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STUDIES ON NITROGEN FIXERS IN SOME NON-LEGUMINOUS PLANTS

By

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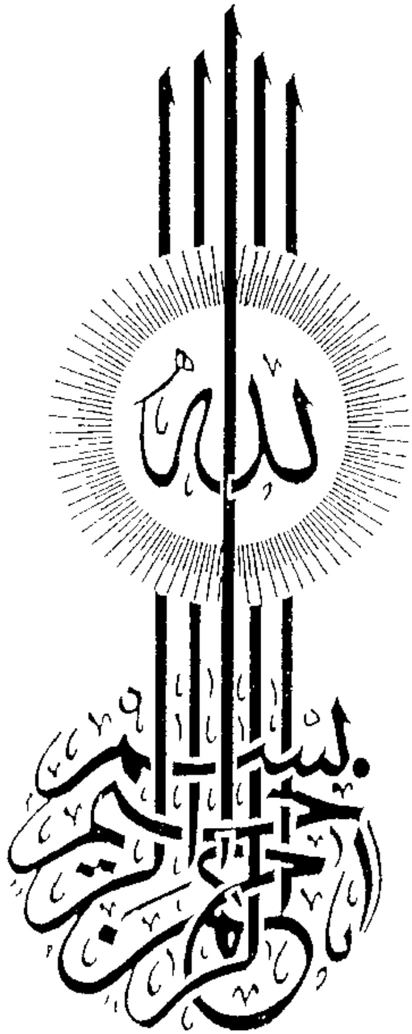
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I- INTRODUCTION

Although deserts constitute about 95% of the total area of Egypt where many wild herbs grow, very few investigations were carried for studying these plants, whose constituents are of highly medicinal value. One of these plants is the Egyptian henbane (*Hyoscyamus muticus L*) which is widely distributed in Egyptian deserts. Egyptian henbane, is locally known by Arabic name "Sakran" (Tackholm, 1974). It is a perennial plant belonging to the family Solanaceae. The plant covers an area of about 2 meters in diameter and a height of 80-120 cm (Mahran, 1967). It is an important source of valuable medicinal alkaloids as hyoscyamine, hyoscine and atropine. These materials are used as a sedative to the nervous system to enhance the hypnotic effect of morphine preliminary used to general anesthesia and in ophthalmic practic to dilate the pupil of the eye (Wah and Pai, 1967).

Therefore, it was found of interest to study the distribution of some important medicinal plants, which grow widely in Egyptian deserts. In addition, the active substnaces of Egyptian henbane plant *Hyoscyamus muticus L* as affected by inoculation with asymbiotic N_2-fixers and chemical treatments were also studied.

REVIEW OF LITERATURE

2- REVIEW OF LITERATURE

2.1. The rhizosphere:

The term rhizosphere was introduced in 1904 by the German scientist Hiltner to describe that part of the soil in which roots generally induce a proliferation of microorganisms.Thom and Smith (1939) referred to the rhizosphere as that ball of earth filled by the roots of a particular plant with the micro-organisms that accompany them. While Starkey (1931) divided the term rhizosphere into three regions, histosphere on the root itself, rhizosphere the adhering soil, and edaphosphere the more distant soil, in which the root effect is not felt. Rovira (1956 a,b) and Rouatt & Katznelson (1957) reported that the rhizosphere supported greater population of bacteria which were more capable of growing rapidly and physiologically active types than do non-rhizospheric organisms. Yoshida (1976) mentioned that rhizosphere is the soil-plant root interface, including the surface of root tissues and the surrounding soil.

It is now clearly established that the root system of higher plants is associated not only with an inanimate environment com-posed of organic and inorganic substances but also with a vast community of metabolically active microorganisms.The microflora that responds to the presence of living roots,are distinctly different from the characteristic soil community, the plant creating a unique sub-terranean habitat for microorganisms. The plant, in turn, is markedly affected by the populations it has stimulated since the root zone is the site from which inorganic nutrients are obtained and through which pathogens must penetrate. Consequently, interactions between the macro-and the microorganisms in this location, can have a considerable significance for crop production and soil fertility. This unique environment under the influence of plant roots is called the rhizosphere(Alexander, 1977). He also mentioned that the rhizosphere is often divided into two general areas, the inner rhizosphere at the very root surface and the outer rhizosphere embracing the immmediately adjacent soil. Recently Dommergues and Krupa (1978) divided the rhizosphere into three areas:

1- The rhizosphere sensu stricto (= Outer rhizosphere) comprising the region immediately surrounding the plant roots and the microbial population inhabiting it.

2- The rhizoplane (= root surface) formed by the root surface and the microorganisms living on it.

3- The endorhizosphere (= inner rhizosphere) formed by the root cortical tissue invaded and colonized by saprophytic soil microorganisms (non-pathogenic host infection).

2.1.1. Rhizosphere microbial population of some desert plants :

The rhizosphere community may have either a favourable or a detrimental influence on plant development. Because the microflora is so intimately related with the root system, partialy covering its surface, any beneficial or toxic substance produced can cause an immediate and profound response. Vancura *et al* (1959) observed that, there is an inhibition of the seedling growth by the application of bacterial cell-free filtrates. The thickening and shortening of plant roots were also observed when the metabolic products of *Azotobacter* were applied. Rovira (1965) referred that the mechanism by which the microflora could affect plant growth has not been established but the production of metal chelating compounds, growth regulating substances and the protection against root pathogens could be of importance. The aspects of plant growth which can be influenced are root morphology, root to shoot weight ratio, rate of development and onset of flowering, crop yield, uptake of mineral elements & organic compounds; and some physiological processes. Clark (1940) noted that fluorescent gram-negative bacteria of the genera *Pseudomonas* and *Xanthomonas* are commonly encountered in greater abundance on roots than in soil. Krassilnikov (1934); Clark (1940) and Lochhead (1940) reported that there is also good evidence that the genus *Bacillus* is less numerous in the rhizosphere than in root-free soil. Webley *et al* (1952); Montasir *et al* (1956,a,b and Mahmoud *et al* (1964) reported low bacterial counts in Egyptian desert soils. On the other hand Elwan and Mahmoud (1960) observed the significance of rhizosphere of some Egyptian desert plants in summer season. They reported few millions of bacteria per gram dry desert soil.

Studying the microflora of the desert plant, *Moltakea callosa*, during flowering stage (March), Mahmoud *et al* (1964) found that bacteria simple in growth requirements represented 25% of total bacteria in the rhizosphere as compared to 21.9% in the soil. Positive rhizosphere effect was noted for microbial population, actinomycetes, cellulose decomposers, nitrifiers, *Azotobacter* and clostridia. Such effect was related to organic matter, root secretion and relatively higher moisture content around roots.

Elwan and Diab (1970 a) found that seasonal variations in temperature, organic matter and rainfall were reflected on the bacterial development in the rhizosphere of *Artemisia monosperma*. Rhizosphere stimulated the development of bacteria simple in nutrition, actinomycetes, acid producing bacteria and cellulose decomposers.

The rhizosphere microflora of *Rhazya stricta*, a widely distributed plant in Arabian desert, stimulated total viable bacteria and cellulose decomposers in all seasons. In winter, bacteria complex in growth requirements predominated both in rhizosphere and soil. In summer, rhizosphere stimulated bacteria simple in growth requirements, actinomycetes and phosphate dissolving bacteria (Elwan and Diab, 1970,b).Anter (1976) mentioned that different microbial groups were more abundant in the rhizosphere of some desert plants than soil. However, counts were affected by community types as well as by soil texture. More recently, Alexander (1977) found that microorganisms in the rhizosphere also affected the growth of higher plants. They stimulate or inhibit the growing plant through their activities in the rhizosphere. Hegazi *et al* (1980) investigated the rhizosphre of some desert plants collected from Wadi- Hoff. They found that *Azotobacter* were not detected in any of the tested samples. They stated that clostridia and azospirilla represented the major forms of asymbiotic N_2-fixers traced and they were stimulated to a great extent in the rhizosphere of plants particularly *Farsetia aegyptiaca.* Rhizosphere/soil values were relatively higher (7-465) for N_2-fixers than for other physiological groups, e.g ammonifiers and denitrifiers (0.07- 129).

Zaki *et al* (1980)indicated that the rhizosphere and soil apart of a variety of salt marsh plants were populated with spore-formers, actinomycetes and free living nitrogen fixers. Counts of these groups varied from one rhizosphere to another, but