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Nutritional variations in three species of alpine endemic *Euphorbia* of Sikkim Himalaya

Durga Kumar Pradhan*

High Altitude Research-Quality Control Laboratory
Forest and Environment Department, Forest Secretariat, Block C, Deorali, Gangtok
*Corresponding author: pradhansikkim@gmail.com

Abstract

Euphorbia sikkimensis Boiss, *Euphorbia griffithii* Hook. f. and *Euphorbia luteoviridis* D. G. Long, collected from the Sikkim Himalaya were reported with different chromosomal numbers and karyomorphology. As these species are endemic to the Nepal and Sikkim Himalayas, the chromosomal numbers of these species are 26 (diploid), 52 (tetraploid) and 20, respectively. These indicate that the species diversification is the result of polypoidy.

The nutritional variations of three species of alpine *Euphoria* of Sikkim Himalaya found so the leaves, stem and fruits of the species were analyzed and compared. The higher concentration of calcium in fruit and leaves of *Euphorbia grifftihii* are interesting findings. Accordingly, *Euphorbia luteoviridis* has relatively high concentration of nitrate in leaves. Thus, this paper deals with the nutritional variations of species of *Euphorbia* along with the cytological information.

Key words: *Euphorbia*, karyomorphology, Nutrients, Sikkim Himalaya.

INTRODUCTION

The alpine species of *Euphorbia* of the Sikkim Himalaya are endemic to this region. These species were collected from the Khanchenzonga National Park area of Sikkim towards way to the Tholung monastery, North Sikkim in the month of July, 2003.

The interest of this study is that these species share gross morphology so there was the misunderstanding about the identification. However, the cytological studies of *Euphorbia* clarified that the species are the diversified due to the polyploidy (Ikeda *et al.*, 2008).

Such the cytological information led to develop an interest to study the nutritional variation of species of Euphorbia. Thus, those species collected during the Tokyo expedition 2003 were studied and collected for the study of the nutritional variations among the species. So, it covers the information of the nutritional variations of three species of *Euphorbia* corresponding to their cytological information.

Materials and Methods

The specimens of the 'Tokyo Expedition – Botanical expedition in Sikkim' examined and studied the nutritional parameters.

Determination of phosphorus, potassium, calcium, magnesium, sulphur, zine, copper, iron and boron in all samples performed by initial digestion in concentrated 10 ml nitric acid in digestion tube. The digestion tube must be kept open for fifteen minutes before the digestion. After the digestion, allow the the digestion tubes to cool for 15-20 minutes. Slowly, decant the digested

sample extract to the test tube and make 50ml. Filter it. Filtrate must be free from any impurities. Filter the digested samples and analyze by induced coupled plasma (ICP).
Setting of digestion: Ramp 15, Hold time 15 min. Temp 65 ° C and Power supply 600 watt.
Supply the ICP instrument with 100 psi flow rate of argon gas. All analysis perfomed in Salsa software maintaining 21-25 pump pressure along with spectrometer temperature 34-35 degree.
Set the mercury lamp aligning Eclips by verifying the delta value and positioning centre.
All standards 1 ppm, 2 ppm, 3 ppm, 4 ppm, 5 ppm, 7 ppm, 10 ppm prepare for the standard curve.

Results and Discussion

Specimen examined:

Euphorbia sikkimensis Boiss, Locality: Chana Tholubng Monastery, alt 2400m , Collection no. 20390160, Acc. no SSFH SK002416 [SSFH].
Euphorbia griffithii Hook. f. Locality : Thollung Monastery- Tamrong, alt 2820 m Collection no. 20390171; Acc. no SSFH SK002425 [SSFH].
Euphorbia luteoviridis Long Locality : Tamrong-Dikillnang, alt. 2890 m; Collection no. 20390176; Acc. no SSFH SK002430 [SSFH].

1. ***Euphorbia sikkimensis*** Boiss.
   The endemic species of *Euphoria sikkimensis* Boiss. has 26 chromosomes. According to the Ikeda *et al.*, 2008, it is reported that the choromosomes are 2.4–7.4 μm long and its complement is bimodal having one pair of relatively large chromosomes (7.2–7.4 μm long) and 12 pairs of relatively small chromosomes (2.4–5.7 μm long) along with no satellite chromosome.
   However, the cultivated species was also reported with 24 (2n) (Roy *et al.*, 1988; Sharma and Saker 1967–1968; Sharma 1970, Roy *et al.* 1988). These reports indicate that there are possibilities of the intraspecific variation.

2. ***Euphorbia griffithii*** Hook. f.
   The somatic chromosome numbers of this species are 52 (2n), the tetraploid. Its chromosomes are 2.2–8.9 μm long having bimodal complement. It comprises of two pairs of relatively large chromosomes (7.3–8.9 μm long) and 24 pairs of relatively small chromosomes (2.2–5.6 μm long) along with no satellite chromosome (Ikeda *et al.*, 2008). This study suggested that it is a distinct species having orange-red flower head and shorter stem as defined by the Hooker (1886-1888), though Long (1987) suggested subspecific rank only.

3. ***Euphorbia luteoviridis*** D. G. Long
   Its diploid somatic chromosome number is 20 having chromosomes 4.7–9.4 μm long that has a correlation in the chromosonmal number of *Euphorbia wallichi*, a himlayan species (Ikeda *et al.*, 2008).

Nutritional variations of the species are as under(expressed in ppm):

Table 1: Tabular representation of elements in the leaves of *Euphorbia species*				
Sr No	Particulars	*E. sikkimensis*	*E. griffithii*	*E. luteoviridis*
01	Ammonia	8.3	10.6	6.5
02	Calcium	17	39	20
03	Magnesium	133	<50	135
04	Nitrate	9.8	6.6	24.6
05	Phosphate	8.8	8.6	6.9
06	Potassium	2.2	1.9	2.3
07	Sulfate	26	33	32

Table 1: Tabular representation of elements in the stem of *Euphorbia species*				
Sr No	Particulars	*E. sikkimensis*	*E. griffithii*	*E. luteoviridis*
01	Ammonia	8.7	9.0	7.5
02	Calcium	24	75	22
03	Magnesium	133	142	139
04	Nitrate	26.6	<30.0	277
05	Phosphate	8.6	6.7	6.4
06	Potassium	2.1	2.7	1.9
07	Sulfate	29	29	30

Table 3: Tabular representation of elements in the fruits of *Euphorbia species*				
Sr No	Particulars	*E. sikkimensis*	*E. griffithii*	*E. luteoviridis*
01	Ammonia	7.8	15.6	NF
02	Calcium	14	64	NF
03	Magnesium	125	137	NF
04	Nitrate	<30	<30.0	NF
05	Phosphate	7.0	6.2	NF
06	Potassium	24	2.2	NF
07	Sulfate	25	25	NF

In the study of three species of *Euphorbia*, the nutritional variation noted (Table 1-3). The leaves of *Euphorbia griffithii* has significant content of ammonia, calcium and magnesium in compare to Euphorbia sikkimensis. On the otherhand, the leaves of *Euphorbia luteoviridis* has relatively higher concentration of nitrate than *Euphorbia sikkimensis* and *Euphorbia griffithii* (Table 1).

On the otherhand, the stem of *Euphorbia griffithii* has relatively higher content of calcium and magnesium. Likewise, the leaves of *Euphorbia luteoviridis* has relatively higher concentration of nitrate than *Euphorbia sikkimensis* and *Euphorbia griffithii* (Table 2).

The fruits samples of two species were found whereby *Euphorbia griffithii* has significant content of ammonia, calcium and magnesium than *Euphorbia sikkimensis*. The content of calcium in fruit of *Euphorbia griffithii* is 64 ppm

that is relatively higher concentration to *Euphorbia sikkimensis* (14 ppm) (Table 3).

Eventually, the nutritional information of species of *Euphorbia* and its cytological information support and ascertain that these are distinctly different in cytological as well as nutritional contents. It requires further detail researches on the molecular matrix of these species.

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REFERENCES

Grierson, A.J.C. and Long, D.G. 1983. *Flora of Bhutan including a record of plants from Sikkim.* **1**(1), Royal Botanic Garden, Edinburgh. Pp. 186.

Hara, H. (ed.) 1966. *The flora of Eastern Himalaya: Results of the botanical expedition to Eastern Himalaya organised by the University of Tokyo 1960 and 1963.* University of Tokyo, Tokyo. Pp. 453-500.

Hara, H. (ed.) 1971. The flora of Eastern Himalaya. Second Report, *Univ. Mus. Univ. Tokyo Bull.* **2**: 197-221.

Hooker, J.D. 1872-1897. *The Flora of British India.* **1-7**. L. Reeve & Co., London.

Hooker J. D. 1886–1888. Euphorbiaceae. In: Hooker J. D. (ed.), The Flora of British India 5: 239–477. L. Reeve & Co., London.

Hooker, J.D. and Thomson, T. 1855. *Flora Indica etc.* **1**. W. Pamplin, London. 461-498.

Ikeda H. 2002. Taxonomy, cytology, and phytogeography of Potentilla sect. Leptostylae (Rosaceae) in the Sino-Himalayan region. In: Noshiro S. and Rajbhandari K. R. (eds.), Himalayan Botany in the Twentieth and Twentyfirst Centuries, pp. 117–122. The Society of Himalayan Botany, Tokyo.

Ikeda H. and Ohba H. 1999. A systematic revision of Potentilla L. section Leptostylae (Rosaceae) in the Himalayan Region. In: Ohba H. (ed.), The Himalayan Plants 3: 31–117. University of Tokyo Press, Tokyo.

Kurosawa T. 2002. An outline of a revision of Nepalese Euphorbiaceae. In: Noshiro S. and Rajbhandari K. R. (eds.), Himalayan Botany in the Twentieth and Twenty-first Centuries. The Society of Himalayan Botany, Tokyo. Pp. 159– 165.

Lancaster R. 1995. A Plantsman in Nepal. Antique Collectors' Club, Suffolk.

Long, D. G. 1987. Euphorbiaceae. In: Grierson A. J. C. and Long D. G. (eds.), Flora of Bhutan 1: 754– 813. Royal Botanic Garden, Edinburgh.

Nishikawa, T. 1990. Chromosome counts of flowering plants of Hokkaido (13). J. Hokkaido Univ. Educ., Sect. 2B, 40: 19–30.

Noshiro, S. 2004. Botanical expedition in Sikkim, India, in 2003. Newslett. Himalayan Bot. (33): 7–15.

Ohashi, H. (ed.). 1975. Flora of Eastern Himalaya. Third Report, *Univ. Mus. Univ. Tokyo Bull.* **8**: 166-205.

Ohba, H. 1988. The alpine flora of the Nepal Himalayas: An introductory note. In: Ohba H. and Malla S. B. (eds.), The Himalayan Plants 1: 19–46. University of Tokyo Press, Tokyo.

Roy S. C., Ghosh S. and Chatterjee A. 1988. A cytological survey of eastern Himalayan plants. II. Cell Chromosome Res. 11: 93–97.

Sapru B. L. and Kaul V. 1971. Chromosome number in Euphorbia wallichii Linn. Sci. & Cult. 37: 153– 154.

Sharma A. K. 1970. Annual report, 1967–1968. Res. Bull. Univ. Calcutta (Cytogenetics Lab.) 2: 1–50.

Sharma A. K. and Sakar A. K. 1967–1968. Chromosome number reports of plants. Ann. Report, Cytogenet. Lab., Dept. Bot., Univ. Calcutta, Res. Bull. 2: 38–48.

Sharma A. K. and Sharma A. 1980. Chromosome Techniques. Theory and Practice, 3rd. ed., p. 55. Butterworths, London.