Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 874-878
Received: 04-11-2019
Accepted: 06-12-2019

Ramesh Kumar Nirala
Assistant Professor& PI, Department of Pharmacology & Toxicology, Veterinary College, Bihar, India

Kumari Anjana
Assistant Professor& PI, Dept. of Pharmacology & Toxicology, Veterinary College, Bihar, India

Preety Raj
M.Sc Scholar, Dept. of Botany, College of commerce, Art & Sciences, Patna MU, Bihar, India

Archana Kumari
Ex- Senior Research Fellow, Indian Council of Medical Research (ICMR), IITR Lucknow, Uttar Pradesh, India

KG Mandal
Univ. Professor& Head, Dept. of Pharmacology & Toxicology, Veterinary College, Bihar, India

Corresponding Author:
Ramesh Kumar Nirala
Assistant Professor& PI, Department of Pharmacology & Toxicology, Veterinary College, Bihar, India

Legacy of Indian herbs: Empirism to economics

Ramesh Kumar Nirala, Kumari Anjana, Preety Raj, Archana Kumari and KG Mandal

Abstract
Medicinal plants are gaining much interest recently because their use in ethno medicine treating common diseases such as cold, fever, diarrhoea, cough and other medicinal claims are now supported with sound scientific evidences. Several plants with various properties have been mentioned earlier in the oldest Indian mythology Rigveda and Ayurveda, thus the use of medicinal plants in India dates back to 3500-1800 B.C.

A large number of the plants are claimed to possess the antibiotic properties in the traditional system and are also used extensively by the tribal people worldwide. It is now believed that nature has given the cure of every disease in one way or another.

The therapeutic value of Indian medicinal plants is well recognized and acknowledged all over the world. There has been an ever enhancing awareness globally to rely on natural remedies in place of the chemical drugs. More recently, the western multinational drug companies, taking leads from ayurveda and Indian folklore medicines, are diverting their R and D activities on Indian medicinal plants to find out the active principles, isolate and patent them.

Keywords: Herb, antibacterial, antiviral, anidaibetic, economic

Introduction

Herbal Medicine: The word herb, as used in herbal medicine means a plant or plant part that is used to make medicine or a type of medicine that uses roots, stems, leaves, flowers or seeds of plants to improve health, prevent disease and treat illness. Indian medicinal plants are the essence of Ayurveda and Ayurvedic treatments. When used judicially with the basic principles they produce miraculous effects. Herbs played important role in treatment, from ancient time to this most modern time. Plants have formed the basis of traditional medicine systems among which are Ayurvedic, Unani, and Chinese amongst others. These systems of medicine have given rise to some important drugs still in use today (Kala, 2004) [16]. WHO defines herbal drugs as active ingredient parts of plant or plant materials in the crude or processed state plus certain excipients, i,e. solvents, diluents or preservatives. Usually, the active principles responsible for pharmacological action are unknown (bulletin of the WHO, 1998).

Nowadays, the search for new molecules, has taken different route where the science of ethno botany and ethno Pharmacognosy are being used as guide to lead the chemist towards different sources and classes of compounds. If a medicinal herb is viewed in synthetic laboratory as it produces and contains a number of chemical compounds. These compounds, responsible for medical activity of the herb, are secondary metabolites like saponins, resins, oleoresins, lactones and volatile oils. Molecules present in plants and secondary metabolites that have led to the development of pharmacologically active extracts or compounds (Khatoon, 1993) [18]. Higher plants are used as sources of pharmaceuticals and as ingredients of traditional medicines and are of value in new drug discovery. Artemisinin, taxol and camptothecin are examples of natural products which are undergoing clinical and commercial development. Several natural products isolated from plants used in traditional medicine have potent antiplasmodial action *in vitro* and represent potential sources of new antimalarial drugs. Plant biotechnology offers the possibility of improved production methods of cultivated medicinal plants as well as alternative approaches to the production of natural products for the preparation of pharmaceuticals. In principle herbal medicines are used to restore balance, remove excess, and also used for supplementation of deficiency. Today, science has isolated the medicinal properties of a large number of botanicals, and their healing components have been extracted and analyzed. Many plant components are now synthesized in large laboratories for use in pharmaceutical preparations. For example, vincristine (an antitumor drug), digitalis (a heart regulator), and ephedrine (a bronchodilator used to decrease respiratory congestion) were all originally discovered through research on plants. More recently, the western multinational drug companies, taking leads from Ayurveda and Indian folklore medicines are

diverting their R and D activities on Indian medicinal plants to find out the active principles, isolate and patent them (Jain, 1991; Handa, 1996; Udayam, 2005) [14, 25, 35]. "There is nothing in this universe, which is non-medicinal, which cannot be made use of for many purposes and by many modes." This is the traditional definition of medicinal plants means "in principle" all plants have a potential medicinal value, although in practice a plant is referred to as medicinal when it is so used by some system of medicine (http://www.dharmaayurveda. com).

Herbal medicine status in our country

The vast and magnificent Indian flora is repository of invaluable medicinal plants. Around 10 % of 250-750 thousand species of higher plants that exist on earth are used in traditional medicine. Over 16,000 species of higher plants are reported to occur in India, of which about 7500 plant species are used for healthcare by various ethenic communities in our country. More than 2,500 plant species of medicinal value have been well documented in Indian system of Medicine and under ethnobotany (Jain, 1991; Handa, 1996; Udayam, 2005) [14, 25, 35]. Because is called as Botanical Garden of World. The herbal remedies are economical and within the reach of common man. Three-fourths of world's population cannot afford the expensive products of western pharmaceuticals (Handa, 1996) [25]. 80% of people are almost completely dependent on traditional means for their primary healthcare needs (Fransworth, 1990; Pushpangadan, 1996 and WHO, 2000) [25, 36]. The knowledge of herbal medicine can be well explained with example of one plant Phyllanthus niruri is used for treating jaundice in village communities in Southern India, the application of this plant for the treatment of Viral Hepatitis B has been validated and patented by American scientists. Over 50,000 herbal formulations have been developed for a very wide range of applications. Depth of study of plants is clearly indicate their manifold applications. Several "hundred" applications of a particular plant used or in various formulations for different purposes. e.g. amla or gooseberry (Emblica officinalis), 180 formulations of Amla is available in market which is used in different disorders for e.g., eye disorders like conjunctivitis, vision disorders; hyperacidity, rheumatic disorders, abdominal disorders, jaundice, hiccough, breathing disorders, fever, cough, ear disorders, good for hair growth and texture, skin disorders, intoxication due to alcohol and gynecological disorders etc (http://www.dharmaayurveda.com). The therapeutic value of Indian medicinal plants is well recognized and acknowledged all over the world. There has been an ever enhancing awareness globally to rely on natural remedies in place of the chemical drugs.

The status of various medical systems in usage of plants in India: Ayurveda, the oldest medical system in Indian, has alone reported approximately 2000 medicinal plant species, followed by Siddha (1121), Unani (751), Homeopathy (482) and Tibetan (337). (Parajapati, 2003 and Rao, 2004) [26]. For the preparation of medicine maximum parts of plants utilized is route i.e. 29% followed by whole plants i.e. 16%, bark 14% fruits 10%, others parts utilized in very less percentage as seeds 7, stem and leaves 6, flowers 5, rhizomes 4, wood 3 etc.

Distribution of Medicinal Plants: Medicinal plants are equally distributed across habits viz., trees, shrubs and herbs. Roughly, one third of the known medicinal plants are trees and equal proportion shrubs and the remaining one-third herbs, epiphytes, grasses and climbers. Very small proportions of the medicinal plants are lower plants like lichens, ferns, and algae. The majority of medicinal plants are higher flowering plants. Preliminary analysis of the distribution pattern shows that medicinal plants are distributed across diverse habitats and landscape elements. Around 70 per cent of India's medicinal plants are found in the tropical zone, mostly in the forests of the Western and Eastern Ghats, the Vindhyas, Chotta Nagpur plateau, Aravalis, the Terai region in the foothills of the Himalayas and the North East. Less than 30 per cent of these medicinal plants are confined to the temperate and colder zones although species of great medicinal value occur in some of these habitats. A quick analysis of the available data shows that the proportion of medicinal plants recorded in the dry and moist deciduous tropical forests is higher as compared to those recorded in the tropical evergreen forest (Kala, et. al., 2006) [6]. Total no. of native species in flora and no. of medicinal plant species reported in India comparison with world: In World 2,97,000 species of flora are found of which 52,885 species are known for its medicinal value (Schippmann, et al., 2002). In Indian Himalayas region 8,000 species of flora are found of which 1,748 species are known for its medicinal value (Samant, et. al., 1998). In India, 17,000 species of higher plants are found, 7500 are known for medicinal uses (Shiva, 1996).This proportion of medicinal plants is the highest proportion of plants known for their medical purposes in any country of the world for the existing flora of that respective country listed in following table (Singh and Hajra, 1996) [34].

Major institutions involved in the medicinal plants research in India: In India, many government and non-government organizations works for improving the medicinal plants sector. These agencies providing fund to other institute and person who is willing to work in the medicinal plants sector. According to the mandate of NMPB, the projects may be submitted for funding within two major schemes: viz., a promotional scheme and a commercial scheme.

The major areas within promotional scheme are: survey and inventory of medicinal plants, in-situ conservation and ex-situ cultivation of selected medicinal plants, production of quality planting material, diffusion of knowledge through education and communication, promotion of global and domestic market system, and strengthening research, development and man power. Within the commercial scheme, the major thrust areas are: bulk production of medicinal plants and ensuring supply of quality planting material, expansion of selected medicinal plants farming areas, value addition in harvesting, processing and marketing of medicinal plants, and developing innovative marketing mechanism (Kala, *et al*., 2006) [16].

Activities concerning medicinal plants in India

Certain activities launched by the Government for conservation and development of medicinal plants in India these are (Hoarou and Dasilva, 1999) Herbal Gene Bank at the Tropical Botanic Garden Research Institute at Thiruvananthapurnam promotes ethnopharmacological research. Central Institute of Medicinal and Aromatic plants in Lucknow deals with tissue culture of medicinal plants of commercial significance and Germplasm Bank, Point Calimere Wildlife Sanctuary at Tamil Nadu here more than 40 species of medicinal plants are maintained and protected.

Indian Scenario

120 plant derived chemical compounds have developed by Pharmaceutical industry. The domestic Ayurvedic market is estimated to be US$ 1 billion and Growth rate is 15% annually. Annual trade of Indian medicinal plants is estimated

to be Rs. 550 crores. Ayurvedic and herbal product turn-over is Rs.25000 crores. This include Rs. 1200 crores of over the counter formulations. Global herbal industry is estimated to be US$ 50 billion annually, growth rate 6.5% annually. The Indian contribution to the global industry is 1% only. World Bank report 1998, world trade in medicinal plants is expected to be of order of US$ 5 trillion by AD 2050. Production of herbal veterinary products: Rs. 500 crores, 2010 (Mody, 2005 and Alam, 2009) [21, 1].

Annual export trends in medicinal plants and Ayurvedic products of India over past four financial years: There are two type of export of herbal plants either in crude form or finished formulation. Here is the report of export of herbal plant from 1999-2003. Both are giving encouraging performance but according to an estimate, the quantity of export of Ayurvedic products/ finished formulation produced in India has tripled and also exceed over crude plant material export between last two financial years (2001–2002 and 2002–2003.

If we see utility of plants then plants are used against trivial therapeutic value to the uses of certain plants in life threatening conditions like viral hepatitis, cancer and many more, like Allium cepa is used to treat stomach carcinoma, Andrographis paniculata is used in viral hepatitis. Boswellia serrata is known to have therapeutic value in ulcerative colitis, osteoarthritis, and rheumatoid arthritis. In emergency treatment treatment of heart failure we can use Cedrus deodara. Cuminum cyminum is one of the best alternative for therapeutic management of diabetes mellitus. Holarrhena antidysenterica is having great cosmetic value used against facial acne resistant to cure chemically. Certain herbs having nutritional value also Peucedanum graveolens having full of vit.A and E in there content. Where as Sesamum indicum is used to remove warts by this way herbs are having versatile therapeutic value.

Antibacterial plants

In the present scenario of emergence of multiple drug resistance to human and animal pathogenic organisms, this has necessitated a search for new antimicrobial substances from other sources including plants. Traditionally used medicinal plants produce a variety of compounds of known therapeutic properties (Iyengar, 1985; Chopra *et al*., 1992; Harborne and Baxter, 1995) [13, 3, 10]. The substances that can either inhibit the growth of pathogens or kill them and have no or least toxicity to host cells are considered candidates for developing new antimicrobial drugs. In recent years, antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world (Grosvenor *et al*., 1995; Ratnakar and Murthy, 1995; Silva *et al*., 1996; David, 1997; Saxena, 1997; Nimri *et al*., 1999; Saxena and Sharma, 1999) [7, 27, 4, 30, 3]. It is expected that plant extracts showing target sites other than those used by antibiotics will be active against drug-resistant microbial pathogens. However, very little information is available on such activity of medicinal plants (Hasegawa *et al*., 1995; Lee *et al*., 1998) [11, 19].

Antiviral plants

Viruses are obligate intracellular parasites which can't replicate independently and must utilize the hosts cell pathways. Drugs that affect the viral processes must penetrate the host cells and in doing so, they are likely to adversely affect the normal pathway of the host cell. Because of the close association between virus and host cell, chemotherapy of viral disease is difficult and antiviral drug are generally having narrow margin of safety. Herbal therapeutic used for viral infections are very scares Locher, 1995 [20].

Antidiabetic plants Diabetes mellitus is a multifactorial disease that has a significant impact on health, qualities of life as well as on the health care system. Despite of considerable progress in the management of Diabetes mellitus by synthetic drugs, the search for indigenous natural anti- diabetic agents is still going on. Ethnobotanical information indicate that more than 800 plants are used as traditional remedies for the treatment of diabetes throughout the world. Plants possess antidiabetic activity reorted by (Grover 2002 and Eddouks 2004) [8, 5]. M. charantia, Eugenia jambolana, Mucuna pruriens, T. cordifolia, T. foenum graecum, O. sanctum, P. marsupium, Murraya koeingii, Brassica juncea. Sabu and Kuttan in 2002 reported that Terminalia chebula, Terminalia belerica, Emblica officinalis these three plants contain antioxidant property along with antidiabetic property.

Antifungal activity of plants

Traditional plants are a valuable source of novel antifungal agents. As per WHO 50% prescription drug for the treatment of fungal infection is of herbal in nature. Following plants and their plant parts having antifungal property.

Antiparasitic plants

Parasitism is one of the major problem for the livestock owner in India, here the livestocks are owned by small farmers in majority and due to poor economic condition modern veterinary medicine many time may not be available at the door of farmers or may be expensive. Several modern researchers have elaborated the use of plant drugs in the treatment of parasitism. At such instances herbal anthelmintics offers valuable alternative for the same. Number of plants have been identified to possess antihelmintic activity following are the list of certain plants:

Antineoplastic plants: Since at least 1500 BC plant and plant extracts have been recognized as having anticancer activities, surveys by Heartwell leasted at least 3000 species posses anticancer activities. However the rationale, organized study of plants as a source of potential antineoplastic agents probably evaluated with the pioneering studies of Heartwell *et al*., during the period 1947-1953 in which for the first time pure plant constituents were isolated, characterized and associated with the antitumor activity of the crude extracts. This is the only area of the herbal therapeutics where treatment is exclusively with active principle instead of crude formulation. Certain plants and drug derived from them is listed below: Cissus quandrangularis, Cyphostemma flaviflorum, Cyphostemma lanigerum Cyphostemma natalitium, Cyphostemma sp., Rhoicissus digitata, Rhoicissus rhomboidea Rhoicissus tomentosa, R. Tridentata reported by (Wall and Wani 1997).

Herbal drugs in veterinary field: Presently comparing to the pharmaceutical company dealing with the allopathic drugs only few (5) pharmaceutical company are in list for the service of herbal drugs formulation and distribution and here 30 medium or small – scale manufactures and about 500 licensed small manufactures are on record. Due to bitter test of synthetic drugs the demand for herbal medicines is increasing day by day. Some companies are dealing with herbal as well as allopathic drug. There are 100 herbal formulations are available in Indian market for veterinary use and number of major plants involved in their formulation is 50 (Alam, 2009) [1].

Safety and efficacy of herbal medicine

Herbal products may be contaminated with excessive or banned pesticides, microbial contaminants, heavy metals, chemical toxins, and for adulterated with orthodox drugs. Excessive or banned pesticides, heavy metals and microbial contaminants may be related to the source of these herbal materials, if they are grown under contaminated environment or during collection of these plant materials. Chemical toxins may come from unfavorable or wrong storage conditions or chemical treatment due to storage (Roy, 2003). The presence of orthodox drugs can be related to unprofessional practice of manufacturers. Some of these environment related factors can be controlled by implementing standard operating procedures (SOP) leading to Good Agricultural Practice (GAP), Good Laboratory Practice (GLP), Good Supply Practice (GSP) and Good Manufacturing Practice (GMP) for producing these medicinal products from herbal or natural sources. The public's belief that herbal and natural products are safer than synthetic medicines can only be ascertained by imposing regulatory standards on these products that should be manufactured using these Good Practices (Calixtro, 2000). Control of quality of raw material and finished herbal formulation: Thin layer chromatography, Gas chromatography, High performance liquid chromatography, Mass spectroscopy and Infrared- spectrometry. The production of crude drugs is subject to the vagaries of the climate, to crop disease, to varying methods of collection and drying which influence quality, and to the inherent variation of active constituents arising from plants of the same species having different genetic characteristics. Certain advance technology like plant cell and tissue culture, biochemical conversions and clonal propagation in indigenous medicinal plants overcome this problem, recently, pharmacognosy has involved the application of tissue culture of plant cells, tissues and organs in the study of medicinal plants. This includes development of commercial production of expensive biomedicaments, discovery of new metabolites, selection of superior strains of medicinal plants and improvement of medicinal plant species by genetic engineering. In some laboratories of India like the Regional Research Laboratories Bhubneshwar, research work is in progress on the enhancement of valuable secondary metabolites of some medicinally important aromatic plants (e.g. geraniol content in Cymbopogon martinii oil) which are produced in plants in low levels. This would definitely attract foreign firms towards such indigenous medicinal plants. A clone of A. annua giving a high yield of the important antimalarial artemisinin, has recently been reported (Evans 2002) Such biotechnological approaches would be beneficial in providing standardized drugs of Indian pharma in bulk for commercial availability in the global market.

Toxicity and adverse effect of herbs

The common belief that the herbal drugs are non-toxic may be quite misleading. Sometimes it may causes toxicity due to presence of chemical toxin and environmental toxin. Herbs usually contain more than one active principles. Among these active principles only few possess therapeutic effect. Some herbs contain active principles having both therapeutic as well as toxic value. Such herbs are having marginal therapeutic index, on high doses or long term use may produce toxicity of non-target area. Today some market preparation is herbomineral that's why problem in export business. Herbal plants having property to absorb the mineral from soil rich environment and also from polluted industrial area.

Toxicity of herbal formulation

Toxicity of Cassia occidentalis plant (component of Liv 52): has recently reportred by (Parekar, 2009) [22]. He has found in acute toxicity study at highest dose, relative weight of organs were increased and TLC and neutrophils count were decreased. In 28 days repetitive toxicity study hematological changes: Hb, PCV and TEC decreases, TP and Globulin increases. Gross and histopathological lesions were found in vital organs.

MAMMARY PLUS® (Herbal brain memory capacity enhancer for children). Banned now because it was found recently that the product is hepatotoxic in Children. Report of death of children after having use of MAMMARY PLUS - after this report from CDRI Scientists the product was banned now by Government of India.

Herbal drugs: comparison with allopathy

In allopathic healthcare: Focused on the individual symptom, on the whole, allopathic healthcare dysfunction and disease management. Often the forms of treatment are technologically based and/or invasive such as surgery or drugs. It is the appropriate choice in life threatening health care situations.

In herbal medicine

This type of medicine is a medicine of health and focuses on maintaining that health before it reaches the point of dysfunction. Active principles are frequently unknown; Standardization, stability and quality control are feasible but difficult; Availability and quality of raw materials are frequently problematic; Well-controlled double-blind clinical and toxicological studies to prove their efficacy and safety are rare; Empirical use in folk medicine; Wide range of therapeutic use and are suitable for chronic treatments; Side effects seems to be less frequent, Cost less.

SWOT analysis of herbal medicine: Strength

Wide variety of agro-climatic zones which allows us to grow almost every type of crop/herb in India. We also have the requisite expertise -technical/academic as well as operational. A Govt. body has to take the initiative in the correct earnest. Weakness: Injectable form is very less unless the drug is extra purify. Lack of awareness amongst the growers. Lack of Marketing infrastructure which leads to distress selling and hence low revenue generation amongst the few ones who dare to venture into something that is not routine. High cost due to low yield & poor quality of the produce due to non-usage of latest/ scientific farming technique. Opportunities: The huge potential for increased revenue generation both in the export as well as in the domestic sector is really very encouraging. We have a old cultural heritage of Ayurvedic medicine and hence identifying the correct crop for a particular agroclimatic zone is not a problem at all. Experts/NGOs can help market the produce. Generating employment among the rural folk. Threats: Lack of education amongst the farmers makes them very vulnerable especially in the hands of unscrupulous people. Indiscriminate shifting from cereals to cash crop can affect the food balance.

Conclusions

Due to side effects of synthetic products, herbal products are gaining popularity in the world market. In spite of well-practiced knowledge of herbal medicine and occurrence of a large number of medicinal plants, the share of India in the global market is not up to the mark. In order to promote

Indian herbal drugs, there is an urgent need to evaluate the therapeutic potentials of the drugs as per WHO guidelines.

References

1. Alam T. Herbalism: Global focus on phytotherapy and opportunities for research. Conference compendium, ISVPT, from 5-7 Nov. Held at AAU, Anand, India, 2009, 273-276.
2. Bulletin of World Health Organization. Regulatory situation of herbal medicines. A worldwide review. Geneva, 1998, 1-43.
3. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian medicinal plants. Council of Scientific and Industrial Research, New Delhi, 1956.
4. David M. Antimicrobial activity of garlic. Antimicrobial Agents and Chemotherapy. 1997; 41:2286.
5. Eddouks M, Lemhadri A, Michel JB. Caraway and caper: potential anti-hyperglycaemic plants in diabetic rats. Journal of Ethnopharmacology. 2004; 94(1):143-148.
6. Fransworth NR. The role of ethnopharmacology in drug development. In bioreactive compounds from plants. Chichester, N. (Editor), Ciba Foundation Symposium, 1980, 2-21.
7. Grosvenor PW, Supriono A, Gray DO. Medicinal plants from Riau Province, Sumatra, Indonesia. Antibacterial and antifungal activity. Journal of Ethnopharmacology. 1995; 45:97-111.
8. Grover JK, Yadav S, Vats V. Medicinal plants of India with anti-diabetic potential. Journal of Ethno pharmacology. 2002; 81(1):81-100.
9. Handa SS. Medicinal plants-prioritiesin Indian medicines diverse studies and implications. In supplement to cultivation and utilization of Medicinal plants. Handa, S.S. and Kaul, M.K. (Editers), CSIR, Jammu-Tawi, 1996, 33-55.
10. Harborne SB, Baxter H. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor and Francis, London, 1995.
11. Hasegawa H, Matsumya S, Yamasak K. Reversal of efflux mediated tetracycline resistance in Staphylococcus aureus clinical isolates by Ginseng prosaponenins. Phytotherapy Research. 1995; 9(4):260-263.
12. http://www.dharmaayurveda.com
13. Iyengar MA. Study of Crude Drugs, 2nd edn. College of Pharmaceutical Sciences, Manipal, 1985, 13-78.
14. Jain SK. Dictionary of Indian Folk Medicine and Ethnobotnay. New Delhi: Deep Publications, 1991.
15. Johnson WC, William OW. Warfarin toxicity. J Vasc. Surg. 2002; 35:413-421.
16. Kala CP. Studies on the Indigenous Knowledge, Practices and Traditional Uses of Forest Products by Human Societies in Uttaranchal State of India. Almora: GB Pant Institute of Himalayan Environment and Development, 2004.
17. Kala CP, Dhyani PP, Sajwan BS. Developing the medicinal plant sector in northern India. Challenges and opportunities. J Ethnobiology and Ethnomedicine. 2006; 2:32.
18. Khatoon S, Mehrotra S, Shome U, Mehrotra BN. Analysis of commercial 'Ratanjot' by TLC fluorescence fingerprinting. Int. J Pharmacol. 1993; 31:269-277.
19. Lee CK, Kin H, Moon KH, Shun KH. Screening and isolation of antibiotic resistance inhibitors from herb materials-resistance inhibition of volatile components of Korean aromatic herbs. Archives of Pharmaceutical Research. 1998; 21(1):62-66.
20. Locher CP, Burch MT, Mower HF, Berestecky J, Davis H, Van Poel B *et al*. Anti-microbial activity and anti-complement activity of extracts obtained from selected Hawaiian medicinal plants. Journal of Ethnopharmacology. 1995; 49(1):23-32.
21. Mody SK. Development of herbal therapeutics in India: Scope and Challenges.Winter school compendium, held at SDAU, Sardarkrushinagar, from Sep. 9-29.Gujarat, India, 2005, 229-233.
22. Parekar SS. Pharmacological and toxicological evaluation of C. occidentalis after single and 28 days repetitive oral exposure in Wister rats. M.V.Sc. thesis submitted to SDAU, Sardarkrushinagar, 2009.
23. Prahalathan S. Export potential of Indian medicinal plants and products. Financing Agriculture. 2004; 36:33-36.
24. Prajapati ND, Purohit SS, Sharma AK, Kumar T. A Handbook of Medicinal Plants. Jodhpur: Agrobios, 2003.
25. Pushpangadan P. Traditional medicine. In supplement to cultivation and utilization of medicinal plants. Handa, SS and Kaul, MK. (Editors), CSIR, Jammu- Tawi, 1996, 313-322.
26. Rao MR, Palada MC, Becker BN. Medicinal and aromatic plants in agro-forestry systems. Agroforestry Systems. 2004; 61:107-122.
27. Ratnakar P, Murthy PS. Purification and mechanisms of action of antitubercular principle from garlic (Allium sativum) active against isoniazid susceptible and resistant Mycobacterium tuberculae H37RV. Indian Journal of Clinical Biochemistry. 1995; 10:14-18.
28. Saluja A. Adverse effects and toxicity of herbal drug. Proceedingg of the symposium, current trends in research on drugs of herbal origin. XIII Annual conference of IPS (Gujarat chapter) held at K.B. Institute of Pharmaceutical education and research. On 2nd March 1997 at Gandhinagar, 1997.
29. Samant SS, Dhar U, Palni LMS. Medicinal Plants of Indian Himalaya: Diversity Distribution Potential Values. Almora: G.B. Pant Institute of Himalayan Environment and Development, 1998.
30. Saxena K. Antimicrobial Screening of Selected Medicinal Plants from India. Journal of Ethnopharmacology. 1997; 58(2):75-83.
31. Saxena VK, Sharma RN. Antimicrobial activity of essential oil of Lantana aculeata. Fitoterapia. 1999; 70(1):59-60.
32. Sharma A, *et al*. Protective Effect of Mentha piperita against Arsenic-Induced Toxicity in Liver of Swiss Albino Mice. Basic & Clinical Pharmacology & Toxicology. 2007; 100(4):249-257.
33. Shiva MP. Inventory of Forestry Resources for Sustainable Management and Biodiversity Conservation. New Delhi: Indus Publishing Company, 1996.
34. Singh DK, Hajra PK. Floristic diversity. In Biodiversity Status in the Himalaya. New Delhi: British Council, 1996, 23-38.
35. Udayam PS, George S, Thusar KV, Balachandran I. Ethnomedicine of the Chellipale community of Namakkal district, Tamilnadu. Indian J f Traditional knowledge. 2005; 4:437-442.
36. WHO. General guidelines for methodologies on research and evaluation of traditional medicine, World Health Organization, Geneva, 2000.