Determination of the effective spray- interval of *Bacillus thuringiensis* against diamond-back moth (*Plutella xylostella*) on chinese cabbage

Han, E. J.[1], Park J. H.[1],Hong, S. J.[1], Ahn N. H.[1], Jee, H. J.[1], Kim, Y. K.[1]

Key words: *Bacillus thuringiensis*, *Plutella xylostella*, Chinese cabbage, pest control

Abstract

In organic Chinese cabbage fields, Commercial Bacillus thuringiensis products are used widely against diamond back moth, Plutella xylostella. We conducted the study to determine the effective spray-interval of commercialized B. thuringiensis against diamond back moth on Chinese cabbages. Chinese cabbage leaves were collected 0, 1, 2, 3, 6, 10days after treatment in first trial and 0, 2, 4, 7, 9, 11days after treatment. We compared the insecticidal property of sprayed B. thuringiensis and the density of it on surface of Chinese cabbages using collected leaves. The insecticidal property maintained high until nine days after commercial B. thuringiensis products sprayed.

Introduction

Plutella xylostella, Diamond back moth is major insect pest of cruciferous crops including Chinese cabbage (Talekar & Shelton 1993). Because it has short lifecycle and high fecundity (Kim & Lee 1991), when *P. xyllostella* flies into cabbage field, the density of *P. xyllostella* increases very rapidly.

However, *P. xylostella* is difficult to control effectively. *P. xylostella* can also live on weeds such as shepherd's purse, *Casella nurse-pastoris* (Talekar & Shelton 1993), distributed around Chinese cabbage fields. The population of *P. xylostella* moves into cabbage fields continuously in the early spring season.

To date, Commercial *B. thuringiensis* have been frequently used in organic agriculture (Seo *et al.* 2009). However, commercial Bt products are used practically without information about effective duration of Bt product.

We studied to determine effective spray intervals of *B. thuringiensis* against diamond back moth on Chinese cabbage

Materials and methods

Experimental insects and plants

The susceptible strain of *P. xylostella* was provided by applied entomology division of National Academy of Agricultural Science (NAAS) and reared on leaflets of Chinese cabbage in for five years.

Chinese cabbage seeds were sown separately in pots filled with horticultural bed soil (Baroker, Seoul Bio co. Ltd, Korea). When two foliage leaves were expended, host

[1] Organic Agriculture Division, National Academy of Agricultural Science, Rural Development Administration, 249, Seodundong, Gwonseongu, Suwon, 441-707, Republic of Korea E-Mail hejs2@korea.kr Internet http://www.naas.go.kr/

plants were individually transplanted to plastic pots (20cm diameter, 15cm height). After 2 weeks transplanted Chinese cabbages were used for experiments.

Treatment

The experiment was conducted in glasshouse in division of organic agriculture, NAAS. It had three treatments. The treatments were two kinds of commercial *B. thuringiensis* products (suspension concentrate and wettable power formulation of *B. thuringiensis* subsp. *aizawai* NT 0423, Dongbu Co., Korea) and distilled water as a control.

Both commercial *B. thuringiensis* products were diluted in distilled water according to the instructions provided by the company.

Bacterial suspensions of *B. thuringiensis* products were sprayed on Chinese cabbages planted on pots. The leaves of Chinese cabbage were collected 0, 1, 2, 3, 6, 10 days after bacterial suspension sprayed in the first trial and collected 0, 2, 4, 7, 9, 11 days after sprayed in the second trial.

The glasshouse where experiment was conducted maintained at 25 ℃

Bioassay

Collected leaves were cut into circular discs (3cm diameter size). A circular leaf disc was put in the petri-dish with filter paper and ten larvae of diamond back moth per a petri-dish were introduced. The mortality was observed after three days. Each treatment had five replications. The mortality was corrected by Abbott's formulation (1925).

$$\text{Corrected percent mortality} = \frac{\%\ \text{Observed mortality} - \%\ \text{Control Mortality}}{100\ -\ \%\ \text{Control Mortality}}$$

Spreading

Collected leaf was cut into ten circular discs (1cm diameter size) with a cork bore. Ten leaf-discs were put in the 20ml tube with distilled water, which shook for thirty minutes. Diluted solutions were spread on TSA and then, they were placed in growth chamber which maintained at 28℃. The number of colony of *B. thuringiensis* was counted 24 hours later.

Results

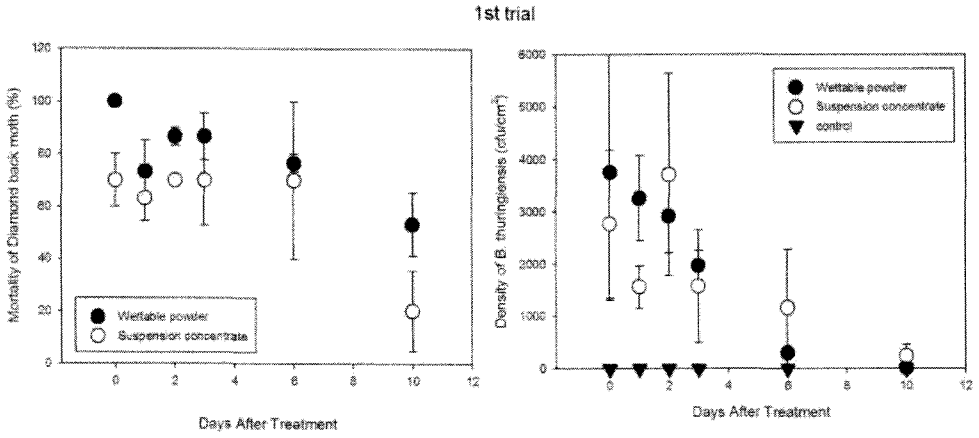

Figure 1: Duration of efficacy of *B. thuringiensis* in first trial (left: mortality of diamond back moth (%), right: density of *B. thuringiensis* (cfu /㎠) on surface of Chinese cabbage after treatment

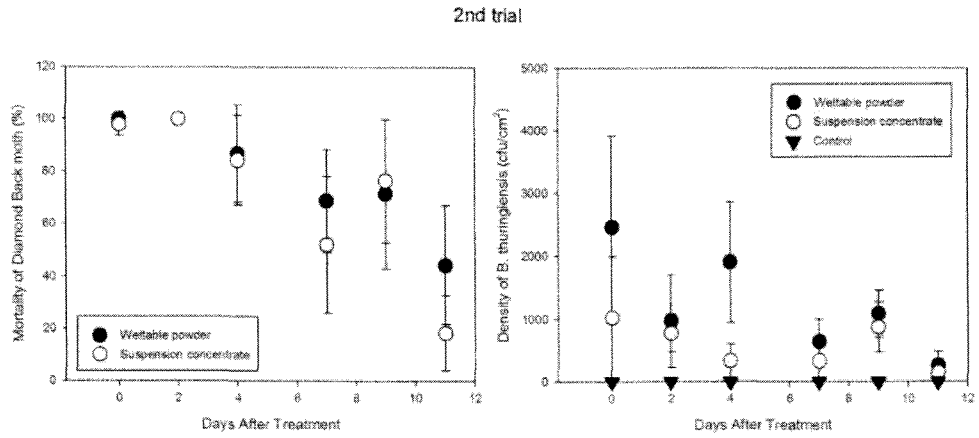

Figure 2: Duration of efficacy of *B. thuringiensis* in second trial (left: mortality of diamond back moth (%), right: density of *B. thuringiensis* (cfu /㎠) on surface of Chinese cabbage after treatment

In both trials of experiment, mortality of *P. xylostella* were 100%, except suspension concentrate treatment in first trial. As time goes by, the efficacies slowly decreased until 9 days after spraying *B. thuringiensis*. However, the day after, the mortality of diamond back moth decreased sharply.

The densities of *B. thuringiensis* on the surface of Chinese cabbage were decreased according to the passage of time.

The comparison between two types of formulation showed that the efficacy of suspension concentrate formulation was decrease rapidly.

Discussion

The result of current study shows that the insecticidal activity of *B. thuringiensis* lasts for nine days. It may be concluded from the result that spray-interval of *B. thuringiensis* should be set as nine days to effectively *P. xylostella*.

However, Behle et al. (1997) suggested that rain causes on reduction in insecticidal activity of *B. thuringiensis* and sunlight degradation of *B. thuringiensis* affects on the insecticidal activity.

For accurate determination of spray-interval of *B. thuringiensis*, the effect of rain and sunlight should be considered.

References

Journal articles:

Talekar N. S. and Shelton A.M. (1993): Biology, Ecology, and Management of the Diamond back moth. Annu. Rev. Entomol. 38:275-301.

Kim M. H. and Lee S. C. (1993): Bionomics of Diamond-back moth, Plutella xylostella (Lepidoptera: Plutellidae) in Southern Region of Korea. Korean J. Entomol. 30: 169-173.

Seo, Y. H., Cho, B. G., Choi, J. K., Kang, A. S., and Jeong, B. C. (2006): Control of Diseases and Insects for Pesticide-free Cultivation of Leafy Vegetables. Korean J. Organic Agric. 17: 253-264

Abbott, W.S. (1925): A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265-267

Behle, R.W., Mcquire,M.R., Shasha,B.S. (1997): Effects of sunlight and simulated rain on residual activity of Bacillus thuringiensis formulations. J. Econ. Entomol. 90: 1560-1566