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POPULATION DYNAMICS OF *THRIPS TABACI* IN ONION

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ABSTRACT

***Thrips tabaci* Lindeman (onion thrips) have become a serious pest threatening onion cultivation. The present study investigated the impact of three planting dates on *T. tabaci* incidence on onion (Giza 20 variety) for two years (2021-22 and 2022-23). The findings revealed that the *T. tabaci* recorded 4 peaks in the 1st planting date, the 2nd with an average population density (677.21 and 703.24 individual/plant), followed by the 2nd with 500.05 and 602.13 insects. While the 3th planting date recorded three peaks (385.77 and 494.04 individual/plant). The interaction between plant age, natural enemies, climatic conditions and *T. tabaci* population density resulted in a strong relationship affecting onion yield.**

Key words: *Thrips tabaci*, onion, natural enemies, population dynamics, plant age, wheather factors, planting dates, correlation coefficients, temprature, relative humidity, predators

T. tabaci is a polyphagous, cosmopolitan pest that causes major output losses all over the world by infecting a variety of crops, principally cotton, tomatoes, chilies, garlic, and onions (Diaz-Montano et al., 2011; Abenaim et al., 2022) polyphagous (Mukhtar and Mir, 2023). Climate activity appears to be an important factor in regulating the presence and accumulation of *T. tabaci*. An adult deposits egg, which hatches into nymphs, which develop up fast into the maturity stage and their lifespan cycle, takes around 10 days. When plants experience a loss in chlorophyll and photosynthesis, their onion leaves turns silver, this is indicative of a *T. tabaci* infestation (Diaz-Montano et al., 2011). Its incidence increased due to a lack of natural enemies, the presence of weeds, and improper planting timing (Panwar et al., 2015; El Kenway et al., 2022). Temperature and relative humidity play an important role in affecting the distribution of *T. tabaci* (Karuppaiah et al., 2020). Insect pests alone are thought to be responsible for between 35 and 100% losses (El-Sheikh and El-Kenway, 2023; Brar and Bhullar, 2023; *T. tabaci* alone may directly or indirectly cause up to 30-50% yield decline by transmission of IYSV (Hsu et al., 2010; Reitz et al., 2020; Randive et al., 2023). Knowing the basic relationship between climatic factors and their impact on *T. tabaci* is crucial for developing IPM strategy (Singh et al., 2017; Wahsh et al., 2023). The current study was conducted to evaluate on the effectiveness of three planting dates and the effect of climatic factors, plant age and natural enemies on the population dynamics of *T. tabaci* on onion.

MATERIALS AND METHODS

The present study was carried out at village of El- Mansouriya, Giza (11° 26′ N, 75° 53′ E), administratively affiliated to Giza Governorate, about 20 km from the pyramids of Giza. The Giza 20 variety was chosen, which the recommended variety in Lower Egypt by the Ministry of Agriculture. The seeds of onion were planted in nursery beds, prepared for this purpose. After the seeds germinated, the plants continued to grow inside the nursery for up to 8 weeks, when they were transferred to the open fields for cultivation (Salari et al., 2023). The experiment area of about 1/ 2 feddan (2100 m^2) was divided into four plots (each part 525 m^2); each plot was divided into three replications (175 m^2). Five plants were chosen randomly in 5 block (4 corners+ center) and inspected for the pest; planting date that was set in the first week of November (recommended by the Egyptian Ministry of Agriculture), the third week of November and the first week of December, with a 15-day interval between planting dates. Experiments were carried out in a randomized complete block design with three replicates for each transplantation date. The direct count approach was used to visually estimate the density of *T. tabaci* nymphs and adults by recording the individuals on plant leaves using a magnifying glass (Duchovskienė et al., 2022). Samples were taken randomly for 5 onion plants/ plot; all leaves were examined at the early morning at weekly intervals for five months from the first appearance of *T. tabaci* until harvest. Records of temperature and relative humidity were obtained from the Central Laboratory for Agriculture Climate (CLAC), Dokki, Giza, Egypt (maxi, mini and R.H. %). Utilizing the Costata product of Cohort software In C., Barkeley, California, U.S.A., a computer software package, the effects of planting dates, climatic conditions on the population fluctuation of *T. tabaci*, simple correlation, and partial regression were calculated.

RESULTS AND DISCUSSION

Data summarized in Figs. 1 and 2 indicated that the first appearance of *T. tabaci* was recorded 4th week of December, 1st week of January and 3th week of January in 1st, 2nd and 3th planting dates. The weekly mean numbers of insects were 15.3, 14.85 and 11.39 individual/ plant, respectively in first season 2021/ 2022. These results are consistent with those of Wahsh et al. (2023) that *T. tabaci* numbers increase during March and April during different planting dates. The counts increased gradually to 1st peak in 1st and 3rd week of January (46.58, 43.45 individual/ plant) in 1st planting

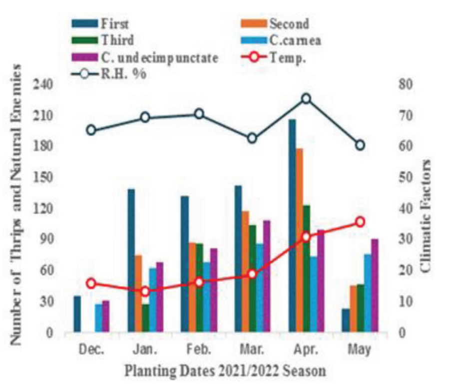

Fig. 1. Population dynamics as influenced by the planting dates on *T. tabaci* (2021-22)

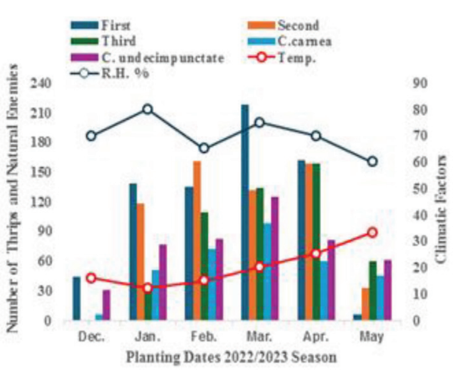

Fig. 2. Population dynamics as influenced by the planting dates on *T. tabaci* (2022-23)

date. The second and third planting dates showed the first peak in the third week of January and the last week of February (25.95 and 30.99). The 2nd peak in the 1st planting date was observed by 4th week of February, while it was in 3rd week of February in second planting date, however, it was the last week of March , in the 3rd planting date (38.63, 27.54 and 34.83, respectively). The 3rd peak appeared in the 4th week of March with weekly mean numbers of 76.42 and 38.28 insects in the 1st and 2nd planting date in the second season Diaz-Montano et al. (2011) reported that the pest reached its peak in March. While, the 3rd peak appeared in the 4th week of April with weekly mean numbers of 36.66 insect in the 3rd planting date of the 2022/ 2023 season. The 4th and final peak was recorded at the 2nd week of April, with weekly mean numbers of 47.94 for 1st planting date; *T. tabaci* reached its highest (Mukhtar and Mir, 2023) in the second week of April. However, 4th peak was observed at the end of April (42.26) in the 2nd planting date. Consequently, the first and second planting dates recorded 4 peaks, and the third planting date recorded only 3 peaks over the two study seasons; *T. tabaci* reached its highest number during the first planting date (677.21and 703.24 individual/ plant) followed by the second planting date, with an average of 500.05 and 602.13 individual/ plant the 2021/ 2022 and 2022/ 2023 seasons. The lowest number of Thrips in onion fields was at the third planting date, at 385.77 and 494.04 individual/ plant, during the two seasons Rachidi (2024) state that *T. tabaci* may not survive in large numbers at the end of the season if there is insufficient green foliage in the surrounding areas during the driest months April and May.

The trend of the population density of the predators on onion, plants depends mainly on densities of *T. tabaci* and other pests. The mean number of predators *Chrysoperla carnea* and *Coccinella undecimpunctata* fluctuated during February (68.06,72.29 and 81.05,82.16) increased gradually to reach its peak during March in both seasons as shown in Fig. 1 and 2 El Kenway et al. (2022) observed that the natural enemies played an important role in reducing the number of *T. tabaci*. The first planting date, as given in Table 1 show that there was a significant relationship between all the factors studied, as the simple correlation between the mean numbers of *T. tabaci* and the mean temperature range was significant and the values of r = 0.307 and 0.445 respectively: El Kenway et al. (2022) and Reitz et al. (2020) observed that biotic and abiotic factors have a clear impact on the dynamics of *T. tabaci*. The r. values were significant with positive relationship between *T.*

Table 1. Statistical analysis of the effect of certain climatic factors the population of *T. tabaci* in (2021-22) seasons

Date	Source of variation		Simple correlation		Partial regulation				
		r	p	b	p	F	P	E.V %	
First date	Rang. Temp.		0.307	0.186	1.075	0.316			
	Rang. R.H%		-0.196	0.406	-0.261	0.071			
	Plant age	Age 1	0.232	0.023	0.432	0.058			
		Age 2	0.425	0.051	-0.362	0.276	8.71	0.0007	83
		Age 3	-0.535	0.015	0.003	0.694			
		C. carnia	0.602	0.004	0.180	0.623			
		C. undiciumpunctata	0.617	0.003	0.069	0.843			
Second date	Rang. Temp.		-0.307	-0.196	2.175	0.114			
	Rang. R.H%		0.186	0.406	-0.192	0.230			
	Plant age	Age 1	0.347	0.033	0.423	0.318			
		Age 2	0.531	0.016	0.173	0.644	9.38	0.0005	86
		Age 3	-0.631	0.002	-0.301	0.790			
		C. carnia	0.593	0.005	-0.018	0.965			
		C. undiciumpunctata	0.622	0.003	0.359	0.379			
Third date	Rang. Temp.		0.127	0.592	1.646	0.060			
	Rang. R.H%		0.673	0.977	-0.090	0.395			
	Plant age	Age 1	0.139	0.057	3.957	0.212			
		Age 2	0.350	0.030	0.630	0.802	12.86	0.0001	88
		Age 3	0.477	0.033	-0.628	0.415			
		C. carnia	0.481	0.013	-0.102	0.717			
		C. undiciumpunctata	0.498	0.025	0.152	0.576			

tabaci mean numbers and age 1, 2, 3 and *C. carnea* and *C. undecimpunctata* the both biotic agents with values were 0.456, 0.302, 0.200 0.289 and 0.275, straight In 2022/2023 season. Karuppaiah et al. (2020) showed that knowing the basic relationship between these climatic factors, natural enemies, plant age, and their impact on *T. tabaci* populations is crucial for developing the IPM programmes. The relationship was negative between the number of *T. tabaci* and the plant age 3 (r = -0.631) in the first season 2021/ 2022. Explained variance (EV %) which was (83% and 63%) showed the impact of all the factors examined together on *T. tabaci* in the two study seasons. In the 2nd planting date the biotic factors showed a significant positive relationship with the insect pests mean numbers except age 3, showed a significant negative relation Panwar et al. (2015); Abenaim et al. (2022) also noted that temperature and relative humidity play an important role in influencing the distribution of *T. tabaci*. The partial regression analysis revealed the mean precise values and the relationship between the mean numbers of *T. tabaci* and the tested factors were significant– b values were 0.868, p=0.411, F=3.36 observed similar results Wahsh et al. (2023).

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AUTHOR CONTRIBUTION STATEMENT

El-Sheikh and Kamel conducted the experiments and wrote the paper. Hariss and El-Tokhy discuss the results and review the writing of the paper.

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CONFLICT OF INTEREST

No conflict of interest

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