EFFECT OF CERTAIN CLIMATIC FACTORS AND PLANT AGE ON THE LEVEL OF INFESTATION WITH COTTON AND ONION *THRIPS TABACI* LIND ON SWEETPEA PLANTS IN DIFFERENT PLANTING DATES

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Abstract

To study the effect of certain climatic factors and plant age on the infestation with cotton thrips, *Thrips tabaci* Lind. on sweetpea plants (Snow wind cultivar) in four planting dates of sweetpea seeds, Oct.,15th, Oct.,29th, Nov.,12th and Nov.,26th were evaluated during 2004- 2005 and 2005- 2006 seasons at Toukh district, Qalyoubia Governorate. The degree of infestation by *T. tabaci* increased by delaying planting date, as sweetpea plants cultivated in the earliest planting date were attacked by the fewest numbers, while the plants of the latest planting date were more liable to insect infestation.

The plant ages could be divided into three periods, the first from planting till 45 days later infested by low numbers of thrips, the second one, from 45 to 90 days attacked by the highest numbers of insects and the third period from 90 to the end of the growing season which infested by the lowest numbers of *T. tabaci*. Regarding the relationship between the infestation of *T. tabaci* in four tested planting dates and plant age, the thrips population density increased during plant development and reached a peak in the second period of plant.

The thrips populations were negatively correlated with minimum temperature and negatively or positively with maximum temperature and mean of relative humidity depending on the planting date.

The plant ages were more effective on thrips population when comparing with the role of certain climatic factors, as the explained variance were 60.13, 88.10, 85.39 and 89.24% for the first season and 77.00, 80.78, 70.87 and 76.90% for the second season in the four tested planting dates, respectively. While, the three tested climatic factors affected by 40.55, 35.70, 10.16 and 27.70% for first season and 63.24, 50.16, 44.95 and 28.78% for the second season in four planting dates, respectively.

INTRODUCTION

Sweetpea plants, *Pisum sativum* var. *macrocarbon* is considered a new important vegetable crop in Egypt for local market and exportation to foreign countries. According to the report of the Department of Agricultural Economic, Ministry of Agriculture, the cultivated area reached about 55955 feddan in 2005 producing about 236263 tons in many Governorate especially in the new reclaimed area.

Thrips tabaci Lind. is an important pest of sweetpea plants, it can cause damage to leaves, flower and sometimes to the developing fruits. Damage to pods consisted of either small raised bumps or scars appearing as silver mottling resulting fruit malformation (Shelton and North 1987).

Thrips tabaci individuals transmit the tomato spotted wilt virus disease to several crop (Armstrong *et al.* 2001, Nagaraja *et al.* 2005 and Reitz 2005).

Many researchers on the role of planting dates, climatic factors and plant age on the infestation with *T. tabaci* infesting leguminous plants has been done previously, (Agostini and Muruaga 1990, Shetgar *et al.* 1994, Wnuk and Wiech 1996, Jarosik *et al.* 1997, Panickar and Patel 2001, Salman and Abou-Elhagag 2001, Booij 2003, Efil 2003, Ghosh *et al.* 2005, Sahu *et al.* 2005 and Emam *et al.* 2006).

MATERIALS AND METHODS

This study was conducted throughout two successive seasons, 2004-2005 and 2005- 2006 at Toukh district, Qalyoubia Governorate. Seeds of sweetpea plants, Snow wind cultivar, were sown in four different planting dates at 15 days intervals, Oct.,15, Oct.,29, Nov.,12 and Nov.,26. Fertilization, irrigation and pruning were conducted according to normal practices and insecticides were entirely avoided.

In both two seasons, the experimental area was divided into 16 plots (each plot was $20m^2$). Each planting date was represented by four plots. All plots were arranged in a complete block design. Sampling of sweetpea plants started 30 days after sowing and were taken weekly until the end of experiment. In each sampling date, twenty leaflets were picked randomly per plot, examined directly in the field and kept in tight closed paper bags and transported to laboratory where all samples were thoroughly examined by the aid of stereomicroscope to count mean number of the adults and nymphs of *T. tabaci* per leaflet.

The mean number of thrips between different planting dates were compared statistically. Levels of certain climatic factors (the daily maximum & minimum temperature and relative humidity) and three periods of plant age (first from planting till 45 days later, the second from 45 to 90 days and the third one from 90 to the end of the growing season) were also recorded for each planting date to determine the relationship between these two factors and infestation of *T. tabaci* on sweetpea plants. The simple correlation and partial regression were adopted to show the average rate of changes in population due to changes in the two mentioned factors. Data were analyzed according to SAS program (1988) which was run under WIN computer system and mean separation was conducted by using Duncan's multiple rang test in this program.

RESULTS AND DISCUSSION

1-Effect of planting dates

Results in Tables (1&2) revealed that the population density of *T. tabaci* (nymphs + adults) on sweetpea plants differed significantly according to the sowing date during the two successive seasons 2004-2005 and 2005-2006. In the first season, the population density of *T. tabaci* individuals increased by delaying planting date. The sweetpea plants were sown in the earliest planting date (Oct.,15) infested significantly by the lowest mean number of *T. tabaci* (4.86 individuals / leaflet) followed insignificantly in the second date (Oct., 29) which infested with 8.13 individuals / leaflet. On the contrary, the plants of the last planting date (Nov., 26) harbored highest numbers of *T. tabaci* followed insignificantly by the third planting date (Nov., 12), as the corresponding mean numbers were 20.61 and 16.61 individuals / leaflet, respectively.

In the second season, results took the same trend as obtained in the first season despite the infestation rates by *T. tabaci* were lower than those recorded in the first season. The seasonal mean numbers of *T. tabaci* found in this season were 4.35, 5.09, 10.83 and 13.93 individuals / leaflet for the four tested planting dates, respectively. Statistically, the first two planting dates (Oct.,15 and Oct.,29) were insignificantly differed from each other and being significantly lower than the two latest planting dates (Nov.,12 and Nov.,26).

The obtained data in the two studied seasons showed clearly that planting of sweetpea seeds in the earliest planting date (Oct.,15) escaped mostly from the infestation of *T. tabaci*.

The present results agree with those of Shetgar *et al.* (1994) on groundnut in India, Wnuk and Wiech (1996) on pea plants (*Pisum sativum* var. *arvense*) in Poland, Salman and Abou-Elhagag (2001) on faba bean in Egypt, Sahu *et al.* (2005) on linseed crop in India and Emam *et al.* (2006) on sweetpea plants (*P. sativum* var. *macrocarbon*), as all reported that there was significantly less thrips population on plants sown in the earliest planting date, while those sown in the latest planting date had the highest thrips population, but it contrast with Efil (2003) in Turkey who stated that the late sowing date of cotton resulted in a very low *T. tabaci* population.

Table1. Mean number of *Thrips tabaci* / leaflet on sweetpea plants in differnt planting dates during 2004 -2005 season at Qalubiya Governorate.

Inspection date	Planting date				Climatic factors		
	Oct.,15	Oct., 29	Nov., 12	Nov., 26	Max. Temp.	Min. Temp.	R.H.
Nov, 15	2.10				30.59	18.13	55.57
22	3.53				25.17	15.94	56.71
29	3.60	2.47			20.20	10.40	56.71
Dec., 6	6.60	3.23			23.94	11.37	58.14
13	3.67	6.53	3.87		22.67	11.61	59.29
19	4.20	5.47	7.33		20.00	11.00	57.14
26	9.63	8.60	11.43	8.97	21.49	9.86	58.14
Jan., 3	7.03	8.63	15.97	14.73	23.63	9.43	55.00
10	9.73	10.77	15.80	14.53	19.17	8.69	67.29
17	7.13	12.27	21.37	27.23	19.66	11.26	66.71
23	6.30	17.30	30.77	30.13	19.00	9.96	61.71
30	2.43	14.00	26.97	29.10	21.01	9.04	57.29
Feb., 7	1.13	9.37	19.67	26.43	18.74	9.83	52.86
14	0.90	10.33	20.43	27.83	15.81	5.80	58.71
21		3.97	26.07	28.87	24.11	10.40	46.57
28		0.87	17.43	24.17	22.43	9.06	55.29
Mar., 7			10.00	20.60	24.77	13.26	47.00
14			5.43	11.80	19.23	9.17	57.14
21				14.77	21.60	7.97	55.86
28				9.33	22.04	9.39	55.86
Mean±S.E.	4.86^{b} ±0.78	8.13^{b}±1.25	16.61^{a}±2.21	20.61^{a}±2.12	21.76±0.71	10.58±0.61	56.95±1.11
F	21.54						
L.S.D.	4.11						

First period of plant age from sowing till 45 days later.
Second period of plant age from 45 days till 90 days.
Third period of plant age from 90 days to the end of growing season.

Table 2. Mean number of *Thrips tabaci* / leaflet on sweetpea plants in different planting dates during 2005 -2006 season at Qalubiya Governorate.

Inspection date	Planting date				Climatic factors		
	Oct.,15	Oct., 29	Nov., 12	Nov., 26	Max. Temp.	Min. Temp.	R.H.
Nov., 15	1.40				22.83	12.83	61.00
22	2.60				22.56	11.86	60.57
29	1.73	1.37			26.39	12.13	58.86
Dec., 6	2.37	2.07			25.20	15.76	65.71
13	4.20	1.47	2.67		23.24	13.29	70.57
19	3.43	2.33	5.13		22.09	11.93	61.14
26	6.30	3.83	5.60	3.87	19.01	9.43	64.57
Jan., 3	8.83	5.23	9.30	10.37	21.49	9.66	64.71
10	8.83	8.67	14.57	12.07	18.49	8.43	61.29
17	10.43	7.73	10.27	15.53	16.09	6.11	61.43
23	4.40	12.30	16.37	16.47	19.67	8.07	58.86
30	3.20	8.37	12.50	17.30	17.46	6.63	59.86
Feb., 7	2.80	8.30	24.77	18.17	21.14	8.61	56.00
14	0.43	5.13	20.93	27.97	19.54	9.86	54.14
21		2.10	9.57	23.03	18.34	7.83	63.14
28		2.37	9.13	12.93	21.21	11.50	61.86
Mar., 7			7.23	9.57	24.23	10.54	58.57
14			3.57	13.50	21.24	10.76	51.29
21				8.80	23.09	10.11	53.43
28				5.37	25.11	11.71	48.43
Mean±S.E.	4.35^{b}±0.82	5.09^{b}±0.92	10.83^{a}±1.73	13.93^{a}±1.75	21.42±0.62	10.35±0.53	59.77±1.16
F	12.03						
L.S.D.	3.45						

First period of plant age from sowing till 45 days later.
Second period of plant age from 45 days till 90 days.
Third period of plant age from 90 days to the end of growing season.

2-Effect of certain climatic factors and plant age stages with cotton thrips numbers on sweetpea leaves.

Tables (3 and 4) show the correlation coefficient factor values between the population density of cotton thrips, *T. tabaci* obtained from the four tested planting dates and mean of maximum & minimum temperature and relative humidity in first side and three periods (stages) of plant ages of sweetpea plants (first stage from planting to 45 days, the second from 45 to 90 days and the third period from 90 to the end of season) in the other one.

In first season, mean number of *T. tabaci* obtained from sweetpea plants in the first date was positively associated with maximum temperature and relative humidity, as the (r) values were (0.53 and 0.48, respectively), while daily rang of minimum temperature showed a negative effect (r = -0.41), it means that the population density of *T. tabaci* during the first planting date increased by increasing the maximum temperature and relative humidity. Correlations for maximum & minimum temperature and relative humidity were negative for the population density of *T. tabaci* in the three other planting dates (Oct.,29, Nov.,12 and Nov., 26) except for relative humidity in the second planting date and minimum temperature in the fourth planting date, (r = 0.31 and 0.04, respectively).

With respect to the effect of plant age on the occurrence of *T. tabaci* on sweetpea leaves during the previously mentioned four planting dates, data clearing that, the population densities of this pest affected by the plant age especially during the first and the second one more than the third period. The relation was positively weak between the first plant age and the population in the first planting date, this relation conversed by delaying the planting date 15 days later, On the other hand, delaying the planting date till Nov. showed a positively significant effect of the first plant age on the infestation of *T. tabaci* as the corresponding r values were 0.13, -0.61, 0.99 and 0.91 for the four planting dates, respectively. Almost the same observation were confirmed throughout the second planting stage, as this stage was positively non effective during the first three planting dates despite of being higher of in case of Oct, 29th (r= 0.16, 0.50 and 0.03). For the last planting date, the degree of infestation decreased by growing of the plant age from the first to the 2nd stage (r = -0.72). Regarding the third plant period (where the plants in the flowering and fruiting stage) the relationship were negative in the first three tested planting dates and positive in the last one (Nov., 26) (r = -0.01,-0.03,-0.02 and 0.02, respectively). Concerning the changes occurred in the population of *T. tabaci* due to the changes in three climatic factors at the four tested planting dates, the calculated explained variance (E.V.%) Were 40.55, 35.70, 10.16 and 27.70%, respectively, while in case of

Table 3. Effect of cerain climatic factors and plant age (stages) on the population of *T. tabaci* on sweetpea plants during 2004-2005 seasons at Qalubyia Governorate.

Planting dates	Seasonal mean number of *T. tabaci*/leaflet	Correlation coefficient values (r)								E.V.3%
		Climatic factors				Plant age (stages)				
		Max. Temp.	Min. Temp.	Mean R.H.	E.V.1%	First	Second	Third	E.V.2%	
Oct.,15	4.86	0.53	-0.41	0.48	40.55	0.13	0.16	-0.01	60.13	68.27
Oct., 29	8.13	-0.65	-0.18	0.31	35.70	-0.61	0.50	-0.03	88.10	90.02
Nov., 12	16.61	-0.01	-0.32	-0.06	10.16	0.99**	0.03	-0.02	85.39	87.23
Nov., 26	20.61	-0.23	0.04	-0.06	27.70	0.91**	-0.72	0.02	89.24	90.60

Table 4. Effect of cerain climatic factors and plant age (stages) on the population of *T. tabaci* on sweetpea plants during 2005-2006 seasons at Qalubyia Governorate.

Planting dates	Seasonal mean number of *T. tabaci*/leaflet	Correlation coefficient values (r)								E.V.3%
		Climatic factors				Plant age (stages)				
		Max. Temp.	Min. Temp.	Mean R.H.	E.V.1%	First	Second	Third	E.V.2%	
Oct.,15	4.35	0.03	-91**	0.51	63.24	-0.87*	0.38	-0.02	77.00	79.13
Oct., 29	5.09	0.02	-0.83*	-0.12	50.16	0.16	0.45	-0.03	80.78	83.08
Nov., 12	10.83	0.35	-0.53	-0.21	44.95	0.95**	0.31	-0.03	70.87	75.04
Nov., 26	13.93	-0.78	-0.42	-0.50	28.78	0.97**	0.09	0.02	76.90	87.05

E.V. = Explained variance

the three planting period, the corresponding values were 60.13, 88.10, 85.39 and 89.24% for the four planting dates, respectively. These values reflected that the combined role of the climatic factors in influencing of the activity and abundance of *T. tabaci* on sweetpea leaves was lower than the role of the three planting stages, beside that, their role decreased by delaying the planting date opposing to the plant age which its role increased by delaying the planting date. For the combined effect of the tested climatic factors and plant age altogether the results indicated that there were other combined factors affecting the activity of *T. tabaci* throughout the four planting dates especially for the first and the third planting dates as E.V. % values were 68.27, 87.23%, respectively, while the opposite values for the 2nd and 4th dates were 90.02 and 90.60%, respectively.

In the second season, the mean numbers of *T. tabaci* in the four tested planting dates were varied in relation to the climatic factors and plant age. The calculated correlation coefficient values indicated insignificant positive with maximum temperature in the first three planting date and with relative humidity in the first planting date, (r = 0.03, 0.02, 0.35 and 0.51, respectively), i.e., the population density of *T. tabaci* increased by increasing the maximum temperature and relative humidity in the previously mentioned planting dates. On the contrary, the minimum temperature showed negative highly significant effect in the two first planting dates (r = -0.91 and -0.83) and insignificant negative in the third and fourth planting dates (r = -0.53 and -0.42) and relative humidity in the three latest planting dates (r = -0.12, -0.21 and -0.50, respectively). These negative relationship indicated that, the abundance of thrips was decreased as these factors increased.

The effect of plant age on the occurrence of thrips on sweetpea plants varied from planting date to another, as for the 1st period of plant age the relation was negatively significant during the first planting date (r= -0.87), then this relation was positively weak in case of the second planting date (r = 0.16). Meanwhile, the population increased significantly by increasing the plant age in its first period during the third and fourth planting date, as the calculated r values were 0.95 and 0.97, respectively. The second period of the plant age showed a non-significant positive effect on the infestation rates of thrips (r= 0.38, 0.45, 0.31 and 0.09 for all planting dates, respectively). With respect to the third period of plant age, the correlation coefficient values indicated a non-significant negatively relationship with the population density of thrips throughout the first three planting dates (r = -0.02, -0.03 and -0.03, respectively) and a positive during the fourth planting date (0.02).

The combined role of the three tested climatic factors showed that their effect on the building up of the target pest decreased by delaying the sowing date, where

the explained variance were 63.24, 50.16, 44.95 and 28.78% for the four sowing dates, respectively. While the role of the three periods of the plant age (stags) showed more than 70% for the four planting dates, respectively, i.e., the plant age is an effective factors more than the climatic factors in the building up of the thrips on sweetpea plants when its seeds planted from mid of October to the end of November. By regarding to the role of the climatic factors and the plant age altogether, the E.V. % values were 79.13, 83.08, 75.04 and 87.05% for the tested four planting dates, respectively. However these results indicated that there were other factors effecting on the activity of this pest.

The above mentioned results of the effect of climatic factors and plant age on the population density of *Thrips tabaci* agree with obtained by several authors in different countries. Agostini and Muruaga (1990) in Argentina and Jarosik *et al.* (1997) in Czech Republic stated that the population density of thrips increased with time age of common bean and cucumber plants and reached to peak during the vegetative period before fruiting. Plants were damaged from emergence until pod information. Booij (2003) in Netherlands stated that the population dynamics of *T. tabaci* on seven crops dose not only depend on the weather factors and the presence of the most susceptible crop but is significantly affected by the interplay of different sources at small and large scale. Ghosh *et al.* (2005) in India mentioned that the maximum temperature and mean of relative humidity had a positive role on the occurrence of *Thrips tabaci* on sweetpea leaves, but disagree in case of the effect of minimum temperature as he reviewed that it had significantly positive effect on thrips population.

In conclusion, the planting of sweetpea seeds in the earliest planting date in mid Oct. escaped mostly from infestation by cotton thrips, *T. tabaci*, individuals. The effect of the climatic factors on the population and abundance of *T. tabaci* on sweetpea leaves was lower than the effect of the three planting periods as the effect of plant age on the occurrence of thrips on sweetpea plants varied from planting date to another. Also, the population increased significantly by increasing the plant age in first period. The combined role of the three tested climatic factors showed that their effect on the building up of the target pest decreased by delaying the sowing date, opposing to the plant age which its role increased by delaying the planting date. The plant age is an effective factor more than the climatic factors in the building up thrips population on sweetpea plants when seeds sown from mid October to the end of November.

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تأثير بعض العوامل الجوية وعمر النبات على مستوى الإصابة بتربس القطن والبصل الذي يصيب نباتات البسلة السكرية في مواعيد زراعة مختلفة

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية- الدقي- جيزة

أجريت تجربة حقلية في مركز طوخ محافظة القليوبية خلال موسمين متعاقبين(٢٠٠٤-٢٠٠٥) و(٢٠٠٥-٢٠٠٦) لدراسة تأثير بعض العوامل الجوية ومراحل نمو النبات على الكثافة العددية لحشرة تربس القطن التي تصيب نباتات البسلة السكرية صنف سنووند المزروعة في أربعة مواعيد زراعة مختلفة هي ١٥ أكتوبر ، ٢٩ أكتوبر، ١٢ نوفمبر ، ٢٦ نوفمبر وقد أوضحت النتائج أن تأخير ميعاد الزراعة كان له تأثير معنوي في زيادة الإصابة حيث كان متوسط الأعداد ٨,١٣، ٤,٨٦، ١٦,٦١، ٢٠,٦١ فرد/ وريقة خلال الموسم الأول و ٤,٣٥، ٥,٠٩، ١٠,٨٣و ١٣,٩٣ فرد / وريقة خلال الموسم الثاني للمواعيد الأربعة على الترتيب .

كما أوضحت النتائج أيضا أن الإصابة بحشرة التربس خلال الأربعة مواعيد قد تأثرت بالعوامل الجوية ومراحل عمر النبات خلال موسمي الدراسة. أثبتت نتائج الموسم الأول أن التعداد أرتبط موجبا مع درجات الحرارة العظمى خلال الميعاد الأول ومع متوسط الرطوبة النسبية خلال الميعادين الأول والثاني و مع درجات الحرارة الصغرى خلال الميعاد الرابع و هذا يدل على زيادة التعداد خلال هذه المواعيد بزيادة العوامل السابقة في حين أن الارتباط كان سالبا مع باقي العوامل الجوية المدروسة .

أما بالنسبة لتأثير عمر النبات فقد بينت النتائج أن التعداد أرتبط ارتباطا موجبا ومعنويا مع النباتات في مرحلة النمو الأول (منذ الزراعة حتى ٤٥ يوم) خلال الميعادين الثالث والرابع بينما أرتبط التعداد ارتباطا موجبا مع النباتات في المرحلة الثانية من النمو (منذ ٤٥ يوم حتى ٩٠ يوم بعد الزراعة) خلال الثلاث مواعيد الأولى في حين أنه الارتباط كان سالبا مع النباتات في مرحلة النمو الأخيرة (من ٩٠ يوم بعد الزراعة و حتى نهاية الموسم).

أظهرت نتائج الموسم الثانى أن تعداد الحشرة أرتبط ارتباطا موجبا مع درجات الحرارة القصوى خلال الثلاث مواعيد الأولى وسالبا مع باقي العوامل الجوية في حين أنه كان سالبا ومعنويا مع درجات الحرارة الصغرى خلال الميعادين الأول والثاني. أما من ناحية تأثير عمر النبات فقد أشارت النتائج أن أعداد التربس قد ارتبطت ارتباطا سالبا ومعنويا مع نباتات الميعاد الأول في مرحلة النمو الأولى و على العكس من ذلك فقد أرتبط التعداد ارتباطا موجبا ومعنويا مع نباتات الميعاد الثالث والرابع في نفس المرحلة بينما ارتبطت أعداد التربس ارتباطا موجبا ومعنويا مع عمر نباتات البسلة السكرية في مرحلة النمو الثانية وارتباطا سالبا في مرحلة النمو الأخيرة.

ومن النتائج المتحصل عليها يتضح أن إصابة نباتات البسلة السكرية بحشرة التربس قد تأثرت تأثيرا واضحا بكل من العوامل الجوية والمراحل المختلفة لنمو النبات خلال موسمي الدراسة ولكن عمر النبات كان الأكثر تأثرا في إصابة نباتات البسلة السكرية بحشرة التربس حيث أنه بدراسة

التأثير المتداخل لدرجات الحرارة العظمى والصغرى والرطوبة النسبية معا على تعداد الحشرة وجد أنهما قد أثروا بنسبة ٤٠,٥٥، ٣٥,٧٠ ، ١٠,١٦ ، ٢٧,٧٠ في الموسم الأول و ٦٣,٢٤ ،٥٠,١٦ ، ٤٤,٩٥ و ٢٨,٧٨ % في الموسم الثاني للمواعيد الأربعة على الترتيب في حين أن مراحل النمو المختلفة للنبات قد أثرت في التعداد بنسبة ٦٠,١٣ ، ٨٨,١٠ ، ٨٥,٣٩ و ٨٩,٢٤ % خلال الموسم الأول و ٧٧,٠٠ ، ٨٠,٧٨، ٧٠,٨٧ و ٧٦,٩٠ % للموسم الثاني للمواعيد الأربعة على الترتيب .

وتؤكد نتائج الموسمين أن الإصابة بحشرة التربس على نباتات البسلة السكرية بلغت ذروتها خلال مرحلة النمو الثانية و هي الفترة التي يزيد فيها النمو الخضري للنباتات.

أي أن عمر النبات يلعب الدور الأكبر في إصابة نباتات البسلة السكرية بحشرة التربس وبدراسة تأثير العاملين معا على الإصابة بالتربس أشارت النتائج أنهما قد أثرا في التعداد بنسبة ٦٨,٢٧ ، ٩٠,٠٢، ٨٧,٢٣ و ٩٠,٦٠% خلال الموسم الأول و ٧٩,١٣، ٨٣,٠٨، ٧٥,٠٤ و ٨٧,٠٥% خلال الموسم الثاني مما يؤكد أنه توجد عوامل أخرى تؤثر في تعداد التربس يجب دراستها.