Nutritive, anti-nutritional, trace elements profile and evaluation on biochemical components of aerial parts of *Ipomoea sepiaria* roxb

Kuppamuthu Kumaresan[1, 2*], Nanjian Raaman[2], Raman Jegadeesh[2,3], Lakshmanan Hariprasath[2,3], Thiyagarajan Sathish Kumar[1]

[1]Department of Biotechnology, Kumaraguru College of Technology, Coimbatore – 641 049, Tamil Nadu, India.
[2]Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai – 600 025, Tamil Nadu, India.
3Mushroom Research Centre, Institute of Biological Sciences, University of Malaya, Kuala Lumpur, Malaysia.
***Corresponding Author: Email: kdpkumaresan@gmail.com; Phone – 91-422-266940**

ABSTRACT

The Convolvulaceae is a vast family with almost 1200 species, which are distributed for the most part in the tropical areas of the world. Traditional uses of medicinal plants for therapeutically values of secondary metabolites have been found in the family Convolvulaceae over the years. In this investigation the effectual utilization of aerial parts of *Ipomoea sepiaria* from Convolvulaceae family have been evaluated for their biochemical components and evaluates their nutritive values. The presence of proximate principles, few vitamins and mineral elements were quantified in the aerial part of *I. sepiaria*. The analysis of vitamins revealed that *I. sepiaria* contain appreciable amount of vitamin A, B_2 and C. The aerial parts contained high concentration protein, carbohydrate, fibre and fat. The aerial part of *I. sepiaria* contained significant amount of trace elements such as calcium, iron, zinc, sodium and potassium. The toxic elements such as Cadmium, Chromium, Arsenic and Lead were observed as below detectable level in the aerial part of *I. sepiaria.* These results clearly show that the aerial parts of *I. sepiaria* plant is a good nutritive supplement in the traditional medicinal practice.

KEYWORDS: *Ipomoea sepiaria*, Nutritive values, Trace elements, Phytochemical

1. INTRODUCTION

The most serious threat to the survival of humanity is the ever-increasing gap between population growth and food supply. It has been estimated that over 500 million people in the world today are malnourished (F.A.O., 1985). Leaves are reportedly inexpensive, easy to cook and rich in vitamins and minerals (Oke, 1966). The decoction of the entire plant of *Ipomoea* is very efficacious for allaying the dyspnoea of asthmatics (Uphof, 1959). The Lele of *Guinea* reportedly eats the leaves and it is superstitiously considered a good talisman for fecundity (Burkill, 1985) and used for treating anaemic cases by local herbalists in Ghana (Wallace, 1998). Only the sweet potato storage roots are traditionally consumed in the United States and the foliage is generally plowed back into the field as an organic fertilizer. In some countries, the fresh or dried foliage is used as an animal feed (Woolfe, 1992). The young leaves and petioles are also eaten in several Asian and a few African countries as a leafy or green vegetable (Villareal *et al.,* 1982; Nwinyi, 1992). To increase the edible plant portion in ALSS, consumption of greens of sweet potato is promoted.

Ishida *et al.* (2000) compared the nutrient contents of the raw of greens of sweet potato with those of greens from greenhouse bed plants. Protein, ash, fat, total dietary fiber, minerals (Ca, Fe, Na, Mg, and Zn), vitamins (ascorbic acid, carotene, thiamine), oxalic and tannic acids, chymotrypsin and trypsin inhibitors in the greens were analyzed. Some parts of this plant, which are not usually used, were found to be rich in nutritive and functional components. In particular, leaves contain a large amount of protein, showing high amino acid score. Any parts of sweet potatoes were rich in dietary fiber and in particular, leaves were soluble dietary fiber. Mineral content, particularly iron, and vitamin content such as carotene, vitamin B2, vitamin C and vitamin E were high in leaves in comparison with other vegetable parts. Revaluation of the crops, which are tolerant to environmental changes such as drought, storms and floods, and which can be cultivated in waste land and tropical areas, is necessary to overcome the unbalanced diet and shortage of food production (Ishida *et al.,* 2000). The leaves, stalks and stems of sweet potato are suggested to be valuable as sources of DF. The leaves were characterized to contain the highest amount of soluble dietary fiber (SDF) among each part of sweet potato. The amount of SDF in leaves was 6.83% on dry matter basis in KS and 5.77% in BA (Ishida *et al.,* 1995). *Ipomoea* sp. has been found to be active against some microorganisms, including *Staphylococcus aureus, Escherichia coli,* and *Bacillus megaterium*.

2. MATERIALS AND METHODS

2.1. Glassware and chemicals: Good quality glassware and chemicals were used for all tests. All the glassware was of brand Borosil or Corning. They were washed with good detergent, rinsed in tap water and soaked in chromic acid clearing solution. Analytical grade chemicals supplied by Loba, Hi-Media, S.D. Fine Chemicals, E. Merck, Qualigens and Sigma Chemicals (U.S.A) were used in this study.

2.2. Plant collection and identification: The plant specimens were collected at flowering stage and identified as *Ipomoea sepiaria* Roxb. with the help of Flora of Madras Presidency (Gamble, 1967) and the flora of the Tamilnadu and Carnatic (Matthew, 1983). The plant *I. sepiaria* was collected throughout the year 2003-2004 from Nachalur near Trichirappalli, Tamilnadu, India and authenticated by Prof. N. Raaman, Centre for Advanced Studies in Botany, University of Madras, and Chennai, India. When the plants were at flowering stage, the floral characters were used for identification of the plant with the help of floras (Gamble, 1967). Photographs of the plant in its original habitat were taken in the field to display the surface features of the leaf, stem, flower and fruit. These organs were photographed in closer views with the help of Nikon digital camera. The plant aerial part was collected, after a through investigation to check for any pathological disorders and from contamination of other plants, washed with dist water and shade dried.

2.3. Preparation of extracts: A dry powder of the plant aerial parts was separated into two ½ kgs. The ½ kg powder was soaked at room temperature in methanol for 48 h; other ½ of plant powder was subjected to nutritive value analysis. The extract was suction filtered using Whatmann filter paper. This was repeated for 2 to 3 times and similar extracts were pooled together and concentrated at 40°C to 45°C under reduced pressure using vacuum rotary evaporator type 350. The concentrated crude methanol extract were subjected to a preliminary phytochemical screening and some of the nutritive analysis.

2.4. Determination of nutritive values: Since the plant under study is being used as staple food by some people, it was decided to determine the nutrient value of leaves, stem bark and root bark. The amount of carbohydrate, protein, fat, fibre, some minerals and few vitamins were determined per 100 g of dry powder of leaves, stem bark and root bark. The protein values were calculated from the nitrogen content and the factor used was 6.25. The fat contents were obtained from total ether extractives. The carbohydrate content was the difference between 100 and the sum of moisture, protein, fat, fibre, ash contents. The moisture, fibre and fat contents were calculated as per standard procedures given in ISO 1990 and 1991. The food energy was calculated from the content of the proximate principles assuming that proteins, carbohydrates and fats yield 4, 4 and 9 K cals, respectively per gram.

The mineral elements were estimated by standard procedures. Calcium and magnesium were estimated as per procedure given in APHA (1985). The elements were estimated with the help of Atomic Absorption Spectrophotometry. Four vitamins were also quantified. The values of Vitamin A, Vitamin B (Thiamine), Vitamin B2 (Riboflavin) and Vitamin C (Ascorbic acid) were estimated. It is usual practice to express Vitamin A value of foodstuff in terms of International Units. In vegetable food, the carotene content is usually given assuming that 0.6 g of carotene is equivalent to one I.U. of Vitamin A. All the values are given per 100 g of edible portion of stem bark, root bark and leaves, separately.

2.5. Statistical analysis: All analyses were performed in triplicate and data reported as mean ± standard deviation (SD).

3. RESULTS AND DISCUSSION

The presence of proximate principles, few vitamins and mineral elements were quantified in the aerial part of *I. sepiaria* and the data are presented in the Table 1. The analysis of vitamins revealed that *I. sepiaria* contain detectable amount of vitamin A, B2 and C.

Table.1.Proximate principle analysis of *Ipomoea sepiaria* on dry weight basis

Name of the principle	Content/100g dry powder	± SD
Loss on drying at 105ºC Moisture	6.12	0.28
Crude fibre	2.31	0.13
Crude Protein	3.38	0.09
Total Fat	2.86	0.19
Total Ash	11.41	0.06
Carbohydrate	76.92	0.24
Total calories/ 100gm	334.94 Calories	-
Reducing sugar	16.09	0.07
Non reducing sugar	28.67	0.09
Total Sugar	44.76	0.03
Nitrogen	3.32	0.06
Acid value	3.10	0.06
Saponification value	228.75	0.10
Iodine value	22.8	0.04
Peroxide	6.24 m eqv/1kg	0.06
P^H of 1% solution	6.46	0.05
Vitamin A	0.14	-
Vitamin B1	0.004	-
Vitamin B2	0.03	-
VitaminB3 - Niacinamide	Nil	-
VitaminB6	Nil	-
VitaminB12	Nil	-
Vitamin C	0.06	-

The aerial parts contained more protein, carbohydrate, fibre and fat. The aerial part of *I. sepiaria* contained appreciable amount of calcium, iron, zinc, sodium and potassium. The toxic elements like Cadmium, Chromium, Arsenic and Lead and were below detectable level in the aerial part of *I. sepiaria* Table 2.

Table.2.Element analysis of *Ipomoea sepiaria*

Sl. No	Name of the element	Level present
Macroelements		
1	Iron	62.09 %
2	Sodium	14.02
3	Potassium	0.12
4	Magnesium	**BDL***
5	Phosphorous	0.1
6	Calcium	0.482
7	Zinc	0.21
Microelements		
1	Arsenic	0.13 ppm
2	Lead	0.36 ppm
3	Copper	0.15 ppm
4	Cadmium	**BDL**
5	Nickel	**BDL**

***BDL-Bellow Detectable Level**

Investigations in the present study showed that aerial part of *I. sepiaria* contain appreciable amount of carotene and chlorophylls, vitamins and minerals and other proximate biochemical values. Vitamin A consists of a group of biologically active compounds closely related to the plant pigment carotene. The carotenoid family consists of approximately 100 naturally occurring pigments, which provide the yellow-red colour of vegetables and some fruits. β-carotene is a provitamin A which is identical to retional McClaren, (1980). Vitamin A is necessary for clear vision in dim light, lack of vitamin A thus leads to night blindness. Another function of vitamin A is to maintain the integrity of epithelial tissues. Advocates for the cause of balanced diet opine that most inexpensive and convenient way of ensuring adequate intake of vitamin A is to include green leafy vegetables (GLV) in the daily diet. Vitamin A deficiency is the important cause of eye malfunction, night blindness and xerophthalmia. It is said that about 50 g of the common leafy vegetables like amaranth will provide adequate β-carotene to meet the vitamin A requirement of an adult. The present study showed that the carotene content in aerial parts of *I. sepiaria* was in high level. Total calories was 334.94 and carbohydrate content was 76.92%. Iron value was 69.22%. Vitamin B1 and B2 was about 0.004% and 0.003% respectively. This clearly shows that the aerial parts of *I. sepiaria* is a good source of iron, carbohydrate, minerals and vitamins in the daily diet.

An adequate provision of all nutrients in the correct proportions is a pre requisite for health. Nutrients are necessary for growth of the whole body, cellular and chemical structure and repair and the provision of energy (Fieldhouse, 1986). It is not surprising that since prehistoric time's man has been trying to find more useful plants and to improve the yield and the quality of the known ones, this had resulted in the knowledge of uses for numerous plants. Archeological evidence indicates that more than 3000 species have been used for food.

Revolutions and industrialization have altered cooking and eating habits. Most of our carbohydrates and proteins are obtained from approximately 30 plant species. Fifteen species are our major supply of vegetables. Fruits are also obtained from only fifteen plant species (Borlaug, 1983). Appropriate nutrition requires that all nutrients, carbohydrates, lipids proteins, minerals, vitamins and water are eaten in adequate amounts and correct proportions. This is essential for normal organ development and function, reproduction, repair of body tissues and combating stress and diseases. Investigations in the present study showed that aerial part of *Ipomoea sepiaria* contain appreciable amount of carotene and chlorophylls, vitamins and minerals and other proximate biochemical values.

This clearly shows that the aerial parts of *Ipomoea sepiaria* is a good source of iron, carbohydrate, minerals an vitamins in the daily diet. Qualitative chemical tests revealed the presence of various phytochemicals in crude methanol extracts of *Ipomoea sepiaria*. Methanolic extract showed positive results for alkaloids, flavanoids, phenolic compounds, carbohydrates, glycosides, amino acids, proteins, volatile oils and saponins. Phytosterols were absent.

The convolvulaceae is a large family with almost 1200 species, which are distributed predmoninantly in the tropical areas of the world. They are known to produce a wide variety of alkaloids such as ergolines, pyrrolidines and the closely related tropanes. Some *Ipomoea* species contain unique indolizidine alkaloids of the ipalbidine-type and serotonin-hydoxycinnamic acid conjugates of the ipobscurine-type. Recently, 1-hydroxymethylpyrrolizidines (pyrrolizidine alkaloids, Pas) and 1-aminopyrrolizidines (Ioline alkaloids) were detected in the tropical bindweed. *Ipomoea hederifolia*, and *Argyreia mollis*, recpectively (Jenett-Siems *et al*., 1977).

The two varieties of Ipomoea species also show a number of chemical differences between them. The typical variety of *I. sepiaria* contained 4'-Ome quercetin, 3'4'-diOMe quercetin, proanthocyanins and p-hydorxybenzoic acid as against 3'OMe quercetin, quinones, syringic acid, p-coumaric acid, melilotic acid and saponins of variety *stipulacea* (Geetha *et al*. 1988). Further studies need to be carried out to prove the medicinal values of the plant *Ipomoea sepiaria*.

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