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Collection and Evaluation of Some Underutilized Leafy Vegetables of Meghalaya

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ABSTRACT

The state of Meghalaya is blessed with unique flora and is considered to be the home of many leafy vegetables, which remain underutilized. Considering the importance of these crops in the nutrition and livelihood of the local population, twenty five underutilized leafy vegetables were collected from different parts of Meghalaya and were evaluated for physical and chemical parameters. Among them, *Passiflora edulis* recorded the highest number of leaves. High dry matter content was recorded in *Diplazium esculentum*, *Fagopyrum cymosum*, *Eryngium foetidum* and *Piper longum*. *Centella asiatica*, *Chenopodium album*, *Amaranthus viridis* were found to be rich in crude protein. *Rumex nepalensis* was found rich in pigment content.

Key Words: Leafy vegetables, nutrition, physicochemical properties

INTRODUCTION

The state of Meghalaya in the northeastern region of India is located between 20° 1' N & 26° 5' N latitude and of 85° 49' E & 92° 52' E longitude; and is endowed with unique physiography and enormous plant genetic resources and diversity. The state is blessed with remarkably unique and rich flora due to its wide variation in climatic and ecological diversity. It is considered to be the home of many leafy green vegetables, which remain underutilized and unexplored. These vegetables, grown in wild and semi-wild conditions without much care and attention, are lesser known outside the local population and less in demand in the market; however, have great promise for contributing to nutritional security and income generation.

These leafy vegetables play an important role in the life of rural people; they form an important part of food and nutrition of local population as many of them are traditionally been esteemed for their utilization in terms of medicinal, therapeutic and nutritional values since time immemorial and are consumed either as raw or as cooked vegetables as traditional delicacies and the sales from the surplus of these vegetables add to the income of many rural families. Moreover, their consumption gives diversity to daily food intake, adding flavours to the diet (Asfaw 1997).

These vegetables are rich in various nutritive elements, which can compensate for the dietary deficiencies of vitamins and minerals necessary for human diet. Malnutrition and subsequent food shortage among the poor rural population are conspicuous. Besides other crops, cultivation of these vegetables will not only increase food production but also provide balanced nutrition, food security, health security and poverty alleviation to the deprived section. So, these leafy vegetables have the potential to become an important alternative to usual agricultural crops.

Since little work has been done on the qualitative and physicochemical properties of these vegetables

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in this part of the country, the present study was undertaken to study morphological and nutritional values of twenty five underutilized leafy vegetables to assess their potential in the nutritional security of the poor farmers.

MATERIALS AND METHODS

Twenty five underutilized leafy vegetables (listed in Table 1) were collected from different parts of Meghalaya and were introduced in the Experimental Farm, Division of Horticulture, ICAR Research Complex for NEH Region, Umiam, Meghalaya during the period of 2009 – 10 and 2010 – 11. A total rainfall of 2377.60 mm during 2009-10 and 2829.30 mm during 2010-11 were received during the experimental period, and the average maximum and minimum temperature during the growth season were 26.35°C and 14.61°C respectively. The experiment was laid out in randomized block design.

Table 1: List of underutilized leafy vegetables used in the study

Sl. No.	Scientific Name	Family
1.	*Centella asiatica* (L.)	Apiaceae
2.	*Plantago major* (L.)	Plantaginaceae
3.	*Houttyunia cordata* (Thunb.)	Sauraceae
4.	*Fagopyrum cymosum* (Meissn.)	Polygonaceae
5.	*Eryngium foetidium* (L.)	Apiaceae
6.	*Commelina benghalensis* (L.)	Commelinaceae
7.	*Polygonum alatum* (Buch. – Ham. Ex Spreng.)	Polygonaceae
8.	*Hibiscus sabdariffa* (L.)	Malvaceae
9.	*Diplazium esculentum* (Retz.) Sw.	Athyriaceae
10.	*Colocasia esculenta* (L.)	Araceae
11.	*Emilia sonchifolia* (L.) DC.	Asteraceae
12.	*Mentha arvensis* (L.)	Lamiaceae
13.	*Spilanthes acemella* (L.)	Asteraceae
14.	*Oxalis corniculata* (L.)	Oxiladaceae
15.	*Basella rubra* (L.)	Basellaceae
16.	*Alternanthera philoxeroides* (Mar.) Grisep.	Amaranthaceae
17.	*Passiflora edulis* (Sims.)	Passifloracea
18.	*Allium hookeri* (Thw.)	Liliaceae
19.	*Rumex nepalensis* (L.)	Polygonaceae
20.	*Amaranthus viridis* (L.)	Amaranthaceae
21.	*Justicia adhatoda* (L.)	Acanthaceae
22.	*Piper longum* (L.)	Piperaceae
23.	*Rumex acetosa* (L.)	Polygonaceae
24.	*Brassica juncea* (L.)	Brassicaceae
25.	*Chenopodium album* (L.)	Amaranthaceae

The collected leafy vegetables were planted during the month of February. Morphological and chemical analyses were done at different stages of maturity. The data collected include number of leaves/plant, plant height (cm), dry matter content (%), crude protein content (%) and total chlorophyll content (mg/g) content, etc. The dry matter content was determined by the oven dry method by drying the samples at 60°C until constant weight of the sample was obtained (Rangana 1997). The crude protein content was determined by modified 'micro-Kjeldhal Method' (Subbiah and Asija 1956). Total chlorophyll was extracted with 80% acetone, and the absorption at 663nm and 645nm were read in a spectrophotometer. Using the absorption co-efficient the amount of chlorophyll was calculated (Witham et al. 1971).

The average data of two years were analyzed as per the method of Gomez and Gomez (1984). The critical difference at 5% level was used for testing the significant differences.

RESULTS AND DISCUSSION

The different leafy vegetables analyzed showed high variability for the plant attributes investigated. The numbers of leaves per plant and plant height (cm) of the crops during 2009 – 10 and 2010 - 11 are presented in Table 2 which ranged from 4.17 – 181.30 leaves/plant and 11.91 – 85.65 cm, respectively among the different leafy vegetables. Leaf number was found to be maximum in *Passiflora edulis*, (181.35 leaves/plant) followed by *Justicia adhatoda* (128.01 leaves/plant) and *Alternanthera philoxeroides* (103.59 leaves/plant), whereas *Colocasia esculenta* recorded the minimum number of leaves per plant (4.17). Since leafy vegetables are mainly grown for fresh leaves, the number of leaves per plant along with leaf size determines total yield. *Passiflora edulis* also recorded the maximum plant height (85.65 cm), followed by *Justicia adhatoda* (80.61 cm). Plant height was found to be lowest in *Rumex acetosa* (11.91 cm).

Wild species may have a great potential as a source of unusual colours and flavours, bioactive compounds and also as sources of dietary supplements or functional foods (Sánchez-Mata et al. 2011). The different type of vegetables had significant variations in the dry matter content as

Table 2: Mean comparison of number of leaves per plant and plant height of the leafy vegetables during 2009-10 and 2010-11

Sl. No.	Crop	Leaves/plant			Plant height (cm)		
		2009-10	2010-11	Mean	2009-10	2010-11	Mean
1.	*Centella asiatica*	12.78	13.12	12.95	12.91	13.01	12.96
2.	*Plantago major*	6.85	6.93	6.89	19.76	20.71	20.24
3.	*Houttyunia cordata*	10.81	11.74	11.28	13.14	13.88	13.51
4.	*Fagopyrum cymosum*	42.81	41.89	42.35	56.32	52.71	54.52
5.	*Eryngium foetidium*	11.92	11.44	11.68	11.98	12.91	12.45
6.	*Commelina benghalensis*	80.67	83.89	82.28	35.48	35.17	35.33
7.	*Polygonum alatum*	51.07	48.11	49.59	36.29	40.20	38.25
8.	*Hibiscus sabdariffa*	40.37	40.70	40.54	68.17	63.38	65.78
9.	*Diplazium esculentum*	19.52	21.22	20.37	44.97	49.73	47.35
10.	*Colocasia esculenta*	4.00	4.33	4.17	19.60	18.76	19.18
11.	*Emilia sonchifolia*	10.41	10.52	10.47	29.79	29.81	29.80
12.	*Mentha arvensis*	42.41	45.11	43.76	23.14	23.14	23.14
13.	*Spilanthes acemella*	19.67	19.89	19.78	34.68	31.42	33.05
14.	*Oxalis corniculata*	13.85	15.70	14.78	10.56	13.63	12.10
15.	*Basella rubra*	18.59	20.85	19.72	55.92	59.26	57.59
16.	*Alternanthera philoxeroides*	103.70	103.48	103.59	48.46	45.29	46.88
17.	*Passiflora edulis*	185.00	177.69	181.35	76.16	95.14	85.65
18.	*Allium hookeri*	20.26	19.85	20.06	19.64	17.12	18.38
19.	*Rumex nepalensis*	20.33	19.74	20.04	32.73	33.21	32.97
20.	*Amaranthus viridis*	20.07	20.26	20.17	30.64	28.92	29.78
21.	*Justicia adhatoda*	128.14	127.88	128.01	76.04	85.17	80.61
22.	*Piper longum*	71.00	69.33	70.17	23.94	27.39	25.67
23.	*Rumex acetosa*	29.33	27.44	28.39	11.62	12.20	11.91
24.	*Brassica juncea*	15.67	17.22	16.45	31.18	54.06	42.62
25.	*Chenopodium album*	35.00	36.07	35.54	33.27	33.44	33.36
	SEM	2.86	2.41	—	1.85	2.27	—
	CD 5%	8.14	6.85	—	5.26	6.47	—

presented in Table 3. In general, leafy vegetables with low dry matter content are tender and succulent, while those with high dry matter content have a harder texture. The dry matter content of the vegetables analysed ranged between 8.11% - 23.32%. The highest dry matter content (23.32%) was recorded in *Diplazium esculentum*, followed by *Fagopyrum cymosum* (21.67%). *Rumex acetosa* recorded the minimum dry matter content of 8.11% due to its high moisture content. *Eryngium foetidum* and *Piper longum* were also found to be high in the dry matter with values of 21.18% and 20.08%, respectively. These results are in conformity with the range (7% - 29%) reported (Guil et al. 1997, Escudero and de Arellano 2003) for dry matter content of different species of wild leafy vegetables. Significant variation in crude protein content was found among the different vegetables (Table 3), with *Centella asiatica* recording the maximum crude protein content of 24.48%, while *Oxalis corniculata* recorded the lowest crude protein content (10.28%). Some other plants rich in crude protein content were *Brassica juncea*, *Rumex acetosa*, *Amaranthus viridis* and *Chenopodium album*, which recorded crude protein content of 23.83%, 23.73%, 23.70% and 23.54%, respectively. The higher crude protein content of these leafy vegetables suggests their richness in essential amino acids. These amino acids serve as alternative sources of energy when carbohydrate metabolism is impaired via gluconeogenesis (Iheanacho and Udebuani 2009). Similarly total chlorophyll content also varied significantly among the different vegetables under study (Figure 1). The content of pigments in plants is important, not only for colouration and physiological function, but also because of their acknowledged roles in health (Liu et al. 2007, Niizu and Rodriguez-Amaya 2005). Highest total chlorophyll was found in *Rumex nepalensis* (1.58 mg/g), followed by *Justicia adhatoda* (1.53 mg/g), whereas the lowest total chlorophyll content was recorded in *Basella rubra* (0.57 mg/g). The total chlorophyll was also found to be high in *Passiflora edulis* (1.39 mg/g),

Table 3: Mean comparison of dry matter content (%) and crude protein (%) of the leafy vegetable during 2009-10 and 2010-11

Sl. No.	Crop	Dry matter (%)			Crude protein (%)		
		2009-10	2010-11	Mean	2009-10	2010-11	Mean
1.	*Centella asiatica*	19.60	17.78	18.69	25.56	23.39	24.48
2.	*Plantago major*	18.89	19.09	18.99	12.33	12.25	12.29
3.	*Houttyunia cordata*	18.10	16.54	17.32	13.92	15.12	14.52
4.	*Fagopyrum cymosum*	22.95	20.39	21.67	21.08	20.79	20.94
5.	*Eryngium foetidium*	20.41	21.95	21.18	21.19	20.43	20.81
6.	*Commelina benghalensis*	17.51	17.94	17.73	20.73	21.90	21.32
7.	*Polygonum alatum*	17.59	15.84	16.72	15.07	15.44	15.26
8.	*Hibiscus sabdariffa*	14.99	14.21	14.60	15.50	15.79	15.65
9.	*Diplazium esculentum*	23.05	23.59	23.32	13.93	13.30	13.62
10.	*Colocasia esculenta*	19.30	19.37	19.34	20.54	20.60	20.57
11.	*Emilia sonchifolia*	15.81	16.46	16.14	16.53	16.86	16.70
12.	*Mentha arvensis*	18.02	17.38	17.70	18.10	17.76	17.93
13.	*Spilanthes acemella*	18.22	15.69	16.96	14.59	15.15	14.87
14.	*Oxalis corniculata*	10.22	11.62	10.92	9.94	10.62	10.28
15.	*Basella rubra*	16.48	13.10	14.79	20.34	19.23	19.79
16.	*Alternanthera philoxeroides*	15.07	16.59	15.83	20.11	20.13	20.12
17.	*Passiflora edulis*	18.92	19.60	19.26	21.78	21.40	21.59
18.	*Allium hookeri*	9.30	12.33	10.82	14.42	14.24	14.33
19.	*Rumex nepalensis*	13.49	14.15	13.82	20.67	19.87	20.27
20.	*Amaranthus viridis*	14.51	13.41	13.96	24.04	23.36	23.70
21.	*Justicia adhatoda*	20.51	19.33	19.92	15.04	14.76	14.90
22.	*Piper longum*	20.96	19.20	20.08	24.90	20.63	22.77
23.	*Rumex acetosa*	8.86	7.35	8.11	23.92	23.53	23.73
24.	*Brassica juncea*	10.30	9.84	10.07	24.33	23.33	23.83
25.	*Chenopodium album*	15.47	15.68	15.33	23.46	23.61	23.54
	SEM	0.54	0.70	—	1.02	0.93	—
	CD 5%	1.53	2.00	—	2.89	2.66	—

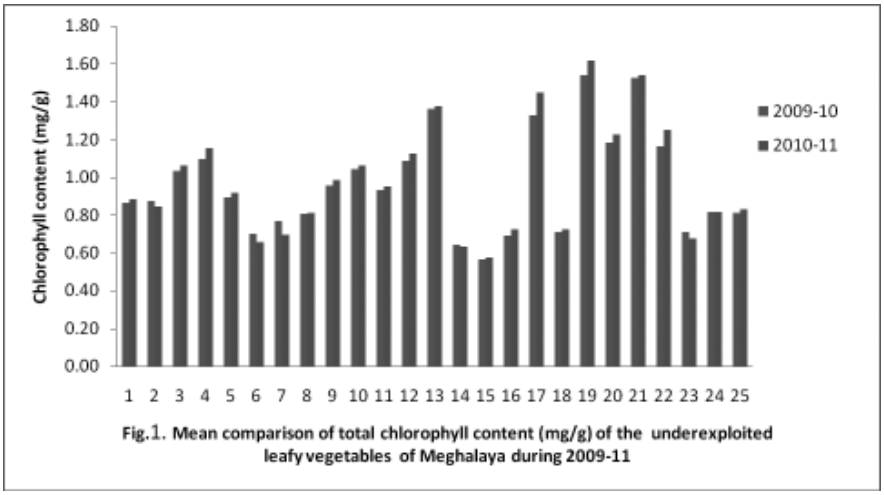

Fig.1. Mean comparison of total chlorophyll content (mg/g) of the underexploited leafy vegetables of Meghalaya during 2009-11

SEM for 2009- 10 = 0.09 SEM for 2010 - 11 = 0.07 CD for 2009 – 10 = 0.27 CD for 2010 - 11 = 0.20

Note: 1-25 represent the different leafy vegetables under study in the order: 1=*Centella asiatica,* 2= *Houttyunia cordata,* 3 = *Plantago major,* 4 = *Fagopyrum cymosum,*5 = *Eryngium foetidium,*6 = *Commelina benghalensi,* 7 = *Polygonum alatum,* 8 = *Hibiscus sabdariffa* , 9 = *Diplazium esculentum,*10 = *Colocasia esculenta*, 11 = *Emilia sonchifolia,*12 = *Mentha arvensis,* 13 = *Spilanthes acemella,* 14 = *Oxalis corniculata,* 15 = *Basella rubra,* 16 = *Alternanthera philoxeroide,* 17 = *Passiflora edulis*, 18 = *Allium hookeri* , 19 = *Rumex nepalensis,* 20 = *Amaranthus viridi,* 21 = *Justicia adhatoda*, 22 = *Piper longum*, 23 = *Rumex acetosa,* 24 = *Brassica juncea,* 25 = *Chenopodium album*

Spilanthes acemella (1.37 mg/g), *Piper longum* (1.21 mg/g) and *Amaranthus viridis* (1.20 mg/g).

CONCLUSION

Considerable variations existed in the different leafy vegetables in terms of leaf number, plant height, dry matter content and total chlorophyll content. It can be concluded from the present study that the underutilized leafy vegetables are rich sources of dry matter, crude protein and total chlorophyll contents. These vegetables can constitute an inexpensive source of these nutrients in the diet of the local people which are missing from the commonly consumed staple foods.

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