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Auto-Resistance to Seeds Germination of Invasive *Acacia saligna* Trees at Al-Jabal Al-Akhdar region

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ABSTRACT

Sustaining the vegetation cover in Libya represents the most important priority that must be taken into account by the Ministry of Agriculture. This study was conducted in the laboratory of the Department of Biology, Faculty of Education, Omar Al-Mukhtar University, Al-Bayda, Libya, to investigate the possibility of controlling seed germination of *Acacia saligna* trees by using aqueous extracts (flower- seeds- leaves - bark) at different concentration (10, 20 and 40%). The results showed highly significant differences in decreasing a germination percentage and increasing an average germination time, between aqueous extracts and concentrations relative to control, where a flowers extract gave the largest effect on inhibitory germination percentages over the rest of other extracts. Commonly 40% concentration was the most toxic effect on *A.saligna* seed germination. The study concluded of *Acacia salgina* trees possess an autotoxicity that can be used to combat thier invasion and expansion in agricultural lands.

1 Introduction

Most Arab countries import many ornamental trees, without considering their harmful effects on local plant communities (Salih and Abdulrraziq, 2021). Acacia sp (Fabaceae) is native to the tropical and sub-tropical region, mainly Australia and Africa (Maslin, 2015). Acacia saligna (Labill.) Wendl. (syn. Acacia cyanophylla Lindl.) was introduced to the Mediterranean basin countries including Libya in 1916 AD, as a multipurpose tree, promoting communities via soil stabilization, windbreak, nitrogen fixation, a source of fuelwood, and livestock fodder (Midgley and Turnbull, 2003; Aly and Hassan, 1993). The tree is an evergreen tree with yellow flowers, and pod or legume fruits (8-12 cm in length) that contain several dark brown to black seeds with hard testa. The tree growing to 5-9 meters within their life spane (40 years) (Maslin, 1974; Midgley and Turnbull, 2003).

It is characterized by its rapid growth, its production of huge numbers of seeds, its adaptation to many arid and semi-arid environments, and its high resistance to drought and salinity (Akkari et al., 2008), but was recently included in a blacklist of invasive alien species in EU Regulation No. 1262 of 2019 (Maccioni et al., 2020), due to its detrimental effects on biodiversity in natural environments, protected areas by invading large areas of land that id reducing the richness, diversity of native species, the emergence of weeds and altering the properties of soils (Nsikani et al., 2018; Marzialetti et al., 2019), in addition to its negative effects on agricultural crops, direct competition for water, light, and food resources, or indirectly, This is what is known as an allelopathic, through the secretion of toxic chemicals impede the growth of neighboring plants (Suhalli et al., 2019), where a study conducted in Egypt showed reclamation of the lands of the Nile Delta region, by an introduction of A.saligna trees, led to a decreased diversity of vegetation cover in this region (Abd El gawad and El Amier, 2015). Recently, as shown by a local Libyan study demonstrated high toxicity of extracts of Acacia trees on germination of agricultural crops (Salih and Abdulraziq, 2021).

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About 500 research papers were published on many aspects of the damage caused by an infestation of Acacia trees in the past twenty-five years (Souza-Alonso et al., 2017), without addressing modern means to combat instead of the traditional methods of removing them by cutting, or burning, or using pesticides costly economically, addition to negative effects on the environment (Van Wilgen et al., 2012), to attempt to find a safe method, Maccioni (et al 2020) used rosemary oil to suppress the growth of A. saligna seed germination, which gave results could be useful for controlling this exotic species invasive.

Therefore, this study aimed to control the germination of seeds of invasive Acacia saligna trees in the Al-Jabal Al-Akhdar region using its aqueous extracts (flowers - seeds - leaves - bark) at a concentration of (10, 20, 40%).

2 Materials and Methods

Samples of *Acacia saligna* trees (flowers - seeds - leaves - bark) were collected from of Al-Bayda city, washed with distilled water, and then dry under natural conditions, grind with an electric grinder, and finally preserving for use.

2.1 Seed selection:

The seeds of the homogeneous *Acacia* trees were selected, cleaned of impurities, and viability was tested by soaking in distilled water to get rid of empty seeds floating on the surface, were soaked in 1% sodium hypochloride solution for 3 minutes, washed with distilled water (Dafaallah *et al*., 2019). After that the seeds were soaked in 6% hydrogen peroxide for 12 h to remove a hardcover (Salih *et al*., 2020).

2.2 Aqueous Extraction:

The aqueous extract (flowers- seeds- leaves- bark) was prepared separately by adding 100 g of air-dried powder to 500 ml of distilled water for 24 h, after that the extract was filtered through filter paper and placed on a Shaker for 24 hours. Then it was centrifuged at the speed of 2000 rounds per minute for 15 minutes. The extract was passed through Whatman filter paper No.1. The obtained extract concentration was considered as the stock solution (100%) (Masoud *et al*.,2018). Then it was appropriately diluted with distilled water to give final concentrations of 10, 20 and, 40%.

2.3 Test for Extracts:

Normally, 30 seeds per each Petri dish, were lined with two Whatman No.1 filter papers, incubated atroom temperature, each treatment was repeated three times, dishes were subjected to daily observation for 12 days and follow-up of germination in terms of addition of extracts to the treated dishes. add distilled water to Control as needed for each dish (Othman et al., 2018), Germination was calculated by recording a number of germinated seeds in all treatments starting from third day, which the first germination occurred. Was germination criterion is appearance of radicle outside seed cover (Ganatsas et al., 2008), at end of the experiment took final results of following qualities:

Germination percentage (PG %) = number of germinated seeds / total number of seeds × 100 (Yousif *et al*., 2020).

Mean germination time (MGT) = the total number of germinated seeds per day / total number of germinated seeds at end of the experiment (Das *et al*., 2017).

Statistical Analysis:

The study experiences were designed according to the completely randomized (CRD). Statistical analysis was performed using Minitab 17 program and ANOVA variance analysis tables. The averages were compared using Tukey's test at $P < 0.05$

3 Results

The data recorded in Fig (1 and 2) indicated there were significant differences, between the tested concentrations in decreasing the germination percentage and increasing the average germination time after 12 days from the beginning of the experiment, compared to the control. Commonly, 10% concentration of flowers extract recorded the lowest rates in reducing the germination percentage from 94.4% for control to 8.8%, an increase in the average germination time from 6.2 days for control to 9.5 days, while other concentrations 20 and 40% were to stop the growth of seeds, two concentrations recorded 10 and 20% of seed extract of germination rates 20, 11.1%, and the average germination time at 7.8, 9.4 days, respectively, compared to the control, and the 40% concentration did not show any germination, and the leaf extract recorded for the two concentrations 10, 20% germination rate 33.3, 15.5%, with an average The germination time 6.8 and 9.0 days, respectively, compared to the control, and the 40% concentration did not show any germination, while bark extract with concentration (10, 20, 40%) recorded germination rates of 56.6, 24.4 and 10%, an average germination time of 7.1, 8.2 and 8.7 days, respectively, compared to the control.

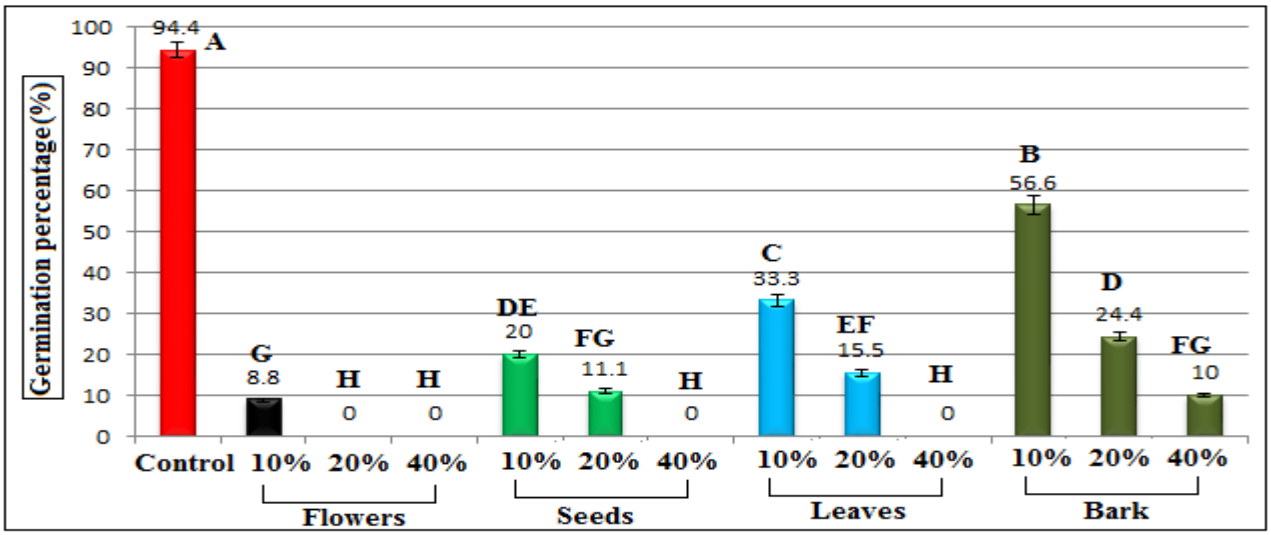

Fig (1): Effect of *Acacia saligna* extracts on germination percentage of its seeds.(Mean ± Standard Deviation).

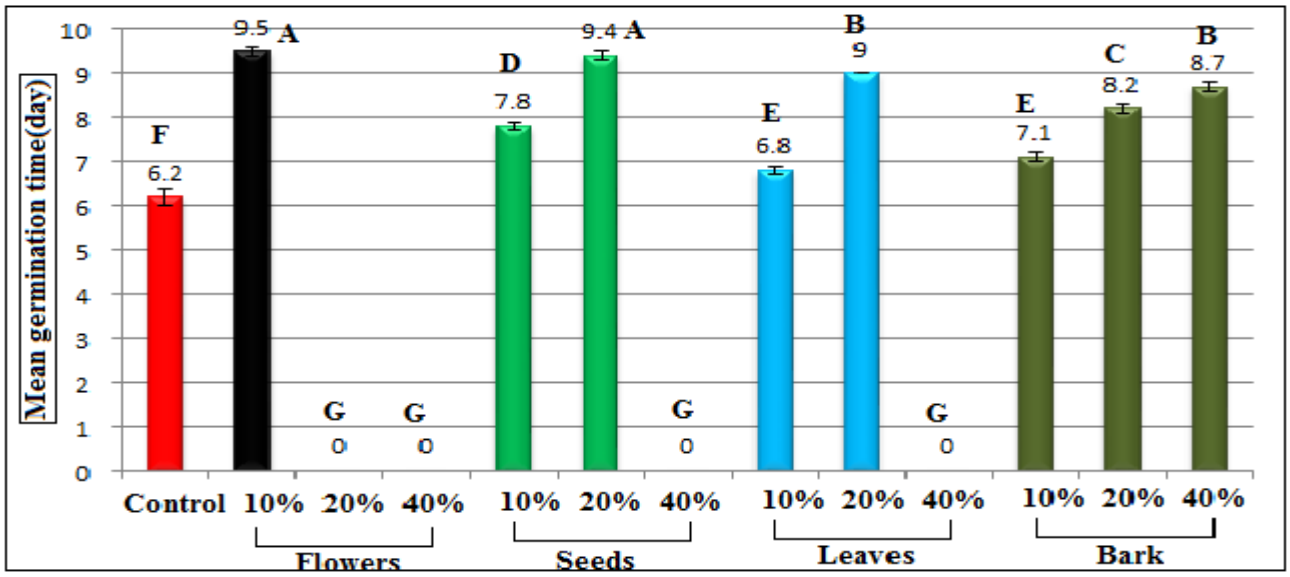

Fig (2): Effect of *Acacia saligna* extracts on Mean germination time of its seeds.(Mean ± Standard Deviation).

4 Discussion

Invasive alien plant species over the past decades have posed serious threats to local biodiversity, ecosystem, environmental quality, which requires confronting this threat and moving towards preventing and eliminating import (Marzialetti, *et al*. 2019; Bartz and Kowarik, 2019), for the rapid and remarkable spread of *A. saligna* trees in This study was conducted in Al-Jabal Al-Akhdar region, which showed the growth of seeds of these trees can be resisted by using the extracts of their parts, this effect is known as auto-toxicity (Favaretto *et al*., 2017), and this explains the growth of its seeds at long distances from the mother tree. This result agreed with Richardson *et al*., (2000) who show that invasive plants spread at long distances from each other, and the results showed that all extracts of golden acacia parts significantly reduced the percentage of germination with a clear increase in the average time of germination, and it was noted that the largest inhibitory percentages were for the flower extract followed by the seeds extract this result was confirmed by ElAyeb-zakhama *et al*., (2015) that the greatest inhibitory rates were for *A. cyanophyll* flower extract on seedlings plants.The high toxicity of the golden acacia flowers may be due to the fact that they contain an abundant amount of phenolic compounds benzoic acid, caffeine, o-coumaric acid, in addition to flavonoids quercetin,

naringenin, kaempferol (Al-Huqail *et al*., 2019), which would It interferes with physiological processes through its effect on cell division and elongation, membrane permeability, ion and water absorption, enzyme synthesis, metabolism, photosynthesis, plant hormone metabolism, respiration, protein and nucleic acid synthesis (Cheng and Cheng, 2015).

5 Conclusion:

We conclude from this study that the aqueous extracts of *A. saligna* have an inhibitory effect against the growth of its seeds, reduced all extracts with all concentrations significantly the germination percentage and increased the average germination time. The flowers extract was the most toxic of all the extracts, the concentration was 40% which was the concentration the most effective in inhibiting the growth of the tested seeds. Therefore, this study recommends setting strict controls for the import of ornamental trees by the Ministry of Agriculture, limiting the spread of *A. saligna* trees, finding new ways to resist its invasion, preserving the diversity of vegetation cover in Al-Jabal Al-Akhdar.

Conflict of interest: The authors declare that there are no conflicts of interest.

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