

Effective seed oil mixtures for managing rice leaf folder

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Abstract : The rice leaf folder *Cnaphalocrocis medinalis*, Guen. is one of the major pests affecting rice. The use of neem products viz. neem seed kernel extract (NSKE) 5% and neem oil (NO) 3% is the available non-chemical method for the management of this pest. A study was carried out at Tamil Nadu Rice Research Institute, Aduthurai during 1993-95 to enhance the effectiveness of this product. Combinations of seed oil viz. pungam (Karanj), illuppai, sesame, castor and mustard at 1% with NSKE 4% and NO 2% were tested for their efficacy against leaf folder under laboratory, glass house and field conditions. Among the seed oil mixtures, NSKE 4% + pungam oil 1% and NO 2% + pungam oil 1% was found superior in effectiveness against leaf folder as compared to recommended dose of NSKE 5% and NO 3%. These effective treatments also registered higher grain yield and showed no adverse effect on the spider predators.

Key words: *Neem Oil, Neem seed kernel extract, Seed oils, Leaf folder.*

Introduction

Rice leaf folder *Cnaphalocrocis medinalis* has recently attained a major pest status occurring in almost all rice growing areas of our country. The yield loss in rice due to leaf folder epidemic was upto 80 percent. Effective crop protection to sustain the rice yield is inevitable but at the same time use of synthetic insecticides, though effective in pest suppression, poses serious problems concerning human health, environmental safety in addition to the resurgence of pests and reduction of natural enemies. On the other hand, use of natural products, particularly neem (*Azadirachta indica*, A. Juss.) with better degree of selective toxicity forms an ideal substitute for synthetic insecticides. The use of simple crude botanicals such as neem oil and neem cake for crop protection by resource limited farmers in developing countries and use of other botanicals to enhance efficacy of neem seed derivatives have been suggested by Saxena (1986). Hence, the present research has been focussed to enhance the bioactivity of neem seed kernel extract and neem oil in crop protection.

Materials and Methods

The bio-efficacy of neem seed kernel extract (NSKE) 5 per cent and neem oil 3 per cent was compared with combination of plant oils with NSKE (4%) and neem oil (2%) under laboratory, glass house and field conditions. The seed oils of pungam (karanji), illuppai, sesame, castor and mustard at one per cent and PBO (Piperonyl Butoxide) at 0.5 per cent concentration

were mixed with NSKE and neem oil after emulsifying in water using 0.5 per cent khadi soap.

In laboratory experiments, leaf bits of 5 x 1 cm long (5 nos.) from 40 days old TN₁ plants were dipped singly in the treatment solution for 5 sec (Saxena *et al.* 1980) and transferred to petridish (10 cm dia). Five numbers of fourth instar larvae of the leaf folder pre-starved for 6h were released into each petridish. The leaf bits were kept fresh by padding the cut edges with a strip of moist filter paper. Each treatment was replicated three times. The consumed and unconsumed leaf area was measured 24h after the commencement of the experiment on a graph paper. The percent leaf protection due to treatment was calculated.

Under glass house condition, two experiments one each for testing the antifeedant efficacy of NSKE (5%) and its combinations with other seed oils, neem oil (3%) and its combinations with other seed oils were carried out. Each experiment consisted of eight treatments with three replications. The treatments were imposed on 40 days old TN₁ plants to complete wetting with pneumatic sprayer. Two hours after spraying, 10 fourth instar larvae, pre-starved for 6h were released to each plant and enclosed with a mylar cage. Seven days after release of larvae, the per cent leaf damage was assessed by counting the number of damaged leaves and total leaves.

Table 1. Use of NSKE alone and with different seed oils (1%) on per cent leaf protection and percentage damage to leaves against 4th instar larvae of *Cnaphalocrosis medinalis*

Treatments	Percent leaf protection (24h after)	Percentage damage to leaves (7 days after)
NSKE5%	93.0 (74.68)ab	13.7 (21.69)b
NSKE 4% + Sesame oil 1%	74.7 (59.79)c	20.3 (26.80)cd
NSKE 4% + Illuppai oil 1%	96.2 (78.72)a	15.9 (23.54)bc
NSKE 4% +Pungam oil 1%	97.3 (80.54)a	5.6 (13.64)a
NSKE 4% + Castor oil 1%	86.2 (68.24)b	19.1 (25.92)cd
NSKE 4% +Mustard oil 1%	69.8 (56.66)c	21.7 (27.75)d
NSKE 4% + PBO 0.5%	89.3 (70.90)b	16.2 (23.74)bc
Control	—	28.1 (31.98)c

Mean of three replications

Figures in parentheses are arcsine transformed values

In a column means followed by the same letters are not significantly different at P=0.05 (DMRT)

Table 2. Per cent leaf protection and damage to leaves against 4th instar larvae of *Cnaphalocrosis medinalis* in neem oil alone and with different seed oils

Treatments	Percent leaf protection (24h after)	Percentage damage to leaves (7 days after)
Neem oil 3%	86.3 (68.30)a	21.6 (27.67)bc
Neem oil 2%+Sesame oil 1%	37.7 (37.90)b	25.7 (30.44)cd
Neem oil 2%+ Illuppai oil 1 %	91.2 (72.73)a	15.7 (23.35)ab
Neem oil 2%+Pungam oil 1%	93.6 (75.36)a	11.6 (19.92)a
Neem oil 2%+Castor oil 1%	87.3 (69 .09)a	24.8 (29.89)cd
Neem oil 2%+Mustard oil 1%	50.3 (45.2)b	24.8(29.88)cd
Neem oil 2%+PBO 0.5%	91.3 (72.82)a	18.9 (27.74)bc
Control	—	32.1 (34.53)d

Mean of three replications

Figures in parentheses are arcsine transformed values

In a column means followed by the same letters are not significantly different at P=0.05 (DMRT)

In the field experiment carried out during samba season of 1994, the crop was sown on 26.08.94 and planted on 8.10.94 with the variety CR 1009. The total number of treatments was 16 which were replicated three times. The treatments were imposed when the leaf damage exceeded the economic threshold level of 10 per cent. The per cent leaf damage in individual plot was assessed by counting the total number of leaves and damaged leaves in 10 hills selected at random in each treatment. The observations were made before, 7 and 14 days after the treatment. Population of spider was recorded on 10 hills

plot on the same periods before and after treatment while assessing the leaf folder damage.

The data gathered in laboratory, glasshouse and field experiments were transformed into their respective transformation values and analysed based on the nature of design (Gomez and Gomez., 1976).

Results and Discussion

In the laboratory experiment with NSKE, maximum leaf protection of 97.3 per cent was obtained in leaves treated with NSKE + pungam

Table 3. Efficacy of neem oil and NSKE with different seed oils against leaf folder under field conditions and grain yield.

Treatments	Pre treatment damage	Leaf damage (%)		Mean	Grain yield (t ha ⁻¹)
		7 DAS	14		
Neem oil 3%	12.4 (20.65)a	10.2 (18.66)c	6.7 (14.97)c	9.6 (18.09)b	4.68cd 5.28ab
Neem oil 2%+Pungam oil 1%	14.9 (22.74)a	5.1 (13.11)ab	2.9 (9.86)ab	6.9 (15.24)a	5.28
Neem oil 2% + Iluppai oil 1%	14.6 (22.44)a	10.1 (18.52)c	5.0 (12.86)abc	9.5 (17.94)b	4.92bcd
Neem oil 2% + PBO 0.5%	15.0 (22.75)a	9.3 (17.73) c	6.0 (14.30)abc	9.8 (18.23)b	4.74cd
Neem oil 2%+Mustard oil 1%	15.5 (23.18)a	11.8 (20.13)c	5.1 (13.02)abc	10.4 (18.78)b	4.93bcd
Neem oil 2% + Castor oil 1%	14.3 (22.21)a	10.8 (19.21)c	4.9 (12.84)abc	9.6 (18.09)b	4.45 ciei
Neem oil 2% + Sesame oil 1%	13.8 (21.79)a	12.1 (20.39) c	6.0 (14.20)bc	10.4 (18.80)b	4.63 abc
NSKE5%	15.5 (21.20)a	11.4 (19.69)c	5.3 (13.29)ab	10.3 (18.73)b	4.72cd
NSKE 4% Sesame oil 1%	14.5 (23.20)a	11.0 (19.40)c	7.5 (15.88)c	10.8 (19.21)bc	4.52cal
NSKE 4% + Iluppai oil 1%	15.3 (23.04)a	9.4 (17.89)c	5.6 (13.65)ab	9.7 (18.19)b	4.90bcd
NSKE 4% + Pungam Oil 1%	13.6 (21.66)a	4.4 (12.18)a	2.5 (9.02)a	6.1 (14.29)a	5.44a
NSKE 4% +Castor oil 1%	14.2 (22.17)a	11.6 (19.94)c	5.8 (13.89)bc	10.2 (18.66)b	4.67cde
NSKE 4% +Mustard oil 1%	15.0 (22.78)a	8.9 (17.36)bc	5.9 (14.05)bc	9.6 (18.06)b	4.64cde
NSKE 4% + PBO 0.5%	15.3 (23.01)a	10.3 (18.73) c	4.7 (12.51)abc	9.6 (18.08)b	4.98 aoc
Khadi soap 0.05%	13.6 (21.65)a	18.4 (25.41)d	9.0 (17.43)c	13.4 (21.50)cd	4.07f
Control	15.2 (22.98)a	19.2 (25.97)d	8.6 (17.05)c	14.0 (22.00)d	4.18e

Mean of Three replications

Figures in parentheses are sine transformed values

In a column means followed respectively by same letters are not significantly different at $P = 0.05$ (DMRT)

oil followed by NSKE + Iluppai oil (96.2%). Both the treatments were on par and also with NSKE (5%) which showed a leaf protection of 93 per cent (Table 1). Regarding damage to leaves by fourth instar larvae under glass house condition, the treatment NSKE + Pungam oil was significantly superior to all other treatments

which had 5.6 per cent leaf damage as against NSKE 5 per cent (13.7%) and untreated (28.1 %).

Similarly the experiment with neem oil under laboratory condition showed that combination of neem oil + pungam oil gave the highest

leaf protection (93.6%) and it was equally effective with all other treatments except neem oil + mustard oil and neem oil + sesame oil which had a leaf protection of 50.3 and 37.7 per cent respectively (Table 2). In the glass house, the leaf damage recorded by neem oil + pungam oil was lowest (11.6%) and was found on par with neem oil + illuppai oil (15.7%), whereas the treatments neem oil + sesame oil, (25.70%); neem oil + castor oil (24.8%) and neem oil + mustard oil (24.8%) were found least effective and on par with untreated control (32.1%).

In the field experiment, the data showed the superiority of NSKE + Pungam oil which had the lowest leaf damage of 4.4 per cent on 7 days after spraying (DAS) and it was equally effective as neem oil + pungam oil (5.1%) (Table 3). The same treatments were also effective on 14 DAS and recorded 2.5 per cent leaf damage in NSKE + pungam oil and 2.9 per cent in neem oil + pungam oil. But, these treatments were on par with NSKE + PBO (4.7%), NSKE + illuppai oil (5.6%), NSKE 5 per cent along (5.3%), neem oil + castor oil (4.9 %), neem oil + mustard oil (5.1%) and neem oil + illuppai oil (5.0%).

The plots treated with NSKE + Pungam oil registered maximum grain yield (5.44 t ha⁻¹) and it was on par with the treatments neem oil + pungam oil (5.28 t ha⁻¹) and NSKE + PBO (4.98 t ha⁻¹). The minimum grain yield of 4.18 t ha⁻¹ was recorded in the untreated control. The spider population recorded over a period of time, indicated that treatment did not affect the spider population (Table 4).

Among the various seed oils tested against rice leaf folder, superior performance was noted in NSKE + Pungam oil and neem oil + Pungam oil combinations. The superior effects of pungam oil combination with neem seed derivatives against leaf feeding insect was also observed by Nanda *et al.* (1993) against gall midge, stem borer, GLF and leaf folder of rice. Whereas Rajasekharan and Kumaraswami (1985) reported boosted antifeedant efficacy of neem seed kernel extract with sesame oil against rice leaf folder.

The increased efficacy was accounted in pungam oil mixture with neem seed derivatives followed by illuppai and mustard oil combinations

against leaf folder. The increased efficacy can be attributed to the multiple action such as potentiation and enhancement of the systemic action, better stability and uniform spread on the leaf surface. The systemic action of neem extract was increased by combining with sesame oil (Schmutterer, 1983).

Although the predator spider population declined over a period of time in both the trials, in relation to the prey densities, the reduction was non-significant. This implies that decrease in the population of predators was prey dependent rather than treatment effect. This was well recognised by the work of Saxena (1989) that mirid, *Cyrtorhinus lividipennis* and wolf spider, *Pardosa pseudoannulata* were not affected by neem applications. Hence it can be concluded that seed oil mixtures, NSKE 4 per cent + pungam oil 1 per cent and neem oil 2 per cent + pungam oil 1 per cent was found superior in their effectiveness against leaf folder as compared to recommended dose of NSKE 5 per cent and neem oil 3 per cent. These treatments also registered higher grain yield and showed no adverse effect on the predatory spiders.

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Table 4. Effect of plant products on the population of spider *Pardosa pseudoammulata*

Treatments	Pre treatment damage	Spiders Nos/plot		Mean
		Post treatment Days after spraying		
		7	14	
Neem oil 3%	3.8 (2.06)a	2.2 (1.64)a	2.3 (1.68)a	2.7 (1.79)a
Neem oil 2%+Pungam oil 1%	2.8 (1.81)a	1.6 (1.44)a	0.6 (1.05)a	1.6 (1.44)a
Neem oil 2% + Iluppai oil 1%	2.8 (1.81)a	1.64 (1.46)a	1.2 (1.29)a	1.8 (1.52)a
Neem oil 2% + PBO 0.5%	4.0 (2.11)a	0.9 (1.18)a	1.3 (1.34)a	1.9 (1.54)a
Neem oil 2%+Mustard oil 1%	3.6 (2.02)a	1.7 (1.47)a	1.3 (1.34)a	2.1 (1.6)a
Neem oil 2% +Castor oil 1%	5.2 (2.39)a	1.0 (1.22)a	2.0 (1.58)a	2.5 (1.73)a
Neem oil 2% + Sesame oil 1%	3.3 (1.95)a	1.7 (1.48)a	2.6 (1.77)a	2.5 (1.73)a
NSKE5%	4.9 (2.32)a	1.6 (1.46)a	0.6 (1.05)a	2.1 (1.61)a
NSKE 4% Sesame oil 1%	3.9 (2.09)a	0.9 (1.17)a	1.6 (1.46)a	2.0 (1.57)a
NSKE 4% + Iluppai oil 1%	3.9 (2.1)a	1.4 (1.39)a	1.6 (1.46)a	2.2 (1.65)a
NSKE 4% + Pungam Oil 1%	5.0 (2.34)a	1.2 (1.29)a	1.6 (1.46)a	2.4 (1.70)a
NSKE 4% +Castor oil 1%	3.0 (1.88)a	0.9 (1.17)a	0.9 (1.17)a	1.5 (1.41)a
NSKE 4% +Mustard oil 1%	2.2 (1.64)a	1.9 (1.56)a	1.3 (1.34)a	1.8 (1.5)a
NSKE 4% + PBO 0.5%	1.9 (1.55)a	0.9 (1.17)a	1.7 (1.48)a	1.5 (1.40)a
Khadi soap 0.05%	3.5 (2.0)a	3.6 (2.02)a	1.0 (1.22)a	2.6 (1.75)a
Control	4.2 (2.16)a	1.9 (1.56)a	0.6 (1.05)a	2.0 (1.59)a

Mean of three replications

Figures in parentheses are sine transformed values

In a column, means followed respectively by same letters are not significantly different at P=0.05 (DMRT)

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(Received: March 1998; Revised: March 2002)

