شبكة المعلومات الجامعية

سامية محمد مصطفى

بسم اللّه الرحمن الرحيم

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جامعة عين شمس

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ECOTYPIC VARIATIONS OF SOME DESERT PLANTS GROWING IN VARIOUS HABITATS

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CONTENTS

INTRODUCTION

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The term ecotype was proposed by Turesson (1925) imblying to the grouping of populations or ecological races or subspecies in relation to different environmental conditions. These are interfertile forms or biotypes of a species which posses different genitic composition or genotypes and arise due to mutations, hypridization or isolation. Though the different ecotypes of a species are morphologically and genetically distinct, yet because of their interfertility, they are put into one taxonomic species (Heywood, 1973; Shukla & Chandel, 1989 and Stace, 1989). Ecotypes are morphologically, phsiologically and developmentally the product of genetic response of a population to a habitat.In ecotypes adaptations are irriversible , i.e. they retain their features even when planted in a natural habitat. The differences in ecotypes are so marked that some of them are treated as separate species (Stace,1989). Mishra & Shava Rao (1948) Found that *Lindenbergia polyantha* and *L. urticaefolia* to be the ecotypes of the same species. The two ecotypes differ from each other in thier respect of thier tolerance to high doses of lime. *L. polyantha* can tolerate high doses of lime. In another study, Ramakrishanan (196o) has shown that the red and green populations of *Euphorbia thymifolia* are two ecotypes. The red ecotype grows in calcium rich (calcicol) as well as calcium deficient soils. However, the green ecotype is a calcifuge,i.e. it cannot grow in calcium rich soil. The red ecotype possessd a pair of dominant alleles, where as the green type possessed a pair of recessive alleles (Shukla & Chandel,1989). Ecotypes have been reported in several species of plants, such as *Euphorbia hirta, Cassia tora, Ageratum conizoides,Cenchrus ciliaris* ,etc.(Shukla& Chandel , 1989).During the last two decades, many investigators have studied either only a few populations or several widely separated populations and have shown that each population was an ecotype and the term now being widely used below the species level (Mc-Millan, 1959 a & b,1960 & 1969; David & Heywood, 1963; Odum, 1971; Snaydon, 1973 and Stace, 1989).

Our increasing knowledge of genecology and population differentiations has shown that an ecotype may be the ecological unit but not an evolutionary one. According to Mc-Millan (1959 & 1969),the concept of genetically based variation that is habitat correlated or population differentiation or microevolution is valid, but ecotype as a word has limited value in its application.

Ecotype is still considered on the basis of morphological,physiological or ecological evidences. According to Davis & Heywood (1963);

Mc-Millan (1969); Heywood (1973); Snaydon (1973) and Stace (1989) an ecotype is based on the relation between genotype and the prevailing environment. They defined ecotype as a population distinguished by morphological and physiological characteristices most frequently of a quantitative nature, interfertile with other ecotypes of the ecospecies, but is prevented from freely exchanging genes by ecological biomass (Shukla & Chandel, 1989).

Free gene exchange, allows favourable mutations to spread rapidely through the whole population, giving material on which natural selection can work. At the sametime, free gene exchange within a large population gives a valuble measrue of stability by showing any diverging groups arising from combinations of genes. But in species where distinct ecotypes from different specialized habitats can be recognized, the variation does not confirm with natural distribution curve More likely the curve of the whole population whould be flattened or even show subsidiary humps. To an extent, this shows that there is not complete free gene exchange within the population. Once it has ganied a foothold, the process of natural selection may be intense, putting a premium on quite different characters and so favouring the survival of different genotypes from those in the main population (Ashby, 1973). The hawkweed *Hieracium umbellatum* which was intensively studied by Turesson , provides a good example.
The naturalform of this species grows in dry sandy meadows in ompitition with grasses and many other herbaceous plants, but where it colonized shifting sand dunes, He can readily see that its survival will depend on its ability to tolerate the exacting conditions of the new habitat than power of compitition withn other species. This was reflected in differences such as a more erect habit of growth and a rapiad shoot regeneration in dune types.These characters persisted in cultures conferming a genetic difference between the two ecotypes. This divergence that imposed by natural selection, is for more likely to become stabilized genetically and assume a unity of its own if there is breeding barriers giving a measure of isolation from the main population of the species (Ashby, 1973).

The existence of habitat associated ecotypes in plants is widespread (Clousen & Hiesery, 1958, Heywood 1959 & 1968, Blits & Gallagher, 1991, Batanouny et.al. 1991, and Chapman & Reiss 1995). The faces leading to habitat specificity have most often remained unexplored. Genetic differentiations between adjacent populations has been recognized as a balance between gene flow and selection (Jain & Bradshow, 1966 and Jain, 1969). and ecotypic differentiation over short distances may be similarly controlled. However, few realistic estimates of either gene flow or selection have been shown in natural populations (Stearn , 1976 and Stace, 1989), and even fewer in populations that have not been disturbed by man (Allord, 1979). Some of the most revealing studies on ecotypification have been carried out on the differentiation of populations in different islands (Strid,1972 Stace, 1989) provide a ready made experiment in which they natural populations is assured . These studied clearly illustrate that as a plant species become widespread, it develops genetic adaptations to the local conditions. In other words, within a particular species, significant genetic exist, some so great that different varieties are longer capable of interbreeding with other varieties. Although we call these variants as ecotypes, where do we draw a line and say that the differences are great enough to constitute two separate species. The decision is clearly a judgment call (Hanson & Churchill, 1965).

The extent to which ecotypes have become morphologically differentiated, varies enormously. Sometimes morphological adaptations are the most crusial factor. For example in dwarf alpine ecotypes are of large leaved, less hairy in shade ecotypes. Examples of the different ecotypes are given by Stace, (1989). who listed cases of e.g. physiological ecotypes involving adaptations to differing soil conditions (salinity, pH, heavy metals, nutrients, moisture), climate(day length,temperature,length of seasons & shade) and biotic influences (grazing & parasitism).

The vitality and vigor as well as phenologic behaviour may also be used to differentiate between ecotypes. For example, five climatic ecotypes of *Doshompsia caespitosa* ssp *genuina*, all morphologically similar in thier natural environment where they differed in heigth of the tallest stems, numbers of flower stalks, diameter of the clumps, time of flowering and fruiting and susceptibility to frost and disease (Lawrence 1945). An ecotype growing outside of its natural environment will usually not be so vigorous as when growing within it. During the course of evolution the habitat requirments of ecotypes apparently become increasingly exacting, so ecotypes, rather than species, are the best indicators of ecological conditions . Species of wide distribution such as *Andropogan scoparius* and *Bouteloua curtipendula* which grow in a variety of habitats, are often represental by a number of ecotypes with special adaptations enabling them to grow under dfifferent conditions of length of day, temperature and soil moisture. However, *Stipa spartea* and *Elymus canadensis* apparentaly respond to conditions in widely separated areas not because of genetic differences among the plants of each, but because of the wide range of phenotypic expression of the same genotyes. (Mc-Millan 1959 a & b and Hanson & Churchill, 1965).

Shukla & Chandel (1989) have summerrized the characteristic features of ecotypes as followes:

1) Ecotypes of a species , though genotypically distinct , are alwayes interfertile.

2) They retain thier original features when cultivated in a natural habitat .
3) Ecotypes are genetacilly fixed.
4) A species with wide ecological amplitude can be distingished on the basis of morphological and physiological characters into different habitat forms or ecotypes.
5) They occur in distinct habitats.
6) Ecotypes are discrete entities with clear differences which separate one ecotype from another.
7) The differences are not due to plastic response to changes in environment,but are actually due to natural selection of locally adapted populations.

The same authers (1989) also showed that ecotypes have been observed in a large number of species and the cause of ecotype differentiation may be the latitude, altitude, light, soil, biotic interference, physiological changes etc. According to varying environmental conditions ecotypes may be of the following types:

1) Climatic ecotypes, which are produced due to varying climatic factores as light, temperature, water, wind, etc.
2) Edaphic ecotypes which are produced due to differences in edaphic or soil factors, such as soil moisture, soil pH,soil nutrients, etc.
3) Climatic-Edaphic ecotypes which are produced due to the influence of both climatic and edaphic factors.
4) Altitudinal and Latitudinal ecotypes which are produced due to changes in altitude and latitude.
5)Physiological ecotypes which are produced due to physiological changes in photoperiods, water absorption, nutrients uptake, etc.

Ecotypes are not always based on morphological characters . Sometimes, single ecotype have several ecophenes which depend upon the habitats. Nowadays the following techniques have been applied to differentiate the different ecotypes as stated by Shukla and Chandel (1989):

1) Morphological Features : In this case morphological or physiological features of several individuals are studied at random in different populations of a species and are a few characters are considered and the results obtained are discussed graphically indicating the existence of distinct ecotypes.
2)Anderson's Scatter Diagrams which was devised by Anderson (1949) to delimit ecotypes. For this some measurable characters are taken into consideration and discussed graphically.
3) Cytological Behaviour .In this case Karyotypes and their behaviour are observed in different forms.The differences in cytological behaviour show the existence of distinct ecotypes .

4) Transplantation Experiments :In this case, plants from all the different localities under uniform environmental conditions are taken and their morpho-physiologicol characters are compared with plants growing in natural habitats .If the characteristic features are not in the neutral area, the existence of particular ecotypes is confermed .

5)Breeding Experiments : In this case , crossing is done between different forms of variable nature followed by self - fertilization to determine the characteristic features of variable forms.If the characteristic features show the persistence in the offsprings ,the presence of distinct ecotyes can be proved (Shukla & Chandel,1989).

Additionally, the significance of ecotypes could be summerized in the following points :

1- Cultivation of economically important plants has been made possible in different habitats .
2- New ecotypes of a species enable it to be adopted to climatically and edaphically different places.
3- Ecotypes help the species to extend its ecological range and spread to new areas .
4- Morpholagical variations can be marked in the species growing on varying habitates which lead to evolution (Shukla & chandel,1989).

The present study aims at investigating the morphological , anatomical and some physiological ecotypic variations for the populations of the different ecotypes of *Zilla spinosa, Echinops spinosissimus,Pituranthus tartuosus* and *Stachys aegyptiaca* .The environmental conditions of different habitats of the Egyptian desert govering the adaptative criteria of these ecotypes to their natural environment as well as their vegetational characteristies are also considered and discussed .