Ecological study and acclimatization of medicinal ferns

Sheetal Anup Kalhapure

Department Of Botany, Annasaheb Waghire College, Otur

Abstract:

Pteridophytes are one of the important components of any mountainous floras well as considered as one of the successful plant groups on the earth. Pteridophytes are vascular cryptogams and form a neglected group of plants in biodiversity.

They almost distributed in Western Ghats, Himalaya and considered as lower vascular plants. Fern acclimatization and conservation can be considered as a part of conservation biology. Various techniques are established for conservation of medicinal, rare, endangered ferns. Whole ecosystems and biodiversity is considered because of various conservation programmes. Various medicinal ferns also acclimatized under Pune condition and they are conserved.

Ferns are one of the successful plant groups on the earth and for reproduction they require a lot of water. They almost distributed in Western Ghats, Himalaya and western ghat.

Rural population and many tribal communities are using many ferns and fern allies for treatment of various diseases. About 110 genera and 600 species are fund in India (Sukumaran et.al.2009). Many taxa of Pteridophytes have been lost or eradicated from Western Ghats due to the present pace of rapid industrialization and exploitation of natural resources.

The change in climate manipulates the ecological features of an ecosystem and has huge effects on plants growth. The environmental factors interact with plants and alter their physiological functions (Hegland et al., 2009).

The environmental factors that influence plant growth and reproduction are light, temperature, water, nutrients and diseases or insect. There are many other types of stresses caused by the changes in the surrounding area of plant either in a minor or major way. These stresses effect plant growth and in the long term and affect the survival of plant.

Accordingly, there is evidence that species restricted to poor resource environments present regular but low levels in functional responses and ecologically wide species show an effective light use both in sun and in shade. Most studies addressing the relationship between phenotypic plasticity and ecological breadth of plants have not included a field quantification of ecological breadth for each species, nor in-situ ecophysiological measurements.

Exhaustive systematic survey of pteridophytic localities for many years by Mahabale (1987) has revealed the occurrence of 59 species from 35 genera in Western Ghats of Maharashtra. Blatter and Almeida (1922) have described 57 species occurring in Bombay Presidency. On the whole, Maharashtra is quite rich in pteridophytes, there are about 55-60 ferns and 11 fern allies known, so far (Mahabale, 1987).

The medicinal uses of some ferns and pteridophytes of India have also been described by Caius (1935 b) and Nair (1959). The medicinal uses of 61 different fern and fern allies have been described by Benjamin and Manikam (2007).

Acclimatization is the process of an individual organism adjusting to a gradual change in its environment, such as a change in temperature, humidity, light intensity, photoperiod, soil pH etc., and allowing it to maintain performance across a range of environmental conditions. Acclimatization occurs in a short period of time and within the organism's lifetime. Organisms can adjust their morphological, behavioural, physical, and biochemical

traits in response to changes in their environment (Anonymous, 2009). While the capacity to acclimate to novel environments has been well documented in thousands of species, researchers still know very little about how and why organisms acclimate the way that they do. However, information about the acclimatization of ferns is scanty.

The ferns, which are acclimatized at Pune conditions, were studied further for the characters like rhizome sprouting time., plant height, plant spread, vegetative growth period up to formation of sori (days required for sori formation), reproductive period (time from sori formation to sori maturation) and rhizome dormant duration (days) All above characters were studied from the selected ferns from Mahabaleshwar forest (habitats initially marked for the collection of rhizomes) as well as ferns acclimatized under Pune conditions.
The acclimatized ferns have been successfully maintained in the house garden.

Key-words-,Pteriophytes, acclimatization, conservation, Ayurvedic, *Cheilanthes farinosa* Kaulf, *Adiuntum capillus- veneris* Linn Pteriophytes, acclimatization, conservation, medicinal uses

Introduction-

Pteridophytes are not only one of the vascular cryptogams but also the most ancient plants .But they are neglected group of plants in biodiversity. These are non flowering, vascular and spore bearing plants which include ferns and fern allies .India is among twelve megadiversity centers.The Eastern Himalayas and Western Ghats are two hotspots which are rich in pteridophytic flora. Although, they have been replaced by the spermatophytes in the modern day flora, they occupy an important and a crucial general position. They are group of plants from phylogenetic and evolutionary point of view.

This group of plants grows abundantly in Himalaya and hilly regions of Central and South India. About 110 genera and 600 species are fund in India (Sukumaran et.al.2009). The only authentic taxonomic work on this group plants are Beddome (1883), Blatter and Almeida (1922), Panigrahi and Dixit (1966, 1967), Sharma et.al. (1977), Dixit (1984), Mahabale (1987), Bir (1987a and b), Manickam and Irudayaraj (1992), Ghosh et al. (2004), Chandra et al. (2008).

Pteridophya is one of the important groups having important contributuion to the plant diversity.It is one of the major groups which are used for medicinal purpose as well as for other purpse like ornamental etc.The forest of Western Ghats having rich flora of various types of fernsMost of the ferns are rare with medicinal value so it should be conserved.The most of the ferns and fern allies are noticed growing luxuriously.But because of human activities there is threat to fern species.Some steps are desired to be taken for their conservation for pteridophytic taxa.Indian fern flora is endemic to country and so it needs specialattention conservation.

Most of the Southern India pteridophytes are found in Western Ghats, which has been explored by many workers like Manickam and Irudayaraj(1992) ,Nimphy and Madhusoodhanan (1998).Pteridophytes found scattered all over the world.They grow luxuriantly in moist tropical and temperate forests.Their occurance in different ecogeographically threated regions from sea level to the highest mountainous are of much interest.

The correlation between phenotypic responses to light availability and ecological extent of plant species has been studied in several taxa, most of them are angiosperms. Ecological breadth has been

related either to the presence of different ecotypes in each habitat type or to plasticity of an individuals in morphological and physiological responses to environmental variation. Plants limited to a restricted range of distribution

are expected to exhibit narrow tolerance to environmental variation, and species of widespread distribution should be able to cope with greater environmental changes. Accordingly, there is evidence that species restricted to poor resource environments present regular but low levels in functional responses and ecologically wide species show an effective light use both in sun and in shade. Most studies addressing the relationship between phenotypic plasticity and ecological breadth of plants have not included a field quantification of ecological breadth for each species, nor in-situ ecophysiological measurements. Plant species established across the completely light gradient should be able to produce leaves morphologically and physiologically suited to a wide range of light environments. The maintenance of a positive carbon balance in a wide range of environments is a key feature of species that successfully occupy diverse habitats Leaf traits relevant to net carbon gain, and hence to components of plant fitness, include photosynthetic rate, respiration and specific leaf area. Given the influence of photosynthetic capacity on plant growth and reproduction, plasticity in this ecophysiological trait could be associated with variation in ecological breadth. Respiration has been associated with acclimation to light variation. Plants adapted to shade should present less carbon losses by respiration, and a decrease of reparation in low light could be expected in order to compensate the low assimilation rate. Respiration increases with light availability because increased assimilation demands a greater amount of enzymes and metabolites with a higher maintenance cost. Under low light conditions, plants produce thin leaves hence optimizing the surface of light capture. Hence, in present investigation it was decided to study the phenotypic characters of naturally growing plants from Mahabaleshwar and ferns acclimatized under garden conditions.

Acclimatization is the process of an individual organism adjusting to a gradual change in its environment, such as a change in temperature, humidity, light intensity, photoperiod, soil pH etc., and allowing it to maintain performance across a range of environmental conditions. Acclimatization occurs in a short period of time and within the organism's lifetime. Organisms can adjust their morphological, behavioural, physical, and biochemical traits in response to changes in their environment (Anonymous, 2009). While the capacity to acclimate to novel environments has been well documented in thousands of species, researchers still know very little about how and why organisms acclimate the way that they do. However, information about the acclimatization of ferns is scanty.

To understand the mechanisms behind acclimatization of ferns in new environment and to suggest conservation means, it is crucial to unravel local and regional dynamics of fern populations. A microclimatic and demographic study of fern populations would give the best information needed for successful conservation of ferns (Menges and Gordon, 1996) and enable the development of realistic spatially open models, allowing for the characterization of local population dynamics and the regional dynamics of the species (Münzbergová *et al.*, 2005; Milden *et al*., 2006).

Aims and Objectives

1. To study the morphological parameters in selected ferns under natural and changed climate

MATERIALS AND METHODS

1. Variation in growth and morphology in acclimatized and wild ferns The ferns, which are acclimatized at Pune conditions, were studied further for the characters like rhizome sprouting time., plant height, plant spread, vegetative growth period up to formation of sori (days required for sori formation), reproductive period (time from sori formation to sori maturation) and rhizome dormant duration (days). All above characters were studied from the selected ferns from Mahabaleshwar forest (habitats initially marked for the collection of rhizomes) as well as ferns acclimatized under Pune conditions.

Table -1 Comparison of growth performance (plant spread) of acclimatized ferns with the ferns in their natural habitat

Plant spread (cm)

Name of the ferns	In the forest	In the Garden	Percent decrease (PD)
Microsorium punctatum (L)	42.50	26.26	-38.21
Adiantum lunulatum Burm.f	45.80	36.04	-21.31
Adiantum capillus-veneris L.	46.12	38.48	-16.57
Cheilanthes farinosa Kaulf.	44.18	41.08	-7.02
Pteris vittata L.	65.42	58.72	-10.24
Tectaria macrodonta C. Chr.	72.72	48.58	-33.20
Christella parasitica (L) Lev.	112.42	80.42	-28.46

Table-2 Comparison of growth performance (fern height) of acclimatized ferns with the ferns in their natural habitat

Fern height (cm)

Name of the ferns	In the forest	In the Garden	Percent decrease (PD)
Microsorium punctatum (L)	40.52	24.14	-40.42
Adiantum lunulatum Burm.f	35.66	30.42	-14.69
Adiantum capillus-veneris L.	32.82	28.82	-12.19
Cheilanthes farinosa Kaulf.	58.24	47.26	-18.85
Pteris vittata L.	90.18	70.48	-21.85
Tectaria macrodonta C. Chr.	78.92	58.32	-26.10
Christella parasitica (L) Lev.	160.54	106.82	-33.46

Result and conclusion

Observations on plant height, plant spread clearly indicate that ferns growing in new environment under botanical garden conditions showed reduced growth in terms of plant height, plant spread as compared to their natural habitats. This reduction in plant height, plant spread and frond length and size might be due to higher light intensity, elevated temperature and less humidity available in new environment. These ecological conditions might have developed some drought stress conditions, which reduced the growth in ferns as compared to their counterparts in natural habitats. According to Hegland et al. (2009), change in climate manipulates

ecological features of an ecosystem and has huge effects on plants growth. Environmental factors interact with plants and alter their physiological functions. Growth is a mechanism, which is achieved by cell division, cell enlargement and differentiation. Farooq et al. (2009) depicted that growth is associated with the physiological, ecological, genetic and morphological measures and their complex interactions. Sunlight has a huge influence on plant growth and function.

Referances

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