

Current status of herbal and their future perspectives

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Abstract

Traditional medicine is the synthesis of therapeutic experience of generations of practicing physicians of indigenous systems of medicine. Throughout the history of mankind, many infectious diseases have been treated with herbals. The traditional medicine is increasingly solicited through the tradipractitioners and herbalists in the treatment of infectious diseases. Among the remedies used, plant drugs constitute an important part. A number of scientific investigations have highlighted the importance and the contribution of many plant families i.e. Asteraceae, Liliaceae, Apocynaceae, Solanaceae, Caesalpinaceae, Rutaceae, Piperaceae, Sapotaceae used as medicinal plants. Medicinal plants play a vital role for the development of new drugs (export and import diverse parts or bioactive compounds in the current market). The bioactive extract should be standardized on the basis of active compound. The bioactive extract should undergo limited safety studies.

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1. Introduction

India is one of the 12 mega biodiversity centres having 45, 000 plant species; its diversity is unmatched due to the 16 different agroclimatic zones, 10 vegetative zones, and 15 biotic provinces. The country has a rich floral diversity (Table 1).

Table 1: Floral diversity in India.

Numbers	Species
15, 000 - 18, 000	Flowering plants
23, 000	Fungi
25, 000	Algae
1,600	Lichens
1,800	Bryophytes
30 million	Microorganisms

Traditional medicine is the synthesis of therapeutic experience of generations of practicing physicians of indigenous systems of medicine. Traditional preparation comprises medicinal plants, minerals and organic matters etc. Herbal drug constitutes only those traditional medicines that primarily use medicinal plant preparations for therapy. The ancient record is evidencing their use by Indian, Chinese, Egyptian, Greek, Roman and Syrian dates back to about 5000 years (Table 2). About 500 plants with medicinal use are mentioned in ancient texts and around 800 plants have been used in indigenous systems of medicine. Indian subcontinent is a vast repository of medicinal plants that are used in traditional medical treatments (Chopra *et al.*, 1956), which also forms a rich source of knowledge (Nadkarni, 1982; Jone, 1984). The various indigenous systems such as Siddha, Ayurveda, Unani and Allopathy use several plant species to treat

different ailments (Rabe and Staden, 1997). In India around 20,000 medicinal plant species have been recorded recently (Dev, 1997), but more than 500 traditional communities use about 800 plant species for curing different diseases (Kamboj, 2000). Currently 80 % of the world population depends on plant-derived medicine for the first line of primary health care for human alleviation because it has no side effects (Veale *et al.*, 1992). Plants are important sources of medicines and presently about 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient. In the last century, roughly 121 pharmaceutical products were formulated based on the traditional knowledge obtained from various sources (Anesini and Perez, 1993).

2. Modern medicine from higher plants

Medicinal plants play a vital role for the development of new drugs. During 1950-1970 approximately 100 plants based new drugs were introduced in the USA drug market including deserpidine, reseinnamine, reserpine, vinblastine and vincristine which are derived from higher plants. From 1971 to 1990 new drugs such as ectoposide, E-guggulsterone, teniposide, nabilone, plaunotol, Z-guggulsterone, lectinan, artemisinin and ginkgolides appeared all over the world. 2% of drugs were introduced from 1991 to 1995 including paciltaxel, toptecan, gomishin, irinotecan etc. Plant based drugs provide outstanding contribution to modern therapeutics; for example: serpentine isolated from the root of Indian plant *Rauwolfia serpentina* in 1953, was a revolutionary event in the treatment of hypertension and lowering of blood pressure. Vinblastine isolated from the *Catharanthus rosesus* (Farnsworth and Blowster, 1967) is used for the treatment of

Hodgkins, choriocarcinoma, non-hodgkins lymphomas, leukemia in children, testicular and neck cancer. Vincristine is recommended for acute lymphocytic leukemia in childhood advanced stages of hodgkins, lymphosarcoma, small cell lung, cervical and breast cancer. (Farnsworth and Bingel, 1977). Phophyllotoxin is a constituent of *Phodophyllum emodi* currently used against testicular, small cell lung cancer and lymphomas. Indian indigenous tree of *Nothapodytes nimmoniana* (*Mappia foetida*) are mostly used in Japan for the treatment of cervical cancer (Table 3). Plant derived drugs are used to cure mental illness, skin diseases, tuberculosis, diabetes, jaundice, hypertension and cancer. Medicinal plants play an important role in the development of potent therapeutic agents. Plant derived drugs came into use in the modern medicine through the uses of plant material as indigenous cure in folklore or traditional systems of medicine. More than 64 plants have been found to possess significant antibacterial properties; and more than 24 plants have been found to possess antidiabetic properties (Arcamone *et al.*, 1980), antimicrobial studies of plants (Perumal Samy and Ignacimuthu, 1998; 1999 and Perumal Samy *et al.*, 2006), plant for antidotes activity - *Daboia russellii* and *Naja kaouthia* venom neutralization by lupeol acetate isolated from the root extract of Indian sarsaparilla *Hemidesmus indicus* R.Br (Chatterjee, *et al.*, 2006). Which effectively neutralized *Daboia russellii* venom induced pathophysiological changes (Alam *et al.*, 1994). The present investigation explores the isolation and purification of another active compound from the methanolic root extract of *Hemidesmus indicus*, which was responsible for snake venom neutralization. Antagonism of both viper and cobra venom and antiserum action potentiation, antioxidant property of the active compound was studied in experimental animals. Recently, Chatterjee *et al.* (2004) from this

laboratory reported that an active compound from the *Strychnus nux vomica* seed extract, inhibited viper venom induced lipid peroxidation in experimental animals. The mechanism of action of the plant derived micromolecules induced venom neutralization need further attention, for the development of plant-derived therapeutic antagonist against snakebite for the community in need. However, the toxicity of plants has known for a long period of time, and the history of these toxic plants side by side with medicinal ones are very old and popular worldwide, they considered the major natural source of folk medication and toxication even after arising of recent chemical synthesis of the active constituents contained by these plants (Adailkan and Gauthaman, 2001; Heinrich, 2000; Pfister et al., 2002).

Table 2: Plant derived ethnotherapeutics and traditional modern medicine.

S.No.	Drug	Basic investigation
1.	Codeine, morphin	Opium the latex of <i>Papaver somniferum</i> used by ancient Sumarians. Egyptians and Greeks for the treatment of headaches, arthritis and inducing sleep.
2	Atropine, hyoscyamine	<i>Atropa belladonna</i> , <i>Hyascyamus niger</i> etc., were important drugs in Babylonium folklore.
3	Ephedrine	Crude drug (astringent yellow) derived from <i>Ephedra sinica</i> had been used by Chinese for respiratory ailments since 2700 BC.
4	Quinine	<i>Cinchona spp</i> were used by Peruvian Indians for the treatment of fevers
5	Emetine	Brazilian Indians and several others South American tribes used root and rhizomes of <i>Cephaelis spp</i> to induce vomiting and cure dysentery.
6	Colchicine	Use of Colchicum in the treatment of gout has been known in Europe since 78 AD.
7	Digoxin	Digitalis leaves were being used in heart therapy in Europe during the 18 th century.

Table 3: Some of the important medicinal plants used for major modern drugs for cancer.

Plant name/family	Drugs	Treatment
<i>Cathranthus rosesus</i> L. (Apocynaceae)	Vinblastine and vincristine	Hodgkins, Lymphosarcomas and children leukemia.
<i>Podophyllum emodi</i> Wall. (Beriberidaceae)	Podophyllotaxin,	Testicular cancer, small cell lung cancer and lymphomas.
<i>Taxus brevifolius</i> (Taxaceae)	Paciltaxel, taxotere	Ovarian cancer, lung cancer and malignant melanoma.
<i>Mappia foetida</i> Miers.	Comptothechin, lrenoteccan and topotecan	Lung, ovarian and cervical cancer.
<i>Comptothecha acuminata</i>	Quinoline and comptothechin alkaloids	used in Japan for the treatment of cervical cancer
<i>Juniperus communis</i> L. (Cupressaceae)	Teniposide and etoposie	Lung cancer

Teniposide and etoposide isolated from *Podophyllum* species are used for testicular and lung cancer. Taxol isolated from *Taxus brevifolius* is used for the treatment of metastatic ovarian cancer and lung cancer. The above drugs came into use through the screening study of medicinal plants because they showed less side effects, were cost effective and possessed better compatibility.

3. Market potential of phytomedicine

The estimation of total phytomedicine sale reported in country wise European Union was about US\$ 6 billion in 1991 and \$ 4 billion in 1996, of which almost half were sold in Germany \$ 3 billion, in France \$ 1.6 billion, in Italy \$ 0.6 billion and in Japan \$ 1.5 billion. The present global market (Table 4) is said to be US 250 billion (Brower *et al.*, 1998). In India the sale of total herbal products is estimated at \$ 1 billion and the export

of herbal crude extract is about \$ 80 million, of which 50% is contributed by Ayurvedic classical preparations. Plant derived drugs are important in Germany and Russia. Particularly, herbal drugs are imported by several countries for their usage of traditional medicinal preparation from various parts of the country (Table 5). Some of the important Indian medicinal plants exported to various countries are reported (Table 6.).

Table 4. Market size of phytomedicine and their sale in US Dollar.

S.No.	Country	Years	Drugs sales in US \$ (billion)
1	Europe	1991	6
	Germany		3.0
	France		1.6
	Italy		0.6
	Others		0.8
2	Europe	1996	10.0
3	USA	1996	4.0
4	India	1996	1.0
5	Other countries	1996	5.0
6	All countries	1998	30.0 - 60.0

Table 5. Percentage of herbal drugs imported by various countries for drug preparation

Country	Percentage of herbal drugs imported
China	45%
USA	15.6%
Australia	10.5%
India	3.7%
South Korea	1.4%
Taiwan	1.7%
Indonesia	8.1%

Table 6. Medicinal plant parts exported from India, importing medicinal plants and their parts.

Exporting of herbals		Importing of herbals	
Botanical names	Parts used	Botanical name	Parts used
<i>Acorus calamus</i>	Rhizome	Aloe vera	Dried leaf
<i>Argemone mexicana</i>	Fruit	Adhatoda vasica	Whole plant
<i>Curcuma amada</i>	Rhizome	<i>Cinnamomum iners</i>	Bark and leaf
<i>Curcuma longa</i>	Rhizome	Curcuma aromatica	Rhizome
<i>Curcuma aromatica .</i>	Wild turmeric	<i>Garcinia indica</i>	Fruit
Cassia lanceolata	Leaves	<i>Gloriosa superba</i>	Tuber and seed
<i>Glycyrrhiza glabra</i>	Root	<i>Juniperus communis</i>	Fruit

<i>Withania somnifera</i>	Vegetable rennet	<i>Myrica nagi</i>	Bark
<i>Myrica nagi</i>	Leaf	<i>Strycnos nux-vomica</i>	Bark and seed
<i>Piper longum</i>	Fruit	<i>Phyllanthus amarus</i>	Fruit
<i>Rubia cordifolia</i>	Madder root	<i>Ricinus communis</i>	Seed
<i>Symplocos racemosa</i>	Bark	<i>Rauwolfia serpentina</i>	Root
<i>Swertia chirata</i>	Whole plant	<i>Ocimum sanctum</i>	Leaf and essential oil
<i>Terminalia chebula</i>	Bark and seed	<i>Tylophora purpuria</i>	Root
<i>Zingiber officinale</i>	Rhizome	<i>Vinca rosea</i>	Leaf, seed and stem
-	-	<i>Wedelia calendula</i>	Leaf and root
-	-	<i>Withania somnifera</i>	Tuber

Important medicinal plants and their parts used for the preparation in indigenous systems of Indian medicines are reported in table 7.

5. Role of World Health Organization (WHO) in phytomedicine medicine

In 1991 WHO developed guidelines for the assessment of herbal medicine, and the 6th International Conference of Drug Regulatory Authorities held at Ottawa in the same year ratified the same. The salient features of WHO guidelines are: 1). **Quality assessment:** Crude plant materials or extract plant preparation and finished product. 2). **Stability:** Shelf life. 3). **Safety assessment:** Documentation of safety based on experience and

toxicological studies. 4). **Assessment of efficacy:** Documented evidence of traditional use and activity determination (Animals and human).

6. Standardization of phytomedicine

In the traditional system of medicine, the drugs are primarily dispensed as aqueous or ethanol extract. Fresh plant juice or crude extract are a rarity rather than a rule. The medicinal plants should be authentic and free from harmful materials like pesticides, heavy metals, and microbial and radioactive contamination. The medicinal plant should be single solvent extraction once or repeatedly or aqueous extract or as described in the ancient texts. The extract should be then checked for biological activity in experimental animal models. The bioactive extract should be standardized on the basis of active compound (Table 7). The bioactive extract should undergo limited safety studies.

Table .7 The major traditional sector of pharmaceutical companies.

S.No	Traditional sector pharmas	Modern sector pharmas	Standardization of phytomedicine (formulation)
1	Himalaya	Ranbaxy	Chromatography techniques
2	Zandu	Lupin	Thin Layer chromatography (TLC)
3	Dabur	Allembic	UV - Spectrophotometer
4	Hamdard	-	High Performance of Liquid Chromatography (HPLC)
5	Maharishi	-	Nuclear Magnetic Resonance spectroscopy (NMR)

7. New sources of tribal medicine for future investigation

Tribal healers in most of the countries, where ethnomedical treatment is frequently used to treat cut wounds, skin infection, swelling, aging, mental illness, cancer, asthma,

diabetes, jaundice, scabies, eczema, venereal diseases, snakebite and gastric ulcer, provide instructions to local people as how to prepare medicine from herbal (Puspangadan and Atal, 1984; Waller, 1993; Perumal Samy and Ignacimuthu, 1998-1999; Perumal Samy et al., 2006). They keep no records and the information is mainly passed on verbally from generation to generation (Dhar *et al.*, 1973; Sofowara, 1982). World Health Organization (WHO) has shown great interest in documenting the use of medicinal plants used by tribals from different parts of the world (Kaido *et al.*, 1987). Many developing countries have intensified their efforts in documenting the ethnomedical data on medicinal plants. Research to find out scientific evidence for claims by tribal healers on Indian herbs has been intensified. Once these local ethnomedical preparations are scientifically evaluated and disseminated properly, people will be better informed regarding efficacious drug treatment and improved health status (Manandhar, 1987).

8. Conclusions

Determining the biological (activity) properties of plants used in traditional medicine is helpful to the rural communities and informal settlements. Several authors are currently being undertaken to isolate the active compound(s) by bioassay-guided fractionation from the species that showed high biological activity during screening. Therefore, these scientific investigations may be utilized to develop drugs for these diseases. Further research is deserved to isolate the compounds responsible for the observed biological activity.

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