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Comparison between different sampling techniques of thrips (*Thrips tabaci*) on onion

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Abstract
An experiment was conducted during *rabi* season of 2014, Department of Plant Protection, Aligarh Muslim University, Aligarh, Uttar Pradesh, India to study the compression between different sampling techniques of thrips (*Thrips tabaci*) of onion the crop varieties (Onion white and Nasik red) was sown in randomized complete block design with plant spacing of 30cm between rows and 15 cm within plants in 16 plots. Results revealed thatMaximum demonstrated of *T. tabaci*, damage, eggs and other insect pests were in March and April. The infestation, population and laying eggs of *T. tabaci* are started from inner bases of leaves then gradual spreading on leaves. The most common predators found were spiders and coccinellidae species. Therefore, more investigations on natural enemies; spiders and coccinellidae predators and their potential for control *T. tabaci* are desired for more than 3 years constantly. The BST were consistently captured and detected adult thrips earlier than other sampling methods, and could be used instead of other samplings early in the season to monitor activity of thrips. The major influence abiotic factors either reduction or increasing population, damage and eggs of *T. tabaci* were the temperature (positive relationship) and relative humidity (negative relationship).

Keywords: sampling techniques of thrips, onion, coccinellidae species.

Introduction
Onion (*Allium cepa* L.) belongs to the liliacae family and one of the most important commercial vegetable crops and widely grown in almost all over the world. Onion and other Allium vegetables are characterized by their rich content of thiosulfinates, sulphides, sulfoxides, and other odoriferous sulphur compounds. Cysteine sulfoxides are primarily responsible for the onion flavour and produce the eye-irritating compounds that induce lacrimation. Thiosulfonates exhibit antimicrobial properties (Diane G. Alston, 2008). Onion is effective against many bacteria including *Bacillus subtilis*, Salmonella and E. coli. It contains carbohydrates, protein, vitamin B6, calcium, magnesium, iron, niacin and ascorbic acid (W.H.O. 2002). Onions have a various variety use for medicinal uses and their production is steadily increasing so that onion is now the second most important horticultural crop after tomatoes. In Onion pungency is due to the presence of allyl propyl disulphide, a volatile oil (Malik 1994). India is next only to China in area and production of vegetables and occupies second position in onion. In India, onion is cultivated in 1173.30 million ha and production is 1, 8777.50 million tons (F.A.O. 2014). Onion is prone to attack by numbers of insect pests; Onion thrips, Thripstabaci, onion fly, leaf minor or leek moth, *Aerolepeopsisaassectella*. *Thripstabaci* is a key insect pest in most onion producing regions of the world (Rueda 2000). Onions are most sensitive to thrips injury during the rapid bulb and also yield reduction due to reduced bulb size is the primary crop loss caused by onion thrips. (Kendall and Capenera 1987). In India, Onion thrips can cause an annual yield loss of about 10 to 15 percent (Gupta *et al*. 1994; Diaz-Montano *et al*. 2011); 34- 43 percent loss in yield (Krishna Kumar *et al*., 2001). Onion thrips also causes indirect damage as vector of viral disease, Iris Yellow Spot Vvirus, Onion thrips can also be vector of other viruses, such as tomato spotted wilt virus (TSWV) and impatiens necrotic spot virus (INSV), although these can be economically important to greenhouse and nursery plants, they are not a concern on onions (Lindorf 1931). A complete generation requires 3-4 weeks during the summer months. Five to eight generation may occur each year. Early bulb enlargement stage of onion growth is the most sensitive to thrips feeding.

Methodology

Anaturaland laboratory experiment was conducted at department of plant protection, Aligarh Muslim University, Aligarh; Uttar Pradesh, Standard agronomic practices for onion commercial cultivation; farmyard manure (FYM), P_2O_5 @45 kg/ha, 30 nitrogen (N) kg/ha were applied at time of sowing. The experimental field was well prepared before transplanting of onion seedlings. Two ploughing was done and field was treated with recommended amount of farm yard manure (20t/ha FYM) before one month of transplanting. No pesticides treatment had been applied on onion cultivars during the experiment. Fertilization, One dose of P_2O_5@45 kg/ha in form of DAP, Fertilizer@ (46% P_2O_5 and 18% N), was applied at the time of transplanting except in P2O5-fertilizer exp. Nitrogen (N) @90 kg/h in form of Urea fertilizer @46%N were, 1st dose (50%) at time of transplanting, 2nd (25%) and 3rd (25%) doses 35 and 45 day after transplanting, respectively. Irrigation and weeding was provided to the crop in field when it is necessary. The compound experiments were conducted to study the compression between different sampling techniques of thrips on onion. Four sampling methods were used to monitoring and estimate thrips in field onion-ecosystem.

A. Blue sticky trap

B. Yellow sticky trap

Both Sticky traps; blue and yellow plastic sheet (7.6 x 12.7 cm, local sheet of market, Aligarh) Plastic sheets were planned to squares (3x3 cm) in the printing press in Aligarh. They were coated with Vaseline® petroleum jelly (Anglo-Dutch Company Unilever) on side only. Plastic sheet was hung on a wooden stake with an binder clip 2-3 cm above the plant canopy and placed in centre of plots. The height of the traps was adjusted with growth of the plants. Traps were applied one week after transplanting. Weekly, the traps are changed by new one. Routine examination of traps was under binocular microscope in laboratory. Average number of thrips (adult and immature stages and other insects) per sticky trap was investing aged in this technique of sampling.

C. *Lab investigation:* Three plants/plots were carefully cut at base of canopies from middle lines in 'W' form with avoiding two plants at the end of middle lines. The plants were carefully handled to avoid disturbing the thrips on the plants. The plants/plots were placed and transported to laboratory in 70X50 cm polyethylene plastic bags (local bags). Insects were not allowed to escape from bags by tying with rubber bands. Plants were filled with 500 ml water with alcohol 70% (9:1) to wish off insects, and sieved the water through two layers of wit tissue paper. In this way, all sieved thrips occurring on a plant could be counted by binocular microscope in laboratory on tissue paper.

D. *Field investigation:* Sampling of thrips was done by visual count using lens (10-15x). Tree plants selected randomly from each plot in the centre and middle lines with 'W' form with avoiding re-selection of the same every next observation. Average number of thrips (adult and immature stages and other insects (other thrips species and natural enemies) per plant were invest aged in this technique of sampling.

Results

Thrips is absolute estimated (both immature and adult stage of *T. tabaci*). Thrips population was registered attacking Nasik Red (0.02 TP) on 14th Dec and (Onion White 0.20 TP) was on 18th Jan. Generally, they were gradually increased with variation gaps and peaks during the trials of seasons with gradual decreasing in end of April. Fluctuation peaks of *T. tabaci* were investigated in different dates of months; Jan, March, and April in both cultivars. Maximum density of TP was 240.80 TP observed on 12th April by Nasik Red and 83.20 TP on 29th March by Onion White. Aligarh has a monsoon-influenced humid subtropical climate, typical of north-central India.In *Rabi* season, cultivation of onion, weather parameters were collected weekly and synchronized with estimation of thrips on onion cultivars. Weekly, temperature-°C (maximum, minimum, morning, evening, and means), relative humidity-%RH (morning, evening and means), rainfall-mm, wind velocity-Km/hr (morning, evening and means) and dewpoint-% were studied in relation to *T. tabaci* population.

After the continuous monitoring of the crop from date of transplanting in field on onion cultivars, percentage of damage was initially observed on 7th Dec. (2nd WAT); 1.87 % on Onion White and 10.74% on Nasik Red at (19.58 °C and 74 % RH). Gradually, percentage of damage was increased up to date of harvesting with fluctuation peaks in both cultivars. Nil percentage of damage was recorded on 11th Jan. (7th WAT) at 12.39 °C and 81.29 % RH on Onion White. The maximum OT damage was observed on 12th April (20th WAT) at 29.66 °C and 51.50% RH) on Onion White (78.25%) and Nasik Red (76.50%). Other insect minor losses by leafminor fly, Coccinellids and spiders.

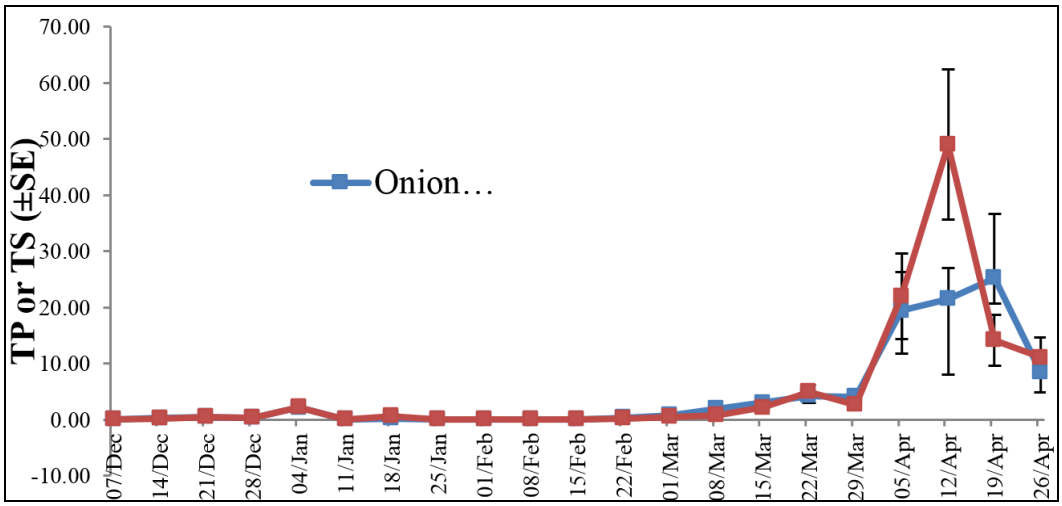

Fig 2: *T. tabaci* adult on two onion cultivars

Table 1: Correlations among the numbers of T. *tabaci* adult on different sampling methods

	YST	Lab investigation	Field observation
BST	0.931**	0.600**	0.586**
Sig.	0	0.004	0.005
YST		0.314	0.514*
Sig.		0.166	0.017
Lab investigation			0.617**
Sig.			0.003

Table 2: Correlation TP and immature stages in lab investigation of both cultivars with adults on sticky traps.

	TP	immature/plant
BST	0.258	0.226
Sig. (2-tailed)	0.258	0.325
YST	0.242	0.215
Sig. (2-tailed)	0.29	0.35

Table 3. *T. tabaci* adults were counted on onion plant and caught by sticky traps on onion cultivars

Treatment Cultivars (A)	Means of adult ±SE	Treatment Interaction (AxB)	Means of adult ±SE
Onion White	4.41	A1xB1	9.68a
	±1.10		±1.59
Nasik Red	5.31	A1xB2	5.24abc
	±1.01		±0.37
F Value	1.69	A1xB3	1.86c
Pr > F	0.21		±0.27
HSD (df=1, P=0.05)	1.48	A1xB4	0.85c
Sign.	ns		±0.20
Sampling methods (B)		A2xB1	8.73ab
BST	9.21a		±1.86
	±1.11	A2xB2	4.57bc
YST	4.91b		±1.12
	±0.55	A2xB3	7.05ab
Lab investigation	4.46b		±0.51
	±1.19	A2xB4	0.88c
Field investigation	0.87c		±0.09
	±0.10		
F Value	24.4	F Value	12.57
Pr > F	<0.0001	Pr > F	<0.0001
HSD (df=3, P=0.05)	2.84	HSD (df=7, P=0.05)	4.88
Sign.	s	Sign.	ns
Means	4.86		
	±0.74		
C.V.	34.87		

Discussion

Symptom of thrips infestation was appeared earlier in December than appearing of thrips population on onion where the weather was optimum (>15 °C and 65Rh) for infestation. That may because the seedlings were infested earlier before transplanting then the damage was disappeared later as because an onion typically generates a new leaf every 2-3 weeks. Adult migrated to onion crops in December as it was recorded earlier than immature stage and more trap to Nasik Red then followed by eggs. However, it was recorded January (El-Sherif and Mahmoud, 2008) [1] and February (Ullah *et al.* 2010) [17]. Generally, population of thrips and damage were gradually increased up to end of season mid-April then decreased from early January to late May (El-Sherif and Mahmoud 2008b) [2]; from October to May (El-Sherif and Mahmoud 2008a) [1] Decline of population was in end of season May (El-Sherif and Mahmoud 2008 and Ullah *et al*., 2010) [1, 10]. This could be similar to our study if the onion was

continually cultivated on May, where it is high temperature. Reported that at the end of the season, thrips might not be able to survive in abundance because there is not sufficient green vegetation in the surrounding areas, as April and May being the driest. However, Appearance of damage of thrips was stable and high on end of season (April) because generating a new leaf of onion needs 2-3 weeks. In contrary, thrips population were lower in beginning of season (Dec, Jan, Feb) than later months (March and April) this is due to weather factors. Fluctuation peaks of thrips densities, damage and eggs were observed from December to April. Moraiet and Ansari (2014) [10] noticed that peaks were on February with in December transplanting. It was also observed in March in various transplanting dates: in December (Moraiet and Ansari 2014) [10] and January. In April, the peak was observed in different dates of transplanting also: in December (Moraiet and Ansari 2014) [10], February, March and Oct. (Ullah *et al*., 2010) [17]. In our study, most and maximum demonstrated of adult and immature, damage and eggs were peaked late on March and April (after 14th WAT) at >18 °C and >55% RH in both cultivars and years because of favorable climate conditions. Similarly, observed that the maximum number of thrips were at temperature 19.8 and 18.37 °C and RH 61.3 and 59.7% in first and second season, respectively. First period flight activity was in early December to February (temperature was 16 °C) and the second one was in March to May (temperature was 22.3 °C). Population density of thrips was highest at 130 and 158 days. Nymphs became more dispersed, as onion plants matured. However, thrips onion was more attracted to onion at the bulb formation stage (45-75 days after planting). However, High trend of OT population was observed during month of December on both cultivars in *rabi* season.

Natural enemies

Mostly of natural enemies appeared on onion in end of season (March or April). Similarly, Population density of *T. tabaci* and spiders peaked in March and April in both seasons. The most abundant predators were coccinllidae insects and spiders and in low number; spiders (0.1 to 0.4 SP) and coccinellidae (0.01 to 0.03 BP). Numbers of predatory insects dwelling on the sampled vegetables were lower in comparison to total numbers of thrips obtained. Similarly, low abundance of predator that among all predators of OT on onion crops, more populations of spider Scytodes sp. (0.59), black ant Camponotuscompressus (0.49), Syrphus sp. (0.53) and Chrysoperla sp. (0.75) were recorded.The mean population of coccinellid, *Menochilussexmaculatus* in 3 different taluks ranged from 0.73 to 2.47 per plant and the population of *Chrysoperlacarnea* ranged from 0.74 to 1.90 per plant.

Conclusion

The result of one year of experiment concludes that *T. tabaci* is the dominant insect pest of onion crops in Aligarh. Maximum demonstrated of *T. tabaci*, damage, eggs and other insect pests were in March and April, which the management of thrips is necessary in these months. The infestation, population and laying eggs of *T. tabaci* are started from inner bases of leaves then gradual spreading on leaves. Lack of natural enemies was on OT. Lack of the natural enemies was as a result of intensive and nonspecific uses of pesticides. The most common predators found were spiders and coccinellidae species. Therefore, more investigations on natural enemies; spiders and coccinellidae predators and their potential for control *T. tabaci* are desired for more than 3 years constantly. Predatory mites will actually perform in biological control of *T. tabaci* in the field cannot yet be concluded from the assessed laboratory potential and has to be evaluated in the field. Management of onion thrips should be implemented in early March. Adult of thrips migrated to onion field early in December and established in crop in mid-February. BST were consistently captured and detected adult thrips earlier than other sampling methods, and could be used instead of other samplings early in the season to monitor activity of thrips.

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