Chapter 2
Threatened Medicinal Plants of Eastern Ghats and Their Conservation

N. Sivaraj, Kamala Venkateswaran, S. R. Pandravada, M. Thirupathi Reddy, and P. E. Rajasekharan

Abstract Traditional medicine has a long history of cultural heritage and ethnic practices in India and in recent years has gained much recognition worldwide. The Eastern Ghats, inhabited by nearly 54 tribal communities, constituting nearly 30% of total population, are a diverse and rich source of threatened medicinal and aromatic plants used in drug, pharmaceutical, and perfumery industries. Out of 2500 species of flowering plants belonging to angiosperms, gymnosperms, and pteridophytes known to occur in Eastern Ghats, about 77 species (67 dicots, 9 monocots, and 1 gymnosperm) are endemic. The variations in altitude and climatic conditions, especially in rainfall, have immensely contributed to the evolution of rich ethnic floristic diversity in the Eastern Ghats. At least 788 medicinal plant taxa and 40 aromatic plants are concentrated in this area which are used in various medicinal systems including codified and folklore which belong to 132 families and 384 genera. The dominant medicinal plant families in the Eastern Ghats are Leguminosae (67 spp.), Apocynaceae (29 spp.), Malvaceae (26 spp.), Euphorbiaceae (25 spp.), Orchidaceae (22 spp.), Solanaceae and Rubiaceae (16 spp. each), Asteraceae (15 spp.), Acanthaceae, Asteraceae and Lamiaceae (14 spp. each), Cucurbitaceae and Zingiberaceae (13 spp. each), Rutaceae (12 spp.), and Araceae (10 spp.). These medicinal plant genetic resources are distributed in various vegetation types in the Eastern Ghats region. Ethnobotanical knowledge from the Eastern Ghats region has

N. Sivaraj (✉) · K. Venkateswaran · S. R. Pandravada
ICAR-National Bureau of Plant Genetic Resources, Regional Station, Hyderabad, Telangana, India

M. T. Reddy
Horticultural Research Station, Dr YSR Horticultural University, Vijayarai, Andhra Pradesh, India

P. E. Rajasekharan
Division of Plant Genetic Resources, ICAR-Indian Institute of Horticultural Research, Bangalore, Karnataka, India

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been recorded by several workers. Indian systems of medicine are reported to utilize around 2500 plant species of which about 800 species are used by the industry and approximately 25% of species are under cultivation. India ranks sixth in essential oil production and export of products derived from medicinal plants. It is estimated that India has a potential to export plant base crude drugs to the tune of Rs. 400 billion but manages to export produce worth only about Rs. 12.6 billion. India with its rich biodiversity and tradition of use of herbal drugs in healthcare holds tremendous opportunity for growth in a multibillion global trade, particularly in the herbal area, which has vast potential for developing multiple products for nutrition, cosmetics, and prevention and cure of diseases. This article provides an overview of the threatened medicinal plants of the Eastern Ghats, their distribution, and reported uses in local health traditions. Blending traditional knowledge with modern science including genomics is a priority area to meet the forthcoming challenges in the light of climate change, and thus conservation strategies, both ex situ and in situ, for these diverse species are also discussed.

Keywords Eastern Ghats · Conservation · Threatened medicinal plants

2.1 Introduction

Plants are being utilized as medicines for thousands of years all over the globe and are a source of many potent and powerful drugs. Traditional medicine has become more popular in the treatment of many diseases due to belief that these are safe, easily available, and with fewer side effects. At least 80% of the population of developing countries depend on plant drugs for their primary healthcare needs (Farnsworth et al., 1985). Medicinal plants are vital components and play a significant role in the healthcare of rural people all over the world. The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed (Reddy et al., 2019). There are many traditional systems of medicine associated with their own different philosophies and cultural origins. The herbal medicines/ traditional medicaments have been derived from rich traditions of ancient civilizations and scientific heritage. The earliest recorded evidence of their use in Indian, Chinese, Egyptian, Greek, Roman, and Syrian texts dates back to about 5000 years. The classical Indian texts including *Rig-Veda*, *Charaka Samhita*, and *Sushruta Samhita* are the evidences for these age-old traditions (Kamboj, 2000).

The Eastern Ghats have a diverse and rich source of threatened medicinal and aromatic group of plants used in drugs, pharmaceutical, and perfumery industries. In the modern era, though synthetic chemicals are contributing appreciably in the pharmaceutical application, the plant-based drugs remain vital source of modern medicine. The spurt in demand of the raw material in world trade has caused large-scale collection of the naturally occurring populations, thus threatening the very existence of these irreplaceable gene pools. The quantity gathered from natural habitats is so large that even protected areas are no longer safe, despite notification from the Government

time to time. Even the ban on ruthless collection of medicinal plants/species has not improved the frequency of their distribution. For example, Eastern Ghats region has lost large populations of several medicinal plants in the past, viz., *Rauvolfia serpentina*, *Commiphora wightii*, *Chlorophytum tuberosum*, *Dioscorea deltoidea*, etc. Threatened medicinal plants are used in various indigenous systems of medicine such as *Siddha*, *Ayurveda*, *Amchi*, *Unani*, and even in allopathy, with pharmaceutical industries depending on plants for preparation of the medicines. Herbal drugs or medicinal plants, their extracts, and their isolated compounds have demonstrated a wide spectrum of biological activities. Such natural medicines have been used and continue to be used as medicine or as food supplements for various disorders as described in various texts and folklore. Safe, effective, and inexpensive indigenous remedies are currently gaining popularity among the people of both the urban and rural areas in India. Plant-based ethnic and traditional knowledge systems have become a recognized tool in search of drugs and pharmaceuticals (Reddy et al., 2019). An attempt has been made to review the conservation strategies, traditional knowledge systems of threatened medicinal plants prevailing in Eastern Ghats of India.

2.2 Eastern Ghats

The Eastern Ghats, one of the major hill ranges of India, located between $77^0 22'$ and $85^0 20'$ E and $11^0 30'$ and $21^0 00'$ N, form an assembly of discontinuous ranges, hills, plateaus, escarpments, and narrow basins and spread in an area of about 75,000 km^2. The Eastern Ghats stretching from Odisha, Chhattisgarh, through Andhra Pradesh to Tamil Nadu and parts of Karnataka are endowed with a large number of biological species, geological formations, and indigenous tribal groups (Fig. 2.1). For Eastern Ghats, the Mahanadi basin marks the northern boundary, while the southern boundary lies in the Nilgiri hills. The tips of Bastar, Telangana, Karnataka plateaus, and Tamil Nadu uplands form the boundary in the West, while the coastal belt forms the boundary in the East.

The Eastern Ghats region is inhabited by nearly 54 tribal communities, which constitute nearly 30% of total population (Chauhan, 1998). The major tribes in the Eastern Ghats are *Arondhan*, *Irular*, *Kota*, *Kotanayakam*, *Kurmar*, *Puniyan*, *Pulayan*, *Sholaga* and *Tuda*, and *Malayali* in the southern region; *Bagata*, *Chenchu*, *Gadaba*, *Jatapu*, *Kammara*, *Kondadora*, *Konda Kapu*, *Konda Reddy*, *Kandha*, *Kotiobenthu Oriya*, *Koya/Goud*, *Kulia*, *Mali*, *Mukadora*, *Mannedora*, *Nayaka*, *Paraja*, *Reddidora*, *Savara*, *Valmiki*, *Yenadi*, and *Yerukala* in central region; and *Bathudi*, *Birjhal*, *Bhuiyan*, *Dhuma*, *Bhumis*, *Bhuttada*, *Gond*, *Khana*, *Kisan*, *Kolba*, *Munda*, *Oraon*, *Soarha*, and *Sounti* in the northern region. The variations in altitude and climatic conditions, especially in rainfall, have immensely contributed to the evolution of rich ethnic floristic diversity in the Eastern Ghats. This region is very rich in terms of natural wealth, which is manifested, in its greatest biological diversity. Out of 2500 species of flowering plants belonging to angiosperms, gymnosperms, and pteridophytes known to occur in Eastern Ghats, about 77 species (67 dicots, 9 monocots and 1 gymnosperms) are endemic.

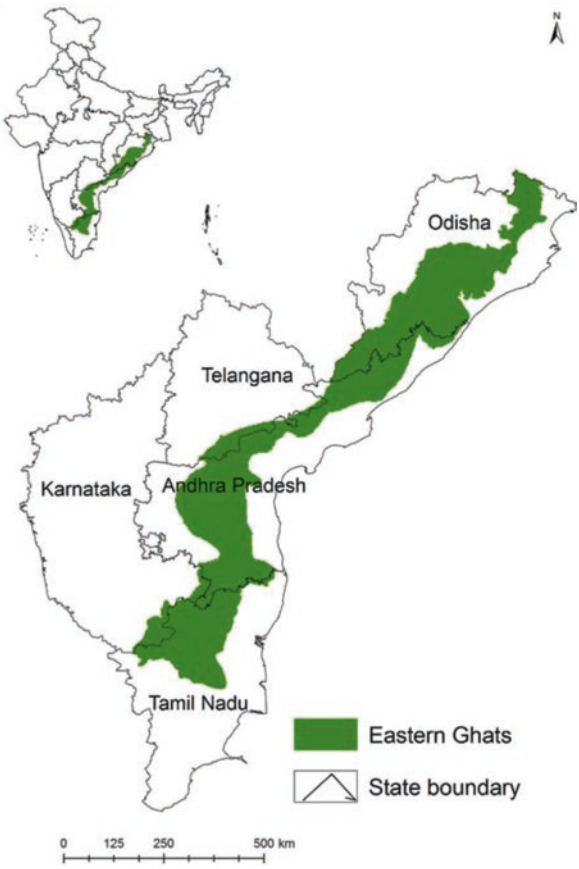

Fig. 2.1 Location map of Eastern Ghats, India. (Courtesy: Dr Sudhakar Reddy, NRSC, Hyderabad)

2.3 Status of Medicinal Plant Genetic Resources in Eastern Ghats

The rich and diverse heritage of traditional indigenous medicinal and aromatic plants in Eastern Ghats is threatened due to various abiotic and biotic stresses coupled with the technological advancement. With increasing interest in herbal medicines worldwide, conservation of medicinal plants in Eastern Ghats has assumed considerable importance. The Eastern Ghats are endowed with rich floristic diversity consisting of more than 2000 species of plants including medicinal plant species (1800) belonging to angiosperms, gymnosperms, and pteridophytes. Eastern Ghats vegetation includes 454 endemic species belonging to 243 genera and 78 families (Reddy et al., 2002a, b). At least 788 medicinal plant taxa and 40 aromatic plants are concentrated in this area which are used in various medicinal systems including codified and folklore which belong to 132 families and 384 genera. The dominant medicinal plant families in the Eastern Ghats are Leguminosae (67 spp.), Apocynaceae (29 spp.), Malvaceae (26 spp.), Euphorbiaceae (25 spp.), Orchidaceae

(22 spp.), Solanaceae and Rubiaceae (16 spp. each), Asteraceae (15 spp.), Acanthaceae, Asteraceae and Lamiaceae (14 spp. each), Cucurbitaceae and Zingiberaceae (13 spp. each), Rutaceae (12 spp.), and Araceae (10 spp.). These medicinal plant genetic resources are distributed in various vegetation types in the Eastern Ghats region (Table 2.1). A total of 560 tree taxa fewer than 262 genera belonging to 80 families are reported to occur in the Eastern Ghats (Rani and Pullaiah, 2002). Dye yielding plants occurring in the southern most point of Eastern Ghats is recorded (Krishnamurthy et al., 2002). The Eastern Ghats region is being exploited in an unregulated manner for this natural wealth. Several published floras by eminent botanists from the region are available on Eastern Ghats such as H.H. Haines, J.S. Gamble, C.E.C. Fischer, C.A.Barber, C.H. Beddome, T. Spring, J.L.Ellis, K.M. Matthew, R.S.Rao, G. Rao, B. Suryanarayana, T. Pullaiah, H.F. Mooney, etc., and changes in plant biodiversity pattern of the region were also a subject of review recently (Pandravada et al., 2004). Genera such as *Anaphalis*,

Table 2.1 Predominant medicinal taxa including threatened species occurring in different vegetation types of Eastern Ghats

Scrub	Deciduous	Evergreen/semi-evergreen
Acacia chundra	*Adina cordifolia*	*Arisaema* sp.
Albizia amara	*Andrographis paniculata*	*Bridelia tomentosa*
Anogeissus latifolia	*Bauhinia vahlii*	*Callicarpa tomentosa*
Apluda mutica	*Boswellia ovalifoliolata*	*Calycopteris floribunda*
Atalantia monophylla	*Bridelia retusa*	*Celtis cinnamomea*
Capparis sepiaria	*Careya arborea*	*Centella asiatica*
Carissa spinarum	*Cassia fistula*	*Cinnamomum zeylanicum*
Cassia auriculata	*Cipadessa baccifera*	*Coelogyne nervosa*
Cissus quadrangularis	*Dendrocalamus strictus*	*Couroupita guianensis*
Curculigo orchioides	*Garuga pinnata*	*Dillenia pentagyna*
Cymbopogon flexuosum	*Grewia tiliifolia*	*Elaeocarpus serratus*
Decalepis hamiltonii	*Helicteres isora*	*Entada pursaetha*
Dichrostachys cinerea	*Kydia calycina*	*Ichnocarpus frutescens*
Dodonaea viscosa	*Madhuca longifolia*	*Ixora montana*
Eclipta alba	*Memecylon umbellatum*	*Macaranga peltata*
Emblica officinalis	*Mucuna pruriens*	*Mallotus philippensis*
Euphorbia antiquorum	*Pterocarpus marsupium*	*Mangifera indica*
Euphorbia tirucalli	*Schleichera trijuga*	*Mesua nagassarium*
Hemidesmus indicus	*Sterculia urens*	*Michelia champaca*
Holarrhena antidysenterica	*Terminalia arjuna*	*Naravelia zeylanica*
Hugonia mystax	*Terminalia chebula*	*Ochna gamblei*
Pergularia daemia	*Terminalia tomentosa*	*Pimpinella tirupatiensis*
Phyllanthus amarus	*Tinospora cordifolia*	*Plumbago zeylanica*
Santalum album	*Toddalia asiatica*	*Rauvolfia serpentina*
Strychnos nux-vomica	*Woodfordia fruticosa*	*Toona ciliata*
Tridax procumbens	*Wrightia tinctoria*	*Xylia xylocarpa*

Source: Sivaraj et al. 2006

Bulbophyllum, *Callicarpa*, *Clematis*, *Debregeasia*, *Delphinium*, *Dillenia*, *Ensete*, *Eulophia*, *Exacum*, *Lobelia*, *Mallotus*, *Meliosma*, *Mucuna*, *Pimpinella*, *Prunus*, *Raphidophora*, *Sapium*, *Saussurea*, *Syzygium*, *Tinospora*, *Vanilla*, and *Viburnum* present in the Eastern Ghats are common to the Himalayas, Khasi, and Jaintia hills of Meghalaya and the Western Ghats (Reddy et al., 2002a, b; Sahu and Dhal, 2012; Sivaraj et al., 2015). *Cycas beddomei*, *Cycas circinalis*, and *Gnetum scandens* and about 30 species of ferns including *Cyathea gigantea*, a tree fern, are also distributed in this region. The following are the red list categories which are applicable to threatened medicinal plant taxa of Eastern Ghats region:

- Critically endangered (CR) – in a particularly and extremely critical state (e.g., *Rauvolfia serpentina*, *Litsea glutinosa*, *Cycas beddomei*, etc.)
- Endangered (EN) – very high risk of extinction in the wild, meets IUCN criteria for endangered (A-E) (e.g., *Homalium zeylanicum*, *Butea monosperma*, *Rhynchosia heynei*, *Tephrosia calophylla*, *Saraca asoca*, *Entada rheedii*, *Plumbago indica*, *Strychnos colubrina*, *Ceropegia spiralis*, *Decalepis hamiltonii*, *Plectranthus barbatus*, *Piper nigrum*, *Santalum album*, *Vanilla wightiana*, *Acorus calamus*, etc.)
- Vulnerable (Vu) – meets one of the five red list criteria and thus considered to be at high risk of unnatural (human-caused) extinction without further human intervention (e.g., *Hildegardia populifolia*, *Sterculia urens*, *Aegle marmelos*, *Rubia cordifolia*, *Gymnema sylvestre*, *Oroxylum indicum*, *Euphorbia fusiformis*, *Phyllanthus indofischeri*, *Stemona tuberosa*, *Gloriosa* superba, etc.).

Detailed threatened category of medicinal plants of Eastern Ghats, species, and family wise are provided in Table 2.2.

2.4 Traditional Knowledge on Threatened Medicinal Plant Systems

Ethnobotanical knowledge from the Eastern Ghats region has been recorded by several workers (Saxena and Dutta, 1975; Banerjee, 1977; Reddy, 1980; Rao and Harasreeramulu, 1985; Thammanna and Rao, 1998; Ravisankar and Henry 1992; Goud and Pullaiah, 1996; Rao and Henry, 1996; Vedavathy et al., 1997; Pandravada and Sivaraj, 1999; Pandravada et al., 2000, 2006; Pullaiah, 2002; Rao and Reddi 2002; Reddy et al., 2002a, b; Basha and Sudarsanam, 2010, Dikshit and Sivaraj, 2014). The tribes living in the Eastern Ghats depend mostly on various forest products, but their careless collection resulted in much damage to the forest wealth particularly rare and endangered medicinal plant species. Many tribal communities are practicing their local health traditional methods using medicinal herbs to cure various ailments. Their understanding of the medicinal flora around them and related indigenous knowledge systems are transmitted through successive generations and practiced as a part of their tradition and culture. Medical practices of local and indigenous people have remained unchanged over long periods of time. In the face

Table 2.2 Threatened medicinal plant families of Eastern Ghats

Family	Threatened status	Botanical name	Distribution
Acanthaceae	Endangered	*Phlebophyllum jeyporense* (Bedd.) Bremekamp	Chhatisgarh, Odisha, Andhra Pradesh
		Santapaua madurensis Balakr. & Subram.	Tamil Nadu
	Extinct or possibly extinct	*Neuracanthus neesianus* (Wight ex T. Anders.) Clarke	Tamil Nadu
	Indeterminate	*Lepidagahis difusa* Clarke	Karnataka, Tamil Nadu
		Strobilanthes dupenii Bedd. ex Clarke	Peninsular India (Anamalais)
	Rare	*Lepidagathis barberi* Gamble	Tamil Nadu
		Mackenziea caudata (T. And.) Ramam.	Karnataka, Tamil Nadu
		Nilgirianthus circarensis (Gamble) Bremek.	Andhra Pradesh, Odisha
Amaranthaceae	NA	*Aerva wightii* Hook. f.	Tamil Nadu
Anacardiaceae	Endangered	*Nothopegia aureo-fulva Bedd. ex Hook. f.*	Tamil Nadu
Annonaceae	Endangered	*Desmos viridiflorus (Bedd.) Safford*	Tamil Nadu
		Uvaria eucincta Bedd. ex Dunn	Odisha
	Rare	*Goniothalamus rhynchantherus Dunn*	Tamil Nadu
		Orophea uniflora Hook. f. & Thoms.	Tamil Nadu, Karnataka
		Polyalthia rufescens Hook. f. &Thoms.	Tamil Nadu
		Popowia beddomeana Hook. f. &Thoms.	Tamil Nadu
	Vulnerable	*Miliusa nilagirica Bedd.*	Tamil Nadu
Apiaceae	Endangered (globally)	*Pimpinella tirupatiensis* Balakr. *et* Subram.	Andhra Pradesh
	Rare	*Peucedanum anamallayense* Clarke	Tamil Nadu
		Vanasushava pedata (Wight) Mukh. *et* Const.	S. India (Shervaroy, Palani, and Anamalis hills)
Apocynaceae	Critically endangered	*Rauvolfia serpentina*	Andhra Pradesh
	Endangered	*Anodendron paniculatum*	Andhra Pradesh
	Near threatened	*Holostemma ada-kodien*	Andhra Pradesh
Aponogetonaceae	Indeterminate	*Aponogeton appendiculatus* van Bruggen	Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
Araceae	Endangered	*Acorus calamus*	Andhra Pradesh
		Lasia spinosa	Andhra Pradesh
		Rhaphidophora decursiva	Andhra Pradesh
	Vulnerable	*Amorphophallus sylvaticus*	Andhra Pradesh
		Cryptocoryne cognatoides Blatt. &McC.	Karnataka, Maharashtra
Asclepiadaceae	Endangered	*Ceropegia barnesii* Bruce *et* Chatterjee	S. India
		Ceropegia omissa Huber [C. intermedia Wight var. wightii Hook. f.]	Tamil Nadu
		Toxocarpus longistigma (Roxb.) Wight & Arn. Ex Steud.	Andhra Pradesh
	Endangered (globally)	*Decalepis hamiltonii*	Andhra Pradesh
	Extinct or possibly extinct	*Ceropegia fantastica* Sedgw.	Karnataka, Goa
		Ceropegia maculata Bedd. [C. parviflora Trimen]	Tamil Nadu
	Near threatened	*Holostemma ada-kodien*	Andhra Pradesh
	Rare	*Ceropegia decaisneana* Wight	Kerala, Tamil Nadu
		Ceropegia metziana Miq.	Karnataka, Tamil Nadu
		Ceropegia pusilla Wight *et* Arn.	Karnataka, Tamil Nadu
		Marsdenia raziana Yog. *et* Subr.	Karnataka
		Toxocarpus beddomei Gamble	Tamil Nadu
	Vulnerable	*Ceropegia fimbriifera* Bedd.	Karnataka, Tamil Nadu
		Ceropegia spiralis Wight	Andhra Pradesh, Karnataka, Tamil Nadu
		Ceropegia thwaitesii Hook.	Tamil Nadu
		Gymnema sylvestre	Andhra Pradesh
Asparagaceae	Indeterminate/ insufficiently known	*Asparagus rottleri* Baker	Deccan Peninsula
	Least concerned	*Chlorophytum arundinaceum*	Andhra Pradesh
Asteraceae	Endangered	*Senecio kundaicus* Fischer	Tamil Nadu
	Extinct or possibly extinct	*Vernonia recurva* Bedd. ex S. Moore	Tamil Nadu
	Rare	*Helichrysum perlanigerum* Gamble	Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
		Senecio mayurii Fischer	Karnataka
Athyriaceae	Rare	*Diplazium travancoricum* Bedd.	South . India
Balsaminaceae	Endangered	*Impatiens neo-barnesii* Fischer	Tamil Nadu
		Impatiens nilagirica Fischer	Tamil Nadu
	Rare	*Impatiens talbortii* Hook. f.	Karnataka
Bignoniaceae	Vulnerable	*Oroxylum indicum*	Andhra Pradesh
Burseraceae	Endangered (globally)	*Boswellia ovalifoliolata*	Andhra Pradesh
Callophyllaceae	Not evaluated	*Mesua ferrea*	Andhra Pradesh
Capparaceae	Indeterminate	*Cleome burmanni* Wight *et* Arn.	Tamil Nadu
	Rare	*Capparis fusifera* Dunn	Kerala, Tamil Nadu
		Capparis rheedii DC.	Tamil Nadu, North Kanara
	Vulnerable	*Capparis diversifolia* Wight & Arn.	Tamil Nadu
		Capparis shevaroyensis Sundararaghavan	Tamil Nadu
Caryophyllaceae	Vulnerable	*Polycarpaea diffusa* Wight & Arn.	Tamil Nadu
Celastraceae	Endangered	*Euonymus angulatus* Wight	Karnataka, Tamil Nadu
	Extinct or possibly extinct	*Euonymus serratifolius* Bedd.	Tamil Nadu
	Extinct or possibly extinct	*Salacia malabarica* Gamble	Karnataka
	Near threatened	*Celastrus paniculatus*	Andhra Pradesh
	Rare	*Salacia beddomei* Gamble	Tamil Nadu
Caesalpiniaceae	Endangered	*Saraca asoca*	Andhra Pradesh
	Extinct or possibly extinct	*Euonymus serratifolius* Bedd.	Tamil Nadu
		Salacia malabarica Gamble	Karnataka
	Near threatened	*Celastrus paniculatus*	Andhra Pradesh
	Rare	*Salacia beddomei* Gamble	Tamil Nadu
Combretaceae	Endangered	*Terminalia pallida*	Andhra Pradesh
Commelinaceae	Endangered	*Belosynapsis kewensis* Hassk.	Tamil Nadu
	Indeterminate	*Cyanotis cerifolia* Rolla Rao *et* Kammathy	Tamil Nadu
	Rare	*Commelina indehiscens* Barnes	Karnataka, Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
		Murdannia lanuginose (Wall. ex Clarke) Bruckn.	Deccan Plateau, Sahyadri hills
	Vulnerable	*Commelina tricolor* Barnes	Tamil Nadu
		Commelina wightii Rolla Rao	Tamil Nadu
		Murdannia lanceolata (Wight) Kammathy	Tamil Nadu
Convolvulaceae	Least concerned	*Merremia turpethum*	Andhra Pradesh
Crassulaceae	Rare	*Kalanchoe olivacea* Dalz.	Tamil Nadu
Cucurbitaceae	Near threatened	*Trichosanthes cucumerina*	Andhra Pradesh
Cyatheaceae	Endangered	*Sphaeropteris crinita (Hook.) Tryon [Cyathea crinita (Hook.) Copel.]*	Tamil Nadu
Cycadaceae	Critically endangered	*Cycas beddomei*	Andhra Pradesh
	Vulnerable	*Cycas beddomei* Dyer	Andhra Pradesh
Cyperaceae	Indeterminate	*Carex pseudo-aperta* Kuekenth.	Tamil Nadu
		Carex vicinalis Boott	Tamil Nadu
	Indeterminate or possibly extinct	*Carex christii* Boeck.	Tamil Nadu
Dicranopteridaceae	Vulnerable	*Dicranopteris linearis* (Burm. f.) Underw. var. *sebastiana* Panigr. & Dixit	Tamil Nadu
Dioscoreaceae	Near threatened	*Tacca leontopetaloides*	Andhra Pradesh
Dipterocarpaceae	Rare	*Hopea jacobi* Fischer	Karnataka
	Endangered	*Shorea tumbaggaia*	Andhra Pradesh
	Near threatened	*Shorea robusta*	Andhra Pradesh
Elaeocarpaceae	Rare	*Elaeocarpus blascoi* Weibel	Tamil Nadu
		Elaeocarpus recurvatus Corner	Tamil Nadu
Elaphoglossaceae	Endangered	*Elaphoglossum nilgiricum* Krajina ex Sledge	Tamil Nadu
Euphorbiaceae	Endangered	*Phyllanthus narayanaswamii* Gamble	Andhra Pradesh
	Indeterminate	*Pseudoglochidion anamalayanum* Gamble	Tamil Nadu
	Rare	*Dalechampia stenoloba* Sundararaghavan *et* Kulkarni	Karnataka
		Phyllanthus talbotii Sedgw.	Karnataka
	Vulnerable	*Euphorbia fusiformis*	Andhra Pradesh
		Phyllanthus indofischeri	Andhra Pradesh

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
Fabaceae	Endangered	*Crotalaria clavata* Wight *et* Arn.	Tamil Nadu
		Crotalaria fysonii Dunn var. *glabra* Gamble	Tamil Nadu
		Crotalaria kodaiensis Debberm. *et* Biswas	Tamil Nadu
		Crotalaria longipes Wight *et* Arn.	Tamil Nadu
		Crotalaria sandoorensis Bedd. ex Gamble	Karnataka
		Entada pursaetha	Andhra Pradesh
		Humboldtia bourdilloni Prain	Tamil Nadu
		Humboldtia unijuga var. *unijuga* Bedd.	Tamil Nadu
		Butea monosperma var. lutea	Andhra Pradesh
	Near threatened	*Pueraria tuberosa*	Andhra Pradesh
	Rare	*Acacia campbellii* Arn.	Andhra Pradesh
		Albizia thompsonii Brandis	Andhra Pradesh, Tamil Nadu, Odisha
		Crotalaria digitata Hook.	Tamil Nadu
		Crotalaria globosa Wight *et* Arn.	Tamil Nadu, Karnataka
		Crotalaria lutescens Dalz.	Karnataka, Maharashtra
		Crotalaria peduncularis Grah. ex Wight *et* Arn.	Tamil Nadu
		Crotalaria priesleyoides Benth. ex Baker	Tamil Nadu
		Crotalaria rigida Heyne ex Roth	Tamil Nadu, Karnataka
		Crotalaria scabra Gamble	Tamil Nadu
		Cynometra travancorica Bedd.	Karnataka
		Eleiotis trifoliolata Cooke	Karnataka
		Humboldtia decurrens Bedd. ex Oliver	Tamil Nadu
		Indigofera barberi Gamble	Andhra Pradesh, Tamil Nadu
		Indigofera constricta (Thw.) Trimen	Goa, Karnataka
		Kingiodendron pinnatum (Roxb. ex DC.) Harms	Karnataka, Tamil Nadu
		Rhynchosia beddomei Baker	Karnataka

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
		Tephrosia barberi Drumm.	Tamil Nadu
		Tephrosia calophylla Bedd.	Tamil Nadu, Karnataka
	Vulnerable	*Cynometra bourdillonii* Gamble	Karnataka
		Rhynchosia velutina Wight *et* Arn.	Tamil Nadu
	Endangered (globally)	*Pterocarpus santalinus*	Andhra Pradesh
Flacourtiaceae	Endangered	*Hydnocarpus macrocarpa* (Bedd.) Warb. ssp. *macrocarpa*	Tamil Nadu
Gesneriaceae	Rare	*Didymocarpus missionis* Wall. ex R. Br.	Tamil Nadu
Lamiaceae	Endangered	*Leucas mukerjiana* Subba Rao *et* Kumari	Andhra Pradesh
		Plectranthus barbatus	Andhra Pradesh
		Pogostemon paludosus Benth.	Tamil Nadu
	Indeterminate	*Acrocephalus palniensis* Mukherjee	Tamil Nadu
		Plectranthus bourneae Gamble	Tamil Nadu
	Possibly extinct	*Plectranthus bishopianus* Gamble	Tamil Nadu
	Rare	*Anisochilus wightii* Hook. f.	Tamil Nadu
		Leucas angustissima Sedgw.	Karnataka
		Pogostemon atropurpureus Benth.	Tamil Nadu
	Vulnerable	*Anisochilus argenteus* Gamble	S. India
Lauraceae	Critically endangered	*Litsea glutinosa*	Andhra Pradesh
	Endangered	*Actinodaphne bourneae* Gamble	Tamil Nadu
		Actinodaphne lanata Meisner	Tamil Nadu
	Rare	*Actinodaphne lawsonii* Gamble	Tamil Nadu
Liliaceae	Endangered	*Iphigenia sahyadrica* Ansari *et* Rolla Rao	Karnataka
		Urginea congesta Wight	S. India
	Indeterminate	*Dipcadi minor* Hook. f.	Deccan Plateau
	Possibly extinct	*Dipcadi concanense* (Dalz.) Baker	S. India

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
	Presumed extinct	*Urginea polyphylla* Hook. f.	Deccan Peninsula
	Vulnerable	*Gloriosa superba*	Andhra Pradesh
Linaceae	Rare	*Hugonia belli* Sedgw.	Karnataka
Loganiaceae	Endangered	*Strychnos colubrina*	Andhra Pradesh
Loranthaceae	Indeterminate	*Viscum mysorense* Gamble	Karnataka
Malpighiaceae	Rare	*Aspidopteris canarensis* Dalz.	Karnataka, Maharashtra.
		Aspidopterys tomentosa var. hutchinsonii (Haines) Srivastava	Odisha
Malvaceae	Endangered	*Decaschistia rufa* Craib	Peninsular India
	Rare	*Decaschistia trilobata* Wight	Peninsular India
Marattiaceae	Endangered	*Angiopteris evecta*	Andhra Pradesh
Melastomataceae	Endangered	*Kendrickia walker* (Wight) Hook. f. ex Triana	Tamil Nadu
		Memecylon flavescens Gamble	Tamil Nadu
	Indeterminate	*Memecylon sisparense* Gamble	Tamil Nadu
Meliaceae	Vulnerable	*Aglaia talbotii* Sundararaghavan	Karnataka
Myrsinaceae	Rare	*Antistrophe serratifolia* (Bedd.) Hook. f.	Tamil Nadu
Myrtaceae	Endangered	*Eugenia discifera* Gamble	Tamil Nadu
		Meteoromyrtus wynaadensis (Bedd.) Gamble	Tamil Nadu
		Syzygium courtallense (Gamble) Alston	Tamil Nadu
		Syzygium gambleanum Rathakr. *et* Chitra	Tamil Nadu
		Syzygium alternifolium	Andhra Pradesh
	Extinct or possibly extinct	*Eugenia singampattiana* Bedd.	Tamil Nadu
Orchidaceae	Endangered	*Nervilia aragoana*	Andhra Pradesh
	Extinct or possibly extinct	*Anoectochilus rotundifolius* (Blatt.) Balakr.	Tamil Nadu
	Indeterminate or insufficiently known	*Chrysoglossum hallbergii* Blatt.	Peninsular India (Tamil Nadu)
	Possibly extinct	*Vanda wightii* Reichb. f.	Tamil Nadu
	Rare	*Bulbophyllum acutiflorum* A. Rich.	Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
		Bulbophyllum albidum Hook. f.	Tamil Nadu
		Corymborkis veratifolia (Reinw.) Bl.	Tamil Nadu
		Eria albiflora Rolfe	Tamil Nadu, Karnataka
		Habenaria barnesii Summerh.	Tamil Nadu
		Oberonia brachyphylla Blatt. & McCann	Karnataka
		Vanilla wightiana Lindl.	Tamil Nadu
	Vulnerable	*Bulbophyllum elegantulum* (Rolfe) J.J. Sm.	Karnataka
		Coelogyne mossiae Rolfe	Peninsular India
		Liparis biloba Wight	Tamil Nadu
Periplocaceae	Endangered	*Utleria salicifolia* Bedd.	Tamil Nadu
Piperaceae	Endangered	*Piper nigrum*	Andhra Pradesh
Plumbaginaceae	Endangered	*Plumbago indica*	Andhra Pradesh
Poaceae	Presumed extinct	*Eragrostis rottleri* Stapf	S. India
		Eriochrysis rangacharii Fischer	Tamil Nadu
		Hubbardia heptaneuron Bor	Karnataka
	Rare	*Glyphochloa divergens* (Hook.) Clayton	Karnataka
		Isachne mysorensis Raghavan	Karnataka
Podostemonaceae	Rare or vulnerable	*Indotristicha tirunelveliana* Sharma, Karthi. & Shetty	Tamil Nadu
Ranunculaceae	Indeterminate	*Thalictrum dalzellii* Hook.	Karnataka, Maharashtra
	Rare	*Clematis theobromina* Dunn	Tamil Nadu
Rosaceae	Vulnerable	*Cotoneaster buxifolius* Wall. ex Lindley	Tamil Nadu
Rubiaceae	Endangered	*Acranthera grandiflora* Bedd.	Tamil Nadu
		Hedyotis albonervia Bedd.	Tamil Nadu
		Psychotria globicephala Gamble	Tamil Nadu
	Indeterminate	*Neanotis carnosa* (Dalz.) Lewis	Karnataka
	Near threatened	*Paederia foetida*	Andhra Pradesh
	Possibly extinct	*Hedyotis hirsutissima* Bedd.	Tamil Nadu
		Pavetta wightii Hook. f.	Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
	Presumed extinct	*Ophiorrhiza brunonis* Wight *et* Arn.	Tamil Nadu, Karnataka
		Wendlandia angustifolia Wight ex Hook. f.	Tamil Nadu
	Rare	*Hedyotis buxifolia* Bedd.	Tamil Nadu
		Hedyotis cyanantha Kurz	Tamil Nadu, Maharashtra, Karnataka
		Hedyotis eualata (Bedd. ex Gamble) Henry et Subramanyam	Tamil Nadu
		Hedyotis swersioides Hook. f.	Tamil Nadu
	Vulnerable	*Hedyotis barberi* (Gamble) Henry *et* Subramanyam	Tamil Nadu
		Hedyotis ramarowii (Gamble) Rolla Rao *et* Hemadri	Tamil Nadu
		Neanotis prainiana (Talbot) Lewis	Karnataka
		Ochreinauclea missionis (Wall. ex G. Don) Ridsd.	Tamil Nadu, Karnataka
		Pavetta hohenackeri Brem.	Tamil Nadu
		Rubia cordifolia	Andhra Pradesh
		Tarenna agumbensis Sundararaghavan	Karnataka
Rutaceae	Endangered	*Zanthoxylum rhetsa*	Andhra Pradesh
	Rare	*Glycosmis macrocarpa* Wight	Tamil Nadu
	Vulnerable	*Aegle marmelos*	Andhra Pradesh
		Melicope indica Wight	Tamil Nadu
Santalaceae	Endangered	*Santalum album*	Andhra Pradesh
Sapotaceae	Indeterminate	*Isonandra villosa* Wight	Tamil Nadu, Andhra Pradesh
	Insufficiently known	*Madhuca diplostemon* (Clarke) van Royen	Peninsular India
	Possibly extinct	*Madhuca insignis* (Radlk.) H.J. Lam	Karnataka
Smilacaceae	Rare	*Smilax wightii* A. DC.	Tamil Nadu
Stemonaceae	Vulnerable	*Stemona tuberosa*	Andhra Pradesh
Sterculiaceae	Endangered	*Hildegardia populifolia* (Roxb.) Schott & Endl.	Andhra Pradesh, Tamil Nadu
	Rare	*Pterospermum reticulatum* Wight & Arn.	Karnataka, Tamil Nadu
	Vulnerable	*Eriolaena lushingtonii* Dunn	Andhra Pradesh, Tamil Nadu

(continued)

Table 2.2 (continued)

Family	Threatened status	Botanical name	Distribution
		Sterculia urens	Andhra Pradesh
		Hildegardia populifolia	Andhra Pradesh
Thelypteridaceae	Endangered	*Pseudocyclosorous griseus* (Baker) Holtt. & Grimes [*Neprodium griseum* Bake]	Tamil Nadu
Vitaceae	Vulnerable	*Cayratia roxburghii* (Wight *et* Arn.) Gagnepain	Tamil Nadu
Zingiberaceae	Endangered	*Zingiber roseum*	Andhra Pradesh
	Near threatened	*Costus speciosus*	Andhra Pradesh
	Rare	*Amomum microstephanum* Baker	Tamil Nadu
	Vulnerable	*Paracautieya bhatii* Smith	Karnataka

of increasing industrialization and modernization, the knowledge base of local health traditions has begun to erode. *Acacia catechu*, *Acacia concinna*, *Cassia auriculata*, *Cassia fistula*, *Cassia javanica*, *Cassia senna*, *Ceratonia siliqua*, *Glycyrrhiza glabra*, *Mucuna pruriens*, *Psoralea corylifolia*, and *Pueraria tuberosa* are some of the medicinal legumes, and *Caesalpinia* and *Indigofera* are some of the dye yielding plants from Eastern Ghats in India. Legumes used for treating various ailments of the body, i.e., ear, nose, throat, and eyes (ophthalmic, odontalgic, sternutatory); chest and lungs (antiasthmatic, demulcent, expectorant); heart and blood (cardiac, blood purifier, vasodilator); liver and kidneys (hepatic, antbilious); stomach (emetic, stomachic, digestive); bowels and bladder (purgative, laxative, carminative); nerves and muscles (antispasmodic, nervine); bones (anti-inflammatory, antirheumatic); skin, hands, and feet (acrid, skin applications); sex and reproduction (abortifacient, aphrodisiac, galactogogue); wounds and bruises (antiseptic, poultice, vulnerary); fever (febrifuge); infectious diseases (antiperiodic, VD); bites and stings (antidote, stings); cancer (cancer); and fungi and bacteria (antibacterial, antifungal) are reviewed and reported earlier (Pandravada et al., 2006; Varaprasad et al., 2006).

The Malayali tribes of the Southern Eastern Ghats region are using 189 plant species belonging to 86 families for the treatment of 85 diseases (Suresh, 2010). Tribals of Rayalaseema region of Eastern Ghats are using about 54 plant species belonging to 50 genera and 34 families for treating asthma alone (Anjaneyulu and Sudarsanam, 2013). The tribal areas of Rayalaseema have reported about 70 medicinal plant species for gynecological and abortive properties (Nagalakshmi, 2001). Eastern Ghats of Odisha has a potential ethnomedicinal resource for treating various human diseases particularly rheumatism for about 62 genera with 78 plant species including *Acanthus ilicifolius*, *Thunbergia fragrans*, *Cerbera odollam*, *Guizotia abyssinica*, *Derris scandens*, *Flacourtia indica*, *Pandanus fascicularis*, *Sesamum indicum*, and *Stachytarpheta jamaicensis* (Panda et al., 2014). Some of the major Eastern Ghats ethnic groups and their traditional healthcare knowledge systems on threatened medicinal plant taxa are presented in Table 2.3.

Table 2.3 Ethnic groups and traditional healthcare knowledge systems in Eastern Ghats

Tribal group	Number of plant families/genera/species used	Major species and ailments	Reference(s)
Southern-Eastern Ghats			
Malayalis	86 plant families/147 genera/250 species	*Achyranthes aspera* (piles) *Aegle marmelos* (fever) *Andrographis paniculata* (poisonous bite) *Clematis gouriana* (eye diseases) *Macaranga peltata* (kidney stones) *Michelia champaca* (scorpion sting), *Naravelia zeylanica* (skin disease), *Nymphaea nouchali* (urinary problem) *Randia dumetorum* (lice and dandruff) *Tinospora sinensis* (rheumatism), *Wattakaka volubilis* (diabetes)	Alagesaboopathi et al. (1999) Dwakaran et al. (1994) Francis Xavier et al. (2011) Karthik et al. (2011) Murugesan et al. (2011) Prabu and Kumuthakalavalli (2012) Senthilkumar et al. (2013) Suresh (2010) Suresh et al. (2011) Vaidyanathan et al. (2013)
Irulas	57 species	*Achyranthes bidentata* (antifertility) *Blepharis maderaspatensis* (mother care) *Caralluma attenuata* (urinary troubles) *Cymbopogon citratus* (repellent) *Datura innoxia* (mental illness) *Ocimum americanum* (lice treatment) *Solanum virginianum* (cough)	Tariq et al. (2012) Kadavul and Dixit (2009) Karthick (2013)
Nakkala, *Sugalis* or *Lambadas*, *Yerukalas*	120 families/179 genera/204 species	*Abrus precatorius* (gonorrhea, night blindness) *Cassia auriculata* (bone fracture) *Nerium oleander* (cuts and wounds)	Anjaneyulu and Sudarsanam (2013) Naidu et al. (2012) Thammana and Rao (1998) Vedavathy and Rao (1994) Vedavathy et al. (1997)

(continued)

Table 2.3 (continued)

Tribal group	Number of plant families/genera/species used	Major species and ailments	Reference(s)
Middle Eastern Ghats			
Chenchus	69 plant species	*Syzygium cumini* (earache, dysentery) *Andrographis paniculata* (fever, jaundice) *Euphorbia hirta* (ulcers and fissures, warts) *Andrographis echioides*, *Boerhavia diffusa*, *Canavalia ensiformis*, *Phyllanthus amarus*, *Physalis minima*, *Tephrosia purpurea* (liver ailments)	Rao and Sunita (2011) Sabjan et al. (2014)
Gonds	59 plant species	*Acacia arabica*, *Albizia odoratissima* (antidote) *Atalantia monophylla* (rheumatism) *Cayratia pedata* (uterine disorder, *Convolvulus sepiaria* (fertility) *Cyanotis tuberosa* (cough) *Litsea glutinosa* (wound healing) *Putranjiva roxburghii* (impotency) *Sterculia urens* (male sterility) *Xylia xylocarpa* (skin)	Murthy (2012) Kumar et al. (2013)
Bagatas, *Konda doras*, *Kotias*, and *Konds*	98 species	*Annona squamosa* (wounds) *Polyalthia longifolia* (rheumatism) *Cissampelos pareira* (stomachic) *Nelumbo nucifera* (dysentery) *Brassica juncea* (diarrhea) *Ziziphus xylopyrus* (asthma) *Pterocarpus marsupium* (eczema)	Padal et al. (2010) Padal et al. (2013)
Northern Eastern Ghats			
Paroja, *Saora*, *Bhumia*, *Godaba*, *Dogaria*, and *Kondha*	77 plant species	*Caryota urens*, *Curcuma montana*, *Sansiveria roxburghiana*, *Sesbania grandiflora*, *Elephantopus scaber* (liver disorders)	Smita et al. (2012) Panda and Misra (2011) Panda et al. (2014)
Bonda, *Didayi*, *Koya*, *Bhatoda*, and *Kondh*	34 plant species	*Barleria prionitis* (cough) *Bauhinia vahlii* (dysentery) *Cassia fistula* (leprosy) *Plumbago zeylanica* (abortifacient) *Ricinus communis* (headache) *Semecarpus anacardium* (wound healing) *Pterocarpus marsupium* (diabetes)	Pattanaik et al. (2009)

(continued)

Table 2.3 (continued)

Tribal group	Number of plant families/genera/species used	Major species and ailments	Reference(s)
Santhals, *Kols*, and *Kharias*	34 plant families/58 species	*Aristolochia indica* (snake bite) *Morinda citrifolia* (body pain) *Pueraria tuberosa* (joint pains) *Soymida febrifuga* (malarial fever) *Syzygium cerasoides* (leucorrhoea)	Rout et al. (2009)
Juang, *Kondha*, *Kol*, *Bhomij*, *Bhuiya*, *Bathudi*, *Kharia*, *Gond*, *Makid*, *Pauri-Bhuyan*, *Mahalis*, *Sounti*, and *Saharas*	551 plant species	*Oroxylum indicum* (dysentery) *Paederia scandens* (diarrhea) *Piper cubeba* (carminative) *Pterocarpus marsupium* (diabetes) *Santalum album* (gonorrhea, syphilis) *Scindapsus officinalis* (asthma) *Semecarpus anacardium* (ovarian cancer) *Smilax zeylanica* (gynatone) *Solanum khasianum* (cough, asthma)	Pandey et al. (2002) Dikshit and Sivaraj (2014) Rout and Pandey (2007) Mohanta et al. (2006)

2.5 Medicinal Plant Wealth in Traditional Health Practices

Eastern Ghats tribal communities use threatened medicinal plants for treating various ailments. The medicinal plant taxa used in local health traditions are enlisted further (disease wise).

2.5.1 Abortifacients

Abrus precatorius, *Acacia leucophloea*, *Lawsonia inermis*, *Gloriosa superb*, *Sterculia urens*, *Madhuca longifolia var. latifolia*, *Ricinus communis*, *Aristolochia bracteolate*, *Plumbago zeylanica*, *Plumbago indica*, *Holoptelea integrifolia*, *Dolichos biflorus*, *Plumbago rosea*, *Rhynchosia beddomei*

2.5.2 Antidote for Poisonous Bites (Snakes, Scorpion)

Boswellia ovalifoliolata, *Pimpinella tirupatiensis*, *Habenaria roxburghii*, *Gymnema sylvestre*, *Rauvolfia serpentine*, *Vernonia cinerea*, *Aristolochia indica*, *Cassia glauca*, *Asparagus racemosus*, *Hemidesmus indicus*, *Cissampelos pareira*,

Corallocarpus epigaeus, *Strychnos nux-vomica*, *Holarrhena antidysenterica*, *Acalypha indica*, *Leucas aspera*, *L. cephalotes*, *Uraria picta*, *Symphorema polyandrum*, *Celastrus paniculatus*, *Tinospora cordifolia*, *Soymida febrifuga*, *Dalbergia paniculata*, *Sapindus emarginatus*, *Cleistanthus collinus*, *Butea monosperma*, *Ziziphus xylopyrus*, etc. are for poisonous snake bites. *Santalum album*, *Canavalia virosa*, *Strychnos potatorum*, *Ziziphus mauritiana*, *Cassia auriculata*, *Tridax procumbens*, *Martynia annua*, *Andrographis paniculata*, *Leucas cephalotes*, *Aegle marmelos*, *Leonotis nepetifolia*, *Geodorum candidum*, *Rauvolfia serpentine*, *Soymida febrifuga*, *Clerodendrum serratum*, *Calotropis gigantea*, *Boswellia serrata*, etc. are used for scorpion sting.

2.5.3 Antifertility (Contraceptives)

Achyranthes aspera, *Aristolochia bracteolata*, *Mitragyna parvifolia*, *Allium sativum*, *Embelia tsjeriam-cottam*, *Cuminium cyminum*, *Schleichera oleosa*, *Plumbago zeylanica*, *Piper nigrum*, *Zingiber officinale*, *Capsicum annuum*, *Argyreia nervosa*, *Abrus precatorius*, *Aristolochia indica*, *Tamarindus indica*, *Salvadora persica*, *Ricinus communis*, *Crotalaria juncea*, *Phyllanthus amarus*, *Momordica dioica*, *Saccharum officinarum*, *Hibiscus rosa-sinensis*, *Dodonaea viscosa*, *Nymphaea nouchali*, *Strychnos nux-vomica*, *Butea monosperma*, *Balanites aegyptiaca*

2.5.4 Aphrodisiacs and Nervine

Curculigo orchioides, *Hybanthus suffruticosus*, *Clitoria ternatea*, *Decaschistia cuddapahensis*, *Maerua oblongifolia*, *Ipomoea mauritiana*, *Bombax ceiba*, *Hemidesmus indicus*, *Cuminum cyminum*, *Mucuna pruriens*

2.5.5 Arthritis, Body Pains, and Fits

Dichrostachys cinerea, *Azima tetracantha*, *Barleria prionitis*, *Lawsonia inermis*, *Limonia acidissima*, *Derris indica*, *Moringa concanensis*, *Sterculia urens*, *Cassia tora*, *Capparis sepiaria*, *Dregea volubilis*, *Ailanthus excels*, *Celosia argentea*, *Terminalia arjuna*, *Delonix alata*, *Ficus religiosa*, *Erythrina indica*, *Vitex negundo*, *Plecospermum spinosa*, *Diplocyclos palmate*, *Albizia lebbeck*, *Semecarpus anacardium*, *Dodonaea viscosa*, *Cassytha filiformis*, *Atalantia monophylla*, *Atylosia scarabaeoides*, *Alstonia scholaris*, *Leonotis nepetifolia*, *Hemidesmus indicus*, *Aristolochia indica*, *Derris indica*, *Butea monosperma*, *Trianthema portulacastrum*, *Boerhavia diffusa*, *Acalypha indica*, *Elytraria acaulis*, *Cryptolepis buchanani*, *Decalepis hamiltonii*, *Erythrina suberosa*, *Holarrhena antidysenterica*,

Mimosa rubicaulis, *Zingiber roseum*, *Bacopa monnieri*, *Gossypium herbaceum*, *Bridelia retusa*, *Garuga pinnata*, *Phyllanthus emblica*, *Gardenia turgid*, *Holoptelea integrifolia*, *Cassia occidentalis*, *Morinda tomentosa*, *Clerodendrum phlomidis*.

2.5.6 Child Care

Acorus calamus, *Cryptolepis buchanani*, *Pterocarpus marsupium*, *Holostemma ada-kodien*, *Emilia sonchifolia*, *Oxalis corniculata*, *Helicteres isora*, *Sida acuta*, *Dichrostachys cinerea*, *Phyla nodiflora*, *Mukia maderaspatana*, *Casearia elliptica*, *Aegle marmelos*, *Cucurbita maxima*, *Citrus aurantifolia*, *Curcuma longa*, *Chloroxylon swietenia*, *Terminalia bellerica*, *Aristolochia indica*, *Aristolochia bracteolata*, *Ximenia americana*, *Blepharispermum subsessile*, *Gymnema sylvestre*, *Argemone mexicana*, *Tridax procumbens*, *Cynodon dactylon*, *Ailanthus excelsa*, *Pavonia odorata*, *Ziziphus xylopyrus*, *Blumea eriantha*, *Ziziphus rugosa*, *Lepidagathis hamiltoniana*, *Lepidagathis cristata*, *Hygrophila auriculata*, *Tamarix ericoides*, *Borassus flabellifer*

2.5.7 Cough and Cold

Leucas aspera, *Hemionitis arifolia*, *Abrus precatorius*, *Euphorbia tirucalli*, *Pergularia daemia*, *Trachyspermum ammi*, *Solanum surattense*, *Azanza lampas*, *Acacia torta*, *Acacia caesia*, *Leucas linifolia*, *Leucas aspera*, *Leucas cephalotes*, *Phyla nodiflora*, *Ficus racemosa*, *Ficus benghalensis*, *Cardiospermum halicacabum*, *Cadaba fruticosa*, *Coccinia grandis*, *Pergularia daemia*, *Solanum nigrum*, *Leucas aspera*, *Barleria prionitis*, *Elephantopus scaber*, *Vanda tessellate*, *Rhynchostylis retusa*, *Sesamum indicum*, *Strychnos nux-vomica*, *Tinospora cordifolia*

2.5.8 Diabetes

Rauvolfia serpentina, *Aegle marmelos*, *Gymnema sylvestre*, *Strychnos potatorum*, *Acacia chundra*, *Syzygium cumini*, *Azadirachta indica*, *Flacourtia indica*, *Coccinia grandis*, *Barleria prionitis*, *Leucas linifolia*, *Pterocarpus santalinus.*

2.5.9 Diarrhea and Dysentery

Lantana camara var. aculeata, *Holoptelea integrifolia*, *Desmodium gangeticum*, *Grewia hirusta*, *Diospyros exsculpta*, *Brassica juncea*, *Abrus precatorius*, *Anogeissus acuminata*, *Cassia auriculata*, *Cassia holosericea*, *Justicia glauca*,

Lannea coromandelica, *Euphorbia prostrata*, *Helicteres isora*, *Psidium guajava*, *Carmona retusa*, *Terminalia pallida*, *Terminalia chebula*, *Anisomeles indica*, *Cassia auriculata*, *Solanum erianthum*, *Maytenus emarginata*, *Tectona grandis*, *Triumfetta rhomboidea*, *Cyanotis tuberos*, *Zanthoxylum rhetsa*

2.5.10 Dysmenorrhea

Andrographis paniculata, *Coccinia grandis*, *Soymida febrifuga*, *Momordica charantia*, *Holarrhena antidysenterica*, *Citrullus colocynthis*, *Cardiospermum canescens*, *Capparis sepiaria*, *Musa paradisiaca*, *Citrus aurantifolia*, *Pergularia daemia*, *Semecarpus anacardium*, *Butea monosperma*, *Sphaeranthus indicus*, *Arachis hypogaea*, *Haldina cordifolia*, *Sesamum indicum*, *Maytenus emarginata*, *Cassia auriculata*, *Cuminum cyminum*, *Sorghum vulgare*, *Eclipta alba*, *Elettaria cardamomum*, *Curcuma longa*, *Momordica dioica*, *Madhuca longifolia var. latifolia*, *Phaseolus radiates*, *Erythrina suberosa*, *Ougeinia oojeinensis*, *Butea monosperma*, *Atylosia scarabaeoides*, *Sida cordifolia*, *Soymida febrifuga*, *Eriolaena hookeriana*, *Securinega leucopyrus*, *Cassia auriculata*

2.5.11 Epilepsy

Solanum indicum, *Helianthus annuus*, *Gardenia turgida*, *Maytenus emarginata*, *Hemidesmus indicus*, *Brassica nigra*, *Chloroxylon swietenia*, *Holoptelea integrifolia*, *Vitex negundo*, *Cassia occidentalis*, *Acalypha indica*, etc.

2.5.12 Eye Diseases

Curculigo orchioides, *Ocimum americanum*, *Carmona retusa*, *Chloroxylon swietenia*, *Phyllanthus amarus*, *Cassia occidentalis*, *Soymida febrifuga*, *Achyranthes aspera*, *Ocimum tenuiflorum*, *Careya arborea*, *Strychnos potatorum*, *Tinospora sinensis*, *Cassia absus*, *Ziziphus mauritiana*, *Achyranthes aspera*, *Argemone mexicana*, *Eclipta alba*, *Aloe barbadensis*, *Gymnema sylvestre*, etc.

2.5.13 Facial Paralysis

Flacourtia indica, *Capparis sepiaria*, *Dichrostachys cinerea*, *Gmelina arborea*, *Capsicum annuum*, *Holoptelea integrifolia*, etc.

2.5.14 Fertility-Promoting Plants

Maerua oblongifolia, *Ferula asafoetida*, *Grewia tenax*, *Ficus religiosa*, *Terminalia bellirica*, *Smilax zeylanica*, *Tectona grandis*

2.5.15 Heart Disorders

Pterocarpus santalinus, *Atalantia monophylla*, *Sida acuta*, *Terminalia arjuna*, *Terminalia alata*, *Cardiospermum halicacabum*, *Mitragyna parvifolia*, etc.

2.5.16 Hepatic Disorders

Phyllanthus amarus, *Lagenaria siceraria*, *Ficus hispida*, *Luffa acutangula* var. *amara*, *Trachyspermum ammi*, *Andrographis paniculata*, *Azadirachta indica*, *Holarrhena antidysenterica*, *Cordia dichotoma*, *Benincasa hispida*, *Cassia tora*, *Curcuma angustifolia*, *Diospyros montana*, *Lawsonia inermis*, *Oroxylum indicum*, *Curcuma longa*, *Phyllanthus amarus*, *Solanum nigrum*, *Ricinus communis*, *Boerhavia diffusa*, *Leucas linifolia*, *Leucas aspera*, *Leucas cephalotes*, *Cassia occidentalis*, *Papaver somniferum*, *Eclipta alba*, *Acalypha indica*, *Balanites aegyptiaca*, *Butea monosperma*

2.6 Immunity Modulators

Aegle marmelos, *Ailanthus excelsa*, *Albizia lebbeck*, *Andrographis paniculata*, *Asparagus racemosus*, *Atalantia monophylla*, *Azima tetracantha*, *Capparis sepiaria*, *Clerodendrum phlomidis*, *Dichrostachys cinerea*, *Gmelina arborea*, *Hemidesmus indicus*, *Hesperethusa crenulata*, *Holarrhena antidysenterica*, *Moringa oleifera*, *Oroxylum indicum*, *Plumbago zeylanica*, *Pterocarpus marsupium*, *Solanum surattense*, *Soymida febrifuga*, *Stereospermum suaveolens*, *Terminalia chebula*, *Tinospora cordifolia*, etc.

2.6.1 Leucorrhea

Hibiscus micranthus, *Cassytha filiformis*, *Ficus racemosa*, *Mangifera indica*, *Syzygium cumini*, *Cassia occidentalis*, *Curcuma longa*, *Argemone mexicana*, *Aerva lanata*, *Cuminum cyminum*, *Bombax ceiba*, *Vernonia anthelmintica*, *Terminalia*

bellirica, *Tephrosia purpurea*, *Sida acuta*, *Abrus precatorius*, *Derris indica*, *Mimosa pudica*, *Erythrina indica*, *Cuminum cyminum*

2.6.2 Malaria and Other Fevers

Andrographis paniculata, *Cissampelos pareira*, *Nyctanthes arbor-tristis*, *Soymida febrifuga*, *Vitex peduncularis*, *Terminalia alata*, *Ailanthus excels*, *Mimosa pudica*, *Paederia foetida*, *Cleome pentaphylla*, *Flacourtia indica*, *Aristolochia indica*, *Rauvolfia serpentina*, *Evolvulus alsinoides*, *Aganosma caryophyllata*, *Aerva lanata*, *Malaxis rheedii*

2.6.3 Miscarriage of Pregnancy

Vernonia cinerea, *mimosa pudica*, *Achyranthes aspera*, *Eclipta alba*, *Ocimum sanctum*, *Caesalpinia bonduc*, and other species

2.6.4 Menorrhagia

Bauhinia racemosa, *Prosopis cineraria*, *Canavalia virosa*, *Hemidesmus indicus*, *Hemidesmus indicus*, *Lepidagathis hamiltoniana*, *Abelmoschus ficulneus*, *Terminalia alata*, *Argemone mexicana*

2.6.5 Mother Care

Acacia catechu, *Butea monosperma*, *Allium sativum*, *Zingiber officinale*, *Capsicum annuum*, *Cuminum cyminum*, *Cinnamomum zeylanicum*, *Acacia catechu*, *Acacia chundra*, *Hesperethusa crenulata*, *Holoptelea integrifolia*, *Chloroxylon swietenia*, *Alangium salviifolium*, *Oroxylum indicum*, *Cassia occidentalis*, *Asparagus racemosus*, *Dillenia pentagyna*, *Piper longum*, *Salvadora persica*, *Dichrostachys cinerea*, *Brassica nigra*, *Symphorema involucratum*, *Canthium parviflorum*, *Trachyspermum ammi*, *Derris indica*, *Holoptelea integrifolia*, *Mundulea sericea*, *Mollugo pentaphylla*, *Ixora arborea*, *Tectona grandis*, *Oryza sativa*, *Raagi java*, *Eleusine coracana*, *Sorghum vulgare*, *Achyranthes aspera*, etc.

2.6.6 Paralysis

Smilax zeylanica, *Azima tetracantha*, *Symphorema involucratum*, *Derris indica*, etc.

2.6.7 Respiratory Disorders

Boswellia serrata, *Dolichandrone falcata*, *Strychnos potatorum*, *Tridax procumbens*, *Strychnos nux-vomica*, *Ocimum sanctum*, *Trachyspermum ammi*, *Achyranthes aspera*, *Capparis zeylanica*, *Andrographis paniculata*, *Anisochilus carnosus*, *Vernonia anthelmintica*, *Semecarpus anacardium*, *Euphorbia thymifolia*, *Barringtonia acutangula*, *Aegle marmelos*, *Anogeissus latifolia*, *Pergularia daemia*, *Leucas aspera*, *Ocimum sanctum*, *Borassus flabellifer*, *Evolvulus alsinoides*, *Dendrocalamus strictus*, *Echinops echinatus*, *Solanum surattense*, *Acalypha indica*, *Plumbago zeylanica*, *Solanum trilobatum*, *Cissus quadrangularis*, *Ziziphus oenoplia*, *Euphorbia hirta*, *Calotropis gigantea*, *Echinops echinatus*, *Albizia lebbeck*, *Alangium salviifolium*, *Leucas cephalotes*, *Helicteres isora*, *Mitragyna parvifolia*, *Derris indica*, *Terminalia arjuna*, *Pterocarpus marsupium*, *Cassia occidentalis*, *Aristida adscensionis*

2.6.8 Skin Diseases

Albizia thompsonii, *Nervilia aragoana*, *Paederia foetida*, *Grewia rhamnifolia*, *Urginea indica*, *Urginea raogibikei*, *Urginea nagarjunae*, *Elytraria acaulis*, *Opuntia dilleni*, *Holoptelea integrifolia*, *Cissus pallida*, *Ventilago calyculata*, *Ximenia americana*, *Boswellia seretta*, *Premna tomentosa*, *Ochna squarrosa*, *Ziziphus mauritiana*, *Eleusine coracana*, *Ailanthus excelsa*, *Tamarindus indica*, *Alangium salviifolium*, *Phyllanthus emblica*, *Argemone mexicana*, *Moringa oleifera*, *Albizia amara*, *Hyptis suaveolens*, *Annona squamosa*, *Terminalia chebula*, *Anisochilus carnosus*, *Coldenia procumbens*, *Commiphora caudata*, *Colocasia esculenta*, *Piper longum*, *Ficus hispida*, *Urginea nagarjunae*, *Solanum melongena*, *Holoptelea integrifolia*, *Ocimum americanum*, *Dendrocalamus strictus*, *Madhuca longifolia*, *Barleria prionitis*, *Rubia cordifolia*, *Trichosanthes tricuspidata*, *Terminalia arjuna*, *Pterocarpus santalinus*, *Mundulea sericea*, *Nerium indicum*, *Hesperethusa crenulata*, *Santalum album*.

2.6.9 Viral, Bacterial, and Fungal Attacks

Lygodium flexuosum, *Curcuma longa*, *Abrus precatorius*, *Mimosa pudica*, *Solanum surattense*, *Xanthium strumarium*, *Adiantum lunulatum*, *Chenopodium anthelminticum*, *Aristolochia indica*, *Barringtonia acutangula*, *Schleichera oleosa*, *Hemidesmus*

indicus, *Solanum indicum*, *Azadirachta indica*, *Commiphora mukul*, *Brassica juncea*, *Acorus calamus*, *Achyranthes aspera*, *Brassica juncea*, *Acorus calamus*, *Calotropis gigantea*, *Leucas aspera*, *Albizia lebbeck*, *Morinda tomentosa*, *Gardenia gummifera*, *Gardenia resinifera*, *Clerodendrum viscosum*, *Solanum giganteum*, *Polycarpaea corymbosa*, *Selaginella rupestris*, *Adiantum incisum*

The detailed treatise on Eastern Ghats tribal medicine for various ailments and vast recipes is provided by Hemadri (2011).

2.7 Conservation Strategies for Threatened Medicinal Plants

The conservation of threatened medicinal plant genetic resources involves two basic strategies: (i) in situ and (ii) ex situ (Fig. 2.2). In situ conservation of medicinal plant taxa has to be carried out in original forest habitats where threatened medicinal plants occur naturally. Ex situ conservation requires collection and systematic storage of seeds/propagules outside the natural habitats of species for short, medium, and long term after proper characterization and evaluation. Threatened medicinal plant taxa under ex situ conservation in the country are to be characterized and evaluated in a phased manner. Storage of medicinal plant parts at an ultralow temperature, such as that of liquid nitrogen (−196 °C) termed cryopreservation, is one of the promising approaches being pursued to achieve prolonged preservation of medicinal plant genetic resources.

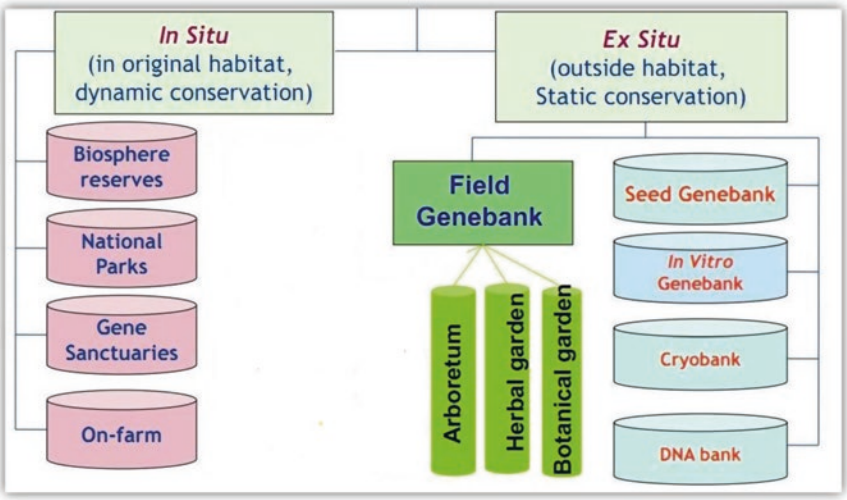

Fig. 2.2 Conservation strategies for threatened medicinal plants

Conservation programs are being implemented in Eastern Ghats region at three levels, viz., genotypes, species, and ecosystems. In situ conservation of wild flora through protection of habitats and ecosystems is being implemented by the Ministry of Environment and Forests and Climate Change. Fourteen biosphere reserves have been identified on the basis of survey data and have already been made operational in India. Concerted efforts were made for conservation of threatened medicinal plant taxa in India and particularly in Eastern Ghats region. Endemicity and usefulness leading to overexploitation are essentially two reasons for a medicinal plant species to come under threat. Apart from this, rapid change in land use pattern has resulted in degradation of specialized natural habitats and along with it rapid depletion of medicinal plants restricted to these habitats. Specialized habitats and threatened plants undeniably deserve exceptional concern for conservation and sustained monitoring in Eastern Ghats region of the country. Collaboration, coordination, and harmonization among institutions and also among naturalists, plant taxonomists, forest and protected area managers, and volunteers possibly give the essential support to realize this objective. Ex situ conservation of genetic variability of medicinal plants is the sole responsibility of the CSIR-CIMAP and ICAR-National Bureau of Plant Genetic Resources (NBPGR) that operates under the Indian Council of Agricultural Research (ICAR). The Indian National Genebank (NGB) was established at ICAR-NBPGR to conserve the PGR including medicinal plant taxa for posterity in the form of seeds, vegetative propagules, in vitro cultures, budwoods, embryos/embryonic axes, genomic resources, and pollen. The NGB has four kinds of facilities, namely, seed genebank (−18 °C), cryogenebank (−170 °C to −196 °C), in vitro genebank (25 °C), and field genebank, to cater to long-term as well as medium-term conservation. Numerous botanical gardens managed by the Botanical Survey of India and several other organizations help in ex situ conservation of endangered, threatened, and rare plant species.

The seed material of different seed-bearing orthodox medicinal plant species collected is stored at −20 °C with seed moisture brought down to 5–8% and RH being maintained at 25–32% in the National Genebank at NBPGR. In some difficult species, which are recalcitrant, pollen and seed material is stored at -180 °C in liquid nitrogen in the cryotanks at ICAR-NBPGR.

For medium-term conservation, the seed material is stored at 7 °C with the seed moisture brought down to 5–8% and RH being maintained at 30–35% in the cold storage modules at NBPGR Regional Station, Hyderabad. The medicinal plant species, which are non-seed bearing, and those that are multiplied by vegetative means (stem cuttings/root cuttings/whole plant) are being maintained in the glass house/field genebank at NBPGR Regional Station, Hyderabad, in live condition.

Regional Stations of the ICAR-National Bureau of Plant Genetic Resources (NBPGR) located at Cuttack and Hyderabad have made extensive exploration surveys and collected about 1800 accessions of medicinal and aromatic plant species from Eastern Ghats region, and the same has been documented. Some of the endangered/endemic medicinal plants collected include *Acorus calamus*, *Aegle marmelos*, *Costus speciosus*, *Cycas bedomei*, *Gloriosa superba*, *Gymnema sylvestre*, *Mucuna pruriens*, *Plumbago indica*, *Rauvolfia serpentina*, and *Withania somnifera*.

Collections of dye-yielding plants include *Bixa orellana* and *Mallotus philippensis*, while collections of aromatic plants include *Artemisia* spp., *Cymbopogon* spp., *Ocimum* spp., *Vetiveria zizanioides*, etc.

Genomic resources of threatened medicinal plant diversity such as cloning vectors, expression vectors, binary vectors, RFLP probes, cloned genes, promoters fused to reporter genes, subgenomic, cDNA, EST, repeat enriched libraries, BAC, YAC, PAC clone set from sequencing projects, genomic, mitochondrial or chloroplast DNA, and cloned DNA from wild medicinal plant species produced exclusively for the repository can be stored in the repository by the following storage methodologies:

- 1–2 years at 4 °C, 4–7 years at −20 °C, and greater than 5 years when stored at −70 °C
- ESTs, full-length cDNAs, BACs, PACs, and YACs, maintained in 96-well or 384-well micro plates at −80 °C
- cDNA clones as plasmid DNA at −20 °C
- Lyophilized DNA for long-term storage
- Ambient temperature storage

To effectively plan a conservation program especially for in situ approaches, the occurrence/ passport data enlisted will be useful in delineating species-rich areas, in general, and diversity-rich pockets, in particular, in the surveyed region. The Medicinal Plants Conservation Center (MPCC), Hyderabad, created eight medicinal plant conservation areas in the Eastern Ghats region of Andhra Pradesh, and a total of 715 medicinal plant species have been identified and conserved in these areas (Jadhav and Reddy, 2002). Based on the deliberations during the Conservation Assessment Management Plan (CAMP) workshop organized by the MPCC in 2001, the threat status for some of the medicinal plant species of this region has been assessed. Concerted and collaborative efforts are highly warranted for sustainable management of threatened medicinal plant wealth in the Eastern Ghats.

2.8 Conclusion and Way Forward

Eastern Ghats are endowed with a rich diversity of medicinal plant species. The ever-increasing growth of global and national herbal-based healthcare and wellness sector is putting enormous pressure on the available medicinal plant resources of this region. It has given rise to concerns about the conservation and sustainable utilization of threatened medicinal plants. Some of the threatened medicinal plant species of Eastern Ghats are in high commercial demand. It calls for active management plans so as to ensure proper conservation strategies of medicinal plant genetic resources and sustained supply of authentic and quality herbal products. Local healthcare traditions, evolved since ancient times, draw heavily from the available plant genetic resources of Eastern Ghats region which are thus increasingly becoming threatened. Conservation of threatened medicinal plant resources is significantly

assuming a very high priority. The following are some of the action points for effective conservation of threatened medicinal plant genetic resources:

- Management of Eastern Ghats genetic resources: Priority management interventions are required on threatened species with a long-term national program on in situ conservation, development, and sustainable utilization of threatened medicinal plant resources of Eastern Ghats.
- Urgent need to strengthen ex situ collections in genebanks, botanical gardens, arboretum, and herbal gardens through systematic germplasm surveys for threatened medicinal plant germplasm collection, characterization, and documentation.
- Networking and coordination of efforts of stakeholders/organizations engaged in medicinal plant conservation are warranted toward focused output for conservation of valuable genetic resources of Eastern Ghats.
- Standardization of protocols for cryopreservation and in vitro conservation of threatened medicinal plant resources of Eastern Ghats.
- Consolidated inventory of threatened medicinal plant genetic resources of Eastern Ghats needs to be prepared, and their commercial demand needs to be worked out.
- Complex state-wise regulatory regimes are to be made uniform for sustainable utilization (collection, cultivation, transport, and trade) of medicinal plant genetic resources of Eastern Ghats.
- Capacity building of local communities/stakeholders on awareness of threatened medicinal resource conservation needs to be encouraged.

References

Alagesaboopathi C, Dwarakan P, Balu S (1999) Plants used as medicine by tribal of Shevaroy Hills, Tamilnadu. Econ J Tax Bot 23(2):391–393

Anjaneyulu E, Sudarsanam G (2013) Folk medicinal plants used in the treatment of asthma in Rayalaseema region of Andhra Pradesh, India. Res Pharm J Biol Chem Sci 1(4):833–839

Banerjee DK (1977) Observation on ethnobotany of Araku valley, Visakhapatnam district, Andhra Pradesh. J Sci Club 33:14–21

Basha SK, Sudarsanam G (2010) Ethnobotanical studies on medicinal plants used by Sugalis of Yerramalais in Kurnool district, Andhra Pradesh, India. Intern Phytomed J 2(4):349–343

Chauhan KPS (1998) Framework for conservation and sustainable use of biological Diversity: action plan for the Eastern Ghats region. In: Anonymous (ed) Proceedings of seminar on conservation of Eastern Ghats. Environment Protection Training and Research Institute, Hyderabad, pp 345–357

Dikshit N, Sivaraj N (2014) Folk medicinal plants, uses and claims of tribal peoples of Similipal Biosphere Reserve, Odisha. In: Proceedings of National Seminar on Ethnobotany, Traditional Knowledge and Access and Benefit Sharing (NSEBTK-2014) organized by the Department of Botany, S.V. University, Tirupati on 29–31 January, pp. 71–77

Farnsworth NR, Akerele O, Bingel AS, Soejarto DD, Guo ZG (1985) Medicinal Plants in Therapy. Bull World Health Organ 63:965–981

Francis Xavier T, Freeda Rose A, Dhivyaa M (2011) Ethnomedicinal survey of malayali tribes in Kolli hills of Eastern Ghats of Tamil Nadu, India. Indian J Tradit Know 10(3):559–562

Goud PSP, Pullaiah T (1996) Ethnobotany of Kurnool district, Andhra Pradesh. In: Jain SK (ed) Ethnobiology in human welfare. Deep Publications, New Delhi, pp 410–412

Hemadri K (2011) A treatise on tribal medicine. Dr Koppula Hemadri's house of tribal medicine, Vijayawada 520 008, India

Jadhav SN, Reddy KN (2002) In situ conservation of medicinal plants in Andhra Pradesh. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 34–54

Kadavul K, Dixit AE (2009) Ethnomedicinal studies of the woody species of Kalrayan and Shevarayan Hills, Eastern Ghats, Tamil Nadu. Indian J Tradit Know 8(4):592–597

Kamboj VP (2000) Herbal medicine. Curr Sci 78(1):35–39

Karthick K (2013) Ethnomedicinal plants used by Irular tribes in Javadhu Hills of Southern Eastern Ghats, Tamilnadu, India. Intern J Curr Res, Dev 2(1):31–37

Karthik V, Raju K, Ayyanar M, Gowrishankar K, Sekar T (2011) Ethnomedicinal Uses of Pteridophytes in Kolli Hills, Eastern Ghats of Tamil Nadu, India. J Nat Prod Plant Resource 1(2):50–55

Krishnamurthy KV, Siva R, Senthilkumar T (2002) Natural dye yielding plants of Shervaroy hills of Eastern Ghats. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 151–153

Kumar RS, Venkateshwar S, Samuel G, Rao SG (2013) Ethnomedicinal uses of some plant barks used by Gondu tribes of Seethagondi grampanchayath, Adilabad District, Andhra Pradesh. India J Nat Prod Plant Resour 3(5):13–17

Mohanta RK, Rout SD, Sahu HK (2006) Ethnomedicinal plant resources of Similipal Biosphere Reserve, Odisha, India. Zoos' Print J 21(8):2372–2374

Murthy EN (2012) Ethnomedicinal plants used by Gonds of Adilabad District, Andhra Prades, India. Intern J Pharm Life Sci 3(10):2034–2043

Murugesan P, Raja G, Marx SK, Selvam BP (2011) Ethnobotanical study of Medicinal Plants used by villagers in Kolli Hills of Namakkal District of Tamil Nadu, India. Int J Pharm Sci Rev Res 10:170–173

Nagalakshmi NVN (2001) Studies on crude drugs used for abortion and antifertility by the tribals of Rayalaseema, Andhra Pradesh, India. PhD Thesis, Sri Krishnadevaraya University, Anantapur, India

Naidu BVR, Haribabu Rao D, Subramanyam P, Prabhakar Raju C, Jayasimha Rayalu D (2012) Ethnobotanical study of medicinal plants used by tribals in Nallamala forest area of Kurnool District, Andhra Pradesh. Int J Plant Animal Environ Sci 2(4):72–81

Padal SB, Murthy PP, Rao DS, Venkaiah M (2010) Ethnobotanical studies on Paderu Division, Visakhapatnam District, Andhra Pradesh. India J Phytol 2(8):70–91

Padal SB, Sandhyasri B, Chandrasekar P (2013) Traditional use of monocotyledons plants of Araku Valley Mandalam, Vishakapatnam District, Andhra Pradesh. Indian J Pharm Biol Sci 6(2):12–16

Panda A, Misra MM (2011) Ethnomedicinal survey of some wetland plants of South Odisha and their conservation. Indian J Tradit Know 10:296–303

Panda SP, Sahoo HK, Subudhiv HN, Sahu AK (2014) Potential medicinal plants of Odisha used in rheumatism and conservation. Am J Ethnomed 1(4):260–265

Pandey AK, Rout SD, Pandit N (2002) Medicinal plants of Similipal Biosphere Reserve. Perspectives of Plant Biodiversity edited by Das AP. Bishen Singh Mahendra Pal Singh, Dehradun, pp 681–686

Pandravada SR, Sivaraj N (1999) Diversity and collection of germplasm of spices, medicinal, aromatic and dye yielding plants from Andhra Pradesh, South India. In: Ravindran et al (eds) Biodiversity, conservation and utilization of spices, medicinal and aromatic plants. Indian Institute of Spices Research, Calicut, pp 219–228

Pandravada SR, Sarath Babu B, Sivaraj N, Maheswara Rao G, Satyanarayana YVV (2000) Species diversity and germplasm collection of medicinal plants from Eastern Ghats. Indian Forester 126(11):1191–1203

Pandravada SR, Sivaraj N, Varaprasad KS (2004) The changing pattern of Plant Biodiversity in the Eastern Ghats. In: Dhillon BS, Tyagi RK, Lal A, Saxena S (eds) Plant genetic resource management. Narosa Publishing House, New Delhi, India, pp 136–152

Pandravada SR, Sivaraj N, Sarath Babu B, Varaprasad KS, Md I (2006) Biodiversity of medicinal plants – exploration, collection and conservation from South East Coastal India. In: Janardhan Reddy K, Bahadur B, Badraiah B, Rao MLN (eds) Advances in medicinal plants. Universities Press (India) Pvt Limited, Hyderabad, India, pp 79–91

Pattanaik C, Reddy CS, Reddy KN (2009) Ethno-medicinal survey of threatened plants in Eastern Ghats. India Our Nature 7:122–128

Prabu M, Kumuthakalavalli R (2012) Folk remedies of medicinal plants for snake bites, scorpion sting and dog bites in Eastern Ghats of Kolli hill, Tamilnadu, India. IJRAP 3(5):696–700

Pullaiah T (2002) Medicinal plants in Andhra Pradesh. Regency Publications, New Delhi 262 p

Rani SS, Pullaiah T (2002) A taxonomic survey of trees in Eastern Ghats. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 5–15

Rao BRP, Sunita S (2011) Medicinal plant resources of Rudrakod sacred grove in Nallamalais, Andhra Pradesh, India. J Biodivers 2(2):75–89

Rao KP, Harasreeramulu S (1985) Ethnobotany of selected medicinal plants of Srikakulam district, Andhra Pradesh. Ancient Sci Life 4:238–244

Rao NR, Henry AN (1996) The ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India, Kolkata

Rao TVR, Reddi CS (2002) Ethno-medicinal plants of Ratnagiri and their conservation. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 169–174

Ravisankar T, Henry AN (1992) Ethnobotany of Adilabad district, Andhra Pradesh. Ethnobotany 4:45–52

Reddy CS, Murthy MRS, Dutt CBS (2002a) Vegetational diversity and endemism in Eastern Ghats, India. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 109–134

Reddy KN, Reddy CS, Raju VS (2002b) Ethnobotany of certain orchids of Eastern Ghats of Andhra Pradesh. In: Anonymous (ed) Proceedings of the National Seminar on Conservation of Eastern Ghats, Tirupati. Environment Protection Training and Research Institute, Hyderabad, pp 154–160

Reddy MT, Kalpana M, Sivaraj N, Kamala V, Pandravada SR, Sunil N (2019) Indigenous Traditional Knowledge on Health and Equitable Benefits of Oil Palm (*Elaeis* spp.). Open Access Libr J 6:e5103. https://doi.org/10.4236/oalib.1105103

Reddy TA (1980) Notes on some medicinal plants of Polavaram agency tracts, West Godavari district, Andhra Pradesh. J Indian Bot Soc 59:169

Rout SD, Pandey AK (2007) Ethnomedicobiology of Similipal Biosphere reserve, India. In: Das AP, Pandey AK (eds) Advances in ethnobotany. Bishen Singh Mahendra PalSing, Dehra Dun, pp 61–72

Rout SD, Panda T, Mishra N (2009) Ethnomedicinal plants used to cure different diseases by tribals of Mayrbhanj district of North Odisha. Ethnomed 3:27–32

Sabjan G, Sundaram G, Reddy D, Muralidhara Rao D (2014) Ethnobotanical crude drugs used in treatment of liver diseases by Chenchu tribes in Nallamalais, Andhra Pradesh. India Am J Ethnomed 1(3):115–121

Sahu SC, Dhal NK (2012) Floristic Composition, Diversity and Status of Threatened Medicinal Plants in Tropical Forests of Malyagiri Hill Ranges, Eastern Ghats, India, Tropical Forests, Dr. Padmini Sudarshana (Ed.), In Tech, DOI: https://doi.org/10.5772/31871. Available from

https://www.intechopen.com/books/tropical-forests/floristic-composition-diversity-and-status-of-threatened-medicinal-plants-in-tropical-forests-of-malyagiri

Saxena HO, Dutta PK (1975) Studies on the ethnobotany of Odisha. Bull Bot Surv India 17:124–131

Senthilkumar K, Aravindhan V, Rajendran A (2013) Ethnobotanical survey of medicinal plants used by Malayali tribes in Yercaud hills of Eastern Ghats, India. J Nat Rem 13(2):118–132

Sivaraj N, Kamala V, Pandravada SR, Sunil N, Elangovan M, Sarath Babu B, Chakrabarty SK, Varaprasad KS, Krishnamurthy KV (2015) Floristic ecology and phenological observations on the medicinal flora of Southern Eastern Ghats. Open Access J Med Aromat Plan Theory 5(2):5–24

Sivaraj N, Pandravada SR, Varaprasad KS, Sarath Babu B, Sunil N, Kamala V, Abraham B, Krishnamurthy KV (2006) Medicinal Plant Wealth of Eastern Ghats with special reference to indigenous knowledge systems. J Swamy Bot Club 23:165–172

Smita S, Sangeeta R, Kumar SS, Soumya S, Deepak P (2012) An ethnomedicinal survey of medicinal plants in Semiliguda of Koraput district, Odisha, India. Bot Res Int 5(4):97–107

Suresh K (2010) Ethno-medico botanical survey among Malayali tribes in the Southern Eastern Ghats, Tamil Nadu. Ph.D. Thesis. Gandhigram Rural Institute-Deemed University, Gandhigram, Tamil Nadu, India

Suresh K, Kottaimuthu R, Norman TSJ, Kumuthakalavalli R, Simon MS (2011) Ethnobotanical study of medicinal plants used by Malayali tribals in Kolli Hills of Tamilnadu. India IJRAP 2(2):502–508

Tariq NPMM, Ifham SR, Ali AM (2012) Data collection methods in research for medicinal plants of Javadhu hills, Tamilnadu, India. Int J Curr Microbiol Appl Sci 2(2):83–89

Thammanna, Rao KN (1998) Medicinal plants of Tirumala. Tirumala and Tirupati Devasthanams, Tirupati

Vaidyanathan D, Senthilkumar MSS, Ghouse Basha M (2013) Studies on ethnomedicinal plants used by Malayali tribal in Kolli hills of Eastern Ghats, Tamilandu, India. Asian J Plant Sci Res 3(6):29–45

Varaprasad KS, Abraham Z, Pandravada SR, Latha M, Divya RS, Lakshminarayanan S, Pareek SK, Dhillon BS (2006) Medicinal plants germplasm of Peninsular India. National Bureau of Plant Genetic Resources, New Delhi. 203 P

Vedavathy S, Rao KN (1994) Herbal folk medicnine of Tirumala and Tirupathi region of Chittoor district, Andhra Pradesh. Fitoterapia 66:167–171

Vedavathy S, Mrudula V, Sudhakar A (1997) Tribal medicine of Chittoor district, A.P. (India). Herbal Folklore Research Centre, Tirupati