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Origins of Plant Derived Medicines

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Abstract

This review article describes the origins of plant derived medicines that have been developed as a result of traditional knowledge being handed down from one generation to the next. Various industries are now searching into sources of alternative, more natural and environmentally friendly antimicrobials, antibiotics, diabetics, antioxidants and crop protection agents. Medicinal plants have provided a good source of a wide variety of compounds, such as phenolic compounds, nitrogen compounds, vitamins, terpenoids and some other secondary metabolites, which are rich in valuable bioactivities, e.g., antioxidant, anti-inflammatory, antitumor, antimutagenic, anti-carcinogenic, antibacterial, or antiviral activities. Medicinal plants have become the main object of chemists, biochemist, and pharmaceutics. Their research plays an important role for discovering and developing new drugs that hopefully have more effectiveness and no side actions like most modern drugs.

Origin of Medicine

Fossil records revealed that the human use of plants as traditional medicine date back to middle Paleolithic age, approximately 60,000 years ago (Solecki *et al.*, 1975). The plants were used as flavors, foods, insect deterrents, ornamentals, fumigants, spices, and cosmetics (Kunin *et al.*, 1996; Pieroni *et al.*, 2004). Generally, the medicinally useful plants are sold as commodities in the market, and those that are sold for medicinal purposes dominate the market (Runner *et al.*, 2001). At present, natural products (and their derivatives and analogs) represent over 50% of all drugs in clinical use, in which natural products derived from higher plants represent *ca.* 25% of the total (Alandrin *et al*., 1998). The World Health Organization estimated that over 80% of the people in developing countries rely on traditional remedies such as herbs for their daily needs (Tripathi *et al.*, 2003), and about 855 traditional medicines include used crude plant extracts. This means that about 3.5 to 4 billion of the global population rely on plants resources for drugs (Farnsworth, 1988).

Many infectious diseases are known to be treated with herbal remedies throughout the history of mankind. The maximum therapeutic and minimum side effects of herbal remedies have demonstrated or verified in numerous scientific investigations. Even today, plant materials continue to play a major

role in primary health care as therapeutic remedies in many developing countries (Czygan, 1993; Ody, 1993).

Market Demands of Medicinal Plants

Nearly 95 percentage of plants used in traditional medicines are collected from forests and other natural sources. The plants collected from different sources show wide disparity in therapeutic values and also much variation in market rates. In the recent years there has been greater expansion of indigenous drug industry in India. Consequently the demand for the new material (medicinal plants) has enormously increased. According to latest estimate, there are about eight thousand licensed pharmacies of ISM in the country, engaged in the manufacture of bulk drugs to meet the requirement of people. The total annual requirement of the raw materials of these pharmacies was estimated to be thousands of quintals. This is presently met by cutting trees in the forest or uprooting herbs and shrubs either on nominal payment or unauthorized. Further, there is prime need to provide authentic or genuine drugs to manufacture standard medicine, as emphasized by earlier worker (Singh and Ghouse, 1993). The annual demand of the global market is $32 million of medicinal plants from developing countries. The herbal drug production in our country has been estimated to be rupees 4000 crores in the year 2000. Out of 15,000 - 20,000 medicinal plants, our rural communities use 7,000 - 7,500 medicinal plants. About 130 pure compounds, which are extracted from 100 species of higher plants of Indian origin, are used throughout the world. India can play a major role for supplying the raw herbs, standardized extracted materials and pure compounds isolated from natural resources (Mitra, 2002).

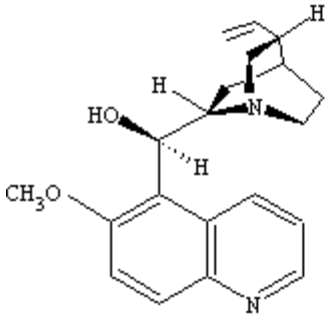
New medicines have been discovered with traditional, empirical and molecular approaches (Harvey, 1999). The traditional approach makes use of material that has been found by trial and error over many years in different cultures and systems of medicine (Cotton, 1996).

Table 1. Currently used Drugs in the United States that are obtained from flowering Plants.

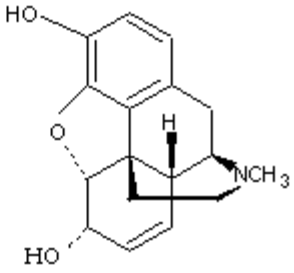
Plant Name	Family	Used Drugs
Ammi majus	Umbelliferae	Xanthotoxin[a]
Ananas comosus	Bromeliaceae	Bromelain
Atropa belladonna	Solanaceae	Belladonna Extract
Avena sativa	Gramineae	Oatmeal Concentrate
Capsicum species	Solanaceae	Capsicum Oleoresin
Carica papaya	Caricaceae	Papain
Cassia acutifolia	Leguminosae	Sennosides A + B
Cassia angustifolia	Leguminosae	Sennosides A + B
Catharanthus roseus	Apocynaceae	Leurocristine (vincristine) Vincaleukoblastine (vinblastine)
Cinchona species	Rubiaceae	Quinine
Citrus limon	Rutaceae	Pectin
Colchicum autumnale	Liliacae	Colchicine
Digitalis lanata	Scrophulariaceae	Digoxin,Lanatoside C, Acetyligitoxin
Digitalis purpurea	Scrophulariaceae	Digitoxin Digitalis whole leaf
Dioscorea species	Dioscoreaceae	Diosgenin
Duboisia myoporoides	Solanaceae	Atropine,Hyoscyamine Scopolamine

Ephedra sinica	Ephedraceae	Ephedrine, Pseudoephedrine
Glycine max	Leguminosae	Sitosterols
Papaver somniferum	Papaveraceae	Opium,Codeine,Morphine Noscapine, Papaverine
Physostigma venenosum	Leguminosae	Physostigmine (Eserine)
Pilocarpus jaborandi	Rutaceae	Pilocarpine
Plantago species	Plantaginaceae	Psyllium husks
Podophyllum peltatum	Berberidaceae	Podophyllin
Prunus domestica	Rosaceae	Prune Concentrate
Rauvolfia serpentine	Apocynaceae	Reserpine,Alseroxylon Fraction Powdered whole root Rauwolfia
Rauvolfia vomitoria	Apocynaceae	Deserpidine, Reserpine Rescinnamine
Rhamnus purshiana	Rhamnacee	Casanthranol
Rheum species	Polygonaceae	Rhubarb Root
Ricinus communis	Euphorbiaceae	Castor Oil, Ricinoleic Acid
Veratrum viride	Liliaceae	Veratrum viride Cryptennamine

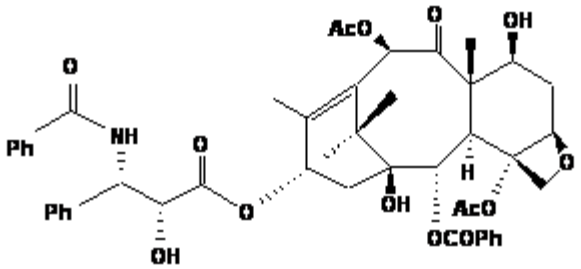
Natural products have provided many effective drugs. These include a wide range of older drugs such as quinine (Kremsner *et al*., 1994) and morphine (Benyhe *et al*., 1994) and newer drugs such as paclitaxel (Taxol™) (Wani *et al*., 1971), camptothecin (Wall *et al*., 1966), etoposide (Endo *et al*., 1976), mevastatin (Keller-Juslén, *et al*., 1971), and artemisinin (Klayman, 1985). Further evidence of the importance of natural products is provided by the fact that almost half of the world's 25 bestselling pharmaceuticals in 1991 were either natural product or their derivatives (O'Neill, 1993).



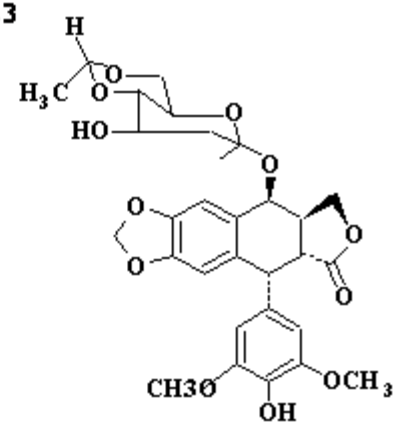
Quinine **1·1**

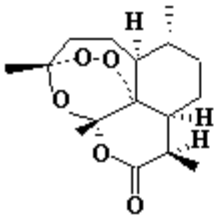


Morphine **1. 2**



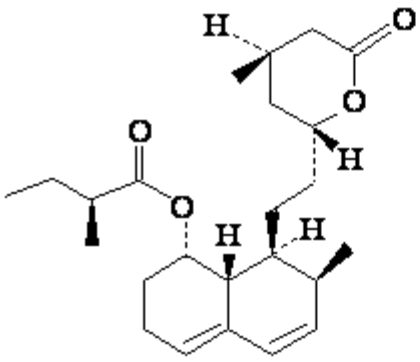
Paclitaxel (Taxol™) **1.3**

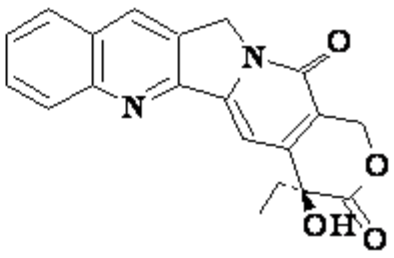




Artemisinin **1. 4**

Etoposide **1.5**





Mevastatin **1. 6**

Camptothecin **1.7**

The number of higher plant species (angiosperms and gymnosperms) on planet earth is estimated

around 250,000 (Ayensu *et al.,* 1978), with a lower level at 215,000 (Cronquist, 1981) and an upper level high as 500,000 (Tippo *et al.,* 1977; Schultes, 1972). Of these, only about 6% have been screened for biological activity, and only 15% have been pharmacologically screened. Moreover, plant extracts contain up to several thousands of secondary metabolites. The major types of compounds identified in Indian medicinal herbs include alkaloids, saponin, flavonoids, anthroquinones, terpenoids, coumarins, lignans, polysaccharides, polypeptides and proteins. Efficient detection and rapid characterization of these components on a molecular basis offer better understanding of the pharmacological application of Indian herbal medicines.

Plant-Derived Drugs from Traditional Systems of Medicine

For thousands of years, plant-derived (herbal) remedies have remained a vital part of traditional Chinese medicine, and even today it constitute about a 30% to 50% proportion of the total drug therapy for a fifth of the world's population who live in the People's Republic of China (PRC). Out of 5500 medicinal plants used in traditional Chinese medicine, between 300 and 500 are commonly used in regular prescriptions (Han *et al.,* 1988). A drug that has been in use in China for at least 5000 years is *Ephedra sinica* (*Ma huang*), from which the potent sympathomimetic amine ephedrine was isolated and pharmacologically tested in the early years of this century, and is now used in western medicine in the form of various salts to combat bronchial asthma (Tyler *et al.,* 1988). Recently phytochemical investigation on plants used in Chinese traditional medicine, both in the PRC and elsewhere, have led to the discovery of several hundred pharmacologically active substances, and about 60 new drugs being derived from such compounds. (Xiao and Fu, 1987).

The drugs commonly used in People's Republic of China PRC include tropane alkaloids anisodamine and anisodine from *Scopolia tangutica*, which are employed as a mild, naturally acting *anticholinergic* agent for septic shock in cases of bacillary dysentery, and in the treatment of migrane headache. An isoquinoline alkaloid, racemic tetrahydropalmatine, from *Corydalis ambigua* is used as an analgesic and tranquilizer, and indirubrin, a nitrogen-containing metabolite produced by *Indigofera tinctoria,* is effective in the treatment of chronic myelocytic leukemia (Xiao and Fu, 1987; Han *et al.,* 1988).

Plant-Derived Antibacterial Chemotherapeutants

Infectious disease is the number one cause of death accounting for approximately one-half of all deaths in tropical countries. Death from infectious diseases, ranked 5^{th} in 1981, has become the 3^{rd} leading cause of death in 1992, with an increase of 58% (Pinner *et al.,* 1996).

More than hundreds of plants world wide are used in traditional medicine as treatments for bacterial infection (Martin *et al.,* 2003). Although many have been treated by conventional pharmaceutical approaches, there is a growing interest in the use of natural products by the general public. In addition the pharmaceutical industry continues to examine their potential as sources novel growth factor, immunomodulatory and antimicrobial activity (Ghose *et al.,* 2003).

Plant-Derived Wound Healing Agents

Wound healing occupies an important field of research in modern biomedical sciences. Wound

healing involves cellular, physiological, biochemical and molecular processes which result ultimately in connective tissue repair and the formation of a fibrous scar (Peacock, 1988). Wound healing process uses a combination of three mechanisms. Contraction is the major method by which wound healing occurs at an amputation site, such as the tip of a finger. Epithelisation predominates in the healing of abrasions and connective tissue deposition occurs when lacerations are sutured and closed (Cockbill *et al*., 2000).

Healing of wound is an important part of the reparative process. A detailed pathophysiology of wound was better understood following the establishment of the theory of a cell signal cascade system involved in the formation of new tissues repairing the wound. Like the alchemist's dream of turning base metal into gold, efforts aimed at achieving a perfect wound healing has inspired many researchers in trying various therapeutic options which were thought to aid or accelerate the wound healing process. The cheaper and more effective the agent, may be better for the patient. Durodola (1977) demonstrated the effectiveness of crude extract of *Ageratum conyzoides* in inhibiting the growth of *Staphylococcus aureus*, a major wound pathogen in *in-vitro* cultures of the organism. Much work has recently been done on the wound healing effect of several medicinal plants **(**Oladejo *et al*., 2003; Biswas *et al*., 2003; Abo *et al*., 2004; Biswas *et al*., 2004).

Plant-Derived Anti-Diarrhoeal Agents

Diarrhoea is a major health problem especially for children under the age of 5 years and up to 17% of all death in the indoor pediatric patients is related to diarrhoea. Worldwide incidence of diarrhoeal death account for more than 5-8 million each year in infants and small children less than 5 year especially in developing countries (Fauci *et al*., 1998). According to WHO estimate for the year 1998, there were about 7.1 million deaths due to diarrhoea (Park *et al*., 2000). A range of medicinal plants with anti-diarrhoeal properties has been widely used by the traditional healers; however, the effectiveness of many of these anti-diarrhoeal traditional medicines have not been scientifically evaluated (Chitme *et al.*, 2004).

Plant-Derived Anti-Diabetic Agents

There are 143 million people worldwide suffering from diabetes, almost five times more than the estimates ten years ago. This number may probably double by the year 2030. Therefore, the global human population appears to be in the midst of an epidemic of diabetes. Reports from the World Health Organization (WHO) indicate that diabetes mellitus is one of the major killers of our time, with people in Southeast Asia and Western Pacific being most at risk.

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia. It may be secondary to a deficiency or disturbance in the secretion of insulin or to an abnormal response of peripheral tissues to insulin. The resulting metabolic derangement of the intermediary metabolism of carbohydrate, lipid, and protein affects all organ systems but most prominent in the arteries, arterioles, and capillaries (Damjanov *et al*., 1996). There are two main categories of this disease. Type 1 diabetes mellitus also

called insulin-dependent *diabetes mellitus* (IDDM) and Type 2, the non-insulin-dependent *diabetes mellitus* (NIDDM). IDDM represents a heterogenous and polygenic disorder, with a number of non-HLA loci (about 20) contributing to the disease susceptibility. Though this form of diabetes accounts for 5 to 10% of all cases, the incidence is rapidly increasing in specific regions. It is estimated that incidence of Type 1 diabetes will be about 40% higher in the year 2010 than in 1997, and yet there is no identified agent substantially capable of preventing this type of disease. NIDDM is far more common and results from a combination of defects in insulin secretion and action. This type of disease accounts for 90 to 95% of all diabetic patients. Treatment of type 2 diabetes is complicated by several factors inherent to the disease process, typically, insulin resistance, hyperinsulinemia, impaired insulin secretion, and reduced insulin-mediated glucose uptake and utilization (Tiwari and Madhusudana Rao, 2002).

The recommended use of plants in the treatment for diabetes needs to be evaluated. Plants are important not only for the control of type 2DM but also for its prevention, especially for people with elevated levels of blood glucose and blood intolerance who have a greater risk of developing diabetes (Anderson *et al*., 2004). Botanical products can improve glucose metabolism and the overall condition of individuals with diabetes not only by hypoglycemic effects but also by improving lipid metabolism, antioxidant status, and capillary function (Bailey *et al*., 1989). A number of medicinal/culinary herbs have been reported to yield hypoglycemic effects in subjects with diabetes. These include cinnamon, cloves, bay leaves, turmeric (Khan *et al*., 1990), bitter melon (Srivastava *et al*., 1993; Raman and Lau, 1996), gurmar (Basakaran *et al*., 1990; Shanmugasundaram *et al*., 1990; Bishayee and Chatterjee, 1994), Korean ginseng (Sotaniemi *et al*., 1995), onions and garlic (Koch and Lawson, 1996), holy basil (Rai *et al*., 1997).

Table 2. Chemical drugs and drugs from medicinal plants.

Drugs	**Chemical Action/Clinical Use**	**Plant Source**
Acetyldigoxin	Cardiotonic	*Digitalis lanata*
Adoniside	Cardiotonic	*Adonis vernalis*
Aescin	Anti-inflammatory	*Aesculus hippocastanum*
Aes culetin	Anti-dysentery	*Frazinus rhychophylla*
Agrimophol	Anthelmintic	*Agrimonia supatoria*
Ajmalicine	Circulatory disorders	*Rauvolfia sepentina*
Allantoin	Vulnerary	*Several plants*
Allyl isothiocyanate	Rubefacient	*Brassica nigra*

Anabesine	Skeletal muscle relaxant	*Anabasis sphylla*
Andrographolide	Baccillary dysentery	*Andrographis paniculata*
Anisodamine	Anticholinergic	*Anisodus tanguticus*
Anisodine	Anticholinergic	*Anisodus tanguticus*
Arecoline	Anthelmintic	*Areca catechu*
Asiaticos ide	Vulnerary	*Centella asiatica*
Atropine	Anticholinergic	*Atropa belladonna*
Benzyl benzoate	Scabicide	*Several plants*
Berberine	Bacillary dysentery	*Berberis vulgaris*
Bergenin	Antitussive	*Ardisia japonica*
Betulinic acid	Anticancerous	*Betula alba*
Borneol	Antipyretic, analges ic, antiinflammatory	*Several plants*
Bromelain	Anti-inflammatory,proteolytic	*Ananas cosmosus*
Caffeine	CNS stimulant	*Camellia sinensis*
Camphor	Rubefacient	*Cinnamomum camphora*
Camptothecin	Anticancerous	*Camptotheca acuminate*
(+)-Catechin	Haemos tatic	*Potentilla fragar ioides*
Chymopapain	Proteolytic, mucolytic	*Carica papaya*
Cis sampeline	Skeletal muscle relaxant	*Cissampelos pareira*
Cocaine *coca*	Local anaesthetic	*Erythroxylum*
Codeine	Analgesic, antitus sive	*Papaver somniferum*
Colchiceine amide	Antitumor agent	*Colchicum autumnale*
Colchicine	Antitumor agent, anti-gout	*Colchicum autumnale*

Convallatoxin	Cardiotonic	*Convallaria majalis*
Curcumin	Choleretic	*Curcuma longa*
Cynarin	Choleretic	*Cynara s colymus*
Danthron	Laxative	*Cassia species*
Demecolcine	Antitumor agent	*Colchicum autumnale*
Des erpidine	Antihypertensive, tranquillizer	*Rauvolfia canescens*
Deslanoside	Cardiotonic	*Digitalis lanata*
L-Dopa	Anti-parkinsonism	*Mucuna sp*
Digitalin	Cardiotonic	*Digitalis purpurea*
Digitoxin	Cardiotonic	*Digitalis purpurea*
Digoxin	Cardiotonic	*Digitalis purpurea*
Emetine	Amoebicide, emetic	*Cephaelis ipecacuanha*
Ephedrine	Sympathomimetic, antihis tamine	*Ephedra sinica*
Etoposide	Antitumor agent	*Podophyllum peltatum*
Galanthamine	Cholinesterase inhibitor	*Lycor is squamigera*
Gitalin	Cardiotonic	*Digitalis purpurea*
Glaucarubin	Amoebicide	*Simarouba glauca*
Glaucine	Antitussive	*Glaucium flavum*
Glasiovine	Antidepressant	*Octea glaziovii*
Glycyrrhizin	Sweetener, Addison's disease	*Glycyrrhiza glabra*
Gossypol	Male contraceptive	*Gossypium species*
Hemsleyadin	Bacillary dysentery	*Hemsleya amabilis*
Hesperidin	Capillary fragility	*Citrus species*
Hydrastine	Hemostatic, astringent	*Hydrastis Canadensis*
Hyoscyamine	Anticholinergic	*Hyoscyamus niger*
Irinote	Anti cancer,antitumour agent	*Camptotheca acuminate*
Kaibic acud	Ascaricide	*Digenea simplex*
Kawain	Tranquillizer	*Piper methysticum*
Kheltin	Bronchodilator	*Ammi visage*
Lanatosides A, B, C	Cardiotonic	*Digitalis lanata*
Lapachol	Anticancer, antitumor	*Tabebuia sp.*
a-Lobeline	Smoking deterrant, respiratory stimulant	*Lobelia inflate*
Menthol	Rubefacient	*Mentha species*
Methyl salicylate	Rubefacient	*Gaultheria procumbens*
Monocrotaline	Antitumor agent (topical)	*Crotalaria sessiliflora*
Morphine	Analgesic	*Papaver somniferum*
Neoandrographolide	Dysentery	*Andrographis paniculata*

Nicotine	Ins ecticide	*Nicotiana tabacum*
Nordihydroguaiaretic acid	Antioxidant	*Lar rea divaricata*
Nos capine	Antitussive	*Papaver somniferum*
Ouabain	Cardiotonic	*Strophanthus gratus*
Pachycarpine	Oxytocic	*Sophora pschycarpa*
Palmatine	Antipyretic,detoxicant	*Coptis japonica*
Papain	Proteolytic, mucolytic	*Carica papaya*
Papavarine	Smooth muscle relaxant	*Papaver somniferum*
Phyllodulcin	Sweetner	*Hydrangea macrophylla*
Physostigmine	Cholinesterase Inhibitor	*Physostigma venenosum*
Picrotoxin	Analeptic	*Anamirta cocculus*
Pilocarpine	Parasympathomimetic	*Pilocarpus jaborandi*
Pinitol	Expectorant	*Several plants*
Podophyllotoxin	Antitumor anticancer agent	*Podophyllum peltatum*
Protoveratrines A, B	Antihypertens ives	*Veratrum album*
Pseudoephredrine	* Sympathomimetic	*Ephedra sinica*
Pseudoephedrine,	nor- Sympathomimetic	*Ephedra sinica*
Quinidine	Antiarrhythmic	*Cinchona ledgeriana*
Quinine	Antimalarial,antipyretic	*Cinchona ledgeriana*
Qulsqualic acid	Anthelmintic	*Quisqualis indica*
Rescinnamine	Antihypertensive, tranquillizer	*Rauvolfia serpentine*
Res erpine	Antihypertensive, tranquillizer	*Rauvolfia serpentine*
Rhomitoxin	Antihypertensive, tranquillizer	*Rhododendron molle*
Rorifone	Antitussive	*Rorippa indica*
Rotenone	Piscicide, Insecticide	*Lonchocarpus nicou*
Rotundine	Analagesic, sedative, traquillizer	*Stephania sinica*
Rutin	Capillary fragility	*Citrus species*
Salicin	Analgesic	*Salix alba*
Sanguinarine	Dental plaque inhibitor	*Sanguinaria Canadensis*
Santonin	Ascaricide	*Artemisia mar itma*
Scillarin A	Cardiotonic	*Urginea maritime*
Scopolamine	Sedative	*Datura species*
Sennosides A, B	Laxative	*Cassia species*
Silymarin	Antihepatotoxic	*Silybum marianum*
Sparteine	Oxytocic	*Cytisus scoparius*
Stevioside	Sweetner	*Stevia rebaudiana*
Strychnine	CNS stimulant	*Strychnos nux-vomica*
Toxol	Antitumor agent	*Taxus brevifolia*
Teniposide	Antitumor agent	*Podophyllum peltatum*
a- ntiemetic	occular tens ion decrease	*Cannabis sativa*
Tetrahydropalmatine	sic, sedative, traquillizer	*Corydalis ambigua*
Tetrandrine	Antihypertensive	*Stephania tetrandra*
Theobromine	Diuretic, vasodilator	*Theobroma cacao*
Theophylline	Diuretic, bronchodilator	*Theobroma cacao and others*
Thymol	Antifungal (topical)	*Thymus vulgaris*
Topotecan	Antitumor, anticancer agent	*Camptotheca acuminate*
Trichos anthin	Abortifacient	*Trichosanthes kirilowii*
Tubocurarine	Skeletal muscle relaxant	*Chondodendron tomentosum*
Valapotriates	Sedative	*Valeriana officinalis*

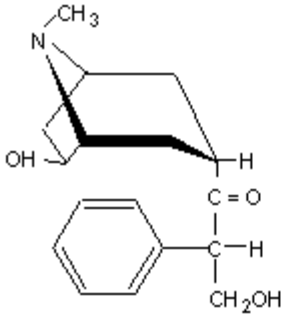
Vasicine	Cerebral stimulant	*Vinca minor*
Vinblastine	Antitumor, Antileukemic agent	*Catharanthus roseus*
Vincristine	Antitumor, Antileukemic agent	*Catharanthus roseus*
Yohimbine	Aphrodis iac	*Pausinystalia yohimbe*
Yuanhuacine	Abortifacient	*Daphne genkwa*

Plant-Derived Drugs from Chinese Herbal Remedies and Other Systems of Traditional Medicine

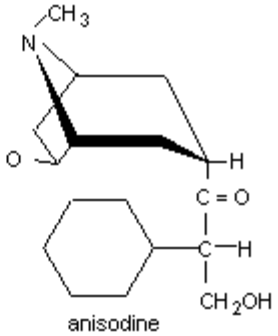
During the past decade, traditional systems of medicine have become a topic of global importance. Current estimates suggest that, in many developing countries, a large proportion of populations relies heavily on traditional practices and medicinal plants may be available in these countries, herbal medicines (phytomedicines) have often maintained popularity for historical and cultural reasons. Concurrently, many people in developed countries have begun to turn to alternative or complementary therapies, including medicinal herbs.

Chinese Traditional Medicine

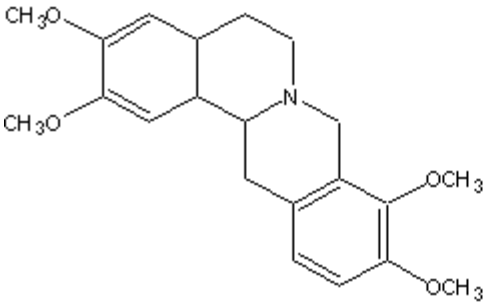
Traditions of plant-collecting and plant based medications have been handed down from generation to generation. For thousands of years, plant-derived (herbal) remedies have remained a vital part of traditional Chinese medicine, and even today constitute about a 30% to 50% proportion of the total drug therapy for a fifth of the world's population who live in the People's Republic of China (PRC). Of about 5500 medicinal plants used in traditional Chinese medicine, between 300 and 500 are commonly used in regular prescriptions. One drug that has been in use in China for at least 5000 years in *Ephedra sinica* (*Ma huang*), from which the potent sympathomimetic amine ephedrine was isolated and pharmacologically tested in the early years of this century, and is now used in western medicine in the form of various salts to combat bronchial asthma. Recently phytochemical investigation on plants used in Chinese traditional medicine, both in the PRC and elsewhere, have led to the discovery of several hundred pharmacologically active substances, with about 60 new drugs being derived from such compounds (**Xiao** and **Fu**, 1987).



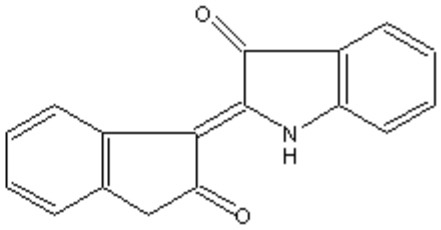
anisodamine



anisodine



dl - tetrahydropalmatine



indirubrin

Examples of plant drugs that are of use in the PRC include the tropane alkaloids anisodamine and anisodine from *Scopolia tangutica*, which are employed as a mild, naturally acting *antichol inergic* agent for septic shock in cases of bacillary dysentery, and as a migraine treatment, respectively. An isoquinoline alkaloid, racemic tetrahydropalmatine, from *Corydalis ambigua* is used as an analgesic and tranquilizer, and indirubrin , a nitrogen-containing metabolite produced by *Indigofera tinctoria,* is effective in the treatment of chronic myelocytic leukemia.

Conclusion of our research article reported that traditional knowledge on medicinal plants plays a vital role in the primary health care and has potential of the discovery of new herbal drugs, new sources of pharmaceuticals, contraceptives and for sustainable utilization of medicinal plants genetic resources and their conservation.

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