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Evaluation the Role of Intercropping Culture in Protection of Potato Plants under Fruit Trees Against Some Sucking Insect Pests and its Relation with Productivity

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Abstract: Field experiments were conducted In winter season to study the effectiveness of integration of sticky color traps with intercropping of potato varieties (Spunta& NikolaVars) with garlic plants under fruit trees (Peach , Pear and Citrus) to suppress the insect infestation with the most serious sap sucking insects such as leafhoppers, *(Empoasca discipiens* Paoli ,Cotton and tomato white fly,*Bemisia tabaci*) Gen and green peach aphid, *Myzus persicae* Sulzer attacking potatoes as the most economic crop and its relationship with productivity.The experiments has been applied on a private farm at Noubariya provens ,Egypt .

The results of field observation (out the garden of fruit trees) showed that intercropping culture for both Nikola and Spunta varieties with garlic plants was found to have lower insect infestation with *B.tabaci, M.persicae* and *E.discipiens* than those cultivated alone.Regarding cultivation under Peach trees ,there is no significant difference between the average number of counted insects caught by sticky traps neither in individual culture of Nikola variety (f = 3.88), nor in mixed culture (f = 0.20 and T = 1.78). The same trend was recorded with Spunta variety in each of single and mixing culture under citrus,trees(f=3.100&1.026),respectively.

Highly significant difference between the average number of captured aphids in the field of Spunta and Nikola varieties mixed with garlic plants (F=6.81& 7.35),and between the average number of *B. tabaci* occurred on individually cultivated of Nikola variety(f = 14.23), while the difference was significant in intercropped with garlic under fruit trees(f = 3.61) .

Both potato varieties (Spunta & Nikola) cultivated under citrus and pear trees were higher productivity than those cultivated under Peach trees.The average of net productivity per acer of spunta variety more than the variety of Nikola.The present results illustrated that the Garlic plants has potential effect as a repellent tool against piercing sucking insects that attack potato plants and the integration between the colored sticky traps and intercropping culture of potatoes with Garlic plants under citrus and pear trees leads to suppression of insect infestation, hence increase in net productivity of perfect tubers of potatoes per acre and increase income of farmers.

Key words: Potato varieties (Spunta & Nikola).Piercing sucking insect, intercropping culture, the sticky traps, Fruit trees and productivity.

1. Introduction

Potato, *Solanum tuberosum* L represents an important part of vegetable production and considered very important in agricultural crops. Potato as an economic crop has been attacked by several insect pests.Aphids are among the most destructive insect pests on cultivated plants in the temperate regions (5, 17) as a vector for more than 110 plant viruses and the green peach aphid *Myzus persicae* is responsible for some leaf curl of cherry trees (12).

Bemisia tabaci (Gen.), a common insect feeding on plants.The flight ability of whitefly enables them to search for food quickly. Thus could encourage whitefly to reproduce in great numbers and subsequently cause severe infestation in the fields and it has caused problems to the crop as a result of direct feeding damage and

indirect damage by acting as a vector for several viral plant pathogens such as gemini viruses and clostero viruses (1, 8, 6 and 15).

Many researchers gave attention to piercing sucking insects.(22,23) who investigated sucking insect pests and reported that *Myzus persicae* (Suzler), *Bemisia tabaci* (Genn.)And *Empoasca discipiens*(Paoli) attacked of potato plants just after the first appearance of seedlings until harvesting and storing dates .Chemical insecticides may protect the potato crop, but its chemical residues may leave hazardous effects in potato tubers, hence, human harm full besides contaminate the agro-ecosystem. Repeated use of pesticides has led to pest resistance to pesticides, pest resurgence, pesticide ubstitution and lethal effects on non-target organisms including human as well as environmental pollution (18).Adding to the problem is the fact that the peach aphid has proved to be resistant to various insecticides; there is a need to shift emphasis on biological control agents and softer chemicals (19).

Moreover, studies performed by (9) and (4) have demonstrated the insecticidal properties of chemicals derived from plants that are active against specific target species, biodegradable to non toxic products and potentially suitable for use in integrated management programs.The toxicity and repellency of aqueous extracts of medicinal plants known to have medicinal activity, were investigated against the sweet potato white-fly, *B. tabaci* (10 and 27).

Due to these limitations, there was need to find alternative control measures with different modes of action that would be effective, user and environment friendly. It was found that whiteflies are attracted by the color yellow, so yellow sticky recommends "an integrated program that focuses on prevention and relies on cultural(2).The USDA and biological control methods when possible, While an initial pesticide application may be necessary to control heavy infestations.

Recently, most of researches have been concentrated on the major pests attacking potato crop. (21) mentioned that aphids are sap-feeding plant pests of great agricultural importance, which this species affect directly or indirectly plant growth and crop yield.There are many plant extracts and plant products that are eco-friendly and control aphids as effectively as chemical insecticides. (25) suggested use of neem products and lantana products to protect plants against aphids (4).

The present work was carried out to explore efficiency of intercropping culture and sticky traps in suppressing the population fluctuation of some sucking insect pests such as cotton white fly,*Bemisia tabaci* ,Green Peach aphid ,*Myzus persicae* and Jassids(Leaf hoppers),*E. discipiens* Paoli in different cultivations of potato plants (Nikola & Spunta varieties). An environmental factor such as temperature, relative humidity and wind speed are of great value for planning IPM programs for controlling sucking insect pests infesting potato plants in the field.

2. Materials and methods

2.1. The field experiment:

The field experiment were carried out at the experimental farm (Gardin City),ELNoubariya Province ,Alexandria Desert Road ,EL Beheera Governorate Egypt .Experimental field has been allocated to plots of land (a half acre/plot) for each varieties of tested potatoes (Spunta &Nikola) .The varieties of potatoes has been cultivated in the period of winter season as it has been growing quarter of an acre potatoes individually and as well as a quarter acre mixed with garlic plants .The experiment was repeated in the same space embedded in the empty spaces between the trees in each of the garden of peach, pear and citrus .

Primarily, this study focused on the population and distribution of some sucking insect pests such whitefly *,B,tabaci* , The green peach phids *Myzus persicae* and leafhoppers *Empoasca discipline* to determine the population density and distribution of sucking insects on the plants of potato varieties in open field and under fruit trees .The distribution patterns of sucking insects within and between plants of potato varieties were observed for over cropping season. Most estimated populations of sucking insects are adult stages which are easier to count .Five plants were randomly tested per sector. Five leaves were randomly investigated per plant. The tested leaves of potato plants were taken from each of the plant strata namely the upper, middle, and lower, representing various stages and distribution of leaves on the plants.

Field observation was carried out weekly until the end of the harvesting stage. Means of weekly observation of insects infesting plants of treated potato varieties were determined and compared to the control plants.

2.2. The sticky traps:

The sticky traps have been laid in the site of experiment (one colored traps per one sector). The height of the painted strip on the top of the plants about 15 cm. The traps were randomly distributed in the areas that planted individually as well as planted mixed with garlic plants among the fruit trees in the garden of peach, Pear and Citrus and in open field. Weekly counting of catches insect to determine the count of attracted insects to the sticky traps. Three circles (diameter 5 cm) on each sticky strip and the number of adult insects (aphids, Jassid and whitefly) in each circle were recorded as an average number of insect in each collection. With regard to assessing the level of insect infestation on the leaves of potato plants have been examined ,five plants in each square (4x4m) were randomly chosen to enumerate the number of insects on the 5 leaves in each plant with a parallel examination of sticky colored traps .

The activity of sucking insects throughout months of the season (2013-2014) on varieties of Nikola and Spunta potato plants was recorded.The seasonal average of the occurred insects has been estimated on the leaves of potato plants during the winter planting season. As the counting was estimated to the insect caught by the sticky color traps in each variety of potato (single & mixed).

2.3. Economic valuation:

It also has been estimated overall productivity of the acre of potato tubers as well as losses and net production in accordance of the following equations:

1. %Aver. Weight Loss (because the insects) =Amount of weight of tubers damaged potato var. /Total weight of potato production x 100.
2. % Aver. Weight losses due to harvesting machine (kg) =Amount of weight loss tubers in potato products /Total weight of the potato product x 100.
3. Aver .total loss =Aver .waste by insects+ Aver .mechanical losses.
4. Aver.net production of non infested potato (kg)/acre=Total weight of potato production – total loss.

2.4. Statistical analysis:

The data were subjected to statistical analysis using ANOVA (SAS Programme), (24). and significantly different means ($p<0.05$) were separated using Duncan Multiple Range Test (DMRT) at 5% probability .

3. Results

3.1. under Peach trees

3.2. Field observations

The results of field observations recorded in the table (1) show that the average number of piercing sucking insects (aphid-Jassids-whitefly) located on the leaves of individual potato plants (Spunta var.) with 4.58±1.7insect / leaf higher than the population of insects occurred on mixed potato plants with garlic plants (2.67±1.1 insect / leaf .There is no significant difference between the average number of piercing sucking insects existing on individual potato plants ($f = 3.44$) and the same trend has been achieved in intercropped potatoes with garlic ($f = 2.58$).

Concerning Nikola variety, it was found that individual cultivation of the potato plants (Nikola variety) was more susceptible to the sucking insects (aphids-whitefly- Jassids) with an average of 3.08± 0.76 insect / leaf more than those potatoes mixed with garlic plants (2.00± 0.66 insect / leaf) .There is no significant difference between the average number of insects existing on individual potato plants($f = 0.86$), as well as the mixed with garlic plants .

3.3. Sticky traps:

Regarding Sticky traps: The results obtained from sticky traps show that garlic's role as a repellent tool against sucking insects that attack potato plants. In the case of potatoes (Spunta var.) the average number of attracted insects was 9.92± 4.23 insect / trap higher than the average number of insects(6.25±3.20 insect / trap) caught by traps in the field intercropped potato with the garlic plants .This confirms that garlic's role in the

expulsion of sucking insects attacking the potato plants .The results of Nikola var.a obtained in table(1) showed that the average number of sucking insects was 7.00± 1.98 insect / trap caught by sticky traps in the field of individual Nikola var.higher than those insects in the field of mixed potato plants (5.92± 0.52 insect / trap) .There is no significant difference between the average number of insects neither those caught by sticky traps in individual culture of Nikola variety(f = 3.88), nor in the field of mixed Nikola var. (f = 0.20).

The results of statistical the analysis using Test-T cleared that there is significant difference between the mean number of insects attacking Spunta variety cultivated individually and the average number of insects attacking intercropped Spunta var. with garlic plants (T = 2.353)While no significant difference was recorded between the mean number of the group of sucking insects caught by sticky traps in individual cultivation of Spunta variety and those mixed with garlic plants cultivated under the peach trees (T =1.96).

Results of T-est-explained that there is no significant difference between the mean number of insect group (aphids - Jassids - whitefly) occurred on the leaves of Nicola variety cultivated individually and those mixed with garlic plants (T = 1.78).The same rend was recorded for the average number of insect group caught by sticky traps in the field of individual potato(Nikola var) and those intercropped with garlic plants under the peach trees where there is no significant difference between them (T = 1.14).

Table(1) Fluctuation of piercing sucking insects in the field of potato plant(Spunta and Nikola varieties) under Peach trees:

Potato Variety	Field observation			Sticky traps	
	Insects	Mean±SE	F-Value (0.05)	Mean±SE	F-Value (0.05)
Spunta	Aphid	2.75±0.63 a	3.44 NS	5.25±1.54 b	4.66 *
	Jassids	4.75±1.25 a		13.50±2.10 a	
	Whitefly	6.25±0.85 a		11.03±2.17 a	
	Mean±SE	4.58±1.76		9.92±4.23	
Spunta +Garlic	Aphid	1.75±0.47 a	2.58 NS	3.50±0.95 a	3.64 NS
	Jassids	2.25±o.48 a		5.50±1.70 a	
	Whitefly	4.00±1.08 a		9.75±2.13 a	
	Mean±SE	2.67±1.18		6.25±3.20	
Nikola	Aphid	3.25±0.85 a	0.86 NS	4.75±1.31 a	3.88 NS
	Jassids	2.25±0.85 a		8.50±0.95 a	
	Whitefly	3.75± 0.75 a		7.75± 0.62 a	
	Mean±SE	3.08±0.76		7.00±1.98	
Nikola + Garlic	Aphid	2.5±0.65 a	0.95 NS	5.75±1.44 a	0.20 NS
	Jassids	1.25±0.48 a		5.50±0.64 a	
	Whitefly	2.25±0.85 a		6.50±1.25 a	
	Mean±SE	2.00±0.66		5.92±0.52	

* Significant difference NS: Non significant in a single column, means followed by the same small letter(s) are not significantly different at 5% level of probability.

3.4. Under pear trees:

3.5. Field observations:

Results of field observations recorded in table 2 **s**how that the potato plants (Spunta variety)cultivated in individual system was more infested with piercing sucking insects (*M. persicae*, *B. tabaci* and *E discipiens*).where the average insect infestation reached 9.83±7.25insect/leaf more than those recorded on the leaves of Spunta variety intercropped with garlic plants where the average number of insects was 6.17±3.84 insect / leaf .It has found significant differences between the mean number of sucking insects found on intercropped potato plants(f = 5.57), while it was high significant differences in the case of individual potatoes (f = 10.02).

For the potato (Nikola var.), it was clear from the Field observation of potato plants that single cultivation of potatoes may have been more injured with piercing sucking insects, the average number of insect occurred on the leaves of potato plants was (8.83±7.72) insect/leaf .Highly significant difference was recorded

between the mean number of sucking insects (f = 14.57) ,while the potato plants (Nicola var.)intercropped with garlic plants was less vulnerable to the insects where the average number of sucking insects was 4.08±2.24 insect / leaf .There were no differences between the average number of sucking insects (f = 3.43).

3.6. Sticky traps:

Results of counting the piercing sucking insects caught by the sticky traps Located in the field of monoculture of spunta variety showed that the presence of sucking insects was (12.42±7.51) insect / trap,it was very close in insect population with those in the field of intercropped potatoes which average number of insect was(13.50±8.01) insect / trap .On the other hand, the results obtained from the traps located in the single cultivation of Nikola variety have shown that the presence of sucking insects more in the potato field (Nikola var.) which average number of insect was(15.67± 4.3) insect/ trap more than those insect caught in the field of intercropped potatoes with garlic plants (6.83±2.74) insect / trap.

According to the results of T-test there is no significant difference between the average number of sucking insects that occurred on the leaves of Spunta variety cultivated individually with the average number of insects located on intercropped potato plants with garlic (T = 1.46), while in the case of Nikola variety there a significant difference between the average number sucking insects that attack leaves of individual potato plants (Nicola var.) and those mixed with garlic plants (T = 2.07).

When comparing the average number of sucking insects caught by the sticky traps in the field of individual cultivation of Spunta variety and those mixed with garlic plants.There is a high significant difference between the average number of captured sucking insects in the field of single agriculture and those intercropped with garlic plant (T = 4.28).

3.7. Under citrus trees

3.8. Field observations:

Table (2) Fluctuation of piercing sucking insects in the field of potato plants (Spunta and Nikola varieties) under pear trees:

Potato Variety	Field observation			Sticky traps	
	Insects	Mean±SE	F-Value (0.05)	Mean±SE	F-Value (0.05)
Spunta	Aphid	2.50± 0.64 b	10.02 * *	3.75± 0.95 b	4.81 *
	Jassids	10.00± 2.94 a		16.50±4.78 a	
	Whitefly	17.00±2.58 a		17.00± 3.36 a	
	Mean±SE	9.83 ± 7.25		12.42± 7.51	
Spunta +Garlic	Aphid	1.75± 0.478 b	5.57 *	5.25 ± 0.85 b	5.81 *
	Jassids	8.75 ± 2.28 a		21.25± 5.29 a	
	Whitefly	8.00± 1.58 a		14.00± 2.08 ab	
	Mean±SE	6.17± 3.84		13.50± 8.01	
Nikola	Aphid	2.50± 0.64 b	14.57 * *	11.00± 1.78 a	2.18 NS
	Jassids	7.00± 2.16 b		16.50± 1.70 a	
	Whitefly	15.00± 1.77 a		19.50±4.40 a	
	Mean±SE	8.83± 7.72		15.67± 4.31	
Nikola + Garlic	Aphid	1.50 ± 0.50 a	3.43 NS	3.75± 0.85 a	5.95*
	Jassids	5.50 ± 0.95 a		9.00± 1.08 b	
	Whitefly	5.25 ± 1.79 a		7.75 ± 1.37 b	
	Mean±SE	4.08 ± 2.24		6.83± 2.74	

***: Significant difference , * *: High significant difference** ,**NS:** Non significant in a single column, means followed by the same small letter(s) are not significantly different at 5% level of probability.

Results of field observations recorded in table 3 showed that the Spunta variety cultivated individually under citrus trees were more susceptible to piercing sucking insects (*M. persicae*, *B. tabaci* and *E discipiens*) infesting potato plants which the average number of sucking insects found on potato leaves about (8.00± 2.78) insect / leaf, while it was about 4.58±1.28 insect / leaf in intercropping potato plants.

The statistical analyzes demonstrated that there is no significant difference between insects number in both cases of Agriculture (f = 3.100 & 1.026) under citrus trees, respectively, Results of field experiments showed single cultivation of Nikola variety led to infestation with sucking insects in an average about(10.58± 4.88) insect / leaf, while the average number of insect was about (7.00± 3.25) insect/ leaf in mixed cultivation.There are significant difference between the population of sucking insects existing on the leaves of Nikola variety while there is no significant difference between the existing number of sucking insects on potato leaves in mixing culture (f = 4.145 & 2.76), respectively.

3.9. Sticky colored traps:

The recorded data in table 3 evidenced that sucking insects caught by the sticky colored traps was more presence on the leaves of Spunta variety in individual culture under citrus trees with an average number of captured insects about (18.92±5.68) Insect / leaf more than those found in the field of intercropped potato with garlic plants (10.92± 2.74) insect / trap .There is no significant difference between the population of sucking insects (*M. persicae*, *B. tabaci* and *E discipiens*) maintained the sticky traps in the field of single cultivation of Spunta variety (f = 1.693) and in the field of intercropping culture (f = 1.51).In the case of individual culture of Nikola variety, the average number of sucking insects caught by the sticky colored traps about (12.42± 4.90) insect / leaf more than those obtained in the field of intercropped potato with garlic (10.67±4.65) insect / leaf.The statistical analysis showed high significant difference between average number of sucking insects (*M. persicae*, *B. tabaci* and *E discipiens*) in the case of solo cultivation of Nikola variety (f = 7.58), while significant difference was recorded between the mean number of sucking insects in the case of intercropped potato plants (f = 3.083).

The results of statistical analysis using T-test showed that there is a significant difference between the average number of sucking insects observed on the leaves of Spunta variety and those mixed with garlic plants (T = 2.629) .There is also a significant difference between the average number of sucking insects caught by the sticky traps in the field of individual potato (Spunta var.) and those mixed with garlic plants (T = 2.66).Regarding Nikola variety, there is no significant difference neither between the average number of sucking insects recorded on the leaves of the individual potatoes and those intercropped with garlic plants nor between the average number of sucking insects caught by sticky traps in the field of potatoes cultivated under citrus trees.

Table (3) Fluctuation of piercing sucking insects in the field of potato plant (Spunta and Nikola varieties) under citrus trees

Potato Variety	Field observation			Sticky traps	
	Insects	Mean±SE	F-Value (0.05)	Mean±SE	F-Value(0.05)
Spunta	Aphid	7.50 ± 1.55 a	3.100NS	14.25± 2.17 a	1.691NS
	Jassids	5.50 ± 1.70 a		17.25± 2.25 a	
	Whitefly	11.00± 1.47 a		25.25 ± 6.78 a	
	Mean±SE	8.00 ± 2.78		18.92± 5.68	
Spunta +Garlic	Aphid	4.25 ± 1.65 a	1.026 NS	10.00± 1.82 a	1.51NS
	Jassids	6.00 ± 1.29 a		8.75± 2.01 a	
	Whitefly	3.50 ± 0.65 a		14.00± 2.73 a	
	Mean±SE	4.58 ± 1.28		10.92± 2.74	
Nikola	Aphid	12.75 ± 3.03ab	4.145*	7.25 ± 1.25 b	7.538**
	Jassids	5.00 ± 1.29 b		13.00 ± 1.82 a	
	Whitefly	14.00 ± 2.12 a		17.00± 2.16 a	
	Mean±SE	10.58± 4.88		12.42± 4.90	
Nikola + Garlic	Aphid	10.25 ± 3.065 a	2.76 NS	16.00± 3.85 a	3.083NS
	Jassids	3.75 ± 1.10 a		7.50± 1.55 a	
	Whitefly	7.00 ± 0.91 a		8.50 ± 1.93 a	
	Mean±SE	7.00± 3.25		10.67± 4.65	

*: Significant difference, * *: High significant difference, **NS:** Non significant in a single column, means followed by the same small letter(s) are not significantly different at 5% level of probability.

According to the present results, it was clear that exposure the potato (spunta ver.)to the loss by insect infestation has reached to 0.68 tones(equivalent to 3.5%)and the mechanical losses reached 1.06

tons(about5.5%)leads to the net production about 17.61 tons/acre, while exposure Nicola ver. has insect injury loads to 0.02 tons(1.1%)and mechanical loss reached to 0.06 tons(3.1%)which leads to obtained net yield about(18.3) tons per acre .

The results of the present study recorded in table (4) showed that the average productivity per acre of spunta veriety more than the variety of Nicola, but exposing spunta verity to loss due to insects and became of the harvest machines, it reach to the lowest of net productivity per acre.Therefore, sticky colored traps in the field of potatoes and caution when harvesting leads to higher productivity of the net production of perfect tubers of potatoes. Mogahed (2000) found that the yield of tubers produced from investigated varieties (Alpha &Draga var.) was significantly higher in potato associated with onion and garlic plants than those varieties cultivated alone.

Table (4): Effect of loss in potato tubers on total net productivity/Feddan

Potato variety	Total aver. Productivity (Ton)/Feddan	Aver.loss (Ton) by insects	Mechanical aver.loss (ton)	Net of total product. (Ton)/Feddan
Spunta (%)	19.3	0.68 (3.5)	1.06 (5.5)	17.6
Nikola (%)	18.3	0.02 (1.1)	0.06 (3.1)	18.3

4. Discussion:

Potato are cultivated in wide areas either old lands or newly reclaimed lands.It is very necessary as a major source of energy for consumers in Egypt and representing as a main of exportation crops which increase the national income .

The present results showed that each of the leaf hopper ,*E. discipiens* and white fly,*B.tabaci* were more present on the plants and the spread in potato fields than green peach aphid,*M.persicae* , With the same trend , field experiments were conducted by(2)who investigated the activity of adults of the sweet potato whitefly, *Bemisia tabaci* (Genn.), and the banded winged whitefly, *Trialeurodes abutilonea* (Haldeman), on different breeding stocks and cultivars of cotton, *Gossypium hirsutum* L., grown in three tests in Arizona and California. Using sticky traps and found that many more *B. tabaci* than *T. abutilonea* were caught.one of the breeding stocks or test cultivars had fewer whiteflies than the cultivar 'Deltapine 61;' 'Deltapine 62,' however, attracted fewer *B. tabaci*.

More experiments were performed in the same trend by (20) and (13) who investigated the effects of intercropping a potato crop with *Allium cepa* or *A.sativum* on insect populations of sap sucking insects and found that mass culturing reduced populations of *M.persicae ,Empoasca* spp.and *A.gossypii* .

(7)investigated the fluctuation of the major sap sucking insects such as aphids ,whitefly ,thrips and leaf hoppers and found that maximum average number of aphids and *B.tabaci* were recorded during the period of 1 st&2 nd week of march and 2 nd&3 rd week of April for *B.tabaci*. Low numbers of *E. discipiens* and *T. tabaci* were observed. Data obtained by (14) revealed that average yield of potatoes was significantly higher in intercropped plots of potato(Nikola var. with Onion or Garlic plants) in Al-Arish aria than those mono-cultured potatoes and found also, that intercropping of Nicola variety in Al-Arish provins produced yield lesser than those produced in Oum Shayhaan area, North Sinai Governorate ,Egypt .Moreover it was noted that a potato varieties (Spunta& Nikola) cultivated in the garden, of pear, citrus were higher productivity than those cultivated in the garden of peach.As the potato (spunta ver.) was the highest productivity in the various gardens of the Nikola variety. The obtained results were supported by (3)in UK ,Cambridge University ,who concluded that intercropping which is a traditional method of crop production in the tropics has potential for insect pest suppression in low-input farming in temperate regions .

It was found that potato plants (spunta var.)in the gardens of citrus and pear occupy the highest levels of infestation of both *B .tabaci* and *E. discipiens* while sucking insect infestation was less in the peach garden .(13) found that *B.tabaci* ,*T.tabaci* and *M.persicae* were the most insect pests attacking potato plants (Alpha &Draga

vars.),and found also ,the sticky colored paper traps were potent tool in suppressing the damage of the whit fly,*B.tabaci*.

The present results showed that the Nikola variety planted individually in the garden of peach has been exposed to insect infestation which got injured severe with both ,*B. tabaci* and ,*M. persicae* a great degree of insect hopper *E. discipiens* .Plants may provide an alternative to currently used pesticides for the control of plant pests, as they constitute a rich source of bioactive chemicals.(11)tested aqueous extracts of nine plants, known to have medicinal activity,for their toxicity against the sweet potato whitefly, *Bemisia tabaci* Genn. (Homoptera: Aleurodidae) compared to the toxicity of the insecticide, Imidacloprid,and found that some aqueous extracts have repellent effect and some of them are preventive.

(19) studied biocontrol approach to management of greenpeach aphid *Myzus persicae* in garden peas for a sustainable ecosystem to evaluate hard and soft chemical products in their ability to control *Myzus persicae* and their effects on aphid parasitoids and found that there was no significant difference in aphid numbers between the three insecticides.The population of aphids on the control was high and mentioned that Teepol and Achook promise to be useful agents for controlling green peach aphids in garden peas and at the same time are friendly to the aphid parasitoid. More over it was noted that potato varieties (spunta& Nicola) cultivated in the garden, of pear, city were higher productivity than those cultivated in the garden of peach.

As the potato (spunta ver.) was the highest productivity in the various gardens of the Nikola variety.The obtained results were supported by (3)in UK ,Cambridge University ,who concluded that intercropping which is a traditional method of crop production in the tropics has potential for insect pest suppression in low-input farming in temperate regions.The results of the present study showed that the average productivity per acre of spunta veriety more than the variety of Nikola, but exposing spunta verity to loss due to insects and became of the harvest machines, it reach to the lowest of net productivity per acre. Mogahed (2000) found that the yield of tubers produced from investigated varieties (Alpha &Draga var.) was significantly higher in potato associated with onion and garlic plants than those varieties cultivated alone.

Data obtained by (14) revealed that average yield of potatoes was significantly higher in intercropped plots of potato(Nicola var) with Onion or Garlic plants) in Al-Arish aria than those mono-cultured potatoes and he found also, that intercropping of Nicola variety in Al-Arish provins produced yield lesser than those produced in Oum Shayhaan area, North Sinai Governorate,Egypt .On the other hand ,the same trend, field experiments were conducted by (20) and (13 and 14) who investigated the effects of intercropping a potato crop with *Allium cepa* or *A.sativum* on insect populations and found that mass culturing reduced populations of *M.persicae* ,*Empoasca* spp.and *A.gossypii* .(22) **s**tudied *Effects of mti-2 Transgenic Potato Plants on the Aphid Myzus persicae* by Feeding assays to evaluate their effects on the green-peach aphid, *Myzus persicae* and found that Potato plants transformed with the mti-2 gene variably affected the life history of *M. persicae* but did not show any insecticidal effect on the aphid.However, (26)studied effect of potato plants expressing snowdrop lectin (GNA) on the performance and colonization behaviour of the peach-potato aphid *Myzus persicae* **.**and concluded that such transgenic potato plants expressing the lectin at a relatively low level, maximum 0.2% of the soluble protein, have no significant impact on the performance of apterous *M. persicae* once on the plant, but may have a potential in controlling the aphids by altering the colonization behaviour of alates.

As shown by the results of the counting insects caught by sticky colored traps that the population of insects captured was higher in the case of individual potatoes than those counted insects on the leaves of potato mixed with garlic plants, which explains the very low levels of insect infestation compared to the individual potatoes (control).

5. Conclusion

Potato, *Solanum tuberosum* L represent an important part of vegetable production and considered very important in agricultural crops.P0otato as an economic crop has been attacked by several insect pests **.**The present results indicated that the integration between sticky colored traps and intercropping system of potato plants with Garlic plants had pronounced effects on the population density of sucking insect pests on potato plants . The results showed that potato individual has high infestation with sucking insects much higher than potatoes mixed with the garlic plants in all the garden of fruits tested .Insect population of sucking pests was

affected significantly by intercropped potato with Garlic plants which the mixed potato plants with garlic plants has been harboured the lowest population of sucking insects, respectively .

It was noted that when the insect population increasingly attracted to the colored traps it leads to a decline in insect population occurred on the leaves of potatoes (Spunta & Nikola) cultivated in the gardens of fruit.The intercropped potato plants showed significant differences in the infestation rates by *B.tabaci*, *M.persicae* and *E.discipiens* , therefore, sticky colored traps in the field of potatoes and caution when harvesting leads to higher productivity of the net production of perfect tubers of potatoes , It mean that the increase in the number of insects caught by sticky traps followed by a decline in the incidence of potato plants and increase productivity of potato tubers per acre.

The present results indicated that the integration between sticky colored traps and intercropping system of potato plants with Garlic plants had pronounced effects on the population density of sucking insect pests on potato plants.

It was concludes that the use of sticky colored traps integrated farming system mixed with garlic plants cultivated in the garden of. Pear or .citrus trees leads to lower incidence of sucking insects on potato plants and thus increase productivity per acre. Regarding Sticky traps.The results obtained from sticky traps show that garlic's role as a repellent tool against sucking insects that attack potato plants. It was also noted that single cultivation of both potato varieties (Spunta and Nikola) under citrus trees were more vulnerable to injury with aphid insect followed by those cultivated under the peach trees and finally potato plants cultivated under the pear trees.

It was found that potato plants (spunta var) in the gardens of citrus and pear occupy the highest levels of infestation of both *B .tabaci* and *E. discipiens* while sucking insect infestation was less in the peach garden.The results of the present study showed that the average productivity per acre of Spunta variety more than the variety of Nikola, but exposing spunta verity to loss due to insects and became of the harvest machines, it reach to the lowest of net productivity per acre.

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