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RESPONSE OF *Orius laevigatus* TO WEED EXTRACTS DURING THE PREDATION OF *Thrips tabaci*

Ruidar Ali Shah[1]*and Imtiaz Ali Khan

ABSTRACT

The predatory response of Orius laevigatus on onion thrips, Thrips tabaci and their response to the extracts from Azadirachta indica, Parthenium hysterophorus and Datura alba were investigated during 2014 at The University of California Davis USA. Aqueous extracts of A. indica, P. hysterophorus and D. alba, caused general deterrent/antifeedant effects on onion thrips. The leaf discs treated with these botanicals extracts showed relatively less feeding damage of T. tabaci and better performance of O. laevigatus against T. tabaci mortality/consumption as compared to leaf discs treated with conserve® (Spinosad) a synthetic insecticide. The conserve® caused 100% mortality of both T. tabaci and O. laevigatus while all the three tested botanicals showed no effect on O. laevigatus in terms of its mortality. The O. laevigatus coupled with these botanicals can reduce the feeding damage of T. tabaci and the feeding reduction was measured as 83%, 80% and 75% for A. indica, P. hysterophorus and D. alba respectively as compared to the O. laevigatus placed on untreated leaf discs. These results indicated that O. laevigatus can effectively control and reduced the feeding damage of T. tabaci showing no or very little effect in response to A. indica, P. hysterophorus and D. alba.

Keywords: *Azadirachta indica, Datura alba, Parthenium hysterophorus*, onion thrips, *Orius laevigatus, Thrips tabaci*.

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INTRODUCTION

Onion thrip, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) is a major pest of onion crop (Malik, 2004) which causes damage directly through feeding and indirectly by transmitting viruses (Whitefield *et al*., 2005). The larvae and adult both cause damage to the crop (Kawai, 1988). Thrips feeds in a piercing-sucking manner

[1]Agriculture Research Institute (Tarnab) Peshawar, Pakistan
[2]Dept. of Entomology, The University of Agriculture Peshawar, Pakistan
Corresponding author's email: ruidar80@gmail.com

(Stafford *et al*., 2003; Chisholm and Lewis 1984) and choose youngest leaves for feeding which show slivery patches. In severe attacks the whole plant converted into silver color and leaves wilted as a result reduced the bulb yield. The maximum reduction (66%) of bulb yield was recorded by (Ochoa *et al*., 1996).

Because of the small size and high fertility of the onion thrips, combined with rapid development of pesticide resistance make this insect very difficult to manage (Gerin *et al.,* 1999). One of the options is the use of insecticides application for its control but regular use of chemicals may kill natural enemies and leave residues in ground water, ecological problems as well as influencing human health (Wabale and Kharde, 2010). Therefore, different, non-chemical control approaches such as management through botanical extract along with biological control agents of thrips should be adopted which is ecologically approachable as part of integrated pest management (IPM) practices. Some alternative pesticides, such as botanical extract from *Parthenium hysterophorus*, *Datura alba* and *Azadirachta indica* as well as predatory bug *Orius laevigatus* (Hemiptera: Anthocoridae) have proved very effective in integrated management program against this pest (Khan *et al.,* 2013; Wabale and Kharde, 2010; Fathi *et al*., 2008; Datta and Saxena, 2001; Riudavets, 1995). In Europe the Orius predatory bugs are now frequently used as biological control agent against this pest (V-D-Meiracker, 1999). In general, botanically derived insecticides are thought to be ecologically acceptable and safe, while offering effective control when used in combination with other IPM practices (Nathan *et al.,* 2004). Our objective was to investigate the response of predation activity of *O. laevigatus* against botanical extract for the management of *T. tabaci*.

MATERIAL AND METHODS

Rearing of onion thrips (*Thrips tabaci*)

The onion thrips were collected from onion *Allium cepa* field located at University of California Davis and were reared on the Cabbage leaves in a plastic jar with size (11cm x 7cm x 9cm) covered by thrips proof screen on top in a 6 foot cage as per methods described by Ullman *et al*. (1992) under laboratory conditions (23.2 **°**C ±1, 50 Ð 60% RH, and 16:8 h photoperiod).

Chemical insecticide

The insecticide "Conserve® (Spinosad) which is used as traditional insecticide against thrips and proved very effective insecticide against this pest (Jones *et al*., 2005) and was collected from the Ullman laboratory, The University of California Davis.

Preparation of *Parthenium hysterophorus* and *Datura alba* extracts

For the preparation of *Parthenium hysterophorus* L. and *Datura alba* extracts, 3 cm small chopped pieces from each plants separately were dried in oven for 72 hours at 65^{o}C and then ground into (approximately 2 mm) small particle size with the help of grinder. Half kilogram of ground sample from each plant was wrapped in Muslin cloth along with 10 grams of detergent as adjuvant and was placed in 5 liters of boiled water for 24hrs this gave us 10% concentration and was stored as stock solution. Further concentration of 5% was made for Lab bioassays.

Preparation of *Azadirachta indica* seed extract

Azadirachta indica seed was crushed with a grinder and for extract preparation the same aforementioned procedure was adopted as used for other extracts. 5% concentration was used for the experiment.

Predatory bug (*Orius laevigatus)*

The true culture of *Orius laevigatus* (Hemiptera: Anthocoridae) was provided by Michel Parrella laboratory, The University of California Davis and was maintained for further experimentation.

Leaf Disc Bioassay

Leaf discs (1.2 cm) were made from healthy leek leaves with the help of a cork borer. A plastic vial of (3cm x 7cm x 3cm) size was used as bioassay unit. Female onion thrips were collected from the culture in a petri dish (50 x 11 mm size) and held on ice to slow down the thrips movement. 5 female onion thrips along with 5 predatory bugs per each treatment were used and were replicated 5 times. Leaf discs were placed singly in bioassay units. The underside of the leaf discs were embedded into 1% agar solution on the cap of each bioassay unit to kept the leaf discs moist and to prevent thrips from crawling underneath them. A fine brush was used to move thrips into the bioassay units. The bioassay units were turned upside down and put them in the laboratory at temperature 23 ± 1 °C. Thrips were allowed to feed for 24-48 hours after which the leaf discs were separated from the vials.

Measurement of Feeding Damage

After thrips were removed from the vials, digital images of the discs were taken with the help of a stereo microscope connected with digital camera and computer. The feeding damage was measured using Image J software (O'neal *et al*., 2002) and converted to mm^2 for statistical analysis.

Treatments

The following treatments in a Completely Randomized Design (CRD) with 10 replications comprising of six treatments were used.

T1: Conserve® @ 0.212ul/400ml of H_2O+ *Orius laevigatus* (Predatory bug)
T2: Conserve half dose + *Orius laevigatus* (Predatory bug)
T3: *Azadirachta indica* (seed extract) @ 5% + *Orius laevigatus* (Predatory bug)
T4: *Parthenium hysterophorus* @ 5% + *Orius laevigatus* (Predatory bug)
T5: *Datura alba* @ 5% + *Orius laevigatus* (Predatory bug)
T6: Control + water + *Orius laevigatus* (Predatory bug)

RESULTS AND DISCUSSION

Chemical insecticides Conserve® (Spinosad) was significantly more effective than *Azadirachta indica*, *Parthenium hysterophorus* and *Datura alba* in killing adult of *T. tabaci.* (Fig.1). Hundred Percent (100%) mortality of both *O. laevigatus* and *T. tabaci* were recorded in leaf disc treated with recommended dose of Conserve® followed by leaf discs treated with half dose of chemical insecticide (Conserve®), while there was no negative or mortality effect of botanical extracts on *O. laevigatus*. Similar findings were also observed by Biondi *et al*. (2012) who used the compatibility of insecticides with bio-pesticides and found 100 % mortality of predatory bug in pesticides while bio-pesticides were recorded slightly harmful or harmless to *O. laevigatus.* The *O. laevigatus* has consume 60% more onion thrips in leaf disc treated with water followed by 40% in *D. alba* and *A. indica* and 30% in *P. hysterophorus.* Frescata and Mexia (1996) recorded lower number of *T. tabaci* on the leaf discs treated with *O. laevigatus*. Brown *et al*. (2003) also recorded similar finding that the predatory bug *O. laevigatus* reduce the number of thrips to a greater extant. Chambers *et al*. (1993) described that *O. laevigatus* can effectively control thrips. The extracts from *A. indica*, *P. hysterophorus* and *D. alba* shows significantly less effective than chemical insecticide Conserve® on the nymphs of *T. tabaci* and biological control agents O. l*aevigatus* (Fig. 2), however the biological control agents consumed 60% more nymphs in the leaf discs treated with water followed by 30% in *D. alba* and *A. indica*, 20% in *P. hysterophorus* while they failed to consume *T. tabaci* in the leaf disc treated with insecticide Conserve® at half as well as recommended dose. Veire (1996) recorded variable toxicity of predatory bug in response to some insecticide in which insect growth regulator were recorded as toxic to predatory bug. Funderburk *et al*. (2000) also observed that *O. laevigatus* significantly suppressed population of thrips and is an effective predator when thrips were rapidly colonizing and developing in the flowers. *T. tabaci* both nymphs and adults showed (0.122 mm^2) and (0.070 mm^2) significantly less feeding damage in chemical insecticides Conserve® (Spinosad)

followed by botanical extracts at 5% each, while significantly high feeding damage of were recorded in leaf discs treated with water (Fig. 3). Results indicated that if we use the botanicals extract along with the biological control agent *O. laevigatus* instead of chemical insecticide, it can be effectively reduce thrips feeding as compared to chemical insecticides which affect biological control agents of thrips. Our results are comparable with the findings of Tang *et al*. (2002) that the application of the extract from *A. indica* had little impact on the parasitoids of aphids on citrus and described that neem extract is compatible with integrated pest management programs. Angeli *et al*. (2005) observed no significant effect on the survival and fecundity of *O. laevigatus* on the application of *Azadirachtin* and mineral oil when compared to predators exposed to pesticide residues. Based on these finding these botanical extract are safe to predatory bug while using for integrated pest management programs.

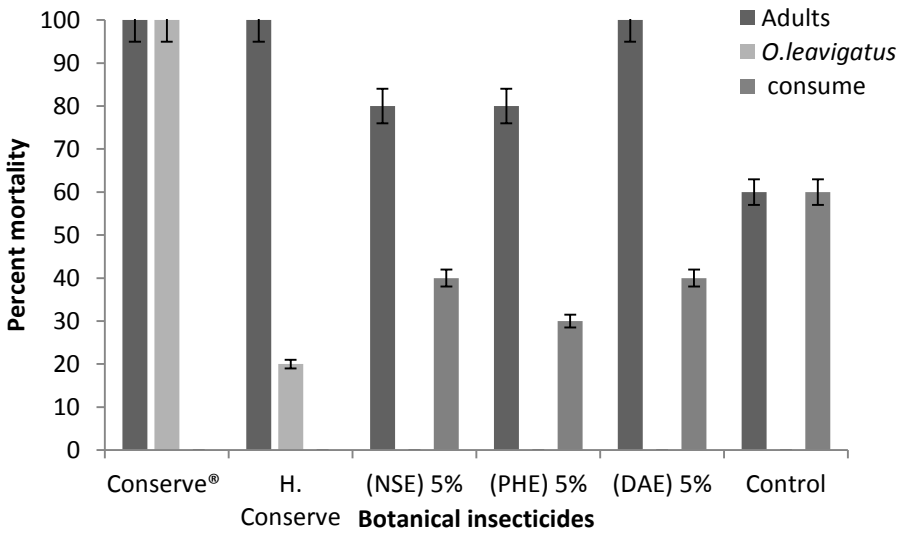

Figure1. Bars graph showing mean mortality of *T. tabaci* (adult) and *O. laevigatus* and consumption of adults by *O. laevigatus* in response to Conserve® at recommended and half dose, three botanicals extracts *A. indica* (AIE), *P. hysterophorus* (PHE), *D. alba* (DAE) @ 5% each and control or plain water.

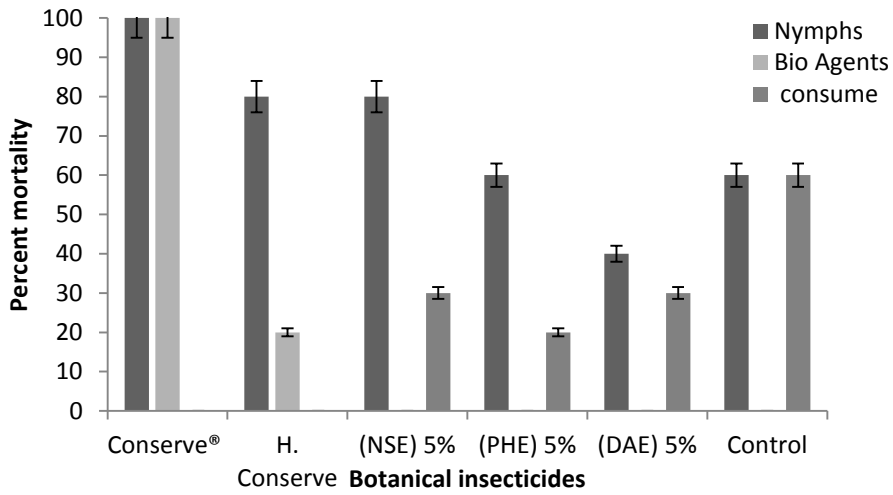

Figure 2. Bars graph showing mean mortality of *T. tabaci* (nymphs) and *O. laevigatus* and consumption of nymphs by *O. laevigatus* in response to Conserve® at recommended and half dose, three botanicals extracts *A .indica* (AIE), *P. hysterophorus* (PHE), *D. alba* (DAE) @ 5% each and control or plain water.

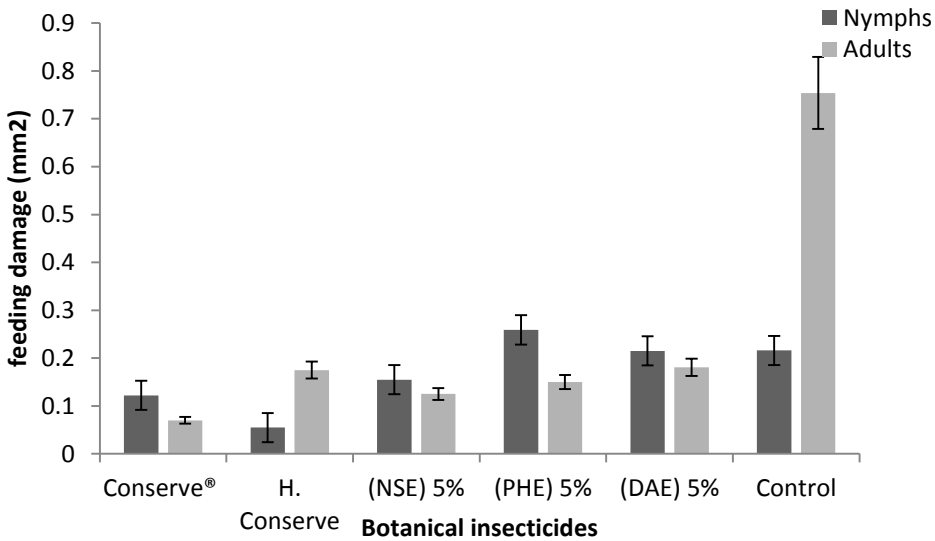

Figure 2. Bars graph showing feeding damage of *T. tabaci* (nymphs and adults) along with *Orius laevigatus* in response to Conserve® at recommended and half dose, three botanicals extracts *Azadirachta indica, Parthenium hysterophorus, Datura alba* @ (5%) each and control or plain water.

CONCLUSION

Botanical pesticides offer a safer alternative of using synthetic chemicals and have less or no impact on the environment and non-target organisms. Further, botanicals can also prevent pest resurgence. In the present study the effect of *P. hysterophorus, D. alba* and *A. indica* seed extract, were confirmed to be safe for the biological control agents and can effectively reduce the damage of onion thrips.

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