

REVIEW
OF
LITERATURE

Nutraceutical evaluation of some wild edible tuberous plants.

Millions of the people in many developing countries do not have enough food to fulfill their daily requirement and a further more people are deficient in one or more micronutrients and same is true about India. In India most of the rural people depend on the wild edible plant resources which constituted important elements in human nutrition as a component of daily meals or during period of famine. The rich diversity of wild edible plant species offers variety in family diet and contributes to household food security. The various publications provide detailed knowledge about the utilization of wild edible plants as food or medicine in the world.

An ethnobotanical study of tribes of Bastar (Madhya Pradesh) was carried out by Jain (1963). The 88 wild plants were screened for their food value and medicinal values. Among these *Arisaema tortuosum* and *Curcuma angustifolia* tubers were freshly eaten, *Costus speciosa* tubers were used to make pickle and tubers of *Dioscorea hispida* were boiled in water then skin is removed and sliced into thin pieces, that pieces is cooked with rice. These tribal people also brought the edible forest products into weekly markets for improving their economic status.

Studies in South eastern part of Kolhapur district (Maharashtra) on wild medicinal plants by Upadhye *et al.* (1986). They observed 34 medicinal plant species used in home remedies by rural communities. Among them *Atylosia lineate* fresh leaves were crushed in water and thick paste was applied on cuts and dried leaves were smoked in asthma and cough. *Atalantia monophylla* leaves were used by tribals as anti-dysentric, *Cyclea peltata* root was eaten raw for snake bite. The tribal community collected herbal material used as drugs so they suggested that such information needs verification through experimental work and clinical investigation in order to ascertain and establish their utility and efficacy in therapeutics.

Nutraceutical evaluation of some wild edible tuberous plants.

Goud and Pullaiah (1996) studied wild food plant of Kurnool (Andhra Pradesh) and enumerated total 40 wild food plants which are used by tribal. Chenchus, Sugalis and Yerukalas constitute major tribal population of Kurnool and each commonly has its own habitat and historical way of life. These tribes depend on minor forest produce items like gums, roots, barks, fruits, seeds. Among these plants *Peuraria tuberosa*, *Curculigo orchinoides*, *Dioscorea hispida*, *Dioscorea oppositifolia* and *Asparagus officinalis* tubers were boiled and eaten. Also *Erthroxylon monogynum*, *Derris scandens*, *Centella asiatica*, *Canthium parviflorum*, *Aerva lanata* leaves were cooked and eaten by these tribal people.

Sahu (1996) studied wild food plants and provided data on the life support promising food plants among aboriginals of Bastar (Madhya Pradesh). He had made an ethnobotanical survey of about 30 villages of Abujhamarh area of Bastar district. The inhabitants of the area were the Abujhamarh, one of the most dominant tribes of Bastar. According to the author, the food produced by the tribes was not sufficient because of very limited area under 'Penda cultivation'. Under such situation several plants were used as emergency food. He surveyed about 30 plants, among these *Dioscorea hamiltoni* boiled tubers were eaten as vegetable, *Dioscorea hispida* tubers dipped in water overnight, made chips and then dried were made into papad and *Dioscorea pentaphylla* tubers were eaten boiled or roasted as a vegetable throughout year.

Radhakrishnan *et al.* (1996) carried out ethnobotanical survey of 32 wild edible plants of food values, among the tribal inhabiting Western Ghats forest of Kerala. Among these the *Dioscorea esculanta*, *Dioscorea oppositifolia*, *Dioscorea pentaphylla*, *Dioscorea wallichii*, *Stephania wightii*, *Utleria salifolia* root tubers were

Nutraceutical evaluation of some wild edible tuberous plants.

consumed after cooking. It is a common belief of tribes that the food plants with medicinal value were induced vitality and longativity. Also they were utilizing the resources in a sustainable manner by maintaining them as renewable resources.

Samant and Dhar (1997) studied wild edible plants of Indian Himalaya used by local communities. Over 675 wild plants species, representing 384 genera and 149 families were used as food and their various parts were either consumed raw, roasted, boiled, fried, cooked or in the form of oils, spice, jams, pickles etc. They analyzed for their diversity in different phytogeographical province, altitudinal distribution, endemism, origin and potentials. West Himalaya shows the highest diversity (50.96%) of edible plants which were utilized by native communities in various purposes like medicine, food, fodder, fuel, timber etc. Significantly, these wild edible plants form supplement food in time of scarcity.

Khan *et al.* (2000) studied the wild food plants of ethnobotanical significance in central India which was used by local people in their day to day life. They recorded food utility of 58 plant species belonging to 49 genera and 34 families of flowering plants. The central India region was floristically rich. The tribal of central India utilized wild plants at the time of scarcity. The underground stem of *Amorphophallus companulatus*, *Cyprus esculentus*, *Dioscorea sativa*, *Dioscorea pentaphylla* and *Peuraria tuberosa* were consumed as vegetables not only by tribals but also rural and urban people.

Sundriyal *et al.* (2004) studied the dietary uses of wild edible plants resources in the Sikkim Himalaya, India. They described wild plants resources with promising potential. Tribal group depends on forest resources for various purposes. They reported in Sikkim Himalaya local people have harbor huge knowledge about the uses

Nutraceutical evaluation of some wild edible tuberous plants.

of wild plants which are and that consumed as food. A total 190 wild edible plants were identified for food value and 45 of them were used on a large scale. Most of species were edible for their fruits, seeds, leaves, shoots, flowers and roots or rhizomes. They discussed these wild species as they were used as a substitute for cultivated species during the lean period of the year. Various wild edible species are sold in markets which alleviate an economy and consumption of these plants provides substantial nutritional and dietary benefits to tribal. They also suggested that there was a need to assess their nutritional quality and their potential market value, so that it will help to future formulation of agriculture, forestry and nutritional strategies and concluded that wild edible plants were greatly valued throughout the Himalayan region and serve as an important source of food for indigenous communities.

A study conducted by Barua *et al.* (2007) in Brahmaputra valley of Assam (Majuli district and Darrang district) which was very unique in its plant resources and inhabited by different communities. Besides the cultivated crops, they were dependent on various wild edible plants for dietary and medicine purposes. The wild edible plants such as tubers of *Dioscorea bulbifera*, leaves of *Drymaria cordata*, *Leea samcina*, *Paederia foetida*, *Phyllanthus niruri*, *Pouzolzia indica*, *Polygonum caespitosum*, *Polygonum chinense*, *Rumex nepalensis* were used as vegetable. The products from these wild plants were consumed by the people as staple foods or direct food as raw or as cooked food. Occasionally, some of these wild species were used as indirect food stuffs as favourable additions to various traditional delicacies. Such edible wild plants also act as supplementary food during lean and stress period. These wild edible plants not only help in relieving diseases but also fetch sometimes a good market price.

Nutraceutical evaluation of some wild edible tuberous plants.

Rashid *et al.* (2008) studied the wild edible plant species consumed by the Gujjar tribe inhabiting the hilly areas of Rajouri district, a part of Jammu and Kashmir. They reported the edible wild plants were common resources of inhabitants. They used barks, flowers, roots, fruits, leaves twigs, young shoots, seeds and tubers as primary food or secondary condiments. Among them raw tubers of *Dioscorea belophylla* were eaten and leaves of *Amaranthus caudatus*, *Capsella bursa-pastoris*, *Diplazium frondosum*, *Nasturtium officinale*, *Plantago lanceolata*, *Rumex acetosa* were cooked as vegetable. They observed that the consumption of wild edible plants species seems to be good and that attributed health, vitality and longativity. They also focused five major factors threatening wild edible plants were overgrazing and overstocking, expansion of agriculture land, forest cuttings, over exploration of forest product and uncontrolled fire settings. So they suggested documentation and conservation of traditional knowledge about edible wild plants is of great significance in the light of food problem likely to be faced in the near future for increasing human population.

Swarnkar and Katewa (2008) studied 42 tuberous plants of ethnobotanical interest from Aravalli hills of Rajasthan used by Bhil, Meena, Garasia, Damor and Kathodi tribal people for their food value and interesting therapeutic properties for various ailments in daily life. Among these, *Ceropegia bulbosa* tuber is eaten either in cooked or raw form, decoction of tuber is taken orally to get rid of urinary bladder stone and paste of seed is dropped in the ear to cure deafness. Although *C. tuberosa* tuber is eaten either raw or cooked form and in case of 'Besu' (Poisonous animal) bite, the powder of tuberous root is applied over infected area to prevent the poisonous effect. Thus plants has dual significance; firstly they will be promising future food

Nutraceutical evaluation of some wild edible tuberous plants.

and secondly these medicinal tuberous plants contain some active constituents for future pharmaceutical analysis. They observed that the environmental changes and lack of conservation of tuberous plants. So that a lot of plants become rare, threatened and endangered. Thus there is a need of proper aid towards identification, utility and compilation of database of tuberous plants by the tribes.

Khyade *et al.* (2009) conducted the ethnobotanical survey in the hilly areas of Akole tahasil of Ahmednagar district and reported 31 wild edible plant species. Among these leaves of *Amaranthus biltum*, *A.spinosus*, *Bauhinia racemosa*, *Celotia argentea*, *Digera muricata* and *Launaea procumbens* are cooked as vegetable along with ingredients. Moreover species like *Arisaema murrayi*, *Amorphophallus paeoniifolius*, *Chlorophytum tuberosum* and *D.bulbifera* tubers are eaten in raw or boiled form. During the survey they revealed that tribals and villagers of Akole have much faith in using the wild plants as a food and suggested need of the future investigation into nutritional profits, processing methods, cultivation techniques, conservational studies and pharmacological properties of the reported plant species.

Dogan *et al.* (2004) reported 121 wild edible plants and recorded detailed preparation method which is used as food in Western and central Anatolia (Turkey). Among these plants, *Cyperus esculentus* tubers are eaten together with chopped cucumber and garlic; tubers of *Ophrys affica*, *O.fusca*, *Orchis anatolica*, *O.purpurea*, *Dactylorhiza iberica* are prepared as hot drink with milk (Sahlep). The leaves of *Rumex crispus* are eaten as a stuffed, pics, soup, meal, salad and roasted. Also the leaves of *Erodium cicutarium* and *Geranium dissectum* are eaten as meal, pic and roasted with yogurd. They feel that the knowledge is handed down through generations about wild edible plants are important for use of all humanity.

Nutraceutical evaluation of some wild edible tuberous plants.

Shretha and Dhillion (2006) studied wild food species in locally managed forest by the inhabitants of nine villages in the Dolakha district, Nepal and presented data on wild food species diversity, traditional knowledge on plant use, propagation and local domestication. They recorded Sixty-two wild food plants belonging to 36 families. Among these most of the food plant species are consumed by the local communities as snacks or supplementary. Tubers of *Dioscorea bulbifera*, *Dioscorea deltoidea*, *Manihot esculenta* are eaten as a vegetable and make its pickle. They reported the dual role of some wild food plants with medicinal properties which are common in rural areas.

Victoria *et al.* (2006) described the cultural, practical and economic value of 114 wild plants in the Bolivian Amazon. These wild plants play a vital role in the daily life of local inhabitants. They reported the low correlation between the practical and cultural values of species in that some species rarely used and were frequently mentioned in interviews where as some frequently used were rarely mentioned and concluded that the combination of indices of cultural, practical and economic value offers a more comprehensive evaluation of the significance of wild plants species to human society than the use of only one index.

Pardo-de-Santayana *et al.* (2007) studied traditional knowledge and use of wild edible plants in six rural regions of the Northwest Iberian Peninsula (Spain and Portugal). They reported 97 wild edible plant species consumed by local inhabitants. Among these wild berries of *Castanea sativa*, *Rubus ulmifolius*, *Fragaria vesca*, herbs *Prunus spinosa*, vegetable of *Rumex acetosa*, Condiments as an *Origanum vulgare* consumed abundantly on survey sites. They indicated that patterns of wild edible

Nutraceutical evaluation of some wild edible tuberous plants.

plants usage appear to depend on sociocultural factors rather than biological ones such as climate or richness of the wild edible flora.

Ghirardini *et al.* (2007) carried out comparative study on wild food plants consumption in twenty-one local communities in Italy. The gathering, processing and consuming wild food plants were important activity in local community of selected areas in Italy. They reported the wild edible plants and pointed out *Helichrysum italicum* and *Symphytum officinale* leaves were used as vegetable. They observed some differences in the gathering and consumption of wild food plants between these areas. In the North, Rosaceae species prevailed, whereas in the South, Asteraceae, Brassicaceae and liliaceae families were most frequently consumed in survey sites.

Yet numerous reports illustrate that rural people in many parts of the world continue to include a number of wild edible plants in their food basket.

Nutraceutical study:

Nineteen percent of the world population lives in undeveloped countries where malnutrition is still a serious problem for the last two decades. Today worldwide attention is focused on the problem to understand the intimate relationship that exists between plants and human beings, especially with respects to medicinal and wild edible plants. The international institute for Environment and Development (1995) noted in its report that many wild edibles are nutritionally rich and can supplement nutritional requirements, especially vitamins and micronutrients. It is known that wild plants are richer in minerals compared to cultivated ones. So during recent years there has been a growing interest to evaluate various wild edible plants for their nutritional value.

Nutraceutical evaluation of some wild edible tuberous plants.

Duhan *et al.* (1992) studied nutritional value of some non-conventional plant foods in India. They analyzed 13 non-conventional food including fruits, leaves and grains consumed in various parts of the India. They noted these unconventional foods found high nutritive value and ample source of minerals. Among these leaves of *Tribulus terrestris* were found to be rich source of calcium and *Boernavia diffusa* were large amount of phosphorus. They observed that the people are aware about the biological utilization of these foods as a source of minerals in diet.

Agrahar-Murugkar and Subbulakshmi (2005) studied the nutritive value of wild edible fruits, berries, nuts, roots and spices consumed by the khasi tribes of India. These wild plants are important food resources of khasi tribe. Among these *Flemingia vestita* tubers is rich in calcium, Zinc, Vitamin C while the root of *Kaempferia galanga* is rich in Zinc, iron and β -carotene. They observed that the nutritive values of wild edible plants were found superior than conventional food. The course of study they re-emphasize the need for including these food groups in regular community nutrition programs so that it will help in mitigating nutritional deficiency problems and also it is recommended for commercial exploitation.

Shanthakumari *et al.* (2008) studied nutritional evaluation and elimination of toxic principle in wild yam (*Dioscorea spp.*). The wild yam tubers consumed by tribal Kanikkars of Kanyakumari district. The *Dioscorea alata*, *D. bulbifera*, *D. esculenta*, *D. oppositifolia*, *D. pentaphylla*, *D. tomentosa* and *D. wallichii* were evaluated for its nutritional quality. Most of them were found to be a good source of protein, lipid, crude fibre, starch and minerals. They observed that autoclaving process was best for removal of antinutritional factors and that help to improve its digestibility.

Nutraceutical evaluation of some wild edible tuberous plants.

Aberoumand (2009) studied the preliminary nutritional assessment of wild edible plants such as *Asparagus officinalis*, *Chlorophytum comosum*, *Cordia myxa*, *Portulaca oleracia*, *Solanum indicum*, *Alocasia indica*, *Eulophia ocherata* and *Momordica dioica*. They reported mineral element and antioxidant phenolic compound levels. Among these tubers of *A.officinalis*, *C.comosum*, *E.ocherata* and leaves of *Portulaca oleracia* provide mineral concentration exceeding 2 % of the plant dry weight. that much higher than conventional edible vegetables and high level of antioxidants in leaves of *P.oleracea*. These plants were contributed the nutritional components of Pune and Behbahan people. They revealed that the plants have rich source of essential nutrients for human consumption and provided evidence that these local traditional vegetables do not require formal cultivation. Further they suggested sampling and additional analysis along with certified reference materials would be necessary to establish definite values for nutrient composition.

Wehmeyer (1986) worked on 300 species of wild edible plants of Southern Africa. Among these *Brachystelma sp.* and *Ceropegia sp.* were two of them. These tubers were providing higher energy value. Although species of *Amaranthus*, *Urtica*, *Asteraceae* and *Chenopodium* leaves contain fairly high protein value. The protein of *Amaranthus* leaves, for instance, can supplement that of maize meal. The other former having lower sulphur amino acid content than maize protein that eaten together and a better quality of protein was provided. So these wild edible plants play a prime role in the diets of the population.

King and Gershoff (1987) observed nutritional evaluation of three underexploited Andean tubers such as *Oxalis tuberosa*, *Ullucus tuberosus* and *Tropaeolum tuberosum*. They observed high amount of variation in both protein and

Nutraceutical evaluation of some wild edible tuberous plants.

essential amino acids from previous published Andean tubers food value. They suggested that the need to carry out vigorous analysis of traditional farming practices of Andean tubers.

Schoeninger *et al.* (2000) pointed out nutritional composition of three wild edible species of tubers *Vigna frutescens*, *Eminia entennulifa* and *Ipomoea transvaalensis* consumed by Hadza foragers in Northern Tanzania. They noted these tubers were rich source of energy and contain edible portion ranged from 42.5 to 91.89 g 100g⁻¹ dry weight, protein 2.3-6.99 g 100g⁻¹ dry weight and 19.6-26.0 g 100g⁻¹ of starch. They suggested that these tubers were important consideration for energetic studies.

Lockett *et al.* (2000) came to know that the energy and micronutrients composition of dietary and medicinal wild plants consumed during drought in rural Fulani, Northeastern Nigeria. They analyzed commonly consumed species of edible wild barks, fruits, leaves, nuts, seeds and tubers for protein, fat, carbohydrate and minerals. They remarked that these edible wild plants were extremely important as food and medicine in rural Fulani diet. Among these roots of *Ficus thonningii* and *Ximenia americana* were eaten without processing or soaked in water in relieving stomach pain. Similarly, roots of *Ziziphus mauritania* were soaked in water, drunk to relieve diarrhea and *Gardenia aquatta* root soaked in water was eaten to cure impotency. Author revealed that wild edible plants used for both food and medicine but most important part of that provides additional calories and essential nutrients to diet during famine and drought.

Yildirim *et al.* (2001) search out nutrient content of wild plant species consumed as food in upper Coruh valley. They analysed *Plantago minor*, *Polygonum*

Nutraceutical evaluation of some wild edible tuberous plants.

bistorta, Astrodaucus orientalis, Camellina rumelica, Lathyrus tuberosus, Galium rotundifolium, Chenopodium album, Sisymbrium officinale. They observed the nutritional value of these wild plant parts was very high. They also reported that the dry matter, ascorbic acid, nitrogen, protein, phosphorus and potassium were also more in these plants. Among these, *Lathyrus tuberosus* is important source of ascorbic acid, protein, nitrogen, phosphorus and potassium. Also, they appreciated the importance of nutritional analysis of wild edible plants as locally consumed as vegetable.

Bhandari *et al.* (2003) studied the nutritional evaluation of wild yam (*Dioscorea spp.*) tubers of Nepal. The *D.bulbifera, D.versicolor, D.deltoidea, D.triphylla* tubers were analyzed which contained more crude fibre, crude fat, crude protein and found good source of dietary minerals. They observed that these wild yams are used as a good alternative source of food to alleviate hunger and malnutrition in Nepal. For well balanced diet author suggests the promoting of production of yams and its utilization.

Sekeroglu *et al.* (2006) studied nutritional values of wild plants vegetable in Eastern Black sea region of Turkey. The study was carried out on some abundantly consumed wild edible plants, such as *Trachystemon orientalis, Similax excelsa, Ornithogalum umbellatum, Amaranthus retroflexus, Aegopodium podagraria* and *Urtica dioica*. Among these the tuber of *O. umbellatum* with high amount of dry matter. They observed the mineral content and nutritional value of these plants were richer than that of the conventional vegetable crops. However, author revealed that rich chemical concentration and good cooking method got importance in diet nutrition.

Nutraceutical evaluation of some wild edible tuberous plants.

Ogbuagu (2008) studied the nutritive and antinutritive composition in the uncooked and cooked wild species of *D.bulbifera* and *D.dumetorum*. He observed that the wild yam contain all the food nutrients within the reported and accepted value for root and tuber crops. However, the cooking of these yam species reduced the alkaloid, oxalates and saponins. They observed that the wild yams serve as source of necessary nutrients and applied food for human and animals.

Alozie *et al.* (2009) studied amino acid compositions of *D.dumetorum* (edible and wild varieties). They observed the wild *D.dumetorum* was richer in amino acid content than that of edible variety and more beneficial in human and animal nutrition. However, both varieties of *D.dumetorum* were used as alternatives source to cereals. So that it was helpful to the nutritionist and chemist to find out addition food sources.

Ukpabi *et al.* (2009) studied wild Polynesian arrowroot (*Takka leontopetaloides*) in Nigeria and assessed for their tuber and starch characteristics. They evaluated the fresh and stored tubers for their relevant physico-chemical properties and starch functional properties. They observed potential usefulness of the starch in aqueous and hydrophobic food and drug system. Although they focused on flavanoid content investigation. So that they help to increase potential utilization of tubers in the local and regional food and feed industry after the elimination of tacca based bitter flavanoid content.

Poornima and Ravishankar (2009) evaluated the of phytonutrients and vitamin contents in a wild yam (*D.belophylla*). They observed that the wild yam contained bioactive compounds comprising saponins, alkaloids, flavanoids, tannins and phenols. So, it provides nutritive health promoting substances in food and herbal medicine.

Nutraceutical evaluation of some wild edible tuberous plants.

The medicinal uses and nutritional properties of wild species were frequently mentioned in above studies that deal primarily with the identification and evaluation of wild edibles. There was a strong relationship between food and medicine, so that in many cases the food use of a plant was not separable from its medicinal action. Therefore, a large number of plants mentioned are possessing recognized nutritional and therapeutic properties.

BRACHYSTELMA: *Brachystelma edulis*

The *Brachystelma* R.Br is one of the interesting genus of family Asclepiadaceae which is famous for its rarity and endemism. In flora of British India, Hooker (1883) recorded 7 species of *Brachystelma* out of them, 3 were originally described by Wight under the genus *Eriopetalum*. One was described by Beddome under the genus *Ceropegia* and remaining 3 were described by Hooker himself. Then Gamble (1923) recorded 6 species from south India. Cooke (1904) not recorded any species of this genus occurring within the limits of Bombay Presidency.

Since, many species have been added to the genus. About 14 species were recorded from India by Char (1978), Arekal and Ramakrishna (1981), Vajravelu (1987), and Yadav *et al.* (1992) as a new species. Similarly, *Brachystelma edulis* found in Thailand was recorded for first time from Maharashtra and forms new record for India (Yadav *et al.* 1989). Due to restricted distribution and tiny nature of the species, locating the species in field is not easy. Although its tuber is edible and destructed by wild animals like hares, rats, wild bears and men. Also, some new species have been described from various parts of the world by Dassana and Jayasuriya in 1975 and by Dyer in 1977, 1978, 1979.

Nutraceutical evaluation of some wild edible tuberous plants.

The *Brachystelma edulis* used by rural people as a source of famine food so they are extremely interesting from botanical point of view. As the species of this genus are growing in difficult habitat very little work has been done on botanical aspects.

Hedrick (1919) compiled the edible plants of the world. Among these *Brachystelma species* was one of them. He mentioned that its raw tubers were eaten as food by local inhabitants in South Africa.

Gaikwad and Yadav (2004) enumerated endemic flowering plant species of peninsular India that occur in Maharashtra. They reported number of neglected endemic plants were used as ornamental, medicines and some of them commercial value. *Brachystelma* was one of them tuberous rootstock with rich food values and suggested by them for further propagation, domestication and cultivation of these endemic plants were two fold benefits for sustainable utilization and conservation biodiversity.

There is lot of work has been done on morphology and taxonomy of the *Brachystelma edulis* species. Patil (1990) studied the morphotaxonomy of the asclepiadaceae genus *Brachystelma* and attempted them under cultivation in botanical garden through tubers and seeds. They observed various morphological characters of *Brachystelma edulis* Such as the flowering were hysternanthus and synanthus. The corona is biseriate and staminal with outer corona copular of 5 emarginate lobes that glabrous outside but hairy inside and along margins or rarely entirely hairy and inner corona of 5 dark purple procumbent processes which bent upon stigma, usually glabrous. He reported the tuber of this species is eaten as food by rural people in Satara and Kolhapur district.

CEROPEGIA: *C.bulbosa* and *C.hirsuta*

The genus *Ceropegia* Linn. is one of the largest genera of asclepiadaceae consisting of about 200 species which distributed over most of the Africa, Madagascar, Arabian peninsular, the Indian subcontinent, the far east and into the Northern part of Australia. The genus *Ceropegia* was first time proposed by Linnaeus. He distinguished this genus from allied genera for its tubular corolla which is swollen at base and funnel shaped and the corolla lobes more or less connate at the tip. In recent revision of Indian species of *Ceropegia* Ansari (1984) reported 44 species out of which 28 are endemic to India. In Maharashtra 22 species are recorded out of which 17 species are endemic to Maharashtra. Many species of *Ceropegia* are famous for its rarity and endemism. In that *C. bulbosa var.bulbosa* and *C.hirsuta* are comparatively found more common and distributed throughout India.

The studies on the occurrence, taxonomy and distribution of *Ceropegia* species has been done by various workers like Blatter and McCann (1933), Santapau (1948), Santapau and Irani (1958,1960), Kanodia and Reddy (1964), Vakatareddi (1968), Hemadri (1968), Wadhawa and Ansari (1968), Ansari (1968,1969,1971,1972), Ansari and Kulkarni (1980), Hemadri and Ansari (1971), Sabnis and Bedi (1971), Raghavan and Ansari (1975).

The genus *Ceropegia* is economically important because their tuberous roots are eaten as a food or medicine. The tubers of *Ceropegia bulbosa var.bulbosa* and *C.hirsuta* are starchy and somewhat bitter in taste. The ethnobotanical study of *Ceropegia* has been done in different regions on both species *Ceropegia bulbosa var.bulbosa* and *C.hirsuta*.

Nutraceutical evaluation of some wild edible tuberous plants.

Hedrick (1919) compiled the edible plants of the world. Among these they reported the *Ceropegia bulbosa* plants were eaten in every part by men in East Indies and similarly, *C. hirsuta* root are eaten raw as food in East Indies.

Varghese (1996) worked on Kharias of central India and reported that *Ceropegia hirsuta* tubers were edible and applied medicinally warm tuber can mumps i.e. viral infection which causes acute inflammation of parotid gland and consequent swelling of neck and face, although its raw tubers are eaten to cure phthisis. Similar work has been done by Tripathi (2000) and Jagtap *et al.* (2008).

Studies conducted by Chuakul and Boonpleng (2004) on the utilization of medicinal plants at Ubon Ratchathani Province (Thailand) recorded about 96 species of medicinal plants belonging to 42 families. Among these *Ceropegia hirsuta* was one of them. Its decoction of whole plant was used for bodily discomfort. They appreciated the need of discoveries in natural resources of potentially valuable pharmaceuticals.

Kamble and Yadav (2005) studied a comprehensive account of wild asclepiads of ornamental potential from Maharashtra. They observed the flowers of *Ceropegia hirsuta* was ornamental attraction and noted that it can be propagated by seeds/tuber and got flowering from July-Nov. Also, they remarked that its tubers are eaten by cowboys as a food supplement.

The ethnobotanical survey of Sitamata Wildlife Sanctuary, Rajasthan was carried out by Jain *et al.* (2005). They documented about 243 genera belonging to 76 families which were used as primary health care to cure various ailments. Out of 243 plants species, 40 are shrubs, 31 are climbers and 20 are tuberous plants. Among these plants *Ceropegia bulbosa* tubers were used to increase fertility and vitality. They

Nutraceutical evaluation of some wild edible tuberous plants.

evaluated medicinal use and provided safety and efficacy information for people and also encouraged the preservation of culture, tradition, conservation and sustainable utilization of plant wealth.

Ishtique *et al.* (2007) carried out similar type of study in the Samahni Valley and observed local inhabitants used many plants as ethnomedicinal herbs and as food medicines. About 95 plant species were recorded which belong to 38 families. Among these *Ceropegia bulbosa* roots were used as tonic for digestion and good source of energy, it is also cooked as vegetable and sometimes eaten as raw. They provided efforts for preservation of tradition and culture on one hand and on other hand helped in conservation of biodiversity and initiation of incentives for phytochemical investigation on medicinal plants to develop and produce new drugs. Similar work was done by Reddy *et al.* (2007).

The *Ceropegia bulbosa* not only used as ethnomedicinally but also used as ethnoveterinary. A study of folk ethnoveterinary practices of Udaipur district of Rajasthan was carried by Nag *et al.* (2007), where they reported about 30 diseases of domestic animals and their treatment by 62 plant species. In which treating all kinds of tumour formation in goats, *C.bulbosa* leaves were given as fodder. Author revealed that indigenous animal healthcare practices mitigate the inadequacy in modern veterinary infrastructure, ensure resource conservation and save expenditure through minimal investment. Therefore, it was necessary to maintain bioresources so that these practices were also continued.

Ethnobotanical survey of Rajasthan by Chaudhary *et al.* (2008) documented the therapeutic properties of plants to cure various diseases of human and pets. The *Ceropegia bulbosa* was one of them containing high nutritive value so that it used as

Nutraceutical evaluation of some wild edible tuberous plants.

food and widely medicinally cure various ailments of ear and urinary systems in the tribal. Similarly, *Ceropegia hirsuta* tubers used as a food as well as antidote by tribals. Various plants have dual significance, firstly they are promising future food, secondly these medicinal tuberous plants can have some active constituents for future pharmaceutical analysis. So they appreciated the need for inventorying and recording all ethnobotanical information among the diverse ethnic communities.

Auti and Jagdale (2008) compiled medicinally important 50 species belonging to 27 families traditionally used to cure different ailments from Mula dam region, Ahmednagar district (Maharashtra). Among these *Ceropegia hirsuta* was one of them. Its tubers are used in diarrhea, dysentery and tonic in bowel complaints and second of them *C. bulbosa* tubers are used in cold, eye diseases to cause sneezing. They observed phytotherapy seems to be one of the remedial measures for the tribals inhabiting the area.

Jagtap *et al.* (2009) compiled ethnomedicinal usage of plants used to cure various diseases by Pawra tribe of Satpura hills of Maharashtra. They described 79 plant species belonging to 59 families. Among these fresh 3-4 leaves of *Ceropegia hirsuta* were chewed to cure stomachache. They revealed that medicinal plants play a vital role in primary healthcare of the pawra people and the knowledge received from them was very useful in further research in order to evaluate their effectiveness and usefulness to cure the diseases.

A study conducted by Patil (1990) on morphotaxonomy of the genus *Ceropegia* observed the morphology, anatomy, cuticular, trichome and starch characters of both species. Both varieties were comparatively more common and found distributed throughout Maharashtra. He observed that leaf of *C. bulbosa* are

Nutraceutical evaluation of some wild edible tuberous plants.

thick, fleshy, isobilateral and amphistomatic and in *C.hirsuta* are dorsiventral and hypostomatic. The trichomes are absent in *C.bulbosa* and long, elongated, uniseriate observed in *C.hirsuta*. In stem anatomy he observed little development of mechanical tissue and secondary xylem with the starch grain in *C.hirsuta* and without starch grain in *C.bulbosa*.