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# Effects of neem based insecticides on Coccinellids and Staphylinids population in rice field

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**Abstract**
The investigation entitled "Effects of Neem based Insecticides on Coccinellids and Staphylinids Population in Rice Field" was carried out at Research cum Instructional Farm of IGKV, Raipur (C.G.) during *Kharif*, 2015-16 and The Field study carried out to evaluate the safety of neem based compounds i.e., Neembaan Neemazal, Nimbecidine, Multineem, Neem oil, NSKE and chemical pesticide i.e., Dinotefuran to Coccinellids (Lady bird beetles) and Staphylinids (Rove beetles) in the rice fields brought out that all six Neem based insecticides were found less toxic to Coccinellids population and among them the safest one is Nimbecidine @ 5ml/l with highest Coccinellid population i.e., 2.32 per hill. The Chemical insecticide i.e., Dinotefuran @ 0.5g/l was more fatal to Coccinellids with lowest mean population i.e., 0.30 whereas maximum Coccinellid population was found in untreated control (2.50). Similarly for rove beetles all Neem based insecticides were found safer than chemical insecticide. Lowest population was recorded from plot treated with Dinotefuran @ 0.5g/l (0.28) and highest population was recorded from untreated control plot (1.86). Among the botanicals lowest population was recorded from plot treated with Neem oil @ 5ml/l which is 1.60.

**Keywords:** Rice, Coccinellids, Staphylinids, Neem, Bio-safety

## Introduction
Rice (*Oryza sativa* L.) occupies the prominent place in Indian agriculture. It is the most important staple food crop of the developing world for more than 3 billion people. The production and productivity of rice is low in Chhattisgarh and India as compared to world production. Chhattisgarh popularly known as "Rice Bowl of India" occupies an area around 3756.80 thousand hectares with the production of 5.22 million tones and productivity of 2050 kg per hectares (Krishi Dairy, 2016) [5]. Amongst various constraints for low productivity of rice the insect pests and diseases are very important. The hot and humid environment in which rice is grown is very conductive for proliferation of insects and diseases. The rice plant is attacked by more than 128 species of insects, 20 of them can cause serious economic loss (Kalode, 2005) [4].

Natural enemies play an important role to prevent the insect pest outbreak in rice field. (Bambaradeniya and Edirisinghe, 2008) [1] and are insect's worst enemies feeding on a variety of prey, thus killing far more pests than commercial insecticides. But the overuse of plant protection chemicals for maximizing production took a heavy toll on these beneficial creatures. Most of the predators in rice fields seem to evacuate the field after application of chemical insecticides, thus their predatory capacity was suppressed and caused a negative impact on the population densities of rice field predators (Lee *et al.*, 1993). Whereas the Neem formulations were found to be quite safe to them (Samiayyan and Chandrase kharan, 1998) [8].

## Materials and Methods
### Study Area and Experimental Design
To determine the Effects of Neem based Insecticides on Coccinellids and Staphylinids population in Rice field, field experiment was conducted during *kharif* 2015-16 in randomized block design with eight treatments and three replications. The seedling of variety Swarna was transplanted in plot size of 20 $m^2$ with a spacing of 20 x 15 cm and normal agronomical practices were adopted. The knapsack sprayer and spray volume @ 500l/ha was used with hollow cone nozzle to impose the spray treatments.

**Neem based insecticides (treatment details)**

**Table 1:** Treatment details are given in.

| S.N. | Trade Name | a.i. in formulation | Rate of formulation/ha | Dose/l |
|---|---|---|---|---|
| $T_1$ | Neembaan | 1.0% Azadirachtin | 1000ml | 2.0ml/l |
| $T_2$ | Neemazal | 1.0% Azadirachtin | 1000ml | 2.0ml/l |
| $T_3$ | Nimbecidine | 0.03% Azadirachtin | 2500ml | 5.0ml/l |
| $T_4$ | Multineem | 0.03% Azadirachtin | 2500ml | 5.0ml/l |
| $T_5$ | Neem Oil | Crude form | - | 5.0ml/l |
| $T_6$ | Dinotefuran | 20 SG | 200g | 0.5g/l |
| $T_7$ | NSKE | Crude form | - | 100ml/l |
| $T_8$ | Untreated Control | - | - | - |

**Coccinellids and staphylinids counting and statistical analysis of the data**

Different Neem formulations were evaluated for the safety of natural enemy (Coccinellids and Staphylinids) of major insect pest of rice. Pre treatment observations were recorded on 10 randomly selected plants a day prior to insecticidal application while, post treatment observations will be recorded at 1, 3, 5 and 7 days after spraying.

Standard statistical procedure was followed as per Gomez and Gomez (1984). The student's t test and contrast test were used for ANOVA and mean comparison respectively.

**Results**

Non- target effect of different Botanical Extracts and Insecticidal treatment was assessed for population fluctuation of lady bird beetle at periodic intervals under different treatment. In the pre-treatment observation average lady bird beetle population ranged from 1.23 to 1.66 per hill which differs non-significantly among all the treatments including untreated control. In post treatment observations recorded at 1, 3, 5, 7 days after first spraying indicated that the chemical insecticide is more fatal to the lady bird beetle, than the Neem products.

At 7$^{th}$ day after first spray results showed that Minimum population of lady bird beetle is recorded from plot treated with Dinotefuran @ 0.5g/l with 0.13 lady bird beetle per hill where as maximum population was recorded in untreated plot with the average number of 2.53. Among Neem based insecticides Neem oil @ 5ml/l was safest with 2.43 lady bird beetle per hill which was at par with Nimbecidine @ 5ml/l (2.33), Multineem @ 5ml/l (1.86) NSKE @ 100ml/l (1.83), Neemazal @ 2ml/l (1.76), Neembaan @ 2ml/l (1.73).

Whereas at 7$^{th}$ day after second spray results indicated that all Neem based insecticides are safer treatment against the lady bird beetle. Highest population was recorded in untreated plot with the average number of 3.83 which is significantly at par with all other Neem based insecticides i.e., Nimbecidine @ 5ml/l (3.56), Neem oil @ 5ml/l (3.60), NSKE @ 100ml/l (3.33), Neembaan @ 2ml/l (3.03), Neemazal @ 2ml/l (2.83) and Multineem @ 5ml/l (2.43). Minimum population of lady bird beetle is recorded from plot treated with Dinotefuran @ 0.5g/l with 0.16 lady bird beetles per hill.

Bio-safety evaluation of different Neem based insecticides against Rove beetles revealed that at 7 days after first spraying of Neem based insecticides rove beetles exhibited range from 0.13 to 2.30. Minimum population of rove beetle was recorded in Dinotefuran @ 0.5g/l with 0.13 rove beetle per hill. Neem oil @ 5ml/l was found best safer treatment against the rove beetles with 1.46 beetles per hill which was at par with Nimbecidine @ 5ml/l (1.30), Neemazal @ 2ml/l (1.23), NSKE @ 100ml/l (1.10), Multineem @ 5ml/l (1.06) and Neembaan @ 2ml/l (1.03). Whereas highest population was recorded in untreated plot with the average number. of 2.30.

Whereas at 7 days after second spraying of Neem based insecticides rove beetles exhibited range from.16 to 2.53. Minimum population of rove beetle was recorded in Dinotefuran @ 0.5g/l with 0.16 rove beetle per hill. Neem oil @ 5ml/l was found best safer treatment against the rove beetles with 2.36 beetles per hill was found best safer treatment against the rove beetles which was at par with Nimbecidine @ 5ml/l (2.16), NSKE @ 100ml/l (2.06), Neembaan @ 2ml/l (2.00), Multineem @ 5ml/l (1.96), Neemazal @ 2ml/l (1.93) whereas highest population was recorded in untreated plot with the average number. of 2.53.

**Table 2:** Effects of insecticides application on Lady Bird Beetles (Coccinellids) of rice ecosystem

| | | | Mean Lady Bird Beetle Population per hill | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Application | | | | 2nd Application | | | | Overall Mean |
| S. NO. | Treatments | DOSE/L | Pre-treatment | 1DAT | 3DAT | 5DAT | 7DAT | 1DAT | 3DAT | 5DAT | 7DAT | |
| $T_1$ | Neembaan | 2.0ml/l | 1.46 (1.56) | 1.53 (1.59) | 1.66 (1.63) | 1.7 (1.64) | 1.73 (1.65) | 1.73 (1.65) | 1.90 (1.70) | 2.30 (1.81) | 3.03 (2.00) | 1.94 (1.70) |
| $T_2$ | Neemazal | 2.0ml/l | 1.36 (1.53) | 1.56 (1.60) | 1.70 (1.64) | 1.76 (1.66) | 1.76 (1.66) | 1.83 (1.68) | 2.16 (1.77) | 2.50 (1.86) | 2.83 (1.94) | 2.01 (1.72) |
| $T_3$ | Nimbecidine | 5.0ml/l | 1.66 (1.62) | 1.76 (1.66) | 1.86 (1.69) | 2.03 (1.73) | 2.33 (1.82) | 1.90 (1.69) | 2.23 (1.79) | 2.93 (1.98) | 3.56 (2.13) | 2.32 (1.81) |
| $T_4$ | MultiNeem | 5.0ml/l | 1.23 (1.49) | 1.30 (1.50) | 1.53 (1.58) | 1.73 (1.65) | 1.86 (1.69) | 1.76 (1.66) | 1.76 (1.66) | 2.10 (1.75) | 2.43 (1.84) | 1.80 (1.66) |
| $T_5$ | Neem oil | 5.0ml/l | 1.26 (1.50) | 1.40 (1.54) | 1.83 (1.68) | 2.1 (1.75) | 2.43 (1.85) | 1.93 (1.71) | 2.26 (1.80) | 2.90 (1.97) | 3.60 (2.14) | 2.30 (1.80) |
| $T_6$ | Dinotefuran | 0.5g/l | 1.43 (1.55) | 0.33 (1.15) | 0.23 (1.11) | 0.16 (1.08) | 0.13 (1.08) | 0.63 (1.27) | 0.50 (1.22) | 0.33 (1.14) | 0.16 (1.08) | 0.30 (1.14) |
| $T_7$ | NSKE | 100ml/l | 1.33 (1.52) | 1.36 (1.53) | 173 (1.64) | 1.80 (1.67) | 1.83 (1.68) | 1.70 (1.64) | 2.03 (1.73) | 2.36 (1.82) | 3.33 (2.08) | 2.01 (1.72) |
| $T_8$ | Untreated Control | - | 1.40 (1.54) | 1.8 (1.67) | 1.93 (1.71) | 2.2 (1.78) | 2.53 (1.88) | 2.00 (1.68) | 2.53 (1.88) | 3.2 (2.04) | 3.83 (2.19) | 2.50 (1.85) |
| SE(m) | | | 0.071 | 0.075 | 0.06 | 0.073 | 0.068 | 0.075 | 0.073 | 0.098 | 0.088 | - |
| C.D. | | | NS | 0.23 | 0.18 | 0.22 | 0.20 | 0.23 | 0.22 | 0.3 | 0.28 | - |

*Figures in parentheses are square root transformation value

* DAT – Days after treatment

**Table 3:** Effects of insecticides application on Rove Beetles (Staphylinids) of rice ecosystem

| | | | Mean Lady Bird Beetle Population per hill | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Application | | | | 2nd Application | | | | |
| S. No. | Treatments | Dose/l | Pre-treatment | 1DAT | 3DAT | 5DAT | 7DAT | 1DAT | 3DAT | 5DAT | 7DAT | Overall Mean |
| $T_1$ | Neembaan | 2.0ml/l | 1.46 (1.56) | 1.53 (1.59) | 1.66 (1.63) | 1.7 (1.64) | 1.73 (1.65) | 1.73 (1.65) | 1.90 (1.70) | 2.30 (1.81) | 3.03 (2.00) | 1.94 (1.70) |
| $T_2$ | Neemazal | 2.0ml/l | 1.36 (1.53) | 1.56 (1.60) | 1.70 (1.64) | 1.76 (1.66) | 1.76 (1.66) | 1.83 (1.68) | 2.16 (1.77) | 2.50 (1.86) | 2.83 (1.94) | 2.01 (1.72) |
| $T_3$ | Nimbecidine | 5.0ml/l | 1.66 (1.62) | 1.76 (1.66) | 1.86 (1.69) | 2.03 (1.73) | 2.33 (1.82) | 1.90 (1.69) | 2.23 (1.79) | 2.93 (1.98) | 3.56 (2.13) | 2.32 (1.81) |
| $T_4$ | Multineem | 5.0ml/l | 1.23 (1.49) | 1.30 (1.50) | 1.53 (1.58) | 1.73 (1.65) | 1.86 (1.69) | 1.76 (1.66) | 1.76 (1.66) | 2.10 (1.75) | 2.43 (1.84) | 1.80 (1.66) |
| $T_5$ | Neem oil | 5.0ml/l | 1.26 (1.50) | 1.40 (1.54) | 1.83 (1.68) | 2.1 (1.75) | 2.43 (1.85) | 1.93 (1.71) | 2.26 (1.80) | 2.90 (1.97) | 3.60 (2.14) | 2.30 (1.80) |
| $T_6$ | Dinotefuran | 0.5g/l | 1.43 (1.55) | 0.33 (1.15) | 0.23 (1.11) | 0.16 (1.08) | 0.13 (1.08) | 0.63 (1.27) | 0.50 (1.22) | 0.33 (1.14) | 0.16 (1.08) | 0.30 (1.14) |
| $T_7$ | NSKE | 100ml/l | 1.33 (1.52) | 1.36 (1.53) | 1.73 (1.64) | 1.80 (1.67) | 1.83 (1.68) | 1.70 (1.64) | 2.03 (1.73) | 2.36 (1.82) | 3.33 (2.08) | 2.01 (1.72) |
| $T_8$ | Untreated Control | - | 1.40 (1.54) | 1.8 (1.67) | 1.93 (1.71) | 2.20 (1.78) | 2.53 (1.88) | 2.00 (1.72) | 2.53 (1.88) | 3.2 (2.04) | 3.83 (2.19) | 2.50 (1.85) |
| SE(m) | | | 0.071 | 0.075 | 0.06 | 0.073 | 0.068 | 0.075 | 0.073 | 0.098 | 0.088 | - |
| C.D. | | | NS | 0.23 | 0.18 | 0.22 | 0.20 | 0.23 | 0.22 | 0.3 | 0.28 | - |

*Figures in parentheses are square root transformation value
* DAT – Days after treatment

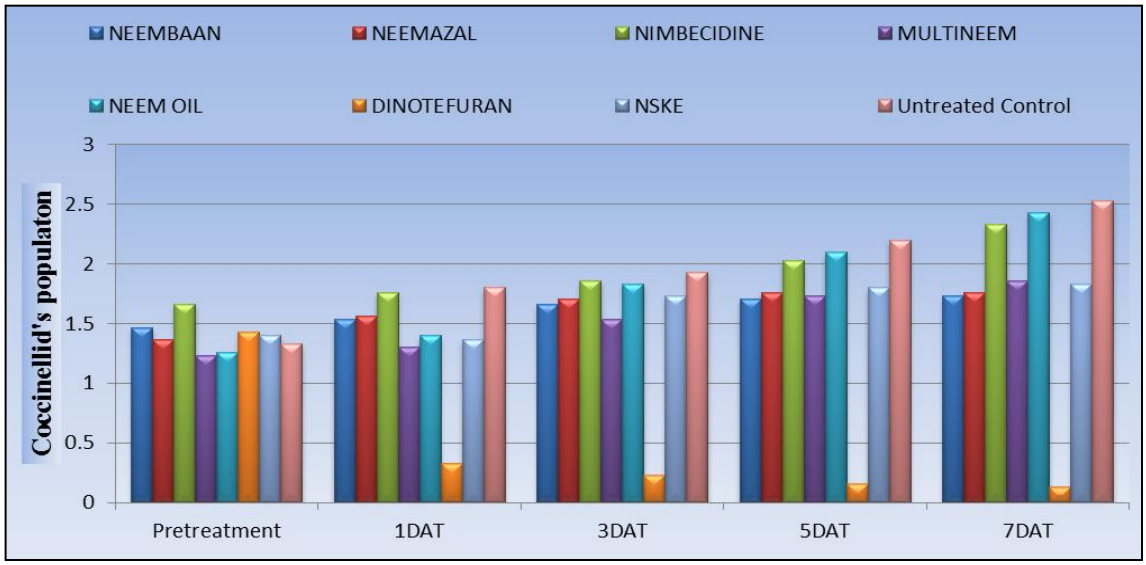


**Fig 1:** Effects of Neem based Insecticides on Coccinellid's population in Rice field after first spray

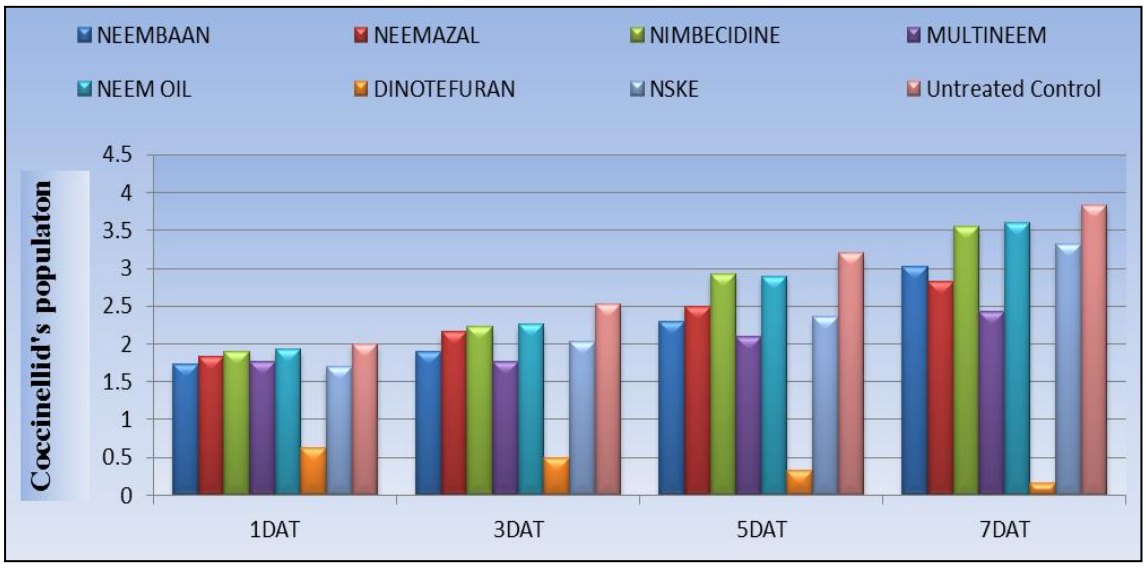


**Fig 2:** Effects of Neem based Insecticides on Coccinellids population in Rice field after second spray

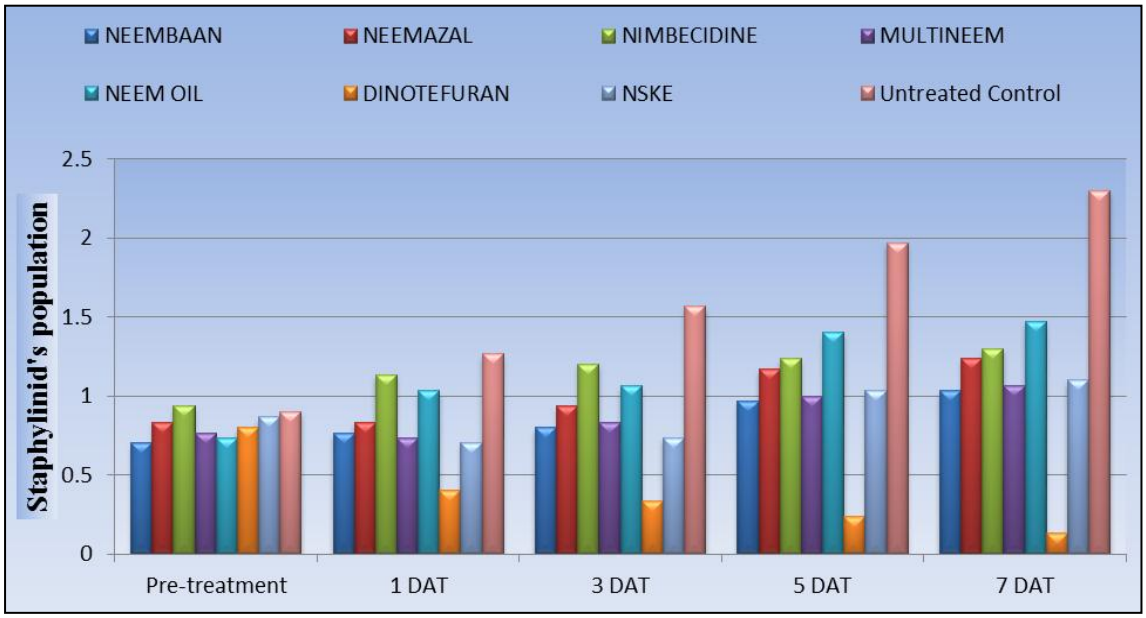


**Fig 3:** Effects of Neem based Insecticides on Staphylinid's population in Rice field after first spray

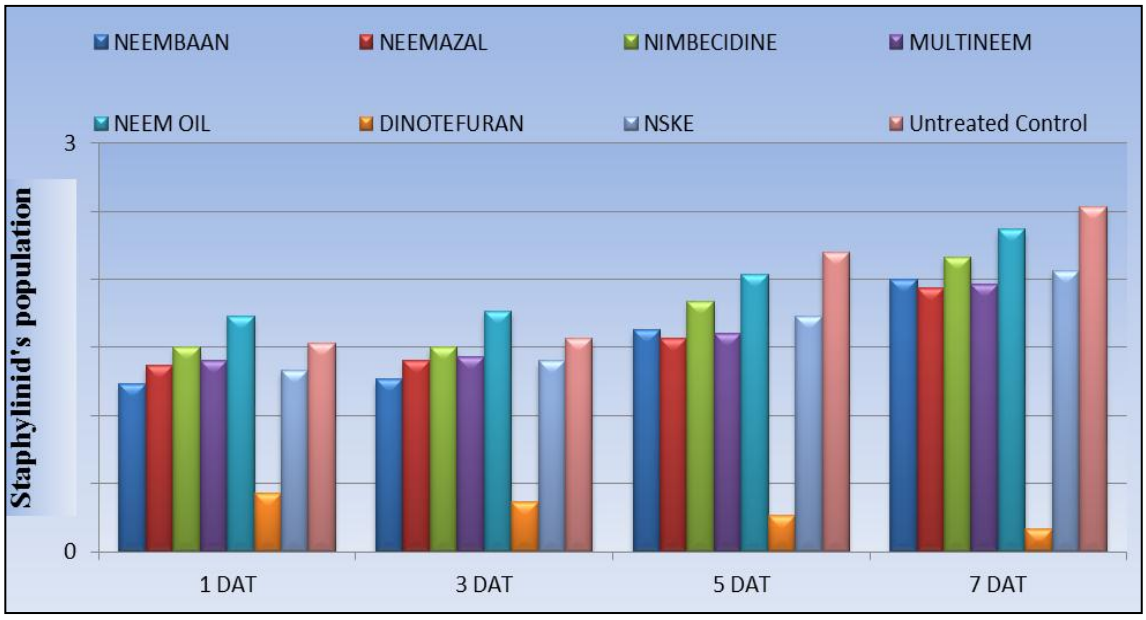


**Fig 4:** Effects of Neem based Insecticides on Staphylinid's population in Rice field after first spray

## Discussion

Present findings are in agreement with Joseph *et al.*, 2010 [3] who reported that among the Neem products, Azadirachtin 0.004 per cent, caused relatively high mortality and was almost similar to the chemical pesticides in its effect, whereas Neem oil and NSKE were safe to the spiders. This was also in agreement with the observations made by Samiayyan and Chandrasekharan (1998) [8]. Broad-spectrum insecticide applications definitely alter the arthropod community in the agro-ecosystem (Michael Nash *et al*., 2010) [7].

## Conclusion

Bio-safety evaluation of different Neem based insecticides revealed that chemical insecticide was more fatal to natural enemies, than the Neem products and all Neem based insecticides were found safer and less toxic for different natural enemies. Among Neem based insecticides Nimbecidine @ 5ml/l was found safest lady bird beetle whereas Neem oil @ 5ml/l was found safest for rove beetles.

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