

Efficacy of neo nicotenoids against wheat aphid and impact on its predators

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Abstract

An experiment was conducted to evaluate the efficacy of different insecticides against wheat aphid and impact on their natural enemies' lady bird beetle and syrphid fly. Three different pesticides (Imidacloprid, Thiamethoxam and Tubaonazole) with different concentrations used to check the efficacy against wheat aphid and their impact on syrphid fly larvae and lady bird beetle adult, larvae both. Actara showed less aphid population but also affected predators population. Results revealed that among these three insecticides (imidacloprid, thiamethoxam and tubaconazole + imidacloprid) thiamethoxam showed very effective against wheat aphid. This also toxic to lady bird beetle and syrphid fly as compared to remaining other two insecticides. So judicious use of insecticides is very necessary. Those insecticides used which are highly effective against wheat aphid and least toxic to their predators.

Keywords: wheat (*Triticum aestivium*); aphids (*Schizaphis graminum*); population dynamics; genotypes

Introduction

About 36 % of the world population feed on wheat crop [8]. In Pakistan people used as staple food and during their daily average diet they get 70% protein and calories from wheat [9]. Wheat contribution in GDP of our country is 1.9% and in Agriculture is 9.6%. During 2016-17 also area of cultivation (9052 thousand hectares) is reduced upto 1.9 percent as compared to 2015-16 (9224 thousand hectares) but production (25.750 million tonnes) increases upto 0.5% as compared to 2015-16 (25.633 million tonnes.) this increase due to better management of inputs [4].

From sowing to harvesting various insect pest attack on the wheat crop but most important and notorious one is aphid [6]. The abundant aphid species found in Punjab are *Schizaphis graminum* R., *Rhopalosiphum padi* S., *Schizaphis graminum* R., *Rhopalosiphum maidis* F. and *Sitobion avenae* F. [13]. Most economically dangerous aphid species is *Schizaphis graminum* and polyphagous in nature feed more than 60 species of plants in which wheat, barley, maize etc [7]. Aphid damaging the crop by direct sucking the cell sap from leaves, spikes and stems and insert the material cause toxicity [12]. In indirect way of damage secrete honey dew that promote the growth and development of fungus [20]. More than thirty percent yield loss reported by 15 aphids per plant [22]. Akhtar conducted experiment to measure the yield loss caused by wheat aphid and he found that maximum aphid population on local variety Punjab-1 cause 2470kg per hectare [2].

Heavy infestation of aphid depend upon favorable climatic conditions, therefore monitoring is necessary throughout the year [24, 3]. Many controlling measures are adopted to manage

the aphid population below economic injury level like chemical, mechanical, physical, cultural, host plant resistance and biological control. Among these biological control is very important and many natural enemies feed on the aphid population and provide significantly control [26]. Coccinellid beetle (*Coccinella septempunctata* L.) is very good predator of aphid feed on both adult and immature stages [23, 25, 17]. Syrphid fly larvae having great potential to manage the aphid population one larvae can eat 400 aphid to complete its life cycle. Also having long oviposition period high reproductive rate [16, 15, 11]. But extensive use of insecticides adversely damaged their population. They exposed to a number of pesticides directly and indirectly by feeding on prey that contaminated with insecticides [10, 29, 14]. So, present study was conducted to evaluate the efficacy of different insecticides against wheat aphid and impact on their natural enemies' lady bird beetle and syrphid fly.

Material and Method

An experiment was carried out at Entomological Research Institute in Ayub Agriculture Research Institute Faisalabad. Three different pesticides (Imidacloprid, Thiamethoxam and Tubaonazole) with different concentrations used to check the efficacy against wheat aphid and their impact on syrphid fly larvae and lady bird beetle adult, larvae both. Galaxy variety was sown in lines by using hand pulled drill on 23 November 2015. Randomized Complete Block Design used consists of three replicates and seven treatments along with control treatment T0. The net plot size was 5m x 6m and in each plot all agronomic practices performed uniformly.

Table 1: Treatments with their common names, active ingredients, recommended dose rate.

Treatments	Common names	Insecticides	Dose rate/kg seed
T1	Confidor 70WS	Imadacloprid	2g
T2	Confidor 70WS	Imadacloprid	3g
T3	Actara 70WS	Thiamethoxam	2g
T4	Actara 70WS	Thiamethoxam	3g
T5	Husk 186.25FS	Tebuconazole+Imadacloprid	2g
T6	Husk 186.25FS	Tebuconazole+Imadacloprid	4g
T0	Control	Untreated	

The data recording was started from 30 December 2015 to 16 March 2016 on weekly basis. Ten randomly selected tillers from each plant and count the aphid population and then get aphid population per tiller basis. The population of syrphid fly and coccinellid beetle observed each plot per five plant. At the completion of the experiment data were analyzed by using ANOVA Analysis of Variance with statistix8.1 software and their pairwise means test by using LSD test.

Results

In last week of December population of aphid seen on the wheat crop. After that gradually increase in population was observed from December to March. At harvesting stage population of aphid vanished due to hardness of wheat crop

and lowest moisture content. Aphid cannot be able to suck cell sap at this stage. During last week December to first week of January aphid population were statistically similar on all the treatments and show no significant difference (Table-2a). In second week of January slightly change occur and show some difference but in first and second week February also show similar results (Table-2a). Peak period of aphid population were started from second week February to second week of March. During this period show significant results at second week February maximum aphid population was observed in control treatment and minimum aphid population observed on Actara (3g/kg seed) that was statistically similar to treatment T3 and T4 Confidor (2g,3g/ kg seed). Moderate population observed on all remaining treatments (Table-2a).

Table 2a: mean aphid population on wheat per tiller basis

	Treatments Date of Observation					
	30-12-15	6/1/2016	28-1-16	2/2/2016	9/2/2016	16-2-16
T1	0.0333A	0.0333A	0.2333AB	0.6000A	0.3667B	1.2333C
T2	0.0001A	0.0001A	0.1667AB	0.5333A	0.3667B	1.1333C
T3	0.0000A	0.0333A	0.2333AB	0.4667A	0.2000B	1.5667BC
T4	0.0002A	0.0333A	0.1000B	0.5333A	0.4333B	0.9667C
T5	0.0008A	0.0333A	0.2667AB	0.4000A	0.7667B	1.7667BC
T6	0.0333A	0.0000A	0.1667AB	0.2333A	0.5667B	1.7333BC
T0	0.0003A	0.0680A	0.4149A	1.0231A	4.4904A	3.8963A
P Value	0.5	0.8	0.5	0.8	0.001	0.0006

Each value is mean of 3 replications. Means having different letters show that statistically different from each other and means sharing same letters are not significantly different from each other by Fisher's LSD test at P= 0.05.

During third week of February maximum aphid population observed in control treatment and minimum aphid population was observed on Actara (3g/ kg seed) that was statistically similar with all remaining treatments. During first week of March maximum aphid population observed in control

treatment and minimum aphid population was observed on plots treated with Actara 2g/kg seed and also 3g/kg seed. During whole season maximum population as usually observed in control treatment and minimum aphid population was observed on Actara (3g/ kg seed) that was statistically similar with Actara (2g/ kg seed) and confidor (3g/ kg seed). When the population of aphid was in peak periods than minimum aphid population was observed also on Actara both 2g, 3g/ kg seed rate.

Table 2b: mean aphid population on wheat per tiller basis

	Treatments Date of Observation					
	23-2-16	3/3/2016	8/3/2016	16-3-16	Whole Season	Peak Period
T1	2.133BC	7.567AB	8.6000A	11.167A	3.5467BC	6.8467BC
T2	2.133BC	5.867AB	5.6333ABC	6.067BC	2.4333DE	3.8333D
T3	1.333C	2.667B	2.9667C	5.733BC	1.6867E	2.8600D
T4	1.367C	2.033B	3.0000C	6.533BC	1.6700E	3.0467D
T5	6.333B	14.700A	7.5333AB	7.200BC	4.3333B	7.6933B
T6	5.167BC	8.633AB	7.5333AB	7.800ABC	3.5367BC	6.2800C
T0	18.875A	13.813A	6.3216 ABC	9.160AB	6.3534A	9.6468A
P Value	0.000	0.1	0.05	0.1	0.000	0.000

Each value is mean of 3 replications. Means having different letters show that statistically different from each other and means sharing same letters are not significantly different from each other by Fisher's LSD test at P= 0.05. In this whole season also observed the population of sryphid flies and Coccenellid beetle in each treatment. As aphid population build up also come their predator sryphid flies and Coccenellid beetle. So, minimum population of Coccenellid

beetle observe on actara (3g/kg seed) and maximum population observed on husk (4g/ kg seed) that was slightly higher than husk (3g / kg seed). In confidor observed moderate population of Coccenellid beetle (Figure-1). Maximum population observed in control treatment due to abundant supply of aphid and no toxic effect of insecticides as compared to other all treatments.

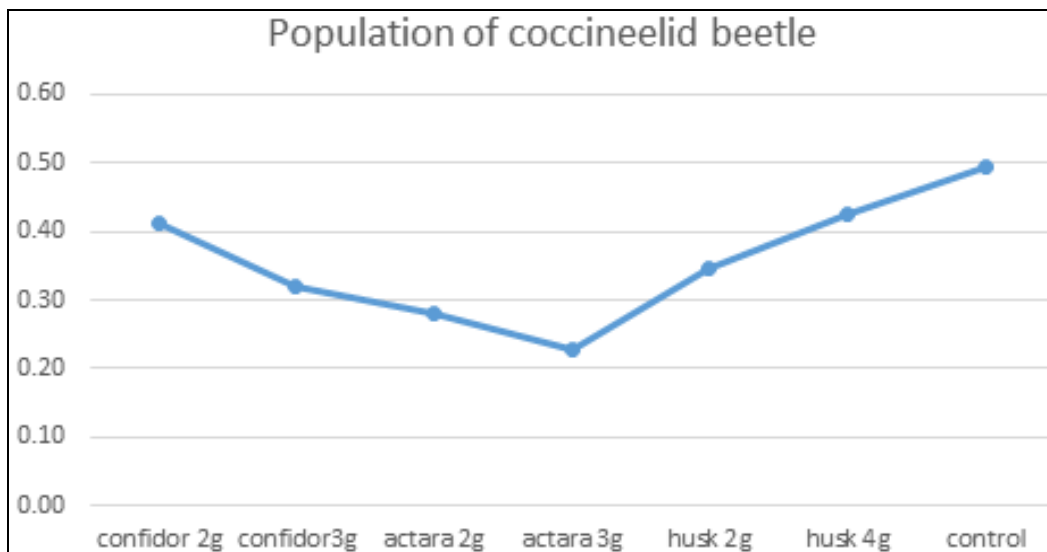


Fig 1: mean coccenellid beetle population per plant on wheat

In case of syrphid fly minimum population observed on actara (3g/kg seed) and maximum population was observed on husk (4g/ kg seed) that was slightly higher than husk (3g / kg seed). In confidor observed moderate population of syrphid fly

(Figure-2). Maximum population observed in control treatment due to abundant supply of aphid and no toxic effect of insecticides as compared to other all treatments.

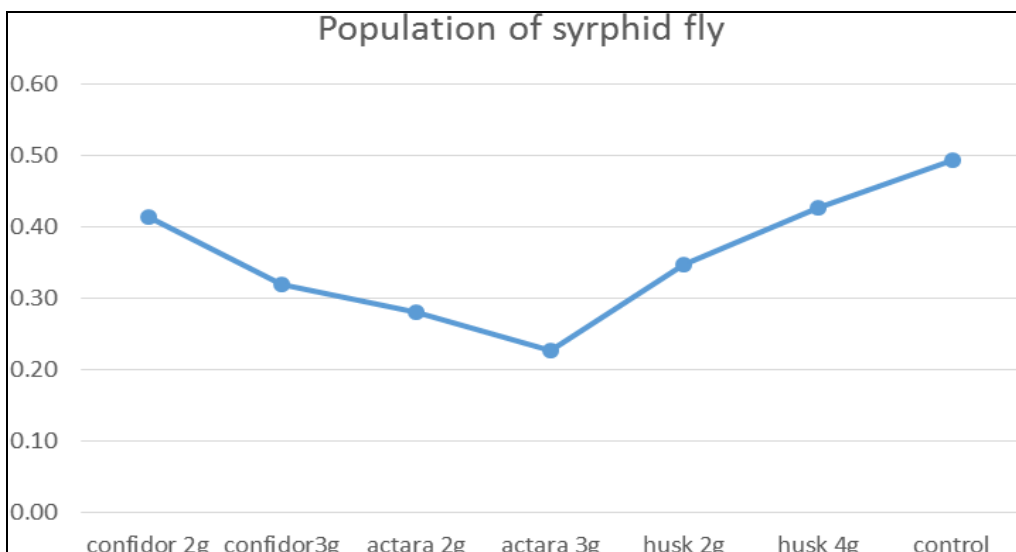


Fig 2: mean syrphid fly population per plant on wheat

Discussion

Thiomethoxam and imidacloprid belong to group neonicotenoids and act on nervous system of insects as nicotinic Acetylcholine receptor competitive modulator and Tebuconazole is systemic fungicide [5]. Four insecticides were

checked against wheat as seed treatment and also their impact on population of coccinellid beetle under field conditions at their recommended field dose rate. Highest population of aphid found on Dividend star and on control treatments while lowest population recorded on hombre and actara that was

similar to our experiment results. Similarly highest population of lady bird beetle recorded on dividend star and control treatment and lowest in actara and hombra as compared to control [28]. Four other insecticides imidacloprid, acetamaprid, thiamethoxam and dinotefuran against wheat aphid on three wheat cultivars. He found that all insecticides prominently reduced the aphid population on all wheat cultivars and increase the more than 60% yield of wheat. Imidacloprid and thiamethoxam gives better result than acetamaprid and dinotefuran [1]. Insecticides evaluated on susceptible (Iqbal-2000) and tolerant wheat genotype (V-00146) in 2003-2004. All insecticides show no significant difference in controlling the aphid population. But in case of yield Deltanet (1.53%), Dc-Tron (1.29%) showed lower increase in yield as compared to Advantage (2.38%) [18]. The efficacy of six Botanicals (Orange peel (*Citrus sinensis*); Hot pepper (*Capsicum frutescens*); Garlic (*Allium vineale*); Bitter goard (*Momordica dioica*); Mari gold and Tobacco (*Nicotiana tabacum*) extract also checked against wheat aphid on wheat cultivar. The results revealed that Garlic showed 57.91% and Tobacco 57.90%. While highest mortality showed by orange peel extract upto 65.69% [19]. Synthetic insecticides also evaluated against wheat aphids on different wheat genotypes through foliar application of pymetrozine 50 WG, lambda-cyhalothrin 2.5 EC and imidacloprid 20 SL. The effectiveness of imidacloprid was found to be better than other two insecticides [27]. Seven different insecticides (imidacloprid 200 SL, flubendiamide 480 SC, thiamethoxam 25WG, acetamiprid 20 SP, quinalphos 25 EC, dimethoate 30 EC, and clothianidin 50 WDG) were tested on aphids of barley crop. Among these flubendiamide 480 SC @250ml/ha was most effective against barley aphid [21].

Conclusion

Among these three insecticides (imidacloprid, thiamethoxam and tubaconazole + imidacloprid) thiamethoxam showed very effective against wheat aphid. This also toxic to lady bird beetle and syrphid fly as compared to remaining other two insecticides. So judicious use of insecticides is very necessary. Those insecticides used which are highly effective against wheat aphid and least toxic to their predators.

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