



Total Free Proline Estimated in Some Selected Species of Pteridophytic Flora of Rajasthan

Shahdab Hussain^{*}, Faten Z. Filimban² and Shirin Quazi¹

¹Department of Botany, Sangam University, Bhilwara -311 001, Rajasthan, India.

²Division of Botany, Department of Biology, Faculty of Sciences, Centre for Medicinal, Aromatic and Toxic Plants, King Abdulaziz University, Jeddah 2115, Kingdom of Saudi Arabia.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Proline, a well-known amino acid, has been estimated in ten different pteridophytes, including *Adiantum capillus-veneris* L., *Adiantum caudatum* L., *Adiantum incisum* Forssk., *Adiantum philippense* L., and *Actiniopteris radiata* (Sw.) link. Christenh. in various organs such as the root, rhizome, and leaves *Hemionitis anceps* (Blanf.) Christenh., *Hemionitis bicolor* (Roxb.) Christenh. *Hemionitis formosana* Christenh (Hayata). Result of study is indicate that the maximum total proline in entire plant was recorded 43.54 mg/gdw and leaves have been recorded 24.10 mg/gdw in *Pteris vittata* subsp. *vittata* and the minimum value was recorded 3.60 mg/gdw in root of *Adiantum caudatum* L.

Keywords: *Kumbhalgarh wildlife sanctuary; proline; sulphosalicylic acid.*

1. INTRODUCTION

The phytochemistry of Rajasthan pteridophytes has been taken up for the first time by Bhardwaja

et al. [1] who have reported five steroidal compounds (sitosterol cholesterol, stigmasterol and two unknown) from sporocarps of *Marsilea minuta* L. (Syn. *Marsilea diffusa* Lepr. ex A.

^{*}Corresponding author: E-mail: drshahdabhussain@yahoo.com;

Braun) and proposed a role for them in the pronounced survivability of *Marsilea* L. megaspores and microspores. Sharma and Vyas [2] studied the phytochemistry of 14 pteridophyte taxa, including *Marsilea minuta* and *Marsilea aegyptiaca* Willd. Sharma and Sharma [3] studied the flavonoids in seven common ferns of Rajasthan. Moore and Stein, [4]; Rathore and Sharma, 1968; Bates et al. [5]; Shankar and Khare, [6]; Kaur et al. [7]; Shankar and Khare, [8]; Khare and Shankar [9]; Rathore and Sharma [10]; Vyas and Sharma, [11]; Vyas, [12]; Sharma, [13]; Vyas et al. [12]; Rathore and Sharma, [14]; De Britto et al. [15]; Gopalakrishnan et al. [16]; Hopkins et al. [17]; Ramachandran et al. [18]; Rathore and Sharma, [19]; Rathore and Sharma, [20]; Verma, [21]; Yadav, [22]; Sharma et al. [23]; Louis et al. [24] and Henry et al. [25]. have reported different aspects.

Total free proline of different organs such as root, rhizome and leaves in 10 selected pteridophytic species which is collected from Kumbhalgarh Wildlife sanctuary of Rajasthan are namely *Adiantum capillus-veneris* L., *Adiantum caudatum* L., *Adiantum incisum* Forssk., *Adiantum philippense* L., *Actiniopteris radiata* (Sw.) Link. *Hemionitis anceps* (Blanf.) Christenh. *Hemionitis bicolor* (Roxb.) Christenh., *Hemionitis formosana* (Hayata) Christenh.; *Hypodematum crenatum* (Forssk.) Kuhn & Decken, *Pteris vittata* subsp. *vittata*. taken up for investigation of proline content for present paper.

2. MATERIALS AND METHODS

Estimation of free proline was carried out following method suggested by Bates et al. [5]. After homogenising 200 mg of plant material with in sulphosalicylic acid (3%) and centrifugation at 5000 rpm at 10 minutes the supernatant was utilised to calculate free proline. 2 ml glacial

acetic acid and 2 ml Ninhydrin reagent were combined with a suitable quantity of aliquot (1 ml in this example). Before being put in an ice bath, the test tubes were submerged in boiling water for 45 minutes. 4 ml toluene was poured into each test tube and shaken vigorously. A separating funnel was used to separate the upper pink-colored organic phase. At 540 nm, optical density was measured. Pure proline was used to create the standard curve.

3. RESULTS

Proline was estimated in different organs i.e., leaf, rhizome and root of plants of same age of 10 selected pteridophytic species from Kumbhalgarh Wildlife Sanctuary of Rajasthan. The results have been shown in Table - 1 and Fig. 1.

The highest proline concentration in the leaf was found in *Pteris vittata* subsp. *vittata* (24.10 mg/gdw), followed by *Actiniopteris radiata* (Sw.) Link. (21.24 mg/gdw) and *Hemionitis formosana* (Hayata) Christenh. (20.64 mg/gdw), while the lowest was found in *Adiantum capillus-veneris* L. (11.76 mg).

In rhizome, *Hemionitis anceps* (Blanf.) Christenh. had the highest proline concentration (15.76 mg/gdw), followed by *Hemionitis formosana* (Hayata) Christenh. (13.72 mg/gdw) and *Actiniopteris radiata* (Sw.) Link. (12.24 mg/gdw), with the lowest concentration (4.10 mg/gdw) in *Adiantum capillus-veneris*.

Actiniopteris radiata (Sw.) Link. had the greatest proline concentration in root (8.80 mg/gdw), followed by *Pteris vittata* subsp. *vittata* (8.40 mg/gdw) and *Hemionitis anceps* (Blanf.) Christenh. (8.16 mg/gdw), with *Adiantum caudatum* L. having the lowest (3.60 mg/gdw).

Table 1. Total free proline (mg/gdw) in different organs of selected species of pteridophytes from Kumbhalgarh wildlife sanctuary of Rajasthan

S. No.	Name of species	Root	Rhizome	Leaf	Total in entire plant
1.	<i>Adiantum capillus-veneris</i>	4.48	4.10	11.76	20.34
2.	<i>Adiantum caudatum</i>	3.60	9.76	12.10	21.92
3.	<i>Adiantum incisum</i>	7.04	5.52	12.8	28.90
4.	<i>Adiantum philippense</i>	5.36	7.04	17.10	29.05
5.	<i>Actiniopteris radiata</i>	8.80	12.24	21.24	42.28
6.	<i>Hemionitis anceps</i>	8.16	15.76	18.08	42.00
7.	<i>Hemionitis bicolor</i>	5.52	9.36	17.76	32.64
8.	<i>Hemionitis formosana</i>	7.72	13.72	20.64	42.08
9.	<i>Hypodematum crenatum</i>	7.36	8.16	16.48	32.00
10.	<i>Pteris vittata</i> subsp. <i>vittata</i>	8.40	11.04	24.10	43.54

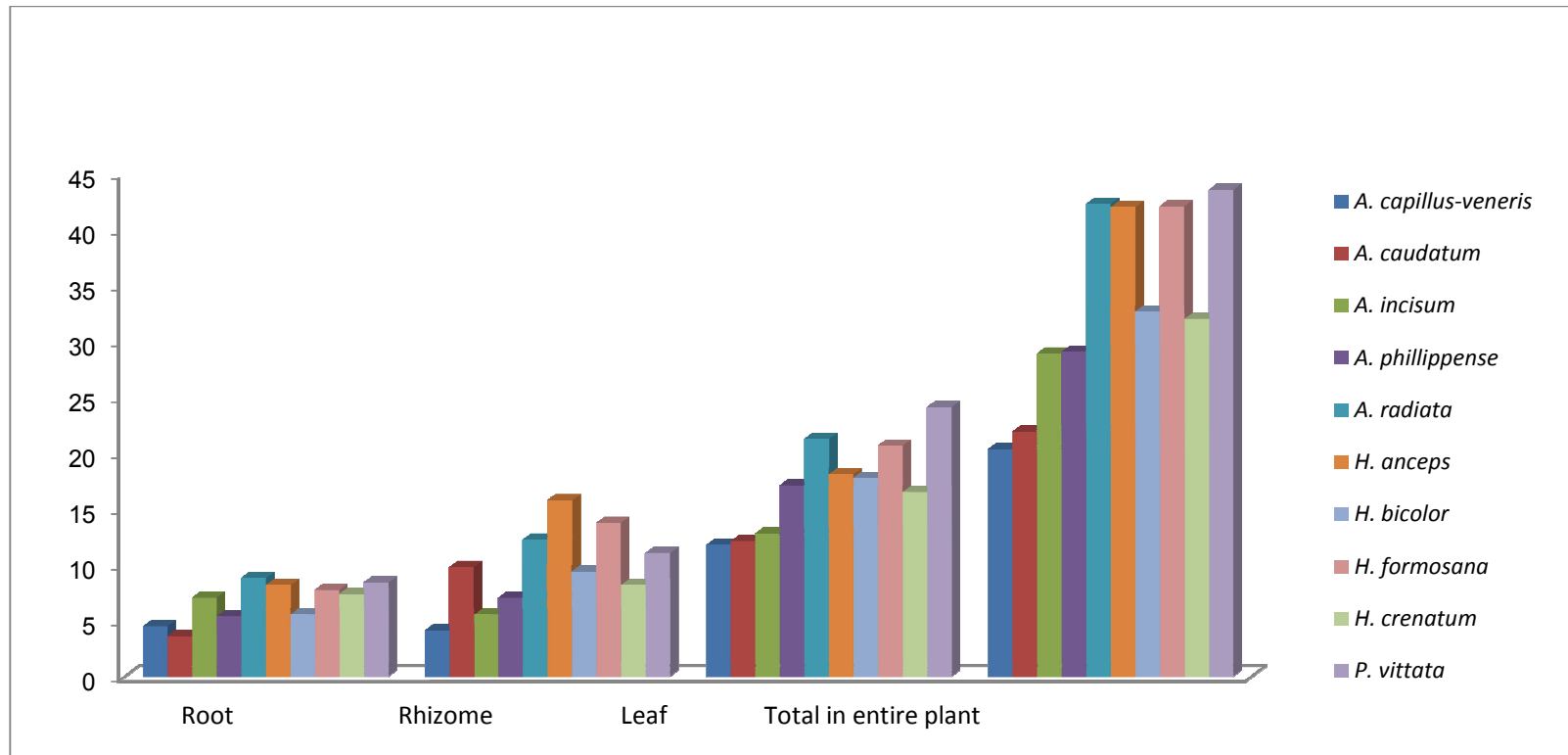


Fig. 1. Total free proline (mg/gdw) in different organs of selected species of pteridophytes from Kumbhalgarh wildlife sanctuary of Rajasthan

The maximum proline concentration in the entire plant was found in *Pteris vittata* subsp. *vittata* (43.54 mg/gdw), followed by *Actiniopteris radiata* (Sw.) Link. (42.28 mg/gdw) and *Hemionitis formosana* (Hayata) Christenh. (42.08 mg/gdw), while the lowest was found in *Adiantum capillus-veneris* L. (20.3 mg/gdw).

4. DISCUSSION AND CONCLUSION

The highest levels of proline were found in the leaves, followed by the rhizome, and the lowest levels of proline were found in the roots. Proline, a well-known amino acid that has been labelled as a drought indicator, has been discovered in higher quantities in taxa that can endure harsher conditions for longer periods of growth, such as *Pteris vittata* subsp. *vittata*, *Actiniopteris radiata*, and *Hemionitis* species.

Many studies have been conducted to illustrate the significance of proline accumulation in angiosperms under water stress conditions [26,27]. Kaur et al. [7], Gena et al. [28], and others have reproduced these findings in Rajasthan pteridophytes. They observed that proline concentration in ferns grown under stress is greater than in ferns cultivated in shade and wetness. Drought-resistant ferns have more proline than aquatic or moisture-loving species, according to Sharma and Rathore [29]. In his research of Rajasthan pteridophytes, Yadav (1990, 2006) revealed that proline concentration is greater in ferns growing in dry conditions than in ferns growing in humid conditions. As a result, free proline in Rajasthan ferns can be utilised to forecast drought behaviour. Taxa that develop in generally dry settings have greater proline levels than taxa that grow in shadow and wet conditions, according to the current study. Thus, *Pteris vittata* subsp. *vittata*, *Actiniopteris radiata*, and *Hemionitis formosana* with standing drought conditions for lengthy periods of growth have a greater proline content, but *Adiantum caudatum* has a lower proline content.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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