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Effectiveness of different synthetic insecticides against *Bemisia tabaci* (genn) on tomato crop

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Abstract
The experiment on the efficacy of different synthetic insecticides on tomato whitefly was carried out at village Wahi Pandhi Taluka Johi District Dadu, during rabbi season 2015. The experiment was designed in Randomised Complete Block Design (RCBD) with five treatments viz., T1; Transform (Sulfoxaflor) 30g/acre, T2; Polo (Diafenthiuron) 200 ml/acre, T3; Confidor (Imidacloprid) 200 sl/acre, T4; Agrovista @ 100 g/acre and T5; Control and repeated three times. The results of present study revealed that all the treatments were found effective against tomato whitefly during the 1st spray. It was observed that the T3 (Confidor 200 ml/acre) brought the highest reduction (93.24%) in whitefly population within 72 hrs of post treatment interval. The treatment T4 (Agrovista 100 g/acre) was also found most effective to combat the whitefly population within 72 hrs of post treatment interval with (89.86%) population reduction followed by T1 (Transform 30g/acre) with efficacy percentage (87.50%) and T2 (Polo 200 ml/acre) with efficacy percentage (86.79%) respectively. Almost same trend of effectiveness was recorded during 2nd and 3rd spray respectively. The maximum yield (22.10 kg/plot 1860sqft) was received in plot sprayed with T3 followed by 20.2, 14.8 and 13.3 kg/plot under T4, T2 and T1 sprayed plots, respectively. Minimum crop yield (5.8 kg) was noticed for untreated plot (control) where no insecticides were applied.

Keywords: Tomato, Whitefly, Efficacy, Synthetic insecticides, rabbi season.

1. Introduction
Tomato (*Lycopersicum esculentum* Mill) is the red berry type edible fruit of the nightshade family, Solanaceae (Anonymous, 2000) [1]. It is mostly regarded as important cash crop of the world. Tomato is originated from South America and Central America. Tomato is rich in minerals, fiber and vitamin A and B which are very essential for the human health. Tomato also contains carotene lycopene, the natural antioxidant. Lycopene is very essential which improves skins ability to protect against ultra-violate rays (Miller *et al*., 2002) [11]. Tomato crop is infested by different insect pests and diseases at nursery as well as field stages. Spider mites, tomato pinworms, leaf minors, whitefly, tomato bugs, thrips and fruit worms are considered as major insect pests of tomato crop out of them whitefly *Bemisia tabaci* is considered as major insect pest of tomato crop which infest at all stages throughout cropping season (Schuster *et al*., 2009) [15].

Whitefly transmit different viruses in different dost plants, in tomato whitefly transmit tomato yellow leaf curl virus (TYLCV) by which crop yield is affected very seriously (Palumbo *et al*., 2001) [14]. Whitefly is the complex morphological traits and depending on hosts at different biotypes, cultivars and environmental conditions (Legg, 1999) [10]. On this respect whitefly has an ability to adapt new environment and damage new hosts at different geographic regions (Basu, 1995) [3]. Heavy infestation leads to stunting and reducing vigour and growth of plants. Different controlling strategies have been adopted to control whitefly in tomato since decades *viz;* biological control, cultural control, mechanical and chemical controls (Jesse *et al*., 2007) [7].

Carbamates (carbosulfan and aldicarb) and pyrethroids (cypermethrin and lambda-cyhalothrin) were used in different vegetables and cotton crop against sucking insect pests i.e. whitefly by which whitefly was shown resistance against carbamates whereas, pyrethroids were shows modratly resistant against whitefly (Kady and Devine, 2003) [8]. (Tayab *et al*., 2005) [16] conducted an experiment against sucking insect pests jassid, thrips and whitefly to determine the efficacy of four new insecticides *viz;* Novastar (bifenthrin+abamectin),

Deltaphos (deltamethrin+triazophos) and confidor which were sprayed twice and highest efficacy was recorded by using Novastar followed by Confidor against these sucking insect pests. (Das and Islam, 2014) [4] Experimented to use pyrifluquinazon new insecticide against whitefly in green houses of tomato, which shown highly effective against adults of whitefly. Research and development have revealed that insecticides have knock down effect against different insects and among them pyrethroids are commonly used in worldwide accounting for more than 30% global use (Kranthi *et al*., 2002) [9]. Keeping in view the importance of damage caused by whitefly in tomato crop at Dadu district the present study was initiated with the aim to compare different insecticides for the control of whitefly for increasing tomato production in the district.

2. Material and Methods

The study was carried out at village Wahi Pandhi Taluka Johi District Dadu, to compare the toxicity of different insecticide against tomato whitefly *Bemisia tabaci* on tomato variety T-1359 during rabbi season 2015. Plot size was 1,860sqft with row to row distance 18-24" and plant to plant distance 8-12". The experiment was laid out in a Randomized Complete Block Design (RCBD) the selected plants were sprayed with five different insecticides *viz:* T1= Transform 30g/acre, T2= Polo 200 ml/acre, T3= Confidor 200 sl/acre, T4= Agrovista 100 g/acre and T5= Control and repeated three times. Five plants from each treatment were randomly selected in such a sequence of two leaves from the lower canopy two from the middle canopy and one leaf from the top of the branch.

Calibration of the insecticides

All agronomic practices were maintained constantly when required the treatment was adjusted according to the plot size, calibrated and sprayed according to the schedule. For this purpose fifteen plants from each treatment were randomly selected to record the effectiveness of different synthetic insecticides on tomato white fly. For the pest counting the pre-treatment observations were recorded 24 hrs before and the post-treatment observations were recorded after 24 hrs, 48 hrs, 72 hrs, 168 hrs and 336 hrs. The data was collected and analysed statistically.

3. Results

The data (Table-1) showed that the treatment Confidor 200 ml/acre brought the highest reduction (93.24) within 3 days interval in whitefly population. Agrovista 100 g/acre was most effective to combat against whitefly population that reduced pre-treatment population of white fly 8.97 by (89.86%) within 3 days of post-treatment interval. The effectiveness of other treatments in descending order was recorded as (87.50%) and (86.79%) by Transform 30g/acre and Polo 200 ml/acre, respectively.There was significant ($p<0.0173$) difference for pest population on observation dates and insecticides. Moreover, the ANOVA shows standard error of 1.3673 and coefficient variation of 52.16%. The F values for the first spray after 24hrs (F= 30.2), 48hrs (F= 68.7), 72hrs (F= 110), 168 hrs (F= 35.8) and 336 hrs (F=3.94) respectively.

Table 1: Overall mean reduction percentage of white fly against different insecticides on tomato crop after first spray.

Treatments	Pre-treatment	Post-treatment					Mean reduction %
		24 hrs	48 hrs	72 hrs	168 hrs	336 hrs	
T1= Transform 30g/acre	9.27	4.41 (62.84)	2.13 (81.13)	1.44 (87.50)	6.50 (51.54)	11.06 (22.35)	87.50
T2= Polo 200 ml/acre	8.59	4.17 (62.09)	2.11 (79.82)	1.41 (86.79)	5.45 (56.15)	10.31 (21.89)	86.79
T3= Confidor 200 sl/acre	10.12	3.21 (75.23)	1.28 (89.61)	0.85 (93.24)	4.75 (67.56)	8.73 (43.86)	93.24
T4= Agrovista 100 g/acre	8.97	4.14 (63.95)	2.08 (80.95)	1.13 (89.86)	5.02 (61.32)	9.00 (34.70)	89.86
T5= Control	8.59	11.00	10.46	10.68	12.43	13.20	

During second spray all the treatments behaved similarly as in case of 1st spray. The data (Table-2) showed that the treatment Confidor 200 sl/acre brought the highest reduction (95.21) within 3 days interval in whitefly population. Agrovista 100 g/acre was most effective to combat against whitefly population that reduced pre-treatment population of whitefly 12.33 by (91.60%) within 3 days of post-treatment interval. The effectiveness of other treatments in descending order was recorded as (89.21%) and (79.73%) by Transform 30g/acre and Polo 200 ml/acre, respectively.

There was significant ($p<0.0145$) difference for pest population on observation dates and insecticides. Moreover, the ANOVA shows standard error of 1.8133 and coefficient variation of 54.02%. The F values for the first spray after 24hrs (F= 32.9), 48hrs (F= 80.0) 72hrs (F= 188), 168 hrs (F= 122) and 336 hrs (F=35.5) respectively.

Table 2: Overall mean reduction percentage of white fly after second spray against Different insecticides on tomato crop

Treatments	Pre-treatment	Post-treatment					Mean reduction %
		24 hours	48 hours	72 hours	168 hrs	336 hrs	
T1= Transform 30g/acre	12.26	5.79 (51.02)	3.66 (71.42)	2.66 (79.73)	4.06 (72.50)	16.93 (-6.41)	79.73
T2= Polo 200 ml/acre	10.31	4.95 (50.21)	2.13 (80.22)	1.19 (89.21)	7.33 (38.21)	12.13 (9.33)	89.21
T3= Confidor 200 sl/acre	11.53	4.15 (62.67)	1.33 (88.95)	0.59 (95.21)	5.20 (60.80)	9.33 (37.64)	95.21
T4= Agrovista 100 g/acre	12.33	5.46 (53.32)	2.93 (76.87)	1.09 (91.60)	7.80 (44.12)	11.33 (28.02)	91.60
T5= Control	13.20	12.73	13.79	14.13	15.19	17.13	

During third spray all the treatments also behaved similarly as in case of 1st spray and 2nd spray. The data (Table-3) showed that the treatment Confidor 200 sl/acre brought the highest reduction (92.25) within 3 days interval in whitefly population. Agrovista 100 g/acre was most effective to combat against whitefly population that reduced pre-treatment population of whitefly 15.24 by (91.64%) within 3 days of post-treatment interval. The effectiveness of other treatments in descending order was recorded as (78.84%) and (75.51%) by Transform 30g/acre and Polo 200 ml/acre, respectively.

There was significant ($p<0.0147$) difference for pest population on observation dates and insecticides. Moreover, the ANOVA shows standard error of 1.9488 and coefficient variation of 52.29%. The F values for the third spray after 24hrs (F= 97.3), 48hrs (F= 152) 72hrs (F= 195), 168 hrs (F= 8.81) and 336 hrs (F=15.5) respectively.

Table 3: Overall mean reduction percentage of white fly after third spray against Different insecticides on tomato crop

Treatments	Pre-treatment	Post-treatment					Mean reduction %
		24 hours	48 hours	72 hours	168 hrs	336 hrs	
T1= Transform 30g/acre	14.33	7.40 (45.36)	4.15 (70.85)	3.00 (78.84)	12.00 (-13.93)	17.02 (58.20)	78.84
T2= Polo 200 ml/acre	9.33	5.20 (41.02)	3.53 (61.92)	2.26 (75.51)	10.66 (-55.45)	14.33 (104.5)	75.51
T3= Confidor 200 sl/acre	12.13	3.00 (73.83)	1.73 (85.64)	0.93 (92.25)	5.73 (35.72)	10.66 (17.06)	92.25
T4= Agrovista 100 g/acre	15.24	3.53 (75.49)	2.26 (85.07)	1.26 (91.64)	9.33 (16.70)	12.00 (-4.88)	91.64
T5= Control	17.13	16.19	17.02	16.95	12.59	12.86	

The figure 1 depicts that maximum yield (22.10 kg/plot) was received in plot sprayed with T3 followed by 20.2, 14.8 and 13.3 kg/plot under T4= Agrovista 100 g/acre, T2= Polo 200 ml/acre and T1= Transform 30g/acre sprayed plots, respectively. Minimum crop yield (5.8 kg) was noticed for untreated plot (control) where no insecticides were applied.

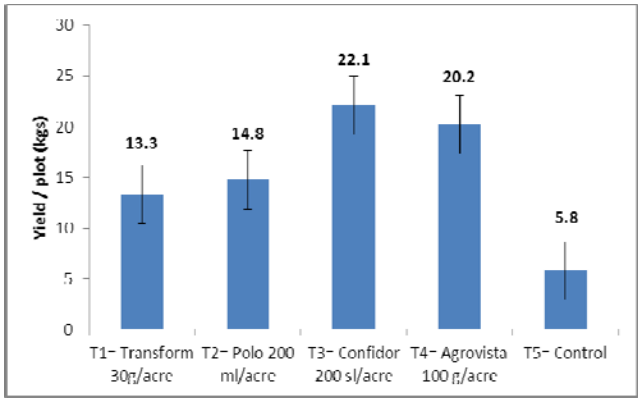

Fig 1: Average per plot yield of tomato crop

4. Discussion

White fly has complex morphological traits and depending on hosts at different biotypes, cultivars and environmental conditions (Legg, 1999) [10]. On this respect white fly has an ability to adapt new environment and damage new hosts at different geographic regions (Basu, 1995) [3]. Heavy infestation leads to stunting and reducing vigor and growth of plants. There different controlling strategies have been adopted to control white fly in tomato since decades *viz;* biological control, cultural control, mechanical and chemical control (Jesse *et al.*, 2007) [7]. All the treatments reduced whitefly population during 1st, 2nd and 3rd spray. Furthermore, the results showed that the treatment Confidor 200 sl/acre brought the highest reduction within 3 days interval in whitefly population. Agrovista 100 g/acre was most effective to combat against whitefly population that reduced pre-treatment population of whitefly within 3 days of post-treatment interval. The effectiveness of other treatments in descending order was recorded as Transform 30g/acre and Polo 200 ml/acre, respectively. Furthermore, the results showed that T3= Confidor 200 sl/acre shown maximum reduction on first spray against white fly after 48 hours and 72 hours, and T4= Agrovista 100 g/acre was also shown maximum reduction against white fly in first spray after 48 hours and 72 hours. The minimum reduction against white fly on second spray was also examined by T3= Confidor 200 sl/acre after 48 hours and 72 hours, and T2= Polo 200 ml/acre after 48 hours and 72 hours. The maximum population reduction of white fly on third spray was evaluated by spraying of T2= Polo 200 ml/acre after 48 hours and 72 hours, and T1= Transform 30g/acre after at 48 hours and 72 hours. All of the above treatments were shown maximum population reduction of white fly on first, second and third spray after 24 hours, 48 hours and 72 hours but efficacy of above treatments were gradually decreased after 168 hours. Furthermore, these results were confirmed by those of El-Naggar and Zidan, (2013) [5] that imidacloprid and thiamethoxam against sucking insect pest like white fly, jassids and aphids shows maximum reduction percentage at 40 days and it was also observed that imidacloprid is more effective than thiamethoxam on soil fauna. Jamshid *et al*,. (2015) [6] *Datura alba* 5% and *P. hystophorous* 5% were compared to Imidacloprid 250g/acre against white fly in tomato and cotton from which *Datura alba* 5% and *P. hystophorous* 5% shown more effective against white fly in tomato and cotton. Asi *et al*., (2008) [2] tested confidor and polo against white fly, jassids and thrips were found very effective on cotton and tomato crop instead of Cascade at the interval of 24, 48 and 72 hrs and 168 hrs. Amjad *et al*., (2009) resulted that Megamos and Confidor were shown maximum efficacy up to seven days, while Actara was least effective against white fly on cotton. Mustafa (2000) [13] found that Mospilan, polo and confidor resulted almost 72.76% mortality of whitefly. Mohan and Katiyar (2000) [12] tested that confidor was the most effective against white fly in cotton and vegetables but continuous uses of confidor resulted in increased population of white fly by the development of resistance. Das and Islam, (2014) [4] resulted that imidacloprid, fipronil and buprofezin were shown maximum efficacy against white flies and jassids and moderate effective was observed by using thiamethoxam+emamectin benzoate.

5. Conclusion

On the basis of results it is concluded that all the treatments effectively reduced the population of white fly on tomato crop. Confidor showed maximum population reduction in first, second and third spray after Agrovista Transform and Polo were shown also reasonable population reduction in descending order during first, second and third spray respectively. Maximum crop yield per plot was also obtained where plot was sprayed with Polo, followed by Confidor Transform and Agrovista.

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