



## Evaluation and dosage standardization of novel molecule, Cyenopyrafen 30% SC against yellow mite (*Polyphagotarsonemus latus*) in chilli (*Capsicum annuum*)

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### ABSTRACT

Field trials were carried out at the Institute of Pesticide Formulation Technology, Gurgaon, Haryana, India during kharif 2013 and 2014 to evaluate the field efficacy and to fix the correct dose of novel molecule cyenopyrafen 30% SC for the management of the yellow mite [*Polyphagotarsonemus latus* (Banks)] infesting chilli (*Capsicum annuum* L.). The chemical cyenopyrafen 30% SC was evaluated @ 150, 200, 250 and 300 ml/ha along with fenpyroximate 5% EC and propargite 57% EC @ 600 and 1500 ml/ha, respectively. The results revealed that at 14 days after spraying (DAS), the chemical treatments, cyenopyrafen 30% SC @ 200ml/ha and fenpyroximate 5% EC emerged significantly the best with record of 1.56 to 2.18 mites/leaf and registering 84.36 to 89.15% reduction over untreated control (13.46 mites/ leaf) at 10 DAS. Other doses of cyenopyrafen 30% SC @ 200 and 250 ml/ha were on par with the higher dose @ 300 ml/ha and fenpyroximate 5%EC @ 600 ml/ha. Significantly highest marketable fruit yield was recorded in the higher doses of cyenopyrafen 30% SC treatments, i.e. @ 200, 250 and 300 ml/ha (26.05 to 27.95 tonnes/ha) with 34.08 to 38.56 per cent increase in fruit yield over untreated control (17.17 tonnes/ha) closely followed by propargite 57% EC @1500 ml/ha (22.07 tonnes/ha).

**Key words:** Cyenopyrafen yellow mite, *Capsicum annuum*, Efficacy, Novel molecule, *Polyphagotarsonemus latus*

Chilli (*Capsicum annuum* L.) is an important and widely cultivated crop throughout the year in all parts of India and also in many other countries for its use as vegetable and spice in every households. The yellow mite [*Polyphagotarsonemus latus* (Banks)] is a serious pest of chilli crop and known as a phytophagous pest. It has been recorded in more than 250 hosts of agricultural and horticulturally important crops (Rai *et al.* 2007). This destructive pest causes malformation of terminal leaves and flower buds. The toxic saliva of the mite causes twisted, hardened and distorted growth in the terminal region of the plant. Leaves turn downward and turn coppery or purplish. Internodes shorten and lateral buds break more than normal. The blooms abort and plant growth is stunted when large populations are present (Denmark 1980). In India, this mite was recorded first time by Mann *et al.* (1920) and Kulkarni (1922) described the tambera disease of potato and murda disease in chilli.

Infested leaves become bronzed with down-curling margins, buds are aborted and flowers distorted, shoots grow twisted and fruit may be deformed and rosette. Heavy population of mites built profuse curling of leaves (Jeppson *et al.* 1975 and Goldsmith and James 2002). The regular

monoculture of chilli without crop rotation has also aggravated the problem. The chilli yellow mite directly affects the leaves and fruits resulting in loss of its market value and yield. At present, the situation is alarming and economic harvest is not possible without the use of pesticides. Farmers mostly depend on synthetic acaricides for managing mite pests because of instant knockdown effect often leading to problems like pesticide resistance (Jeyarani *et al.* 2010), pest resurgence, environmental pollution and destruction of natural enemies of the pest etc. (Vinoth kumar *et al.* 2009). With the aim of finding out an alternative chemical with novel mode of action with satisfactory control of the target pest, the present field investigation was undertaken.

### MATERIALS AND METHODS

The present investigation was carried out at Research Farm, Institute of Pesticide Formulation Technology, Gurgaon, Haryana, during two seasons July to November, 2013 and February to June, 2014. The experiment was designed in randomized complete block design with seven treatments including control replicated three times. The plot size was 4 m × 3 m with row to row and plant to plant spacing was maintained at 60 and 45 cm apart respectively. The insecticide treatments includes cyenopyrafen 30% SC

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Table 1 Efficacy of different chemical treatments on population of yellow mite at Gurgaon (Pooled 2013 and 2014)

| Treatment           | Dose<br>(ml/ha) | No. of yellow mites/leaf in chilli |                             |                              |                              |                              |                              | % reduction<br>over control |
|---------------------|-----------------|------------------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------|
|                     |                 | 1 DBS                              | 1 DAS                       | 3 DAS                        | 7 DAS                        | 10 DAS                       | 14 DAS                       |                             |
| Cyenoxyrafen 30% SC | 150             | 5.30<br>(2.27)                     | 4.43<br>(2.07) <sup>b</sup> | 3.51<br>(1.86) <sup>b</sup>  | 3.03<br>(1.73) <sup>b</sup>  | 2.76<br>(1.66) <sup>b</sup>  | 3.04<br>(1.73) <sup>b</sup>  | 79.77                       |
| Cyenoxyrafen 30% SC | 200             | 4.66<br>(2.10)                     | 3.10<br>(1.74) <sup>a</sup> | 2.60<br>(1.60) <sup>a</sup>  | 2.11<br>(1.45) <sup>a</sup>  | 1.98<br>(1.40) <sup>a</sup>  | 2.11<br>(1.43) <sup>a</sup>  | 85.96                       |
| Cyenoxyrafen 30% SC | 250             | 4.80<br>(2.12)                     | 2.86<br>(1.67) <sup>a</sup> | 2.48<br>(1.55) <sup>a</sup>  | 1.79<br>(1.33) <sup>a</sup>  | 1.65<br>(1.27) <sup>a</sup>  | 1.88<br>(1.34) <sup>a</sup>  | 87.49                       |
| Cyenoxyrafen 30% SC | 300             | 5.11<br>(2.16)                     | 2.56<br>(1.59) <sup>a</sup> | 1.84<br>(1.35) <sup>a</sup>  | 1.60<br>(1.25) <sup>a</sup>  | 1.56<br>(1.23) <sup>a</sup>  | 1.63<br>(1.24) <sup>a</sup>  | 89.15                       |
| Fenpyroximate 5% EC | 600             | 5.45<br>(2.27)                     | 3.19<br>(1.77) <sup>a</sup> | 2.66<br>(1.62) <sup>a</sup>  | 2.36<br>(1.53) <sup>a</sup>  | 2.18<br>(1.46) <sup>a</sup>  | 2.35<br>(1.51) <sup>a</sup>  | 84.36                       |
| Propargite 57% EC   | 1500            | 6.88<br>(2.61)                     | 6.23<br>(2.48) <sup>c</sup> | 5.68<br>(2.37) <sup>d</sup>  | 5.15<br>(2.14) <sup>d</sup>  | 5.30<br>(2.29) <sup>d</sup>  | 5.38<br>(2.31) <sup>d</sup>  | 64.20                       |
| Untreated control   |                 | 7.45<br>(2.82)                     | 10.6<br>(3.23) <sup>d</sup> | 12.36<br>(3.51) <sup>e</sup> | 13.45<br>(3.65) <sup>e</sup> | 13.46<br>(3.65) <sup>e</sup> | 15.03<br>(3.87) <sup>e</sup> |                             |
| SEm ±               |                 | 0.24                               | 0.06                        | 0.08                         | 0.09                         | 0.07                         | 0.06                         |                             |
| CD (P=0.05)         |                 | NS                                 | 0.19                        | 0.26                         | 0.30                         | 0.24                         | 0.20                         |                             |

DBS, Days before spraying. Figures in parentheses are X +0.5 square root transformed values. Means followed by a common letter in a column are not significantly different from each other

@ 150, 200, 250 and 300 ml/ha, fenpyroximate 5% EC @ 600 ml/ha, propargite 57% EC @ 1500 ml/ha and untreated control. Once the incidence of mites were noticed on the crop the chemical treatments were applied through foliar spraying with high volume knapsack sprayer fitted with hollow cone nozzle using 500 l of water spray fluid per hectare. Altogether three applications were made at two weeks intervals.

The observations were recorded from randomly selected five tagged plants per plot at one day before each spraying (DBS) and at 01, 03, 07, 10 and 14 days after spraying (DAS). Two leaves were taken from upper, middle and lower portion, i.e. 6 leaves were collected from each plant and 30 leaves from each plot for taking observations. The mite population was counted on the basis of per leaf area. The leaf samples were collected and observed under stereo binocular microscope in the laboratory for different stages (nymphs and adults) of phytophagous mites. Treatment wise marketable fruit yield was recorded at each economic harvest. The data were subjected to transformation wherever necessary before statistical analysis following Gomez and Gomez (1984) and subjected to analysis of variance (ANOVA).

## RESULTS AND DISCUSSION

The pooled mean data (Table 1) on population of yellow mite did not vary at one day before spraying (DBS) (4.66 to 7.45 mites/leaf) indicating uniform distribution of the pest throughout the experimental plot. All the chemicals evaluated in the field proved their superiority in significantly suppressing the mite population compared to untreated control up to 14 DAS. A day after spraying lowest mite population 2.56/leaf was recorded in chemical treatment cyenoxyrafen 30% SC @ 300 ml/ha and it was on par with

its lower doses (250 and 200 ml/ha) which recorded a mean population of 2.86 and 3.10 mites per leaf respectively and standard check fenpyroximate 5% EC @ 600 ml/ha (3.19 mites/leaf) respectively. The result indicates that the pesticidal management of yellow mite *P. latus* on chilli, clearly revealed that the maximum per cent reduction was registered when treated with cyenoxyrafen 30% SC @ 250 and 300 ml/ha (87.49 and 89.15% respectively). The decrease in yellow mite population is statistically significant at 5% probability level in comparison to control. Among chemical treatments maximum mean mite population of 6.23/leaf was reported in propargite 57% EC @ 1500 ml/ha and it was statistically inferior over all the chemical treatments after one day of spraying (DAS). Singh and Singh (2013) also reported that cyenoxyrafen was effective against *P. latus* on chilli crop. Untreated control recorded 10.60 mites per leaf one day after spray (DAS). Similar trend was noticed on 3, 7, 10 and 14 days after treatment. However, pooled mean population successively decreased up to 10 days in almost all the chemical treatments except in control. On 14 days after spray, the effectiveness of treatments started to decline and higher population was recorded 10 days after spray. In the present study, cyenoxyrafen 30% SC @ 250 and 300 ml/ha and fenpyroximate 5% EC have been found to be almost equally effective against yellow mite. Biswas *et al.* (2009) reported the fenpyroximate 5% EC gave the satisfactory control against this mite. This was supported by many workers (Rai *et al.* 1993, Kumar *et al.* 2005, Somchoudhary *et al.* 2008 and Mishra 2014).

The marketable fruit yield of chilli (cv Phule Jyoti) recorded significantly higher in all the chemical treated plots (22.34 to 28.05 tonnes/ha) compared to untreated control (17.24 tonnes/ha) during *kharif* 2013 (Table 2). Similar trend of results were also observed during 2014

Table 2 Marketable fruit yield of chilli at IPFT Gurgaon (Haryana)

| Treatment           | Dose<br>(ml/ha) | Marketable chilli fruit yield (Tonnes/ha) |                                     |                    |                                     |                       |                                     |
|---------------------|-----------------|---|-------------------------------------|--------------------|-------------------------------------|-----------------------|-------------------------------------|
|                     |                 | 2013                                      | % Increase in<br>yield over control | 2014               | % Increase in<br>yield over control | Pooled fruit<br>yield | Increase in yield<br>% over control |
| Cyenopyrafen 30% SC | 150             | 24.76 <sup>b</sup>                        | 30.37                               | 24.43 <sup>b</sup> | 30.00                               | 24.59 <sup>b</sup>    | 30.17                               |
| Cyenopyrafen 30% SC | 200             | 26.19 <sup>a</sup>                        | 34.17                               | 25.92 <sup>a</sup> | 34.02                               | 26.05 <sup>a</sup>    | 34.08                               |
| Cyenopyrafen 30% SC | 250             | 27.43 <sup>a</sup>                        | 37.14                               | 26.39 <sup>a</sup> | 35.20                               | 26.91 <sup>a</sup>    | 36.19                               |
| Cyenopyrafen 30% SC | 300             | 28.05 <sup>a</sup>                        | 38.53                               | 27.85 <sup>a</sup> | 38.59                               | 27.95 <sup>a</sup>    | 38.56                               |
| Fenpyroximate 5% EC | 600             | 24.16 <sup>b</sup>                        | 28.64                               | 23.62 <sup>b</sup> | 27.60                               | 23.89 <sup>b</sup>    | 28.12                               |
| Propargite 57% EC   | 1500            | 22.34 <sup>c</sup>                        | 22.82                               | 21.80 <sup>b</sup> | 21.55                               | 22.07 <sup>c</sup>    | 22.20                               |
| Untreated control   |                 | 17.24 <sup>d</sup>                        |                                     | 17.10 <sup>c</sup> |                                     | 17.17 <sup>d</sup>    |                                     |
| SEm ±               |                 | 0.68                                      |                                     | 1.06               |                                     | 0.87                  |                                     |
| CD (P=0.05)         |                 | 2.12                                      |                                     | 3.18               |                                     | 2.65                  |                                     |

Means followed by a common letter in a column are not significantly different from each other

registering fruit yield of 21.80 to 27.85 tonnes /ha in chemical treatments compared to untreated control (17.10 tonnes/ha). The pooled mean of marketable fruit yield of chilli followed the same trend as *khariif* 2013 and 2014, in which highest marketable fruit yield were observed in the treatments cyenopyrafen 30% SC @ 250 and 300 ml/ha (26.91 to 27.95 tonnes/ha) with 36.19 to 38.56 per cent increase in yield over untreated control (22.20 tonnes/ha) followed by cyenopyrafen 30% SC @ 150 and 200 ml/ha (26.05-24.59 tonnes/ha) with 30.17- 34.08 per cent increase in yield over untreated control, fenpyroximate 5% EC @ 600 ml/ha (23.89 tonnes /ha) with (28.12% YOC) and propargite 57% EC @ 1500 ml/ha (22.07 tonnes/ha) with (22.20 % YOC). In all other chemical treatments the fruit yield ranged from 22.07 to 23.89 tonnes/ha reported 22.20 to 28.12 per cent increase in yield over untreated control. Significantly highest fruit yield of chilli with cyenopyrafen 30% SC @ 200 ml/ha and above may be attributed due to both insecticidal and acaricidal action of the chemical compared to only acaricidal effect of cyenopyrafen.

It may be concluded from the present study that the efficacy of both cyenopyrafen 30% SC @ 200 ml/ha and above dosage were statistically similar to fenpyroximate 5% EC @ 600 ml/ha in suppressing yellow mite population. But, cyenopyrafen 30% SC @ 200ml/ha may be recommended as an alternative to fenpyroximate and other conventional acaricides.

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