

THE EFFECT OF *AZADIRACHTA INDICA* IN BIO-ERADICATION OF SNAILS IN AQUARIUMS

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ABSTRACT

The effect of different concentrations of neem extract (*Azadirachta indica*) in bio- eradication of aquarium snails and its effect on the ornamental fish (*Poecilia reticulata*) were analysed in this study. Snail attack in aquarium tank is an issue with excessive reproduction, disfiguring the aquarium by attaching their young ones on plant surfaces and eating live plants. In this experiment 12 numbers of 3.5mm, 5L glass aquarium tanks of 22.5cm×22.5cm×15cm dimension were taken. Each tank was distributed with one pair fish and one snail (*Planorbarius spp.*). Tanks were kept as 4 sets, each set having 3 tanks (triplicates). First set of tanks (S_0), were kept as control and different concentrations of neem were applied into the other 3 sets, namely, S_1 , S_2 and S_3 . The concentration of neem extract applied in S_1 , S_2 and S_3 were 5ml v/v, 10ml v/v and 30 ml v/v, respectively. Water quality parameters and snail behaviour were recorded for fifteen days. Temperature remained constant at all concentrations, while pH showed slight and gradual fluctuation which had no detrimental effect on organisms. But at high concentration of extract, light penetration was reduced and effected animal behaviour. There was significant difference in survival rate of the snails

and fishes in S_0 compared to those in S_1 to S_3 . Ornamental fishes in S_1 thrived well but, showed reduction in snail whereas, S_3 recorded adverse effect on pet fishes too. The study showed that low concentrations of extract had lethal effect on the snails without causing adverse effect on fishes. Thus in aquariums, neem leaf extract at low concentration can be used as a bio-eradicator against aquarium snails without affecting the aquarium fishes.

Key words: *Azadirachta indica*, Snails, *Poecilia reticulata*, Aquarium, Bio-eradication

INTRODUCTION

Freshwater snails are considered to be undesired pests in an aquarium. Some of the reasons why hobbyists consider freshwater snails to be pests are related to egg laying, excessive reproduction and eating live plants. Snails usually get into the system along with the vegetation. Damage done to tank plants disfigures the beauty of the set aquariums. Snail overpopulation can lead to lack of oxygen, since the majority of snails breed rather intensively.

There are different ways to get rid of snails including manual hand picking, chemical treatment and by

setting traps. Molluscicide, niclosamide, is acceptable for operational use in snail control programmes. According to Mitchell (2002), application of copper sulfate is an effective treatment to control snails. But, there has been increasing concern about chemical usage and its related toxicity issues. Uncontrolled use of chemical irritants/preservatives has been inducing factor for appearance of pest/microbial strains more and more resistant to classic chemical agents. This perspective has put pressure on the industry for progressive removal of chemicals and adoption of natural alternatives. This resulted in increasing search for new bio-eradicants.

The increasing amount of studies on plant-pest chemical interactions in the last few decades

has unveiled the potential of utilising botanical pesticides in the form of secondary plant

metabolites as pest control agents (Senthil-Nathan et al., 2007). *Azadirachta indica* (Neem) of family Meliaceae is a native of India which has emerged as the most important alternative source for plant based pesticides. It is largely relied on for herbal medicine in its ingrained countries and is used for pharmaceutical and pest control purposes (Berger, 2005). One of the most promising natural compounds in neem is azadirachtin, a tetranotriterpenoid which is known to possess antiviral, antibacterial and antifungal properties since time immemorial (Isman et al., 1990; Harikrishnan et al., 2003; ICAR, 1993). This compound in neem have insecticidal properties as an antifeedant, repellent, oviposition deterrent, molting inhibition and a growth retardant for a variety of insects and arthropods (Mala et al, 2008 ; Lale et al ,1999 ;Seljäsena et al, 2005 ; Rimpi et al ,2010).

Aqueous extract of neem leaves and other allied products find extensive use in fish-farms for controlling fish parasites and fish fry predators (Martinez, 2002). Most of these plants appear to work as aquatic molluscicides affecting surface tension at the gills of aquatic snails and leading to toxic haemolytic effects. Considering all the above, neem, is a good candidate as bio-eradicant in the agricultural and fisheries sector. In this paper, the effectiveness of neem in eradicating pest snails in an aquarium is studied. The survival of ornamental fishes at the experimental doses is also recorded.

MATERIAL AND METHODS

Test Animals

The experiment were performed using Ramshorn snails (*Planorbis spp.*) of average 4mm diameter, collected from affected aquarium tanks. Guppy (*Poecilia reticulata*) were acquired through local fish suppliers. Fishes were randomly chosen generating heterogeneity of sizes with an average length of 3cm. The fishes were acclimatized for about two weeks in indoor tanks filled with tap water. During this period the water was constantly aerated with conventional aerators and fishes were fed daily with commercial food pellets (2-3 powdered 1mm pellets per fish). Once acclimation was achieved, healthy fishes were distributed in 12 aquarium tanks in male-female ratio of 1:1.

Experimental Set Up

12 numbers of 3.5mm, 5L glass aquarium tanks of 22.5cm×22.5cm×15cm dimension were taken for the experiment. 4L of tap water was filled in all the tanks with constant aeration using aeration tubes and stones. Each tank was distributed with one pair fish and one snail. They were fed daily with commercial food pellets (4-5 grounded pellets per

tank). Tanks were kept as 4 sets, each set having 3 tanks (triplicates).

Preparation of Neem Leaf Extract (Caguan et al., 2004)

Fresh leaves of neem plant (*Azadirachta indica*; Family: Meliaceae) were collected locally and cleansed with dechlorinated tap water to remove dust. 45gm of neem leaves were taken. Water was added to it in the ratio of 3:1 and then finely grounded in blender. The resulting solution was filtered to obtain an aqueous extract. Fresh aqueous extract was used directly after 12-13 hrs at the desired concentrations.

Application of Neem Leaf Extract

The experiment was planned to be done for three different concentration of aqueous neem extract and one set of control. For this purpose, four sets of aquaria were arranged (set S_1 , S_2 , S_3 and S_0 for 5 ml, 10 ml, 30 ml and control, respectively), each set containing three aquaria (triplicates).

RESULTS

Effect of Neem Extract on Water Quality

Temperature is one of the important parameters often used in water quality assessment. Drastic changes in temperature values will cause harmful effects to distribution of aquatic organisms. The change of temperature value of the aquaria before and after using neem leaf extract is given in Table 1. Significant variation in temperature was not observed during the experimental period. The active ingredient neem did not show any negative impact on the temperature of the treated water.

pH is another important parameters used in water quality assessment. Low or high pH values will cause harmful effects to distribution of aquatic organisms (Martinez, 2002). The change of pH

value of the aquaria after using neem leaf extract is shown in Table 2. There was only slight and gradual change in the pH which was not detrimental to the survival of aquatic organisms.

Water colour affect the luminous intensity of the sun on the water hence, has an impact on the photosynthesis (Martinez, 2002). As shown in the Table 3, application of low concentrations didn't affect the light penetration, hence the survival of fishes and snails was not affected (Set S_1). But tanks treated with high concentration (S_2 and S_3) showed reduction in the light penetration. The tanks subjected to higher concentration of neem also had detrimental effect on the survival of aquatic organisms as observed in set S_3 .

Effect of neem leaf extract on Snail and Fish

Set S_0 test tanks had the general aquarium set up. The set of tanks from S_1 to S_3 were treated with neem extracts. The neem extract treatment in S_1 was 5 ml/tank. After the treatment all test fishes was alive for the 15 days of the experimental period whereas, the snails survived only the first 4 days of treatment. The reduction in snail was recorded on the 5th, 10th and 13th day. This indicates that at 5ml, neem leaf extract had a slow negative impact on snail survival rate, while there is no adverse effect on fishes. The experiment was continued to estimate the point at which the given concentration affected the ornamental fishes. The fishes survived upto 15th day at the given condition which was 3 times that of snail survival days.

Set S_2 tanks had the general aquarium set up. The neem extract treatment in this set was 10 ml/tank. After the treatment all the test fishes were alive for the 15 days of the experimental period whereas, the snails survived only for the first two days. The reduction in snail was recorded on the 3rd, 6th and

10th day. This indicates that increase in concentration of neem extract shows a proportionate decrease in snail survival rate. It had much better and quick effect on snails, while there was no visible effect on fishes in the 15 day period.

The neem extract treatment in S₃ tanks was with 30 ml neem extract. After the treatment all the test fishes and snails was alive for only one day. Mass mortality of all the test fishes and snails was observed by the 2nd day. This indicates that at 30 ml, neem leaf extract is highly detrimental for both fishes and snails.

From the above results it was evident that there was significant difference in survival of the snails and fishes in different concentrations of neem leaf extract treatments. 5 ml and 10 ml concentrations had detrimental effect (even though slow) on the snails without causing adverse effect on fishes. While 30 ml concentration proved to be highly toxic to both test fishes and snails.

Table no 1. Effect of Neem Extract on Temperature(°C)

Sl.no	Neem Extract used (ml)	Days														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S ₁	5	30	30	30	30	30	30	30	30	30	30	30	30	D	D	D
S ₂	10	30	30	30	30	30	30	30	30	30	D	D	D	D	D	D
S ₃	30	30	30	D	D	D	D	D	D	D	D	D	D	D	D	D

Values are the mean±SD, n=3

D – Snail died, No further analysis

Table no 2. Effect of Neem Extract on pH

Sl. no	Neem Extract used (ml)	Days														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S ₁	5	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	7	7	D	D	D
		2	2	5	5	5	5		8	8	8					
S ₂	10	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	D	D	D	D	D	D
		6	6	7	7	7	7	8	9	9						
S ₃	30	6.3	6.3	D	D	D	D	D	D	D	D	D	D	D	D	D
		4	4													

Values are the mean±SD, n=3

D – Snail died, No further analysis

Table no 3. Effect of Neem Extract on Colour

Sl. no	Neem Extract used (ml)	Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S ₁	5	LG	LG	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	CL	D	D	D
S ₂	10	G	G	G	G	LG	LG	LG	CL	CL	D	D	D	D	D	D	D
S ₃	30	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
		G	G														

Values are the mean±SD, n=3 D – Snail died, No further analysis, LG – Light Green , G –Green , DG – Dark Green , CL – Colourless

DISCUSSION

This study was done to reduce the undesired growth of aquarium pest, Ramshorn snails (*Planorbarius spp*), using different concentration of neem leaf extract. Ploomi et al.(2009) have tested *Azadirachtin* on herbivorous snail and concluded that the treatment could control the snail as effective repellent. In a study conducted by Venkatalakshmi & Michael (2001), neem leaves prevented the spread of infection and promoted the survival and growth of fish.

The result obtained in this study showed that Neem leaf extract in low concentrations didn't affect the survival of fishes in the aquarium. Neem leaf is used for leprosy, eye disorders, intestinal worms treatment, have anti-bacterial, antiviral properties (Sumana et al, 2015) hence, they directly or indirectly enhance the health of fishes. Nguyen et al. (2016) reported that the use of active ingredients extracted from neem is capable of affecting the quality of the water. At low concentration, the extract from neem leaf did not have observable negative impact on ornamental fishes (*Poecilia reticulata*).

CONCLUSION

The result of the present study indicates that the water quality parameters like temperature, pH and colour didn't change drastically by the application of low concentration (5 ml, 10ml/tank) of the neem extract. This result indicated that low concentration of neem leaf extract applied to fresh water was not harmful to the species in the aquaria. Whereas, at the highest test concentration used (30 ml/tank), adverse effects were evident with mortality of both snails and fishes within two days of treatment. This study proves that the application of low concentration neem leaf extract can be used as a molluscicide in water as environment friendly material instead of deleterious molluscicides.

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