



PHYTOCHEMICAL ANALYSES IN *DIPCADI ERYTHRAEUM* DURING DIFFERENT DEVELOPMENTAL STAGES - AN ENDEMIC AND THREATENED BULBOUS MEDICINAL PLANT FROM THE INDIAN ARID ZONE

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Primary metabolites are of prime importance and essentially required for growth of plants such as sugar, protein, lipids, starch, etc. Many primary metabolites act as precursors of pharmacologically active metabolites. The present study deals with phytochemical analyses in *Dipcadi erythraeum*, an endemic and threatened bulbous medicinal plant of the Indian Thar desert. Primary metabolites such as leaf pigments, proline, osmotic potential, total sugars, crude protein and phosphorus were estimated during different developmental stages, i.e. vegetative, flowering and fruiting. The results revealed that leaf pigments were maximum during flowering stage, while remaining parameters in vegetative stage.

Keywords : *Dipcadi erythraeum*, Leaf pigments, Osmotic potential, Proline, Threatened

Plants have been an integral part of traditional medicine across the continents since time immemorial. Medicinal plants have their values in the substances present in various plant tissues with specific physiological action in human body. Many of the plant species that provide medicinal herbs have been scientifically evaluated for their possible medicinal applications. India is endowed with a rich wealth of medicinal plants. India recognizes more than 2500 plant species which have medicinal values. Plants are like natural laboratories where a great number of chemicals are biosynthesized and in fact they may be considered the most important source of chemical compounds (Kirtikar and Basu 1995).

Dipcadi erythraeum Webb. and Berth. (Family : Liliaceae), commonly known as Piazi, is reported as an endemic and threatened plant in India whose distribution is restricted to rocky and gravelly soil of north-west Rajasthan (Bhandari 1990). The bulbs are eaten raw during the famine. It is a small stout herb with tunicate bulbs, which are used as a substitute or adulterant for *Urginea indica*, the bulb of which resembles *Digitalis* in action and is used mainly as an expectorant in the treatment of cough (Anon. 2006).

Primary metabolites are directly involved in growth and development of plants. Primary metabolites, viz. chlorophylls, amino acids, nucleotides and carbohydrates have a key role in metabolic processes such as photosynthesis, respiration and nutrient assimilation. Many primary metabolites lie in their impact as precursors or pharmacologically active metabolites in pharmaceutical compounds. Plant synthesizes primary metabolites (lipid, protein, starch, sugar, etc.) for the normal growth and development of itself. They are also used as raw material and food additives (Samria and Sarin 2014). No reports are available on phytochemical analyses in *Dipcadi erythraeum*, an important bulbous medicinal plant of the Indian arid zone. Thus, the present study was conducted to investigate phytochemical estimation of primary metabolites such as leaf pigments, proline, osmotic potential, total sugars, crude protein and phosphorus during different developmental stages, i.e. vegetative, flowering and fruiting, so that suitable time can be found to harvest this plant to gain maximum amount of commercially important primary metabolites.

MATERIALS AND METHODS

For chemical analyses of plant, leaf samples were collected randomly from Bhimbhadak,

Jodhpur (15 km away in north-west direction from the University Campus) in three developmental stages (vegetative, flowering and fruiting) during rainy season (July-September) 2013 and 2014. Plant materials were washed with running tap water to remove the adherent foreign particles, air-dried and used for chemical analyses. Osmotic potential, proline and pigments were estimated in fresh leaf samples, while remaining parameters from oven-dried ones. Fresh leaves were extracted with 80% acetone for estimation of leaf pigments as per Arnon (1949). Free proline and osmotic potential (OP) were estimated as per Bates *et al.* (1973) and Janardhan *et al.* (1975), respectively. The total sugars were estimated as per standard methods given by Plummer (1971), while nitrogen by Micro-kjeldahl apparatus as suggested by Peach and Tracey (1955) and phosphorus as per Allen *et al.* (1976). Experiment for each parameter was performed in triplicate and confirmed twice.

The data collected during both the years (2013 and 2014) were subjected to analysis of variance (ANOVA) as suggested by Gomez and Gomez (1984) and mean values are presented in tabular form.

RESULTS AND DISCUSSION

Table 1 presents data on leaf pigments, proline, osmotic potential, total sugars, crude protein and phosphorus during different developmental stages in *D. erythraeum*. It is clear from this table that the highest values of total chlorophylls and carotenoids were observed during flowering stage. Mohammed and Sen (1988) reported higher values of leaf pigments during flowering stage in *Trianthema portulacastrum*. Kedia *et al.* (2008) also reported highest values of leaf pigments during flowering stage in *Phyllanthus fraternus*, which is in agreement with present investigations.

The proline values ranged from 0.406 to 1.213 $\mu\text{g g}^{-1}$ fresh weight during three stages, being maximum in vegetative stage. Kedia *et al.* (2008) recorded maximum accumulation of proline at vegetative stage in *P. fraternus*.

Shukla *et al.* (2001) reported highest value of osmotic potential when proline content was at peak in *Prosopis cineraria* and similarly in the present study it was maximum with maximum proline accumulation. The proline values showed decreasing trend at advance phases (flowering and fruiting) along with similar patterns for osmotic potential. In some species only partial osmotic adjustment was observed, while in others over adjustment was noted (Krishnamoorthy 1993). Probably, the majority of succulents belong to the adjustment group, while non-succulents belong to partial osmotic adjustment group (Waisel 1972). The present findings also accord with the above observations.

Plant sugars can be used as artificial sweeteners and they can even help diabetics by supporting the body in its rebuilding (Freeze 1998). Total sugars values ranged from 27.28 to 38.24 mg g^{-1} dry weight during three phases and maximum was in vegetative stage. Kedia *et al.* (2009) observed maximum values of total sugars in rainy season during vegetative stage in *Peganum harmala*, which is in accordance with present study.

The presence of higher protein level in the plant points towards their possible increase food value or that a protein base bioactive compound could also be isolated in future (Thomsen *et al.* 1991). Crude protein was observed highest (4.882 mg g^{-1} dry weight) during vegetative phase followed by flowering (4.650) and minimum at fruiting phase (3.022 mg g^{-1} dry weight). Total proteins increased till the maturity of plant and thereafter decreased remarkably, similar observations were made by Khatun *et al.* (2003) in *Moringa oleifera*.

The phosphorus content was highest during vegetative stage followed by flowering and minimum at fruiting stage. The amount of phosphorus was more at the time of new foliage formation followed by a gradual decrease with advancement of growing season up to leaf fall in *Terminalia arjuna* (Naidu and Swami 1994). In the present studies, it also decreased with advancement of growth phases. Kedia *et al.* (2008) recorded

Table 1 : Analyses of various primary metabolites parameters in *D. erythraeum* during three developmental stages (values are average of six replicates).

Parameters	Developmental stages			CD
	Vegetative	Flowering	Fruiting	
Chlorophyll <i>a</i> (mg g ⁻¹ f. wt.)	0.544	0.551	0.288	45.36*
Chlorophyll <i>b</i> (mg g ⁻¹ f. wt.)	0.300	0.308	0.185	29.46*
Total chlorophylls (mg g ⁻¹ f. wt.)	0.846	0.860	0.473	47.25*
Carotenoids (mg g ⁻¹ f. wt.)	0.000401	0.000426	0.000261	49.88*
Proline (µg g ⁻¹ f. wt.)	1.213	0.734	0.406	44.35*
Osmotic potential (-MPa)	0.108	0.113	0.116	0.565 ^{ns}
Total sugars (mg g ⁻¹ d. wt.)	38.24	27.28	31.86	1.35 ^{ns}
Crude protein (mg g ⁻¹ d. wt.)	4.882	4.650	3.022	13.90*
Phosphorus (%)	0.429	0.345	0.252	26.19*

* = significant at $p < 0.05$; and ns = non-significant

maximum phosphorus during vegetative in *P. fraternus*.

ANOVA showed that data on all the parameters except for osmotic potential and total sugars were significant at $p < 0.05$ during three developmental stages.

CONCLUSION

By estimating primary metabolites during different developmental stages we can find out most suitable stage to obtain maximum amount of these products for commercial importance. Thus, it is concluded from present studies that leaf pigments were accumulated in highest amount during flowering phase of *D. erythraeum*, while remaining parameters during vegetative stage.

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