



Review article

Traditional use of plants against leprosy in India: a review of the recent literature

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Abstract

Leprosy is an age-old disease. Throughout history the people afflicted have often been ostracized by their communities and families. The present review deals with the enormous amount of ethnobotanical work performed in the last few years involving use of different plants against leprosy in India. From a variety of literature sources the data has been compiled mentioning the scientific name of plants, their geographical locations, name of the user ethnic groups, mode of administration, parts used, dosage, etc. depending on availability of information. These traditional knowledge of plants in medicine was losing and it may preserved that should provide a base for its further phytochemical research and its conservation.

Introduction

India with its great topography and climatic diversity has a very rich and diverse flora and fauna. It is one of the 12 mega diverse countries of the world with 16 agro climatic zones, 12 vegetative zones, 15 biotic provinces and 426 biomes with 15,000 medicinal plants, out of which 7,000 are used in *Ayurveda*, 700 in *Unani* and 600 in *Siddha* systems of medicine [1]. There are over 400 different tribal and other ethnic groups constituting about 7.5% of India's population [2]. World Health Organization estimates over 80% of the people in developing countries depend on traditional medicines for their primary health needs. In the developed countries, 25% of the medicinal drugs are based on plants and their derivatives [3, 4]. In India there are many ethnic groups with rich cultural heritage still using the traditional herbal medicine for treating various diseases [1, 5, 6, 7]. From the ancient times various types of skin diseases like leprosy, eczema, leucoderma, ringworm, and scabies are treated completely with plant origin medicines. Leprosy is an infectious disease that caused by bacillus bacteria, *Mycobacterium leprae* and has been known since biblical times. It is characterized by disfiguring skin sores, nerve damage, and progressive debilitation [8]. The total number of leprosy cases registered globally 171948 in March, 2017. The new cases of leprosy detected globally 214783 among these 135485 are from India in 2016. During the same year the number of leprosy cases with Grade- 2 disabilities detected globally 12819 and India alone contributes 5098 [9]. Though, leprosy is curable with treatment known as multidrug therapy (MDT).

Several drugs are used in combination in multidrug therapy. These drugs must never be used alone as monotherapy for leprosy. The World Health Organization system distinguishes "paucibacillary" and "multibacillary" based upon the proliferation of bacteria. MDT consists of 2 or 3 drugs: dapsone and rifampicin for all patients, with clofazimin added for multibacillary disease. This drug combination kills the pathogen and cures the patient. The Bacillus Calmette–Guerin (BCG) vaccine offers a variable amount of protection against leprosy in addition to tuberculosis [10, 11]. These few allopathic drugs are not enough to fight worldwide with this massive number of leprosy patients in poor countries like India. So alternative way should be search and plant medicine will be one of the best options for the treatments of leprosy in poor countries where easily available diverse medicinal plants that are cost effective and biologically safe. Therefore, herbal medicine has played the most important role in the treatment of leprosy in Africa [12]. In a study in Nigeria 59% of leprosy patients were found to first consult folk medicine [13]. Medicinal plants and plant based natural products have been reported to possess anti bacterial properties [14]. Gautam *et al.* highlight the enormous chemical diversity of plant kingdom and provide detailed information on 255 plant species that have demonstrated antimycobacterial activity, of these 35 have been reported in *Ayurveda* for use against leprosy [13, 15]. There is huge collection of Indian medicinal plants used for treating leprosy. This review therefore attempts to compile their traditional knowledge including preparations, doses, mode of administration etc. with proper management and

conservation of these plants that provide a base which can offers immense scope for researchers engaged in validation of the traditional claims and development of new bio-actives for cure or management of quite prevalent disease like leprosy.

Enumeration

The author has compiled the data collected from available reports on plants used against leprosy disease from India in the last few years. The plant families (40) and species (75) are documented alphabetically on the basis of respective families, genera and species.

Acanthaceae

Adhatoda vasica (L.) Nees

Vernacular name: *Adusa* /*Bakas* (Buxar district of Bihar)
This plant is used by the indigenous people of Buxar district in Bihar for leprosy treatment [16].

Andrographis paniculata (Burm.f.) Wall. Ex. Nees.

Vernacular names: *Kaalmegh* (Buxar district of Bihar); *Chireita* (Bhadrak district of Odisha); *Kalmegh* (Bankura district of West Bengal).

To treat leprosy paste made from leaf is applied topically twice daily till cure by tribes of Bhadrak district of Odisha [17]. This plant is also used by the people of Buxar district in Bihar for leprosy treatment [16]. Whole plant extract is useful for leprosy by the local health healers of Bankura district of West Bengal [18].

Amaranthaceae

Achyranthes aspera L.

Vernacular name: *Naaiurvi* (East Godavari District of Andhra Pradesh); *Ubhatkara* (Mayong area of Morigaon district of Assam).

The people of the reserve forest and other tribal areas of East Godavari district of Andhra Pradesh is also used this plant for the treatment of leprosy [19]. The people of Myong area in the Morigaon district of Assam under Myong Community Development Block on the southern bank of the river Brahmaputra use the dried roots and leaves powder of this herb for the treatment of leprosy infected area [20].

Achyranthes bidentata L.

Vernacular name: *Minamkachi* (Meghalaya).
It is used for the treatment of leprosy by the indigenous people of North eastern India [21].

Amaranthus spinosus L.

Vernacular name: *Rangasuturia* (Mayong area of Morigaon district of Assam).

The roots and leaves paste of this herb is used in infected part of the skin by the people of Myong area in

the Morigaon district of Assam under Myong Community Development Block on the southern bank of the river Brahmaputra [20].

Amaranthus viridis L.

Vernacular names: *Thoia*, *Mullukkeerai* (East Godavari District of Andhra Pradesh).

It is used by the people of East Godavari area district of Andhra Pradesh for the treatment of leprosy [19].

Anacardiaceae

Anacardium occidentale Linn.

Vernacular names: *Jidimamidi* (East Godavari District of Andhra Pradesh); *Kollamaram* (Kanyakumari district of Tamilnadu).

The nut oil irritant and rubifacient used in leprosy by the people of reserve forest and other tribal areas of East Godavari district of Andhra Pradesh [19]. The community of Kanyakumari district uses powdered bark mixed with honey and taken orally once a day for six months against leprosy [22,23].

Semecarpus anacardium L.f.

Vernacular names: *Bhilwa* (Udham Singh Nagar in Uttarakhand).

The gum is applied topically on leprosy by the *Tharu* community of Udham Singh Nagar in Uttarakhand [24].

Angiopteridaceae

Angiopteris evecta (Forst.) Hoff.

Spores are said to be effective in the treatment of leprosy and other skin diseases by the tribes of North eastern India [25].

Apiaceae

Centella asiatica (L.) Urban

Vernacular name: *Brahmi* (Mayong area of Morigaon district of Assam); *Sarswathiaku* (East Godavari district of Andhra Pradesh).

It is also used by the people of East Godavari district of Andhra Pradesh for the treatment of leprosy [19]. The people of Mayong area of Morigaon district of Assam uses decoction of the whole plant for treatment of leprosy disease [20].

Apocynaceae

Holarrhena antidysenterica (L.) Wall

Vernacular name: *Minamkachi* (Garo- Meghalaya)
This plant is used for the treatment of leprosy by tribal people of Northeast India [21].

Holarrhena pubescens Wall.ex G. Don

Vernacular name: *Kurchi* (Udham Singh Nagar in Uttarakhand).

The *Tharu* community of Udham Singh Nagar in Uttarakhand recommended seeds decoction internally to cure leprosy [24].

Asclepiadaceae

Calotropis gigantea (L.) R. Br.

Vernacular name: *Kempu yekke* (Bidar district of Karnataka); *Madar* (Balaghat district of Madhya Pradesh).

Roots bark, leafy and latex are used in leprosy and skin diseases for a period of 8-10 days by the people of Central Bastar district in Chhattisgarh state [26]. Poultice of leaf with latex is applied externally by the tribes of Balaghat district of Madhya Pradesh [27]. The latex is applied for treating leprosy by the rural people of Bidar district of Karnataka [28].

Calotropis procera W.T. Aiton

Vernacular name: *Aak/Akwan* (Raigarh district of Chattisgarh); *Aak/ Shishudurw* (Dantewada, Dakshin Bastar of Chattisgarh).

The tribes of *Oraon*, *Agharia*, *Gond* and *Korwa* community of Raigarh district of Chattisgarh used fruit and whole plant for the treatment of leprosy [29]. Milky juice (leaf and root) is used for treatment of leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30].

Aracaceae

Borassus flabellifer Linn.

Vernacular name: *Tadi* (Dantewada of Chhattisgarh).

Fresh sap of palm is useful in leprosy to the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30].

Asteraceae

Ageratum conyzoides L.

Vernacular names: *Janglipudina* (Forest area of Bihar) *Neelam*, *Khajju* (Rewa district of Madhya Pradesh); *Gindhoni* (H) (Udham Singh Nagar district of Uttarakhand).

Plant juice is used to treat leprosy by the people from pains of Yamuna Nagar district in Haryana [31]. The *Tharu* community of district Udham Singh Nagar in Uttarakhand is taken whole plant decoction orally to cure leprosy, 2 ml thrice a day [24]. Fermented leaves and stems are used in leprosy [32].

Bidens pilosa L.

Vernacular names: *Ara-kajhar/Samsa* (Buxar district of Bihar).

The people of Buxar district in Bihar uses leaf paste on leprosy affected part [16].

Eclipta alba Hassk.

Vernacular name: *Kaharaj* (Mayong area of Morigaon district of Assam).

The *Lalung* tribe at Mayong area of Morigaon district of Assam uses the whole plant part and powder is used in leprosy disease [20].

Saussurea costus (Falc.) Lipschitz

Vernacular names: *Kuth*, *Shahruta* (Lahaul-Spiti region of Himachal Pradesh).

The root paste is applied externally for 7-8 days for the treatment of leprosy by the different community mainly Bods or Budhists of Lahaul-Spiti region of Himachal Pradesh which is locally called as *Kod/Jai* [33].

Celastraceae

Celastrus paniculatus Wild.

Vernacular names: *Kunkunilata* (Mayong area of Morigaon district of Assam); *Kakundan* (Udham Singh Nagar district in Uttarakhand); *Malkagni* (Selected districts of Chhattisgarh).

Tribes of selected districts of Chhattisgarh take 2 tsp of root juice in empty stomach in the morning for 3 days. Besides root paste is also applied [34]. The seed paste is applied topically on leprosy by the *Tharu* community of Udham Singh Nagar district in Uttarakhand [24]. Powder and oil of its seeds are used in leprosy infected part of the body by the *Lalung* tribe of Mayong area of Morigaon district in Assam [20].

Combretaceae

Terminalia arjuna (Roxb.ex DC.) Wight & Arn.

Vernacular name: *Kawa* (Udham Singh Nagar district in Uttarakhand).

The paste of bark is applied topically on leprosy by the *Tharu* community of Udham Singh Nagar district in Uttarakhand [24].

Terminalia bellarica Roxb.

Vernacular name: *Baheda* (Mokhada region of Thane district of Maharashtra).

The dried fruit of this tree is used in the treatment of leprosy [35].

Terminalia catappa Linn.

Vernacular name: *Pateebadam* (East Godavari district of Andhra Pradesh).

The people of reserve forest and other tribal areas of East Godavari district used young leaf juice to prepare ointment for leprosy & other skin diseases [19].

Commelinaceae

Commelina benghalensis Linn.

Vernacular names: *Konasimalu* (Mayong area of Morigaon district of Assam); *Venneveduru* (East

Godavari district of Andhra Pradesh); *Kanchara* (Karnal district of Haryana); *Kanchira* (Bankura district of West Bengal).

The people of reserve forest and other tribal areas of East Godavari district used it in leprosy [19]. Whole plant is used in leprosy by the local people and traditional healers of Karnal district of Haryana [36]. Whole plant extraction used by the local health healers of Bankura district of West Bengal for the treatment of leprosy [18]. The *Lalung* tribal people on Myong area of Morigaon district in Assam use leaf paste, latex, root powder for the leprosy disease [20].

Convolvulaceae

Evolvulus alsinoides Linn.

Vernacular name: *Shankhyapuspi* (Bankura district of West Bengal).

Whole plant extraction is used to treat leprosy by the local health healers of Bankura district of West Bengal [18].

Ipomoea eriocarpa R. Br.

Vernacular name: *Nakhari* (Rewa district of Madhya Pradesh).

Indigenous communities of Rewa district of Madhya Pradesh boiled whole plant in oil that is used in leprosy [32].

Cornaceae (Alangiaceae)

Alangium salvifolium (L. f.) Wangerin

Vernacular name: *Ankol* (Forest area of Bihar).

The seed oil and the root bark are useful in the treatment of leprosy by the people of Bihar [2].

Cucurbitaceae

Citrullus colocynthis (L.)

Vernacular name: *Verripuccha* (East Godavari district of Andhra Pradesh).

The tribal people of reserve forest and other areas of East Godavari district used it in the early stage of leprosy [19].

Corallocarpus epigaeus Hk.f.

Vernacular names: *Kurudankizhangu* (Kanyakumari district of Tamil Nadu); *Kurudankixhangu* (South Travancore of Kanyakumari district of Tamil Nadu).

The community of Kanyakumari district uses tubers boiled in coconut oil is applied once a day for six months on the affected parts to cure leprosy [22, 23].

Luffa acutangula (L.) Roxb.

Vernacular name: *Tori* (Buxar district of Bihar).

The indigenous communities of Buxar district in Bihar are used leaves in leprosy [16].

Momordica charantia L.

Vernacular names: *Kerala* (Buxar of Bihar); *Titakerala* (Mayong area of Morigaon district of Assam).

The tribal people of Buxar district in Bihar are used fruits in leprosy [16]. The *Lalung* tribal people of Myong area of Morigaon district of Assam use fruit paste in leprosy [20].

Trichosanthes lobata Roxb.

Vernacular name: *Peppudal* (South Travancore of Kanyakumari district).

The community of Kanyakumari district uses whole plant paste is applied once a day for one year on the affected parts to cure leprosy [22, 23].

Dryopteridaceae

Dryopteris cochleata (Ham ex D. Don) C. Chr.

The rhizome is antibacterial and antileprotic. It is powdered and taken with water (twice a day) by the north eastern Indian specially Arunachal Pradesh tribes in leprosy [25].

Euphorbiaceae

Jatropha gossypifolia L.

The roots, leaves and seeds are used in leprosy by the indigenous people of Buxar district of Bihar [37].

Fabaceae

Acacia catechu (L.f.) Willd. (Mimosaceae)

Vernacular name: *Kattha* ((In the forest area of Bihar).

It is given to the leprosy patients in Bihar area [2].

Albizia lebbek (Linn.) Willd. (Leguminosae)

Vernacular name: *Siris*, *Sireen* (Karnal district of Haryana).

The stem bark extract used to cure leprosy by the local people and traditional healers of Karnal district of Haryana [36].

Cassia fistula Linn.

Vernacular name: *Amaltas* (Raigarh district & Dantewada area of Dakshin Bastar in Chattisgarh).

The people of *Oraon*, *Agharia*, *Gond* and *Korwa* community of Raigarh district of Chattisgarh used leaf, root, seed and wood for the treatment of leprosy [29]. Leaves are also used in leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30].

Clitoria ternatea Linn.

Vernacular name: *Syahiful* (Dantewada area of Dakshin Bastar in Chattisgarh).

The root is used in leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30].

***Bauhinia variegata* L. (Caesalpiniaceae)**

Vernacular name: *Kachnar* (Udham Sing Nagar district of Uttarakhand); *Kachnar* (Buxar of Bihar); *Kachnar*, *Kaniar*, *Kural* (Shimla Catchment Area Reserve Forest and Wildlife Sanctuary and its adjoining villages of Shimla Hills).

The *Tharu* community of Udham Sing Nagar district of Uttarakhand takes root bark decoction orally thrice a day to treat leprosy [24]. The bark is tonic and used in leprosy by the people of Shimla and neighborhood [38]. The indigenous communities of Buxar district in Bihar it is used as an antidote to cure leprosy [16]. The bark is also used to cure leprosy [39].

***Butea monosperma* (Lam) Taub.**

Vernacular names: *Palas* (Udham Sing Nagar district of Uttarakhand); *Palaso* (Niyamgiri Hills range borders of Rayagada and Gunpur subdivision of southwest part of Odisha).

The juice of flowers is used to cure leprosy by the *Tharu* community of Udham Sing Nagar district of Uttarakhand [24]. Likewise the decoction of flower is applied on the affected area of leprosy and other skin diseases by the *Dongaria Kandha* tribe of Niyamgiri forests in Odisha [40].

***Cassia fistula* L. (Caesalpiniaceae)**

Vernacular name: *Amaltas* (Udham Sing Nagar district of Uttarakhand); *Sunaru* (Mayong area of Morigaon district of Assam).

The root paste is applied topically on leprosy by the *Tharu* community of Udham Sing Nagar district of Uttarakhand [24]. The *Lalung* tribal people of Myong area of Morigaon district of Assam use bark paste and decoction are used in leprosy [20]. The tribal in reserve forest and other area of East Godavari district use those for the same purpose [19].

***Cassia tora* L. (Caesalpiniaceae)**

Vernacular name: *Sarumedeluwa* (Mayong area of Morigaon district of Assam).

The leaf juice and seed powder are applied to cure leprosy by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

***Dalbergia sissoo* DC.**

Vernacular name: *Siswa* (Udham Sing Nagar district of Uttarakhand); *Sisso* (East Godavari district of Andhra Pradesh).

The tribal people of reserve forest and other areas of East Godavari district used in leprosy [19]. The stem bark is soaked in water for 4-5 hours, made into paste and applied topically on leprosy by the *Tharu* community of Udham Sing Nagar district of Uttarakhand [24]. The wood is useful in leprosy to the local people and

traditional healers of Karnal district of Haryana [36]. Bark powder is used in leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30]. Decoction of the bark and leaf are used in leprosy by the tribal of Jharkhand. They make a decoction of 10gm sissoo bark with 500gm of water and it should be boiled till the liquid reduces into half. Mix the juice of the bark and consume it for forty days every morning which helps in leprosy [41,42].

***Senna occidentalis* (L.) J.H. Friedrich Link**

Vernacular name: *Dandepadla* (Dantewada area of Dakshin Bastar in Chattisgarh).

Seeds are used in skin diseases and leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada of Dakshin Bastar in Chattisgarh [30].

***Indigofera aspalathoides* Vahl. (Papilionaceae)**

Vernacular names: *Sivanarvembu* (Nagapattinam district and South Travancore of Kanyakumari district in Tamil Nadu).

The powdered bark mixed with coconut oil is applied twice a day for six months on the affected parts by the traditional user of Nagapattinam district, Kanyakumari district and South Travancore of southern peninsular India [3,22,23].

***Pongamia glabra* Vant. (Papilionaceae)**

Vernacular name: *Koras* (Mayong area of Morigaon district of Assam).

Seed powder and seed oil are mixed with each other and applied in infected part. Bark and leaf juice is also applied in leprosy disease by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

***Psoralea corylifolia* Linn.**

Vernacular name: *Bavachi* (Mokhada area of Thane district, Maharashtra).

Seeds are especially recommended in leprosy and other skin diseases by the people of Bastar district in Chhattisgarh state [26]. The seed oil is recommended orally, with beatlenut leaf, amalaki and Khandira are valuable adjuvants with bakuchi in leprosy and dermatoses [43]. The seed powder or paste is used in leprosy by the tribes of Mokhada area of Thane district in Maharashtra [35].

Flacourtiaceae

***Hydnocarpus pentandra* (Buch, Hem.)**

Vernacular name: *Kadu Kavath* (Aurangabad district of Maharashtra).

The mixture of oil and the lemon juice is applied on leprosy gives relief to the local and tribal people of some selected areas of Aurangabad district of Maharashtra state [44].

Guttiferae

Calophyllum inophyllum Linn.

Vernacular name: *Punnai* (Villupuram district of Tamil Nadu).

The plant is also recommended in leprous nephritis by the traditional practitioners in Villupuram district of Tamil Nadu [45].

Lamiaceae

Ocimum sanctum L.

Vernacular names: *Tulasi* (Bhadrak of Odisha); *Tulsi* (Dantewada, Dakshin Bastar of Chattisgarh).

The leaf paste is very effective for treating wounds of leprosy by the local inhabitants of Bhadrak district of Odisha [17]. The oil is used in leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada, Dakshin Bastar of Chattisgarh [30].

Premna mollissima Roth

Vernacular name: *Baka* (Udham Sing Nagar district of Uttarakhand).

The decoction of bark (2 teaspoonfuls) is taken orally twice a day as a remedy for leprosy and its paste is also applied externally for the same by the *Tharu* community of Udham Sing Nagar district of Uttarakhand [24].

Liliaceae

Allium sativum L.

Vernacular names: *Lahasun* (Buxar district of Bihar).

The preparations from all parts are used in leprosy [16].

Gloriosa superba L.

Vernacular names: *Kalihari* (Korea and other selected district of Chhattisgarh); *Adavinabhi* (East Godavari district of Andhra Pradesh).

The leaves paste is applied on leprosy by the traditional healers in some selected district of Chhattisgarh [34]. Its anodyne application in leprosy by the tribal people of East Godavari district is also reported [19]. The tuber is used by the tribal and rural people of Korea district of Chattisgarh for the treatment of leprosy [46].

Linaceae

Aquilaria malccensis Lamk.

Vernacular name: *Agaru* (Mayong area of Morigaon district of Assam).

The oil is used in the infected area by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

Lythraceae

Lawsonia inermis Linn.

Vernacular name: *Mahendi* (Plains of Yamuna Nagar district in Haryana).

The fresh leaves paste of this shrub used to treat leprosy by the indigenous people of Yamuna Nagar district of Haryana [31].

Malvaceae

Abutilon indicum G. Don.

Vernacular name: *Pedipedika* (Dhenkanal district of Odisha); *Thuthi* (Villupuram district of Tamil Nadu).

The fried leaves are used as a remedy for leprosy by the traditional practitioners in Villupuram district of Tamil Nadu [45]. The fried leaves are used as remedy for leprosy [47].

Bombax ceiba L.

Vernacular name: *Semal* (Forest area of Bihar); *Semar* (Raigarh district & Dantewada of Chattisgarh).

Seeds and roots were used in the treatment of serious skin disease like leprosy in the forest area of Bihar [30]. The people of Oraon, Agharia, Gond and Korwa community of Raigarh district of Chattisgarh used bark, fruit and leaves for the treatment of leprosy [29]. Bark is used in leprosy by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada district of Chhattisgarh [30].

Meliaceae

Azadirachta indica A Juss.

Vernacular names: *Neem* (Dantewada, Dakshin Bastar of Chhattisgarh); *Nim* (Bankura district of West Bengal); *Neem* (Buxar of Bihar); *Mahanin* (Mayong area of Morigaon district of Assam).

Seed oil is used by the *Madiya*, *Muriya*, *Gond* and *Bhatra* tribes of Dantewada of Dakshin Bastar of Chhattisgarh for the treatment of leprosy [30]. Leaf extract is used by the local health healers of Bankura district of West Bengal for the treatment of leprosy [18]. Root powder is used in leprosy by the indigenous communities of Buxar district in Bihar [16]. The dried plant parts like stem, leaves, seed and root are mixed to make powder and apply it daily by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

Menispermaceae

Tinospora cordifolia (Willd.) Hk.f. & Th.

The root paste is used commonly in leprosy by the people of Bastar district in Chhattisgarh [26].

Moraceae

Ficus racemosa L.

Vernacular name: *Gular Trees* (Plains of Yamuna Nagar district in Haryana).

The people in the plains of Yamuna Nagar district in Haryana take bark powder with milk to treat leprosy [31].

Nelumbonaceae

Nelumbium speciosum

Vernacular name: *Kamalam* (East Godavari district of Andhra Pradesh).

The tribal in reserve forest and other areas of East Godavari district used it in leprosy [19].

Oleaceae

Jasminum grandiflorum L.

Vernacular name: *Jasmine* (Paschim Medinipur of West Bengal).

The roots, leaves and flowers are used for leprosy and other skin diseases by different tribal communities in western parts of Paschim Medinipur district of West Bengal [1].

Papaveraceae

Argemone Mexicana L.

Vernacular name: *Sialkata* (Mayong area of Morigaon district of Assam); *Kanta agara* (Dhenkanal district of Odisha).

The leaf paste is mixed with turmeric and applied in leprosy infected area by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20]. The latex of the stem is applied externally to cure wounds of leprosy by the people of Dhenkanal district of Odisha [47].

Pedaliaceae

Sesamum indicum L.

Vernacular name: *Til* (Udham Sing Nagar district of Uttarakhand).

The oil seeds are applied topically in leprosy by the *Tharu* community of Udham Sing Nagar district of Uttarakhand [24]. Similar uses are also observed among the indigenous people of Hatras district area [48].

Poaceae

Bambusa arundinaceae L.

Vernacular name: *Baans, Bans* (Raigarh & Dantewada district of Chhattisgarh).

The tribal people of Oraon, Agharia, Gond and Korwa communities of Raigarh district of Chhattisgarh used whole plant for the treatment of leprosy [29]. Similarly whole plant is also used in leprosy by the *Madiya, Muriya, Gond and Bhatra* tribes of Dantewada district of Chhattisgarh [30].

Primulaceae

Anagallis arvensis Linn.

Vernacular name: *Jonkmari, Dhabbar* (Karnal district of Haryana).

The plant extract is used in leprosy by the local people and traditional healers of Karnal district of Haryana [36].

Rubiaceae

Mussaenda frondosa Linn.

Vernacular name: *Mussanda* (Bankura district of West Bengal).

The root paste is used in the treatment of white leprosy by the local health healers of Bankura district of West Bengal [18].

Rutaceae

Aegle marmelos (L.)

Vernacular name: *Maredu* (East Godavari district of Andhra Pradesh).

The tribal people of East Godavari district used its different parts on leprosy [19].

Sapindaceae

Sapindus mukorossi Gaertn

Vernacular name: *Ritha* (Paschim Medinipur of West Bengal).

The young leaves are used in leprosy and other skin diseases by different tribal communities in western parts of Paschim Medinipur district of West Bengal [1].

Solanaceae

Datura metel L.

Vernacular name: *Dhatura* (Chhattisgarh area).

The root paste is mixed with neem oil and applied it to cure leprosy by the traditional healers in some selected district of Chhattisgarh [34].

Nicotiana tabacum L.

Vernacular names: *Pogaku* (East Godavari district of Andhra Pradesh).

The root is powerful solvent and alternant applied to leprosy by the tribal people of reserve forest and other areas of East Godavari district [19].

Solanum viarum Dunal.

Vernacular name: *Titwakuri* (Mayong area of Morigaon district of Assam).

The root paste is applied in leprosy by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

Withania somnifera Dunal.

Vernacular name: *Achagandha* (Mayong area of Morigaon district of Assam).

The leaves and roots pastes are used in leprosy by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

Verbenaceae

Lantana camara L.

Vernacular name: *Nagaairi* (Dhenkanal district of Odisha).

The bark is an astringent and used as a lotion for leprosy by the people of Dhenkanal district of Odisha [47].

Vitaceae

Cissus quadrangularis L.

Vernacular names: *Harjora* (Mayong area of Morigaon district of Assam).

The stem paste is used in leprosy infected part by the *Lalung* tribal people of Myong area of Morigaon district of Assam [20].

Discussion and Conclusion

From the present review of 40 plant families (38 angiosperm and 2 pteridophyte families) having 75 species used against leprosy were found to be reported from different ethno-botanical investigations mostly carried out during the last few years in India. Plant family Fabaceae represents the maximum species (13) followed by Cucurbitaceae (5), Amaranthaceae (4), Asteraceae (4), Solanaceae (4), Combretaceae (3) etc. Among the most common genera are *Terminalia* sp. (3), *Achyranthes* sp. (2), *Amaranthus* sp. (2), *Calotropis* sp. (2), *Cassia* sp. (2), *Holarrhena* sp. (2). (Digit within parenthesis indicates number of species). *Dalbergia sissoo* (5) represents the highest usage, followed by *Azadirachta indica* (4), *Bauhinia variegata* (4) *Commelina benghalensis* (4), *Ageratum conyzoides* (3), *Anacardium occidentale* (3), *Andrographis paniculata* (3) *Bombax ceiba* (3), *Calotropis gigantea* (3) *Cassia fistula* (3) *Celastrus paniculatus* (3) *Gloriosa superba* (3), *Psoralea corylifolia* (3). (Digit represent to the number of reports).

Among the above reported plants *Adhatoda vasica*, *Alangium salvifolium*, *Bauhinia variegata*, *Bidens pilosa*, *Calotropis gigantea*, *Citrullus colocynthis*, *Eclipta alba*, *Holarrhena antidysenterica*, *Indigofera aspalathoides*, *Jatropha gossypifolia*, *Momordica charantia*, *Ocimum sanctum*, *Terminalia catappa*, *Tinospora cordifolia* [8]; *Achyranthes aspera*, *Centella asiatica*, *Azadirachta indica*, *Semecarpus anacardium*, [8,51]; *Acacia catechu*, *Albizia lebeck*, *Allium sativum* [51]; *Hydnocarpus pentandra* [13,15,49,51-53]; *Psoralea corylifolia* [43, 54-57]. *Lantana camara*, *Clitoria ternatea*, *Callophyllum inophyllum* [50] were shows anti leprotic properties.

Now if we considered about the activity performance in connection with eradication of leprosy, *Hydnocarpus* species may be considered as top as the chaulmoogric acid (Chaulmoogra oil) and hydnocarpic acid is obtained probably reached its height popularity in the treatment of leprosy in 1920s and 1930s [51- 53,13,49]. Overall this plant contains taraktophyllin, hydnocarpic acid, 3,4-dihydroxybenzyl alcohol, 3,4-dihydroxybenzoic acid, 3-hydroxy-4 methoxybenzoic acid and also flavonoligands, flavonones, phenolic and chaumoogric acid which exhibited antibacterial, antioxidant and anticancer activities [53]. The activity of *Psoralea corylifolia* is reported in Indian pharmaceutical codex, the Chinese,

British and the American pharmacopoeias and in different traditional system of medicines which is not below the rank of *Hydnocarpus* sp. in connection with the treatment efficiency on leprosy due to its bio active molecules like corylifols a-c (prenylflavonoids) in seeds; psoralen, isopsoralen and neobavaisflavones in dried fruits. Diadzein (4:7 dyhydroxiflavon) and genistein (4'6'7 trihydroxyisoflavon) are also present in natural plant. Other active constituents have since been identified, including neobavaisflavone, borachin, bavaisflavone, bavachalcone, bavachromene psoralidin, corylifolinin, barachini psoralenoides, isopsoralenoside and coumarins have been isolated from this plant. Beside these it is also reported that the presence of fourteen compounds which include aromatic, sesquiterpenes, furocoumarins, sterols, fatty acid and their methyl esters. The seeds represented a unique chemical composition with considerable antimicrobial activity which not only validates their traditional medicinal uses in leprosy but also indicates their potential as a source of natural antimicrobial compound [43, 54-57]. Likewise brombexine in leaf extract of *Adhatoda vasica* [8], allicin of sulfur group in *Allium sativum* [51], methanol extract and asiaticoside under triterpene in *Centella asiatica* [8,51], methanol extract in *Holarrhena antidysenterica* and *Azadirachta indica* [8,51]; ethanol (95%) extract in *Calotropis gigantea*, *Bidens pilosa*, *Terminalia catappa*, *Citrullus colocynthis*, *Momordica charantia* and *Jatropha gossypifolia*; ethanol (80%) extract in *Eclipta alba*; ether extract in *Ocimum sanctum*, and volatile oil from the leaf of *Tinospora cordifolia* [8] are bio active molecules investigated. They are also responsible for effective treatment of leprosy.

It is interesting to note that a positive correlation exists between traditional use of medicinal plants and their pharmacological investigations. A very small percentage of the folklore has been evaluated scientifically. Further investigation of crude extracts and purified compounds may lead to the discovery of active biomolecules having therapeutic potential for diseases which they were originally used but also for diseases unknown to the natives. It is also important to investigate their toxic effects. Some of the principles contained in these plants may be toxic in large amounts but may prove of benefit to disease conditions when used in small amounts.

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