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EFFECT OF NITROGEN FERTILIZATION DOSES OF COTTON CROP INSECTS AND THEIR CERTAIN ASSOCIATED PREDATORS

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ABSTRACT

Field experiments were carried out at Sidi Salem District, Kafr El-Sheikh governorate to study the influence of two nitrogen rates in combination with phosphorus (P) and Potassium (K) at their balance rate N:P:K = by ratio of (67:30:24) and high (N) rate 1.5N:P:K by ratio of (100.5:30:24) on the population numbers of cotton aphids and whitefly (adults) infesting cotton crop in addition to some associated predators during tow seasons (2011 and 2012). Obtained results revealed that the population densities of aphids and whitefly (adult) were maximum during mid and later stages of cotton seasons according to temperature (Temp.) and relative humidity (R.H %) levels. The highest means of aphid, whitefly and associated predators populations in both study seasons were scouted in plot fertilized with high N fertilization 1.5N:P:K and vice versa. Statistical analysis showed highly significant differences between the population means of aphids, whitefly (adults) and associated predators No. in the two fertilizer ratios in both seasons. Also, the population densities of aphids and whitefly was higher in 2012 than that in 2011 season, it is dependent upon of the corresponding Temp. and R.H %. On the other hand, insignificant positive correlation was found between predators and aphids and whitefly (0.290 and 0.042) respect. in plants fertilized with N:P:K ratio, while there was highly positive correlation (0.697 and 0.608) with both sucking insects respect. in 1.5N:P:K during 2011 season. But, in 2012, season predators was positive and highly significant correlated (0.789 and 0.881) with aphids and whitefly respect. in fertilization ratio 1.5N:P:K. Highly significantly positive (0.728) and significant positive (0.500) correlations were found with aphids and whitefly respect. with fertilization N:P:K ratio.

Keywords: Nitrogen fertilization, Aphis *gossypii*, *Bemisia tabaci* , predators ,cotton

INTRODUCTION

Cotton crop being the best natural fiber that is grown in Egypt and in many other countries in the world, the cotton is not only principal cash crop but also each and every parts of cotton plant are useful Shivanna *et al*., (2009). Cotton crop is highly vulnerable to many sucking pests during crop growth season, which cause heavy losses in cotton yield. Cultural practices such as crop fertilization can affect susceptibility of plants to insect pests and there are positive interaction between soils and pests (Miguel and Clara 2003). In spite of crop yield largely depends upon synthetic fertilizer, the occurring of insect herbivores especially sucking pests is closely related to the nutrient status in plant tissues applied by soil fertility (Bi *et al*., 2001 and Bi *et al*., 2003). Also, nitrogen fertilizer are the major factors can influence pest populations by reducing plant resistance to insects Awamack and Leather (2002), Altieri and Nichollas (2003) and Way *et al*., (2006).Many attempts such as cultural practices were decided to prevent pest losses and resulted in an increase use of pesticides.

The objective of the current study was to evaluate the effect two nitrogen doses on infestation by aphids and whiteflies. Also, the correlation between insect pests and their dominant predators was investigated at both doses of nitrogen

MATERIALS AND METHODS

1- Cultural practices and design:

The current experiment was conducted at Baz village, Sidi Salem District Kafr EL-Sheikh governorate. Egyptian cotton cultivar Giza 86 was used in 2011 and 2012 seasons. Seeds were sown on 12 and 14 May, during 2011 and 2012 seasons, respectively. The field experimental design was a Completely Randomized Block (C R B) with two treatments and four replicates, the field area was 0.08 fed. (336 m^2), and was divided into 8 plots. Each plot consisted of 6 rows, 7m long, with rows spaced o.7m apart. The fertilizer treatments were separated by three rows of cotton. In each row, cotton plants were planted in one line with 25cm space. Two levels of different fertilizer rates (doses) of nitrogen were used in combination with phosphor (p) and potassium (K). The fertilizers used in the experiment were ammonium nitrate 33.5%. super phosphate 15% P_2O_5 and potassium sulphate 24% K_2 S O_4 as sources of nitrogen (N) Phosphorus (P) and potassium (K) respectively. Nitrogen fertilizer was used as two treatments; 67 and 100 kg N, while phosphorus and potassium doses were used as 30 and 24 units, respectively. Each treatment of N:P:K ratio was repeated in four times, half of nitrogen fertilizer amount was applied to the soil with the second irrigation post thinning. The remaining part of the fertilizer amounts was applied to the experiment plots with the fourth irrigation. The total amounts of phosphorus and potassium fertilizers were added to the soil during the soil preparation. Cotton field was irrigated every two weeks; no pesticides were used in both seasons. Cotton plants of two treatments received the same other normal agricultural practices.

2. Sampling of sucking pests for population scouting.

For scouting the population densities of cotton aphids, A. *gossypii* (Glover) and whitefly, *B. tabaci*, the data were recorded from 1st week of June till September 8 at weekly intervals, twenty-five cotton leaves were sampled from each replicate. Sampling were taken early in the morning when insects had minimum activity, at random from both diagonals of each experimental

replicate. Sucking insects were counted from three different levels, upper leaf of first plant, middle leaf of second plant, lower leaf of third plant and so on. The upper and lower surfaces of the randomly selected cotton leaves were carefully examined to count whitefly adults, and by using hand lens (5 xs) to count all individuals of aphids.

3. Sampling of associated predators for population scouting:

The numbers of larval and adult stages of predacious species (i.e *Coccinella* spp, *Chrysopa* spp. and true spiders)of insect pests of cotton were included in counting. The population was recorded visually on five randomly selected plants from each replicate at weekly intervals through the scouting period in early hours (before 6 AM) when insect adults had minimum activity. Plant samples were selected at random from both diagonals of the inner square across the area of each experimental replicate (Hafez 1960). For counting the population of predators of sucking pests, both leaf surfaces, squares and blooms of each cotton plant were considered for examined to count by hand lens or without. The leaf was held at the petiole by thumb and forefinger and turned until the entire underside of leaf clearly visible (Shish and Bhanwar, 2007).

4- Statistical analysis

All sampling data of the aphids and whitefly population were presented as numbers per100 cotton leaves and for predators were as numbers per 20 cotton plant, Throughout the observation period. The means of numbers for each fertilization of nitrogen level were computed and compared with one way analysis of variance (ANOVA). Duncan's multiple range test was used to determine significant differences ($p \leq 0.05$) between means of numbers for each fertilization treatment. Also, a computer program was used for estimating the simple correlation coefficient between the populations of sucking pests and their associated predators. (Duncan,1955) .

RESULTS

Effect of fertilization treatments on: *Aphis gossypii*:

In 2011 season, data in Table (1) and illustrated in Fig (1,1a and 3) indicated that the incidence of aphids on cotton in treatment fertilized with N:P:K dose was observed during last week of Jun.(4 aphids /100 cotton leaves) on 6 weeks old crop.

Table (1): Weekly mean Population of *Aphis gossypii, Bemisia tabaci* /100 cotton leaves, Predators/ 20 cotton plant and means of weather factors (Temp. ,R .H) by different fertilizer doses on cotton plants during 2011 season

Scouting date		Average No. of *Aphis gossypii, Bemisia tabaci,* / 100 cotton leaves and *Predators* / 20 cotton plant at indicated different fertilizer doses						Weekly Average of weather factors	
		Aphis gossypii		*Bemisia tabaci*		*Predators*			
		N:P:K	1.5N:P:K	N:P:K	1.5N:P:K	N:P:K	1.5N:P:K		
Month	day	67:30:24	100.5:30:24	67:30:24	100.5:30:24	67:30:24	100.5:30:24	Temp.	R.H%
		(1)	(2)	(3)	(4)	(5)	(6)		
	5	0	0	0	0	0	2	27.74	69.92
June	12	0	0	0	0	2	6	30.21	70.92
	19	1	0	0	0	4	4	28.92	70.13
	26	4	64	4	5	13	8	30.28	71.5
	3	0	30	4	6	11	4	28.53	72.71
	10	42	40	17	8	4	6	30.89	73.89
July	17	62	164	20	13	2	4	31.69	71.42
	24	70	100	18	22	2	10	31.77	73.21
	31	120	216	15	18	7	18	31.09	74.49
	7	153	336	10	25	9	20	31.35	73.64
August.	14	156	188	20	64	7	18	31.88	73.06
	21	120	170	17	84	5	16	31.2	73.3
	28	100	208	20	90	4	18	30.78	72.28
Sept.	4	103	288	25	82	9	8	30.21	76.24
	11	176	284	15	36	11	10	30.39	74.21
Total	–	1107	2088	185	453	*90*	*152*	*456.93*	*1090.9*
Mean	–	73.8	139.2	12.33	30.2	*6*	*10.13*	*30.46*	*72.7*
M.comparison	–	1,2	--	3,4	--	5,6	--	–	–
significant	T	**	--	**	--	**	--	–	–

(1), (2),(3) ,(4),(5) and (6) = Number of treatments (Fertilizer doses)
N.S = not significant
*** = significant ** = Highly significant**

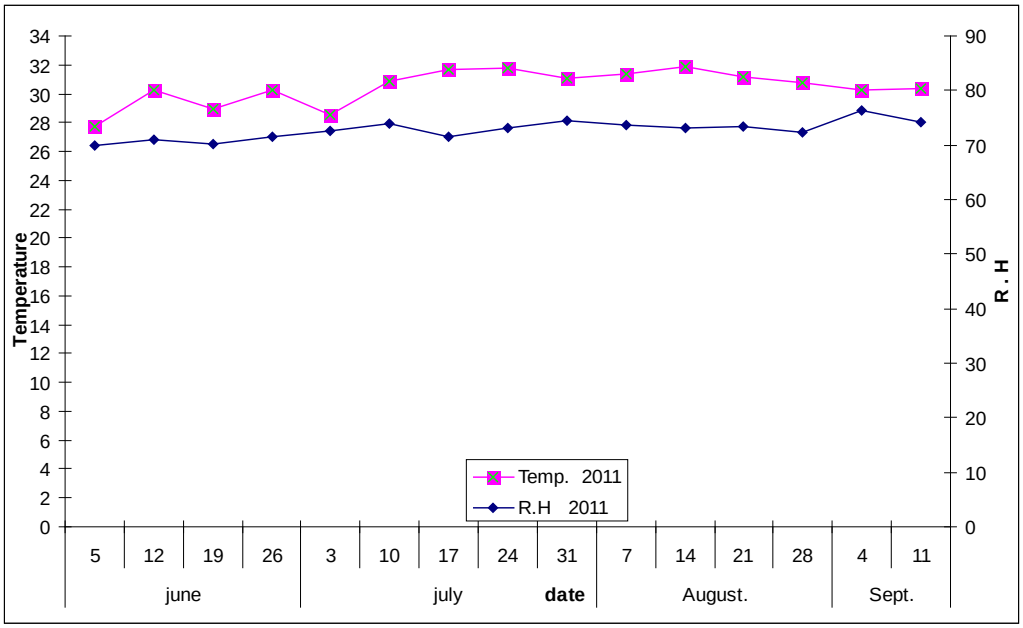

Fig (1) Weekly mean temperature (Temp.) and mean relative humidity (R.H) during scouting period (*Aphis gossypii, Bemisia tabaci* and some associated predators) in season 2011

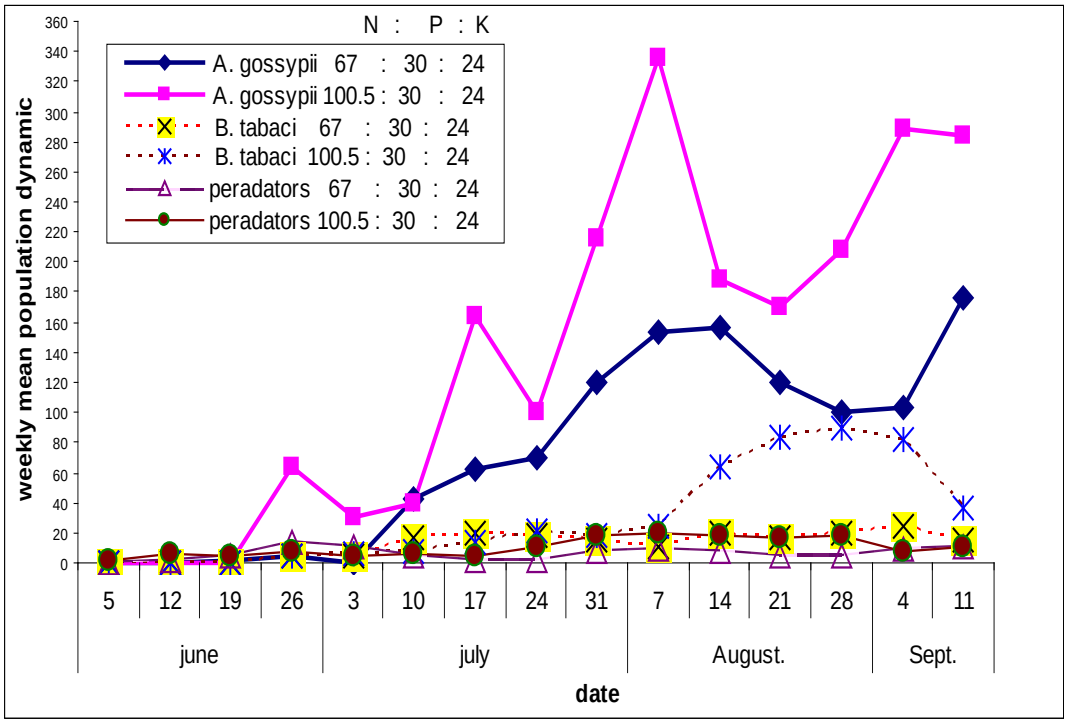

Fig (1a): Weekly mean population dynamics of *Aphis gossypii, Bemisia tabaci* and some associated predator at two (N) fertilization doses in 2011 season

I st density gradually increased in subsequent two months and peaked in Aug. 14 (156 aphids /100 cotton leaves).1st peak. Population of the pest gradually decreased in subsequent weeks and reached to 103 insects in Sept.4, then increased again in Sept. 11 to highest number 176 aphids /100 cotton leaves, second peak, last observation. From data shown in Table (1) and Fig. (1 and 1a), the seasonal densities of aphids in cotton plots fertilized with 1.5N:P:K highest nitrogen dose , indicated that aphids started infesting cotton plants during Jun. 26 (64 insects/100 cotton leaves) and continued by fluctuated number till the end of scouting Sept.11. Also four peaks appeared in the same treatment (highest N fertilizer) on Jun. 26, Jul. 17, Aug.7 and Sept.4 which recorded (64, 164, 336,) (highest density) and 288 individual /100 cotton leaves, respectively.

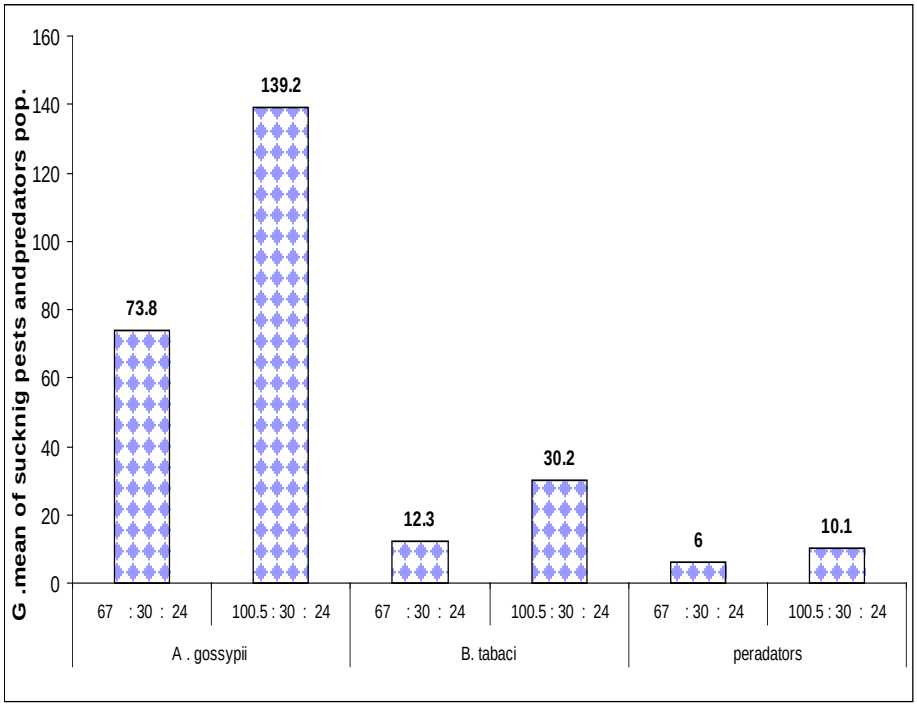

Fig (3) General mean of *Aphis gossypii, Bemisia tabaci* and some associated predators at two treatment (N) fertilization doses in 2011 season

Concerning the population dynamics of aphids in 2012 season, data presented in Table (2) and Fig. (2 , 2a and 4) showed that, in cotton plants fertilized with N:P:K aphids was recorded in cotton plants during Jun. 8 (23aphids /100 cotton leaves) about 3 weeks after planting date and gradually increased with time elapsing of cotton growing season till the end of observation Sept.7. Three peeks were noticed on Aug. 3.Aug. 17. And Sept. 7 coincided with 724 (highest one), 541 and 523 aphids /100 cotton leaves. Cotton plants fertilized with 1.5N:P:K, aphid population density appeared also during Jun. 8 and its density increased gradually and reached to maximum level on Aug. 3. In this fertilizer ratio (high N dose), four peaks of aphids were recorded, i.e. Jun.15 Jul.6 Aug. 3 and 31 (44, 360, 1064) (highest one in two treatments) then 700 individual /100 cotton leaves respect.

Table (2): Weekly mean Population of *Aphis gossypii, Bemisia tabaci* /100 cotton leaves, predators/20 cotton plant and means of weather factors (Temp., R .H) by different fertilizer doses on cotton plants during 2012 season

Scouting date		Average No. of *Aphis gossypii, Bemisia . tabaci,* / 100 cotton leaves and Predators / 20 cotton plant at indicateddifferent fertilizer doses						Weekly Average of weather factors	
		Aphis gossypii		*Bemisia tabaci*		Predators			
		N:P:K	1.5N:P:K	N:P:K	1.5N:P:K	N:P:K	1.5N:P:K		
Month	day	67:30:24	100.5:30:24	67:30:24	100.5:30:24	67:30:24	100.5:30:24	Temp.	R.H%
		(1)	(2)	(3)	(4)	(5)	(6)		
	1	0	0	0	0	9	6	28	68
	8	23	12	0	0	7	20	28.8	70.1
June	15	23	44	0	4	11	18	30.5	71.2
	22	5	20	0	10	17	16	31.2	73.8
	29	30	32	15	20	5	20	31.9	72.3
	6	59	360	13	25	9	20	29.8	74.1
July	13	155	348	11	32	11	26	32.3	72.2
	20	503	640	13	44	21	28	33	73.1
	27	657	984	21	43	20	30	34.2	74.5
	3	724	1064	32	55	36	34	29.8	74.1
	10	357	572	17	47	30	36	32.3	72.2
August.	17	541	632	30	60	23	32	33	73.1
	24	413	696	26	53	20	29	34.2	74.5
	31	361	700	15	50	28	30	29.8	74.1
Sept.	7	523	580	34	30	11	18	30	74
Total	–	4374	6684	*227*	*473*	258	363	*470.2*	*1099.5*
Mean	–	291.6	445.6	*15.13*	*31.53*	17.2	24.2	*31.35*	*73.3*
M. comp.	–	1,2	--	3,4	--	5,6	--	–	–
significant	T	**	--	**	--	**	--	–	–

(1), (2),(3) ,(4),(5) and (6) = Number of treatments(Fertilizer doses
N.S = not significant
*** = significant ** = Highly significant**

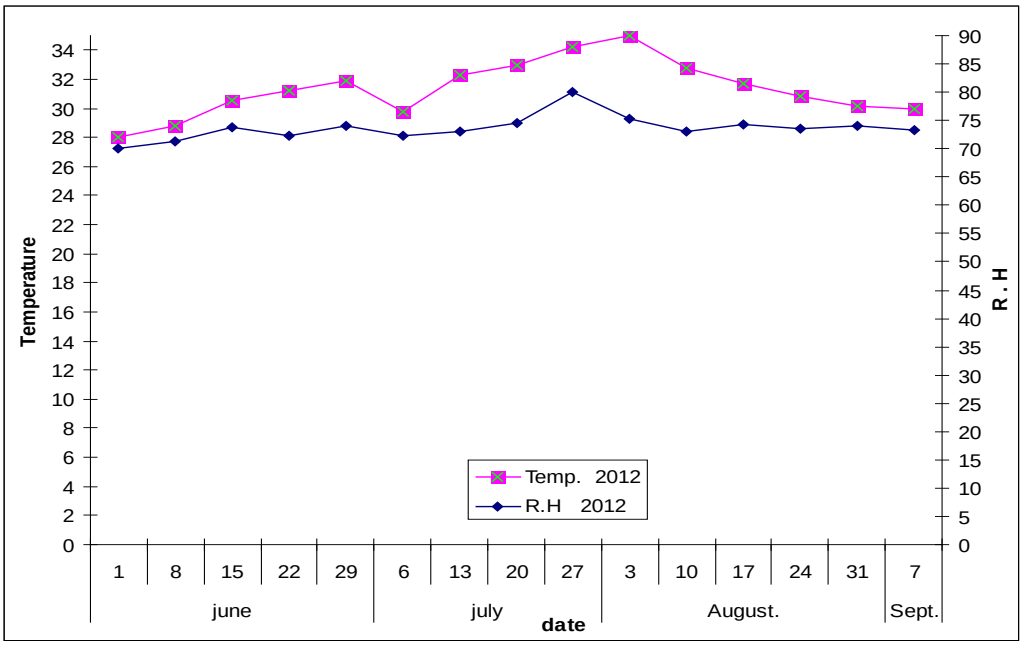

Fig (2) Weekly mean temperature (Temp.) and mean relative humidity(R.H) during scouting period (*Aphis gossypii, Bemisia . tabaci* and some associated predators) at 2012 season

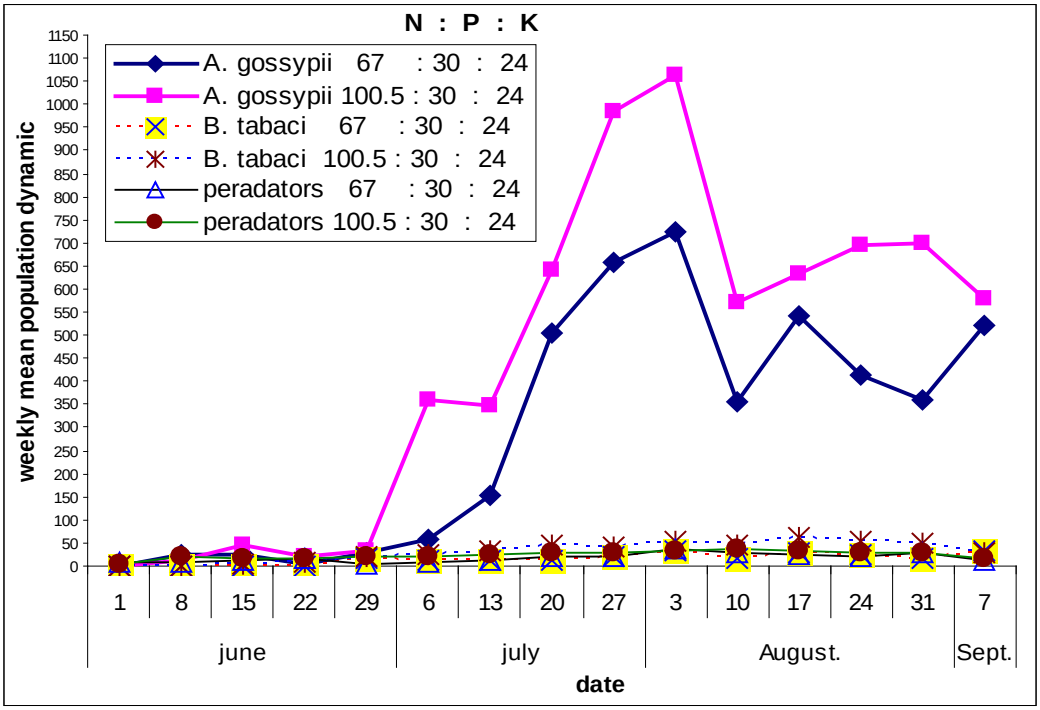

Fig (2a): weekly mean population dynamics of *Aphis gossypii, Bemisia . tabaci* and some associated predator at two (N) fertilization doses in 2012 season

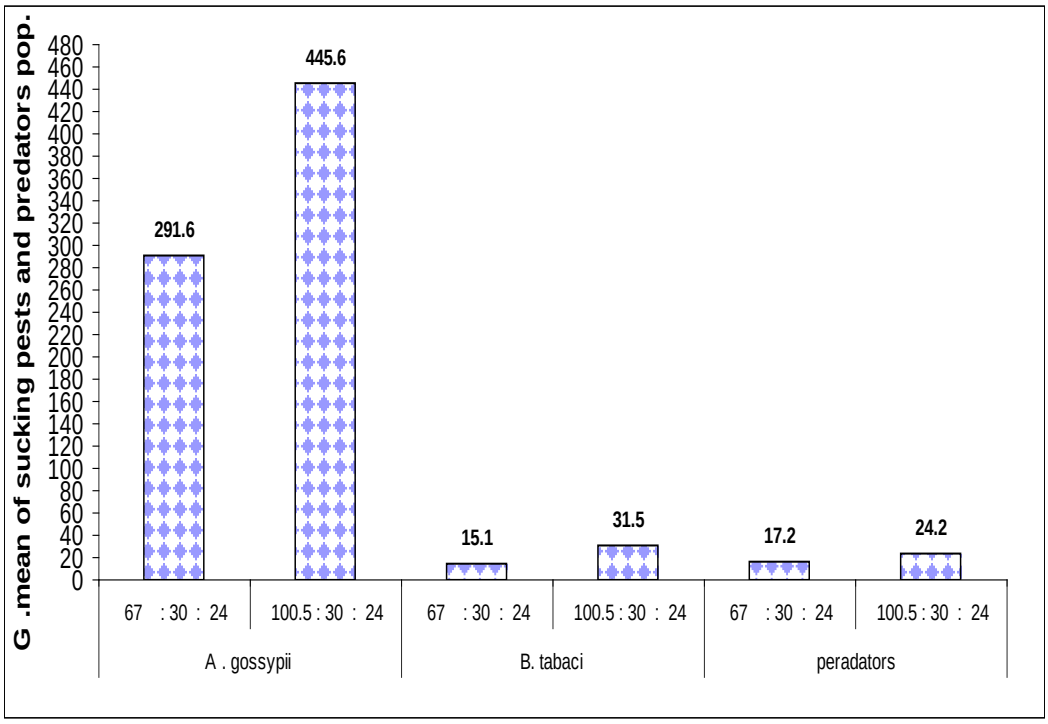

Fig (4) General mean of *Aphis gossypii* , *Bemisia tabaci* and some associated predators at two treatment (N) fertilization doses in 2012 season

From the previous results, it could be concluded that, aphids insects was observed during the 4th and 2nd week of Jun. in 2011and 2012 seasons respect. Aphid density was affected positively with fertilization doses of nitrogen. Statistical analysis showed highly significant differences between the means of aphids /100 cotton leaves for the two fertilizer treatments in both seasons. The population of aphids was maximum during mid and later stages of cotton crop or were mostly active during Jul. Aug. and Sept. according to Temp. and R.H% records, but, were more active on plants fertilized with high nitrogen dose. The highest means of aphids population (139.2 and 445. 6 insects /100 cotton leaves) in 2011 and 2012 seasons was recorded in treatment treated with high N fertilizer 1.5N:P:K while lowest means of aphids densities (73.3 and 223.9) /100 cotton leaves) was observed on cotton plants treated with N:P:K: in 2011 and 2012 seasons respect. Fig's (3 and 4).The population density of aphid was higher in 2012 than that in 2011 season, it is dependent upon of the corresponding Temp. and R.H%.

***Bemisia tabaci*:**

Data of population fluctuation of *B. tabaci* adults stages during the observation period from Jun. 1st to Sept. 2nd week in 2011 and 2012 seasons are presented in Tables (1 and 2) and illustrated in Fig. (1.1a, 2.2a and 3, 4). Results recorded in 2011 season showed that the abundances of *B. tabaci* appeared as low number (4 and 5 insects /100 leaves) on Jun. 26 and on about 6 and 7 weeks after planting in cotton plants fertilized with N:P:K and 1.5N:P:K respect. Also, the incidence of whitefly adults increased gradually to reach maximum level on Sept. 4 (25 insects /100 cotton leaves and Aug. 28 (90 adults/100 leaves) in cotton plots fertilized with N:P:K and1.5N:P:K, respect. With respect to 2012 season, the population fluctuation of *B.tabaci* adults was similar to that occurred during 2011 The results revealed that adult population appeared as 15 and 20 adults / 100 leaves on Jun. 29 in both cotton plants fertilized with N:P:K and 1.5N:P:K respect.(and on 6 and 4 weeks after planting date respect.). Adult population increased slowly and fluctuated then increased to the first of Aug, but the rate of population increased to reach its maximum peak on Sept. 7 and Aug. 17, represented by 34 and 60 adults /100 cotton leaves in cotton plots fertilized with N:P:K and 1.5N:P:K(highest N) respect.

It is clear that cotton plants treated with N:P:K ratio infested with the less mean of insects of whitefly adults (12.33 and 15.13 insects /100 leaves) than plants fertilized with 1.5N:P:K ratios which infested by higher means (30.2 and 31.53 insects /100 leaves) during the two seasons of study. Also, statistical analysis of the obtained results revealed highly significant differences between two means of infestation with adult's of whitefly in two seasons of study. Thus whitefly densities were affected positively with fertilization rates of nitrogen and the values of (Temp. and R.H %).

Associated predators:

The population fluctuation of certain predators (*Coccinella* spp., *Chrysoperla carnea* and True spiders) were scouted weekly per 20 plants to find the effect of fertilization (N) level on that previous predatory insects during 2011 and 2012 cotton crop seasons. Obtained data are shown in Tables (1and 2) and Fig's (1.1a, 2.2a, 3 and 4). The incidence of predator densities was noticed throughout the observation period in both study seasons. In 2011 season, data on predator populations

revealed that in both fertilization of study, the population densities of the certain predators were recorded three low peaks , these peaks were represented on Jun 26 , Aug .7 and Sept . 11, The insect numbers of each peak were 13, 9 and 11 insects /20 plant respect., in cotton plants treated with N:P:K fertilization and recorded 8,20 and 10 insects/20 cotton plants respect in cotton plots fertilized with 1.5N:P:K.at the same scouting date.

As for 2012 season, data in Table (2) and Fig's (2 and 2a and 4) indicated that the population of predators started to appear on the first of the scouting time Jun. 1st week (on three weeks old crop) and increased gradually up to the end of Aug., then the population decreased until the end of the season. However, three low peaks were recorded in plots fertilized with N:P:K on Jun. 22. Aug. 3 and 31 by the respective numbers of predators, of weekly means 17,36 ,and 28 individuals /20 cotton plants respect. While two peaks were observed in other cotton plots fertilized with 1.5N:P:K (highest N) as the following: Jun 8 and Aug. 10 showing a means of 20 and 36 insects / 20cotton plants respect.

Statistical analysis revealed highly significant differences in predator numbers between the normal dose of nitrogen and higher dose. Also the highest means of insects (10.13 and 24.2) in 2011 and 2012 respect. Fig's (3 and 4) were recorded in cotton plants fertilized with 1.5 N:P:K, but, the lowest means of insects (6 and 17.2 insects) in 2011 and 2012 season respect were recorded in cotton plots fertilized with N:P:K ratio. The incidence of predator populations was noticed also during in both study season but in 2012 season was more than that in 2011 season. Finally, the dose levels of nitrogen fertilizer had an important role in the population dynamics and distribution of cotton sucking insect pests and their certain associated predators.

Correlation between sucking insects and associated predators:

The correlation coefficient between the seasonal incidence of some associated predators (*Coccinella* spp, *Chrysopea* spp and True spider) with population numbers of some cotton sucking pests aphids and whitefly at two fertilization doses of nitrogen ,in combination with P and K elements were studied during two successive cotton crop seasons 2011-2012. The obtained results in season 2011 (Table 3) revealed that associated predators was insignificant positive correlation with aphids and whitefly (0.290 and 0.042) at plants fertilized with (N:P:K ratio), while in cotton plots fertilized with (1.5N:P:K) associated predators exhibited highly positive correlation with both aphid and whitefly by simple correlation r- values of 0.679 and 0.608, respect.

Table (3): The Correlation coefficient of some sucking pests, population dynamics and associated predators at two different fertilizer doses of nitrogen on cotton crop during 2011 and 2012 seasons

Season	2011		2012	
Factor	**predators**		**predators**	
Fertilizer Units / fed.	N : P : K 67 : 30 : 24	1.5 N : P : K 100.5 : 30 : 24	N : P : K 67 :30 : 24	1.5 N : P : K 100.5 : 30 : 24
Pests *A. Gossypii*	0. 290	0.679**	0.728**	0.789**
B.Tabaci (adult)	0.042	0.608**	0.500*	0.881**

*** = significant at probability ≥ 0.05**
**** = Highly significant at probability ≥ 0.01**

On the other hand, the data in table (3) regarding the correlation between aphids and whitefly population with prevailing predators in 2012 seasons concluded that predators was positive (0.728) and highly significant correlated with aphids(0.789) and whitefly (0.881) in cotton plants with fertilized (1.5N:P:K). Whereas associated predators was highly significantly positive (0.728) and significantly positive (0.500) correlated with aphids and whitefly respect in cotton plots treated with recommended dose (N:P:K).

DISCUSSION

1: Effect of fertilization treatments (two nitrogen rates) on population numbers of aphids, whitefly and some associated predators.

The obtained results showed that nitrogen rates significantly affected the preferability of sucking insects to cotton plants and their population numbers. The obtained data agree with reports of other numerous investigations. Lin *et al*. (1999) stated that build up of whitefly population was obviously higher in nitrogen fertilized cotton plants than on nitrogen lowest rates cotton plants. Increasing nitrogen application enhanced whitefly population density Bi, *et al*.,(2000). Many previous studies indicated that, cotton aphids abundance was positively correlated with application of nitrogen fertilizer, also the density of cotton aphid was positively associated with increasing levels of leaf nitrogen Rustamani, *et al*., (1999) and Cisneros and Godfrey (2001). Also, a strong positive relationship between nitrogen fertilization of cotton plants and aphid abundance in the field, but they used higher levels of N, population of sucking insects aphids and several predators were sporadically and in consistently increased by N treatments. Nevo and Coll., (2001) suggested that cotton aphids fecundity increases with increasing nitrogen fertilization. Studies of individual aphids on cucumber and cotton showed that body weight, body size, fecundity, developmental rate and population growth rate are enhanced by N fertilization. The present study is in conformity with that of Bi *et al*.

(2003) who mentioned that a positive response was observed between N application rates and the numbers of whiteflies. Miguel and Clara (2003) reported that farming practices, such as, excessive use of inorganic fertilizers can cause nutrient imbalance and lower pest resistance. Ahmed *et al*. (2007) found that the highest rates of nitrogen resulted in the highest per leaf mean abundance of jassid and whitefly. The same study concluded that also, an excessive dose of N fertilizers may produce flush green plants, which will attract high pest population. Moreover higher doses of fertilizer also affect the crop maturity and heavy attack of sucking insects. Cotton plants fertilized with N in combination with other fertilizer elements were infested with the highest population density. (El–Zahi, *et al*., 2012) .

2. The correlation coefficient between sucking insects and their certain associated predators at two nitrogen fertilization doses.

No work is available on the effect of the fertilization types and amounts on the relationship between sucking pests population with their associated predators on cotton or other crop, which were studied in our present findings. As for relationship between cotton sucking pests and associated predators the present findings generally agreed and relatively are in corroborates with that of other investigations. Nassef *et al*., (1996) concluded insignificant simple correlation coefficient between the population of certain sucking pests and the total population of their associated predators; also their correlation was generally positive. El-Naggar (2000) indicated that the true spiders play an important role in reducing the infestation ratio of cotton sucking pests field crop. Abo-Shaeshae (2001) found that the population density of some predators (*C. Carnea, Palfieril, C.Undecimpunctata, Scymnus Syriacus and Orius Spp.)* and sucking pests (aphid and whitefly) were positive significant correlation in two study seasons (1999 and 2000). The population of predator mites was positively correlated with aphids but it was negatively correlated with whitefly nymphs. While a positive correlation was recorded between predatory insects and whitefly nymphs Gamieh and El-Bassuony (2001). Taha *et al*., (2001) recorded a positive correlation coefficient was found between the whitefly with their beneficial insects. The results of our study closely agree with data of other investigators, Rathod and Bapodra (2004) reported that the Coccinellid predators showed highly significant positive correlation with population of aphids. Solangi *et al*., (2008) recorded (r = 0.563) recorded positive correlation (r=0.563) between insect predators and sucking pest population.

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تـأثير مسـتويات التسـميد النيتروجينـى لمحصـول القطـن علـى تعـداد المـن والذبابـه البيضـاء وبعـض المفترسـات المرتبطة بها

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****قسم اختبار مبيدات القطن ، معهد بحوث وقايه النباتات – سخا –كفر الشيخ**

أجريت هذة الدراسة فى حقول القطن بمركز سيدى سالم محافظة كفر الشيخ لدراسة تأثير معدلين من التسميد النيتروجينى (ن) متحدة مع الفوسفور (فو) والبوتاسيوم (بو)بنسب هى(ن : فو : بو =٦٧ :٣٠ :٢٤) ، (ن:فو :بو = ١٠٠.٥: ٣٠ :٢٤) لنباتات القطن على معدل الزيادة فى تعداد كل من المن والذبابة البيضاء وكذلك بعض المفترسات المرتبطة بها وذلك خلال موسمى نمو القطن ٢٠١١، ٢٠١٢ وكذلك دراسة مقدار الإرتباط بين الأفات والمفترسات تحت ظروف التسميد . أوضحت النتائج أن متوسط تعداد للمن والذبابة االبيضاء وصل الى أقصى حد له خلال وسط ونهاية موسم نمو المحصول (مرتبطة بالحرارة والرطوبة إرتباطا إيجابيا) . وكان متوسط التعداد لها فى المعاملة ذات التسميد النيتروجينى المرتفع (١.٥ن :فو : بو)،(٤٤٥,٦ ، ١٣٩,٢) أعلى من المعاملة ذات التسميد النتروجينى الموصى به (ن : فو :بو) (٢٩١,٦ ، ٧٣,٨) للمن والذبابه فى كلا الموسمين (أى وجود تأثير موجب للتسميد على التعداد) مع وجود فروق معنويه عالية بين متوسط التعداد فى المعاملتين لكلا الحشرتين فى الموسمين . كما دلت النتائج على حدوث نفس الاتجاه فى التأثير على التغير فى متوسط تعداد المفترسات المرتبطة (١٠.١٣، ٢٤,٢) ،(٦ ، ١٧.٢) للمعاملتين فى الموسمين على الترتيب مع وجود فروق معنوية عالية أيضا بين متوسط التعداد للمفترسات في المعاملتين .وبالنسبة لنتائج معامل الإرتباط بين الأفات والمفترسات دلت النتائج على وجود إرتباط موجب غير معنوى فى حاله النباتات المعامله بالتسميد النيتروجينى المنخفض (ن : فو : بو)، (٢٩٠, ، ٠٤٢,) للمن والذبابه على التوالى بينما حدث إرتباط موجب عالى المعنويه (٦٧٩, ،٦٠٨,) للحشرتين فى حاله المعاملة بالتسميد النتروجينى العالى (١,٥ن :فو :بو) وذلك خلال موسم ٢٠١١. بينما أشارت النتائج خلال موسم ٢٠١٢ إلى حدوث إرتباط عالى المعنوية موجب بين المفترسات المرتبطة والمن(٧٢٨, ،٧٨٩,) على مستوى كلا من معاملتى التسميد . وكان الإرتباط بين معدل التغير فى تعداد المفترسات المرتبط وتعداد الذبابة البيضاء معنوياً (٥٠٠,) فقط على مستوى التسميد النيتروجينى المنخفض(ن :فو : بو) وكان عالى المعنوية(٨٨١,) على مستوى التسميد النيتروجينى المرتفع(١,٥: فو :بو).