

Full Length Research Paper

An ethnobotanical study of medicinal plants in Sonebhadra District of Uttar, Pradesh, India with reference to their infection by foliar fungi

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Accepted 6 January, 2012

Sonebhadra district is one of the less studied regions of India for its ethnobotanical values. The present paper synthesizes the first report related to the documentation of ethnomedicinal plants of Sonebhadra district and their infection by foliar fungi. Ethnobotanical data were collected using semi-structured interviews and field observations. Correct identity of the plants was done with the help of relevant flora. Fungal organisms were identified on morphotaxonomic bases. The use of 143 medicinal plants belonging to 56 angiospermic families, by the tribal communities of Sonebhadra district has been documented. Out of 143 medicinal plants, 31 were found infected by different species of foliar fungi viz. *Pseudocercopsora*, *Alternaria*, *Cercospora*, *Passalora*, *Corynespora*, *Mycovellosiella*, *Veronia* and *Dreschlera*. Documentation of indigenous knowledge used for cure of different diseases by the tribes of the area can be used as basis for developing management plans for conservation and sustainable use of ethnomedicinal plants of the area. The report on foliar fungi infecting medicinal plants may draw attention of pharmaceutical firms and responsible sectors for proper care of the traditionally used medicinal wealth of the area.

Key words: Ethnobotanical, medicinal plants, indigenous knowledge, foliar fungi, Sonebhadra district.

INTRODUCTION

Plants, since times immemorial, have been used virtually in all the cultures as a source of medicine. The widespread use of herbal remedies and healthcare preparations from traditionally used plants, as those described in ancient texts such as the Vedas and the Bible, has been traced to the occurrence of natural products with immense medicinal properties in the cure of human diseases and in the development of different types of medicines for public health.

According to World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine for their primary healthcare needs (Singh et al., 2010; Dubey et al., 2004). Moreover, there are considerable economic benefits in the development of indigenous medicines and in the use of medicinal plants for the treatment of various diseases (Azaizeh et al., 2003).

The traditional systems of medicine are still very effective particularly in rural areas of India for the treatment of various ailments (Singh and Singh, 2009). India, with its glorious past of traditional medical system and use of different plants, is one of the eight major centers of origin and diversification of domesticated taxa (Siva, 2007). India is also one of the world's twelve mega diversity countries.

The country enjoys the benefits of varied climate, from alpine in Himalayas to tropical wet in the south and arid in Rajasthan state. Such climatic conditions have given rise to rich and varied biodiversity of medicinal plants in the Indian subcontinent (Dubey et al., 2004). According to the all India coordinated project sponsored by the Ministry of Environment and Forest New Delhi, 40% of 18,000 recorded flowering plants have ethnomedicinal value; and scientific validation of these plants can very well prove them as a potential source of new drugs (Pushpangadan, 1997).

Medicinal plants should be free from microbial infection in general and fungal infection in particular because in

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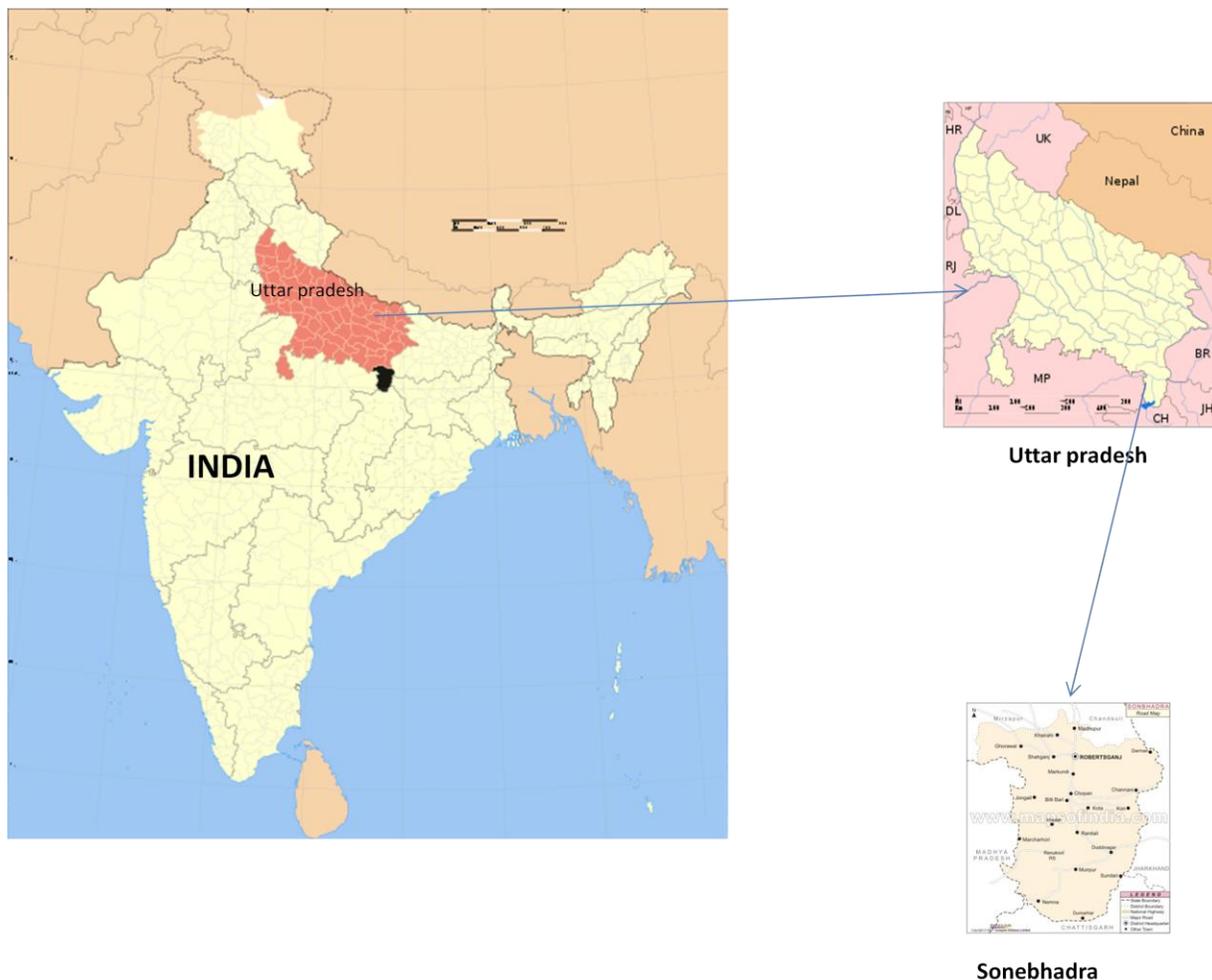


Figure 1. Location map of study area (Sonebhadra district) in Uttar Pradesh, India (http://en.wikipedia.org/wiki/File:India_Uttar_Pradesh_locator_map.svg, http://wikiflex.wikispaces.com/file/view/Uttar_Pradesh.png/133903651/Uttar_Pradesh.png, <http://www.mapsofindia.com/maps/uttarpradesh/roads/sonbhadra.htm>).

the most of the cases fungi infecting the leaves of medicinal plants directly affect photosynthesis by reducing the productivity and formation of secondary metabolites. In addition, the fungal infection also sometimes degrades the quality of medicinally important active principle (D'Aulerio et al., 1995; Chutia et al., 2006; Pati et al., 2008; Shivanna and Mallikarjunaswamy, 2009).

Moreover, the pathogenic micro-organisms can also produce different types of toxins during pathogenesis, which may alter the nature of the active principle leading to serious health hazards instead of curing the diseases. Foliicolous fungi causing diseases to medicinal plants may thus play a very important role in curative potency of traditionally used herbal raw materials. Sonebhadra forests are located within North – Eastern Uttar Pradesh in Northern region of India. The area exhibits a great diversity with large number of medicinal plant. The area comprises different types of ethnic races who traditionally

use these plants for cure of their different diseases. The climatic conditions of the area are congenial for the growth of different foliicolous fungi and for the infection of the medicinal plants of the area.

So far the area is not properly surveyed for the documentation of ethnomedicinal plants and the foliar fungi infecting them. Hence, in the present piece of investigation for the first time an effort has been made to document the ethnobotanically used medicinal plants of Sonebhadra forests and the foliicolous fungi causing diseases to them.

MATERIALS AND METHODS

Study site

The area under investigation for ethnomedicinal studies (Figure 1) falls under district Sonebhadra, U.P. India and came into existence in 1989 after division of district Mirzapur. It is situated on Vindhyan plateau and Kaimur range lying between 24°42' N to 25°3'55' N and

83°3' 24" E to 83°22'55" E, covering an area of 6788 Km. It is present in the extreme south east of the state and is bound by Mirzapur district to the northwest, Chandauli district to north, Bihar State to the northeast, Jharkhand state to the east, Chhattisgarh state to the south and Madhya Pradesh state to the west. Climatically, the area is of dry tropical type. The summer temperature ranges between 21.5 to 42°C and winter between 10 to 17.5°C.

The temperature in summer may reach up to 45°C and in winter below 5°C (up to 2°C). The average annual rainfall is 1065 mm. The forest is of tropical dry deciduous type covering an area of 2447 Sq. km (Dense Forest – 1078 SQ. Km., open Forest – 1369 SQ. Km). The tribal inhabitants of this area are Agaria, Baiga, Dhangar, Chero, Painika, Gond, Kharwar, Dharkar and Kol.

Survey of the area and collection of ethnomedicinal information

The extensive ethnomedicinal studies of the area were conducted during the period 2009 to 2010 with the help of tribal people and village medicine-men of the area. Regular trips were made during 2009 to 2010 in different seasons in different parts of the area to collect and observe different ethnomedicinally important angiospermic plants. Information regarding ethnomedicinally important plants of the area was collected through interviews with 14 persons aged between 43 and 71, who had the traditional knowledge of plants.

The methods used for ethnobotanical data collection were semi-structured interviews as described by Cotton (1996) field observation, preference ranking and direct-matrix ranking according to Alexiades (1996). The respondents' background of our questionnaire based upon health problems treated, diagnosis and treatment methods, local name of medicinal plants, plant parts used methods of application, threats to medicinal plants and conservation practices were carefully recorded. As a result, it was possible to collect most of the plants in vegetative, flowering, and fruiting stage.

During field trips, observation on the habit and habitat, flowering time, flower colour, fragrance, fruiting time, colour of bark and blaze in case of trees and shrubs were noted in the field diary. Information regarding medicinal and other uses, and local names of the plants were collected from the local inhabitants of the nearby area. Plants of small size were uprooted carefully and pressed as such. Care was taken to collect the plants in flowering/ fruiting stage. At least, four specimens were pressed at the spot. On return to laboratory, all specimens were carefully checked and dried by placing under sun. The sheets were regularly changed for rapid desiccation. Dried specimens were poisoned with saturated solution of mercuric chloride and were then pasted on standard herbarium sheets. Fresh specimens were carefully studied under hand lens and a detailed description of the individual taxon was prepared. An attempt was made in every case to identify the plants with the help of floras (Duthie, 1903 to 1929; Hooker, 1872 to 1897; Raizada, 1976; Dubey, 2004).

The plants of doubtful identity were checked against their authentic specimens lodge at the herbarium of National Botanical Research Institute, Lucknow. During this process, help of expert persons was also frequently taken. The medicinal plants specimens were collected for the preparation of herbarium. The voucher specimens were deposited in the Department of Botany, B. H. U. Varanasi.

Observations on foliicolous fungi infecting medicinal plants

The diseased leaf specimens of medicinal plants were first examined carefully with naked eye to have a clear picture of

symptomatology. Thereafter, the scrap mounts of infected tissue were prepared in lactofuchsin (Carmichael, 1955), lactophenol-cottonblue (Purvis et al., 1966) and glycerin separately. The slides were studied promptly but carefully under the compound microscope. The fungi were identified tentatively with the help of available literature. Some of the fungi could be identified right up to the species level and some up to the level of genera only.

Specimens representing maximum developing stages of symptoms of each type of sample were spread on the blotters bearing collection number and date. The whole stock of such blotters was pressed in the herbarium press under gentle pressure in beginning. Side by side the blotters of partly pressed specimens brought in the press from collection cramps were also changed. This was followed by periodic release of pressed specimens out side and change of their blotters at short intervals till completely pressed and dried. While changing the blotters the collection number, date etc were carried out to the new set.

The specimens studied tentatively were again studied in detail for final confirmation of their identity and rectification of the discrepancies, if any kept in the host parasite list. Separate mounts of scraps and freehand sections of infected tissue were prepared in lactophenol cotton blue mixture (for permanency of stain), lactofuchsin (for best transparency and better staining of walls and septa) and glycerin (for making correct comparative study of pigmentation indifferent structures of the fungi). The slides were made semi permanent by ringing them with nail polish (Dade, 1968) and were preserved for further use.

Whenever necessity arose the mounts of freeze, microtome sections were also prepared. Now, the slides were critically studied under the compound microscope in different combinations of eye pieces (6x, 10x, 15x) and objectives (10x, 15x oil immersion). The desired camera lucida diagrams depicting all possible details of morphology and ontogeny (the extent to which could be observed under the light microscope) of the propagules of these fungi were drawn and the measurements taken. Then all the including symptomatology were consolidated.

On the basis of observations recorded during the detailed study, the identity of the fungi was reaffirmed with the help of different monographs, reviews, authoritative books in respective fields and the research papers appeared in standard journals. The hyphomycetes, were identified mainly with the monograph of the fungus genus "Indian Cercospora" (Vasudeva, 1983), "Demataceous Hyphomycetes" and "More demataceous Hyphomycetes" (Ellis, 1971, 1976), "Hyphomycetes" (Subramanian, 1983), "Mycosphaerellea and its anamorph. 1 Names published in the Cercospora and Passalora" (Crous and Braun 2003) and several mycological papers (Deighton, 1976; Bhalla and Sarbhoy, 2000; Braun, 2009, 2000; Jain et al., 2002; Braun et al., 2003) which were useful in confirming the identity of various genera and species of hyphomycetes.

Beside aforesaid literature, the "Index of Fungi" published regularly from C.A.B. International Mycological Institute Kew England, and two website www.mycobank.org/mycotaxo.aspx and www.indexfungorum.org/names/names.asp were also taken in account. In addition, some important references were also consulted for example, "Morphology and taxonomy of fungi" (Bessey, 1968) and "Introductory mycology" (Ainsworth and Bisby, 1961).

RESULTS

The data on ethnomedicinal survey of the plants of Sonebhadra district is presented in Table 1. A perusal of the survey report emphasizes that tribal people of the Sonebhadra district use 143 species of the plants belonging to 56 angiospermic families as traditional

medicinal plants for cure of their diseases. The most commonly represented families with respect to ethnomedicinal plants used by tribal people of the area are Fabaceae (16), Euphorbiaceae (9) and Asteraceae (8). Though, more than 154 different diseases were recorded to be cured by medicinal plants in the area, the most reported use was for wounds, fever, cough and cold, stomach infections and gastric trouble, skin trouble, piles, rheumatism and snake and scorpion bite.

The results of growth form analysis (Figure 2) of ethnomedicinal plants of the area showed that herb made up the highest proportion being represented with 44 species (31%), followed by tree (42 species, 29%), shrub (22 species, 15%), climbers (17 species, 12%), under shrub (16 species 11%) and succulents (3 species 2%). This finding is similar to the general pattern observed in most medicinal inventories (Giday et al., 2003, 2007) where herbaceous medicinal plants dominate. Amongst 143 plant species surveyed for their ethnomedicinal value, 31 species were found to be infected by different foliar fungi.

Details about the symptoms produced by these fungi on the ethnomedicinal plants are presented in Table 2. Amongst different foliar fungi, *Pseudocercospora* sp was recorded to cause infection to most of the medicinal plants. Besides, some plants were found severely infected by sooty moulds covering the whole canopy of the tree like *Acacia catechu*, *Terminalia bellerica* and other plants. Sooty mold is a charcoal black fungus that appears as a black coating on the surface of leaves, fruits, twigs and branches of many deciduous and evergreen shrubs and trees. This fungus is not pathogenic to plants but obtains its nourishment from insect honeydew or on exudates from leaves of certain plants.

Typically, sooty mold growths are composed of fungal complexes made up of ascomycetes and fungi imperfecti. The dark color of sooty mold growth is due to the presence of melanoid pigments in the cell walls of the hyphae that make up the sooty mold colonies. On leaves, this coat of mold screens out light and reduces the plant's capacity to produce food.

DISCUSSION AND CONCLUSION

The presence of such a large number of ethnomedicinal plant species indicates that the area has a very high diversity of medicinal plants and is a site for various indigenous knowledge. The study also indicates that the ethnic people of the area largely depend on the wild medicinal plants for cure of their ailments. Due to the lack of the government health facilities in the district, the people are largely dependent on the traditional health care system. This practice would definitely affect the availability of these plants and some of the plants would become threatened in near future. Thus, the area faces

over exploitation of these plants by traditional practitioners.

Moreover, some factors viz. deforestation, agricultural expansion, overgrazing and frequent drought were observed by the authors as main threats for luxuriant growth of medicinal plants. The effort to conserve medicinal plants in the district area was observed to be very poor. Hence, efforts must be taken to protect these species in this area involving the local communities in preservation and conservation aspects; otherwise there would be the possibility of losing this wealth of ethnomedicinally important plants of the area in near future.

Although, some traditional practitioners have started to conserve medicinal plants by cultivating at home gardens, though the effort was minimal. Moreover, due to lack of interest among the younger generation of tribes as well as their tendency to migrate to cities for lucrative jobs, this wealth of knowledge on ethnomedicinal plants of the area may be lost. Hence, proper attention is urgently required to scientifically validate the information gathered on ethnomedicinal plants of the area through pharmacological and reverse pharmacological investigations

The area also appears to be nursery of phytoparasitic fungal forms. Most of the common medicinal plants were found severely infected by foliar fungi. The climatic condition of the area is congenial for the growth of medicinal plants as well as for the foliar fungi also. Amongst different fungal forms *Pseudocercospora* sp showed broad host range for infection to most of the medicinal plants. This may be due to its ability to tolerate a spectrum of secondary metabolites present in medicinal plants. The symptoms produced in severely infected medicinal plants would cause damage of histological tissues and reduce the photosynthetic area of the leaves.

Hence, there would be decline in quantity of active secondary metabolites and change in chemical profile of the ethnomedicinal plants due to host-pathogen interactions. There are some reports on such decline of quantity of active components of different medicinal plants used by pharmaceutical firms (D'Aulerio et al., 1995; Chutia, et al., 2006; Pati et al., 2008; Shivanna and Mallikarjunaswamy, 2009).

The survey report presented in Table 1 also emphasizes that the tribal people of the area mostly use leaves of the ethnomedicinal plants as source of medicine. Moreover, leaves are the main centre of the metabolic activities of the plants. Hence, such infections may also affect the secondary metabolites of raw materials of other parts of ethnomedicinal plants. There are also some reports on transformation of medicinally important active components to another undesirable form due to fungal infection (Wakdikar, 2004). In view of these facts, there is urgent need to investigate disease cycle of the infected ethno medicinal plants of the area in collaboration with plant pathologists. In normal host

Table 1. Documentation of ethnomedicinal plants in Sonebhadra district, India.

S/N	Ethnomedicinal plant	Family	Habit	Plant part	Vernacular name	Ethnomedicinal Uses
1	<i>Abroma augusta</i> L. F.	Sterculiaceae	Shrub	Bark	Ulatkambal	Dysmenorrhoea, urine tonic, syphilis, bronchitis, diabetes.
2	<i>Abrus precatorius</i> Linn.	Fabaceae	Climber	Seed, leaf	Gumachi, Gunj, Ratti.	Eczema, inflammation of gums, leucoderma, scabies, sciatica, scorpion bite, skin disease, swelling
3	<i>Abutilon indicum</i> (Linn) Sweet	Malvaceae	Shrub	Root, seed	Jhumka, Kanghi, Sonpatari	Cough diarrhoea, dysentery, febrifuge, gonorrhoea, headache, leprosy, piles, stomach complaints, wounds.
4	<i>Acacia catechu</i> (Linn.f.)Wild	Mimosaceae	Tree	Heart wood, bark	Khair, Kattha	Astringent, bleed from nose, consumption, diarrhoea, dysentery, leucorrhoea, menstrual complaints, pain in chest, sore in mouth, toothache.
5	<i>Acacia nilotica</i> (Linn.) Del	Mimosaceae	Tree	Bark, gum	Babul, Kikar,	Burns, cholera, diarrhoea, dysentery, ear complaints, eye complaints, hair fall, headache, leprosy, liver complaints, skin disease, syphilis, throat infection,
6	<i>Acacia sinuata</i> (Lour.) Merr.	Mimosaceae	Climbing shrub	Pod	Shikakai, Rijoh	Biliousness, constipation, skin disease.
7	<i>Acalypha hispida</i> Burm	Euphorbiaceae	Herb	Leaf, whole plant	Khokali, Sultan Kuppi,	Asthma, bronchitis, cough, earache, expectorant, scabies, skin disease, snake bite, sting of centipedes.
8	<i>Achyranthes aspera</i> Linn.	Amarathaceae	Herb	Root, leaf	Adhajhara, Latjira, Chirchiti.	Abortifacient, antifertility in women, bleeding in delivery, boils, child birth, dog bite, , ear complaints, eye complaints, febrifuge, insect bite, leucoderma, piles, scabies, scorpion bite, skin disease, snake bite, sore, toothache, wounds.
9	<i>Adina cordifolia</i> (Roxb.) Hook	Rubiaceae	Tree	Bark, leaf	Haldu,	Cholera, cold, cough, , fever, headache, scars on skin and yellowing of body, urine complaints,
10	<i>Aegle marmelos</i> (L)Corr.	Rutaceae	Tree	Fruit, leaf, bark	Bel, Sripthal	Abdominal pain, abscess, astringent, cholera, constipation, diabetes, diarrhoea, dysentery, eye complaints, fever, gastric troubles, heat in abdomen, jaundice, stomach disorder, tonic, vomiting,

Table 1. Contd.

11	<i>Agave americana</i> Linn	Agavaceae	Succulent	Leaf, root	Chick-kuri, Rambans	Ascites, dropsy, dysentery, syphilis, anthelmintic, boils, burns, cut, wound, diarrhoea, skin disease.
12	<i>Ageratum conyzoides</i> Linn.	Asteraceae,	Herb	Leaf	Ajgandha, Sadevi,	Leprosy, muscular pain, piles, ring worm, scabies, skin disease, snake bite, sores, swell body, tumor, urine disorders, wounds.
13	<i>Albizia lebbbeck</i> (Linn.) Benth	Mimosaceae	Tree	Seed, bark, flower	Siris,	Boils, diarrhoea, dysentery, gonorrhoea, eyes sores, gum ulcer, night blindness, piles, swelling.
14	<i>Aloe barbadensis</i> Mill	Liliaceae	Succulent	Leaf	Gheekumar, Gwarpatha	Boils, breast tissue hardening, constipation, jaundice, fever, liver complaints, menstrual complaints, piles, refrigerant, rheumatism, sexual vitality, skin disease, vermucidal, wounds.
15	<i>Alpinia galanga</i> Willd	Zingiberaceae	Herb	Bulb	Kulanjan	Rheumatic pain, asthma, cough and cold, aphrodisiac and stimulant.
16	<i>Alstonia Scholaris</i> R.Br.	Apocynaceae	Tree	Bark	Satian, Saptparni	Cholera, diarrhoea, fever, malaria, pneumonia, rheumatism, stomachache, ulcer of mouth, cholera, headache, neuralgia, pain in leg
17	<i>Amaranthus spinosus</i> Linn.	Amaranthaceae	Herb	Whole plant, seed, root	Kanta-bhaji, Kateli-chaulai,	Blood purifier, cough, cold, colic, eczema, piles, scorpion sting, snake bite.
18	<i>Amorphophallus companulatus</i> Blume	Araceae	Herb	Corn	Jangali suran	Constipation, earache, inflammation throat, respiratory complaints, pimples, piles.
19	<i>Andrographis paniculata</i> Nees	Acanthaceae	Herb	Whole plant, leaf, root	Kalmegh, Kariyatu	Cholera, colic, diarrhoea, dysentery, fever, filaria, malaria, , stomach complaints, tonic,
20	<i>Annona squamosa</i> Linn.	Annonaceae	Tree	Seed, leaf, bark, fruit	Sharifa,	Abdominal pain, carbuncle, cold, cuts, dandruff, diarrhoea, dysentery, fits, guinea worm, hysteria, insecticidal, lice, menstrual complaints, purgative, spinal disease, syphilis, tonic, ulcers
21	<i>Anogeissus pendula</i> Edgew.	Combretaceae	Tree	Bark	Dhav, Dhaura,	Dysentery, gastric disorders.
22	<i>Anthocephalus cadamba</i> (Roxb) Miq.	Rubiaceae	Tree	Bark	Kadamb	Antifertility, , cholera, dysentery, pimple, sores

Table 1. Contd.

23	<i>Argemone mexicana</i> Linn.	Papaveraceae	Prickly herb	Seed, latex, leaf, root	Bhatkataia,	Boils, arthritis, asthma, caries, eye complaints, gum trouble, headache, inflammation, mouth wash, piles, ring worm, scabies, skin disease, syphilis, toothache
24	<i>Argyrea speciosa</i> SW	Convolvulaceae	Climbing shrub	Leaf	Samudrasok	Antidote, boils, diabetes, small pox, sores, stomach complaints, syphilis.
25	<i>Asparagus racemosus</i> Willd.;	Liliaceae	Scandent shrub	Tuberous root	Satawar, Satmul	Aphrodisiac, rheumatism, bleeding from nose, galactagogue, lactation, gonorrhoea, impotence, leucorrhoea, menstrual complaints
26	<i>Asphodelus tenuifolius</i> Cav.	Liliaceae	Herb	Seed	Bbanpiyazi	Toothache, diuretic.
27	<i>Azadirachta indica</i> Juss.	Meliaceae	Tree	Bark, leaf, fruit	Neem	Antifertility, antipyretic, antiseptic, blood purifier, boils, cancer, cholera, cold, debility, diabetes, dyspepsia, febrifuge, inflammation gums, leprosy, malaria, measles, piles, post natal, scabies, skin disease, small pox, snake bite, ulcers, urine complaints, vermicide
28	<i>Bacopa monneiri</i> (Linn.) Pennell.	Scrophulariaceae	Herb	Whole plant	Brahami, Choti brahami	Blood purifier, boils, epilepsy, eczema, nervine tonic, rheumatism, tonic for hair, tonic general.
29	<i>Bambusa arundinacea</i> (Retz.) Willd.	Poaceae	Shrubby or arborescent plant	Stem, blacksoot on clums	Bans, Kanta-bans	Abortifacient, antifertility, wounds, cuts.
30	<i>Barleria prionitis</i> Linn.	Acanthaceae	Under shrub	Leaf, bark	Vajradanti, Kansaraiya	Cough, dropsy, glands swelling, gum trouble, cold, piles, toothache
31	<i>Basella alba</i> var. <i>rubra</i> (Linn.) Stewart	Basellaceae	Succulent twining herb	Leaf	Poi	Constipation, syphilis, ulcer in nose.
32	<i>Bauhinia purpurea</i> Linn	Caesalpiniaceae	Tree	Bark, leaf, flower	Katmahuli,	Astringent, bone fracture, small pox, tumor in stomach, wounds, rheumatism, swelling.
33	<i>Bauhinia variegata</i> L.	Caesalpiniaceae	Tree	Bark	Kachnar,	Leprosy, malaria, piles, scrofula, skin disease, snake bite, ulcers, worms.

Table 1. Contd

34	<i>Biophytum sensitivum</i> (Linn.) DC	Oxalidaceae	Herb	Leaf	Chuimui, Lajwanti,	Antiexcitement, antifertility, antiseptic, bilious fever, burns, convulsion, cramps, cuts, wounds as haemostat, fever, decreases sexual vigour, diarrhoea, giddiness, headache, malaria, muscular and rheumatic pain, tonic
35	<i>Blumea lacera</i> (Lour.) Merrill	Asteraceae	Under shrub	Leaf	Nirmudi, Purroh	Burns, cuts, wounds, bronchitis, fever, piles, toe injury, urine complaints.
36	<i>Boerhaavia diffusa</i> Linn.	Nyctaginaceae	Herb	Root, leaf	Punarnava	Jaundice, kidney complaints, liver complaints, pain in abdomen, piles
37	<i>Bombax ceiba</i> Linn	Bombacaceae	Tree	Bark, leaf root	Semal	Acne, pimples, toothache, tubercular fistula, ulcer, urine complaints,
38	<i>Boswellia serrata</i> Roxb. ex Colebr.	Burseraceae	Tree	Bark, resin, leaf	Salai,	Cold, cough, diarrhoea, dysentery, toothache, wounds
39	<i>Buchanania lanzan</i> Spr.	Anacardiaceae	Tree	Bark, seed	Chironji, Piyar	Bronchitis, consumption, cough, diarrhoea, febrifuge, inflammation of gums, wounds.
40	<i>Butea monosperma</i> (Lamk.) Taub.;	Fabaceae	Tree	Seed, flower, bark, leaf	Dhak, Palash, Tesu.	Abortifacient, antifertility, menorrhagia, piles, pimples, skin disease, stomachache, sun stroke, vermifuge, wounds.
41	<i>Caesalpinia bonduc</i> (Linn.) Roxb.;	Caesalpinia e	Straggling, thorny shrub	Seed	Karanj, Kantkarej	Colic, fever, intermittent fever, malaria, menstrual complaints, skin disease, swelling, tonic
42	<i>Caesalpinia pulcherima</i> (Linn.) Swartz	Caesalpinia e	Shrub	Seed	Puraiphul	Body ache, gum trouble, ring worm.
43	<i>Calatropis gigantea</i> (Linn.) R. Br.	Asclepiadaceae	Shrub	Latex, leaf, root	Madar, Safed Aak	Abortifacient, body ache, boils, burns, ear complaints, ring worm, scabies, scorpion bite, skin disease, small pox, sprain, swelling, tooth ache, wounds.
44	<i>Calatropis procera</i> (Ait)R.Br.	Asclepiadaceae	Shrub	Latex, leaf, root	Madar, Aak	Abortifacient , boils, skin disease, small pox, swelling, tooth ache, tooth worms, wounds.

Table 1. Contd

45	<i>Cannabis sativa</i> Linn.	Canabinaceae	Herb	Leaf	Bhang, Ganja,	Anthelmintic, bowel complaints, cold, cough, epilepsy, cuts, dyspepsia, ear complaints, hydrocele, labour, laxative, narcotic, nervine stimulant, paralysis of tongue, sleep pills, sores.
46	<i>Capparis decidua</i> (Forsk.) Edgew.	Capparaceae	Sraggling glabrous shrub	Leaf, stem	Karil	Appetizer, intestinal worms, tooth troubles including, pyorrhoea.
47	<i>Carissa carandas</i> L.	Apocynaceae	Shrub	Seed, root	Karonda, Karauna	Itch, rheumatism, sores, wounds.
48	<i>Cassia fistula</i> Linn.	Caesalpiniaceae	Tree	Leaf, fruit, seed	Amaltas	Asthma, blood purifier, chest infection, constipation, cough, swelling, toothache, vermicide.
49	<i>Cassia occidentalis</i> Linn.	Caesalpiniaceae	Under shrub	Leaf	Barkachakwar,	Eczema, fever, gastric complaints, ring worm, skin disease, throat infection, whooping cough, wounds.
50	<i>Cassia tora</i> Linn.	Caesalpiniaceae	Herb	Leaf, seed, root	Chakwar	Anthelmintic, antiseptic, boils, cuts, eczema, ring worm, scabies, scorpion bite, skin disease, sores, vermicide, wounds.
51	<i>Chlorophytum tuberosum</i> Baker.	Liliaceae	Herb	Tuber	Safed musli	Expectorant, fever, leucorrhoea, sex tonic.
52	<i>Chromolaena odorata</i> Linn.	Asteraceae	Shrub	Root, leaf, whole plant	Gandhuri, Kusuri,	Burn, cuts, dysentery, gastric complaints, sprain, to stop bleeding, wounds
53	<i>Citrullus colocynthis</i> (Linn.) Schrad	Cucurbitaceae	Woody Climber	Fruit	Indrayan	Abortifacient, galactagogue, purgative, stomachache
54	<i>Cleome gynandra</i> L.	Cleomaceae	Herb	Leaf, seed	Hul-hul,	Asthma, cough, ear complaints, eye disease, fever, headache, round worm, scorpion bite, skin disease, stiff neck, vermicide, wounds
55	<i>Cleome viscosa</i> L.	Cleomaceae	Herb	Seed, leaf	Jangali -hurhur,	Anthelmintic, boils, checks pus formation, ear ache, fever, headache, inflammation ear ,wounds
56	<i>Clerodendrum viscosum</i> Vent.	Verbenaceae	Woody Shrub	Root, leaf	Bhant, Bhatas	Anthelmintic, body ache, boils, burns, cuts, skin disease, sores, swelling, ulcer, wounds.

Table 1. Contd.

57	<i>Clitoria ternatea</i> Linn.	Fabaceae	Climber	Root, seed	Aparajita	Abortifacient, goitre, stomach ache, swelling
58	<i>Convolvulus arvensis</i> Linn.,	Convolvulaceae	Climber	Root	Birihara, Hiran khuri;	Purgative.
59	<i>Cordia myxa</i> Roxb.	Boraginaceae	Tree	Leaf, fruit	Lisora	Antihelminthic, chest infection, lung disease, cholera, cold, colic, constipation, cough, expectorant, fever, headache, urine disease, urticaria
60	<i>Curculigo orchioides</i> Gaertn.	Amaryllidaceae	Tuberous geophilous herb	Root, rhizome	Kali musli	Abortifacient, asthma, cough, cuts, filaria, fever, galactagogue, impotence, itching, leucorrhoea, nose bleeding, piles, bleed, tonic, unconsciousness of children, wounds.
61	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Climber	Whole plant	Akasbel, Amarbel,	Body ache, burns, cuts, cold, cough, diphtheria, displaced knee cap, fall of hairs, skin disease, stomach ache, swelling of leg, testicles and body, wounds.
62	<i>Cynodon dactylon</i> (Linn.) Pers.	Poaceae	Herb grass	Whole plant	Doob, Durba	Snake bite, stops bleeding, wounds.
63	<i>Cyprus rotundus</i> Linn.	Cyperaceae	Herb grass	Bulb, root, whole plant	Motha	Astringent, bowel complaints, heat stroke, sores wound, urine complaints.
64	<i>Dalbergia sisso</i> Roxb.	Fabaceae	Tree	Leaf, stem	Shisham	Eruptions, headache, leprosy, skin disease
65	<i>Datura innoxia</i> Mill;	Solanaceae	Under shrub	Leaf, fruit	Dhatura	Asthma, boils, rheumatism
66	<i>Datura metel</i> Linn.	Solanaceae	Under shrub	Leaf, fruit, root	Kala-dhatura,	Asthma, blisters, boils, cough, cramps, fistula, gonorrhoea, headache, hydrocele, leprosy, mumps, piles, rheumatism, ring worm, small pox, tooth decay, urticaria, whooping cough, wounds.
67	<i>Dendrophthoe falcata</i> (L. f.) Etting.	Loranthaceae	Stem parasite herb	Stem, whole plant	Banda	Abortifacient, antifertility, brain tonic, headache, impotence
68	<i>Desmodium gangeticum</i> (L.) DC.	Fabaceae	Under shrub	Root, whole plant	Salparni	Antidote to snake venom, asthma, bronchitis, cough
69	<i>Dioscorea bulbifera</i> L.	Discoreaceae	Climber	Tuber	Ratalu	Abdominal pain, boils, dysentery, piles, jaundice

Table 1. Contd

70	<i>Diospyros melanoxylon</i> Roxb.	Ebenaceae	Tree	Bark, fruit	Kendu, Tendu	Dysentery, skin disease
71	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey	Cucurbitaceae	Tendrill climber	Seed,	Shivlingi	Asthma, cholera, colic, constipation, post natal complaints, promotes fertility in women.
72	<i>Drypetes roxburghii</i> (Wall.) Huru.	Euphorbiaceae	Tree	Fruit	Putranjivah, Jivputrak,	Aphrodisiac, anti-inflammatory, elephantiasis, eye infection, habitual abortion and sterility, laxative.
73	<i>Echinops echinatus</i> Roxb.	Asteraceae	Herb	Root, whole plant	Gokrul	Fever, malaria, skin disease
74	<i>Eclipta prostrata</i> L.	Asteraceae	Herb	Leaf, whole plant	Bhringraj	Asthma, bronchitis, itching, jaundice, promotes hair growth, toothache.
75	<i>Euphorbia hirta</i> Linn,	Euphorbiaceae	Herb	Whole plant	Dudhi,	Burns, cough, cuts, eczema, excess lactation, eye complaints, kidney disease, lactation complaints, pain in joints, postnatal complaints, wart.
76	<i>Euphorbia hypericifolia</i> L.	Euphorbiaceae	Herb	Leaf	Choti Dudhi	Dysentery, diarrhoea, leucorrhoea.
77	<i>Evolvulus alsinoides</i> L.	Convolvulaceae	Herb	Root, leaf, whole plant	Shankhpushpi	Aphrodisiac, asthma, bronchitis, dysentery, fever, leucorrhoea,
78	<i>Ficus benghalensis</i> L.	Moraceae	Tree	Latex, arial root, fruit	Bar, Bargad,	Diabetes, gum trouble, leucorrhoea, promotes hair growth, scabies, sex disease, skin disease, snake bite, scores in mouth, spermator, tonic, tooth ache,
79	<i>Ficus cairica</i> L.	Moraceae	Tree	Latex	Anjir	Boils, eruptions, skin disease
80	<i>Ficus hispida</i> L.	Moraceae	Tree	Fruit, latex	Kathgular,	Emetic, purgative, ulcers in mouth
81	<i>Ficus racemosa</i> L.	Moraceae	Tree	Latex, fruit, bark	Gular	Astringent, blisters, boils, carminative, dermatitis, diarrhoea, dysentery, leprosy, menstrual complaints, piles, cracks on heel
82	<i>Ficus religiosa</i> L.	Moraceae	Tree	Leaf bark, fruit	Pipal	Blisters, boils, ulcer, scabies, skin disease, small pox, snake bite, sores in mouth

Table 1. Contd

83	<i>Fumaria indica</i> (Hausk.) Pug.	Fumariaceae	Herb	Whole plant	Pitapapra,	Anthelmintic, blood purifier, body ache, diarrhoea, diuretic, fever, flue, indigestion, liver complaints, skin disease
84	<i>Gloriosa superba</i> L.	Liliaceae	Climbing Herb	Rhizome	Kalihari	Abortifacient, infertility, facilitates child birth, gonorrhoea,
85	<i>Grewia hirsuta</i> Vahl	Tiliaceae	Shrub	Root	Nagbala,	Blisters, boils, cuts, dysentery, inflammation, wounds
86	<i>Grewia subinequalis</i> DC	Tiliaceae	Tree	Fruit, root	Phalsa	Boils, cooling in fever, debility, stomachache, inflammation
87	<i>Gymnema sylvestre</i> (Retz.) R.Br.	Asclepiadaceae	Woody climber	Leaf	Gurmar,	Eye disease, cornea opacity, diabetes, gastric disease, stomachache, urine complaints.
88	<i>Helicteres ixora</i> Linn.	Sterculiaceae	Large shrub	Fruit, root, bark	Marorphali	Cholera, cold, colic, cough, diarrhea, dysentery, ear complaints, eczema, intestinal germs, stomachache
89	<i>Heliotropium indicum</i> L.	Boraginaceae	Herb	Inflorescence, whole plant	Siriyari	Astringent, emollient, vulnerary and diuretic, ulcers, sores, wound, skin infections, stings of insect, ulitis and rheumatism
90	<i>Holarrhena antidysenterica</i> Wall.	Apocynaceae	Tree	Bark, seed	Indrajav, Koraya	Constipation, diarrhoea, digestive complaints, dysentery, gastric disorder, stomachache, worms.
91	<i>Holoptelea integrifolia</i> (Roxb.) Planch.;	Ulmaceae	Tree	Bark, leaf	Chilbil	Boils, bone fracture, inflammation body, rheumatism, ring worm, scabies
92	<i>Hygrophila auriculata</i> (Schum.) Heine.	Acanthaceae	Herb	Leaf, whole plant	Talmakhana	Diuretic, dropsy, tubercular fistula.
93	<i>Hyptis suaveolens</i> (Linn.) Poit.;	Lamiaceae	Herb	Leaf, whole plant	Ban tulsi, Gandhu phul	Fever, headache, toothache, wounds
94	<i>Ipomoea aquatica</i> Forsk.	Convolvulaceae	Creeping Herb	Whole plant	Kalmi-sag, Karmua ka sag	Boils, liver disease, purgative

Table 1. Contd.

95	<i>Justicia adhatoda</i> Linn.	Acanthaceae	Shrub	Leaf, root	Adusa, Vasak	Asthma, , bronchitis, cough, expectorant, febrifuge, malaria, pulmonary infection
96	<i>Lantana camara</i> Linn	Verbenaceae	Large scrambling shrub	Leaf	Galphusia,	Itching, ring worm
97	<i>Lawsonia inermis</i> Linn.	Lythraceae	Shrub	Leaf, seed	Menhdi	Burning sensation, headache, pain in muscle, sprain, weakness,
98	<i>Leucas cephalotus</i> (Roth) Spreng.	Lamiaceae	Herb	Leaf, flower, whole plant	Gumbi,	Cold, constipation, cough, diarrhoea, earache, eye disease, fever, headache, malaria, piles, gum trouble, wounds.
99	<i>Limonia acidissima</i> Linn.	Rutaceae	Tree	Fruit bark	Kaitha	Asthma, bronchitis, body pain, diarrhoea, digestive complaints, dysentery,
100	<i>Madhuca longifolia</i> (Koen.) Mac Br.	Sapotaceae	Tree	Flower, bark, seed oil	Mahua	Astringent, bronchitis, burns, chest pain, colic, cough, pneumonia, toothache, ulcer.
101	<i>Mallotus philippinensis</i> Muel	Euphorbiaceae	Tree	Fruit, seed	Kamela, Kampilak	Anthelmintic, blisters, boils, skin disease, snake bite, sores, tonic for pregnant women, ulcers, vermifuge
102	<i>Mannihot esculenta</i> Crantz	Euphorbiaceae	Shrub	Leaf	Kasava	Skin disease, diarrhea, malaria, irritable bowel syndrome.
103	<i>Mimosa pudica</i> Linn.	Mimosaceae	Under shrub	Root, leaf	Chhuimui, Lajouni,	Child birth, diuretic, dysentery, epilepsy, fistula, gum trouble, headache, leucorrhoea, loose motion, piles, toothache, wounds
104	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae	Climber	Root, fruit	Bankarel,	Pain in breast due to swell, piles, bronchitis, dysentery, diabetic problem
105	<i>Mucuna pruriens</i> (L.)DC	Fabaceae	Climber	Seed, fruit	Kevach, Konch	Night dreams, ring worm, round worms, scorpion bite, snake bite, sores, vermifuge
106	<i>Nelumbo nucifera</i> Gaerth.	Nelumbonaceae	Aquatic herb	Seed, flower	Kamal, Kanwal,	Astringent, diarrhoea, cholera, tonic
107	<i>Nyctanthes arbor-tristis</i> L.	Nyctagineae	Tree	Bark, leaf	Harsingar, Parijat, Shihor	Cough, dysentery, fever, hiccups, intestinal injuries, malaria

Table 1. Contd.

108	<i>Ocimum basilicum</i> Linn.	Lamiaceae	Herb	Leaf	Babui-tulsi	Cholera, cough, cramp, earache, fever, headache, stomachache
109	<i>Oxalis debilis</i> H.B.K. var. <i>corymbosa</i> (DC.) Lour.	Oxalidaceae	Small herb	Rhizome, leaf	Khatti-booti	Antidote toxicity
110	<i>Peristrophe paniculata</i> (Forsk.) Burm.f.	Acanthaceae	Under shrub	Whole plant	Chirchiri,	Fracture, sprain, rheumatism
111	<i>Phyllanthus emblica</i> Linn.	Euphorbiaceae	Tree	Fruit, leaf, bark	Aonla,	Burns, cold, constipation, diuretic, dysentery, eye trouble, indigestion, liver complaints
112	<i>Phyllanthus fraternus</i> Webst.	Euphorbiaceae	Herb	Whole plant	Bhui-amla	Gastric disease, jaundice
113	<i>Physalis minima</i> Linn.	Solanaceae	Herb	Leaf, whole plant	Rasbhari	Abdominal disorder, stomachache.
114	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Shrub	Root	Chitrak	Abortifacient, antifertility, diarrhoea, dysentery, indigestion
115	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Tree	Wood, bark, resin	Bijasal, Vijay Sal	Cholera, chest pain, cooling, diabetes, diarrhea, dysentery, fever
116	<i>Pueraria tuberosa</i> (Willd.) DC.	Cucurbitaceae	Climber	Tuber, root	Patal-kumra, Ghoar-bel	Abdominal pain, antiemetic, asthma, body ache, chest pain, cholera, diarrhoea, fever, lactation, menorrhagia, rheumatism, skin disease, swelling, syphilis, tonic, ulcer.
117	<i>Rauwolfia serpentina</i> (L.) Benth. ex Kurz.	Apocynaceae	Under shrub	Root	Sarpghandha,	Abortifacient, anthelmintic, antidote snake bite, blood pressure, checks vomiting, fever, insanity, insomnia
118	<i>Ricinus communis</i> L.	Euphorbiaceae	Small tree	Seed, leaf	Arandi, Rendi	Boils, burns, contraceptive, dropsy, heat stroke, hydrocele, injuries, joint pain, muscle pain, rheumatism, sciatica
119	<i>Rumex dentatus</i> L.	Polygonaceae	Herb	Whole plant	Jungali palak	Sunstroke

Table 1. Contd.

120	<i>Shorea robusta</i> Gaertn. f.	Dipterocarpaceae	Tree	Bark, resin	Sakhu, Sal	Burning sensation, chest pain, cholera, cramp, diarrhoea, skin infection, small pox, sores, fistula, tumor, wounds
121	<i>Sida cordifolia</i> L.	Malvaceae	Under shrub	Root, leaf,	Bariyari ,	Boils, dysentery, leucorrhoea, sexual weakness , wounds
122	<i>Sida rhombifolia</i> L.	Malvaceae	Under shrub	Root, leaf	Bariara,	Boils, child birth, fever, gum infection, swelling, tonic, wounds
123	<i>Solanum nigrum</i> L.	Solanaceae	Under shrub	Fruit, leaf, whole plant	Makoi	Antidote to opium toxic, boil, fever, goitre, piles, sores, sprain, stomachache, swelling, ulcers in mouth, urine complaints.
124	<i>Solanum surattense</i> Burm. f.	Solanaceae	Under shrub	Fruit, root, whole plant	Bhatkataiya	Cough, pyrrhoea, swelling, toothache, tooth decay
125	<i>Sphaeranthus indicus</i> L.	Asteraceae	Herb	Whole plant	Gorak-mundi, Mundi	Anhelminthic, blood purifier, cough, eye disease, jaundice
126	<i>Spilanthes acmella</i> L.	Asteraceae	Herb	Flower	Akarkara	Affections of throat and gums, toothache
127	<i>Tamarindus indica</i> L.	Caesalpiaceae	Tree	Leaf, fruit, seed	Amlī, Imli	Boils, cold, cough, eye complaints, muscular pain, stomachache, sunstroke, swelling, syphilis, toothache
128	<i>Tephrosia purpurea</i> (Linn.) Pers.	Fabaceae	Herb	Root	Sarpokha	Blood purifier, bronchitis, fever, piles, stomachache, toothache
129	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wt. and Arn.	Combretaceae	Tree	Bark, leaf	Arjuna	Heart disease, tonic, wounds
130	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Combretaceae	Tree	Fruit	Bahera	Cold, constipation, gastric complaints, intestinal complaints, muscular pain, piles, stomachache
131	<i>Terminalia chebula</i> Retz.	Combretaceae	Tree	Fruit	Harra,	Cold, constipation, eczema, measles, menstrual complaints, sore in throat, stomach complaints.
132	<i>Tinospora cordifolia</i> Miers	Menispermaceae	Climber	Leaf, stem, whole plant	Giloe, Guduchi	Antipyretic, aphrodisiac, cough, debility, fever, jaundice, malaria, sex strength, tonic
133	<i>Tridax procumbens</i> L.	Asteraceae	Herb	Leaf, whole plant	Phulani,	Blisters, boils, cuts & wounds, eczema, eye disease, leprosy, sores, stomachache, toothache, ulcers.

Table 1. Contd.

134	<i>Urena lobata</i> L.	Malvaceae	Under shrub	Root	Boriyal	Diarrhoea, dysentery, hyperacidity
135	<i>Vanda tessellata</i> (Roxb.)Hook. ex G.Don.	Orchidaceae	Epiphytic herb	Aerial root, whole plant	Banda,	Bone fracture, earache & pus, eye disease, rheumatism
136	<i>Withania somnifera</i> Dunal	Solanaceae	Under shrub	Leaf, root	Asgandh	Aphrodisiac, bronchitis, chest complaints, rheumatism
138	<i>Woodfordia fruticosa</i> (Linn) Jourz	Lythraceae	Shrub	Flower	Dhai, Dhavai	Bleeding in pregnancy, loss of appetite in pregnancy, menorrhagia
139	<i>Wrightia tinctoria</i> Br.	Apocynaceae	Tree	Bark, leaf, latex	Khirna	Dysentery, piles, toothache, wounds.
140	<i>Xanthium strumarium</i> Linn.	Asteraceae	Under shrub	Root, leaf, seed	Gokhru	Boils, herpes, piles, rheumatism, ring worm, toothache
141	<i>Zizyphus mauritiana</i> Lamk.	Rhamnaceae	Shrub	Fruit, leaf	Ber, Beri,	Blood purifier, dysentery, fall of hair, stomachache, ulcers, wounds, whooping cough.
142	<i>Zizyphus nummularia</i> (Burm.f.) Wt. and Arn.	Rhamnaceae	Shrub	Fruit, root, bark	Jhar-beri	Boils, inflammation gums, jaw ache
143	<i>Zizyphus oenoplea</i> (L)Mill.	Rhamnaceae	Shrub	Fruit, bark, leaf	Makkay	Blood purifier, febrifuge, indigestion, piles, swelling, wounds.

Percentage of habit of medicinal plants

■ Herb ■ Under shrub ■ Shrub ■ Tree ■ Climber ■ Succulent

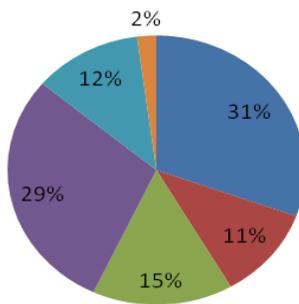


Figure 2. Growth form analysis of ethnomedicinal plants of Sonebhadra district.

Table 2. Foliar fungi causing infection to ethnomedicinal plants.

S/N	Medicinal plant (host)	Symptoms	Fungus
1	<i>Abroma augusta</i> (Linn) Linn	Leaf spot amphigenous, irregular in shape, greyish brown in center and blackish brown towards margin, scattered on entire leaf surface, up to 8 mm in diam.	<i>Cercospora</i> sp.
2	<i>Adina cordifolia</i> (Roxb.) Hook	Leaf spot amphigenous, circular to sub circular, discrete, blackish brown, scattered on entire leaf surface, up to 8 mm in diam.	<i>Mycovellosiella adinicola</i> (Bhalla and Sarbhy, 2000)
3	<i>Anogeissus pendula</i> Edgew.	Leaf spot amphigenous, circular to sub circular, later coalescing to form irregular patches, discrete, blackish brown, scattered on entire leaf surface, up to 12 mm in diam.	<i>Pseudocercospora anogeissi</i> (Braun et al., 2003)
4	<i>Argyreia speciosa</i> SW	Leaf spot epigenous, circular to sub circular, spreading along the veins, discrete, reddish brown, up to 10 mm in diam.	<i>Aternaria</i> sp.
5	<i>Bambusa</i>	Leaf spot amphigenous, circular to oval, discrete, blackish brown at margin and pale brown towards center, scattered on entire leaf surface, 1-2 mm in diam. later coalescing to form bigger patches	<i>Drechslera</i> sp.
6	<i>Barleria prionitis</i> Linn.	Leaf spot amphigenous, circular to sub circular, necrotic, dark brown on upper surface and grayish brown towards lower surface, up to 12 mm in diam.	<i>Cercospora barleriicola</i> (Payak and Thirum, 1949)
7	<i>Bauhinia purpurea</i> Linn	Leaf spots amphigenous, irregular, primarily discrete later coalescing, dark brown on upper surface and light brown towards lower surface, spreading along the margin of leaf, appears like discoloration, up to 18 mm in diam.	<i>Veronia</i> sp.nov.
8	<i>Bauhinia</i> sp.	Leaf spots amphigenous, circular to irregular, primarily discrete later coalescing to form big patches, pale brown in center and dark brown towards margin, minute to 15 mm in diam.	<i>Pseudocercospora</i> sp.
9	<i>Bombax ceiba</i> Linn	Leaf spots amphigenous, sub circular to irregular, near mid rib of leaf let, necrotic, brown in centre and dark brown at margin, forming concentric rings, up to 10 mm in diam.	<i>Corynespora bombacearum</i> (Jain et al., 2002)
10	<i>Caesalpinia pulcherima</i> (Linn.) Swartz	Leaf spots amphigenous, dark brown, spreading from margin towards base, up to 5 mm in diam.	<i>Alternaria</i> sp.
11	<i>Calotropis gigantea</i> (Linn.) R. Br.	Leaf spots amphigenous, circular, velvety, discrete, primarily with pale green discoloration later become greenish black after sporulation, up to 14 mm in diam.	<i>Passalora calotripidis</i> var. <i>megalospora</i> (Braun and Crous, 2003)

Table 2. Contd.

12	<i>Calatropis procera</i> (Ait)R.Br.	Leaf spots amphigenous, circular, velvety, discrete, scattered on entire leaf surface , greenish grey to black, 2-12 mm in diam.	<i>Passalora calotropidis</i> (Braun, 2000)
13	<i>Chromolaena odorata</i> Linn.	Leaf spot amphigenous, angular to irregular, discrete, vein limited, reddish brown, scattered on entire leaf surface, up to 4 mm in diam.	<i>Passalora assamensis</i> (Chawdhury Braun and Crous, 2003)
14	<i>Clerodendrum viscosum</i> Vent.	Leaf spots amphigenous, necrotic, circular to angular, spreading on entire leaf surface near veins, dark reddish brown towards margin and pale brown in centre, 1-6 mm in diam.	<i>Cercospora apii</i> f. <i>sp.clerodendri</i> (Sobers and Martínéz, 1967)
		Leaf spots amphigenous, necrotic, circular, forming concentric rings, reddish brown, up to 13 mm wide.	<i>Corynespora</i> sp.
15	<i>Dalbergia sisso</i> L.	Leaf spot amphigenous, circular to irregular, necrotic, dark brown, up to 5 mm in diam.	<i>Alternaria</i> sp.
16	<i>Ficus benghalensis</i> L.	Leaf spots amphigenous, irregular, discrete, blackish brown, scattered along the veins, up to 8 mm in diam.	<i>Pseudocercospora</i> sp.
17	<i>Ficus hispida</i> L.	Leaf spot amphigenous, circular to subcircular, necrotic, blackish brown, forming concentric rings, spreading on entire leaf surface, up to 10 mm in diam.	<i>Corynespora</i> sp.
18	<i>Ficus religiosa</i> L.	Leaf spot amphigenous, circular to sub circular, necrotic, pale brown in centre and reddish brown at margin, up to 4 mm in diam.	<i>Alternaria</i> sp.
		Leaf spot amphigenous, angular, discrete, brown, effuse, up to 2mm	<i>Cercospora</i> sp. and <i>Pseudocercospora</i> sp.
19	<i>Grewia hirsuta</i> Vahl	Leaf spot amphigenous, circular to irregular, necrotic, light brown in centre and dark brown towards margin, scattered on entire leaf surface, up to 10 mm in diam.	<i>Alternaria</i> sp.
20	<i>Grewia subinequalis</i> DC	Leaf spot amphigenous, angular, vein limited, brown, necrotic, spreading on entire leaf surface, up to 4 mm diam	<i>Alternaria</i> sp.
21	<i>Helicteres ixora</i> Linn.	Leaf spot amphigenous, circular to irregular, discrete, brownish black, scattered on entire leaf surface, up to 15 mm in diam.	<i>Pseudocercospora</i> sp.
22	<i>Lantana camara</i> Linn	Leaf spot amphigenous, angular, vein limited, discrete, blackish brown on upper surface and light brown on lower surface, up to 7 mm in diam.	<i>Pseudocercospora formosa</i> (Yamam.) Deighton, 1976)

Table 2. Contd.

23	<i>Mallotus philippinensis</i> Muel	Leaf spot amphigenous, minute circular to angular, discrete, dark brown on upper surface and grayish brown on lower surface scattered on entire leaf surface, up to 2 mm in diam.	<i>Pseudocercospora malloti</i> (Kharwar et al., 1967; Braun 2009)
24	<i>Mannihot esculenta</i> Crantz	Leaf spot amphigenous, circular to irregular, spreading along the margin of leaf surface, necrotic, brown, approx. 4 mm wide	<i>Alternaria</i> sp.
25	<i>Mucuna pruriens</i> (L.)DC	Leaf spots amphigenous, angular, discrete, spreading on entire leaf surface, reddish brown, up to 3 mm in diam.	<i>Cercospora</i> sp.
26	<i>Nyctanthis arbor-tristis</i> L.	Leaf spot amphigenous, irregular, spreading along the margin of leaf surface, necrotic, brownish black, 4 mm to large coalescing patches	<i>Cercospora</i> sp.
27	<i>Ricinus communis</i> L.	Leaf spot amphigenous, sub circular to irregular, pale brown in centre and dark brown at margin, spreading on entire leaf surface, minute to 4 mm in diam.	<i>Cercospora ricinella</i> (Sacc. and Berl, 1885)
28	<i>Spilanthes acmella</i> L.	Leaf spot amphigenous, irregular, spreading along the leaf surface, necrotic, brownish black, up to 5mm in diam.	<i>Alternaria</i> sp.
29	<i>Tinospora cordifolia</i> Miers	Leaf spot amphigenous, sub circular to irregular, blackish brown, scattered along the veins, up to 16 mm in diam.	<i>Pseudocercospora tinosporae</i> (Kamal et al., 2003; Braun, 2000)
30	<i>Withania somnifera</i> Dunal	Leaf spot amphigenous, circular to sub circular discrete, pale brown on upper surface and brown towards lower surface, scattered along the entire leaf surface ,up to 4 mm in diam.	<i>Pseudocercospora withaniae</i> (Syd. and P. Syd.) (Deighton, 1976)
31	<i>Woodfordia fruticosa</i> (Linn) Jourz	Leaf spot amphigenous, circular to sub circular, necrotic, dark brown on upper surface and grayish brown towards lower surface, up to 8 mm in diam.	<i>Pseudocercospora</i> sp.

pathogen interaction, the infecting fungi secrete different macerating enzymes for their establishment in the hosts and later on they also produce different types of toxins for degradation of living protoplast of the host. These fungal toxins are systemic in nature and may be easily translocated to different parts of the host. Such fungal toxins secreted by the foliar fungi within the ethno-medicinal plants would definitely cause undesira-

ble side effects to the tribes of the area if the infected medicinal plants are used for cure of their ailments. There are also some earlier reports (Hosagoudar et al., 1997; Chakraborty et al., 2002; Shivanna and Mallikarjunaswamy, 2009) emphasizing the increase in proline content of the medicinal plants due to fungal infection.

Proline is an important osmoregulator in plants enhanced under stress conditions (Sabry et al.,

1995). Efforts should be also made by the government organizations to spray some pesticides on these medicinal plants which are prone to infection. The collateral wild plants which help in perpetuation of the foliar fungi should also be eliminated time to time. The information gathered in this survey from the tribes of Sonebhadra district would be useful for protection of the medicinal plants of the area from fungal infections

as well as in devising suitable conservation strategies. This is the first report on documentation of ethno-medicinal plants of Sonebhadra district and the foliar fungi causing diseases to these plants.

ACKNOWLEDGEMENTS

The authors are thankful to Prof B.R. Chaudhary, Head, Center of Advanced Study in Botany, Banaras Hindu University, Varanasi, for providing laboratory and library facilities for the same. Dr. Archana Singh is thankful to Department of Science and Technology, Government of India, New Delhi for providing financial support under Women Scientist Scheme (WOS-A).

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