PART I

Introduction and Literature Review

The arid and semi- arid regions cover an area of about 48520,000 km^2, representing about 38 % of the global land surface area. On average, about 20 % of the world's arid zone are covered by aeolian sand, although the proportion varies from as little as 2 % in North America, to more than 30 % in Australia and >45 % in central Asia (Gad 1999).

The distribution of sand dunes in the world were corresponds to the regional distribution of arid climates (Hagedorn *et al.*, 1977 and Fahmy 2004). Aeolian activities are among the dominant phenomena in the arid and semi- arid regions (Gad 1999).

Egypt is a part of the Sahara "North African Desert". Its area is about one million km^2 divided geographically by the River Nile into two main parts: a western part (Western Desert) of about 681,000 km^2 and an eastern part comprising the Eastern "Arabian" Desert 223,000 km^2 and the Sinai Peninsula 61,000 km^2. The Nile Valley including the Delta forms, a riparian Oasis 40,000 km^2 that's the densely inhabited farm lands of Egypt (El Nagger and Abd El- Ghani 2004). Phytogeographically, Egypt comprises four main regions as considered by Zahran and Willis (1992) as follows: The Western Desert region, The Eastern Desert region, The Sinai Peninsula and The Nile region.

Egypt is located in the arid and extremely arid belt of North Africa. The aeolian sand accumulation occupies an area of about 16 % of the total surface area. About 95 % of this ratio is located in the Western Desert (Gad 1999). Sand formations represent a morphological feature of the coastal and inland deserts in both arid and hyper arid provinces of

Egypt (Batanouny & Batanouny 1969 and Zahran & Mashaly 2000). They vary in origin, size, height, structure, texture, water content and salinity. They may be categorized into: dunes, hillocks, hummocks, mounds and bars (Zahran & Mashaly 2000). Psammophytes are plants that inhabit the sand formation, sand bars, sand hillocks and sand dunes which are usually associated with the lakes of the Oases and depressions (Danin 1983 and Zahran 1989).

The psammophytic vegetation comprises species of special ecological adaptations. They are capable of building sand formations and can stand living under burial with sand without being damaged. Their distribution and dominance varies. Some species build up sand formations in the coastal and inland deserts of both arid and hyper arid provinces of Egypt e.g. *Nitraria retusa, Zygophyllum album, Artemisia monosperma* etc. The second group of psammophytes inhabit sand dunes of the attenuated arid province under the maritime influence of the Mediterranean Sea never grow southwards (Ayyad 1973 and Zahran & Mashaly 2000). These include: *Ammophila arenaria, Elymus farctus, Euphorbia paralias, Lotus polyphyllos, Lygeum spartum, Cyperus capitatus, Silene succulenta* etc. *Halopyrum mucronatum* is a littoral psammophyte predominates in a very limited area in the most southern section of the Red Sea coast of Egypt. It was neither recorded northwards along Red Sea coast nor in the other parts of Egyptian deserts. *Atriplex farinosa* is also a littoral psammophyte that inhabits sand dunes along the whole stretch of the Red Sea coast absent elsewhere in Egypt (Kassas & Zahran 1967 and Zahran & Mashaly 2000). *Populus euphratica* is a naturalized psammophytic tree growing on the sand dunes of some lakes of Siwa Oasis. This species was introduced to Siwa Oasis during the Roman time about 331 B.C. (Belgrave 1923; Zahran 1972 and Zahran & Mashaly 2000) to stabilize sand dunes. The third group of psammophytes

inhabits sand formations of both arid and hyper arid provinces e.g. *Stipagrostis scoparia* and *Asparagus stipularis*.

Psammophytes are sometimes classified under xerophytes due to the extreme edaphic and climatic conditions prevailing in their habitats. Hydroecological studies on sand dune vegetation revealed that the sand dune plants differ in their water ecological behavior from both halophytes and xerophytes (Zohary& Fahan 1952 and Zahran *et al.*, 1996). Psammophytes have highly specialized growth forms and many have the ability to elongate vertically on burial with sand (Girgis 1973 and Zahran *et al.*,1996).They are also adapted to survive partial exposure of their under ground organs without serious effect. Fixation of such dunes is a pressing need to reduce the erosion of the shore (Zahran *et al.*, 1996).

For this study, seven psammophytic species have been selected: *Ammophila arenaria, Elymus farctus* and *Halopyrum mucronatum* (family Gramineae), *Atriplex farinosa* (Chenopodiaceae), *Euphorbia paralias* (Euphorbiaceae), *Lotus polyphyllos* (Leguminosae) and *Populus euphratica* (Salicaceae). Each of these species has been studied autecologically with particular reference to its distribution, habitat and floristic composition of its community in the Egyptian deserts. Also, the taxonomical features (morphological and anatomical characteristics) have been investigated.