International Journal of Agricultural Technology 2017 Vol. 13(7.1): 1269-1275
Available online http://www.ijat-aatsea.com
ISSN 1686-9141

Application of Plant Essential Oil Formulas to Control Insect Pests of Rice in Field Condition

Ammorn Insung[1*] Jarongsak Pumnuan[1] and Patima Usungnoen[2]

[1] Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand.; [2] Suwanvajokkasikit Animal R&D Institute, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom 73140, Thailand..

Ammorn Insung, Jarongsak Pumnuan and Patima Usungnoen (2017). Application of Plant Essential Oil Formulas to Control Insect Pests of Rice in Field Condition. International Journal of Agricultural Technology 13(7.1): 1269-1275.

Brown plant hopper (BPH), *Nilaparvata lugens* (Stål) is an economically important insect pest of rice in Thailand and other Asian countries. Definitely, chemical insecticides are mostly applied by farmers and bring to induce insect resistance, harmful to human and environment particularly to the natural enemy insects. The objectives of this study were to evaluate the use of plant essential oil formulas incorporated with petroieum oil to control BPH and other insect pests as well as the effect to natural enemies in field condition. The I2C2 and I1C3 EO formulas at 1.0% were applied in the field experiments. The numbers of BPH, other rice insect pests and natural enemy numbers were observed before and after treatments, then, compared with insecticide and control. The result found that in general, I2C2 and I1C3 EO formulas and insecticide showed high effectiveness against BPH with no significant difference. Numbers of other insect pests as *Nephotettix virescens* and *Recilia dorsalis* also greatly reduced. The natural enemies such as *Micraspis discolor*, *Argyrophylax nigrotibialis*, *Tytthus chinensis*, *Cyrtorhinus lividipennis*, *Paederus fuscipes*, *Ophionea ishii* and spiders (*Lycosa pseudoannulata*, *Oxyopes linestipes* and *Argiope* sp.) were found. The *P. fuscipes*, *O. ishii* and spiders tended to increase after treatment in all experiments with no significant difference when compared to the control. Besides, *A. nigrotibialis*, *T. chinensis* and *C. lividipennis* tended to reduce after treatment in all experiments with no significant difference when compared to the control.

Keywords: insect pests, natural enemies, insecticidal, petroleum oil

Introduction

Rice field areas of Thailand are normally attacked by brown planthopper (BPH), *Nilaparvata lugens* (Stål) (Delphacidae). They damage rice directly through feeding and also transmitting virus disease (Rice Department, 2010).

[*] **Coressponding Author**: Ammorn Insung; **E-mail address**: kiammorn@gmail.com

Chemical insecticides are still widely used among rice farmers those definitely, cause directly toxic effect to both grower and consumer and to non-target insects as well as to the environment. Many insect management methods are developed to replace the chemical use. Petrolieum oil is being developed in order to control various insect pests such as citrus psyllid (Shrichantra *et al.*, 2009), oriental fruit fly, a pest of pepper (Siripoltangmun, 2009), mealybug damaging on cassava (Pumnuan *et al.*, 2012) and BPH, the most important pest of rice (Insung *et al.*, 2012).

Botanical insecticide is an alternative control strategy to be applied for various insect pests, particularly, BPH. Essential oil from star anise (*Illicium verum* Hook.f) and lemon grass (*Cymbopogon citratus* (Dc.ex.Nees)) incorporated with petroleum oil were reported as high insecticidsl effect to BPH at both laboratory and insectary conditions (Chantawee *et al*., 2012; Insung *et al*., 2014).

There for, the objectives of this study were to evaluation the insecticidal property of those essential oil formulas mixed petroleun oil against BPH in field condition as well as their effect to other rice insect pests and with the natural enemies.

Materials and methods

Essential oil formula preparation

From the preliminary study revealed that star anise (Illicium verum Hook.f.) and lemon grass (*Cymbopogon citratus* (Dc.ex.Nees)) with the 2:2 and 1:3 ratios at 1% concentration incorporated with petroleum oil (0.5%) (referred as I2C2 and I1C3, respectively) were highly toxic against BPH in laboratory and insectary conditions. Both essential oils were obtained by using water distillation method for 3-6 hrs. Then essential oil formulas were prepared as above mentioned.

Control of BPH by essential oil formulas in field condition

The experiment of 3 treatments, I2C2, I1C3 and imidacloprid insecticide (at recommendation rate) were applied to rice plots during seedling stage. The applications were repeated 7 days after the first time and compared with the control (water). Numbers of BPH and other insect pests or natural enemies were observed by random sampling and sweep net method (20 times), respectively,

before and after treatment. The experiment was 4 replications and the number of BPH at the beginning was calculated to be 100%.

Results and Discussion

Both essential oil formulas, I2C2 and I1C3 and imidacloprid insecticide could reduce the BPH number less than 5% with thin 2 days after treatment with no significant difference, whereas control showed BPH number more than 30% comparing from the beginning (Figure 1). BPH number of control tended to decrease might be due to the toxic and repellent effects of plant essential oil treated nearby. And this was the main reason that why the BPH or other insect numbers decreased. The repellent property of plant essential oil against insect is not only according to species of plant but also the concentration or volatile ability of essential oil and contact period of the insect (Nerio *et al.*, 2010; Yang and Ma, 2005). Beside, high repellent activity appeared at the beginning time and then rapidly decreased (Barnard, 2000; Thongtokit *et al.*, 2005; Zhu *et al.*, 2001).

Other important insect pests found were green leafhopper (*Nephotettix virescens* (Distant)) and zigzag leafhopper (*Recilia dorsalis* (Motsuchulsky)) with high number at the beginning and then a lot of decrease was appeared after treatment, remarkably in I2C2 and imidacloprid insecticide (Figure 2). Many natural enemy insects such as *Micraspis discolor* (Fabricius), *Argyrophylax nigrotibialis* Baranov, *Tytthus chinensis* (Stål), *Cyrtorhinus lividipennis* Reuter, *Paederus fuscipes* Curtis and *Ophionea ishii* Habu, and spiders *Lycosa pseudoannulata* (Bosenberg et Stand), *Oxyopes linestipes* (C.L. Koch) and *Argiope* sp. were found. Numbers of *P. fuscipes*, *O. ishii* and spiders tended to be increase when *A. nigrotibialis* and *T. chinensis* tened to decrease with no significant difference among treatments (Figure 3). Normally number of insect pests showed a relationship to the natural enemies in organic farm system (Sorapongpisan *et al.*, 2011).

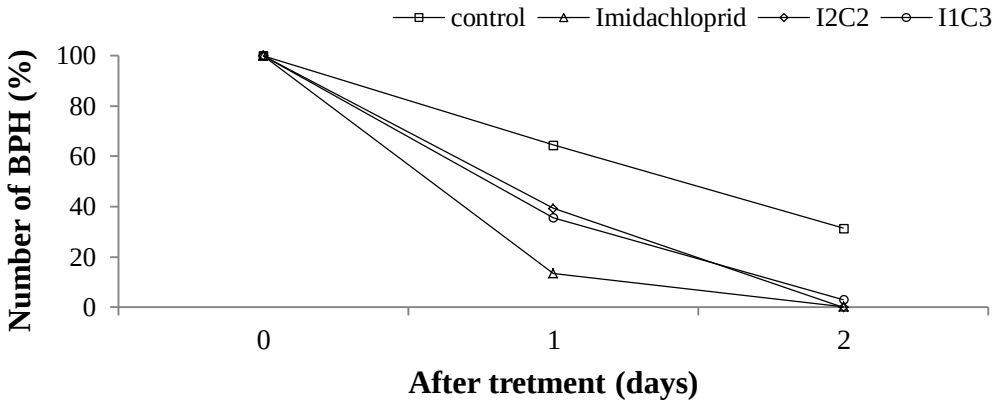

Figure 1. Mortality percentage of brown planthopper (BPH), *Nilaparvata lugens* (Stål) found before and after treated with essential oil formulas at 1% concentration and compared to imidacloprid insecticide in field condition.

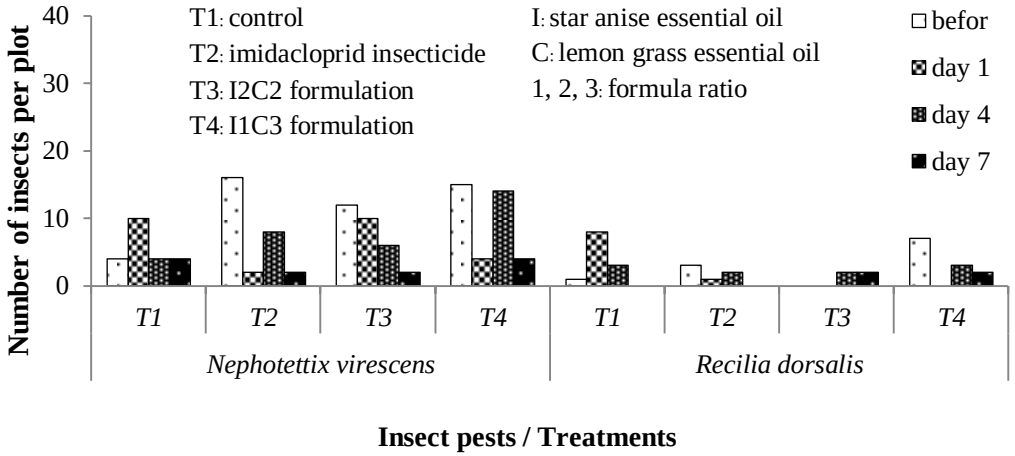

Figure 2. Number of other insect pests found in rice plots after treated with essential oil formulas during 7 days.

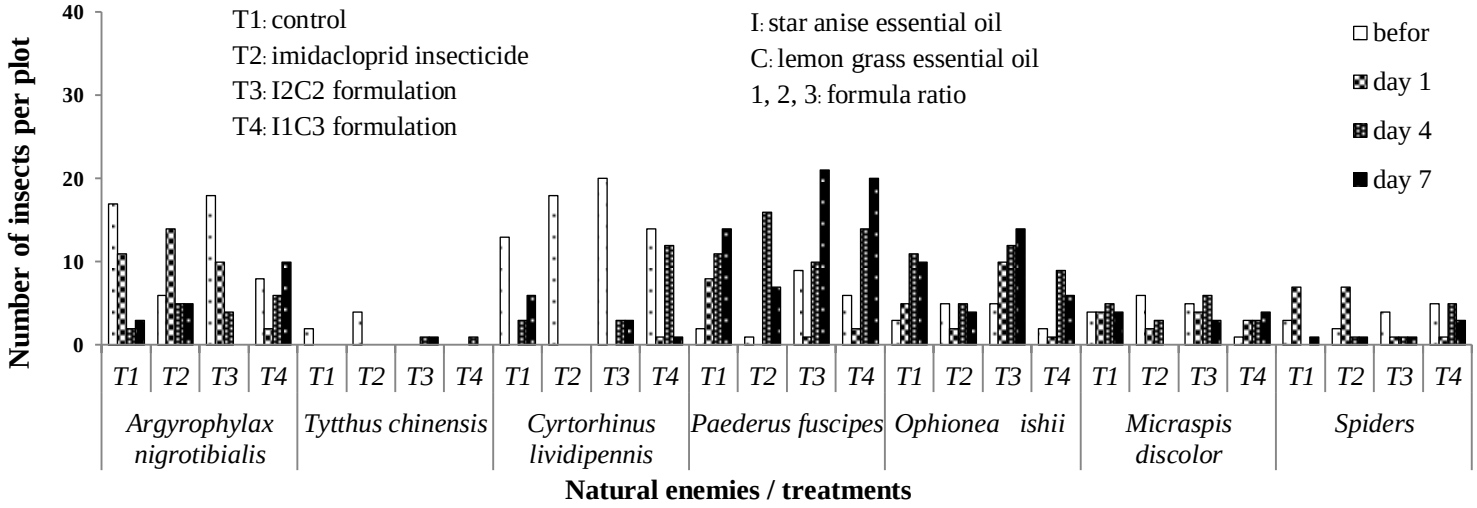

Figure 3. Number of natural enemies found in rice plots after treated with essential oil formulas during 7 days.

Conclusion

Essential oil formulas I2C2 (the ratio between star anise and lemon grass essential oils, respectively) and I1C3 at 1% concentration incorporated with Petroleun oil and imidacloprid insecticide contained high insecticidal property. They could reduce BPH number less than 5% within 2 days after treatment. Other insect pest numbers were also decreased, when most natural enemies seen to be increase in all experiment.

Acknowledgement

This work was supported by annual governmental budget via National Research Council of Thailand in fiscal year 2016.

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(Received: 20 October 2017; accepted: 25 November 2017)