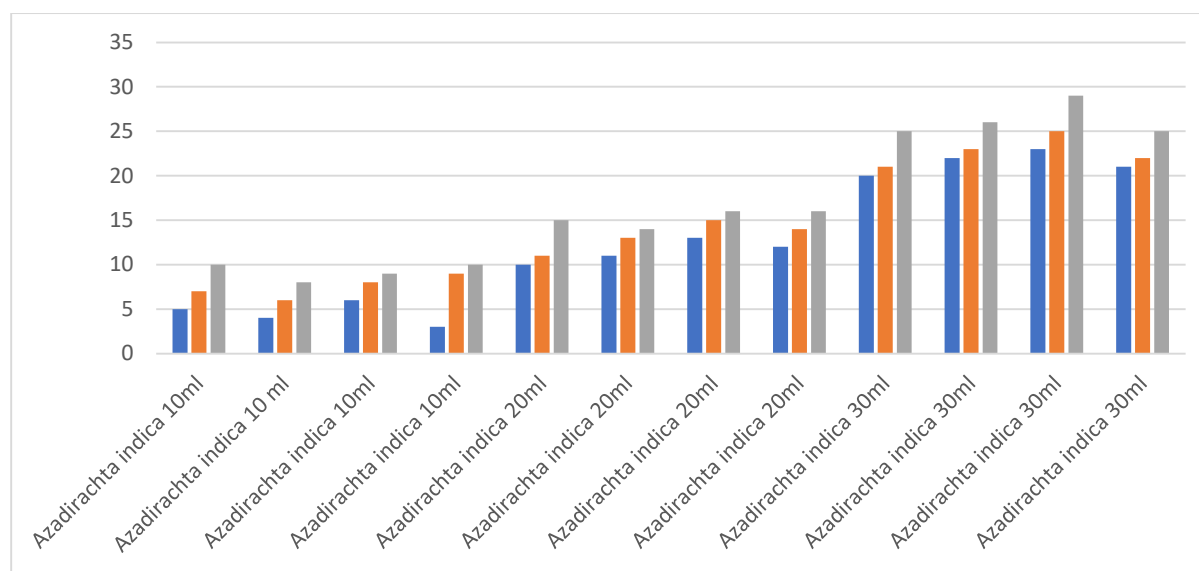


Table 2— Showing Mortality (Mean ± S.E) and average %mortality after exposure to *Eucalyptus saligna* leaf extract on aphids

Plant extract	Conc.	Mean ± S.E.			Average mortality percentage		
		DAY1	DAY2	DAY3	DAY1	DAY2	DAY3
<i>Eucalyptus saligna</i>	10ml	3.25±0.47	4.25±0.25	5.75±0.47	16.25%	21.25%	28.75%
	20ml	8.0±0.40	9.25±0.25	10.25±0.25	40%	46.25%	51.25%
	30ml	12.75±0.47	14.75±0.25	17.0±0.40	63.75%	73.75%	85%

Graph 2- The graph shows the mortality of the aphids after spraying the *Eucalyptus saligna* leaf extracts

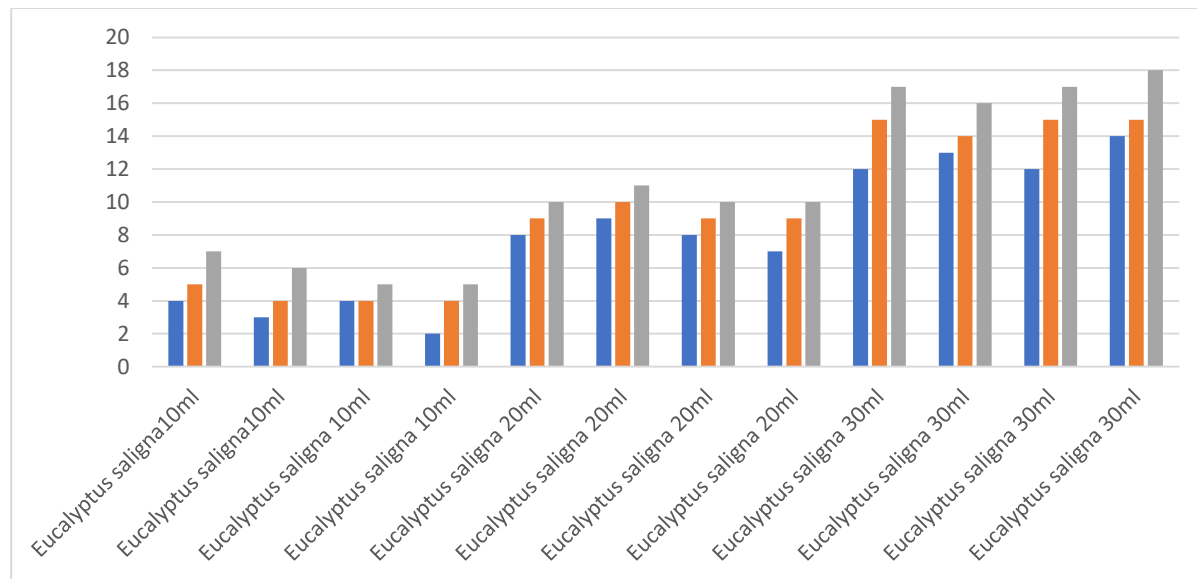


Table 3- Mortality (Mean ± S.E) and average %mortality after exposure to *Murraya koenigii* leaf extract on aphids

Plant extract	Conc.	Mean ± S.E.			Average mortality percentage		
		DAY1	DAY2	DAY3	DAY1	DAY2	DAY3
<i>Murraya koenigii</i>	10ml	1.0±0.40	2.25±0.47	3.0±0.40	5%	11.25%	15%
	20ml	3.0±0.40	4.25±0.47	5.25±0.47	15%	21.25%	26.25%
	30ml	6.0±0.40	6.50±0.28	8.25±0.25	30%	32.5%	41.25%

Graph 3- The graph shows the mortality of the aphids after spraying the *Murraya koenigii* leaf extracts

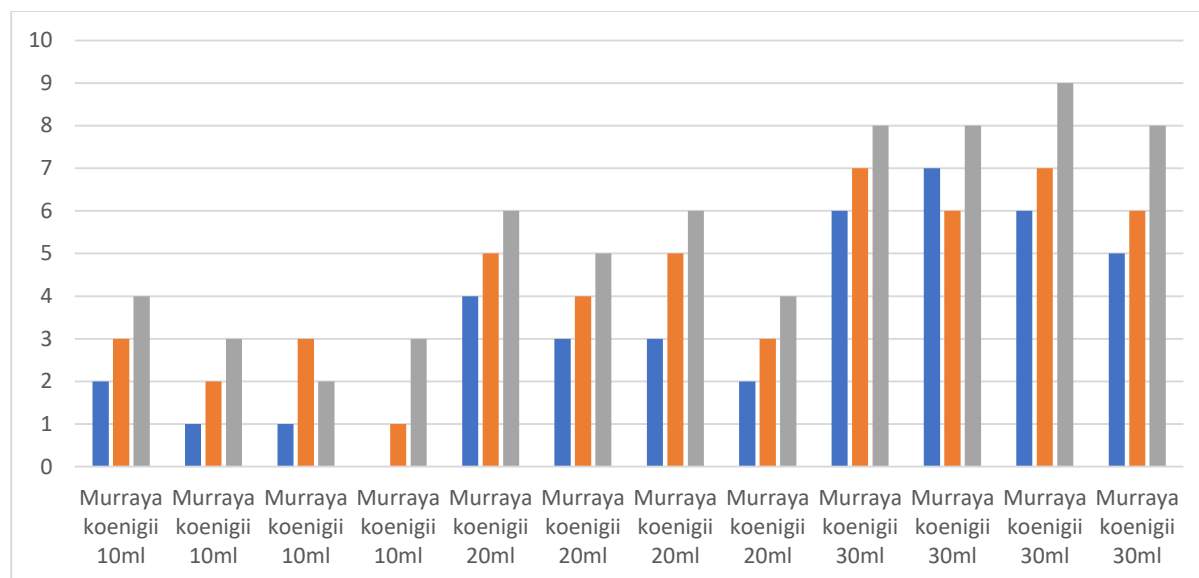
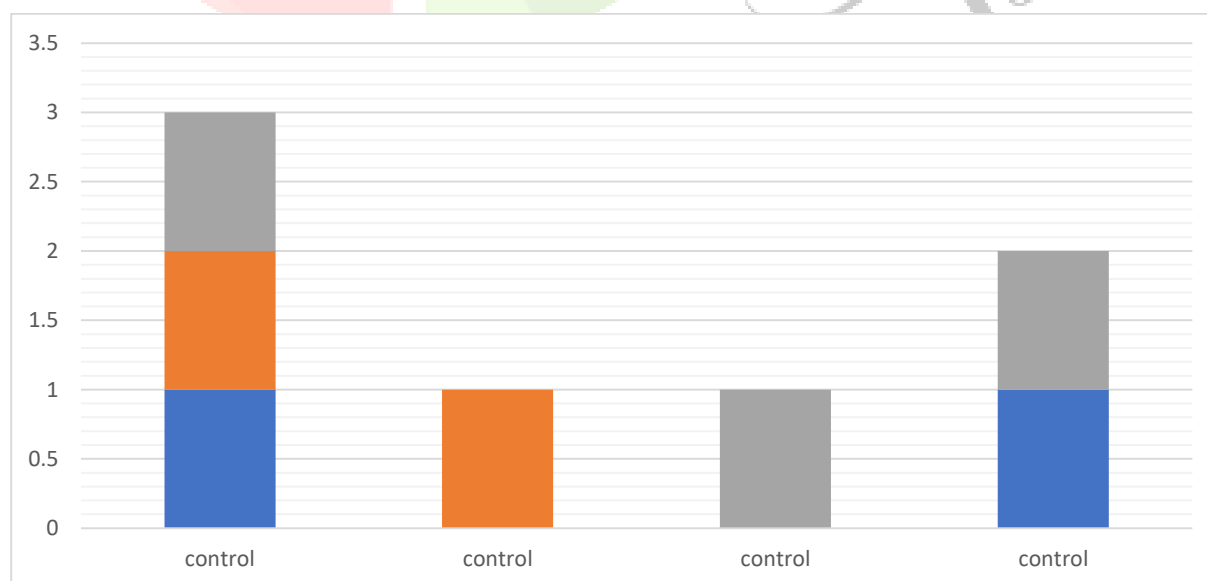


Table 3- Mortality (Mean ± S.E) and average %mortality after exposure to control i.e., Water on aphids

Control	Mean ± S.E.			Average mortality percentage		
	DAY1	DAY2	DAY3	DAY1	DAY2	DAY3
Water	0.5±0.28	0.5±0.28	0.75±0.25	2.5%	2.5%	3.75%

Graph 4- The graph shows the mortality of the aphids after spraying control i.e., Water on aphids.



## RESULT

### TEST 1

The *Azadirachta indica* treatment showed the highest average mortality percentage in aphids at 10ml concentration was 46.25%, at 20ml concentration the average mortality percentage was 76.25% and at 30ml concentration the average mortality percentage was 98.2%. This depicts that *Azadirachta indica* has a very high potency rate of mortality of the aphids in the chrysanthemum plant hence gaining almost elimination of the aphids up to 98.2% at 30ml concentration (Table 1) as average mortality percentage.

### TEST 2

The second most potent treatment was *Eucalyptus saligna*. The average mortality percentage was observed to be 28.75% at 10ml concentration. At 20ml concentration the average mortality percentage observed was 51.25% and at 30ml concentration it was 85% (Table 2). The highest mortality percentage was observed at 30ml concentration. Although the effectiveness on the mortality of the aphids were significantly lowered in the second treatment as compared to the first one but still displayed an eminent mortality of the aphids.

### TEST 3

The least mortality was observed in the third treatment that is *Murraya koenigii* that is the curry leaf extract (table 3). The potency of mortality of the aphids against this treatment is very low as compared to the first two treatments. The average mortality rate was observed to be 15% at 10ml concentration, 26.25% at 20ml concentration and 41.25% (Table 3) at 30ml concentration. Though the competence of the third treatment was lower as compared to the first two treatment but still showed abounding mortality.

## DISCUSSION

Neem leaf extract is one of the genuine products which gives 100% result by showing its insecticidal properties. Azadirachtin contained in neem seeds acts as a substance that can inhibit the work of ecdyson hormone, which is a hormone that functions in the process of metamorphosis of insects. Insects will be disrupted in the process of changing the skin, or the process of change from egg to larvae, or from larvae to cocoons or from cocoons to adulthood. Usually, failure in this process often results in death (Kuba et al., 1986). The neem leaf extract is a great substitute to the chemical insecticides because it does not harm to our environment and are eco-friendly. The plant leaf extract or the botanicals are very effective when used at a certain concentration and time interval. Definitely results will be obtained. Neem leaf extract repels aphids by inhibiting feeding and by disrupting their growth, metamorphosis and reproduction. Neem leaf extract usually alter the behaviour of insects and reduce their reproductive potential (Rukmana, R and Yuyun Y.O. 2002). Various research and investigations have been carried out on the insecticidal properties of the neem and its parts such as neem flower neem tree bark. The neem is also used in medicines and do have medicinal properties.

*Eucalyptus saligna* leaf extract is the second most effective extract on the aphids with second highest mortality rate. As per a report, essential oil from *Eucalyptus* species is among the world's top traded oils and oil extracted from *E. citriodora* is one of the world's major oils in terms of trade volume (Green, 2002). *Eucalyptus* species not only provide fuel biomass and reduce atmospheric carbon dioxide levels directly (Barton, 2000; Martin, 2002), but also perform a variety of indirect services through their essential oil used as insect/pest repellent and as a pesticidal agent (Barton, 2000). In fact, eucalyptus oil has been known for hundreds of years as antibacterial, antifungicidal and antiseptic in nature (Brooker and Kleinig, 2006). *Eucalyptus* oil ranks superior in quality and has advantages over essential oil from other tree crops, since it has multipurpose uses in perfumery, pharmaceutical and other industries (Boland et al., 1991; FAO, 1995).



Curry leaf *Murraya koenigii* is a leafy spice, belongs to the Rutaceace family, is native to India, Sri Lanka, Bangladesh and the Andaman Islands. Its leaves are widely used in Indian cookery for flavouring foodstuff. The major constituent responsible for the aroma and flavour is due to presence of essential oils used in the soap industry (Salikutty and Peter, 2008). It has anti carcinogenic properties due to the presence of carbazole alkaloids (Khanum et al.,2000). Apart from these characteristics the curry leaf does have insecticidal properties. Though the curry leaf extract was less effective than the neem and *Eucalyptus saligna* leaf extract but still have shown a major result.

## CONCLUSION

The experiment has given us a clear picture that *Azadirachta indica* leaf extract have shown a significance amount of mortality against *M. sanbornii* with an average mortality rate of more than 90%. It clearly depicts that *Azadirachta indica* leaf extract could be used as a natural ingredient for controlling Aphids on the chrysanthemum plant. *Eucalyptus saligna* leaf extract and *Murraya koenigii* leaf extract have also shown a significance mortality rate against *M. sanbornii*. The average percentage of the mortality of the aphids were observed in the *Azadirachta indica* extract treatment. One of the best ways to control the effect of aphids on flowering plant like chrysanthemum is to use natural sources which do not harm the quality of the flowers. Leaf extract of various leaves can be used as natural method to eradicate this problem.

These extract shows that the potency of mortality rate of the *M. sanbornii* against several chemical insecticides which not only harm the quality of chrysanthemum flowers but also harms the nature. Hence the effectiveness of the leaf extracts is as follow:

*Azadirachta indica* > *Eucalyptus saligna* > *Murraya koenigii*

## ACKNOWLEDGEMENTS

The authors are grateful to Dr. E Charles president and Dr. V. Prakash, Principal of Isabella Thoburn College, Lucknow, Uttar Pradesh, India for her providing facilities for conducting experiment in college premises. The authors are also grateful to Dr. Chitra Singh, Head of the department, Zoology for her great support and encouragement.

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