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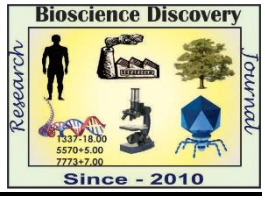

Secondary metabolite and enzyme activity on some moss species from Western Ghats, Maharashtra, India

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Abstract

Mosses are grown in various natural habitats which are surrounded by an enormous number of biotic and abiotic environmental stresses. In natural ecosystems found a wide variety of bacteria, viruses, fungi, nematodes, mites, insects, and other herbivorous animals, which affected growth and development of moss species. By their nature, mosses protect themselves by producing some compounds called as secondary metabolites. Secondary metabolites, like Polyphenol, amino acid and tannin compounds, these compounds protect to mosses against a variety of herbivores and pathogenic microorganisms as well as abiotic stresses. Enzyme also plays important role in biosynthesis of different pathways of mosses species

INTRODUCTION

Mosses are considered as a highly evolved and dominant group of bryophytes occupying a unique position between vascular and non-vascular plants. Mosses are considered to have the largest number of species among green plants, next to angiosperms. They are the simplest and the most primitive of the land plants. They do not have a well developed conductive tissue system. It has been luxuriantly growing in Lonawala and khandala, Mahabaleshwar in Western Ghats of India (Dabhade, 1964) Only 30 years ago, the chemistry of mosses was unknown. Recent research on the biology of mosses and progress is analytical techniques has resulted in a deeper knowledge about the chemical constituents of mosses, although our understanding of their biochemical processes, especially biosynthetic pathways, compared to vascular plants, is still rather poor. So, this chapter aimed to present it in tandem with new developments in the biochemistry of mosses. The free proline increased level protein in plants it is routine in pathology and physiology of agricultural science (Chinard, 1952). The Polyphenol compound is stimulated due to salinity is increase in plants (Strognov, 1964). (Goodman *et al.*, 1964) Phenolic play important role. It is instrumental in the decomposition of H_2O_2, which is produced outside the chloroplasts by the H_2O_2 generating oxidases present in the peroxisomes (Tolbert, 1971). It is instrumental in the decomposition of H_2O_2 generating oxidases present in the peroxisomes Catalase is localised in the peroxisomes and cytoplasm of higher plants (Bray *et al.*, 2000). Catalase is tetramericheme protein, occurring in almost all aerobic organism and one of the few enzymes showing dual activity: it has hyperoxidase activity (catalytic activity) when it catalyzes the breakdown of hydrogen peroxide into water and oxygen.

It also shows peroxidase activity (Luhova *et al*., 2003) several physiological processes are dramatically affected by peroxidase over-production, severe wilting was found in transgenic plants (Arora *et al*., 2002). Proline occurs widely in higher plants and accumulates in larger amounts than amino acids (Abraham *et al*., 2003). Study on some of the contents of some Bryophytes-ii Musci. (S. Kaur *et al*., 2010). Effect of drought stress and subsequent recovery on protein, carbohydrate contents, Catalase and peroxidase activities in three chickpea (*Cicer arietinum*) cultivars (Mafakheri *et al*., 2011)**.** Seasonal variations in carbohydrate, protein, free amino acids and enzyme activities in three species of Marchantiaceae. (Sunita *et al*., 2014). Recently Pharmacognostic Study of Adhatoda vasica Nees. (Kanthale and Panchal, 2015).

MATERIALS AND METHODS

The collection of mosses done from localities like Sinhagad, Kas; Satara, Lonawala, Khandala, Mahabaleshwar, Pratapgad, Pachgani, Aundh-Kartik Swami; Satara and Lawasa., Western Ghats, Maharashtra, India from moist along with shady area. Before evaluation, mosses were cleaned along with dried to room temperature for 24 hrs after that this dried up plant material were useful for chemical analysis. Bates *et al.* (1973) determined the free proline content in the leaves. Polyphenol determined by Folin-Denis (1915) Tannin is determining by Folin-Denis method (Schanderl, 1970) Peroxidase was determine following Maehly (1954) method. Estimation of Catalase by Herbert method (1955) Estimation of polyphenol oxidase was assayed as per the method of Sato and Hasegawa (1976).

RESULTS AND DISCUSSION

The Polyphenol, amino acid and tannin were higher in *S. ancens* and *B. turgidum* while case of *H. reflexum* those were minimum (Table 1). In Drought Stress of moss species amino acid play an important role in protecting the photosynthetic apparatus against the destructive effects of light and ROS. The Secondary metabolites, including proline, polyphenol and tannin content in mosses increased during drought condition. (Goodman *et al.*, 1964) observed that phenolics play variety of roles in the plant and many have a role in defence against herbivores and plant pathogens.

Table No. 1: Biochemical composition of ten moss species

Sr. No.	Name of Extract Species	Proline µg/mg dry wt.	Polyphenol µg/mg dry wt.	Tannin µg/mg dry wt.
1	*Bryum ghatens* Broth. Ex. Dix.	8.2	3.0	6.4
2	*Hypnum reflexum* F. E. Tripp.	3.5	2.6	6.3
3	*Steeriophyllum* ancens (Bosch et. Lac.) Broth	9.1	4.5	9.0
4	*Fissidens crenulatus* Mitt.	5.5	2.6	11.5
5	*Trachypodiopsis blanda* (Mitt.) Fleisch.	8.6	2.6	9.0
6	*Funaria hygrometrica* Hedw.	6.3	8.1	8.3
7	*Hyophila involuta* (Hook) Jaeg.	5.8	3.0	9.6
8	*Brachymenium turgidum* Broth.	4.4	9.0	9.0
9	*Bryum coronatum* Schwaegr.	7.5	7.5	9.3
10	*Macromitrium sulcatum* Brid.	4.5	6.1	9.5

Table 2 : Enzyme composition of ten moss species

Sr. No.	Name of Extract Species	Peroxidase Δ O.D. min^{-1} mg^{-1}	Catalase Amt.of H_2O_2	Polyphenol oxidase Δ O.D. min^{-1} mg^{-1}
1	*Bryum ghatens* Broth. Ex. Dix.	25.7	11.9	1.79
2	*Hypnum reflexum* F. E. Tripp.	3.32	52.7	1.42
3	*Steeriophyllum ancens* (Bosch et. Lac.) Broth	22.8	18.7	1.61
4	*Fissidens crenulatus* Mitt.	40	44.2	1.49
5	*Trachypodiopsis blanda* (Mitt.) Fleisch.	21.8	44.2	1.42
6	*Funaria hygrometrica* Hedw.	4.15	71.4	1.4
7	*Hyophila involuta (*Hook) Jaeg.	8.16	28.9	1.42
8	*Brachymenium turgidum* Broth.	4.18	73.1	1.86
9	*Bryum coronatum* Schwaegr.	40	39.5	1.41
10	*Macromitrium sulcatum* Brid.	15.7	62.9	1.62

Details of the enzyme in moss species is given in (Table 2). It will be observed that Peroxidase content is more in *B. coronatum* but less in *H. reflexum*. Catalase activity contain amount of H_2O_2 is maximum in *B. turgidum* and minimum in *B. ghatens* and Polyphenol oxidase activity is higher in *B. coronatum* while less in *F. hygrometrica*. \In the ten-moss species shows studied enzymes activity contains general trends of decrease as Catalase>Peroxidase > Polyphenol oxidase. (Kaur *et al.,* 2010) have observed that the specific activity of enzymes α-amylase, ß-amylase, Proteases and polyphenol oxidases. The four enzymes tested with regard to their specific activity show the following sequential order in all the studied taxa. Protease> Polyphenol oxidase > α-amylase > β-amylase. In drought stress condition of moss species shows increase activity of oxidase enzymes like Catalase, Peroxidase, and polyphenol oxidase. This indicates the accumulation of reactive oxygen species and protection against drought stress indicating activated drought tolerance mechanism in this moss species

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