Indian J. Pl. Genet. Resources 1(1&2) : 98-102

Genetic Resources of Medicinal Plants

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About 35 medicinal plants are extensively collected from the wild growing populations. These have acquired the status of vulnerable types. The current programme on collection, evaluation and domestication of medicinal plants under the ICAR system is given. There is need to develop a net-work of collaborative institutions to hasten collection and ultimate domestication of superior types suited to different agriculture and agro-forestry systems. Systematic management of genetic resources of medicinal plants is required.

India has a long and ancient history on the use of plants in the Ayurvedic system of medicine. A few of these species which generated bulk demand in medicine within the country and for export, were introduced into commercial agriculture. However, the native systems of Ayurveda, Unani and Siddha medicine still depend largely on collection of wild growing populations in the forests. It is estimated that over 5,000 large and medium scale pharmacies cater to the needs of indigenous system of medicine and produce drugs valued over Rs. 1,000 million annually. The Central Council of Research in Ayurveda and Siddha medicine has drawn a list of 243 commonly used medicinal plants having bulk demand for manufacture of gelanicals, mixtures, compound formulations and patent medicines. The cumulative effect of all this expansion is gradual depletion of natural populations of medicinal plants, which are under threat. This paper highlights certain aspects of management of genetic resources of medicinal plants in India. Timely efforts are required in collection, evaluation and conservation of existing diversity.

THREATENED MEDICINAL PLANTS

The Government has notified ban on collection of wild growing populations of *Rauvolfia serpentina, Coptis teeta, Dioscorea deltoidea* (and *D. prazerii*), *Podophyllum hexandrum, Rheum austrata* (syn. *R. emodi*), *Inula racemosa, Aconitum deinorrhizum* and *Colchicum luteum*. However, these legislative measures have failed to reduce the threat of loss of genetic diversity present in the forests and the crude drugs based on these species are available for sale in varying quantities in the markets in small towns. In general, there is absence of developmental schemes drawn to improve biological productivity of these plants in the reserve and protected forests. In the absence of proper development and management programmes, large populations of some of these medicinal plants, with growing

market demands, are gradually vanishing and, therefore, have been categorised as endangered species.

Endangered species : This category includes those medicinal plants whose distribution has been reduced to a critical level in the known habitats and the species are in immediate danger of extinction unless the causal factors operating against their growth and spread in the region are removed. These species include : *Aristolochia bracteata* (and *A. indica*), *Aconitum deinorrhizum, Commiphora stocksiana, Chlorophytum arundinaceum, Coptis teeta, Colchicum luteum, Dioscorea deltoidea* (and *D. prazerii*), *Ephedra gerardiana, Inula racemosa, Nardostachys grandiflora, Podophyllum hexandrum, Rauvolfia serpentina, Rheum austrata* and *Saussurea sacra.*

Vulnerable species : These taxa belong to those groups of threatened plants where the populations are still large but are decreasing fast due to over-exploitation for economic gains. These are : *Atropa acuminata, Aconitum heterophyllum* (*A. chasmanthum. A. violaceum, A. ferox*, etc.), *Carum bulbocastranum, Commiphora wightii, Curculigo orchiodes, Coleus forskohlii, Clerodendron serratum, Ferula jaeschkeana, Gymnema sylvestre, Gloriosa superba, Gentiana kurroo, Habenaria intermedia, Hemidesmus indicus, Microstylis nucifera, Mesua officinalis, Piper cubeba, Picrorhiza kurroa, Orchis latifolia, Swertia chirayita, Thymus serphyllum* and *Urgenia indica.*

The author has earlier described medicinal plant components of Indian forests and listed those which command larger commercial demand in local trade and for export (Gupta, 1977; 1982). Ecologlcal studies on their distribution has now established that over-exploitation of these herbs for trade is the main reason for loss of their populations in the forest habitats viz. of Chirayata herb (*Swertia chirayita*), Aconite tuber (*Aconitum chasmanthum, A. violaceum, A. heterophyllum*), Gentian root (*Gentiana kurroo* and *Picrorhiza kurroa*), Indian Podophyllum (*Podophyllum hexandrum*), Spikenard root (*Nardostachys grandiflora*), Valerian root (*Valeriana grandiflora*), Coptis herb (*Coptis teeta*), Berberis root and berberine sulphate (ex. *Berberis aristata*), Nux-vomica seed (*Strychnos nux-vomica*), *Kaladana* (*Ipomoea hedracea*) and *Unnab* fruits (*Zizyphus sativa*) etc. In addition, *Gudmar* herb (*Gymnema sylvestre*), Squill bulbs (*Urgenia indica*), *Gloriosa* seed (*Gloriosa superba*) and a few others also find regular market abroad in recent years but their demand fluctuates widely. One can guage the growing demand of certain items considering the projection that the market received between 500 to 2,000 tonnes of *Safed musli* (*Chlorophytum tuberosum*) in a year and this is based on a mixture of 6 to 10 species from western and central India. The demand for Gugglu gum has gone high, estimated between 300 to 500 t per annum. It is found that the country imported 50 t Gugglu gum from Pakistan in 1986 and onwords. The demand for *Kapoor Kachri* (*Hedychium spicatum*) and *Pipli* (*Piper longum*) is met partly through imports from Bangla Desh and Indonesia. Even *Rasna* (*Alpinia officinalis*) is imported from Sri Lanka and a large part of demand of Chirayata, estimated between 3000 to 5000 t per annum, is met by import from Nepal. The demand of *Kalmegh* (*Andrographis paniculata*) has risen to 100 t due to its wider use in liver toning preparations. Even demand of *panchang* of *Kantakari* (*Solanum*

xanthocarpum) is estimated around 500 t per annum. The Bombay market and neighbourhood receive between 300 t to 500 t of Giloe stem (*Tinospora cordifolia*) and 500 t of Ashoka wood (*Ashoka indica*) and the produce is found to be a mixture of several allied species.

COLLECTION AND EVALUATION

The variation in form and content of a large number of medicinal taxa found in nature suggests existence of distinct morphological and chemical forms in *Ocimum basilicum, Cymbopogon flexuosus, Solanum viarum, Rauvolfia serpentina, Artemisia maritima, Taraxacum officinalis, Acorus calamus*, etc. In some cases, these variations have shown promise of commercial preference in pharmaceutical industry but unfortunately no institution maintains such collection of variants. There appears to be no organised attempt on collection of genetic diversity in medicinal plants except that reported on *Dioscorea deltoidea* and *Rauvolfia serpentina*. However, under the All India Coordinated Research Project on Medicinal and Aromatic Plants, systematic collections were made on certain species commercially cultivated in India such as *Psyllium*, Senna, Opium poppy, *Asgand*, Palmarosa and Vetiver. These population samples have been evaluated under multi-location trials for a set of agro-botanical and chemical characters. As such, superior genotypes have been identified in *Psyllium* (Gujarat Isabgol-1), Opium Poppy (Trishna), Palmarosa oil grass (IW-31245), *Asgand* (WS-20) and Vetiver (NC-60416) and some of these have been released for commercial cultivation.

In the last two years, the Project has developed a small programme on collection and evaluation of relatively important native medicinal plants whose demand is met by collection made in the forests but which could possibly be cultivated due to their large demand. The Udaipur centre has done intensive collection of *Chlorophytum tuberosum* (*Safed musli*) in Udaipur division (Rajasthan) and Indore centre in Indore and Jhabua divisions (MP); the evaluation of over 140 populations in augmented design indicated a wide range of variability in size of flowering spathe, number of flowers, colour of flower, number, size and dry weight of tubers per plant. The Anand centre collected 55 population samples of *Commiphora wightii* (*Gugglu* tree) from Kutch and Agriculture College, Jobner collected over 58 population samples of this species from 11 districts of Rajasthan. *C. stocksiana* has been located in Kutch and its plants, raised through stem cuttings, are under evaluation. A small collection programme for *Swertia chirayita* and *Valeriana grandiflora* has been initiated at Solan centre in the Shimla hills and rooted plants are brought and raised there for study on comparative growth, yielding ability and contents under cultivation. Initial studies on *Valerian* have shown that transplanted plants grew vigorously under partial shade of several tree species at Solan. These flowered and produced fruits and seeds. Similar collection work was taken up at NBPGR, Delhi on *Coleus forskohlii* from UP hills (8 lines), *Urgenia indica* (squill) from Rajasthan and UP hills (18 lines) and *Aloe barbadensis* from Delhi (7 lines). A preliminary evaluation of squill material has shown great diversity for tuber size and total glycoside content. In particular,

the fresh tuber weight was recorded upto 700 g from wet habitats, whereas the arid tracts of Rajasthan produced small sized tubers but gave high total glycoside content. Similarly, the *Aloe* material showed total barbaloin ranging from 0.008 to 6.04% but the variation in forskolin content in *Coleus* tubers was not much. The genetic resources programme on medicinal plants in India needs an integrated team of Economic Botanist, Breeder and Organic Chemists to characterise and document the existing diversity found in nature. The medicinal plants are our national heritage and the indigenous medical systems possesses an store-house of valuable information that can help combat diseases and sufferings and therefore, should receive high national priority.

The countries of south, south-east and west Asia largely depend upon local medicinal plants for primary health care needs of their teeming populations. It is therefore, interesting to record that many common species or their allies are prescribed for same ailments in the national pharmacopoeias of this region. Despite this common heritage of medicinal plants, the trade in raw materials and products used in traditional medicine is meagre amongst the Asian republics. Most of these countries export herbs, and the phytochemicals derived from them, to European countries and compete amongst themselves. This is another reason for unstable market conditions both in demand and price which has largely extinguished enterpreneurs efforts for their domestication into regular agriculture. We have not made any efforts for joint exploration for collection and evaluation of genetic resources of commercially important medicinal plants, which transcend national boundaries in distribution for fear of loss of immediate export trade. It is time that we take a long range view of the entire plant genetic resources activity on medicinal plants in this region and draw a collaborative plan by identifying species having large demand both in the region and in world trade. This programme will help to collect, evaluate, document and conserve the existing genetic diversity in this group of plants found in the region which we are losing due to lack of imaginative planning and short term gains. An important element of this programme is to conserve the germplasm under long and medium term storage in different genebanks to make it available to the countries of the region. Gupta and Sethi (1984) have given a broad out-line procedure for *ex-situ* and *in-situ* conservation of important medicinal plant species for the Himalayas. It may be pointed out that enrichment of these resources will benefit the entire region and the humanity at large. A long-term international funding of this activity in the region will not only forge cooperation to share the resources but energise the programme of better health-care for all by the end of this century.

MANAGEMENT ASPECTS

The genetic resources management in medicinal plants will not be complete unless useful and high yielding lines are identified through multi-location testing and are placed into cultivation in agriculture, and forestry sectors. Cultivation, in turn would attract attention for concentrating efforts on crop improvement for yield and quality. These new crops could be integrated into local cropping systems

both rainfed and irrigated. Exploratory studies carried out in this field on medicinal plants in India have given encouraging results in different regions in the country (Gupta, 1984; Gupta and Pareek, 1985; Pareek and Gupta, 1988).

The domestication of perennial crops including trees demands longer period and space. It has been reported that selection of plus trees through provenance trials have upgraded yield by 20 to 30 per cent. The introduction of medicinal plants into different agro-forestry systems in India will provide both opportunties and challenges. The success in raising of medicinal plants as part of silvi-horticultural systems in India has been demonstrated (Gupta, 1987). The importance of these plants can be easily estimated when we realise that around 40 plant species provide starting raw materials for all medicinal products in modern medicine that generate commercial sales averaging 500 million US dollars annually.

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