THE ALLELOPATHIC EFFECT OF MAIZE AND SORGHUM ON SOME PHYSIOLOGICAL TERISTICS OF WHEAT AND BROAD BEAN USING HYDROPONICS

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ABSTRACT

Two experiments were conducted to test the allelopathic potential of aqueous extracts concentrations of maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* L.) on some physiological characteristics of wheat (*Triticum aestivum* L.) and broad bean (*Vicia faba* L.) plants in two cultures. The effective allelochemicals available in extracts of maize and sorghum have been isolated and identified. The experiments included two factors, the Main plots were the growing culture (Sand culture and Soil culture) and the Sub-plots were five concentrations of (0,25,50,75 and 100%) the aqueous extracts of the whole plants (root and shoot for maize (in first experiment) and sorghum (in the second one), Results indicated that:

Most of the studied characteristics in wheat and broad bean decreased in sand culture when treated with the aqueous extracts of maize and sorghum.

Increasing the aqueous extracts of maize to 100% decreased the plant content of soluble carbohydrate, chlorophyll a, chlorophyll b, protein to 0.29 ,0.39, 0.39 and 0.28 % in wheat, and to 0.28 , 0.46 , 0.53 and 0.46 % in broad bean. While Increasing the aqueous extracts of sorghum to 100% decreased the plant content of soluble carbohydrate, chlorophyll a, chlorophyll b, protein to 0.34 and 0.56 and 0.64 and 0.39 % in wheat, and to 0.41 and 0.47 and 0.44 and 0.20 % in broad bean, respectively compared to control treatment (0%).

Chromatographic analysis revealed the presence of 8 compounds in aqueous extracts of maize. The isolated compounds are phenolic in nature and known to have potential phytotoxicity as syringic, gallic, caffeic, vanillic, ferulic, coumaric, catechol and hydroxybenzoic. While Chromatographic analysis revealed the existence of 10 compounds in aqueous extracts of sorghum, 8 of them similar to what found in maize in addition to quinon, benzaquinon .

Key words : allelopathy; allelochemicals.

التأثيرات الأليلوباثية للذرة الصفراء والبيضاء على بعض الصفات الفسيولوجية للحنطة والباقلاء باستخدام تقنية الزراعة المائية

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الملخص

نفذت تجربتين لدراسة التأثير الأليلوباثي لتراكيز المستخلصات المائيـــة للذرة الصفراء *Zea mays* L. والذرة البيضاء *Sorghum bicolor* L. على بعض الصفات الفسيولوجية لنباتي الحنطة *Triticum aestivum* L. والباقلاء *Vicia faba* L. في وسطين للزراعة، كما تم عزل وتشخيص المركبات الأليلوباثية الفعالة المتوفرة في مستخلصات الذرة الصفراء والبيضاء. طبقت التجربتين باستخدام ترتيب الألواح المنشقة وفق تصميم القوالب الكاملة المعشاة بثلاث مكررات، تضمنت التجربتين عاملين، مثل العامل الرئيسي وسطي الزراعة وهي (الزراعة المائية والزراعة بتربة عادية) وتضمن العامل الثانوي خمسة تراكيز من المستخلصات المائية للنباتات بأكملها لكل من الذرة الصفراء في التجربة الأولى والذرة البيضاء في التجربة الثانية وهي أربعة مستخلصات مائية (٢٥ و٥٠ و٧٥ و١٠٠%) + معاملة المقارنة (ماء مقطر). وقد تم التوصل الى النتائج التالية :

انخفضت اغلب الصفات التي تم تقديرها في نباتات الحنطة والباقلاء عند نموها في الوسط المائي عند ريها بالمستخلصات المائية لنباتات الذرة الصفراء والبيضاء .

أدى زيادة تراكيز المستخلصات المائية للذرة الصفراء الى ١٠٠% الى انخفاض محتوى نباتات الحنطة من السكريات الذائبة وكلوروفيل a وb والبروتين بنسبة ٠.٢٩ و٠.٣٩ و٠.٣٩ و٠.٢٨ %، والى انخفاضها بنسبة ٠.٢٨ و٠.٤٦ و٠.٥٣ و٠.٢٦ % في نباتات الباقلاء، أما تراكيز المستخلصات المائية للذرة البيضاء فقد ادت زيادة تراكيز مستخلصها المائي الى ١٠٠% الى انخفاض محتوى نباتات الحنطة من السكريات الذائبة وكلوروفيل a وb والبروتين بنسبة ٠.٣٤ و٠.٥٦

و٠.٦٤ و٠.٣٩ %، والى انخفاضها بنسبة ٠.٤١ و٠.٤٧ و٠.٤٤ و٠.٢٠ % في نباتات الباقلاء قياساً بمعاملة المقارنة على الترتيب.

بينت نتائج التحليل بجهاز الكروموتوكرافي السائل عالي الأداء High Performance Liquid Chromatograph (HPLC) وجود ثمانية مركبات كيميائية في المستخلص المائي للذرة الصفراء وهي: Syringic acid و Vanillic acid و Gallic acid و Caffeic acid و Ferulic acid و P- Coumaric و Catechol acid وP- Hydroxyl benzoic acid. أما المستخلص المائي للذرة البيضاء فقد احتوى على عشرة مركبات كيميائية phenolic nature ومعظمها من الفينولات وهي Syringic acid و Vanillic acid و Gallic acid و Caffeic acid و Ferulic acid و P- Coumaricو Catechol acid و P- Hydroxyl benzoic acid و Quinon و Benzaquinon .

Introduction

The allelopathy is a complicated environmental case which includes the biochemical materials that happen between the plants and the other living beings. The allelopathy happens as a result of releasing some chemical components which surrounding interact in different ways with the environments, then it might negatively or positively affects the growth of the living beings that receive the allelochemicals . The newest definition for the alleloppathy was made in the sixth international conference for the allelopathic science that held in china at 2012 and referred to the interactions between the plants, insects, animals (Lahmod, 2012).

The allelopathic effect of a crop can effect another crops in crop rotation. The effect depends on the concentrations of the materials that contained it. Sorghum and maize can have toxicity effect on some other crops and weeds (Al-Mezori,1996, Cheema and Khaliq, 2000,Cheema *et al.*, 2002, Alsaadawi *et al.*, 2007,Grien, 2009 and Lahmod, 2012).

The crop rotation are used as one of the widespread planting methods increase planting production and the preservation of the production energy of the land, and despite the positivity of the agricultural routine, a lot of troubles happened ,one of them led to the decrease of the crops productivity, the worst of these troubles are the effects of the residues decomposition of the last crops thtat have the allelopahic effects and what they leave behind from poisonous components that their effects may stay for more than three months and can affect the life of the living beings and the productivity of crops grown after that (Al-Mezori,1996), (Rice,1984) also the stability of these allelopathic components in the soil has a great importance as it reflects the great phytotoxic potential of the plant containing it.

Most cases maize and sorghum planted in crop rotation with wheat and broad beans crops. (Alyoonis,1993), (Oslen,1981). The study of allelopahic impact on other crops is not that easy due to many reasons .It depends on method of extraction, soil, plant environment and microorganisms which release toxic materials in soil that causes interactions.(Patrick *et al.*,1964).

The aims of this study was to investigate the allelopathic effect of Maize and Sorghum on wheat and broad bean in soil culture and hydroponic.

Materials and Methods

Two experiments were conducted in the botanical garden of science dep.– college of basic education / Mustansiriyah university during the winter season 2010/2011, using split plots design in (RCBD) with three replications. Two experiments each included two factors, the main plots was the growing culture (Hydroponic and Soil culture) and the Sub-plots were five concentrations of the aqueous extracts (25, 50, 75 and 100 %) + 0 % (distilled water) of the whole plants (root and shoot) of maize *(Zea mays L.)* (in first experiment) and sorghum *(Sorghum bicolor L.)* (in the second one).

The allelopathic potential were tested of maize and sorghum on some physiological characteristics of wheat *(Triticum aestivum L.)* and broad bean *(Vicia faba L.)* plants .

The water extracting and concentrations were prepared by taking 200 gram from the dry powder of sorghum and maize plants, and they were soaked in a 1000 milliliter of nutrient solution Hoagland solution (Arnon and Hoagland,1944) for the sand culture, and the same weight soaked it 1000 milliliter of distilled water in the soil culture, to get an extract with a concentration of 20% (w/v), then shaking the mixture manually for 10 minutes and keeping it in room temperature for 48 hours then filtering the mixture and completing the extract volume to 1000 milliliter and keeping it in refrigerator at 4^{-} C^{o} till its used. the extract is used as a stock solution with a concentration of 100% in the both of experiments, and from this solution the concentrations 25,50,75 % are made for each plant (sorghum and maize) besides the control treatment with the concentration 0% (1/10 Haogland solution in hydroponic and distilled water in soil culture) The extract was taken from the refrigerator and left in a room temperature (about 25 C^o) for 24 hours before it was used for making the required concentrations levels (Chon and Kim , 2004, Al-mezori *et al.* ,1999) and with the required quantities while renewing the solution in the hydroponic every 48 hours.

the cultures were prepared by using the sand for the hydroponic culture after sieving it and adding the HCL acid with the concentration 0.1 % then washing it with a normal water and sterilizing it in an electric oven for three hours on a temperature 160°, the planting was in plastic pots with the same size and they are fixed in a system and irrigated by using the solution of (Hoagland 1/10), after modifying its acidity (PH) to be between 6- 6.5 (Haddad and Obied, 2011) .

In soil culture, a sample of soil took from different places from the field (which did not planted before with sorghum and maize) and packed in pots with in the same size and weight, and a sample of soil is analyzed to discover the chemical and physical characteristics . Wheat seeds are of a EBAA 99 type and the broad beans seeds of a LOZDE ATONO types brought from Agricultural Researches office/ MOA. The seed were sterilized before planting by soaking in 1:10 (1 ml of Sodium hypochlorite 10 milliliter of a distilled water) for 10 minutes (Ben-Hamouda *et al.*,1995) 20 seeds of wheat is planted in each pot and 10 seeds of a broad beans planted in each pot, then the irrigation and fertilization added according to the requirements. After 7 weeks of the beginning of emergence of broad beans and wheat, the plant pigments (carotenoids, chlorophyll a ,b and Total) in the leaves were estimated (mgl^{-1}) by using Arnon method (1949), and also the soluble carbohydrates (%) by method of (Herbert *et al.*, 1971) and the protein (%) according to method of A.O.A.C (1980) and Vopyan (1984). and the proportion of some of the mineral elements (%) (Phosphorus, potassium, calcium, magnesium) according to Anonymous (1976) and Page *et al.* (1982).

The allopathic compounds were diagnosed for the plants of sorghum and maize by using the HPLC (High performance Liquid Chromatography) under the given circumstances as described in the following table (Table 1)

Parameter	Characteristic
Column dimensions	50 length × 4.6 mm I.D
Flow rate	1.8 ml/min.
Detector	SPD-2010 spectrophotometer at 264 nm
Volume injection sample	20µ1
Type of column	Ods-C18
Mobile face	0.1 % actic acid in deionized water: acetonitrile (20:80 V/V)
Temperature	25° C

The dignosing were made in the ministry of science and technology's laboratories/the chemical researches office in Al-jadiria area.

The least significant difference test (L,S,D.$\leq$0.05) were used to compare between the Arithmetic mean (Steel and Torrie,1980).

RESULTS and DISCUSSION:

The effect of the planting cultures on some of the wheat and broad beans characteristics :

Results of the two experiments are shown in table (2), showed the plants in hydroponic suffered from the reduction of pigments, soluble carbohydrates, protein and minerals in a huge percentage more than the plants in soil when irrigated with water containing the extract concentrations of maize and sorghum, and may be this is because of the hydroponic was suitable culture for the compounds that have the ability to dissolve in the water and the absorbing it by plants (Lambers *et al.*, 1998), and as to the unsolved compound, there is a possibility to change them to solved compounds with a toxic quality in the soil because of the microscopic living beings and chemical processes that happen inside the soil (Ingham ,1976).

The results of the first experiments of the effects of aqeous extract concentrations of maize, on wheat and broad beans plants contain of pigments, soluble carbohydrates, protein and the minerals that are given in table (3), indicate to the increase of the aqueous extract of maize’s concentrations 0,25,50 %, with non-significant difference between them in wheat plants contain of chlorophyll (a) when comparing it with the concentrations 75 and 100% that gave an average to this characteristic reached 2.50,2.23 mg/l with non-significant difference between them . As to the contain of the chlorophyll (b) the treatment of the concentration 25% was the highest in chlorophyll(b), and it gave an average of 2.99 mg/l and they are significantly the same with the concentration 0% (2.61 mg/l). and it is noticed that there is a gradual decrease for the chlorophyll (b) to be 2.24,1.75,1.58 mg/l when increasing the concentrations to a 50,75,100 %. The increase of the aqueous extract concentrations from the control treatment led to a significant decrease in wheat plants of the contain of the total chlorophyll, it decreased from 6.46 mg/l to a 5.63,5.30,4.50,4.20 mg/l when increasing the concentration from 0% to 25,50,75,100 % with a decrease percentage reached 12.84,17.95,30.34,34.98 %. The two concentrations of 0 and 25 % showed significant similarity between them and they gave the highest rate for the carotenoids pigments that reached 0.85,0.78 mg/l and these two concentrations were significantly higher than the concentrations 50,75,100 % which gave (0.75,0.61,0.54 mg/l) respectively.

The effect of extracts on broad beans, that table no. (3) shows, there is a significant similarity between the two concentrations 0, 25% in their containing of (chlorophyll a) (2.14, 2.04 mg/l) and chlorophyll b) (1.96, 1.77, mg/l) and the total chlorophyll (4.03, 3.72 mg/l) that surpass the other concentrations in this attributes . As to the contain of the carotenoids pigments in the plants, the decreasing in the concentrations from 100% to a 75,50,25 % resulted in the increase of the carotenoids pigments in broad beans plants from 0.38 mg/l to 0.59,0.62,0.67,0.72 mg/l respectively, these results indicate to a decrease in the contain of wheat and broad beans plants of chlorophyll and carotenoids pigments significantly when they treated with high concentrations levels of maize extracts, comparing with its contain when they were treated to a lesser concentrations levels of these extracts . This is as a result of the existence of the phenolic acids that caused a reduction in the plant contain of the chlorophyll because of the shortage in the building processes of the chlorophyll and also in the affects of the mineral elements absorption that participate in the processes of building the chlorophyll specially the magnesium, or as a result of the obstruction of the coenzyme which build the chlorophyll (Inderjit and Dakshini , 1992, Saeed , 2004) and it is found by (Alsaadawi *et al.*,1986) that the shortage in the quantity of the chlorophyll came equally to the shortage of up taking the elements that contribute in the chlorophyll composition and building the coenzyme that takes part in the building processes of the chlorophyll molecules, these results are match to the results that discovered by each of Zwain (1996), Al Mezori (1996), Yang *et al.* (2002) and with the results of(Alshaakir and Mahdi ,2001).

Results in table (3) shows the effects of the aqueous extracts concentrations of maize in the contain of wheat and broad beans from the soluble carbohydrates as the concentrations 0, 25 % were similar significantly and their levels reaches 14.87, 14.67 % and they surpassed the other concentrations 50,75,100 % (12.98,12.04,10.49 %) which they significantly differ, and as to broad beans plants, their level of the soluble carbohydrates were decreased when increasing the concentrations of the extracts from 17.34 % to 17.13,15.68,14.42,12.46 % and the reduction percentage reached 1.21, 9.57,16.83,28.14 % respectively. the decrease of the soluble carbohydrates level gives an indication to the exposure of the plants to the highest levels of the allelopathic compounds that have the ability to dissolve and make the Inhibitory effects as a result of their contain of the phenolic compound that are considered toxic to the plants and an inhibitor to the physiological processes inside them (Chou and Patrick,1976, Al-Mezori,1996, Saeed,1999, Alshaakir and Mahdi,2001, Alsaadawi *et al.*,2007).

Results in Table (3) indicate the surpass of the two concentrations treatments 0, 25 % that they were similar in the protein percentage in wheat plants, in comparing it with the percentage of the other concentrations. These two treatments gave the highest rate of protein 19.62,19.15 % and this percentage decreased to 17.93, 16.19,14.08 % at the concentrations of 50,75,100 %. The protein percentage in the plants were decreased in broad beans plant from 23.71 % to 21.82,19.94, 18.47,17.47 % when increasing the concentration of the aqueous extract of maize plant from 0 to 25,50,75,100 % respectively. This decrease is as a result of the influence of the allelochemicals in the cellular structures or in the different physiological processes of protein building (Holappa and Blum,1991) and photosynthesis and respiration (Einhellig,1995) and enzymes function and ions absorption (Alsaadawi *et al.*,1986) and amino acids mobility and protein formation, in the same way Julian and Cameron (1980) emphasized that the the two acids Cinnamic and Ferulic inhibited the protein formation, and the Tannin reduced the activity of the enzymes Trypsin, Amylase and Chymotrypsin (Starkey , 1986).

Table (3) shows also that wheat plants which irrigated with the concentrations 0 and 25% are significantly the same in their contain of phosphorus (0.96 and 0.75 %) and surpassed on the plant that irrigated with the concentrations 50,75 and 100 % which it decreased it's contain of phosphorus to be ٠.٤٦ , ٠.٣٤and ٠.٣٠ %. Also it's contain of potassium were reduced to 1.17 and 1.12% with non-significant difference when they irrigated with the concentrations 75 and 100% of maize aqueous extracts, in comparing with the concentrations 0, 25 and 50% which gave the highest contain of potassium with the rate 1.40,1.37 and 1.33 % with non significant differences between them .

The concentrations 0 and 25 % treatments were significantly similar to each other when they gave the highest contain of calcium of wheat plants and the rate was 0.44 and 0.42% and this contain reduced to 0.38, 0.35 and 0.33% when the concentrations increased to 50,75 and 100 % . In the same way the contain of wheat plant of magnesium were reduced from 0.21% to 0.18,0.14,0.12 and 0.10 % at the increasing of the extract concentrations from 0% to 25,50,75,100 % respectively. Concerning of the containing of broad beans plants of minerals elements, the results in table (3) indicates that the phosphorus were reduced ٣٦.٣٦ , ٤٨.٠٥ ,٦٣.٦٣ ,67.53% and potassium 1.30,1.28,1.10 ,0.92 % and calcium 0.50,0.45,0.40,0.35 and Magnesium 0.20,0.16,0.13,0.11 % and that found when the concentration of the extract increased from 0 to 25,50,75 and 100% respectively. This reduction came from the inhibition of the cellular membrane natural function and this because of the increasing of Permeability of the membranes and that reflects negatively in the absorption of non-organic phosphorus by the roots after treating it with fifteen acids of (Hydroxy- Benzoic acid) and the inhibition level reached for some of the acids concentrations to 50 % (Glass, 1975). Acids like caffeic, syrinigic have inhibited the absorption of the plants to the nitrogen and phosphorus, potassium from the soil solution .(Alsaadawi *et al.*,1986) .

Effect of the aqueous extract of sorghum in the contain of wheat and broad beans plants of the plant pigments, soluble carbohydrates, protein, the mineral elements that clarified in Table (4), which indicate the surpass of the two concentrations 0, 25 % with non-significant difference between them of wheat plant contain of the chlorophyll(a) (3.03,2.90 mg/l) and broad beans (2.11,1.84 mg/l), and they surpassed the other concentrations where plants contain of the chlorophyll (a) reduced gradually till it reached the lowest level at the concentration 100%, as it reached 1.33,1.10 mg/l. Concerning wheat contain of the chlorophyll (b) it registered the highest value at the concentrations 0, 25% (3.54,2.95 mg/l) with non-significant difference between them and they surpassed significantly at concentrations 50,75,100 % where the 100% concentration gave the least average for this attribute and reached 1.26 mg/l. The effects of the concentrations of the extract on broad bean's contain from the chlorophyll (b), it was found that the increase of the concentrations from the control treatment 0% resulted to significant decrease in the chlorophyll (b) as it gave the highest rate of (1.67 mg/l) comparing it with the rate of the concentrations of 25,50,75,100 %, these concentration treatments contained 1.40, 1.24, 1.09, 0.93 mg/l with an increase reached 19.28 ,34.67,53.21, 79.56%. Wheat and broad beans plants that are irrigated by the water contains the two concentrations 0 and 25 % surpassed in their contains of the total chlorophyll, to be 5.40,5.08 mg/l, 3.73,3.36 mg/l and with non-significant difference between them, while the plant contain of the total chlorophyll amount reached the least average at the concentratinon 100 % as the chlorophyll level reached 3.50, 2.07 mg/l. The irrigation of wheat and broad beans with a water contain the two concentrations of 0, 25 % led to the surpass of their plant contain of carotenoids pigments, as they gave values for their rate reached 0.93, 0.84 mg/l and 0.81,0.70 mg/l with non-significant difference between them, and the increase of the concentrations to 50,75,100 % led to a gradual decrease to the plants content of this pigments as their level reached in wheat 0.77,0.65,0.60 mg/l, and in broad beans reached 0.63,0.53,0.43 mg/l respectively.

The reason for this decrease is the mechanism of the direct and indirect effect of the allopathic compounds that most of them are phenolic compounds in the inhibition of some metabolically processes ways (Alsaadawi *et al.*, 2007) that have a relation in building the plant pigments (Einhellig and Rasmussen, 1979, colton and Einhellig,1980). It works as a obstruct for absorption of each of the nutritious elements especially the magnesium and the work of the enzymes and building the molecules ATP, DNA, RNA, in the cells (Alsaadawi *et al.*,1986, Inderjit and Dakshini, 1992, Saeed, 2004). Table (5) shows the surpass of the two concentrations 0,25 % and with non-significant difference between them on the other concentrations by giving them the highest percentage of the soluble carbohydrates in wheat and broad beans plants as their values average reached 13.66,13.48 %,17.34,17.18 % in comparing them with the average values of concentrations 50,75,100 % that reached 11.76, 10.10, 8.89 % and 15.01,10.91,10.11 % respectively. The decrease happened in the plant contain of the soluble carbohydrates as a result of the negative effects of the allelopathic compounds in the photosynthesis process, as the phenolic acids inhibit the chlorophyll build and the molecules of ATP, DNA, RNA, in the cells (Inderjit and Dakshini,1992) and the work of enzymes through their association with the proteins (Irwin,1982,Chesworth *et al.*,1998) the oily material that come from sorghum (sorgoleone) and contain the benzoquinone (czarnota *et al.*,2003, cook *et al.*,2010), that oily material obstructs the work of the second light system PSII, and result in preventing of the reduction of blastokoinon (Q**B**) B (Gonzalez *et al.*,1997) and making the energy (ATP) and the reductive compound NADPH**2** that the plant need them in the Calvin cycle, and the functions of the mitochondria by inhibiting the enzyme P-hydroxphenyl pyrovate deoxygenase, which is known HPPD .(Hejl and Koster , 2004 , Dayan *et al.*, 2009).

Table (4) shows that the irrigation of wheat plant with the two concentrations 0, 25 % led to surpass them in protein percentage comparing them with the other concentrations as these two gave a percentage of 18.84,18.43 % and with non-significant difference between them. the increase of concentrations level in the irrigation water to a 50,75,100 % led to a gradual decrease of the protein percentage in the plants as this a rate of 17.06,14.65,11.41 % and the increasing of concentrations from the control treatment (0%) to 25,50,75,100 % led to a significant decrease for the protein percentage in broad beans plants with a percentage of 5.62, 1103, 14.71, 20.83 % respectively. The inhibitory mechanism of the allelopathic compounds for the protein in the plants is based on their association with proteins and their sedimentation (Holappa and Blum,1991) and they also inhibit the build of the Molecules ATP, DNA, RNA in the cells (Inderjit and Dakshini, 1992) besides the obstructing of the enzyme work by formation of complexes with it, (Starkey) found in (1968) that there are a lot of important enzymes in the tested plants such as the enzyme Trypsin, Amylase , Chymotrypsin. A lot of Studies' results that tested the allelopathic effects for some of plants, matched with this result (Julian and Cameron, 1980, Altaaie, 2001)

Table (4) indicates to the increase of the concentrations from control treatment (0%) to 25, 50,75,100 % led to significant decrease in the contain of wheat and broad beans plants of the Phosphorus element as its percentage reached in the plants 1.09, 0.80,0.51, 0.39 % and 1.12, 0.86, 0.64, 0.25 % and with a percentage of decrease reached 30.12, 48.71, 67.30, 75% and 42.24, 64.65, 83.62,117.24 %. The level of the potassium in wheat plants decreased when increasing the concentrations from 0,25 that gave the highest contain of the potassium that reached 1.34,1.23 % and with non-significant difference between them, and they made a significant increase in the concentrations 50,75,100 % that gave values which their average reached 1.20,1.08.1.09 %, and as to the contain of broad bean plants from the potassium element, it is found that the increase of the concentration from the control treatment (0) which gave the highest value of the rate reached to 1.87 % and it has gradually decreased to 1.29, 1.14, 1.11, 0.93 % when increasing the concentrations of extract to a 25,50,75,100 %. The two concentrations 0,25 % showed significant similarities between them in the contain of wheat plants of the calcium element at a rate of (0.43,0.41 %) and they have significantly surpassed the other concentrations 50,75,100 %, and also the contain of the calcium in broad beans plant decreased from 0.50 % at the concentration of 0 % to a 0.48, 0.43, 0.40, 0.35 % at the concentrations 25, 50,75,100 % . And also the contain of wheat and broad bean plants of the magnesium were decreased at a rate 18.18, 36.36, 45.45, 54.54 % and 17.39, 30.43,43.47, 52.17 % when increasing the concentrations from 0% to a 25,50,75,100 % respectively. The plant ability for absorbing the mineral nutrients are affected by a lot of reasons, most of them are the effects of the allelopathic compounds (Chambers and Holm, 1965), these compounds cause the damages to the top of the root and change the grow of the roots hair positions and reduce their length (Buchholtz,1971, chou,1999) that directly affect in the decrease of the up taking the nutritious elements from the soil solution (Glass ,1975, Bhowmik and Doll,1984, Alsaadawi *et al.*, 1986, Alrebaaie, 2005 , Grien, 2009) .

Isolating and Identifying of the Allelopathic Compounds in the Aqueous Extracts of Maize and Sorghum .

Results in Figure (1,3) and Table (5), showed the existence of eight phenolic compounds in Maize extract, as well as other unspecified compounds, the highest registered concentration of these compounds was vanillic acid comparing it to other identified compounds, then the compound concentrations come after it :ferulic acid ,caffeic acid ,catechol acid, P-Hydroxybenzoic acid and Gallic acid that their concentrations gradually decreased, while the two compounds p-coumaric, syringic acid are the lowest. These results matched Chou and Patrick (1976) about the existence of a lot of the compounds in the residue of maize found in the soil, the most important of them is Benzoic acid, P-Hydroxybenzoic acid, vanillic acid, ferulic acid, P-Coumaric acid, Salicylic acid, Syringes acid, Cinammaic acid and Caffeic acid. These compounds have negative effects on a lot of the metabolic processes in the plant. this result also has partially matched with (Al- Mezori,1996) as his results confirmed (by using the chromatography) the existence of four phenolic acid; Vanillic acid, Syringic acid, P-Caumaric acid and Ferulic acid, and also confirmed that the existence of these toxics in the water has negative effects shown clearly in the growth of the coming crops in the agricultural cycles. Ten kinds of phenolic compounds also were isolated and identified from sorghum extract and they are: Syringic acid, Vanillic acid, Gallic acid, Caffeic acid, Ferulic acid, P-Coumaric, Catechol, P-Hydroxyl Benzoic acid, Quinon and Benzaquinon, in the aqueous extract of sorghum plants, as it clarified in the Figure (2,3) and Table (5), and also the test showed the existence of other unspecified compounds, and the highest concentration of the compounds is (sorgoleone) Benzaquinon then the compounds Catechol acid, Ferulic acid and P-Coumaric that their concentrations decreased gradually, while the two compounds Vanillic acid and Syringes acid are the least of the concentrations, comparing them with the other compounds. These results are matched to the results of (Alsaadawi *et al.*, 2007) who have identified and isolated five kinds of the allelopathic compounds in the residue of one of sorghum types and these compounds are Vanillic acid, Gallic acid, Caffeic acid, P-Coumric acid and Ferulic acid. And these results also matched the results of Lahmod (2012) who identified nine kinds of the phenolic compounds and they are Syringic acid, Vanillic acid, Gallic acid, Caffeic acid, P-Coumaric acid, Ferulic acid, Catechol, P-Hydroxyl benzoic and Protocatechuic acid, in the soil that contained residue of sorghum .

Table 2. : Effect of two cultures to wheat and broad beans pigments, soluble carbohydrates, protein and mineral elements.

The experiment	The cultures		Chlorophyll a (mg/l)	Chlorophyll b (mg/l)	The total chlorophyll c (mg/l)	Carotenoids (mg/l)	soluble carbohy-drates (%)	Protein (%)	P (%)	K (%)	Ca (%)	Mg (%)
The first (The aqueous extract of maize)	Hydro-ponic	Wheat	1.52	2.35	3.64	0.16	11.0	15.08	0.97	1.37	0.53	.015
	By soil		3.06	2.28	5.46	1.35	12.11	17.08	0.77	1.00	0.39	0.16
	Hydro-ponic	The broad beans	1.28	0.89	2.20	0.30	12.98	19.45	1.11	1.14	0.4	0.17
	By soil		1.90	1.63	3.58	0.94	15.24	20.96	0.68	1.40	0.44	0.16
The second The aqueous extract of sorghum)	Hydro-ponic	Wheat	3.15	2.41	4.61	0.18	12.72	16.62	0.66	1.37	0.36	0.14
	By soil		2.74	2.05	5.82	1.24	13.30	18.17	60.4	1.18	0.41	0.16
	Hydro-ponic	The broad beans	1.70	1.49	3.05	0.27	14.86	19.38	1.34	1.22	0.43	0.17
	By soil		1.74	1.55	3.35	0.92	15.94	21.18	0.41	1.21	0.46	0.16

Table 3. :Effects of aqueous extract concentrations of maize to wheat and broad beans pigments, soluble carbohydrates, protein and mineral elements.

The Extract concent-rations of maize (%)		Chlorophyll a (mg/l)	Chlorophyll b (mg/l)	The total chlorophyll c (mg/l)	Carotenoids (mg/l)	soluble carbohy-drates (%)	Protein (%)	P (%)	K (%)	Ca (%)	Mg (%)
0	wheat	3.67	2.61	6.46	0.85	14.87	19.62	0.96	1.40	0.44	0.21
25		3.11	2.99	5.63	0.78	14.67	19.15	0.75	1.37	0.42	0.18
50		3.21	2.24	5.30	0.75	12.98	17.93	0.46	1.33	0.38	0.14
75		2.50	1.75	4.50	0.61	12.04	16.19	0.34	1.17	0.35	0.12
100		2.23	1.58	4.20	0.54	10.49	14.08	0.30	1.12	0.33	0.10
(P=0.05) LSD value		0.75	0.48	0.58	0.09	0.27	0.76	0.22	0.08	0.02	0.01
0	Broad beans	2.14	1.96	4.03	0.72	17.34	23.71	1.54	1.47	0.54	0.23
25		2.04	1.77	3.72	0.67	17.13	21.82	0.98	1.30	0.50	0.20
50		1.82	1.54	3.33	0.62	15.68	19.94	0.80	1.28	0.45	0.16
75		1.48	1.43	2.77	0.59	14.42	18.47	0.56	1.10	0.40	0.13
100		1.14	0.92	2.15	0.38	12.46	17.47	0.50	0.92	0.35	0.11
(P=0.05) LSD value		0.27	0.25	0.50	0.13	0.17	0.60	0.29	0.50	0.02	0.02

Table 4. : Effect of the aqueous extract concentrations of sorghum to wheat and broad beans pigments, soluble carbohydrates, protein and mineral elements.

The Extract concent-rations of sorghum (%)		Chlorophyll a (mg/l)	Chlorophyll b (mg/l)	The total chlorophyll c (mg/l)	Carotenoids (mg/l)	soluble carbohy-drates (%)	Protein (%)	P (%)	K (%)	Ca (%)	Mg (%)
0	wheat	3.03	3.54	5.40	0.93	13.66	18.84	`1.56	1.34	0.43	0.22
25		2.90	2.95	5.08	0.84	13.48	18.43	1.09	1.23	0.41	0.18
50		2.54	1.91	4.50	0.77	11.76	17.06	0.80	1.20	038	0.14
75		1.64	1.90	4.27	0.65	10.10	14.65	0.51	1.08	0.34	0.12
100		1.33	1.26	3.50	0.60	8.89	11.41	0.39	1.09	0.29	0.10
(P=0.05) LSD value		0.25	0.62	0.69	0.12	0.41	1.01	0.27	0.11	0.2	0.01
0	Broad beans	2.11	1.67	3.73	0.81	17.34	22.56	1.61	1.87	0.50	0.23
25		1.84	1.40	3.36	0.70	17.18	21.29	1.12	1.29	0.48	0.19
50		1.53	1.24	2.82	0.63	15.01	20.07	0.86	1.14	0.43	0.16
75		1.36	1.09	2.47	0.53	10.91	19.24	0.64	1.11	0.40	0.13
100		1.10	0.93	2.07	0.43	10.11	17.86	0.25	0.93	0.35	0.11
(P=0.05) LSD value		0.31	0.21	0.57	0.11	0.56	1.18	0.29	0.05	0.01	0.01

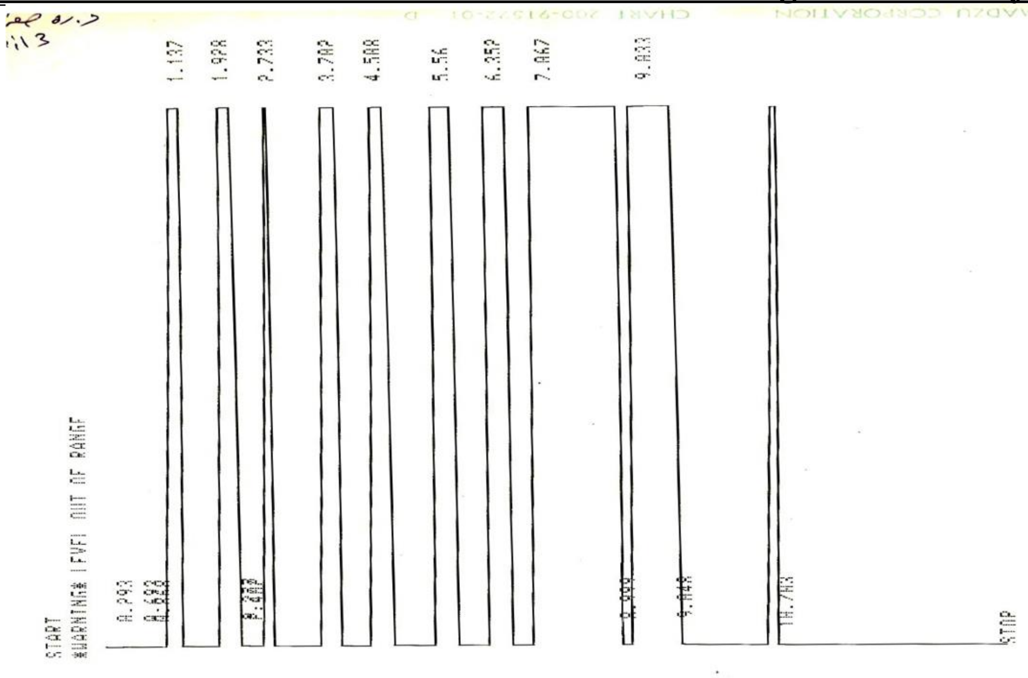

Figure 1. Isolation and identification of the allopathic compounds in the aqueous extracts of maize.

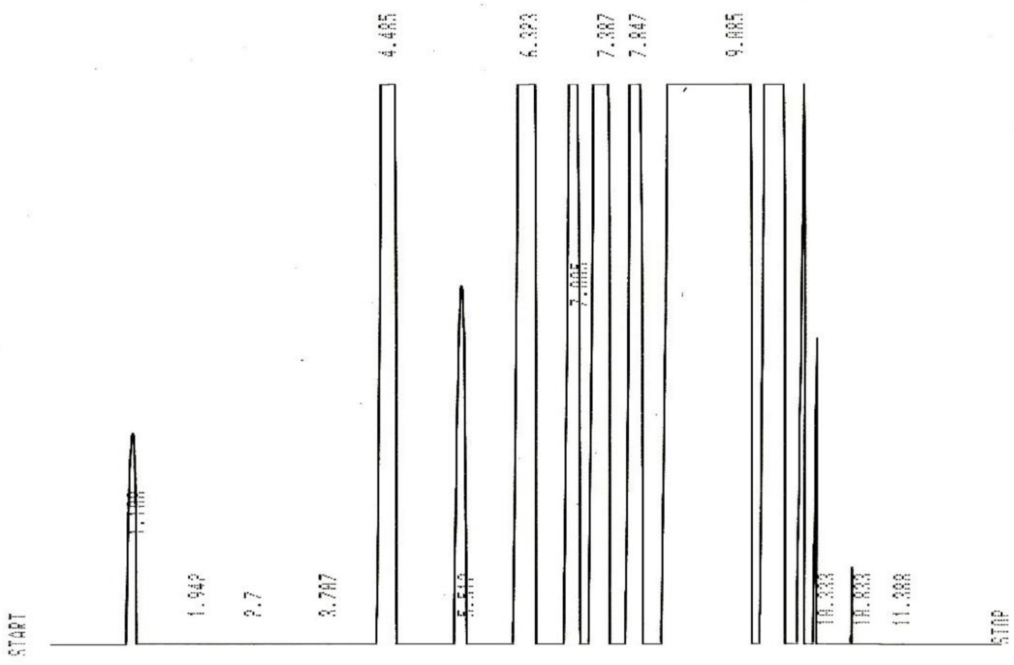

Figure 2. Isolation and identification of the allopathic compounds in the aqueous extracts of sorghum .

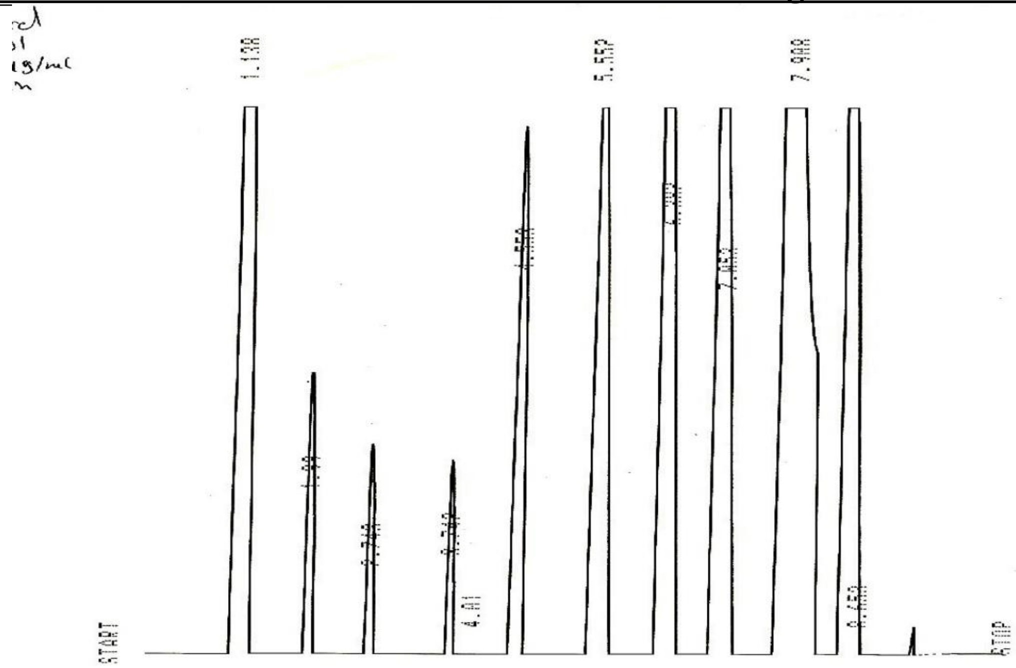

Figure 3. Curve of the standard compound existed in the maize and sorghum .

Table 5. Identification of the allelopathic compounds existed in aqueous extracts of maize and sorghum by using the chromatography (HPLC).

No.	The allelopathic compounds	The appearance time of the compound in the device (minute)	The compound concentration in maize (mg/ml)	The compound concentration in sorghum (mg/ml)
1	Syringic acid	1.13	135.69	33.38
2	Vanillic acid	1.99	1391.21	59.40
3	Gallic acid	2.74	186.7159	59.90
4	Gaffeic acid	3.74	366.28	67.13
5	Ferulic acid	4.55	461.55	97.51
6	P-Coumaric	5.55		130.39
7	Catechol acid	6.38	351.64	119.72
8	P-Hydroxyl benzoic acid	7.05	172.09	1.12
9	Quinon	7.90	_____	40.36
10	Benzaquinon	8.65	_____	2.333.59

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