Ain Shams University
Faculty of Science

Physiological Studies on Lupine (*Lupinus termis* L.) Plant Cultivated in Sandy Soil

THESIS

Submitted for the Degree of Doctor of Philosophy of Science (Botany, Plant Physiology)

By

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Approval Sheet

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Ph.D. Thesis

Title of Thesis: Physiological Studies on Lupine (*Lupinus termis* L.) Plant Cultivated in Sandy Soil

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Degree: Ph.D of Science in Botany (Plant Physiology)

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بسم الله الرحمن الرحيم

صدق الله العظيم

ABSTRACT

This study aimed to extend cultivating lupine (*Lupinus termis* L.) plants in sandy soil. These included experimenting different sowing dates (11th November as D1, 3rd December as D2 and 25th December as D3) to optimize the period of time for achieving maximum plant productivity. Seeds were also soaked pre-sowing for 8 hours in either glutamine (Q) or salicylic acid (SA) solutions, each at 100, 200, and 300 ppm for assessing the suitable treatment that might improve plant growth and productivity in sandy soil.

Cultivation at first sowing date (D1) and treatment with the relatively low concentration (100 ppm) of either SA or Q significantly increased the growth criteria, photosynthetic pigment contents, fruit set, , seed filling rates and the yield components of lupine plants at both the vegetative and flowering stages (A, B) and at both cultivation years S1 and S2. Sowing lupine on 11th November (D1) and pre-sowing treatments with Q and SA, each at 100 ppm significantly increased the different carbohydrate contents, total free amino acids, total protein, macro-element contents and elevated the percentage of oil in lupine seeds, as compared with control. Fatty acids of the yielded lupine oil were higher in D1 than in D2 and D3. All treatments of Q and SA significantly decreased the total alkaloid content in lupine seeds. Electrophoretic patterns of protein bands in the extracts of lupine seeds from the plants treated with different concentrations (100, 200 and 300 ppm) of either Q or SA showed the appearance of new protein bands and caused the disappearance of others at D1, D2 and D3. Protein bands were either induced or repressed as a result of treatment with different concentrations of Q and SA and sowing on D3. Planting lupine at D1 and treatments with Q and SA, each at 100 ppm significantly increased the different carbohydrate fractions, total free amino acids, total protein, mineral ion contents and enhanced the levels of the growth hormones (IAA and GA_3) and attenuated those of abscisic acid in lupine leaves at vegetative and flowering stages (A, B). Protein electrophoretic pattern of the leaf extracts from 60- day- old lupine plants treated with different concentrations (100, 200 and 300 ppm) of either Q or SA revealed that these treatments induced the appearance of new protein bands and caused the disappearance of others at the different sowing dates (D1, D2 and D3). The GC-MS analysis of the methanol extract of each of the seed coat (testa) and cotyledon and the aqueous extract of whole seed of the commonly used lupine in Egypt (cv. Giza 1) revealed the presence of various chemical compounds having significant benefits, which recommended extending cultivation of lupine (Giza 1) as a plant of pharmaceutical value and medical application. Regarding the anticancer activity of lupine seed oil, its major constituent oleic acid and its main phospholipid lecithin were screened against breast (MCF-7), colon (HCT-116) and hepatocellular (HepG2) cell lines of human carcinomas, where oleic acid induced more potential cytotoxicity against HepG2, HCT-116 and MCF-7 cancer cell lines than lupine oil. Lupine oil is however likely promising for application as a novel therapeutic agent against certain carcinomas.

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Dedication

This thesis is dedicated to everyone who has loved and supported me while I was working on my Ph.D degree at Ain-Shams University.

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