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ORIGINAL ARTICLES

Allelopathic potentiality of the leaf powder of *Morus alba* and *Vitis vinifera* on the growth and propagative capacity of Purple Nutsedge (*Cyperus rotundus* L.) and Maize (*Zea mays* L.)

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ABSTRACT

Two pot experiments were conducted during two successive summer seasons of 2010 and 2011 in the greenhouse of National Research Centre, Egypt to study the effect of incorporating *Morus alba* and *Vitis vinifera* leaf powder to the soil on the growth and propagative capacity of purple nutsedge as well as maize plants. The experiment included soil treatments with *Morus alba* and *Vitis vinifera* leaf powder at the rate of 0, 25, 50 and 75g/kg soil. Generally, in the 1st stage of growth 45 days after sowing (DAS)*, all concentrations used of both *Morus alba* and *Vitis vinifera* significantly inhibited to high extent the growth of foliage as well as the underground organs and the dry weight of purple nutsedge. In the 2nd stage of growth (75 DAS) complete eradication was recorded with all concentrations except the low concentrations of both *M.alba* and *V.vinifera*. The total phenolic contents in foliage and underground organs of purple nutsedge were significantly increased by increasing the concentrations of both materials used. On the other hand, all treatments applied caused significant increase in the growth characters and total carbohydrate contents of maize comparing to the corresponding controls. Maximum increase was recorded with the highest concentration of *V.vinifera* . Results suggested that both *M.alba* and *V.vinifera* leaves could be used as safety tools to suppress purple nutsedge growth and stimulate maize growth. * (DAS) = Days after sowing

Key wrods: *Cyperus rotundus*, maiz, phenolic content, allelopathy, *Morus alba, Vitis vinifera*

Introduction

During the 20th century, pronounced attention was paid to the use of herbicides to control the growth of weeds which compete with crops. Numerous herbicides were tested especially for controlling the perennial weeds such as purple nutsedge (*Cyperus rotundus* L.) as well as bermuda grass (*Cynodon dactylon* L.). However, the results raised pronounced doubts concerning the safety from their continuous use. (Altland *et al*. 2003; Ferell *et al*.2004; Durigan *et al*.2006, EL-Rokiek *et al*. 2006, 2007 and 2009).

Allelopathy is a safe alternative technique that could overcome this serious problem through reduction of the environmental pollution and could be defined as an eco –friendly method. (Abdul Khaliqa *et al*. 2012).

The main principal in allelopathy arises from the fact that plants produce thousands of chemicals and many of these could be released by either leaching or by exudation or through the decomposition processes. These allelochemicals include numerous compounds such as phenolic compounds, flavonoids, terpenoids, alkaloids, steroids as well as carbohydrates and amino acids (Einhellig, 2002). As the allelopathic effects are either positive or negative , these effects could be used usefully. Negative allelopathic effects (stimulatory effect) of any plant could be utilized to promote the growth of crops, while the positive effects (inhibitory) could be utilized to develop safely green herbicides. (Oudhia, 1999).

Since, few reports are available concerning the allelochemicals present in the leaf powder of both mulberry (*Morus alba*) and grape (*Vitis vinifera*) (Guo *et al*.2010 ; Razia *et al*.2010 and Li *et al*. 2011), it was thought advisable to evaluate the allelopathic potentiality of the leaf powder of the two plants *Morus alba* and *Vitis vinifera* on the growth and propagative capacity of both purple nutsedge (*Cyperus rotundus* L.) and maize (*Zea mays* L.).

Materials and Methods

Two pot experiments were carried out during two successive summer seasons in (September) of 2010 and 2011 in greenhouse of National Research Centre, Egypt. The stock of purple nutsedge (*Cyperus rotundus* L.) used as a source of tubers was collected from a dense stand at National Research Centre garden. Maize (*Zea mays* L.) grains c.v. pioneer 30 k8 were obtained from Agricultural Research Centre,Giza, Egypt.

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Healthy *Morus alba* and *Vitis vinifera* leaves were collected from a farm at Giza Governorate. The leaves were washed thoroughly with running tap water to remove dust and other undesired materials and air dried in shadow at room place then grinded to fine powder. Fine powdered of *Morus alba* and *Vitis vinifera* leaves were incorporated in the soil surface at the rate of 0, 25, 50 and 75g/kg soil before sowing. Dormant tubers of purple nutsedge and grains of maize were sown 2cm deep in plastic pots filled with 2kg of soil. The experiment consisted of 9 treatments including controls, each treatment consist of 8 replicates. All pots were arranged in a complete randomized design.

Data recorded

A-On purple nutsedge:-

Four replicates were collected from each treatment at every stage of growth (45 and 75 DAS) and the following growth characters were taken :

1- Number of mother shoots /tuber. 2- Number of leaves of mother shoots /tuber.
3- Length of mother leaves (cm). 4- Number of daughter shoots /tuber.
5- Number of leaves of daughter shoots /tuber.
6- Number of propagative organs/tuber (basal bulbs and tubers) /tuber.
7- Number of rhizomes/tuber. 8- Length of rhizomes/tuber (cm).
9- Dry weight of foliage (g/plant). 10- Dry weight of underground organs (g/plant).
11- Total dry weight (g/plant).

B- On maize plants:-

In both seasons, samples of maize plants were collected at 45 and 75 (DAS) to determine :-
1- Plant length / cm. 2- Number of leaves of /plant. 3- Root length / cm.
4- Fresh weight of plant /g. 5- Fresh weight of root /g. 6- Fresh weight of total plant /g.
7- Dry weight of plant /g. 8-Dry weight of root /g. 9- Dry weight of total plant /g.

Chemical analysis :-

1-Total phenolic contents (mg/g DW) :-

Total phenolic compounds in purple nutsedge were extracted from dry samples of the foliage and underground organs as well as leaf powder of both *Morus alba* and *Vitis vinifera*. Drying tissues was carried out in an electric oven at 60° C till constant weight. Total phenolic contents were determined colorimetrically according to the method defined by Snell and Snell (1953) using Folin and Cioalteu phenol reagent.

2- Total carbohydrate contents (mg/g DW):-

Total carbohydrate contents in maize leaves were extracted from dry finely ground maize leaves (powdered). Total carbohydrates were extracted according to Herbert *et al*. (1971) and estimated colourimetrically by the phenol-sulphuric acid method as described by Montogomery (1961).

Statistical analysis:

Combined analyses of the two seasons were statistically analyzed at 5% propability according to Snedecor and Cochran (1980).

Results:

A-Growth characters of purple nutsedge:-

1- Growth characters of mother shoots:-

The experimental results recorded in Table (1) revealed that all growth characters of purple nutsedge alone after 45 and 75 (DAS) increased by the increase in plant age. Mixed stand of purple nutsedge + maize showed that all growth characters of mother shoots in both stages (45 and 75 DAS) were significantly decreased as compared to corresponding control (purple nutsedge alone), except the number of mother shoots/ tuber in the 1st stage (45 DAS). Significant reduction in the number of mother shoots/ tuber of purple nutsedge was also recorded with the highest concentration of *M. alba* (75 g/kg soil) in the 1st stage (45 DAS), while with *V. vinifera* significant reduction was recorded with the 2nd and 3rd concentrations (50 and 75 g/kg soil) as compared ***with*** the corresponding controls. After 75 DAS, both *M. alba* and *V. vinifera* at the 2nd and 3rd concentrations (50 and 75 g/kg soil) caused complete eradication on the same character.

M. alba as well as *V. vinifera* with different concentrations caused significant reduction in the number and length of leaves of mother shoots/ tuber as compared to their corresponding controls in the 1st stage (Table 1). The rate of reduction increased by increasing the rate of concentration used. In the 2nd stage (75 DAS) complete eradication was recorded with the 2nd and 3rd concentrations (50 and 75 g/kg soil) with both *M. alba* and *V. vinifera* on the same characters of purple nutsedge.

The results demonstrated in Table (1) revealed the effect of *M. alba* and *V. vinifera* on the number of daughter shoots/tuber and number of leaves of daughter shoots/tuber of purple nutsedge. Significant reduction in both characters of purple nutsedge was recorded due to the application of low concentration (25g/kg soil) of both *M. alba* and *V. vinifera* in the 1st stage (45 DAS) comparing to the corresponding controls, while higher concentrations of both materials used cause complete eradication on both characters. In the 2nd stage of growth all concentrations of both materials used caused complete eradication in the growth characters of daughter shoots of purple nutsedge except the low concentration of *M. alba* only.

2- Growth characters of underground organs :-

The results recorded in Table (2) showed the effect of *M. alba* and *V. vinifera* with different concentrations on the growth parameters of the underground organs of purple nutsedge in the two stages of growth. Significant reduction was recorded after 45 DAS on the number of basal bulbs and tubers/tuber, number of rhizomes/ tuber and length of rhizomes (cm) with all concentrations of both materials used. The rate of reduction increased by increasing the rate of concentration as compared to the corresponding controls. In the 2nd stage of growth (75 DAS), the low concentration (25g/kg soil) of *M. alba* caused significant reduction in different growth parameters of underground organs comparing to their corresponding controls. The rate of inhibition in the number of basal bulbs and tubers/tuber reached to 86.1 and 68.0%, respectively when compared to the corresponding controls, while the higher concentrations (50 and 75 g/kg soil) of *M. alba* as well as all concentrations of *V. vinifera* caused complete eradication in all growth characters of the underground organs of purple nutsedge (Table 2).

3-Dry weight:-

The results presented in Table (3) showed that dry weight of foliage, dry weight of underground organs as well as the total dry weight of purple nutsedge alone increased by increasing plant age. All concentrations of *M. alba* and *V. vinifera* induced significant reduction in the dry matter accumulation of foliage of purple nutsedge in the 1st stage (45 DAS). The rate of reduction increased by increasing the concentration used as compared to the corresponding controls. In the 2nd stage (75 DAS) all concentrations used caused complete eradication , except the low concentration of both *M. alba* and *V. vinifera* (25g/kg soil).

The underground organs are the main storage parts of nutsedge plants. *M. alba* as well as *V. vinifera* treatments induced significant reduction in this character in the 1st stage (45 DAS) as compared to corresponding controls, while in the 2nd stage of growth, complete eradication was recorded with different concentrations of both materials used except the low concentration (25g/kg soil) of *M. alba* only comparing to the corresponding controls.

The pattern of change in the total dry weight of purple nutsedge (foliage + underground organs) showed the same tendency in the dry weight of foliage (Table 3) at the two stages of growth (45 and 75 DAS) comparing to the corresponding controls.

4- Changes in total phenolic contents:-

Total phenolic contents of purple nutsedge tissues (foliage or underground organs) at the two stages of growth exhibited significant response to soil applied of all concentrations used of both *M. alba* and *V. vinifera* (Table 4). The results revealed significant increase in the total phenolic contents in both foliage and underground organs due to the different applied rates of both materials used in comparison to the untreated corresponding controls. The increase in total phenolic contents increased by increasing the rates of concentration. The results also indicated that total phenolic accumulations in underground organs exceeded than those found in their corresponding foliage in each treatment. The highest concentrations of both *M. alba* and *V. vinifera* in foliage and underground organs in the 1st stage of growth increased the total phenolic contents to about 3 folds than that recorded in the corresponding maize + purple nutsedge (mixed control).

In this connection it is worthy to mention that the total phenolic contents in the leaf powder of *V. vinifera* is more than twice the amount present in *M. alba* (23.1 and 10.1 mg/g DW).

B-Growth characters of maize :-

Results in Tables (5 and 6) revealed that all growth characteristics of maize alone in the two stages of growth were significantly increased by the increase in plant age, while the data of maize recorded in the mixed stand (maize + purple nutsedge) showed that all growth characters of maize in both growth stages (45 and 75 DAS) were significantly decreased as compared to the corresponding control.

Data recorded in Tables (5 and 6) illustrated also that both *M. alba* and *V. vinifera* with different concentrations used caused significant increase in all growth characters of maize in the two stages of growth as compared to the corresponding controls. It is worthy to mention that the maximum increase in plant length, number of leaves/plant as well as the fresh and dry weight of plant was recorded with the highest concentration of *V. vinifera* (75 g/kg soil) as compared to the corresponding controls.

Changes in total carbohydrate contents :-

Total carbohydrate contents of maize leaves at the two stages of growth were illustrated in Table (7). Total carbohydrate contents of maize leaves significantly increased when treated with all concentrations of both materials used (*M. alba* and *V. vinifera*) in the two stages of growth (45 and 75 DAS). The rate of total carbohydrate contents significantly increased by increasing the rate of concentration as compared to their corresponding controls. The highest total carbohydrate contents in maize leaves in the two stages of growth was recorded with the highest concentration of V.vinifera (169.4 and 268.7) as compared to mixed corresponding control (88.4 and 136.6) after 45 and 75 DAS, respectively.

Discussion:

As mentioned in the introduction, the main principal in the phenomenon of allelopathy, is the fact that plants produce thousands of chemicals, many of these could be released and subsequently could alter the growth or the physiological functions of other species (Singh *et al*. 2003). This means that more attention must be paid to evaluate the potentiality of the leaf powder of many plant species , in an attempt to find an eco-friendly herbicides.

In the last fifty years, numerous researches were carried out to control the associated weeds infesting crop plants. Pronounced attention was made to study the control of perennial weeds such as purple nutsedge because of its capability to regenerate from dormant underground buds present on its tuber and basal bulbs, even after herbicidal treatments. Owing to the fact that dormant tubers do not accumulate phytotoxic doses from many foliarly applied herbicides (Messiha, 1989 and 2005).

Few reports are available concerning allelochemicals present in the leaf powder of both mulberry (*Morus alba*) and grape (*Vitis vinifera*). However,these reports showed the possibility of using these plants in this respect. For example, Razia *et al*. (2010) reported that postemergence of two foliar sprays of mulberry leaf water extract suppressed the growth of bermudagrass (*Cynodon dactylon*) and in the same time promoted the growth and yield of wheat. However, pregermination application of 100% mulberry leaf water extract caused complete inhibition of bermudagrass and wheat germination. With respect to the allelochemicals present in *Vitis vinifera* plants, Guo *et al*. (2010) and Li *et al*. (2011) mentioned that root decomposition substance significantly inhibited grape growth and the inhibiting effect became stronger with the increase of grape root in soil .

Since, purple nutsedge is one of the most common perennial weeds infesting maize fields in Egypt. **(**Ahmed, 1999; Ahmed, 2000; EL-Metwally *et al*.2001 and Ahmed *et al*., 2008). Cruz *et al*. (1971) reported that the reduction in corn yield reached to 40% when competed with purple nutsedge. Therefore, it was desirable to make use from the allelochemicals present in the leaf powder of *Morus alba* and *Vitis vinifera* to control purple nutsedge associating maize plants.

The results of this study revealed that the powder of *M. alba* and *V. vinifera* induced significant reduction in most growth characters of mother shoots/tuber of purple nutsedge with all concentrations used in the 1^{st} stage of growth, while in the 2^{nd} stage complete eradication was recorded with the higher concentrations (50 and 75 g/kg soil) of both materials used (Table 1). The data of different growth characters of daughter shoots/ tuber of purple nutsedge recorded complete eradication in the 1^{st} stage with different concentrations of both *M. alba* and *V. vinifera* except their low concentration (25 g/kg soil) .In the 2^{nd} stage of growth, the same tendency of data was recorded except the low concentration of *M. alba* only (Table 1). The allelopathic effect of different concentrations of *M. alba* and *V. vinifera* caused highly significant inhibition in all growth characters of the underground organs as compared to corresponding controls in the 1^{st} stage and it reached to complete inhibition in the 2^{nd} stage of growth except with the low concentration of *M. alba* only (Table 2). Consequently, the data recorded in Table (3) revealed the same tendency in the dry matter accumulation of foliage, underground organs and whole plant. Similar results were also reported by other allelochemicals present in the powder of other plants (Duke *et al*., 1998; Olofsdotter *et al*., 2002; James and Bala, 2003; Padmanaban and Daniel,2003; Rudramuni *et al*., 2006 and EL-Rokiek,*et al*., 2010 and 2011).

In this connection, it is worthy to mention that the powder of both *M. alba* and *V.vinifera* significantly increased the total phenolic compound contents in purple nutsedge plants to about three folds in the first stage of growth before causing the complete eradication of the weed in the second stage of growth. The accumulation of phenolic compounds could indicate a sort of allelopathic stress (positive allelopathic effects) (Ahmed and Rashad, 1996; EL-Rokiek *et al*., 2010; EL-Rokiek *et al*., 2011 and Dawood *et al*. 2012).

Although both *M. alba* and *V.vinifera* achieved to a great extent good results in controlling purple nutsedge, yet *V.vinifera* recorded more pronounced effect than that of *M. alba*, this could be due to its total phenolic contents.

On the other hand, the results of the present study reveal that all treatments of *M. alba* and *V.vinifera* have stimulatory effects (negative allelopathic effects) on different maize growth characters and total carbohydrate contents in the two stages of growth and significantly increased by increasing the rate of concentrations comparing to their corresponding controls. Similar results were also reported by other allelochemicals present in the powder of some plants. (Minorsky, 2002; Sanchez *et al*.,2003; Stephanie *et al*., 2004; EL-Rokiek,*et al*., 2006; EL-Metwally and EL-Rokiek, 2007; Abdelhamid and EL-Metwally, 2008).

Generally, we can conclude that different treatments of both of M. *alba* and V. vinifera leaf powder minimized to a great extent, the growth characters of purple nutsedge until it reached the complete eradication with the higher concentrations in the 2nd stage of growth, accompanied by significant increase in maize growth characters as well as its total carbohydrate contents.

Finally, the allelopathic activity of M. *alba* and *V. vinifera* leaf powder could be used as a safety tool to control purple nutsedge growth and to improve the growth and total carbohydrate contents of maize plants.

Table 1: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on the different growth parameters of foliage of purple nutsedge (*Cyperus rotundus* L.). (Average of the two seasons).

Treatments	Rate (g/kg soil)	Growth characters									
		No. of mother shoots/tuber		No. of leaves of mother shoots/tuber		Length of mother leaves (cm)		No. of daughter shoots/tuber		No. of leaves of daughter shoots/tuber	
		45 days	75 days	45 days	75 days	45 days	75 days	45 days	75 days	45 days	75 days
Purple nutsedge alone (P)	---------	2.00	3.0	20.5	24.0	45.0	57.0	4.0	5.0	11.0	15.0
Purple nutsedge + Maize (M)	---------	2.00	2.0	15.6	20.0	41.0	31.9	3.0	1.9	8.0	5.5
P.+M.+ Morus alba	25	2.00	2.0	14.0	10.0	39.0	27.6	1.0	1.0	3.0	2.0
	50	2.00	0.0	13.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0
	75	1.33	0.0	10.0	0.0	33.0	0.0	0.0	0.0	0.0	0.0
P.+ M.+ Vitis vinifera	25	2.00	2.0	12.0	8.0	37.0	24.0	1.0	0.0	2.0	0.0
	50	1.00	0.0	6.0	0.0	34.0	0.0	0.0	0.0	0.0	0.0
	75	1.00	0.0	5.0	0.0	30.0	0.0	0.0	0.0	0.0	0.0
LSD at 5%		0.24	0.10	1.06	0.13	1.26	1.09	0.63	0.07	0.68	0.43

Table 2: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on the different growth parameters of underground organs of purple nutsedge (*Cyperus rotundus* L.). (Average of the two seasons).

Treatments	Rate (g/kg soil)	Growth characters					
		No. of basal bulbs and tubers/tuber		No. of rhizomes / tuber		Length of rhizomes (cm)	
		45 DAS	75 DAS	45 DAS	75 DAS	45 DAS	75 DAS
Purple nutsedge alone	---------	4.00	5.75	3.75	5.00	12.0	13.5
Purple nutsedge + Maize	---------	2.25	2.50	1.75	1.50	10.5	6.1
P. +M. + Morus alba	25	1.28	0.80	1.05	0.85	9.6	3.5
	50	0.80	0.00	0.80	0.00	5.0	0.00
	75	0.33	0.00	0.40	0.00	2.7	0.00
P. + M. + Vitis vinifera	25	1.20	0.00	0.90	0.00	7.7	0.00
	50	0.10	0.00	0.30	0.00	2.2	0.00
	75	0.10	0.00	0.20	0.00	1.5	0.00
LSD at 5%		0.45	0.35	0.38	0.37	0.17	0.16

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Table 3: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on the dry weight of foliage, dry weight of underground and total dry weight (g/plant) of purple nutsedge (*Cyperus rotundus* L.). (Average of the two seasons).

Treatments	Rate (g/kg soil)	Growth characters					
		Dry weight of foliage (g/plant)		Dry weight of underground organs (g/plant)		Total dry weight (g/plant)	
		45 DAS	75 DAS	45 DAS	75 DAS	45 DAS	75 DAS
Purple nutsedge alone	----------	0.70	1.25	1.00	1.28	1. 70	2.53
Purple nutsedge + Maize	----------	0.32	0.30	0.30	0.23	0.62	0.53
P. + M.+ Morus alba	25	0.25	0.20	0.25	0.15	0.50	0.35
	50	0.20	0.00	0.15	0.00	0.35	0.00
	75	0.13	0.00	0.10	0.00	0.23	0.00
P. + M.+ Vitis vinifera	25	0.23	0.15	0.18	0.00	0.41	0.15
	50	0.18	0.00	0.10	0.00	0.28	0.00
	75	0.10	0.00	0.10	0.00	0.20	0.00
LSD at 5%		0.05	0.07	0.06	0.07	0.14	0.06

Table 4: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on total phenolic contents (mg/g DW) in foliage and underground organs of purple nutsedge (*Cyperus rotundus* L.).

Treatments	Rate (g/kg soil)	Foliage		Underground	
		45 DAS	75 DAS	45 DAS	75 DAS
Purple nutsedge alone	---------	16.60	44.4	18.15	62.5
Purple nutsedge + Maize	---------	26.17	93.3	41.2	124.5
P.+ M.+ Morus alba	25	43.86	118.9	65.4	212.0
	50	73.04	0.0	90.1	0.0
	75	84.48	0.0	122.8	0.0
P. + M.+ Vitis vinifera	25	48.85	0.0	73.5	0.0
	50	78.68	0.0	95.8	0.0
	75	89.17	0.0	131.6	0.0
LSD at 5%		1.19	1.24	1.98	1.85

Table 5: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on growth characters of maize (*Zea mays* L) plants at 45 and 75 days after sowing. (Average of the two seasons).

Treatments	Rate (g/kg soil)	Growth characters					
		Plant length /cm		No. of leaves/plant		Root length /cm	
		45 DAS	75 DAS	45 DAS	75 DAS	45 DAS	75 DAS
Maize alone	----------	57.0	61.0	5.0	6.1	33.8	56.8
Maize + Purple nutsedge	----------	50.7	59.0	4.5	5.4	31.0	50.9
M.+ P.+ Morus alba	25	62.3	70.2	5.4	6.6	38.4	63.0
	50	77.0	81.7	6.4	7.1	42.5	68.1
	75	80.0	85.5	6.7	7.3	47.8	76.0
M.+ P.+ Vitis vinifera	25	65.3	75.0	5.6	6.7	36.2	59.5
	50	87.5	99.0	7.6	8.1	40.3	65.8
	75	96.7	106.0	8.0	8.6	44.6	71.0
LSD at 5%		1.56	1.06	0.33	0.40	1.49	1.96

Table 6: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on growth characters of maize (*Zea mays* L) plants at 45 and 75 days after sowing. (Average of the two seasons).

Treatments	Rate(g/kg soil)	45 days after sowing						75 days after sowing					
		Fresh weight /g			Dry weight /g			Fresh weight /g			Dry weight /g		
		Plant	Root	Total	Plant	Root	Total	Plant	Root	Total	Plant	Root	Total
Maize alone	----------	7.5	2.5	10.0	1.24	0.85	2.09	12.0	8.1	20.1	2.10	2.20	4.30
Maize + Purple nutsedge	----------	6.7	2.2	8.9	0.99	0.62	1.61	09.5	6.6	16.1	1.36	1.53	2.89
M.+ P.+ Morus alba	25	8.4	2.9	11.3	1.34	0.93	2.27	14.2	10.1	24.3	2.25	2.40	4.65
	50	11.9	3.4	15.3	1.96	1.06	3.02	16.9	11.6	28.5	2.81	3.05	5.86
	75	15.5	4.3	19.8	2.75	1.30	4.05	22.1	15.5	37.6	3.71	3.66	7.37
M.+ P.+ Vitis vinifera	25	8.8	2.8	11.6	1.36	0.92	2.28	14.9	11.2	26.1	2.41	2.46	4.87
	50	13.7	3.4	17.1	2.45	1.01	3.46	19.0	13.4	32.4	3.33	3.31	6.64
	75	17.4	4.1	21.5	3.14	1.20	4.34	22.6	17.2	39.8	3.77	4.41	8.18
LSD at 5%		0.72	0.28	0.43	0.06	0.06	0.07	0.95	0.69	0.67	0.08	0.12	0.11

Table 7: Effect of different concentrations of *Morus alba* and *Vitis vinifera* leaves powder on total carbohydrate contents (mg/g DW) maize (*Zea mays* L) leaves.

Treatments	Rate(g/kg soil)	Days from sowing	
		45	75
Maize alone	-----------	133.9	147.3
Maize + Purple nutsedge	-----------	88.4	136.6
M.+P.+ Morus alba	25	138.3	152.6
	50	146.5	169.0
	75	156.3	190.3
M.+P.+ Vitis vinifera	25	143.7	154.9
	50	162.7	228.9
	75	169.4	268.7
LSD at 5%		2.19	6.01

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