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Effect of Foliar Application of some Zinc and Phosphorus Sources on Controlling Helminthosporium Leaf Spot Disease and Production of Sesame

El-Fawy, M. M.[1] and M. A. A. El-Said[2]
[1]Department of Agricultural Botany, Plant Pathology Branch, Faculty of Agriculture Al Azhar Univ. (Assiut Branch), Egypt.
[2]Department of Agronomy, Faculty of Agriculture Al-Azhar Univ. (Assiut Branch), Egypt.

ABSTRACT

Nineteen isolates of *Helminthosporium sesami* were obtained from infected sesame plants with Helminthosporium leaf spot taken from different locations in Nubaria region, El-Behera Governorate, Egypt. All the obtained isolates of the pathogen were able to infect Del Al-Jamal sesame variety plants causing Helminthosporium leaf spot disease symptoms with different degrees. The objectives of this study were to evaluate the efficiency of some zinc and phosphorus sources against the pathogen and their effect on some agronomic characters of sesame. *In vitro* studies, the effects of zinc oxide (ZnO), zinc sulfate ($ZnSO_4$) as sources of zinc and dipotassium phosphate (K_2HPO_4) and disodium phosphate *(*Na_2HPO_4) as sources of phosphorus on the pathogen have been studied by using different concentrations on potato dextrose agar medium (PDA). These results suggest that these compounds reduced the mycelial growth of the pathogen. The highest reduction of mycelial growth was obtained when $ZnSO_4$ at concentration 100 mM (78.57%), followed by ZnO. Under field experiments, foliar spraying of sesame plants with ZnO, $ZnSO_4$, K_2HPO_4 and Na_2HPO_4 at the rate of 100 mM reduced disease severity compared to the control treatment. ZnO gave the highest reduction in disease severity followed by $ZnSO_4$. These compounds improved agronomic characters of sesame*, i.e.* plant height, number of branches and capsules/plant, weight of 1000 seeds (g), seed yield/feddan and percentage of oil seeds. K_2HPO_4 treatment was the most effective on all studied agronomic characters than other compounds.

Keywords: Helminthosporium leaf spot, *Sesamum indicum*, zinc, phosphorus, yield, oil content.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the most important and oldest oil seed crops in tropical and subtropical areas of the world. Among oil crops, sesame is one of the highest in oil content which ranges from 34 to 63% (Baydar *et al.*, 1999), protein from 17 to 19% and 16 to 18% carbohydrates (Uzoh, 1998 and Marri *et al.*, 2012). It is also a rich source of vitamins (pantothenic acid and vitamin E) and minerals such as calcium (1,450 mg/100 g) and phosphorous (570 mg/100 g) (Balasubramaniyan and Palaniappan, 2001).

Sesame is attacked by several pathogens which are responsible for a major damaging factor to crop plants. Among important diseases is Helminthosporium leaf spot, Helminthosporium blight or brown leaf spot and all these names are for the same disease which is caused by *Helminthosporium sesami* (Miyake)=*Drechslera sesami* (Miyake) Richards and Fraser. This disease is a new record for this host in the United States in a breeding nursery near College Station, Texas, in 1954 (Poole, 1956). Since that time, few studies have involved Helminthosporium leaf spot disease. The disease symptoms are small and circular dark brown or purple-brown spot eventually becoming oval brown spot with gray to whitish center. The spots also appear on the stems, necks of the leaves and capsules and up to the seeds, which leads to a shortage of seed yield and reduced quality of oil produced. The infected seeds become a source of infection in the following season when used as a seed (Wasnikar *at al.*, 1987).

Zinc and phosphorus are two of the most important nutritional constraints for plant (Marschner, 1995 and Ismail *et al*., 2007). There are numerous studies on the use of nutrients as zinc and phosphorus to control plant diseases (Kasemets *et al.*, 2009; Kumar *et al.*, 2013 and Savi *et al.*, 2015). For example, $ZnSO_4$ and Zn $(ClO_4)_2$ were most effective, inhibiting completely the *Fusarium graminearum* and *Penicillium citrinum* growth in the concentration of 100 mM (Osinaga *et al.*, 2003). Zinc has shown significant toxicity to bacteria; inhibition and inactivation of cell growth have been reported as an antibacterial effect of zinc (Xie *et al.*, 2011). Phosphorus application as a foliar treatment can induce local and systemic protection against powdery mildew in cucumber, roses, wine grapes, mango and nectarines (Reuveni and Reuveni 1998). Hussein *et al*. (2007) found that the highest reduction in disease severity of Stemphylium blight of onion was observed when K_2HPO_4 was used at 50 mM (66.81%) compared to other treatments. Mono and dipotassium phosphates have shown efficacy against powdery mildew diseases on cucumber (Reuveni *et al.*, 2000), pepper (Reuveni *et al.*, 1998), tomato (Ehret *et al.*, 2002) and sugar beet (Mosa, 2002).

Foliar fertilization is gaining more importance in recent years due to the availability of soluble fertilizers and is of great significance in rain fed areas under changing climatic conditions. Many research reports indicated the positive effect in enhancing the crop yield and quality of oil seed crops. Application of nutrients through foliar spray helps in quick regain in drought situation and also prevents loss of nitrogen in different means. Mahajan *et al*. (2016) revealed that foliar with diammonium phosphate significantly improved the yield attributes, number of capsules per plant and oil%. Krishnaprabu and Kalyanasundaram (2007) revealed that foliar spray of 1.5% diammonium phosphate after 40 and 55 days from sowing increased significantly seed yield of sesame and also recorded the highest seed yield (902 kg/ha) compared to the control (470 kg/ha). Mahdi (2014) showed that foliar spray of zinc higher response of sesame in the average of plant height, number of branches, number of capsules/plant and seed yield.

The objectives of this study were to evaluate the efficacy of some zinc and phosphorus sources as a foliar treatment for controlling of Helminthosporium leaf spot disease and their effect on some agronomic characters of sesame.

MATERIALS AND METHODS

Isolation, purification and identification of *H. sesami* isolated from sesame plants:

Infected sesame plants with Helminthosporium leaf spot were collected from different fields in Nubaria region, El-Behera Governorate, Egypt. Infected leaves, stems, capsules and seeds surface sterilized using 1% sodium hypochlorite for 1 minute, then rinsed in sterilized water. The surface sterilized samples were dried by sterilized filter paper and plated onto PDA medium. Petri dishes were incubated at 27°C and were examined every 24 hrs to observe the hyphal growth in the plates. The obtained isolates were purified using single spore technique. Identification of the purified cultures was carried out according to the cultural properties, morphological and microscopical characteristics described by Mew and Gonzales (2002) and confirmed by Assiut Univ. Mycol. Center (AUMC). Pure cultures of all identified isolates were maintained at 4°C on PDA in slants until use.

Pathogenicity test:

Pathogenicity of *H. sesami* was carried out on Del Al-Jamal sesame variety. Three seeds were sown directly in each perforated plastic bag (30 cm in diam) on 1st Oct., and irrigation was done twice a week. A spore suspension of each isolate was prepared by growing it on sugar beet leaves extract dextrose agar medium. The growth of each isolate was collected and blended using a warring blender. The number of spores in the suspension was estimated by counting with a hemacytometer and adjusted to approximately 1×10^5 spores/ml as mentioned by Shabana *et al.* (2008). 30 days old plants were sprayed with spore suspensions until runoff. Three replicates were used for each isolate. Disease severity was measured into five categories following a disease grading scale where 0= No visible symptom; 1= 1 to 10% leaf area affected; 2=11 to 20% leaf area affected; 3= 21 to 50% leaf area affected; 4= 51 to 80% leaf area affected and 5= > 80% leaf area affected (Pawar *et al.,* 1994). The disease intensity accomplished with percent disease index was calculated by using following formula (Bdliya and Gwio-Kura, 2007).

Sum of all disease rating

$$\textbf{Disease severity \%} = \frac{\textbf{Sum of all disease rating}}{\textbf{Total number of rating} \times \textbf{maximum disease grade}} \times 100$$

Efficacy of some zinc and phosphorus sources against growth of *H. sesami in vitro*:

Laboratory work was directed to study the effect of ZnO, $ZnSO_4$, K_2HPO_4 and Na_2HPO_4 on linear growth of the pathogen have been studied *in vitro* by using different concentrations from each treatment. PDA medium was prepared in conical 250 ml flasks each containing 200 ml medium. The chemicals were added singly to PDA medium at concentrations 0, 25, 50, 75 and 100 mM, and mixed thoroughly before solidification at 50-60°C (Fraternale *et al.,* 2003**)**. The medium was poured into Petri dishes and four plates for each treatment were used as replicates. Plates without chemicals were used as a control. All plates were inoculated with isolate No. 13 of *H. sesami* and incubated at 25±2ºC. Data were recorded as a diameter of linear growth when the control plates were completely covered by the fungal mycelium. Percentage of growth inhibition was calculated according to the following formula:

$$\mathbf{R = (C - B/C) \times 100}$$

Whereas: R= % of growth inhibition, C= growth in control and B = growth in treatment.

Effect of spraying with some zinc and phosphorus sources on Helminthosporium leaf spot disease and production of sesame under field conditions:

Field experiments were carried out at Nubaria Research Station, El-Behera, Governorate, Egypt, growing seasons 2016 and 2017 to study the effect of some zinc and phosphorus sources on Helminthosporium leaf spot disease and production of sesame plants. Each experimental sup plot consisted of 6 ridges, 4 m in length and 50 cm in width (plot area was 12 m^2). Seeds of sesame (Del Al-Jamal new sesame variety) were sown on one side of the ridge in hills 15 cm apart on May 11 and 8 in 2016 and 2017 seasons, respectively. After 21 days from sowing, sesame plants were thinned to two plants per hill. Seeds were sown directly in plots of 3×4 m^2 arranged in completely randomized design, with three plots for each treatment as replicates. After thirty days from sowing, sesame plants were sprayed with a spore suspension of *H. sesami* isolate No. 13 as mentioned before in pathogenicity test. Infected plants were sprayed with ZnO, $ZnSO_4$, K_2HPO_4 and Na_2HPO_4 separately at concentration 100 mM (Reuveni *et al*., 1998) when the first sign of disease has appeared. The spreading agent Triton Mok was added to the spray solution to ensure full distribution on the surfaces of plants. The fungicide Curve 25% (Difenoconazole 25%) at concentration 0.5 cm^3/L was used as a comparison treatment. Some plots were sprayed once and others were sprayed twice (10 days between each spray) and disease severity was calculated for each plot as mentioned above. All other practices were uniformly applied as recommended for sesame production in the region. At the end of the experiment, plants were sprayed two times were chosen at random from each plot and the following traits were recorded: plant height (cm), number of branches and capsules per plant and weight of 1000 seeds (g). In addition, seed yield was recorded on the plot basis. The recorded values were used to estimate the corresponding value per feddan (kg). Oil percent of sesame seeds was determined according to A.O.A.C (1975) using a Soxhlet apparatus.

Statistical analysis:

The obtained data were subjected to statistical analysis using MSTAT-C program version 2.10 (1991). The Least significant difference (L.S.D., p = 0.05) for comparison between means of treatments was used as mentioned by Gomez and Gomez (1984).

RESULTS

Isolation and identification of the causal organism of Helminthosporium leaf spot disease of sesame plants:

Nineteen fungal isolates were obtained from diseased sesame plants (leaves, stems, capsules and seeds) collected from different localities in Nubaria region, El-Behera Governorate, Egypt. The cultural and microscopic examination showed that the obtained isolates belonged to *H. sesami*. The isolates were identified according to their morphological and microscopic characteristics of conidial spores as show in Fig. 1 (B, C and D). Isolates No. 4, 6, 8, 9, 11, 14, 16, 17 and 19 were isolated from leaves and isolates No. 1, 3, 5 and 13 were isolated from capsules. While isolates No. 2, 12, 15 and 18 were isolated from stems and isolates No. 7 and10 were isolated from seeds.

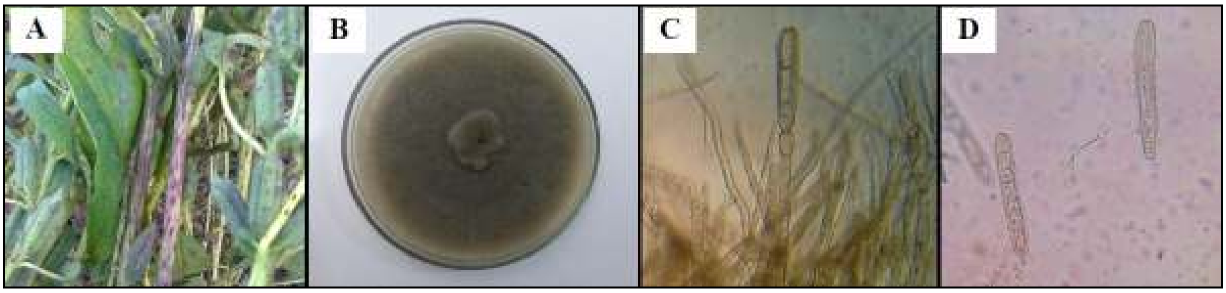

Fig. 1. (A) Symptoms of Helminthosporium leaf spot disease on sesame plants (B) mycelial growth of *H. sesami* (C) conidium spore on conidiophore (D) conidial spores of *H. sesami* at 40X magnification.

Pathogenicity test of *H. sesami* isolates on sesame plants:

Data presented in Table (1) indicate that all *H. sesami* isolates were able to infect Del Al-Jamal sesame cultivar and produced typical symptoms of Helminthosporium leaf spot disease. The tested isolates significantly differed in their ability to cause leaf spot disease on sesame plants and their severity was greatly differed. The highest percentage of disease severity was caused by isolate No. 13 (51.94%), followed by isolates No. 1 (50.04%), then isolate No. 3 (45.21%) and isolate No. 5 (42.10%). Meanwhile, isolates No. 4 and No. 19 caused the lowest percentages of infection (10.03 and 10.51%, respectively) followed by isolate No. 18 (13.23%), while other isolates gave moderate percentages of infection.

Table. 1. Pathogenicity tests of Helminthosporium isolates on sesame plants

Isolates No.	Plant part	Disease severity %
1	capsule	50.04
2	stem	36.35
3	capsule	45.21
4	leaf	10.03
5	capsule	42.10
6	leaf	40.16
7	seed	38.75
8	leaf	30.34
9	leaf	13.23
10	seed	35.63
11	leaf	21.82
12	stem	20.91
13	capsule	51.94
14	leaf	32.61
15	stem	29.43
16	leaf	33.50
17	leaf	21.33
18	stem	13.23
19	leaf	10.51
Mean	-	30.49
L.S.D. at 5%		3.47

Data also indicate that the isolates which obtained from capsules were more pathogenic to sesame plants than other isolates. These results indicate that isolate No. 13 was highly pathogenic so it was selected for *in vitro* and *in vivo* studies.

Effect of certain zinc and phosphorus sources on mycelial growth of *H. sesami in vitro*.

Data in Table (2) indicate that these compounds significantly reduced the mycelial growth of the pathogen. In general, application of ZnO, $ZnSO_4$, K_2HPO_4 and Na_2HPO_4 into the media inhibited significantly the growth of the pathogen at all tested concentrations compared to the control. Data also indicate that $ZnSO_4$ caused the highest reduction in the mycelial growth of the pathogen. $ZnSO_4$ was the highest effect on the pathogen growth at the all tested concentrations (Fig. 2) and had a strong inhibitory activity on the pathogen. The concentration 100 mM of all the tested compounds was the more effective on pathogen growth than the other concentrations.

The highest reduction of mycelial growth caused by $ZnSO_4$ (78.57%) at 100 mM, followed by ZnO (70.59%), while Na_2HPO_4 caused the lowest inhibition of growth (32.38%).

Table 2. Effect of some zinc and phosphorus sources on mycelial growth of *H. sesami in vitro*.

Treatment	Inhibition growth (%) at (mM)					
	0.0	25	50	75	100	Mean
ZnO	0.00	13.81	40.00	54.67	70.95	35.89
$ZnSO_4$	0.00	26.19	57.14	68.10	78.57	46.00
K_2HPO_4	0.00	16.67	16.19	23.34	35.24	18.29
Na_2HPO_4	0.00	7.62	13.81	17.14	32.38	14.19
Mean	0.00	16.07	31.79	40.81	54.29	-

L.S.D. at 5% for:
Treatments (T) = 0.29
Concentrations (C) = 1.51
Interaction (T×C) = 3.03

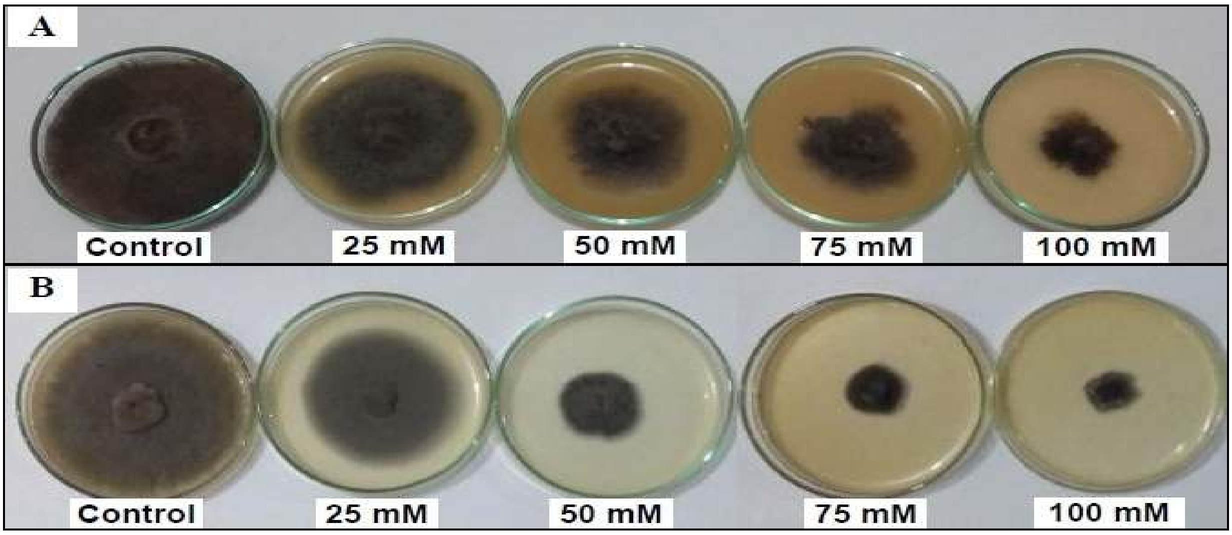

Fig. 2. Antifungal activity of ZnO (A) and $ZnSO_4$ (B) at different concentrations against *H. sesami* on PDA medium.

Effect of spraying of sesame plants with some zinc and phosphorus sources in reducing Helminthosporium leaf spot under field conditions:

Data presented in Table (3) indicate that spraying of sesame plants with zinc and phosphorous at concentrations 100 mM significantly decreased Helminthosporium leaf spot disease compared to untreated plants. Generally, Zn compounds (ZnO and $ZnSO_4$) were the most effective on the disease than phosphorus compounds (K_2HPO_4 and Na_2HPO_4). Zinc oxide caused the highest reduction in the disease severity followed by Zinc sulfate. The fungicide Curve 25% at 0.50cm^3/l gave the highest effect in controlling the disease. Zinc oxide decreased the severity of the disease to 11.23 and 10.09% during 2016 season and 13.10 and 11.85 during season 2017 when applied one and two sprays, respectively. Two sprays with all treatments gave the best results in controlling the disease. Also, data revealed that there were highly significant differences among all treatments on the disease severity percentage at both seasons.

Table 3. Effect of foliar treatment with some zinc and phosphorus sources on Helminthosporium leaf spot disease under field conditions during 2016 and 2017 growing seasons.

Treatment	Disease severity (%)					
	Season 2016			Season 2017		
	One spray	Two sprays	Mean	One spray	Two sprays	Mean
ZnO	11.23	10.09	10.66	13.10	11.85	12.48
$ZnSO_4$	12.52	11.35	11.94	15.00	14.10	14.55
K_2HPO_4	15.41	12.82	14.12	17.35	17.12	17.24
Na_2HPO_4	18.62	16.91	17.77	18.95	17.47	18.21
Curve 25%	10.05	7.98	9.02	12.03	11.96	12.00
Control	49.84	47.37	48.61	51.09	50.87	50.98
Mean	19.61	17.75	-	21.25	20.56	-
L.S.D. at 5%						
Treatments (T)		1.17			1.01	
Sprays (S)		0.65			0.58	
Interaction (T×S)		1.58			1.42	

Effect of some zinc and phosphorus sources as a foliar treatment on growth and yield characters of sesame under field conditions:

Data presented in Table (4 and 5), indicate that treatments with zinc and phosphorus sources significantly improved agronomic characters of sesame, *.i.e.* plant height, number of branches and capsules per plant, weight of 1000 seeds (g), seed oil content (%), seed yield (kg/feddan). Data also indicate that zinc and phosphorus have a significant positive effect on all studied characters. The highest mean for height plant (235 and 220 cm), No. of branches (11.67 and 11.00 per plant), No. of capsules (202.67 and193.33 per plant), the weight of 1000 seeds (4.90 and 3.99 g), seed yield (522.00 and 483 Kg per feddan) and seed oil content (48.00 and 47.33%) was obtained from plots sprayed with dipotassium phosphate at both seasons (2016 and 2017), respectively as compared to the control.. Data also indicate that all tested parameters reduced by increasing disease severity. The plots which were sprayed twice with zinc and phosphorus sources were the best in all tested parameters.

Table 4. Effect of zinc and phosphorus as a foliar spray on growth and yield characters of sesame under field conditions during season 2016.

Treatments	Season 2016					
	Plant height (cm)	No. of branches per plant	No. of capsules per plant	Weight of 1000 seeds (g)	Seed oil content (%)	Seed yield (kg/ feddan)
ZnO	172.67	7.67	187.00	3.67	41.67	385.67
$ZnSO_4$	193.67	9.00	167.33	3.24	39.33	421.00
K_2HPO_4	235.00	11.67	202.67	4.90	48.00	522.00
$Na2HPO_4$	223.00	8.33	182.67	3.70	42.67	458.00
Curve 25%	160.33	6.00	161.00	3.83	40.33	408.00
Control	142.67	5.33	121.67	2.96	38.00	273.00
Mean	187.89	8.00	170.39	3.51	41.67	411.29
L.S.D	N. S	3.47	N. S	0.38	2.33	28.53

Table 5. Effect of zinc and phosphorus as a foliar spray on growth and yield characters of sesame under field conditions during season 2017.

Treatments	Season 2017					
	Plant height (cm)	No. of branches per plant	No. of capsules per plant	Weight of 1000 seeds (g)	Seed oil content (%)	Seed yield (kg/ feddan)
ZnO	161.67	7.33	161.00	3.58	44.00	383.50
$ZnSO_4$	203.33	8.00	171.67	3.91	46.67	416.00
K_2HPO_4	220.00	11.00	193.33	3.99	47.33	483.00
$Na2HPO_4$	211.67	8.00	177.00	3.75	45.67	452.00
Curve 25%	155.00	6.33	155.00	3.73	44.67	387.00
Control	130.00	5.33	115.00	2.90	38.00	310.00
Mean	180.28	7.67	162.17	3.65	44.39	405.25
L.S.D	22.03	2.28	7.53	0.34	4.41	40.48

DISCUSSION

Application of zinc (ZnO and $ZnSO_4$) and phosphorus (K_2HPO_4 and Na_2HPO_4) compounds into the medium significantly inhibited the mycelial growth of *H. sesami* at all the tested concentrations. Data also indicate that Zn compounds gave the highest reduction in the mycelial growth of the pathogen. The obtained results are consistent with those obtained by many other researchers (Osinaga *et al.*, 2003; Sawai and Yoshikawa, 2004). Savi *et al.* (2013) who found that zinc sulfate and zinc perchlorate completely inhibited the growth of *F. graminearum, P. citrinum* and *Aspergillus flavus* and their ability to produce mycotoxins. The conidia production of all fungi also was reduced after the treatment with zinc compounds. In previous studies, KH_2PO_4 at 1% and K_2HPO_4 at 1.5% completely inhibited spore germination and germ tube elongation of *Uromyces appendiculatus* and *Puccinia triticina*, respectively (Arslan, 2015). In this study, $ZnSO_4$ at 100 mM caused the highest inhibition of mycelial growth of *H. sesami*. The phosphate and potassium salts may have direct antifungal properties as microscopic observations showed a direct effect of phosphates on the collapsing and malformation of conidia and mycelia on *Sphaerotheca fuliginae* in cucumbers (Reuveni *et al.*, 1995) and on *Leveillula taurica* in pepper (Reuveni *et al.*, 1998).

Under field experiments, application of zinc and phosphorous as a foliar treatment significantly decreased Helminthosporium leaf spot disease compared to untreated plants at both seasons. ZnO caused the highest reduction in the disease severity followed by zinc sulfate. In this study, two sprays with all treatments gave the best results in control of the disease. The obtained results are consistent with those obtained by Graham and Webb (1991) who found that zinc application reduced disease severity, which could be because of the toxic effect of Zn on the pathogen directly and not through the plant's metabolism. Foliar sprays with KH_2PO_4 or K_2HPO_4 as pre or post-inoculation reduced the incidence of powdery mildew in sugar beet compared to the control (Mosa, 2002). Reuveni *et al.* (1998) showed that the foliar spray of 1% solution of KH_2PO_4 on the upper surfaces of lower leaves of peppers induced local and systemic control of *L. taurica* under greenhouse conditions.

The use of zinc and phosphorus as a foliar treatment have a significant positive effect on agronomic characters of sesame, *.i.e.* plant height, the number of branches and capsules per plant, the weight of 1000 seeds, seed yield and seed oil content. These results were consistent with the findings of (Reuveni *et al.*, 1998 and Mohsin *et al.*, 2014). Misagh *et al.* (2016) showed that foliar application of zinc led to a significant increase in seed yield of sesame. In this study, phosphorus compounds (K_2HPO_4 and Na_2HPO_4) were the most influential on all studied agronomic characters compared to zinc compounds. Sprayed plants with phosphorus gave the best results in all tested agronomic characters. These results are in line with the findings of (Reuveni *et al.*, 1998 and Mohsin *et al.*, 2014). Many researchers reported an increase in grain and biomass yields with foliar phosphorus (Dixon, 2003 and Poulsen *et al.*, 2005). Phosphorus is a part of many organic molecules of the cell (deoxyribonucleic acid (DNA), ribonucleic acid (RNA), adenosine triphosphate (ATP) and phospholipids) and is also involved in many metabolic processes in the plant and also in the pathogen (Kiraly 1976). Data also indicate that all tested parameters reduced by increasing disease severity. In others studies, the foliar application of Zn significantly improved starch contents of forage maize (Leach and Hameleers, 2001). Zn is required for the synthesis of tryptophan (Brown *et al.*, 1993), which is a precursor of IAA. This metal also has an active role in the production of auxin, an essential growth hormone (Brennan, 2005). Also, it plays an important role in protein and starch synthesis and therefore a low zinc concentration induces accumulation of amino acids and reducing sugars in plant tissue (Marschner, 1995). Mohsin *et al.* (2014) showed the positive response of biomass and grain yields in hybrid maize to foliar Zn application. Foliar application with zinc increasing number of branches and capsules/plant, weight of 1000 seeds, seed yield/ha. and oil% of sesame (Roul *et al*., 2017). This study concludes that application of zinc and phosphorus as a foliar treatment led to reduce Helminthosporium leaf spot disease severity and improve agronomic characters of sesame plants such as plant height, number of branches and capsules per plant, seed yield and seed oil content.

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تأثير رش المجموع الخضرى ببعض مصادر الزنك والفوسفور على مقاومة مرض تبقع الأوراق الهلمنثوسبوريومى وإنتاجية السمسم

منصور مازن الفاوى[١] و محمد عبد العزيز أحمد السيد[٢]
[١]قسم النبات الزراعى (أمراض نبات) كلية الزراعة - جامعة الأزهر- أسيوط- مصر.
[٢]قسم المحاصيل- كلية الزراعة - جامعة الأزهر- أسيوط- مصر.

تم الحصول على تسعة عشر عزلة من الفطر هلمنثوسبوريوم سيسامى من نبات السمسم المصابة بتبقع الأوراق الهلمنثوسبوريومى من مواقع مختلفة في منطقة النوبارية بمحافظة البحيرة - مصر. وكانت جميع العزلات التي تم الحصول عليها من الفطر قادرة على إصابة نباتات السمسم الصنف ديل الجمل مسببة أعراض مرض تبقع الأوراق الهلمنثوسبوريومى بدرجات مختلفة. وتهدف هذه الدراسة إلى تقييم كفاءة بعض مصادر الزنك والفوسفور ضد المسبب المرضى تحت ظروف المعمل والحقل وأثر ذلك علي الصفات المحصولية للسمسم.وتحت ظروف المعمل تم دراسة تأثير كل من أكسيد الزنك وكبريتات الزنك كمصادر للزنك، وفوسفات ثنائي البوتاسيوم وفوسفات ثنائى الصوديوم كمصادر للفوسفور على النمو الميسليومى للفطر الممرض وذلك على البيئة الصناعية بإستخدام تركيزات مختلفة من هذه المركبات. وتشير نتائج هذه الدراسة إلى أن هذه المركبات خفضت النمو الميسليومى للفطر الممرض بدرجات مختلفة. حيث تم الحصول على أعلى تثبيط فى النمو الفطرى فى حالة كبريتات الزنك عند تركيز ١٠٠ ملليمول (٧٨.٥٧٪)، تلاها فى ذلك أكسيد الزنك. وتحت الظروف الحقلية، أدى رش المجموع الخضرى لنباتات السمسم بهذه المركبات بمعدل ١٠٠ ملليمول إلى إنخفاض فى شدة المرض مقارنة بالنباتات الغير معاملة. حيث اتضح أن أكسيد الزنك أعطى أعلى نسبة إنخفاض في شدة المرض تلاه فى ذلك كبريتات الزنك. وعلاوة على ذلك فقد أدى الرش بهذه المركبات إلى تحسين الصفات المحصولية لنبات السمسم، كإرتفاع النبات، عدد الأفرع، عدد الكبسولات لكل نبات، وزن ١٠٠٠ بذرة، محصول البذور للفدان ونسبة الزيت فى البذور. وكان فوسفات ثنائى البوتاسيوم الأكثر فعالية على جميع الصفات المحصولية التى تم اختبارها من باقى المركبات الأخرى.