



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2018; 6(2): 243-249

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Received: 05-01-2018

Accepted: 06-02-2018

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International Journal of Chemical Studies

Evaluation of newer chemical insecticides in comparison with botanicals against coccinellids, spiders, and *Chrysopa* in pigeon pea

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Abstract

To assess the effect of different treatments on natural enemies, the field experiment was conducted at Entomology section, College of Agriculture, Nagpur during *kharif* season 2016-17, in randomized block design with three replications. Total eight treatments viz., NSE 5%, Neem oil 2% Chlorantraniliprol 18.5 SC, Spinosad 45 SC, Indoxacarb 14.5 SC, Emamectin benzoate 5 SG, Flubendiamide 20 WDG, and control (water spray) were studied. The observations on natural enemies Coccinellids, Spider, *Chrysopa*/five plant) in pigeon pea was recorded after each spray of above insecticides. The treatment Indoxacarb 14.5 SC recorded minimum number of natural enemies population compared to other treatments including control (water spray) and treatments of NSE 5% and neem oil 2% observed highest in natural enemies population, as compared to all other treatments except control (water spray).

Keywords: pigeonpea, natural enemies, botanicals, insecticides

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.) also known as red gram, arhar and tur is second most pulse crop of India next to gram and in Maharashtra 32.37% of area is covered under the pigeonpea crop, generally grown in *kharif* season. In India, pigeonpea occupies about 3.90 million hectare of area with an annual production of 3.17 M tones and productivity of 813 kg/ha (Anonymous 2015-16).

Insecticide resistance and resurgence in insect pest occur due to repeated use of same chemicals, insecticides and hence become the vital important to study tactics dealing with Natural enemies. In the present experiment it was focused on efficacy of different insecticidal treatments in comparison with botanicals on Natural enemies population after each spray.

Materials and Methods

The present field experiment was carried out on Tur crop, variety PKV-TARA during *kharif* season 2016-17 on the field of Entomology section, College of Agriculture Nagpur (Dr. PDKV, Akola, M.S. India). The experiment was laid out in a randomized block design with eight treatments consisting NSE 5% @ 50g/l, Neem oil 2% @ 20ml/l, Chlorantraniliprole 18.5 SC @ 0.25 ml/l, Spinosad 45 SC @ 0.3 ml/l, Indoxacarb 14.5 SC @ 0.55ml/l, Emamectin benzoate 5 SG @ 0.2 g/l, Flubendiamide 20 WDG @ 0.5 g/l, including control (water spray) were evaluated after each spray against natural enemies and observed the effect on their population. The plot size was kept 18.48 m² with a spacing of 60 x 30 cm between rows and plants respectively and recommended agronomical practices were followed.

Results and Discussion

The data obtain was subjected to statistical analysis after appropriate transformations and are presented in Table 1 and fig1 and described below under the respective headings. The results obtained are discussed below in the light of relevant, literature available under respective headings.

Effect of different treatments on coccinellids/five plant in pigeon pea**At first spray**

The data on effect of different treatments on Coccinellids in pigeon pea presented in Table 1 and fig. 1 revealed that all the treatments significantly superior.

The data recorded at 3 days after first spray the maximum no. of Coccinellids population found in (T₈) control (water) (2.80), followed by (T₂) Neem oil (2.11) and (T₁) NSE 5% (2.10) were found at par with each other. Among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.11). The data recorded at 7 days after first spray revealed that the maximum no of Coccinellids population found in (T₈) control (water spray) (2.82) followed by (T₂) Neem oil (2.13) and (T₁) NSE 5% (2.12) were found at par with each other. Among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.13). The data recorded at 10 days after first spray revealed that the maximum no of Coccinellids population found in (T₈) control (water spray) (2.82), followed by (T₂) Neem oil 2%(2.15)and (T₁) NSE 5% (2.12) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.13).

At second spray

In the present investigation the data recorded at 3 days after second spray the maximum no. of Coccinellids population found in (T₈) control (water spray) (2.82) followed by (T₂) Neem oil 2% (2.16) and (T₁) NSE 5% (2.13) were found at par with each other. Among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.12). The data recorded at 7 days after second spray revealed that the maximum no. of Coccinellids population found in (T₈) control (water spray)(2.83) followed by (T₂) Neem oil 2% (2.19) and (T₁) NSE 5% (2.16) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.13). The data recorded at 10 days after second spray revealed that the maximum no. of Coccinellids population was found in (T₈) control (water spray) (2.83), followed by (T₂) Neem oil 2% (2.21) and (T₁) NSE 5% (2.18) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.14).

At third spray

In the present investigation the data recorded at 3 days after third spray revealed that the maximum no. of Coccinellids population found in (T₈) control (water spray) (2.84) followed by (T₂) Neem oil 2%(2.21) and (T₁) NSE 5% (2.18) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.13). The data recorded at 7 days after third spray result revealed that the maximum no. of Coccinellids population found in (T₈) control (water spray), (2.85), followed by (T₂) Neem oil 2%(2.20) and (T₁) NSE 5% (2.19) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (1.14). The data recorded at 10 days after third spray the result revealed that the maximum no. of Coccinellids population found in (T₈) control (water spray) (2.85) followed by (T₂) Neem oil 2% (2.22) and (T₁) NSE 5% (2.20) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC(1.16)

Effect of different treatments on Spiders /five plant in pigeon pea

At first spray

The data on effect of different treatments on Spider in pigeon pea presented in Table 2 and fig.2 revealed that all the treatments significantly superior. In the present investigation the data recorded at 3 days after first spray, revealed that the

maximum no. of Spider population found in (T₈) control (water spray) (2.46) followed by (T₁) NSE 5% (1.66) and (T₂) Neem oil 2% (1.50) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.46). The data recorded at 7 days after first spray revealed that the maximum no. of Spider population found in (T₈) control (water spray) (2.48) followed by (T₁) NSE 5%(1.69) and (T₂) Neem oil 2% (1.51) among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.49).

The data recorded at 10 days after first spray revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.49) followed by (T₁) NSE 5% (1.69) and (T₂) Neem oil 2% (1.52) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.50).

At second spray

In the present investigation the data recorded at 3 days after second spray revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.49), followed by (T₁) NSE 5% (1.69) and (T₂) Neem oil 2% (1.52) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.50).

The data at 7 days after second spray result revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.49), followed by (T₁) NSE 5% (1.70) and (T₂) Neem oil 2% (1.53) were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.52).

The data recorded at 10 days after second spray on population of natural enemies the result revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.48), followed by (T₁) NSE 5% (1.72) and (T₂) Neem oil 2% (1.51), among all these treatments lowest no. of population found in Indoxacarb 14.5 SC (0.52).

At third spray

In the present investigation the data recorded at 3 days after third spray on population of natural enemies, the result showed that the maximum no. of spider population found in (T₈) control (water spray) (2.49), followed by (T₁) NSE 5%(1.71) and (T₂) Neem oil 2% (1.51), among all these treatments lowest no. of population found in Indoxacarb 14.5 SC (0.54). The data recorded at 7 days after third spray, result revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.50), followed by (T₁) NSE% (1.72) and (T₂) Neem oil 2% (1.52), among all these treatments lowest no. of population found in Indoxacarb 14.5 SC (0.55). The data recorded at 10 days after third spray, result revealed that the maximum no. of spider population found in (T₈) control (water spray) (2.50), followed by (T₁) NSE% (1.72) and (T₂) Neem oil 2% (1.52), among all these treatments lowest no. of population found in Indoxacarb 14.5 SC (0.58)

Effect of different treatments on *Chrysopa* /five plant in pigeon pea

The data on effect of different treatments on *Chrysopa* in pigeon pea presented in Table 3 and fig. 3 revealed that, all the treatments were significantly superior. In the present investigation the data recorded at 3 days after first spray on population of natural enemies revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray)

(1.40), followed by (T₂) Neem oil 2%(1.16) and NSE 5% (1.10) and were found at par with each other, among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.46). The data recorded at 7 days after first spray on population of natural enemies, the result revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray) (1.43), followed by (T₂) Neem oil 2% (1.18) and NSE 5% (1.12) and were found at par with each other, Among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.47). The data recorded at 10 days after first spray revealed that the maximum no. of *Chrysopa* population found (T₈) control (water spray) (1.43), followed by (T₂) Neem oil 2%(1.17) and (T₁) NSE 5% (1.11) and were found at par with each other, among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.47).

At second spray

The data recorded at 3 days after second spray on population of natural enemies the revealed that the maximum no. of population found in (T₈) control (water spray) (1.44), followed by (T₂) Neem oil 2% (1.17) and (T₁) NSE 5% (1.12) and were found at par with each other, among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.50). The data recorded at 7 days after second spray revealed that the maximum no. of population found in (T₈) control (water spray) (1.44), followed by (T₂) Neem oil 2% (1.16) and (T₁) NSE 5% (1.12) and were found at par with each other, Among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.52)

The data recorded at 10 days after second spray revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray) (1.45), followed by (T₂) Neem oil 2%(1.17) and (T₁) NSE 5% (1.13) and were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.55).

At third spray

The data recorded at 3 days after third spray on population of natural enemies revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray) (1.47), followed by (T₂) Neem oil 2%(1.18) and (T₁) NSE 5% (1.12) and were found at par with each other among the insecticidal treatment, lowest no. of population found in Indoxacarb 14.5 SC (0.55)

The data recorded at 7 days after third spray revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray) (1.48), followed by (T₂) Neem oil 2% (1.18)) and NSE 5% (1.14) and were found at par with each other among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.58)

The data recorded at 10 days after third revealed that the maximum no. of *Chrysopa* population found in (T₈) control (water spray) (1.48), followed by (T₂) Neem oil 2% (1.19) and (T₁) NSE 5% (1.14) and were found at par with each other, among the insecticidal treatments lowest no. of population found in Indoxacarb 14.5 SC (0.57).

Cumulative effect of different treatments on natural enemies (Coccinellids, Spider, *Chrysopa*/ five plant) in pigeon pea

The data on cumulative effect of different treatments on natural enemies (Coccinellids, Spider, *Chrysopa*/five plant) in Pigeon pea presented in Table 4 and fig. 4, showed that all the treatments were significantly superior.

At first spray

In the present investigation the data recorded at 3 days after first spray on cumulative mean no. of population of natural enemies/five plant the result showed that the maximum no. of population found in (T₁) NSE 5% (1.62) and (T₂) Neem oil 2% (1.59) and found at par with each other followed by (T₆) Emamectin benzoate 5 SC (1.13), (T₃) Chlorantraniliporil 18.5 SC (1.06), (T₇) Flubendiamide 20 WDG (1.01), (T₄) Spinosad 45 SC (0.82), (T₅) Indoxacarb 14.5 SC (0.67). Among all these treatments highest no. of population found in (T₈) control (water spray) (2.22). The data recorded at 7 days after first spray on cumulative mean the maximum no. of natural enemies' population found in (T₁) NSE 5% (1.64) and (T₂) Neem oil 2% (1.60) and found at par with each other followed by (T₆) Emamectin benzoate 5 SG (1.18), (T₃) Chlorantraniliporil 18.5 SC (1.09), (T₇) Flubendiamide 20 WDG (1.02), (T₄) Spinosad 45 SC (0.84), (T₅) Indoxacarb 14.5 SC (0.69). Among all these treatments highest no. of population found in control (water spray) (2.24). The data recorded 10 days after first spray showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.64) and (T₂) Neem oil 2% (1.61) and found at par with each other followed by (T₆) Emamectin benzoate 5 SG (1.18), (T₃) Chlorantraniliporil 18.5 SC (1.12), Next better treatment (T₇) Flubendiamide 20 WDG (1.03), (T₄) Spinosad 45 SC (0.87), (T₅) Indoxacarb 14.5 SC (0.71). Among all these treatments highest no. of population found in control (water spray) (2.24).

At second spray

The data recorded at 3 days after second spray result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.64) and (T₂) Neem oil 2% (1.61) and found at par with each other followed by (T₆) Emamectin benzoate 5 SC (1.17), (T₃) Chlorantraniliporil 18.5 SC (1.11) Next better treatment (T₇) Flubendiamide 20 WDG (1.04), (T₄) Spinosad 45 SC (0.87), (T₅) Indoxacarb 14.5 SC (0.70). Among all these treatments highest no. of population found in control (water spray) (2.25).

The data recorded after at 7 days after second spray the result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.66) and found at par with (T₂) Neem oil 2% (1.62), followed by (T₆) Emamectin benzoate 5 SG (1.18), (T₃) Chlorantraniliporil 18.5 SC (1.14) Next better treatments (T₇) Flubendiamide 20 WDG (1.04), (T₄) Spinosad 45 SC (0.88), (T₅) Indoxacarb 14.5 SC (0.72). Among all these treatments highest no. of population found in control (water spray) (2.25).

The data recorded after at 10 days after second spray result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.67) and found at par with (T₂) Neem oil 2% (1.63) followed by (T₆) Emamectin benzoate 5 SC (1.20), (T₃) Chlorantraniliporil 18.5 SC (1.14) Next better treatment (T₇) Flubendiamide 20 WDG (1.04), (T₄) Spinosad 45 SC (0.88), (T₅) Indoxacarb 14.5 SC (0.73). Among all these treatments highest no. of population found in control (water spray) (2.25).

At third spray

The data recorded at 3 days after third spray on the result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.67), and found at par with (T₂) Neem oil 2% (1.63) followed by treatment (T₆) Emamectin benzoate 5 SC (1.20), (T₃) Chlorantraniliporil 18.5 SC (1.14) Next better treatment (T₇) Flubendiamide 20 WDG (1.06),

(T₄) Spinosad 45 SC (0.87), (T₅) Indoxacarb 14.5 SC (0.74). Among all these treatments highest no. of population found in control (water spray) (2.26).

The data recorded at 7 days after third spray the result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.68) and found at par with (T₂) Neem oil 2% (1.63), followed by (T₆) Emamectin benzoate 5 SG (1.22), (T₃) Chlorantraniliporil 18.5 SC (1.17), Next better treatment (T₇) Flubendiamide 20 WDG (1.08), (T₄) Spinosad 45 SC (0.89), (T₅) Indoxacarb 14.5 SC (0.75). Among all these treatments highest no. of population found in control (water spray) (2.27).

The data recorded at 10 days after third spray the result showed that the maximum no. of natural enemies population found in (T₁) NSE 5% (1.69) and found at par with (T₂) Neem oil 2% (1.64), followed by (T₆) Emamectin benzoate 5 SG (1.23), (T₃) Chlirantraniliporil 18.5 SC (1.17) Next better treatment (T₇) Flubendiamide 20 WDG (1.10), (T₄) Spinosad 45 SC (0.90), (T₅) Indoxacarb 14.5 SC (0.77). Among all

these treatments highest no. of population found in control (water spray) (2.27).

Ameta *et al.* (2011) carried out an experiment with insecticidal treatments such as Emamectin benzoate 5 SC at 50, 75 and 100 ml/ha along with Indoxacarb 14.5 SC at 500 ml/ha, Spinosad 45 SC and 187.5 ml/ha and reported that there was no adverse effect on the population of natural enemies in pigeon pea.

Jasmine and Kuttalam (2011) found that Emamectin benzoate 5 SG and 1.9 EC to be safer to Coccinellids at all concentrations tested.

Govindan *et al.* (2013) showed that Emamectin benzoate 5 SG was safer to Coccinellids at all the tested concentration the highest population was recorded in plots treated with Emamectin benzoate 5 SG at 11 g a.i. /ha was observed in Rynaxpyr @ 30 g. a.i/ha (0.05 larvae per plant) while Rynaxpyr @ 20 g. a.i /ha and Flubendiamide. Thus the results of these workers are in agreement with the findings of present investigation and gave support to the present data.

Table 1: Effect of different treatments on Coccinellids/five plant in pigeon pea.

Treatment No.	Treatment	Conc. (%)	Dose/l	First spray			Second spray			Third spray		
				3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS
T ₁	NSE	5%	10 gm/l	2.10 (1.44)	2.12 (1.45)	2.12 (1.45)	2.13 (1.45)	2.16 (1.46)	2.18 (1.47)	2.18 (1.47)	2.19 (1.47)	2.20 (1.48)
T ₂	Neem oil	2%	20ml /l	2.11 (1.45)	2.13 (1.45)	2.15 (1.46)	2.16 (1.46)	2.19 (1.47)	2.21 (1.48)	2.21 (1.48)	2.20 (1.48)	2.22 (1.17)
T ₃	Chlorantraniliprol 18.5 SC	0.01	0.25 ml/l	1.60 (1.26)	1.67 (1.19)	1.71 (1.30)	1.71 (1.30)	1.71 (1.30)	1.72 (1.31)	1.73 (1.30)	1.74 (1.31)	1.74 (1.31)
T ₄	Spinosad 45 SC	0.027	0.3 ml/l	1.26 (1.12)	1.29 (1.13)	1.30 (1.14)	1.33 (1.15)	1.33 (1.15)	1.34 (1.15)	1.34 (1.15)	1.36 (1.16)	1.37 (1.17)
T ₅	Indoxacarb14.5 SC	0.015	0.55 ml/l	1.11 (1.05)	1.13 (1.06)	1.13 (1.06)	1.12 (1.05)	1.13 (1.06)	1.14 (1.06)	1.13 (1.06)	1.14 (1.06)	1.16 (1.07)
T ₆	Emamectin benzoate 5 SG	0.002	0.2g/l	1.71 (1.30)	1.74 (1.31)	1.78 (1.33)	1.78 (1.33)	1.78 (1.33)	1.79 (1.33)	1.77 (1.33)	1.79 (1.33)	1.78 (1.33)
T ₇	Flubendiamide 20 WDG	0.02	0.5 g/l	1.56 (1.24)	1.58 (1.25)	1.58 (1.25)	1.57 (1.25)	1.58 (1.25)	1.58 (1.25)	1.59 (1.26)	1.62 (1.27)	1.68 (1.29)
T ₈	Control (water spray)	-	-	2.80 (1.67)	2.82 (1.67)	2.82 (1.67)	2.82 (1.67)	2.83 (1.68)	2.83 (1.68)	2.84 (1.68)	2.85 (1.68)	2.85 (1.68)
F test				Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
S.E (m)±				0.11	0.13	0.10	0.12	0.14	0.11	0.09	0.08	0.08
CD at 5%				0.34	0.39	0.31	0.36	0.43	0.33	0.27	0.26	0.25

(Figures in parentheses are the corresponding square root transformed values), DAS = Days after spraying

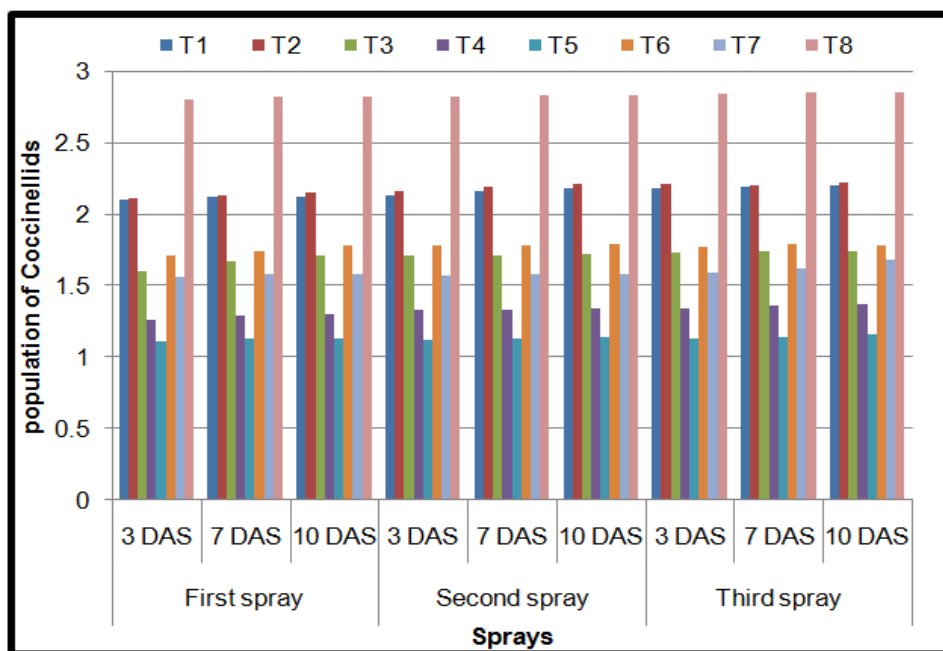


Fig 1: Effect of different treatments on Coccinellids/ five plants in pigeon pea.

- T₁: NSE 5%
- T₂: Neem oil 2%
- T₃: Chlorantraniliprol 18.5 SC
- T₄: Spinosad 45 SC
- T₅: Indoxacarb 14.5 SC
- T₆: Emamectin benzoate 5 SG
- T₇: Flubendiamide 20 WDG
- T₈: Control (water spray)

Table 2: Effect of different treatments on Spiders/ five plant in pigeon pea.

Treatment No.	Treatment	Conc. (%)	Dose/l	First spray			Second spray			Third spray		
				3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS
T ₁	NSE	5%	10 gm/ l	1.66 (1.28)	1.69 (1.30)	1.69 (1.30)	1.69 (1.30)	1.70 (1.30)	1.72 (1.31)	1.71 (1.30)	1.72 (1.31)	1.72 (1.31)
T ₂	Neem oil	2%	20ml /l	1.50 (1.22)	1.51 (1.22)	1.52 (1.23)	1.52 (1.23)	1.53 (1.23)	1.51 (1.22)	1.51 (1.22)	1.52 (1.23)	1.53 (1.23)
T ₃	Chlorantraniliprol 18.5 SC	0.01	0.25 ml/l	0.82 (0.90)	0.84 (0.91)	0.88 (0.93)	0.90 (0.94)	0.92 (0.95)	0.89 (0.94)	0.91 (0.95)	0.92 (0.95)	0.92 (0.95)
T ₄	Spinosad 45 SC	0.027	0.3 ml/l	0.62 (0.78)	0.65 (0.80)	0.70 (0.83)	0.70 (0.83)	0.71 (0.84)	0.69 (0.83)	0.70 (0.83)	0.72 (0.84)	0.73 (0.85)
T ₅	Indoxacarb 14.5 SC	0.015	0.55 ml/l	0.46 (0.67)	0.49 (0.70)	0.50 (0.70)	0.50 (0.70)	0.52 (0.72)	0.52 (0.72)	0.54 (0.73)	0.55 (0.74)	0.58 (0.76)
T ₆	Emamectin benzoate 5 SG	0.002	0.2g/l	0.90 (1.27)	0.92 (0.95)	0.95 (0.97)	0.94 (0.96)	0.96 (0.97)	0.97 (0.98)	0.95 (0.97)	0.97 (0.98)	0.98 (0.98)
T ₇	Flubendiamide 20 WDG	0.02	0.5 g/l	0.80 (0.89)	0.82 (0.90)	0.84 (0.91)	0.84 (0.91)	0.86 (0.92)	0.85 (0.92)	0.88 (0.93)	0.89 (0.94)	0.90 (0.94)
T ₈	Control (water spray)	-	-	2.46 (1.56)	2.48 (1.57)	2.49 (1.57)	2.49 (1.57)	2.49 (1.57)	2.48 (1.57)	2.49 (1.57)	2.50 (1.58)	2.50 (1.58)
F test				Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E (m) _±				0.07	0.025	0.07	0.06	0.056	0.04	0.044	0.046	0.054
CD at 5%				0.23	0.076	0.22	0.19	0.17	0.14	0.127	0.141	0.164

(Figures in parentheses are the corresponding square root transformed values), DAS = Days after spraying

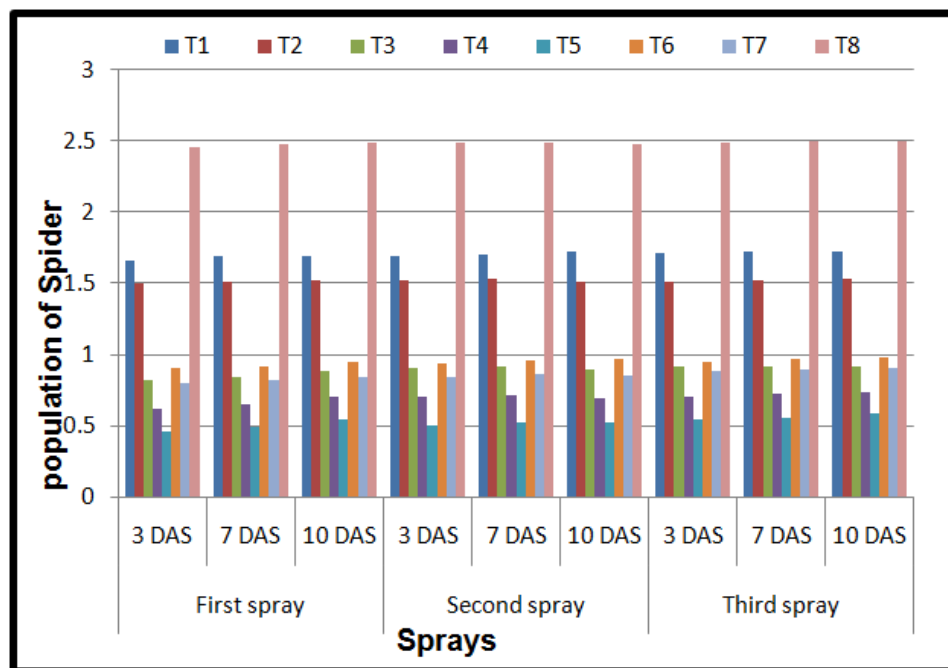


Fig 2: Effect of different treatments on Spiders/ five plants in Pigeon pea

Table 3: Effect of different treatments on *Chrysopa*/ five plant in pigeon pea.

Treatment No.	Treatment	Conc. (%)	Dose/l	First spray			Second spray			Third spray		
				3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS
T ₁	NSE	5%	10 gm/ l	1.10 (1.04)	1.12 (1.05)	1.11 (1.05)	1.12 (1.05)	1.12 (1.05)	1.13 (1.06)	1.12 (1.05)	1.14 (1.06)	1.15 (1.07)
T ₂	Neem oil	2%	20ml /l	1.16 (1.07)	1.18 (1.08)	1.17 (1.08)	1.17 (1.08)	1.16 (1.07)	1.17 (1.08)	1.18 (1.08)	1.18 (1.08)	1.19 (1.09)
T ₃	Chlorantraniliprol 18.5 SC	0.01	0.25 ml/l	0.76 (0.87)	0.78 (0.88)	0.79 (0.88)	0.80 (0.89)	0.82 (0.90)	0.83 (0.91)	0.84 (0.91)	0.87 (0.93)	0.86 (0.92)

T ₄	Spinosad 45 SC	0.027	0.3 ml/l	0.60 (0.77)	0.61 (0.78)	0.62 (0.78)	0.61 (0.78)	0.62 (0.78)	0.63 (0.79)	0.63 (0.79)	0.64 (0.80)	0.64 (0.80)
T ₅	Indoxacarb14.5 SC	0.015	0.55 ml/l	0.46 (0.67)	0.47 (0.68)	0.47 (0.68)	0.50 (0.70)	0.52 (0.72)	0.55 (0.74)	0.55 (0.74)	0.58 (0.76)	0.57 (0.75)
T ₆	Emmamectin benzoate 5 SG	0.002	0.2g/l	0.80 (0.89)	0.81 (0.90)	0.82 (0.90)	0.86 (0.92)	0.87 (0.93)	0.89 (0.94)	0.91 (0.95)	0.92 (0.95)	0.93 (0.96)
T ₇	Flubendiamide 20 WDG	0.02	0.5 g/l	0.66 (0.81)	0.67 (0.82)	0.69 (0.83)	0.66 (0.81)	0.68 (0.82)	0.69 (0.83)	0.72 (0.84)	0.74 (0.86)	0.74 (0.86)
T ₈	Control (water spray)	-	-	1.40 (1.18)	1.43 (1.19)	1.43 (1.29)	1.44 (1.20)	1.44 (1.20)	1.45 (1.120)	1.47 (1.21)	1.48 (1.21)	1.48 (1.21)
F test				Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E (m) _±				0.057	0.063	0.062	0.074	0.065	0.058	0.056	0.048	0.048
CD at 5%				0.174	0.191	0.187	0.225	0.198	0.176	0.171	0.145	0.147

(Figures In parentheses are the corresponding square root transformed values), DAS = Days after spraying

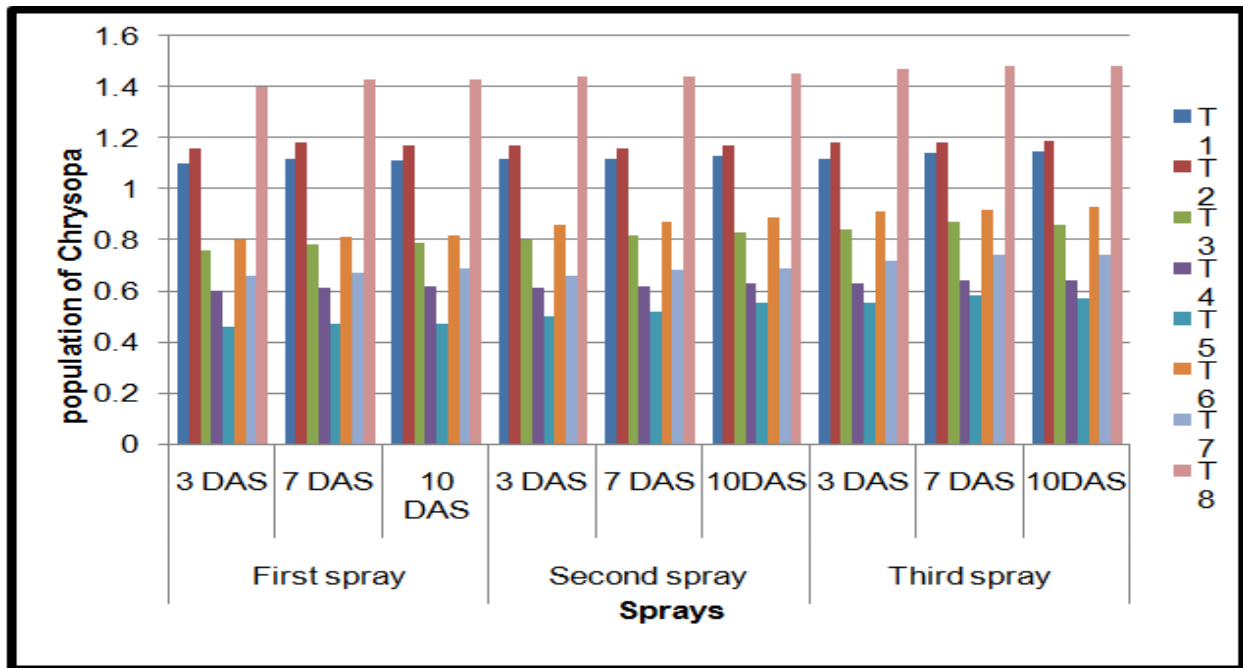


Fig 3: Effect of different treatments on *Chrysopa*/ five plants in pigeon pea

Table 4: Cumulative effect of different treatments on natural enemies (Coccinellids, Spiders and *Chrysopa*/five plants) in pigeon pea

Treatment No.	Treatment	Conc. (%)	Dose/l	First spray			Second spray			Third spray		
				3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS
T ₁	NSE	5%	10 gm/ l	1.62 (1.27)	1.64 (1.28)	1.64 (1.28)	1.64 (1.28)	1.66 (1.28)	1.67 (1.29)	1.67 (1.29)	1.68 (1.29)	1.69 (1.30)
T ₂	Neem oil	2%	20ml /l	1.59 (1.26)	1.60 (1.26)	1.61 (1.26)	1.61 (1.26)	1.62 (1.27)	1.63 (1.27)	1.63 (1.27)	1.63 (1.27)	1.64 (1.28)
T ₃	Chlorantraniliprol 18.5 sc	0.01	0.25 ml/l	1.06 (1.02)	1.09 (1.04)	1.12 (1.05)	1.12 (1.05)	1.14 (1.06)	1.14 (1.06)	1.14 (1.06)	1.17 (1.08)	1.17 (1.08)
T ₄	Spinosad 45 SC	0.027	0.3 ml/l	0.82 (0.90)	0.84 (0.91)	0.87 (0.95)	0.87 (0.93)	0.88 (0.93)	0.88 (0.93)	0.87 (0.93)	0.89 (0.94)	0.90 (0.94)
T ₅	Indoxacarb14.5 SC	0.015	0.55 ml/l	0.67 (0.81)	0.69 (0.83)	0.71 (0.84)	0.70 (0.83)	0.72 (0.84)	0.73 (0.85)	0.74 (0.86)	0.75 (0.86)	0.77 (0.87)
T ₆	Emmamectin benzoate 5 SG	0.002	0.2g/l	1.13 (1.06)	1.18 (1.08)	1.18 (1.08)	1.17 (1.08)	1.18 (1.08)	1.20 (1.10)	1.20 (1.10)	1.22 (1.10)	1.23 (1.10)
T ₇	Flubendiamide 20 WDG	0.02	0.5 g/l	1.01 (1.00)	1.02 (1.00)	1.03 (1.01)	1.04 (1.01)	1.04 (1.01)	1.04 (1.03)	1.06 (1.02)	1.08 (1.03)	1.10 (1.04)
T ₈	Control (water spray)	-	-	2.22 (1.48)	2.24 (1.49)	2.24 (1.49)	2.25 (1.50)	2.25 (1.50)	2.25 (1.50)	2.26 (1.50)	2.27 (1.51)	2.27 (1.51)
F test				Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E (m) _±				0.083	0.071	0.071	0.082	0.064	0.076	0.074	0.065	0.068
CD at 5%				0.25	0.216	0.216	0.250	0.194	0.229	0.23	0.196	0.207

(Figures in parentheses are the corresponding square root transformed values), DAS = Days after spraying)

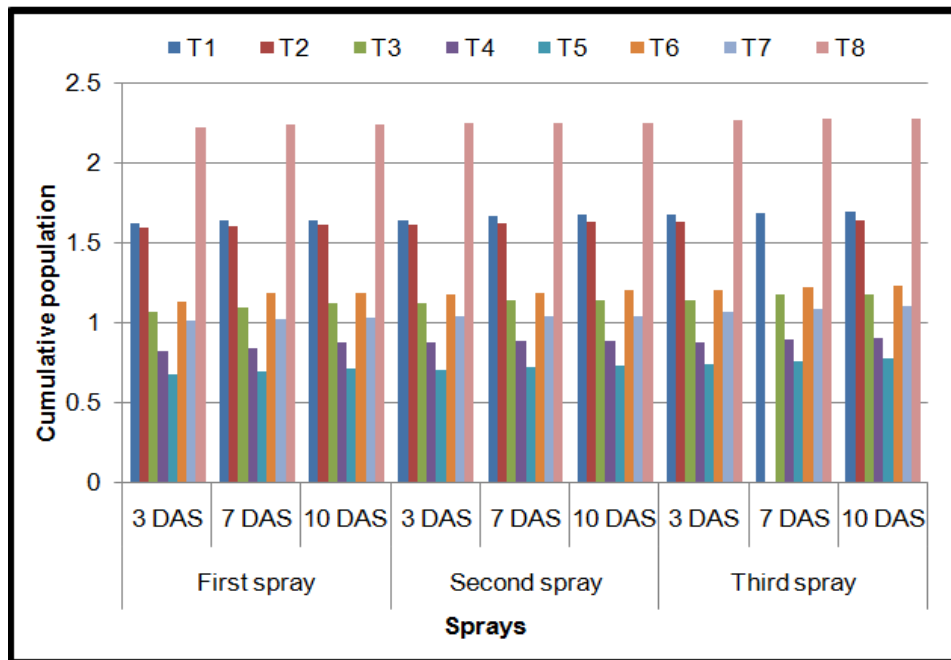


Fig 4: Cumulative effect of different treatments on natural enemies (Coccinellids, Spider, *Chrysopa*/ five plants) on pigeon pea.

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