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Medicinal and Aromatic Plants Biodiversity of India- A Review

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ABSTRACT
Plants are a very important source of many products considered as useful for human bodies. Many plant species are used as a source of treatment of various disorders, so these plants are also known as Medicinal and Aromatic plants. Plants have been used since ancient times of all civilizations and cultures, mostly as home remedies for treating seasonal flu viruses, cough, cold, stomachache, sore throat and headaches. Besides, the aromatic plants are still used in making perfumes, because of their pleasant smelling flowers, in cooking because of their strong flavors, and liquor industries. At the present there are used many herbal treatments that are becoming very popular in the society because of their efficiency and less side effects. Of course the medicinal and aromatic plants are less expensive, more available and have potential to control disorders. The use of these plants is also a potential material for maintaining good health and conditions, not only for a remedy for specific diseases. Of course, the role of medicinal and aromatic plants in national economy is also enormous. And it will only keep growing, just like our favorite platform that has a plethora of no deposit bonuses that will maximize your winnings and take your game to the next level.
Key words: *Medicinal Plants, Aromatic Plants,herbal, disorders.*

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INTRODUCTION

The new philosophy of health care throughout the world is moving from illness to wellness, from treatment to prevention as well as early diagnostics and from generalized approach to personalized medicine. Alternative medicines are slowly taking up important space in the world market. The market growth is being stimulated by nature-based products, based on the presumption that these products cause lesser side effects than modern medicines and its comparatively lower costs. The projection made by World Health Organization (WHO) states that the global herbal market would grow to $5 trillion by 2050 from the current market level of $62 billion [1].

Alternative medicine disciplines such as Yoga, Acupuncture, Homeopathy, massage, Traditional Indian System of Medicines (TISM) and Traditional Chinese Medicine (TCM) are now gaining more popularity in the western world being recognised as natural products having no side-effects. Both TISM and TCM mode of treatments are centered around the patient rather than on the disease with promotion of health and treatment of diseases in a holistic fashion as the focus is on both [2]. Many of their herbal sources used as medicines are common and both the systems follow similar philosophies for classification of individuals, materials and diseases

Human beings have been utilizing plants for basic preventive and curative health care since time immemorial. Recent estimates suggest that over 9,000 plants have known medicinal applications in various cultures and countries, and this is without having conducted comprehensive research amongst several indigenous and other communities [3]. Medicinal

plants are used at the household level by women taking care of their families, at the village level by medicine men or tribal shamans, and by the practitioners of classical traditional systems of medicine such as Ayurveda, Chinese medicine, or the Japanese Kampo system. According to the World Health Organization, over 80% of the world's population, rely upon such traditional plant-based systems of medicine to provide them with primary health care [4]. Allopathic medicine too owes a tremendous debt to medicinal plants: one in four prescriptions filled in a country like the United States are either a synthesized form of or derived from plant materials [5].

The global context briefly sketched above suggests several tremendous opportunities for India, a country unrivaled in terms of diversity of medical systems and practices, in addition to being a major storehouse of biological diversity, with 2 of the 14 megabiodiversity areas of the world located within its borders. The global market would appear to be more receptive than ever to the mounting of a concentrated Indian effort at supplying it with medical materials and know-how. Such an effort would also appearto be increasingly remunerative for the country. India is of course already an active participant in the global medicinal plants market having been for some time the world's largest supplier of raw materials (though an insignificant supplier of finished products) [6,7]. Of the 74 species accounted for in one of the studies mentioned above, India was known to be exporting 22 and importing 8 [8], while the German study quoted earlier, which is now underway, has found India to be Germany's largest trading partner by far [9]. Moreover, medicinal plants are one of the most important components of the non-wood forest products sector which supplies over 80% of India's net forest annual export earnings [10,11].

Despite these promising indications, however, it is unclear whether India is truly exploiting her comparative advantage in the medicinal plants sector and tapping the full potential of an expanding consumer base. In addition, several concerns arise in relation to the current consequences of participation in the market, with regard to the sustainability and equitability of prevailing practices in the sector. Although only micro-studies are currently available in this regard, most of these indicate that current practices are both unsustainable, as hey rapidly deplete the natural supplies of the country's plant base, and inequitable, perpetuating impoverishment for those charged with stewarding and harvesting the resource, while a few profit in dramatic disproportion to their inputs. Negative impacts on local primary health care, as plants become diverted to national and international markets, have also been cited in some cases [12]. To add to all of these negative aspects, the market in India has been shown to be highly inefficient and imperfect. The need of the hour, then, is to replan India's participation in the expanding global market, in light of the interests of all the stakeholders who are affected and who play a role in this sector. There is a need to collate all the available information regarding medicinal plants development in the country in order to obtain a comprehensive overview which will provide the necessary insight for coordinated and effective action. Such an overview could form the basis of a renewed development of India's medicinal plants sector, and a strategic exploitation of her comparative advantage in the global market on a sustainable and equitable basis [13].

This review then is a mapping exercise, which tries to identify the who, what, how, where, why and when of medicinal plants development in India, in order to supply a comprehensive understanding and overall picture to researchers, NGOs, health care workers, private companies, conservation and development agencies, policy makers and other interested stakeholders. It is intended to provide a framework and knowledge base, and an initial way forward, for those interested in seeing India exploit her comparative advantage in the global market, both sustainably and equitably.

MEDICINAL PLANTS: THE CULTURAL HISTORICAL CONTEXT

Medicinal systems in India date back to at least 5000 BC, coinciding with the emergence of the cities of the agricultural based Indus Valley civilization around 4500 BC. This civilization was, however, superimposed upon earlier mesolithic hunter - gatherer societies centred in Mehrgath in the plains of Kacchi, which themselves bore traces of a similar society based in the Vindhyas, south of the River Ganges. While farming villages had emerged by 9000 BC in Mehrgath, which was situated in the transitional zone between the hills of Baluchistari and the Irido-Gangetic plains, settlement became more pronounced by about 5500 BC [14]. However, colonization of the alluvial plains only occurred after the

formation of more complex societies, firstly in the Indus Basin and 2500 years later in the Ganges valley. This latter delay was due to the impenetrable nature of this area which was densely forested and therefore unsuitable for dense human populations until the advent of the iron age.

Firstly, ethnic changes between 2000 BC and 1500 BC, resulting from the arrival of Aryan immigrants, led to the domination of a new culture over the earlier pre-Caucasoid Dravidians settlers [15]. These immigrants came from areas immediately north and west of the Indus valley and had links to the first city civilizations of Mesopotamia, for example, Sumer where, as in Egypt, medicinal systems were established. These influences necessarly had an impact on the development of the Vedic period with its written texts.

A second major factor involved the trade links of the Indus valley civilization overland to Gandhara and Bactria in Afghanistan, as well as by sea to Persia and the Persian Gulf. Although the Persian Empire under Darius had already incorporated the Indus valley, some 200 to 300 years earlier, paving the way for Alexander's expeditionary forces, the Mauryan dynasty had united most of the country, barring the South by 250 BC [16]. The resulting ties between the emerging Indian civilization and other civilizations with which it came into contact, must undoubtedly have affected not just trade relations but also available knowledge regarding the use of plants for food and medicine.

Soon afterwards, world trade, particularly with regard to spices began to intensify, both along sea routes as well as overland routes, resulting in linkages between the Near East and East and Southeast Asia. By the time of the Graeco-Roman era, pepper and ginger form India, and cassia, cinnamon and cloves from South East Asia, all of which were used for their medicinal properties, were widely known in the Mediterranean.

India obtained, by diffusion rather than by trade, some important medicinal species including Cannabis sat/va and garlic from Central Asia; Aloe vera, Cum/num cymin urn, opium poppy and Glycyrrhiza (liquorice) from the Mediterranean; nutmeg from Southeast Asia; Thgonella foenum-graecum, Crocus sativus, Carum carvi (caraway) and Medicago sat/va (alfalfa) from Southwest Asia; Coriandrurn sativurn from the Mediterranean and Southwest Asia; Ric/nus coinmunis, So/anum ni'rum and tamarind from Africa; Acorus ca/amus from the Eurasian steppes; Lepid/um sativum (cress) from Tibet; and numerous other species. Most of these were ancient introductions. A further influx took place after the Muslim conquest of India from 1221 AD onwards, placing a new emphasis on the Graeco-Arab system of Medicine (Unani) which had already incorporated elements from Egypt, Greece, Persia, India itself and China. At one point in time, approximately around 1526 AD, the Vedic and Unani systems interacted and functioned in an integrated manner as documented [17].

Over time other influences from the East, particularly the Chinese/Tibetan systems of medicine affected the medicinal cultures of numerous tribal peoples of India. More importantly, oriental medicinal plants diffused into diverse regions of the Himalayas and interacted with those used in the Indian subcontinent.

Although many of the ancient as well as the more recent introductions and innovations described above, have become vital components of traditional medicine systems, India has over the millennia primarily relied on her own indigenous plant diversity in this regard. This is not surprising in light of the fact that she is one of the only countries to contain two of the globally identified areas of megabiodiversity, in addition to being a centre of origin and diversity for many crop species. The Botanical Survey of India records over 15,000 plant species occurring in the country, of which at least 7,500 have been used for medicinal purposes [18].

Although there are around 8,000 medicinal plant species used by different communities in India across different ecosystems, only around 10% of them (880species) are in active trade. Among these, around 48 species are exported in the form of raw drugs and extracts, while around 42species are imported [18,19]. The wild populations of about 100 of the traded species are known to have declined, thereby making them to be considered threatened. This is the situation of raw drug trade in India that unfolds. Before ascertaining the reasons for this, let us try to understand the “what”, “where” and “how much” of these raw drugs.

Habit wise analysis of these 880 medicinal plants, indicates that these are well distributed across different life forms with the majority belonging to the herbaceous category. The

highest proportion of herbs (41%), including grasses, is followed by trees (26%), shrubs (17%) and climbers (16%) [19].

Geographic distribution

India is one of the world's top 12 mega diversity countries with 10 bio geographic regions. Many essential oils, dyes and cosmetics are made of plants and many species of medicinal and aromatic plants are cultivated for such industrial needs, but most of them are available and wild collected. The medicinal and aromatic plants cultivation should be patterned to guarantee the known levels of the active compounds. *Directorate of Medicinal and Aromatic Plants Research* DMAPR gives us information about the medicinal and aromatic plants in India and its cultivation is becoming a popular field in the agro-industry which is changing the lifestyle of numerous growers and entrepreneurs. From collecting medical plants from the forest, India is becoming one of the most important cultivator of medicinal and aromatic plants, as well as for the export of the final products. India has 8000 medical plants and it ranks first in the world as a global leader in the field of medicinal and aromatic plants cultivation, production of aromatic essential oils [20]. The Indian Government and the National Bank for Agriculture and Rural Development are offering to the people many policies and by giving loans in order to encourage them for Medicinal and Aromatic Plants cultivation. India alone includes two among the world's eight biodiversity hotspots. The climatic and altitudinal variations, coupled with varied ecological habitats of this country, have contributed to the development of immensely rich vegetation with a unique diversity in medicinal plants which provides an important source of medicinal raw materials for traditional medicine systems, as well as for pharmaceutical industries in the country and abroad. World Health Organization has listed over 21000 plant species used around the world for medicinal purpose. In India, about 2500 plant species are being used in indigenous system of medicine. The red data book lists 427 Indian Medicinal plant entries on endangered species, of which 28 are considered extinct, 124 endangered, 81 rare and 34 insufficiently known.[21]

The natural occurrence of traded species is another element of interest here. It is found that these species are distributed across different bio-geographic zones, diverse habitats and landscape elements. About 18% of these species are confined to Himalayan and Trans Himalayan zone including North East India while around 4% is restricted to Western Ghats and 0.5% is found only in the Desert zone. The rest of the species (around 77%) have a wide range of distribution across the other bio-geographic zones of the country.[22]

ENDANGERED MEDICINAL PLANTS

Plant parts like leaves, bark, roots, fruits, seeds or even whole plant is indiscriminately collected from wild sources without taking care of saving the plants. Many of the important useful species are on the verge of extinction due to over-exploitation and habitat destruction [23]. More than 95% of the medicinal plants are collected from the wild; a number of them have become endangered in their natural habitats. There is need to encourage multiplication and cultivation of these plants. Collection of the following species from wild sources should be prohibited.

Aconitum sp. (Monk's Hood, Bachang), *Acorus* spp.(Sweet Flag, Vekhand), *Anchusa strigosa* (Gaozaban), *Aristolochia bracteata* (Kiramar), *Artemisia annua* (Worm wood), *Atropa acuminata* (Indian belladonna), *Berberis aristata* (Indian Berbery, Daru Haridra), *Brunium persicum* (Kala Zeera), *Chlorophytum* spp (Safed Musli), *Colchicum luteum* (Tara-Tutiya, Suranjan-1- Talah, Golden Collyrium), *Commiophora wightii* (Guggul), *Concinum fariestatum* (Jeevanti), *Coptis teeta* (Halad-Vachnag, Gold Thread, Mamira), *Curculigo orchioides* (Kali Musli), *Didymocarpus pedicellata* (Shila-Pushpa), *Dorsera* sp. (Sundew), *Ephedra gerardiana* (Somlata), *Eulophia campestris* (Saleb Misri), *Ferula jaeskaena* (Indian Hing), *Gentiana kurroa* (Indian Gentian Pashanbheda), *Gloriosa superba* (Glory Lily, Agnisikha), *Gynocardia odorata* (Kadu Bonsha), *Holostemma annualare* (Peet Chandan, Kasturi Mazil*), Hydrocarpus* sp., *Hyoscyamus niger* (Henbane), *Inula racemosa* (Pshkar Mool*), Iphigenia indica* (Nirpani), *Lilium polyphyllum* (Kshira Kankoli), *Microstylis nicifera* (Jeevaka), *Microstylis wallichii* (Rishvake), *Nardostachys grandiflora* (Jata mansi), *Onosma bracteatum* (Ratnajyot), *Orchis latifolia* (Salam Panja), *Panax pseudo-ginseng* var. *himalicus* (Indian Ginseng), *Physochlaena praelta* (Scholar, Lalthang), *Picrorhiza kurroa* (Kutki), *Piper cubeba* (Kababchini), *Podophyllum hexandrum*

(Bankari), *Rauwolfia serpentina* (sarpagandha), *Rheum astrata* (Rewadchini), *Rheum emodi* (Indian Rhubarb, Gandhini), *Saussurea sacra* (Yogispada), *Swertia chirayata* (Chirayata), *Taxus baccata* (Talispatra), *Taxus wallichiana* (Indian Yew).

CAUSES OF LOSS OF BIODIVERSITY OF MEDICINAL PLANTS

Environmental factors

Rainfall: For the past few years the annual rainfall has decreased resulting in the health of many herbaceous species during summer months.

Deforestations: Deforestations have been reported over the last two decades. The spread of agriculture, logging, fire wood collection, heavy wood collection, heavy grazing, etc., are the main reasons for reduction in area under valuable forests. Many valuable wild medicinal plant species are eradicated or minimized every year due to the deforestation activities.

Siltation of water bodies: Siltation of water bodies in the forests has resulted in the reduction of water holding capacity heading to depletion of underground water.

Lack of pollinators: Honey bee colonies have declined in numbers to the extent of 50- 60%, in forests and other areas. Loss of pollinators has resulted in reduced seed set and dispersal of seeds.

Developmental activities

Submersion: Loss of many species of medicinal plants has been noticed in forests due to submersion, eg., the Maradavally forest is the catchments of Linganamakki Dam, the main reservoir of Karnataka for irrigation and power generation. Submersion of nearly 10 sq. km of forest area during monsoons has resulted in loss of valuable medicinal plant species.

Infrastructure: Expansion of roads, installation of power lines and construction of buildings has caused extensive damage to forests and medicinal plants, eg., Devanarayandurga forest in Karnataka.

Agriculture and forestry methods

Monoculture: There has been a progressive increase in monoculture plantations of economically important indigenous as well as exotic species in forest. Monoculture plantation totally affects the organic productivity and reduces the natural stability and complexity resulting in loss of medicinal plants. eg., *Eucalyptus* and *Acacia* species in many forests.

Encroachments: Encroachments over forestlands have assumed alarming levels. Apart from felling of trees and clearing vegetation, the cultivation practices followed on high sloppy lands has caused soil erosion, and decline of medicinal plant wealth.

Over-exploitation: Gathering of medicinal plants from the forests are rampant. The collection was by unorganized forest collectors, who, in turn sold the product to a contractor at the price fixed by the latter. But now, due to the awareness created by the members of the 'Local Traditional Medicinal Practitioners Association', illegal gathering has been controlled to a certain extent.[24]

Strategies for conservation of medicinal plants

The conservation of the wild medicinal plants or any other such threatened species can be tackled by scientific techniques as well as social actions.
There are basically three scientific techniques of conservation of genetic diversity of these plants.

A. *In-situ*conservation
B. *Ex-situ*conservation
C. Legislation

***In-situ* conservation**

a. Conservation of a given species in its natural habitat or in the area where it grows naturally is known as *in-situ* conservation.
b. It includes Gene bank / Gene sanction, Biosphere reserves, national parks, sacred sites, Sacred grooves etc.
c. It is only in nature that plant diversity at the genetic, species and eco-system level can be conserved on long-term basis
d. It is necessary to conserve in distinct, representative biogeographic zones inter and intra-specific genetic variation.
   It is cost-effective way of protecting the existing biological and genetic diversity is the 'in-situ' or on the site conservation wherein a wild species or stock of a biological

community is protected and preserved in its natural habitat. The prospect of such a 'ecocentric', rather than a species centred approach is that it should prevent species from becoming endangered by human activities and reduce the need for human intervention to prevent premature extinctions. Establishment of biosphere reserves, national parks, wild life sanctuaries, sacred groves and other protected areas forms examples of *'in-situ'* methods of conservation.

Ex-Situ Conservation

Conservation of medicinal plants can be accomplished by the ex-situ i.e. outside natural habitat by cultivating and maintaining plants in botanic gardens, parks, other suitable sites, and through long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries, etc.) and in plant tissue culture repositories and by cryopreservation).

Botanical gardens/arboreta

A botanical garden is an institution holding documented collection of living plants for the ' purpose of scientific research, conservation, display and education.[25] They serve as repositories of germplasm collections, specially rare and endangered ones of indigenous and exotic origin. Botanic Garden Conservation International (BGCI), an international organisation with its headquarters in London (UK) was established in 1987 for global co-operation and monitoring the conservation programmes of the botanical gardens. The BGCI has 500 member botanical gardens in III countries all over the world [26] There are about 1,846 botanical gardens worldwide as per the BGCI database. India has a network of about 140 botanical gardens which include 33 botanical gardens attached to 33 universities botany departments. But hardly 30 botanical gardens have any active programme on conservation. Tropical Botanical Gardens & Research Institute (TGBRI), located in a degraded forest region of Western Ghat Mountains in Kerala has an excellent example in ex-situ conservation of plant diversity in India [27].

There are no separate policies or regulations for conserving medicinal plants growing in forests in India. There conservation is covered under existing laws pertaining to forestry. Following are the laws formulated by government of India for conservation of forests which directly or indirectly protects the wild herbal flora.

a. Forest Act, 1927
b. Wildlife (Protection) Act 1972 and Wildlife (Protection) Amendment Act 1991
c. Forest (Conservation) Act, 1980
d. Environment Protection Act, 1986
e. National forest policy, 1988
f. National biodiversity act, 2002

IMPORTANCE OF MEDICINAL PLANTS TO HUMAN BEING

Medicinal plants have played an essential role in the development of human culture, for example religions and different ceremonies. Many of the modern medicines are produced indirectly from medicinal plants, for example aspirin. Many food crops have medicinal effects, for example garlic.

Medicinal plants are resources of new drugs. It is estimated there are more than 250, 000 flower plant species. [27]

Studying medicinal plants helps to understand plant toxicity and protect human and animals from natural poisons.

Cultivation and preservation of medicinal plants protect biological diversity, for example metabolic engineering of plants. The medicinal effects of plants are due to metabolites especially secondary compounds produced by plant species. Plant metabolites include: primary metabolites and secondary metabolites

Phytotherapy is the use of plants or plant extracts for medicinal purposes (especially plants that are not part of the normal diet). *Phytochemistry* is the study of phytochemicals produced in plants, describing the isolation, purification, identification, and structure of the large number of secondary metabolic compounds found in plants[28].

Table 1. Some medicinal plants of India having good antioxidant potential [25]

S. No.	Name of plant	Uses
1.	*Aquilaria mallaccensis*	Wood is stimulant, tonic, aphrodisiac, carminative, astringent, also used in diarrhoea, constipation, vomiting and snakebite.
2.	*Abies spectabilis*	Asthma, bronchitis, Carminative, Expectorant, Diuretic
3.	*Acorus calmus*	Chronic diarrhoea and dysentry
4.	*Achyranthes aspera*	Dysentry, piles ulcer, diuretic
5.	*Vanda coerulea*	Eye drops for the treatment of Glaucoma. Catract and blindness
6.	*Renanthera imschootiana*	Gonorrhoea, control eye sores
7.	*Rauvolfia serpentina*	Sedation, hypertension, brodyeardia, myosis, ptosis, tremors
8.	*Hibiscus manihot*	Tuberculosis, anti-diabetic
9.	*Abroma augusta*	Diabetes and headache
10.	*Arbus precatorius*	Diuretic, emetic, aphrodisiac

CONCLUSION

India consist of rich varieties of medicinal plants and herbs. Most of those plants and their medicinal uses are known only to the inhabitant and the tribes residing in various parts of India. The active ingredients present in these plants may be used for designing some new drugs and pharmaceutical agents which can pave some new alleys in the world of pharmaceutical sciences and be a blessing for mankind. Plant-derived pharmaceutical formulations used to treat diseases[29,30].

Alternative medicine is better than our conventional allopathic medication and can enhance the impact of conventional drugs if used properly. Natural product derived from plants may be do not have any side effects till date if used in a specific dose.[31,32] Some of the medicinal plants work unbelievably in certain diseased conditions according to the tribal people of India. Maybe while hunting for drugs in laboratories for certain deadly diseases day and night, researchers and scientists are missing some miraculous and potent phytochemical constituents which could be modified for formulating the drug, which are present in the plants grown in wild and ignorance on the roadside, backyards and valleys of India.

REFERENCES

1. Mao AA, Hynniewta TM. (2000). Floristic diversity of North East. India J Assam Sci Soc ;41:255-66.
2. Hynniewta TM. (1984). Ethnobotanical investigations of some tribes of Arunachal Pradesh. Proc Second Annual workshop on MAB Project; p. 83-7.
3. Bhattacharya PC, Muzumder R, Sarmah GCD. (1991). Rare medicinal plants of Assam. Ancient Sci Life 10:234-8.
4. Ghosh D, Parida P. (2015). Medicinal plants of Assam, India: a mini review. Int J Pharmacol Pharm Sci ;2:5-10.
5. Mao AA, Hynniewta TM, Sanjappa M. (2009). Plant wealth of Northeast India with reference to ethnobotany. Indian J Traditional Knowledge ;8:96-103.
6. Mensah AY, Bonsu AS, Fleischer TC. (2011). Investigation of the bronchodilator activity of abrus precatorius. Int J Pharm Sci Rev Res;6:9-13.
7. Taid TC, Rajkhowa RC, Kalita JC. (2014). A study on the medicinal plants used by the local traditional healers of Dhemaji district, Assam, India for curing reproductive health-related disorders. Adv Appl Sci Res ;5:296-301.
8. Vijayalatha SJ. (2004). An Ornamental garden with medicinal plants an indirect approach for conservation of medicinal plants. *Indian J Arecanut Spices and Medicinal Plants.*;6(3):98–107.
9. Singh S. (2005). Medicinal plants –A Natural gift to mankind. *Agriculture Today*. 3(3):58–60.
10. Roberts EH. (1972). *Viability of Seeds*. London: Chapman and Hall.

11. Harrington JF. (1970). 'Seed and pollen storage for conservation of plant genetic resources'. In: *Genetic Resources in Plants*. Their Exploration and Conservation. Frankel OH, et al. editors. UK: Blackwell; p. 501–521.
12. Roberts EH. (1975). Problems of long–term storage and seed and pollen of genetic resources conservation'. In: *Crop Genetic Resources for Today and Tomorrow*. Frankel OH, et al. editors. Cambridge, UK: Cambridge University Press; p. 226–296.
13. Withers LA. (1991). Biotechnology and plant genetic resources conservation. In: *Plant Genetic Resources Conservation and Management*. Paroda RS, et al. editors. New Delhi: IBPGR Regional Office; p. 273–297.
14. Towill LE. (1985). Low temperature and freeze/vacuum–drying preservation of pollen. In: *Cryopreservation of Plant Cells and Organs*. Kartha KK, et al. editors. Florida, USA: CRC Press; p. 171–198.
15. Alexander MP, Ganeshan S.(1993). 'Pollen storage'. In: *Advances in Horticulture. Fruit Crops–part I*. Chadha KL, et al. editors. New Delhi: Malhotra Publishing House; p. 481–496.
16. Jackson WP. (1999). 'Plenary address, BGCI. 4th International Congress on Education in Botanic Gardens held in Thiruvanthapuram. Kerala, India.
17. Sharma SC, Goel AK. (1994). Role of botanic gardens in modern times. *Indian J Forestry*.17:230–238.
18. Das NJ, Saikia SP, Sarkar S, Devi S. (2006). Medicinal plants of North-Kamrup district of Assam used in the primary healthcare system. Indian J Traditional Knowledge;5:489-93.
19. Hazarika R, Abujam SS, Neog B. (2012). Ethnomedicinal studies of common plants of Assam and Manipur. Int J Pharm Biol Arch 3:809-15.
20. Lai Y, Lim YY, Kim KH. (2010). Blechnum Orientale linn-a fern with potential as an antioxidant, anticancer and antibacterial agent. BMC Complementary Altern Med ;10:15.
21. Pelagic V. (1970). Pelagic folk teacher. Beograd: Freedom; pp. 500–2.
22. Katic R. (1958). La medicine en Serbie au moyen age. Beograd: Scientific work; pp. 7–36.
23. Bazala V. (1943). The historical development of medicine in the Croatian lands. Zagreb: Croation publishing bibliographic institute; pp. 9–20.
24. Nikolovski B. (1995). Essays on the history of health culture in Macedonia. Skopje: Macedonian pharmaceutical association; pp. 17–27.
25. Tucakov J. (1984). Pharmacognosy. Beograd: Academic books; pp. 8–21.
26. Thorwald J. (1991). Power and knowledge of ancient physicians. Zagreb: August Cesarec; pp. 10–255.
27. Katic R. (1967). The Serbian medicine from 9th to 19th centuries. Beograd: Scientific work;pp. 22–37.
28. Stojcevska-Antic V. (1982). Clement and Naum of Ohrid in folk tradition. Skopje: Our book; pp. 25–86.
29. Celakoski N. (1997). Saint Naum of Ohrid Miracle worker. Prilep: Raster; pp. 85–6.
30. Nikolovski B. (1961). Arab pharmacy in Macedonia. Bulletin. :20–7.
31. Kelly K. (2009). History of medicine. New York: Facts on file; pp. 29–50.
32. Bottcher H. (1965). Miracle drugs. Zagreb: Zora; pp. 23–139.