J. Agric. Sci. Mansoura Univ., 31 (11): 7391 - 7398, 2006

EFFECT OF INFESTATION WITH CERTAIN SUCKING INSECTS ON GROSS CHEMICAL COMPOSITION AND EPICUTICAL LIPIDS IN LEAVES OF TWO LOCAL GLOBE ARTICHOKE CULTIVARS

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ABSTRACT

The effect of the natural infestation with certain sucking insects of aphids spp. , whiteflies , jassids and thrips on the gross chemical composition and epicutical lipids in leaves of two local globe artichoke cultivars , Cordoon and Hybrid c.vs. ,grown at Shubramunt village in Giza Governorate in the season , 2002 / 2003 , in order to protect the crop properties . The aphid population of some species was the highest number on leaves of both the cultivars during the tested season , followed by *Bemisia tabac* (Genn.) while *Empoasca decipiens* Poali and *Thrips tabaci* Linn .were the lowest one . This is considered as the first record of this cultivars in Egypt . Chemical analysis were made at the Central Laboratory of Fac. Of Agric., Ain Shams Univ ., Egypt . to evaluate the constituents and epicuticual lipids , the percent measurements of its fractions and the effect of these sucking infestation .The total nitrogen , reducing sugar , non-reducing sugar ,total soluble sugar ,starch , protein , fats and moisture besides the epicuticual lipids were determined in leaf samples collected at two intervals ranging from 2 weeks from each the two tested seasons . The results showed that each reducing , non-reducing sugars and total soluble sugars are positively affected the infestation with sucking insects as 36.17 , 19.26 , 28.80 respectively in leaf samples of Cordoon cv. While on Hybrid cv. It reduced completely (100 %) in leaf samples . An increase showed in total nitrogen and protein contents as 1.89 % and 1.90 % respectively in infested leaf sample of Cordon but it decreased in Hybrid infested leaves as 3.64 % and 3.67 % respectively . Fats decreased in both tested cultivars as 22.01 % and 18.68 % while starch and moisture increased each as 67.64 % , 70.49 % for starch and 23.80 % , 25.49 % for the second content , respectively for both the cultivars (all based on dry weight). Furthermore , leaf sample were assayed for their specific phenolic composition (Tannic acid) when the analysis recorded decrement as 72.39 % , where its percentage decreased from 0.163 % in infested leaves ample to 0.045 % in uninfected leave sample for the Hybrid c.v. Affected these sucking infestation . Also , there were a distinct differences in epicuticular lipids contents between both the infested and uninfected leaves of the two tested cultivars . Some of these epicuticular lipids ; phospholipids ,monoglyceride , sterol , fatty acids , triglyceride and sterol ester markedly increased while diglyceride decreased and hydrocarbon were constant , in Cordoon infested leave sample whereas , in hybrid an increase recorded in monoglyceride , diglyceride , sterol ester and hydrocarbon contents , a decrease showed in sterol but phospholipids , fatty acids and triglyceride were constant in both the infested and uninfected leaves sample. Therefore , it is recommended to control these sucking insects on g . artichoke plants using rules based on safe and modern I .P .M . programs from public health point of view .

INTRODUCTION

Globe artichoke [*Cynara scolymus* L.] plants belongs to the Composite family, are receiving more attention in recent years due to the increasing demand for their nutritional value and pharmaceutical products as shown by Zaposochnaya *et . al* . (1992) in Russia , who appeared the globe artichoke

contains coffeoylquinic acids have cholagogic properties , Gebhardt (1995) in Germany , proved that the leaf extracts of artichokes reduce serum cholesterol, moreover, Mossi *et. al.* (1999)in Brazil examined the antibacterial properties of dichloromethane and ethanol extracts of g . artichoke leaves and Ismail *et . al .* (2004) , showed a negative association between the intake of some leafy vegetables and certain diseases such as cancer , cardiovascular disease and cataracts . A wide range of these plants is cultivated in different regions in Egypt which provide suitable habitats for the insect infestations . It was formerly believed that the main contents of these plants might serve affected insects infestations especially sucking pests such as aphids , whiteflies , jassids and thrips which are the most important infestations on g . artichoke under Egyptian conditions . According to previous literatures there was lack of investigations about the chemical composition of g . artichoke till end the seventieth decade of the twentieth century . Recently different chemical analysis were made on g . artichoke composition by many investigators *;* Ragazzi and Veronese *(1973)* , Macleod *et. al .* (1982) , Adzet and Puigmacia (1985) , Adzet *et. al .* (1987) , Muller *et. al.* (1988) , whom studied and listed the aroma volatiles , polyphenolic compounds (Cynarin , Chlorogenic , Luleolin – 7-glucoside , caffeic and quinic acids) , the chromium contents of *Cynara scolymus* and its usage .In Egypt , since insect infestations might affect the nutritiousness and properties of g. artichoke , the present work is a first attempt to study the gross chemical composition and epicuticul lipids in leaves of two local g. artichoke cultivars affected the infestation with certain sucking insects .The present study aimed to search the effect of natural infestation with certain sucking insects on the gross chemical composition and epicuticual lipids in leaves of two local globe artichoke cultivars .

MATERIALS AND METHODS

Random samples of 25 leaves were taken weekly and send to the laboratory in order to count the population density and identified certain sucking insects of aphid spp. , whiteflies , jassids and thrips from two local globe artichoke cultivars together , Cordoon and Hybride grown in area of one feddan at at Shubramnt village in Giza Governorate during the growing season , 2002 / 2003 . The chemical analysis was carried out at the Central Laboratory of Fac. of Agri ., Ain Shams Univ. , Egypt . Two successive samples , each of 10 mature mid –shoot leaves of g. artichoke were taken randomly for each the infested and uninfested (from 5 selected covered protected plants with muslin) ones , of the two tested cultivars , 120 days after planting (on 16 August) ranging from two weeks of the mentioned season . All usual agriculture practices were followed in field . Leaf samples were washed three times with tap water , then washed again with distilled water and dried with air at room temperature for at least 72 hr. Dried samples of infested and uninfested leaves of the two tested cultivars were milled , subdivided to 5 replicates (each 20 gr.) for each are used to determine the reducing , non-reducing sugars , total soluble sugar , total nitrogen , protein , starch , fat and moisture according to the method described by the A.O.A.C.

(1990).Reducing , Total sugars ,non –soluble sugars and starch were determined by using the Picric method . Non – reduced sugars were calculated as the difference between total and reducing sugars . Total nitrogen was determined using the modified " Microkjeldahel " apparatus method as described by Pregl (1945) . Protein was determined depending on leaf nitrogen content as (N % × 6.25) due to Pregl (1945) . Fats were determined using gas Liquid chromatography (GLC) method . Phenolic compounds were determined by using colorimetric 750 method according to Sitaramaiah and Pathak (1979) . Epicutical lipids were identified and determined by using thin layer chromatography (TLC)method described by Mangold and Malins (1960) .All results are recorded as mean percentages on dry of 5 replicates in two interval of each the two tested seasons except the epicuticul lipids determination expressed as a mean relative values .

RESULTS AND DISCUSSION

A mixed population of Aphis spp.(included *Aphis fabae* L., *Aphis gossypi* Glov. , *Myzus persicae* Sulzer , *Macrosiphum rosefolium* Theo. , *M. euphorbiae* (T .) , *Bemisia tabaci* (Genn .) , *Empoasca decipiens* Paol, *Thrips tabaci* (Linn.) , usually occurred as sucking insects on g. artichoke leaves at Shubramunt , Giza , showing a rather serious infestation . The first species was more abundant on leaves (Table 1) . The aphids began to appear with a considerable numbers during 4 $^{th.}$ week of September in both the tested seasons . This aphids showed a tendency to increase through October , November , December and January and diminished gradually through February to end the season , In 2002 /2003 , the highest number (593.3 and 632.0 aphids per 25 leaves) occurred in each the 2 $^{nd.}$ week of December . and January , respectively . High significant variance existed between weekly populations of the aphids on leaves in the mentioned season. Similar results were obtained by Barbagallo (1974) and Apablaza (1984) who recorded that the aphids fauna are most commonly found for several years in eastern Sicily on g . artichoke , while Foddi *et al* . (1991) reared the aphid borne ,caused serious damage on artichoke in Italy . Concerning *B . tabaci* , its adults were generally found occupying the second rank as a sucking insects on g . artichoke leaves after the aphids . It was found that relatively low density of its adults on leaves occurred during the 4 $^{th.}$ week of September and October of the tested season and began to increase during November , recording its highest number of 28.0 individuals per 25 leaves during the 4 $^{th.}$ week of November in tested season, then it leveled off . significant variance existed between the whitefly populations during the tested season . Few numbers of each *E. decipiens* and *T. tabaci* individuals were found on leaves during the season .The population of *E . decipiens* usually appear in 1 $^{st.}$ week of October and fluctuated with ups and downs throughout the tested season while disappeared during December of the season . The individuals of *T. tabaci* were recorded in very few numbers on plant leaves (Table 1), when it began to appear during the 2 $^{nd.}$ week of November in 2002, fluctuated in low numbers till end the season . Nonsignificant was showed between the weekly populations for the two later

insects . The accumulated mean numbers were 264.3 , 9.6 , 3.4 and 1.1 individuals in season 2002/2003, the four sucking insects , respectively . Thus , this is considered a first record on g . artichoke in Egypt . Chemical analysis was made to determine the components of reducing , non-reducing sugars , protein , fats and carbohydrates as affected the sucking insects infestation in leaf samples collected at 2 intervals ranging from 2-4 weeks of the two tested seasons , together .The obtained results are shown in Table (2) .The result show that each of reducing , non reducing sugars and total soluble sugars are positively affected the infestation with sucking insects as 36.17 , 19.26 and 28.8 % respectively in leaf samples of Cordoon cv. while on Hybride cv. , this contents reduced completely (100 %) in leaf samples . An increase showed in total nitrogen and protein content as 1.89 % and 1.90 % respectively in infested leaf sample of Cordoon but it decreased as 3.64 % and 3.67 % respectively in the hybride infested leaves . Fat decreased in both tested cultivars as 22.01 % and 18.68 % while starch and moisture increased each as 67.64 % , 70.49 % for starch and 23.80 % , 25.49 % for the second content , respectively of both the cultivars (All based on dry weight) . Similar results were reported by Macleod *et. al* . (1982) who stated that eight sesquiterpene hydrocarbons affected the major group of components (over 12 %) in g , artichoke samples with beta selinene (Ca. 32 %) as the main constituent . Loo *et. al.* (1995) , reported the presence of inulin and digofructose as natural ingredient in g . artichoke . Hussein *et. al.* (1999) only prepared the leaf protein concentrates from g . artichoke in Egypt for detecting the amino acids .Furthermore , the analysis showed the g . artichoke leaves are a good source of phenols as natural antioxidants for human and in plant tissues play an important role in resistant for different pests and diseases Abd- Allah (1993) Leaf samples were assayed for their specific phenolic composition so that differences might be detected between the infested and uninfested leaves . Its decrement recorded 72.39 % as tannic acid content , where the percentage of its tannic decreased from 0.163 % in uninfested leaves to 0.045 % in infested ones per sample for the hybride cv. , affected these sucking infestation . In this respect ; Ragazzi &Veronese (1973) , Adzet & Puigmacia (1985) , Adzet *et. al.* (1987) and Zuposochnaya *et. al.* (1992) studied and recorded the polyphenolic compounds and its medical usage in this plant leaves . Concerning the epicuticular lipids ; as shown in Table (3) there were distinct differences in the contents of these lipids between both the infested and uninfested leaves of the two tested cultivars . Some constituents of epicuticular lipids ; phospholipids, monoglyceride , sterol , fatty acids , triglyceride and sterolester markedly increased while diglyceride decreased and hydrocarbon were constant , in Cordoon infested leave sample . Also , considerable increase recorded in monoglyceride , diglyceride , sterolester and hydrocarbon contents and a decrease showed in sterol content , phospholipide , fatty acids and triglyceride were constant hybride infested leave sample. Similar findings were recorded by Sanford & Karl (1995) who stated that different leaf epicuticular lipids in glossy plants are usually reduced in a mount affected by insect herbivores in Arizona , USA . Therfore ; it is recommended to control

the insect pests on g . artichoke plants using rules based on safe and modern IPM programs from public health point of view.

Table (1) Weekly population growth of cretain sucking insects on globe artichoke leaves, grown in Shubramunt, Giza, during the tested season.

Date Month week	Mean no. / 125 leaves 2002/2003			
	Aphis spp.	*B. tabaci*	*E. decipiens*	*T. tabaci*
Sep. 4th.	11.0	10.0	0	0
Oct. 1st.	14.7	11.0	3.7	0
2nd.	23.7	8.7	5.3	0
3rd.	49.5	12.0	7.0	0
4th.	79.7	11.3	6.0	0
Nov.1st.	109.6	14.0	8.0	0
2nd.	276.0	18.0	10.0	1
3rd.	298.0	24.0	11.0	1
4th.	340.0	28.0	10.0	2
5th.	322.0	17.0	3.0	1.3
Dec.1st.	314.0	13.0	0.0	1
2nd.	593.3	12.0	0.0	1
3rd.	403.9	9.0	0.0	1.7
4th.	463.9	6.0	0.0	0
Jan. 1st.	484.0	4.0	1.3	1
2nd.	632.0	3.0	2	4
3rd.	427.3	2.0	1.7	3
4th.	347.0	3.0	2.0	1
5th.	291.0	5.0	2.0	2
Feb. 1st.	239.0	2.0	1.3	1
2nd.	128.7	3.0	0.0	1.3
3rd.	126.0	3.0	2.0	1
4th.	104.6	2.3	2.0	2
Mean	264.3**	9.6*	3.4*	1.1*
L.S.D.(0.05)	21.40	2.51	1.12	1.06

** High significant at 5 % level . *Significant at 5% level .

Table (2): Gross chemical composition in the leaves of two local globe artichoke cultivars affected the infestation with certain sucking insect infestation .

Chemical compositions %	Cordon c.v.			Hybride c.v.		
	Uninfestd Leaves	Infestd leaves	Differences %	Uninfested Leaves	Infested leaves	Differences %
Reducing sugars	1.41	1.92	+ 36.17	2.75	0	- 100
Non- reducing sugars	1.09	1.30	+ 19.26	1.40	0	- 100
Total soluble sugars	2.50	3.22	+ 28.8	4.15	0	- 100
Total nitrogen	2.11	2.15	+ 1.89	2.18	2.10	- 3.64
Protein	13.18	13.45	+ 1.90	13.62	13.12	- 3.67
Fats	10.9	8.5	- 22.01	1.98	1.61	- 18.68
Starch	6.8	11.40	+ 67.64	8.10	13.81	+ 70.49
Moisture	0.42	0.52	+ 23.80	0.51	0.64	+ 25.49

Table (3) : Chemical composition of leaf epicuticular lipids of two local globe artichoke cultivars affected by certain sucking insects infestation

RF.	Chemical components	Cordon cv.			Hybride cv.		
		Uninfested Leaves	Infested leaves	Differences %	Uninfested Leaves	Infested leaves	Differences %
0.00	Phospholipid	+ 1	+ 3	+ 2	+ 3	+ 3	0
0.03	Monoglyceride	+ 1	+ 2	+ 1	+ 2	+ 3	+ 1
0.04	Diglceride	+ 4	+ 1	- 3	+ 1	+ 2	+ 1
0.08	Sterol	+ 1	+ 3	+ 2	+ 3	+ 2	- 1
0.012	Fatty acids	+ 1	+ 4	+ 3	+ 4	+ 4	0
0.20	Triglyceride	+ 1	+ 4	+ 3	+ 4	+ 4	0
0.70	Sterolester	+ 1	+ 2	+ 1	+ 2	+ 3	+ 1
0.88	Hydocarbon	+ 1	+ 1	0	+ 1	+ 2	+ 1

RF. : Distance between compounds analysis .

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أثر الإصابة ببعض الحشرات الثاقبة الماصة على التركيب الكيماوي وليبيدات القشرة الفوقية لأوراق صنفين محليين من الخرشوف

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من أجل وقاية محصول الخرشوف في مصر و المعروف بأهميته الغذائية و الدوائية في علاج كثير من الأمراض قديما وحتى الآن ، اجري هذا البحث بهدف دراسة تأثير الإصابة ببعض الحشرات الثاقبة الماصة كالمن و الذباب الأبيض والجاسيدز و التربس والتي تم تسجيل أعدادها ، على المكونات الكيماوية الأساسية وأيضا على ليبيدات القشرة الفوقية لأوراق صنفين محليين من الخرشوف هما صنف كوردون والصنف هجين واللذان تمت زراعتهما في قرية شبرا منت بالجيزة وذلك خلال الموسم الزراعي ٢٠٠٢/٢٠٠٣ وأثبتت النتائج المتحصل عليها من التحليل الكيماوي والذي تم إجراؤه بالمعمل المركزي للتحاليل بكلية الزراعة ، جامعة عين شمس بالقاهرة بعد ١٢٠ يوم من زراعة الخرشوف أن هناك اختلافات واضحة في مكونات التركيب الكيماوي لأوراق الخرشوف المصابة و غير المصابة والذي تمت تغطيته بشاش خفيف لوقايته من الحشرات الثاقبة الماصة وقد دلت النتائج على الآتي :-

تناقص محتويات كل من السكريات المختزلة و غير المختزلة والسكريات الكلية الذائبة بنسب ٣٦,١٧%، ١٩,٢٦%، ٢٨,٨٠% على التوالي في أوراق الصنف كوردون المصابة بينما تناقص تلك السكريات الثلاث في أوراق الصنف هجين المصابة بنسبة ١٠٠% لكل منهم ٠ كما حدث تزايد في محتويات كل من النيتروجين الكلى و البروتين في كل من أوراق الصنف كوردون بنسبة ١,٨٩ % ، ١,٩٥ % في حين تناقصتا بنسبة ٣,٦٤% ، ٣,٦٧ % في أوراق الصنف هجين أما الدهون فقد تناقصت نسبتها في كلا الصنفين المختبرين للخرشوف كنتيجة للإصابة بهذه الحشرات الثاقبة الماصة بمقدار ٢٢,٠١ % ، ١٨,٦٨ % على التوالي ، ولكن تزايد كل من النشا و الرطوبة النسبية بنسب متفاوتة في أوراق كلا الصنفين المذكورين وتمثل الزيادة في حالة النشا ٦٧,٦٤ % ، ٧٠,٤٩% وفي حالة الرطوبة النسبية كانت الزيادة٢٣,٨% ، ٢٥,٤٩ % على التوالي لكلا الصنفين المذكورين ٠ وقد دلت التحاليل الكيماوية على ظهور نقص في تركيب احد الفينولات المتعددة (حامض التانيك) بنسبة ٧٢,٣٩ % في أوراق الصنف الهجين المصابة وأظهرت التحاليل الكيماوية وجود فروق واضحة ومتباينة في مكونات ليبيدات القشرة الخارجية (الفوقية) لأوراق كلا الصنفين والمصابة بهذه الحشرات وذلك عندما قورنت بنتائج تحليتها في الأوراق الغير مصابة ٠ حيث إزدادت نسب بعض هذه الليبيدات وهى الفسفوليبيدات و الجليسريدات الأحادية والأسترول والأحماض الدهنية و الجليسريدات الثلاثية وإسترول الاستر بينما تناقصت الجليسريدات الثنائية فقط وبقيت الهيدروكربونات ثابتة وذلك في أوراق الصنف كوردون المصابة أما في أوراق الصنف هجين تزايدت نسب كل من الجليسريدات الأحادية والثنائية والأسترول إستر و الهيدروكربونات بينما تناقص الأسترول فقط وتبقت كل من الفسفوليبيدات و الأحماض الدهنية والجليسريدات الثلاثية ثابتة بدون تغيير في عينات الأوراق المصابة ٠ ولذلك يوصى الباحث بضرورة مقاومة الأفات الحشرية الثاقبة الماصة على نباتات الخرشوف في مصر من أجل محصول أفضل في مكوناته الغذائية من أجل صحة الإنسان ٠