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ELEMENTAL COMPOSITION OF SOME ECONOMICALLY IMPORTANT LESS EXPLORED ALLIUM CULTIVARS OF WESTERN HIMALAYAN REGION

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ABSTRACT

Elemental composition of some economically important less explored Allium species namely Allium auriculatum Kunth, Allium ampeloprasum L., Allium ascalonicum, Allium rubellum M: Bieb. and Allium tuberosum L., was carried out. These species are distributed in temperate and alpine regions of Western Himalayas. The edible part i.e. leaves and bulbs of these species were analyzed separately for some important minerals like sodium, potassium, calcium, phosphorus, sulfur, copper, zinc, iron, manganese and cobalt. Among these Allium species maximum concentration of phosphorus, and sodium were found in the leaves of A. ampeloprasum. The leaves of A. ascalonicum were rich in calcium and manganese. Highest sulfur content was present in the leaves of A. auriculatum while, in its bulbs maximum zinc was reported . Iron and copper were observed maximum in the bulbs of A. rubellum. This study showed that The leaves of A. ampeloprasum are rich source of minerals followed by A. rubellum bulbs and A. ascalonicum. The quantitative yield of A. ampeloprasum, Allium rubellum and A. ascalonicum were also found better than other species. Hence these Allium species can be exploited for commercial cultivation in Western Himalayan region.

Key words: Elemental composition, Atomic absorption spectrophotometer, Flame photometer, Bio-chemical composition, Micro-elements.

INTRODUCTION

In Western Himalayas Allium is one of the important genuses of family Amarylliadaceae. It is widely distributed throughout the temperate and alpine regions. The wild Allium species have been utilized as spice and condiments, locally called Jamboo, Doona, Dunn, Dhun, Pharan etc. Allium species are aromatic green, used in pulverized state, primarily for seasoning or garnishing food and beverages, characterized by pungency, strong odour, sweet and bitter taste . The leaves, bulbs and flowers of plant have been harvested, dried and used as condiment (Chopra et al., ; Gaur et al.,). The wild species of Allium found in this region are consumed by the locals whenever these are found in abundance. The plant parts like leaves, bulbs, flowers, seeds etc. are collected for consumption. The local inhabitants of high altitude areas and shepherds usually collect these Allium species from its wild sources, while taking their herds to high altitude areas for grazing. Mostly these plants are used as condiments for seasoning various dishes either in fresh or dried form. The persons who generally do not consume onion and garlic also use these species. In some cases the aerial parts are collected , crushed and made into small cakes which are dried in the sun and are used during lean season (Negi et al.,). The market value of these wild

species is very high and the cost of dried aerial parts of plants is around 300- 400 rupees per kg. Due to over exploitation these species, many highly demanded wild Allium species are at the stage of extinction.

The influence of different cultivation practices viz. organic and conventional cultivation (with the use of fertilizers and pesticides) on the elemental concentration had been studied by (Gundersen et al.,) in onions (*Allium cepa* Hysam) and Peas (*Pisum sativum*). Some earlier workers (Ahmed et al.; Pandey et al.; Saily et al. ; Sondhi et al.) screened some important medicinal plants for macro and micro elemental composition.(Naeem et at.) evaluated mineral distribution in some fenugreek cultivars.

MATERIALS AND METHODS

The fully mature leaves and bulbs of Allium species viz. *Allium auriculatum, Allium ampeloprasum, Allium ascalonicum, Allium rubellum and Allium tuberosum* were collected from temperate and alpine regions Western Himalayas, authentically identified and grown at Defence Agricultural Research laboratory, Field Station, Auli (Joshimath) , Chamoli (9000 feet altitude) . The leaves and bulbs were taken from mature plants, washed, oven dried. The moisture free, dried samples were kept in airtight sample containers. One gram-dried sample was first digested with 15 ml of triple acid mixture (10 part HNO_3+ 4 parts of $HClO_4$ + 2 parts H_2SO_4) at 110 ^{0}C and reduced to about 1.0 ml. The digested residue was dissolved in triple distilled water, filtered and diluted to 100 ml. This solution was used for the estimation of minerals. In similar condition blank samples were also prepared. The samples of each cultivar were taken in three replications.

Reference standards were prepared from E. Merck, AAS Spectrosol (1000 mg L-1). Estimation of element like Na, K, Ca & Li were carried out by AIMIL, Photoflame, photometer, New Delhi, while Fe, Co, Mn, Cu & Zn were determined by Atomic Absorption Spectrophotometer, model 4129, Electronic Corporation of India Ltd, Hyderabad (A.P.). The S and P were estimated by spectrophotometric methods. The instruments were calibrated by using standard solutions (0.20-10 mgL-1) of above cited elements.

RESULTS AND DISCUSSION

Calculation of data was carried out on mg per 100 g dry wt. of Allium leaves and bulbs. Concentration range and mean value of Na, K, Ca, P and S are given in Table 1, while micro elements Fe, Cu, Zn, Mn & Co are mentioned in Table 2.

It is evident from the data that potassium, calcium, phosphorus and sulfur are the most prominent minerals in concentration terms. The concentration of minerals in analyzed samples of *Allium* were found almost in similar trend as reported by earlier workers (Gundersen et al.; Pandey et. al.). It was observed from table 1 that the concentration range of sodium varied from 11.01 mg to 269.48 mg/100 g. dry wt. of *Allium* leaves and bulbs. Highest concentration of sodium (269.48 mg) was found in the leaves of *A. ampeloprasum* followed by the bulbs (91.65mg) and least quantity (11.01mg) was present in the leaves of *A. rubellum*. Potassium on the other hand ranged between 628.29 mg to 3025.00 mg. Maximum concentration of potassium (3025.00 mg) was found in the leaves of *A. tuberosum* followed by (1808.32 mg) in the leaves of *A. auriculatum*. The calcium content ranged between 141.47mg to 697.06 mg. The leaves of *A. ascalonicum* reported highest calcium (697.06 mg), while lowest calcium (141.47 mg) was found in the bulbs of *A. tuberosum*. Concentration of phosphorus varied from 144.83 mg to 235.50 mg. In the leaves of *A. ampeloprasum* maximum phosphorus (235.50 mg) was reported followed (212.83 mg) in the bulbs of *A. rubellum*. Element sulfur was ranged between 34.67mg to 228.50 mg in different species. Highest sulfur (228.50 mg) was present in the leaves of *A. auriculatum* and least quantity (34.67mg) was observed in the bulbs of *A. tuberosum*.

Micro-element iron was ranged between 1.37 to 29.12 mg. Highest iron content (29.12 mg) was found in the bulbs of *A. rubellum* followed by (20.27 mg) in the leaves of *A. ascalonicum* while, least quantity of iron (1.37 mg) was observed in the bulbs of *A. ascalonicum*. The Copper content varied from 0.98 mg to 2.75 mg. Maximum copper (2.75 mg) was found in the

Table –1. Elemental Composition of some less explored *Allium* Species

S. No.	Name of Species	Plant part screened	Metal contents (mg/100g dry wt.)									
			Sodium		Potassium		Calcium		Phosphorus		Sulfur	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1.	*Allium auriculatum*	Leaves	19.90–21.40	20.65	1791.62–1825.03	1808.32	437.60– 495.05	467.19	56.00-168.25	169.75	205.50-258.00	228.50
2.	-do-	Bulbs	23.95–27.90	25.42	1213.04-1246.94	1225.99	151.00-189.57	170.78	143.00-207.00	176.17	83.00-109.00	96.77
3.	*Allium ampeloprasum*	Leaves	265.89-273.50	269.48	971.47-1079.33	1010.80	651.12-670.83	659.81	169.50-275.00	235.50	103.00-113.00	107.67
4.	-do-	Bulbs	89.50–93.27	91.65	633.56–683.59	660.07	348.00-361.49	356.42	142.00-162.00	150.83	55.00-70.00	64.83
5.	*Allium ascalonicum*	Leaves	32.70–35.56	34.17	1655.16-1690.29	1655.16	607.28-786.83	697.06	183.00-193.00	189.33	172.00-189.00	176.33
6.	-do-	Bulbs	86.00–88.99	87.18	619.00–639.64	628.29	134.55-155.76	144.10	188.00-226.00	202.00	127.00-159.00	143.17
7.	*Allium rubellum*	Leaves	7.97-13.33	11.01	1242.25-1292.89	1266.80	614.45-635.25	626.59	161.00-170.00	165.00	82.00-90.00	86.00
8.	-do-	Bulbs	16.00–26.00	21.00	930.00–1040.00	985.00	267.30-286.00	276.77	176.00-249.00	212.83	59.00-66.00	62.33
9.	*Allium tuberosum*	Leaves	20.69–22.60	21.08	2991.13–3058.88	3025.00	327.05-378.99	348.99	137.50-152.00	144.83	44.00-55.00	49.17
10.	-do-	Bulbs	2.33-3.39	21.55	834.50 - 877.07	858.56	133.20- 148.17	141.47	168.80- 185.25	175.52	31.00- 38.00	34.67
	Sem			1.458		19.463		19.285		6.979		7.015
	C.D. at 5%			5.936		79.219		78.496		28.407		28.552
	C.D. at 1%			4.333		57.825		57.298		20.735		20.552
	CV			4.180		2.56		8.580		11.522		11.580

Table –2. Micro elemental status of some less explored *Allium* Species

S. No.	Name of Species	Plant part screened	Metal contents (mg/100g dry wt.)									
			Iron		Copper		Zinc		Manganese		Cobalt	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1.	*Allium auriculatum*	Leaves	19.50- 20.79	20.11	1.40-1.86	1.65	3.96-4.25	4.10	2.00-2.98	2.63	0.00-0.00	0.00
2.	-do-	Bulbs	18.24- 20.65	19.97	1.58-1.87	1.73	6.08-6.61	6.40	1.23-1.65	1.37	0.00-0.00	0.00
3.	*Allium ampeloprasum*	Leaves	10.17- 16.45	12.91	1.45-2.62	1.85	2.62-2.93	2.82	2.96-3.53	3.40	0.48-1.37	0.94
4.	-do-	Bulbs	5.98- 6.62	6.28	1.09-2.67	1.86	2.96-3.47	3.18	1.33-1.83	1.55	0.69-1.39	1.11
5.	*Allium ascalonicum*	Leaves	19.58- 21.22	20.27	0.79-1.35	1.07	1.38-2.05	1.71	3.60-4.24	3.91	0.20-1.36	0.60
6.	-do-	Bulbs	0.50- 1.92.	1.37	1.09-1.30	1.20	3.28-3.70	3.46	0.65-0.79	0.70	0.00-0.86	0.43
7.	*Allium rubellum*	Leaves	7.05- 9.42	7..98	0.97-0.99	0.98	3.97-4.76	4.23	2.76-2.96	2.88	0.00-0.00	0.00
8.	-do-	Bulbs	21.41 – 35.94	29.12	2.66-2.85	2.75	2.85-4.12	3.32	1.14-1.60	1.30	0.00-0.78	0.52
9.	*Allium tuberosum*	Leaves	11.04 – 14.62	12.82	1.18-1.49	1.35	3.90-4.16	4.00	1.34-1.80	1.52	0.00-0.00	0.00
10.	-do-	Bulbs	5.68-8.46	7.08	0.93-1.16	1.05	3.00-3.76	3.37	0.23-0.60	0.42	0.00-0.00	0.00
	Sem			1.596		0.205		0.193		0.505		0.395
	C.D. at 5%			6.498		0.836		0.788		0.691		1.610
	C.D. at 1%			4.743		0.610		0.575		0.505		1.175
	CV			20.05		22.97		9.16		15.05		48.79

bulbs of *A. rubellum* and least copper content (0.98 mg) was observed in the leaves of *A. rubellum*. Concentration of zinc ranged between 1.71 mg to 6.40 mg. In the bulbs of *A. auriculatum* maximum zinc content (6.40 mg) was reported, followed by leaves of *A. rubellum* (4.23mg) while, least zinc (1.71mg) was found in the leaves of *A. ascalonicum*. Manganese content varied between 0.42 mg to 3.91 mg. Maximum concentration of manganese (3.91 mg) was present in the leaves of *A. ascalonicum*, followed by (3.40 mg) in the leaves of *A. ampeloprasum* and least quantity (0.42mg) was observed in the bulbs of *A. tuberosum.* Cobalt was in the range of 00.00 to 1.11mg. Highest cobalt concentration (1.11 mg) was found in the bulbs of *A. ampeloprasum* followed by its leaves (0.94 mg). Cobalt was found absent in *A auriculatum* and *A. tuberosum* species.

The results reveal that, in the leaves of A. ampeloprasum *maximum quantity of phosphorous and sodium, second highest concentration of calcium and manganese were reported. The calcium and manganese were found highest in the leaves of* A. ascalonicum *while it also contains good concentration of sulfur and iron. In the* A. auriculatum *sulfur and zinc contents were present highest in leaves and bulbs respectively. Maximum amount of iron and copper were found in the leaves of* A. rubellum. A. tuberosum *was found rich in potassium content.*

Hence it can be concluded that among five Allium *species* A. ampeloprasum *,* A. ascalonicum *and* A. auriculatum *are superior cultivars for mineral contents. These species are also useful in cardiac disorders; the presence of ample concentration of minerals may be one of the reasons responsible for their medicinal superiority. Due to high economic value of these cultivars, they can be exploited for commercial scale cultivation in western Himalayan region.*

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