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SEASONAL VARIATION IN FREE PROLINE CONTENT IN SOME SPECIES OF FAMILY EUPHORBIACEAE OF THE RAJASTHAN, INDIA

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KEYWORDS

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ABSTRACT

Proline is with stress tolerance in various plants species. In the present study, free proline was estimated in the root, stem and leaves of seven species of family Euphorbiaceae collected in Rainy and Summer seasons during 2015-2016 from Sikar district of Rajasthan. Result of study revealed that proline content was higher in summer seasons as compared to other season. The maximum content of proline was reported in the stem of *Euphorbia hirta* while minimum was in the root of *Phyllanthus maderaspatensis*.

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1 Introduction

Proline accumulation is a common metabolic response of higher plants to water deficits, and salinity stress, and has been the subject of numerous reviews over the last 20 years (Stewart & Larher, 1980; Stewart, 1981; Hanson & Hitz, 1982; Taylor, 1996; Rhodes et al., 1999).

Proline primarily accumulated in the cytosol under water stress conditions (Leigh et al., 1981; Pahlich et al., 1983). Similarly, Singh et al. (1972) reported that amount of proline found higher in drought resistance varieties as compared to susceptible varieties of barley. Mohammed & Sen (1987) have examined 65 Indian desert plant species for proline contents under stressed and non-stressed condition and have reported contradictory findings that some of the well adapted desert plants do not accumulate proline. Rathore & Sharma (1988) investigated proline contents during stress and non-stress conditions in 11 species of ferns of Rajasthan. These authors confirmed that drought resistant ferns possess more amount of proline than the aquatic or moisture loving plants. They further concluded that proline influences stress tolerance in ferns probably through its effect on the degradation of chlorophylls and accumulation of carotenoids. Meena (2013) investigated free proline content in 12 species of family Acanthaceae in Southern Rajasthan India.

Euphorbiaceae, the spurge family, is one of the most complex, large and diverse family of Angiosperms (Wurdack et al., 2004) with 334 genera (Webster, 1994) and over 8,000 species (Radcliffe-Smith, 2001), which are distributed mainly in the tropics in the several types of vegetations and habitats. In India, 73 genera and 410 species have been reported by Divya et al. (2011). The present study, enumerates 7 species of family Euphorbiaceae which were collected from Sikar district of Rajasthan, India and investigated for their proline content. The studied plants include *Croton bonplandianum* Bail, *Euphorbia heterophylla* L., *Euphorbia hirta* L., *Euphorbia thymifolia* L., *Phyllanthus fraternus* Webster, *Phyllanthus maderaspatensis* L. and *Phyllanthus virgatus* Forst.

2 Materials and Methods

2.1 Sampling area

The sampling area is situated on the north eastern part of Rajasthan it lies between 27°21' to 28°12' N latitudes and 74°44' to 75°25' E longitudes. The major part of the region is an undulating sandy tract. The soil of the region varies from sandy to loam.

2.2 Sample collection and processing

Root, stem and leaves of all seven plant species viz., *C. bonplandianum*, *E. heterophylla*, *E. hirta*, *E. thymifolia*, *P. fraternus*, *P. maderaspatensis* and *P. virgatus* were collected during rainy and summer seasons of 2015 and 2016. The collected samples were brought to laboratory in plastic bags, shaded-dried and ground to make powder. Free proline was estimated in different plant parts according to Bates et al. (1973). In the process, 200mg of plant material was homogenized in Sulphosalicylic acid, after centrifugation, supernatant was used for free proline estimation. Optical density was recorded 2206 double beam UV-VIS Spectrophotometer at 540 nm wavelength. Standard curve was prepared using pure proline.

3 Results

Proline was estimated in rainy and summer seasons, the root, stem and leaves of *C. bonplandianum*, *E. heterophylla*, *E. hirta*, *E. thymifolia*, *P. fraternus*, *P. maderaspatensis* and *P. virgatus* of family Euphorbiaceae. The results of proline concentration have been presented in Table 1 and 2. Organ wise, among the tested various root tissues, *E. heterophylla* (9.83 mg/gdw) possesses highest quantity of proline while lowest proline concentration was reported from the root tissue of *P. maderaspatensis* (2.33 mg/gdw). In case of stem and leaves, maximum proline concentration was reported from the stem of *E. hirta* (26.02 mg/gdw and 24.57 mg/gdw respectively) while minimum from *P. virgatus* stem and *P. maderaspatensis* leaves (4.65 mg/gdw and 5.64 mg/gdw respectively).

It has been observed that the average proline content was higher in *E. hirta* (18.35 mg/gdw), *E. thymifolia* (13.82 mg/gdw) and *P. fraternus* (10.91 mg/gdw) as compared to the other members of family Euphorbiaceae. On the basis of proline content, *C. bonplandianum*, *E. hirta*, *E. thymifolia* and *P. fraternus* can be considered as the most drought tolerant species while, *E. heterophylla*, *P. maderaspatensis* and *P. virgatus* may be treated as the least drought tolerant species among the selected species of Euphorbiaceae. According to table 1 and 2 the proline content was analyzed minimum in rainy season and highest in summer season.

4 Discussion

Accumulation of Proline in higher plants is an indication of disturbed physiological condition, triggered by biotic or abiotic stress condition. Free proline content can increase by exposure of various drought conditions such as salinity, cold, heavy metals, or certain pathogens. Determination of free proline levels is a useful assay to monitor physiological status and to assess stress tolerance of higher plants.

Table 1 Total free proline content (mg/gdw) in different organs of the selected species of family Euphorbiaceae during rainy season

S. No.	Names of species	Root	Stem	Leaves	Total Average
1.	<i>Croton bonplandianum</i>	6.31	11.80	13.10	10.40
2.	<i>Euphorbia heterophylla</i>	9.10	6.45	13.98	9.84
3.	<i>Euphorbia hirta</i>	3.12	25.13	24.12	17.45
4.	<i>Euphorbia thymifolia</i>	8.72	14.18	17.13	13.34
5.	<i>Phyllanthus fraternus</i>	5.21	6.72	19.70	10.54
6.	<i>Phyllanthus maderaspatensis</i>	2.33	8.17	5.64	5.38
7.	<i>Phyllanthus virgatus</i>	4.15	4.65	9.21	6.003

Table 2 Total free proline content (mg/gdw) in different organs of the selected species of family euphorbiaceae during summer season

S. No.	Names of species	Root	Stem	Leaves	Total Average
1.	<i>Croton bonplandianum</i>	6.89	12.17	14.02	11.02
2.	<i>Euphorbia heterophylla</i>	9.83	6.86	14.07	10.25
3.	<i>Euphorbia hirta</i>	4.46	26.02	24.57	18.35
4.	<i>Euphorbia thymifolia</i>	8.97	14.69	17.80	13.82
5.	<i>Phyllanthus fraternus</i>	5.83	7.01	19.90	10.91
6.	<i>Phyllanthus maderaspatensis</i>	2.87	8.69	5.87	5.81
7.	<i>Phyllanthus virgatus</i>	4.63	5.01	10.00	6.54

It is well described that the under stress conditions many species accumulate proline as an adaptive response to adverse conditioned. Although, relationship between proline accumulation and stress adaptation is not clear (Hare & Cress, 1997) but proline estimation as drought resistance parameter can provide an ecological basis to differential tolerance in Sikar district taxa of family Euphorbiaceae. Many workers have shown the relevance of proline accumulation in condition of water stress in angiosperms. These observations have been confirmed in case of pteridophytes by Kaur et al.(1986) Gena et al. (1987) and Yadav (1990), who reported that proline content is higher in ferns growing in drought conditions compared to the ferns growing in humid conditions.

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Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research or publication of this article.

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