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Research Article

Impact of Different Levels Alternaria Alternata on the Weights, Leaves and the Number of Flowers of the Water Hyacinth in a Controlled Environment

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Abstract: *Alternaria alternata* is a pathogen of the water hyacinth, which is a worst grass on our water ways in southern Benin. It has been tested under glass on the water hyacinth to assess its effectiveness. The device consists of seven treatments distributed in 7 blocks. *Alternaria alternata* was tested at different concentrations of 10^6 sp ml, 10^7 sp/ml, 10^8 sp /ml, 10^9 s/ml, 10^{10} sp/ml 10^{11} sp /ml and 10^{12} sp/ml of water hyacinth for three months and some days. The average values of significant parameters of its growth at the end of the experiment such as the weight with a concentration of 10^{12} sp/ml 82,90 ± 0, 5 g and 35.00 ± 0.29 g; those sheets are 8.90 ± 0.35 and 6.30 ± 0.16 at the end and those flowers are zero at the beginning but at the end 0.50 ± 0.16. Thus *A. alternata* is a potential biocontrol agent against the water hyacinth.

Keywords: *Alternaria alternata*, biological control, water hyacinth, concentration.

INTRODUCTION

Water hyacinth (*Eichhornia crassipes*) is a floating macrophyte plant, developing on the surface or in the mud of rivers. Its presence in infested areas in tropical and subtropical countries like Benin has caused serious economic and ecological consequences[1, 2]. Thanks to its height and the density it can reach, can reduce light and oxygen underwater. It hinders water transport, fisheries and clog water intakes hydroelectric dams and irrigation networks. Given the reproductive capacity of the water hyacinth, its adaptability, nutritional requirements and resistance to adverse conditions, it is so far impossible to eradicate once introduced into a new area Harly[3] and[4]. During the last ten years, this plant has caused ecological and agricultural water crises in Africa[5]. Although the origin of the infestation of water hyacinth worldwide is known in the early twentieth century, that its current expansion is poorly understood. Several battles were conducted for the destruction of the plant, including mechanical and chemical control fight that did not incur a result data. Biological control could be an interesting alternative to chemical control because of its impact on the environment. Biological control against the hyacinth has developed in the 1960s by importing insects from the Amazon basin of Brazil[6]. *Neochetina eichhorniae* and *bruchi* were associated data and good results on the water hyacinth[7].This struggle is based on the use of natural enemies of the plant in order to create constant pressure on it. Studies of *Cercospora. Rodmanii*, *A. alternata* and *A. eichhorniae*, showed effective control possibilities on *Eichhornia crassipes*[8, 9, 10]. Studies were conducted in controlled and natural conditions on certain pathogens isolated on hyacinth. The death of the plant was achieved a few weeks after spraying with *Acremonium zonatum*, Alternaria *alternata* and *Cercospora rodmanii*. The objective of this work is to evaluate the impact of *Alternaria alternata* combination at various concentrations on the leaves and the weight of the water hyacinth in a controlled environment.

MATERIAL AND METHODS

Material: The biological material that has been the subject of experiments consists of *Alternaria alternata* and water hyacinth.

Methods:

Culture of water hyacinth: *Eichhornia crassipes* was cultivated outdoor in containers far from insect reassign facilities to prevent accidental infestation on the site of plant physiology and Environmental Stress Laboratory at the University of Abomey-Calavi. Plants are fed periodically with dropping from poultry every two weeks.

Photo 1: Culture of water hyacinth[11]

Multiplication of the fungus *Alternaria alternate:* The multiplication of the inoculums has been carried out in Petri boxe each containing nutriment medium PDA(Potato Dextose Agr) to which are added 5 µl of spore suspension of *Alternaria alternata*. Then the boxe have been incubated at 25°C oven for three weeks

Experimental Device: The experimental device used is a complete random block with 7 treatments and 7 technical runs with different concentrations of the fungus such as 10^{6} sp/ml, 10^{7}sp/ml, 10^{8} sp/ml, 10^{9} sp/ml, 10^{10} sp/ml, 10^{11} sp/ml and 10^{12} sp/ml in the **Table1** below.

Table 1: Experimental device of the different treatments[11]

Bloks	Treatments	elements of each treatments
	T1	Evidence With 10 plants of *E*.crassipes without *N. eichhorniae* in the basin.
1	T2	10 plants d'*E*. crassipes with 10^{6} sp/ml of *Alternaria alternata* in the basin.
	T1	Evidence With 10 plants of *E*. crassipes without *N.eichhorniae* in the basin.
2	T3	10 plants d'*E*. crassipes with 10^{7} sp/ml of *Alternaria alternata* in the basin.
	T1	Evidence With 10 plants of *E*. crassipes without *N.eichhorniae* in the basin.
3	T4	10 plants d'*E*. crassipes with 10^{8} sp/ml of *Alternaria alternata* in the basin.
	T1	Evidence With 10 plants of *E*.crassipes without *N.eichhorniae* in the basin.
4	T5	10 plants d'*E*. crassipes with 10^{9} sp/ml *Alternaria alternata* in the basin.
	T1	Evidence With 10 plants of *E*.crassipes without *N.eichhorniae* in the basin.
5	T6	10 plants d'*E*. crassipes with 10^{10} sp/ml of *Alternaria alternata* in the basin
	T1	Evidence With 10 plants of *E*.crassipes without *N.eichhorniae* in the basin.
6	T7	10 plants d'*E*. crassipes with 10^{11} sp/ml of *Alternaria alternata* in the basin.
	T1	Evidence With 10 plants of *E*.crassipes without *N.eichhorniae* in the basin.
7	T8	10 plants d'*E*. crassipes with 10^{12} sp/ml of *Alternaria alternata* in the basin.

Photo 2: Experimental device of the different treatments[11]

Data on different plant growth parameters have been taken at the beginning and at the end of experiments on the weight, number of leaves, and flower buds. These data are recorded every two weeks

Statistical analysis of the data: The excel table has been used to capture and process the data that have been noted in the form of average value standard error. This table is used to plot curves. The collected raw data have undergone a transformation by the function inverse sine of the root square prior to analysis. The other raw data have been transformed by the function log(x+1). A factorial analysis of variance (factorial ANOVA) has been used to examine the differences between treatments for each studied parameter. The method of comparison of variable used is the Student Newman Keuls (SNK) test. The analyses are performed using SAS analytical software (version9.2).

RESULTS

AVERAGE CHANGE OF WEIGHT ON THE WATER HYACINTH PLANTS: The evolution of weight average rate of plants in our experiments to *A. alternata* at a concentration of 10^6 sp/ml is shown in **Figure 1.** For the treatment T1, the average values of plants weight at the beginning of the experiment are 80.9 ± 0.31 g and 86.4 ± 0.16 g after twelve weeks. These results show an increase in plant weight. The average weight of the original T2 treatment plants is 80.80 ± 0.24 g and after twelve weeks of treatment was 66.8 ± 0.13 g. At the end of the experiment, the treatment of T2 *A. alternata* concentration of 10^6 sp /ml is significantly different from T1 control treatment at 5% level (P <0.0001).

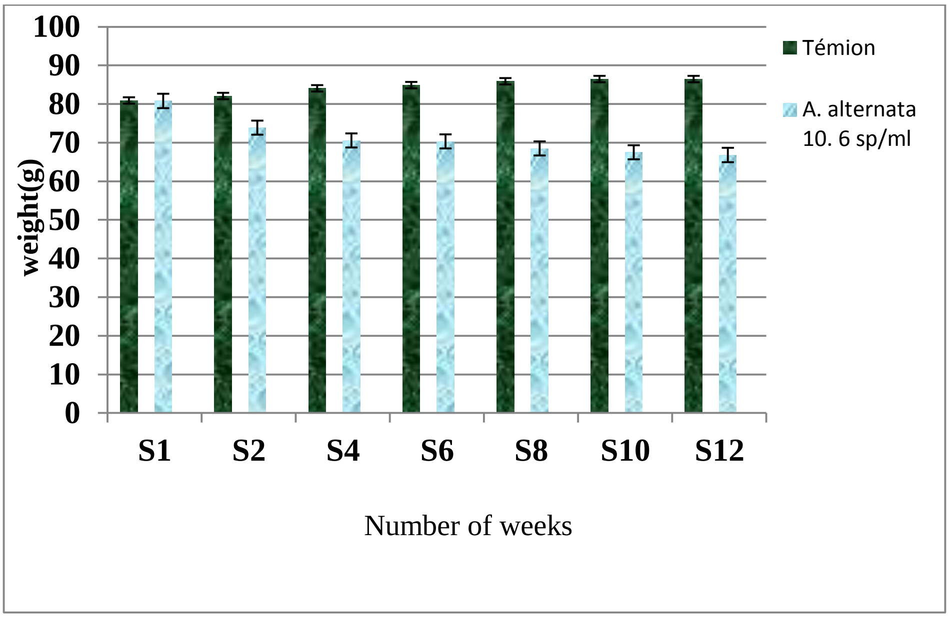

Figure 1: Average change of weight on the water hyacinth plants

The evolution of weight average rate of plants in our experiments to *A. alternata* at a concentration of 10^7 sp/ml is shown in **Figure 2**. For the treatment T1, the average values of plants weight at the beginning of the experiment are 81.9 ± 0.36 g and 86.20 ± 0, 29 g after twelve weeks.

The average weight of the original T3 treatment plants is 80.90 ± 0.23 g and after twelve weeks of treatment was 54.50 ± 1.23 g. Around twelve weeks of testing, treatment T3 10^7sp / ml *A. Alternata* highly significantly different from control treatment T1 at 5% level (P <0.0001).

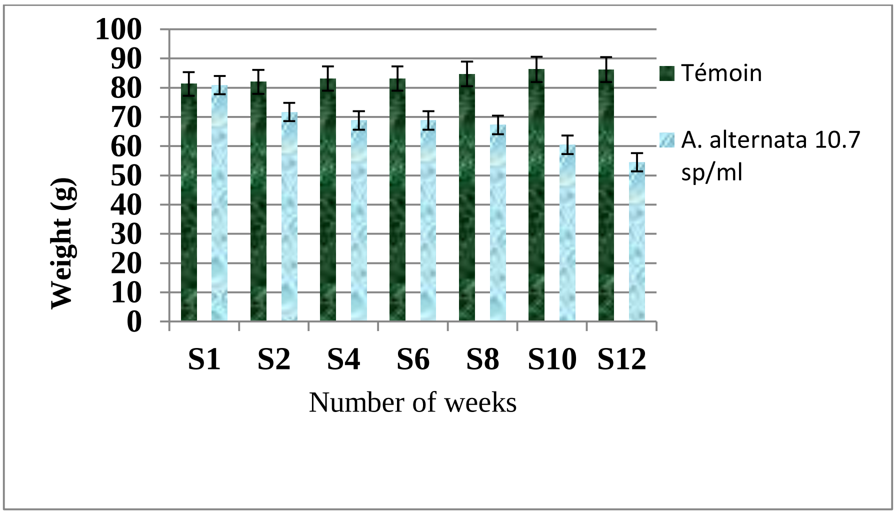

Figure 2: Average change of weight on the water hyacinth plants

Figure 3 shows the evolution of weight average rate of plants in our experiments to *A. alternata* at a concentration of 10^8 sp/ ml. For the treatment T1, the average values of plants weight at the beginning of the experiment are 82.5 ± 0.87 g and 0.16 ± 93, 60 g after twelve weeks. These results show a significant growth among their plants. The average weight of the initial T4 treatment plants is 87.70 ± 0.47 g and after twelve weeks of treatment are 59, 30 g ± 0.15 g. At the end of the experiment, treatment with T4 10^8 sp/ml *A. alternata* are highly significantly different from T1 control treatment at 5% level (P <0.0001).

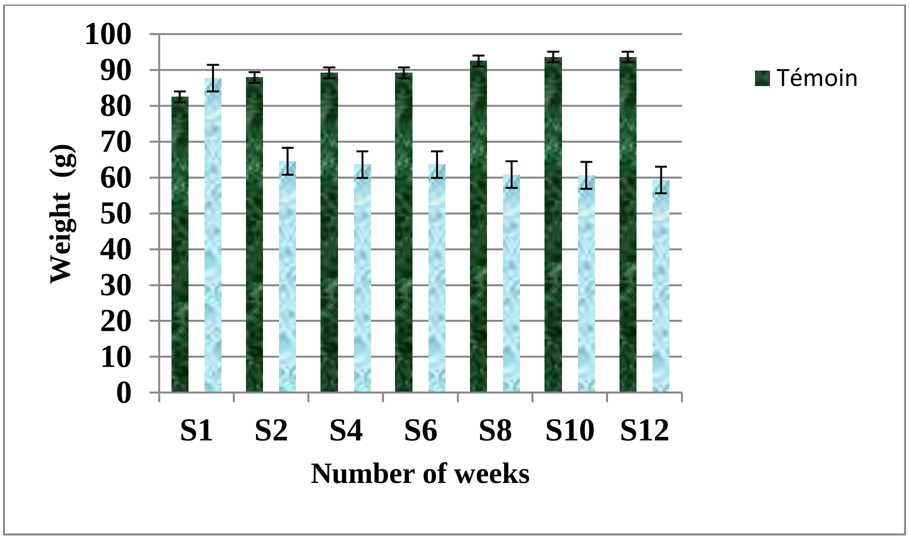

Figure 3: Average change of weight on the water hyacinth plants

Figure 4 shows the evolution of weight average rate of plants in our experiments with *A. alternata* at a concentration of 10^9 sp/ml. For the treatment T1, the average values of plants weight at the beginning of the experiment are 80.5 ± 0.30 g and 86.60 ± 0.20 g after twelve weeks. The average weight of the initial T5 treatment plants is 81.40 ± 0.30 g and after twelve weeks of treatment was 42.90 ± 0.56 g. Around end of the experiment, the T5 treatment at 10^9 sp/ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

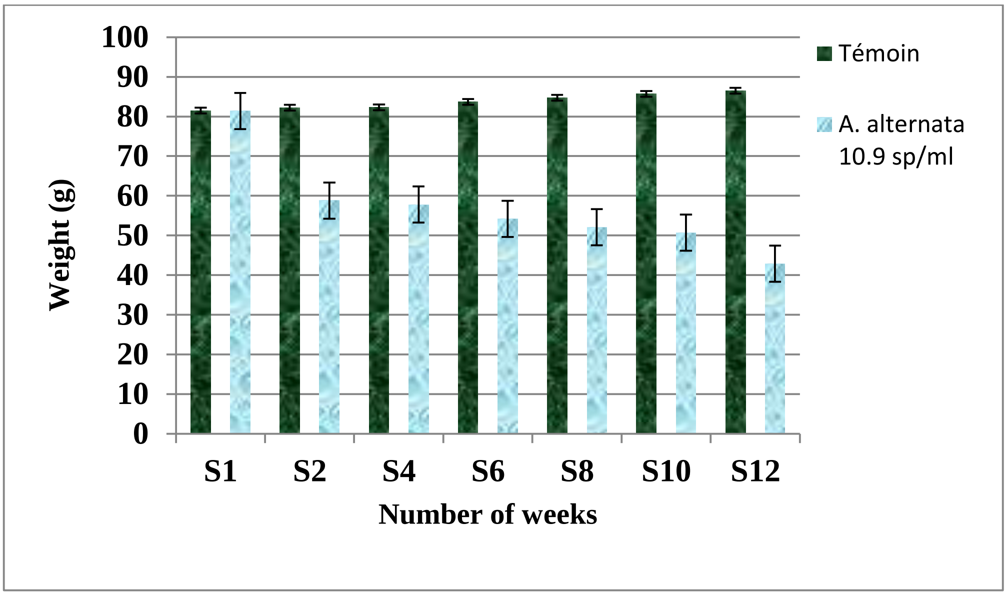

Figure 4: Average change of weight on the water hyacinth plants

Figure 5 shows the evolution of weight average rate of plants in our experiments with *A. alternata* at a concentration of 10^{10} sp /ml. For the treatment T1, the average values of plants weight at the beginning of the experiment are 82.00 ± 0.64 g and 90.50 ± 0.22 g after twelve weeks. The average weight of initial T6 treatment plants is 83.90 ± 0.73 g and after twelve weeks of treatment was 40.80 ± 0.13 g. At the end of the experiment, the treatment in 10^{10} sp /ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

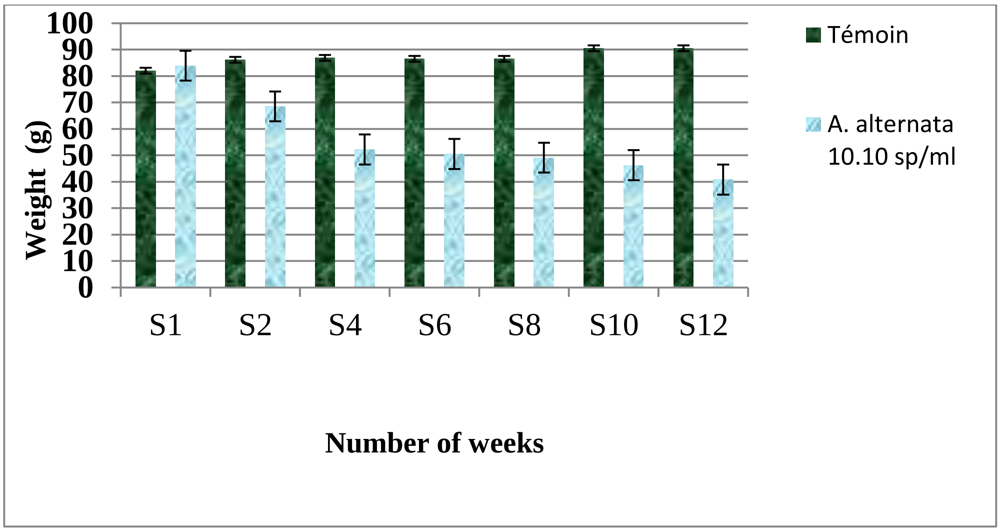

Figure 5: Average change of weight on the water hyacinth plants

Figure 6 shows the evolution of weight average rate of plants in our experiments with *A. alternata* at a concentration of 10^{11} sp /ml. For the treatment T1, the average values of plants weight at the beginning of the experiment are 81.5 ± 0.30 g and 88.40 ± 0.16 g after twelve weeks. The average weight of the original T7 treatment plants is 81.40 ± 0.30 g and after twelve weeks of treatment was 36.40 ± 0.42 g. At the end of the experiment, the T6 treatment to 10^{11} sp /ml of *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

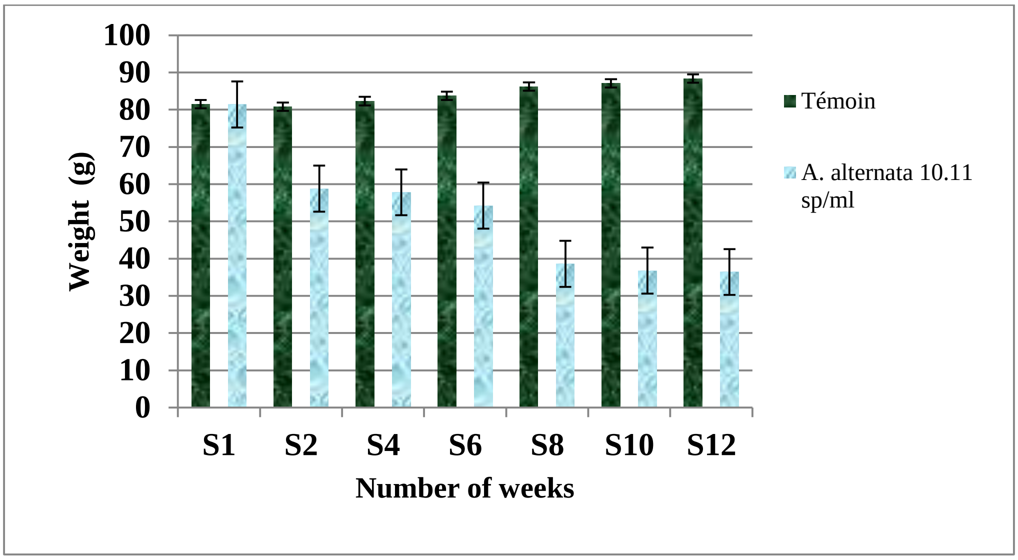

Figure 6: Average change of weight on the water hyacinth plants

Figure 7 shows the evolution of weight average cost of plants in our experiments with *A. alternata* at a concentration of 10^{12} sp /ml. For the treatment T1, the average values of plants weighed at the start of the experiment are 81.5 ± 0.71 g and 88.0 ± 0.91 g after twelve weeks. The average weight of the original T3 treatment plants is 82.90 ± 0.52 g and after twelve weeks of treatment was 35.00 ± 0.29 g. At the end of the experiment, the treatment T8 10^{12} sp /ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

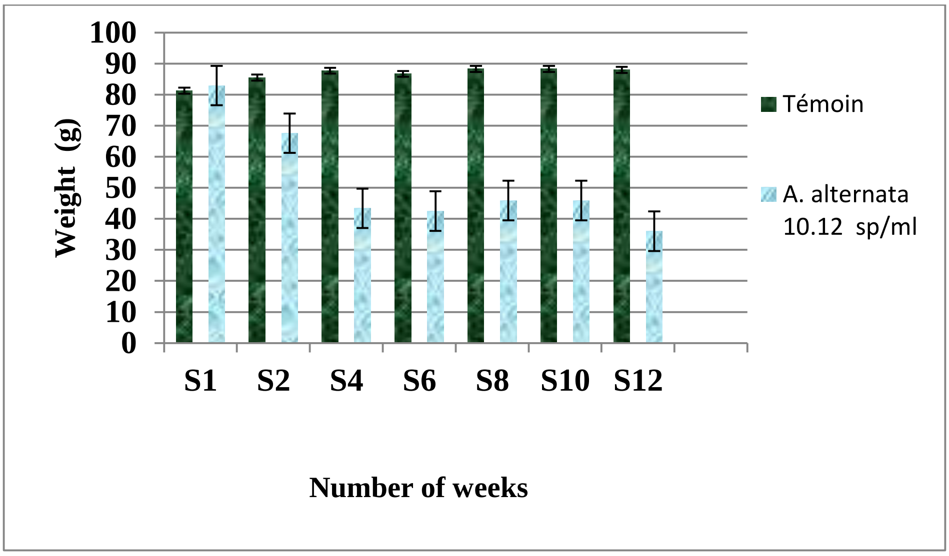

Figure 7: Average change of weight on the water hyacinth plants

Average Grown of The Number of Leaves on the Water Hyacinth Plants: Figure 8 shows the number of leaves on the water hyacinth with *A. alternata* at a concentration of 10^6 sp /ml. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning was 8.80 ± 0.29 and at the end of the tests was 9.40 ± 0.14. For the T2 treatment, the mean values of number of leaves on 10 plants of water hyacinth were 9.34 ± 0.25 and after twelve weeks, we obtained 5.30 ± 0.15. At the end of the experiment, treatment T2 10^6 sp/ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

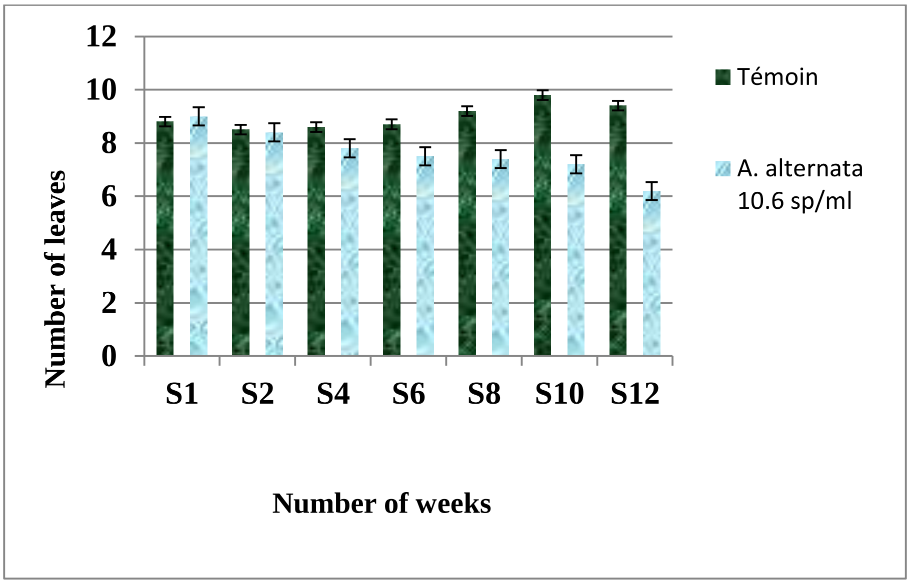

Figure 8: Average grown of the number of leaves on the water hyacinth plants

Figure 9 shows the number of leaves on the water hyacinth in our experiments with *A. alternata* at a concentration of 10^7 sp/ml. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning of 8.80 ± 0.29 and at the end of the tests is 10.50 ± 0.16. For the T3 treatment, the mean values of number of leaves on the 10 water hyacinth plants were 8.94 ± 0.23 and after twelve weeks, we have achieved 5.60 ± 0.47. At the end of the experiment, the treatment T3 10^7 sp/ ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

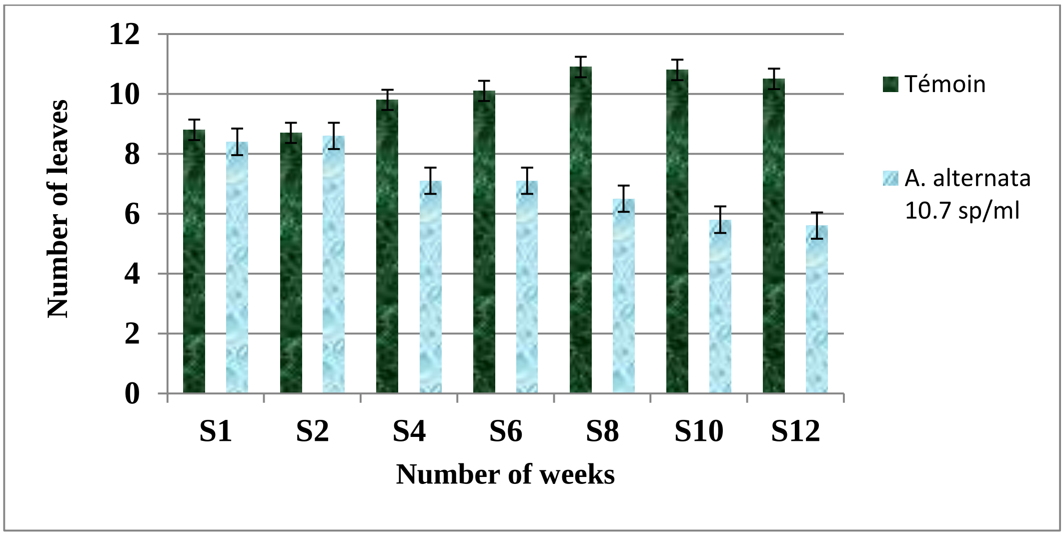

Figure 9: Average grown of the number of leaves on the water hyacinth plants

Figure 10 shows the number of leaves on the water hyacinth in our experiments with *A. alternata* at a concentration of 10^8 sp/ml. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning was 8.40 ± 0.22 and at the end of the tests is 9.30 ± 0.33. For the T4 treatment, the mean values of number of leaves on 10 plants of water hyacinth were 8.30 ± 0.29 and after twelve weeks we obtained 6.90 ± 0.10. At the end of the experiment, the treatment T4 with

10^8 sp/ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0, 0001).

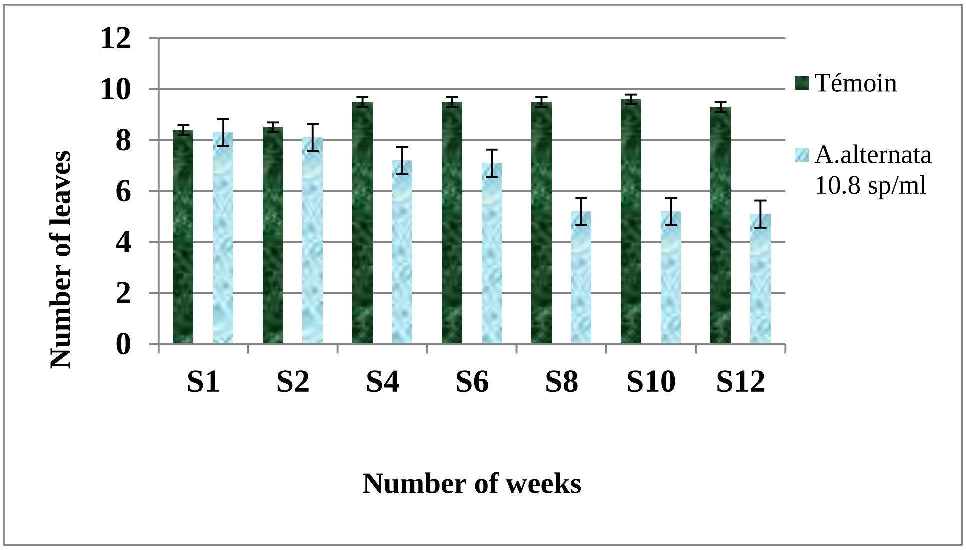

Figure 10: Average grown of the number of leaves on the water hyacinth plants

Figure 11 shows the number of leaves on the water hyacinth with *A. alternata* at a concentration of 10^9 sp/ml for twelve weeks. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning of 8.60 ± 0.22 and at the end of the tests is 9.90 ± 0.16 for the T5 treatment, the average values of number of leaves on 10 plants of water hyacinth were 8.50 ± 0.22 and after twelve weeks, we have achieved 6.10 ± 0.29. At the end of the experiment, the T5 treatment at 10^9 sp/ml *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

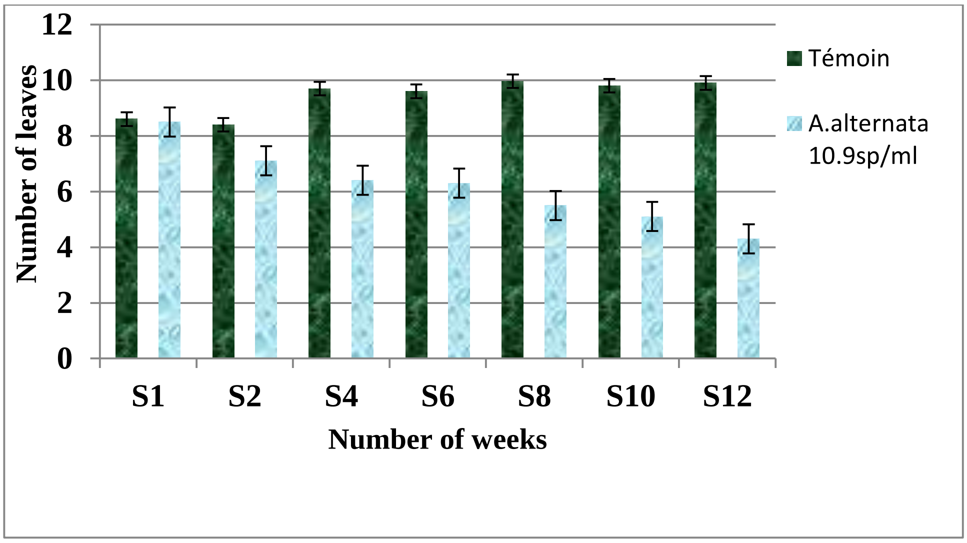

Figure 11: Average grown of the number of leaves on the water hyacinth plants

Figure 12 shows the number of leaves on the water hyacinth in our experiments with *A. alternata* at a concentration of 10^{10} sp/ml. For treatment T1 number of leaves on the plants of the water hyacinth counted at the beginning is 8.20 ± 0.24 and at the end of the tests is 9.30 ± 0.21. For the T6 treatment, the mean values of number of leaves on 10 plants of water hyacinth were 8.10 ± 0.23 and after twelve weeks, we have achieved 6.0 ± 0.15. At the end of the experiment, the T6 treatment to 10^{10} sp/ml of *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

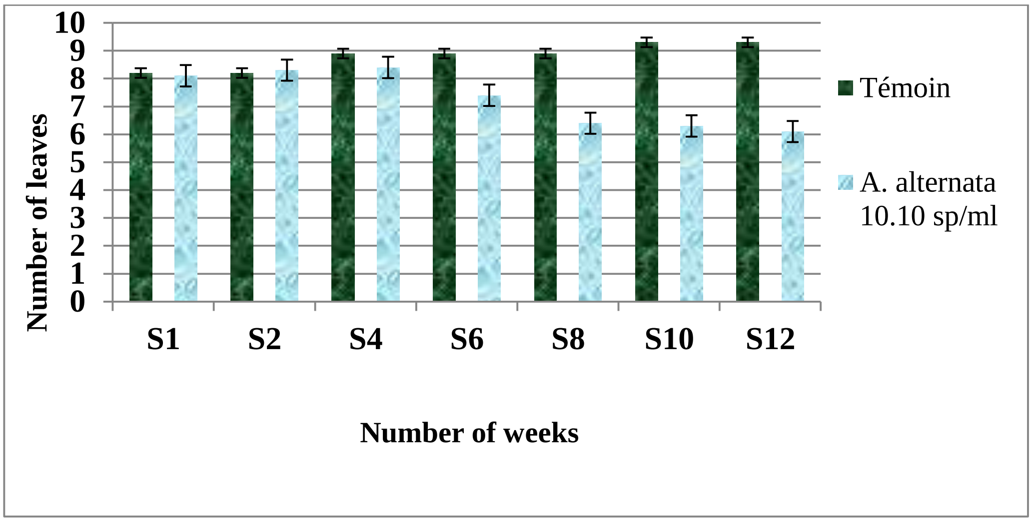

Figure 12: Average grown of the number of leaves on the water hyacinth plants

Figure 13 shows the number of leaves on the water hyacinth in our experiments with *A. alternata* at a concentration of 10^{11}sp/ml. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning of 8.60 ± 0.22 and at the end of the experiment was 9.40 ± 0.33. For the T7 treatment, the mean values of number of leaves on 10 plants of water hyacinth were 8.50 ± 0.22 and after twelve weeks, we have achieved 4.20 ± 0.33. At the end of the experiment, treatment T7 to 10^{11} sp/ml of *A. alternata* is highly significantly different from control treatment T1 at 5% level (P <0.0001).

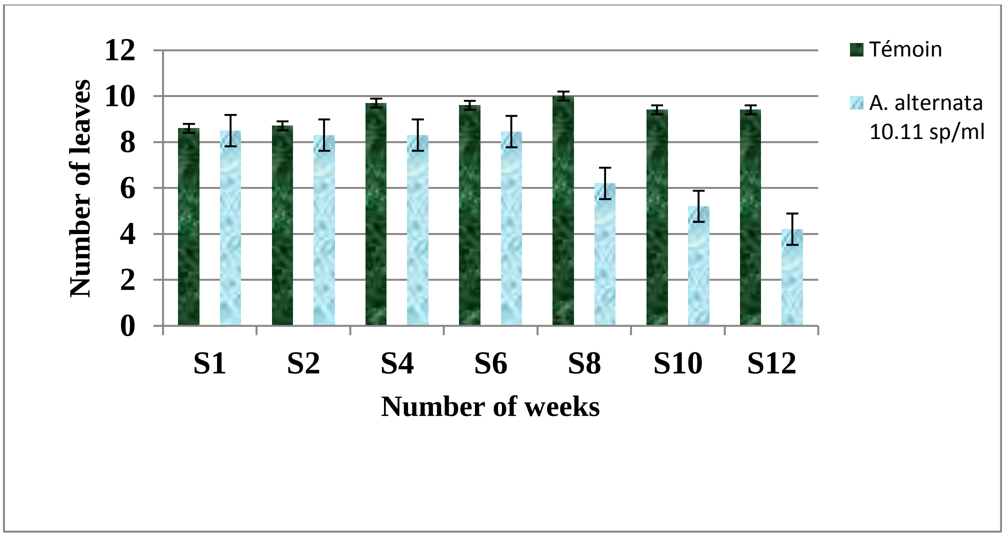

Figure 13: Average grown of the number of leaves on the water hyacinth plants

Figure 14 shows the number of leaves on the water hyacinth with *A. alternata* at a concentration of 10^{12} sp/ml. For treatment T1 the average number of leaves on the plants of the water hyacinth is counted at the beginning of 9.60 ± 0.24 and at the end of the tests is 7.40 ± 0.21. For the T8 treatment, the mean values of number of leaves on 10 plants of water hyacinth were 8.90 ± 0.31 and after twelve weeks, we have achieved 6.30 ± 0.16. At the end of the experiment, the treatment T8 10^{12} sp/ml *A. alternata* is very highly significantly different from control treatment T1 at 5% level (P <0.0001).

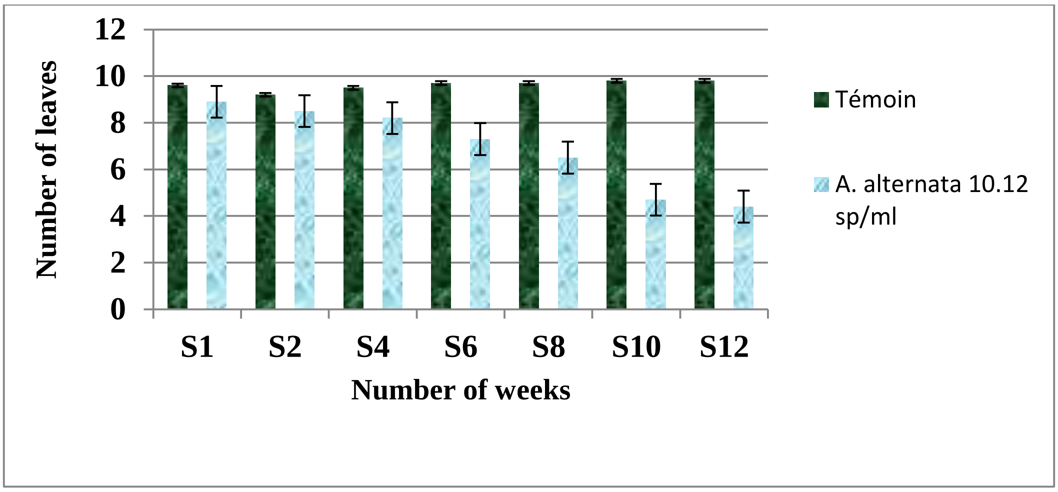

Figure 14: Average grown of the number of leaves on the water hyacinth plants

Evolution of The Average Number of Flower Buds on Water Hyacinth Plants of the Blocks: Tables 2, 3, 4, 5, 6, 7 and 8 below show the average number of flowers on the water hyacinth plants in our experience. The results show that a very small number of flowers began to appear in the fourth week of the plants every seven blocks in general. At the end of the experience a very low number is observed on the plants. For bloc7, the average values at the end of the experiment are relatively low for Treatments T8 0.50 ± 0.16 and an increase in the treatment T1 1.70 ± 0.1.

Table 2 : Evolution of the average number of flower buds on water hyacinth plants of the block 1.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1 (Evidence)	0 ±0,00[a]	0 ±0,00[a]	1,00 ±0,00[a]	1,40±0,22[b]	2,30±0,39[a]	2,20±0,29[a]	2,40±0,33[a]
T2 (*Alternaria alternata*10^6 sp/ml)	0 ±0,00[a]	0 ±0,00[a]	1,20± 0,32[a]	1,10±0,33[a]	1,10±0,26[a]	1,00±0,21[a]	1,00±0,20[b]
Probability	0	0	<0,8250	<0,0914	<0,6247	<0,5160	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 3 : Evolution of the average number of flower buds on water hyacinth plants of the block 2.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1 (Evidence)	0 ±0,00[a]	0 ±0,00[a]	1,60±0,16[a]	1,70±0,16[a]	1,80±0,16[a]	1,80±0,16[a]	1,90±0,16[a]
T3(*Alternaria alternata* 10^7sp/ml)	0 ±0,00a	0 ±0,00a	1,60±0,20a	1,60±0,22a	1,60±0,16a	1,40±0,16a	1,30±0,16[a]
Probability	0	0	<0,9588	<0,4197	<0,7445	<0,8765	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 4: Evolution of the average number of flower buds on water hyacinth plants of the block 3.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1(Evidence)	0 ±0,00^a	0 ±0,00^a	1,70±0,16^a	1,70±0,16^a	1,60±0,16^a	2,30±0,16^a	2,30±0,16^a
T4 (*Alternaria alternata*10^{8}sp/ml)	0 ±0,00^a	0 ±0,00^a	1,70±0,20^a	1,70±0,22^a	1,30±0,16^a	1,20±0,16^b	1,20±0,16^b
Probability	0	0	<0,0030	<0,0030	<0,2962	<0,0001	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 5 : Evolution of the average number of flower buds on water hyacinth plants of the block 4.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1(Evidence)	0 ±0,00^a	0 ±0,00^a	1,60±0,16^a	1,60±0,16^a	1,70±0,16^a	1,70±0,16^a	1,70±0,16^a
T5(*Alternaria alternata* 10^{9}sp/ml)	0 ±0,00^a	0 ±0,00^a	1,50±0,20^a	1,40±0,22^a	1,40±0,16^a	1,30±0,16^a	1,20±0,16^b
Probability	0	0	<0,5405	<0,3169	<0,0068	<0,3814	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 6 : Evolution of the average number of flower buds on water hyacinth plants of the block 5.

Treatements	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1(Evidence)	0 ±0,00^a	0 ±0,00^a	1,70±0,16^a	1,60±0,16^a	1,40±0,16^a	1,60±0,16^a	1,90±0,1^a
T6 (*Alternaria alternata* 10^{10} sp/ml)	0 ±0,00^a	0 ±0,00^a	1,50±0,20^a	1,40±0,22^a	1,30±0,16^a	1,30±0,16^a	1,10±0,16^b
Probability	0	0	<0,1974	<0,8145	<0,9316	<0,7531	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 8: Evolution of the average number of flower buds on water hyacinth plants of the block 6.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1(Evidence)	0 ±0,00^a	0 ±0,00^a	1,60±0,16^a	1,60±0,16^a	1,40±0,16^a	1,60±0,16^a	2,30±0,1^a
T7 (*Alternaria alternata* 10^{11} sp/ml)	0 ±0,00^a	0 ±0,00^a	1,50±0,20^a	1,40±0,22^a	1,30±0,16^a	1,20±0,16^a	1,10±0,16^b
Probability	0	0	<0,5405	<0,3169	<0,9643	<0,5447	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK)

Table 7 : Evolution of the average number of flower buds on water hyacinth plants of the block 7.

Treatments	weeks						
	S1	S2	S4	S6	S8	S10	S12
T1(Evidence)	0 ±0,00[a]	0 ±0,00[a]	1,60±0,16[a]	1,60±0,16[a]	1,40±0,16[a]	1,60±0,16[a]	1,70±0,1[a]
T8(*Alternaria alternata*10^{12}sp/ml)	0 ±0,00[a]	0 ±0,00[a]	0,50±0,20[b]	0,40±0,22[b]	0,30±0,16[b]	0,50±0,16[b]	0,50±0,16[b]
Probabilité	0	0	<0,0045	<0,0021	<0,0012	<0,1110	<0,0001

The averages on the same column affected by the same alphabetical letter are not statistically different at the threshold of 5% with ANOVA followed by student- Newman Keuls test (SNK).

DISCUSSIONS

Alternaria alternata has been described as a pathogen in the world of water hyacinth[10--21] . It has shown over 85% colonization frequency in all of the tested locations. For this work, several growth parameters such as weight, leaves and flowers were weight recorded. Overall, the results of this study was conducted in greenhouses with different concentrations : *A. alternaria* 10^6 sp/ml, 10^7sp/ml, 10^8 sp/ml, 10^9 sp/ml, 10^{10} sp/ml, 10^{11} sp /ml and 10^{12} sp/ml in ten plants water hyacinth corroborates the observations made by the authors cited above. The inoculation of *A. alteranata* on the plants of the water hyacinth in these concentrations caused disease symptoms (tasks and lesions) primarily on leaves and less severely on stolons and finally progressively leads to death of the plant. For blocks 1, 2, 3, 4, 5,6 and 7 we got at the final weight average values 86.40 ± 0.16 g, respectively; 86.5 ± 0.16 g; 93.60 ± 0.16 g; 86.5 ± 0.20 g; 90.50 ± 0.22 g; 88.40 ± 0.16 g and 88.21 ± 0, 91 g for the T1 treatment. For treatments T2, T3, T4, T5, T6, T7 and T8, the fungus *A. alternarta* tested on the plants of the water hyacinth in different concentration. The average values are weighed from 80.80 ± 0.24 g, respectively, 80.90 ± 0.23 g, 87.70 ± 0.47 g, 81.40 ± 0.30 g, 83.90 ± 0.73 g, 81 40 ± 0.30 g and 82.90 ± 0.52 .A the end of the experiment, we obtained 66.80 ± 0.1 g; 54.50 ± 1.23 g; 59.30 ± 0.15 g; 42.90 ± 0.56 g; 40.80 ± 0.13 g; 36.40 ± 0.42 g and 36.00 ± 0.29. These results show that *Alternaria alternata* caused considerable damage on the growth of plant organs, which significantly decreased the weight of the plants. A better result is obtained for the concentration of 10^{12} sp /ml on the plants until the average weight initially rose from 82.90 ± 0.96 to 36.00 ± 0.29 at the end of the experience. These results confirm those of Babu Mohan et *al*., 2002, 2003a, b, c) that *A. alternarta* significantly reduce the weight of the plants of the water hyacinth in a high concentration. As regards the sheets, in the eighth, fourth and sixth week, respectively, a small number of (necrotic lesions and tasks) have important started by appear on the leaves of all treatments. Similar results were obtained by El-Sayed M. El-Morsy et *al*., 2004, they have observed the same leaf spots with brown center, lesions on leaves and plant death after 15, 30 and 60 days. As for the flowers, which are crucial elements of growth, have remained virtually absent during testing at the start of all treatments. It was not up to the fourth week a few flowers appear on plants hyacinth and virtually zero for the treatment T4 concentration 10^{12} sp/ml *A. alternata* at the end of the experiment.

CONCLUSIONS

The aim of this work is to seek the most effective ways to improve the biological fight against the water hyacinth on our waterways. At the end of this work, *Alternaria altenrnata* at different concentrations of 10^6 sp/ ml, 10^7sp / ml, 10^8 sp/ml, 10^9 sp/ml, 10^{10} sp/ ml, 10^{11} sp /ml and 10^{12} sp/ml on hyacinth water tested under glass is effective to reduce *Eichhornias crassipes* growth parameters.

At a concentration of 1012 sp / ml of *A. alternata*, it affects more significantly and faster growth parameters such as weight leaf and flower.

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