

Ethnomedicinal plants used by primitive tribes of Hukumpeta Mandal, Alluri Sitaramaraju District, A.P, India

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Abstract

Intensive field surveys were carried out during 2022–2023 in the interior tribal pockets of Hukumpeta Mandal, Alluri Sitaramaraju Raju district, Andhra Pradesh, India. The present paper deals with about 173 plant species of 164 genera belonging to 80 families that have been recorded which are potentially used by the different tribal groups in this area. The tribal population of the region primarily depends upon these plants for curing 124 various diseases. Further studies on chemical and pharmacological actions are suggested to validate the claims.

Keywords: Ethnomedicinal practice; Primitive tribes; Hukumpeta Mandal; Alluri Sitarama Raju District

1. Introduction

Man depends on plants and plant products in many ways Ethnobotany is the interrelationship between plants and the primitive tribes residing in the interior forest areas is known as ethnobotany. Early man acquired the knowledge of the medicinal and economic values of many plants by trial and error methods. The World Health Organization (WHO) has estimated that as many as 80% of the world population is dependent on traditional medicine for their primary health needs [1]. Recent notable work on ethnomedicine of Andhra Pradesh. The ethnic-medico-botanical studies of Paderu and Araku Valley in Andhra Pradesh were reported [2]. Some ethnomedicinal plants were used by the Chenchus, Yerukalas, Yanadis, and Sugalis for fevers and anthrax in cattle in the hills of the Cuddaph district [3]. Some ethnomedicinal plants are used for paralysis by Sugali tribes in Andhra Pradesh [4]. Studied on medicinal plants of Warangal and Srikakulam district [5-6] At present about 65% of Indians are dependent on the traditional system of medicine [7]. Skin diseases like eczema, leukoderma, ringworm, scabies, and many other conditions are treated completely with herbal drugs. Hundreds of medicinal plant species worldwide are used in traditional medicine as a treatment for skin diseases caused by bacteria, fungi, and viruses [8]. In India also there is a huge base of herbal treatment for skin diseases Ethno-medicinal studies showed that herbal medicine is an alternative therapy for the treatment and control of skin ailments [9]. Herbal anti-skin medicines have many useful properties including low side effects and cost treatment with high significant efficacy [10-11]. Medicinal flora has shown a pivotal part in the management of dermatological conditions [12], particularly communities in developing countries local communities depend on traditional medicine for their health care [13]. The objective of the present study was the investigation and documentation of the ethnomedicinal plants used by primitive tribal people of Hukumpeta Mandal, Alluri Sitaramaraju District, Andhra Pradesh.

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2. Material and methods

2.1. Study area

Hukumpeta Mandal harbors luxurious vegetation with coffee and pepper plantations on the hilly slopes. So the present study has been undertaken in Hukumpeta Mandal. It lies in between latitudes 17°50' and 18° – 35' north and longitude 82°-17' and 83°-1' East with a total geographical area of 3249.65 sq. K.Ms. out of which the forest area under the control of the Division is 1038.62 Sq. K.M (Figure.1) Alluri Sitaramaraju district, Hukumpeta is rich in forest resources. The forests of the district occurring over extensive areas have graded diversity in composition as well as in quality which one can witness while passing from the seacoast to the Agency areas. Primitive people like Gadaba, Konda Dora, Mali, Manne Dora, Valmiki and Khondu communities are residing in the area.

2.2. Methodology

The survey was conducted by recording the information obtained from the questionnaires on medicinal plants with their local names, parts used, mode of preparation, and administration with the aged farmers and local tribes. Intensive field surveys were carried out during 2022–2023, covering all the seasons. Collected specimens were made into a herbarium as per the methods suggested by Jain & Rao (1977). The collected specimens were identified only after a critical examination with the help of different floras like Flora of the Presidency of the Madras (Gamble & Fischer 1915–1936), Flora of Visakhapatnam District (Rao & Kumari 2002–2008), and Flora of Vizianagaram District (Venkaiah 2004). The voucher specimens were deposited at the Botany Department Herbarium (BDH), Andhra University, Visakhapatnam.

3. Results and discussion

The study area comprises Hukumpeta Mandal, Alluri Sitaramaraju district covering. The ethnobotany of all the 20 Villages was taken up by consulting 30 local vaidyas/elderly people for the use of plants in medicine for their health care. During exploration trips, medicinally useful information have been recorded on 173 plant species belonging to 164 genera and 80 families were recorded which are exploited by the tribals for their day-to-day living.

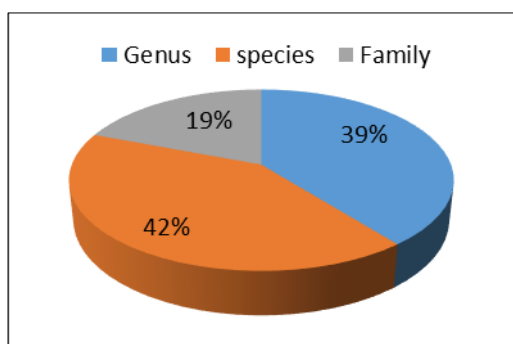


Figure 1 Genera, species and family of EMPs

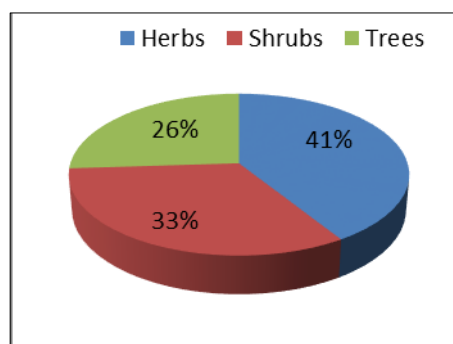


Figure 2 Habit-wise analysis of ethnomedicinal plants

The family-wise analysis of ethnomedicinal data revealed that of the 80 families, the top 10 dominant ones are Fabaceae represented by 10 species followed by Asteraceae with 8 species, Verbenaceae, Poaceae, Mimosaceae, Malvaceae, Apocynaceae with 6 species, Solanaceae and Acanthaceae with 5 species each. Rutaceae, Lamiaceae, Capparidaceae, Asclepiadaceae and Araceae with 4 species. Anacardiaceae, Lamiaceae, Liliaceae, Mimosaceae, and Verbenaceae with 3 species each. From the present study, it is clear (Fig. 2) evident that the local people use Herbs 71 followed by Shrubs 57 and Herbs 45. Of the total 173 plant species recorded for ethnomedicinal purposes, 119 species are wild, 23 species are wild as well as cultivated and 37 species are purely cultivated for their basic use as food plants and ornamentals. The morphological plant parts used for ethnomedicinal purposes were classified into leaf, root, stem bark, whole plant, seed, fruit, flower, stem, gum, latex, rhizome, root bark, corm, fronds, inflorescence, nut, perianth, plant, tuber, and unripe fruit. Depending upon the plant part used for medicinal purposes leaves constitute the highest followed by Root 56, whole plant 38, root bark 20, rhizome 18, Seed 16, stem bark 15, fruit 12, tuber 11, stem 5, wood and flower 4. Fig. 3). Intensive surveys and repeated personal interviews in different pockets resulted in coming across 124 diseases in the area. The common diseases prevailing in tribal group habitations are ascertained in consultation with local doctors.

The most common ailments are Abortion, abscess, acidity, allergy, alopecia, anaemia, anasarca, anthelminthic, antidote, antifertility, antifertility, antiseptic, aphrodisiac, appetite, asthma, back ache, black quarter disease, blisters, blood pressure, boils, bone fracture, breast pain, bronchitis, bruises, burns, cataract, chest pain, chicken pox, cholera, cobrabite, cold, conjunctivitis, constipation, cough, cracks, cuts, dandruff, deworming, diabetes, diarrhea, digestive tonic, dysentery, dysmenorrhoea, dyspepsia, dysuria, earache, eczema, emetics, epilepsy, eruptions, eye infections, fever, fits, fractures, galactagogue, gastric troubles, gingivitis, gonorrhoea, haemorrhage, haemorrhoids, hair fall, head ache, herps, high blood pressure, HIV, hydrocele, impotency, indigestion, inflammation, intestinal worms, irregular menstruation, jaundice, kidney stones, leuoderma, leprosy, leucorrhoea, mad dog, malaria, memory, menorrhagia, mental disorders, mosquito repellent, motions, muscle pain, neuritis, night blindness, obesity, paralysis, paronychia, piles, pimples, psoriasis, rabies, rat bite, respiratory diseases, rheumatoid artharitis, ring worm, scorpion sting, scurvy, skin diseases, sperm production, stomach pain, swellings, syphilis, throat infections, tooth ache, tuberculosis, tumours, ulcers, urinary infections, wounds and wrinkles. Ramarao Naidu *et al.* (2008) described 38 plant species for curing rheumatism by tribals of the Srikakulam district of Andhra Pradesh. Khare and Khare (1999) reported 21 medicinal plants used to cure rheumatism by rural people of the Chhatrapur district of Madhya Pradesh.

Table 1 Ethnomedicinal plants used by Primitive tribes of Ananthagiri Mandal, Alluri Sitaramaraju District

S.No	Disease	Plant name	parts
1	Abortifacient	<i>Adiantum lunulatum</i>	Fern
		<i>Annona squamosa</i>	Root
		<i>Costus speciosus</i>	Rhizome
2	Antibacterial	<i>Nerium indicum</i>	Whole plant
3	Anticancer	<i>Nerium indicum</i>	Whole plant
4	Antiperiodic	<i>Bixa orellana</i>	Root
5	Antiseptic	<i>Barleria strigosa</i>	Whole plant
		<i>Cassytha filiformis</i>	Stem
6	Asthma	<i>Dendrophthoe falcata</i>	Stem bark
		<i>Piper nigrum</i>	seeds
		<i>Syzgium cumini</i>	Fruit
		<i>Terminalia arjuna</i>	Stem bark
		<i>Zaleya decandra</i>	Root
7	Boils	<i>Ageratum conyzoides</i>	Leaf&Root
		<i>Arisaema tortuosum</i>	Root
		<i>Artocarpus heterophyllus</i>	Leaves
8	Bone fractures	<i>Viscum articulatum</i>	Stem
9	Bronchitis	<i>Albizia odoratissima</i>	Root bark
		<i>Solanum trilobatum</i>	Fruit
		<i>Tectona grandis</i>	Stem bark
		<i>Trichosanthes tricuspidata</i>	Root
10	Cancer	<i>Agave americana</i>	Leaves
		<i>Bidens pilosa</i>	Whole plant
		<i>Bixa orellana</i>	Leaves
		<i>Catharanthus roseus</i>	Root
11	Cardiac diseases	<i>Zingiber roseum</i>	Rhizome

12	Cough	<i>Cyathea gigantea</i>	Rhizome
13	Cough & cold	<i>Abrus precatorius</i>	Root
		<i>Piper nigrum</i>	seeds
		<i>Solanum trilobatum</i>	Whole plant
		<i>Sphaeranthus indicus</i>	Leaves
		<i>Bidens pilosa</i>	Whole plant
14	Diabetes	<i>Hugonia mystax</i>	Root
		<i>Kyllinga nemoralis</i>	Rhizome
		<i>Pandanus fascicularis</i>	Root& Rhizome
		<i>Saraca asoca</i>	Flower
		<i>Strychnos nux-vomica</i>	Wood
		<i>Tectona grandis</i>	Stem bark
		<i>Tephrosia villosa</i>	Leaves
		<i>Albizia odoratissima</i>	Root bark
15	Diarrhea	<i>Cyathea gigantea</i>	Rhizome
		<i>Soymida febrifuga</i>	Stem bark
		<i>Woodfordia fruticosa</i>	Flower
		<i>Ximenia americana</i>	Leaves
		<i>Zehneria maysorensis</i>	Root
		<i>Oroxylum indicum</i>	Root bark
16	Diuretic	<i>Phyla nodiflora</i>	
		<i>Trianthema portulacastrum</i>	Leaves
		<i>Cyperus rotundus</i>	Tuber
17	Dysentery	<i>Arisaema tortuosum</i>	Root
		<i>Oroxylum indicum</i>	Root bark
		<i>Oxalis corniculata</i>	Leaves
		<i>Rostellularia diffusa</i>	Whole plant
		<i>Rubia cordifolia</i>	Root
		<i>Sansevieria roxburghiana</i>	Whole plant
		<i>Saraca asoca</i>	Flower
		<i>Sida cordifolia</i>	Leaves
		<i>Soymida febrifuga</i>	Stem bark
		<i>Tamarindus indica</i>	seeds
		<i>Tephrosia villosa</i>	Root
		<i>Thespesia populnea</i>	Root
		<i>Artemesia vulgaris</i>	Leaves
		<i>Cyathea gigantea</i>	Rhizome
18	Ear troubles	<i>Bidens pilosa</i>	Leaves

		<i>Ocimum basilicum</i>	Leaves
19	Epilepsy	<i>Anisomeles indica</i>	Whole plant
		<i>Nicotiana tabacum</i>	Root
		<i>Solanum melongena</i>	Root
20	Eye diseases	<i>Wattakaka volubilis</i>	Whole plant
		<i>Acacia nilotica</i>	Leaves
		<i>Aegle marmelos</i>	Stem bark
		<i>Phaseolus trilobus</i>	Leaves
21	Family planning	<i>Abrus precatorius</i>	seeds
22	Fever	<i>Diplocyclos palmatus</i>	Fruit
		<i>Artocarpus heterophyllus</i>	Leaves
		<i>Cymbopogon citrates</i>	Leaves
		<i>Ipomoea nil</i>	Whole plant
		<i>Kyllinga nemoralis</i>	Rhizome
		<i>Leonotis nepetifolia</i>	Whole plant
		<i>Operculina turpethum</i>	Whole plant
		<i>Oxalis corniculata</i>	Leaves
		<i>Phaseolus trilobus</i>	Leaves
		<i>Phyla nodiflora</i>	Whole plant
		<i>Pogostemon benghalensis</i>	Leaves
		<i>Polygala arvensis</i>	Leaves
		<i>Rostellularia diffusa</i>	Whole plant
		<i>Scoparia dulcis</i>	Whole plant
		<i>Selaginella rependa</i>	Whole plant
		<i>Sida cordifolia</i>	Leaves
		<i>Solanum nigrum</i>	Fruit
		<i>Tragia involucrata</i>	Root
		<i>Vanda tessellata</i>	Leaves
		<i>Ventilago madraspatana</i>	Root bark
		<i>Zehneria maysorensis</i>	Root
		<i>Zizyphus mauritiana</i>	Root
		<i>Cleome viscosa</i>	Leaves
23	Gonorrhoea	<i>Acacia nilotica</i>	Leaves
		<i>Bixa orellana</i>	Leaves
		<i>Xylia xylocarpa</i>	Root bark
24	Gynic problems	<i>Memecylon umbellatum</i>	Root bark
25	Headache	<i>Acacia nilotica</i>	Leaves
		<i>Acacia nilotica</i>	Leaves

		<i>Cleome gynandra</i>	Leaves
		<i>Passiflora foetida</i>	Leaves
		<i>Trichosanthes tricuspidata</i>	Root
		<i>Aerva lanata</i>	Root
26	Heart diseases	<i>Pseudarthria viscida</i>	Root
27	Insect bites	<i>Albizia odoratissima</i>	Root bark
28	Itches	<i>Encostema axillare</i>	Whole plant
		<i>Ocimum basilicum</i>	Leaves
29	Jaundice	<i>Flacourtia indica</i>	Root
		<i>Phyllanthus amarus</i>	Whole plant
		<i>Physalis minima</i>	Leaves
		<i>Rubia cordifolia</i>	Root
		<i>Santalum album</i>	Wood
		<i>Terminalia bellirica</i>	Stem bark
		<i>Triumfetta rhomboidea</i>	Root bark
		<i>Tylophora indica</i>	Root
		<i>Ximenia americana</i>	Leaves
		<i>Zaleya decandra</i>	Root
30	Joint pains	<i>Murraya paniculata</i>	Root
31	Kidney Problems	<i>Portulaca oleracea</i>	Whole plant
		<i>Tribulus terrestris</i>	Seeds
		<i>Aerva lanata</i>	Whole plant
32	Leprosy	<i>Albizia odoratissima</i>	Root bark
		<i>Argemone mexicana</i>	seeds
		<i>Schrebera swietinioides</i>	Root
		<i>Zingiber capitatum</i>	Rhizome
33	Leucoderma	<i>Tinospora cordifolia</i>	Tuber
34	Liver problems	<i>Portulaca oleracea</i>	Whole plant
35	Malaria	<i>Ocimum basilicum</i>	Leaves
		<i>Cynodon dactylon</i>	Leaves
		<i>Vernonia cinerea</i>	Leaves
		<i>Xanthium indicum</i>	Root
		<i>Artocarpus heterophyllus</i>	Stem bark
		<i>Scindapsus officinalis</i>	Stem
36	Menstrual problems	<i>Catharanthus roseus</i>	Leaves
		<i>Dendrophthoe falcata</i>	Stem bark
		<i>Artemesia vulgaris</i>	Leaves
		<i>Leonotis nepetifolia</i>	Whole plant

		<i>Polyalthia longifolia</i>	Stem bark
37	Nervous disorders	<i>Abrus precatorius</i>	seeds
		<i>Teramnus labialis</i>	pod
38	Night blindness	<i>Emilia sonchifolia</i>	Leaves
39	Paralysis	<i>Atlantia monophylla</i>	seeds
		<i>Smilax zeylanica</i>	Tuber
		<i>Murraya paniculata</i>	Root
		<i>Sida cordata</i>	Leaves
		<i>Solanum surattense</i>	Leaves
40	Piles	<i>Arisaema tortuosum</i>	Root
		<i>Pseudarthria viscida</i>	Root
		<i>Rivea hypocrateriformis</i>	Whole plant
		<i>Sansevieria roxburghiana</i>	Whole plant
		<i>Solanum nigrum</i>	Fruit
		<i>Zingiber roseum</i>	Rhizome
41	Purgative	<i>Baliospermum montanum</i>	seeds
42	Rabies	<i>Elytraria acculis</i>	Root
43	Rheumatic pains	<i>Cocculus hirsutus</i>	Root
		<i>Nicotiana tabacum</i>	Leaves
		<i>Solanum surattense</i>	Leaves
		<i>Enicostema axillare</i>	Whole plant
		<i>Cymbopogon citrates</i>	Leaves
		<i>Ipomoea nil</i>	Whole plant
		<i>Pueraria tuberosa</i>	Tuber
		<i>Urena lobata</i>	Whole plant
		<i>Vitex negundo</i>	Leaves
		<i>Atlantia monophylla</i>	seeds
44	Scabies	<i>Argemone mexicana</i>	seeds
		<i>Passiflora foetida</i>	Whole plant
		<i>Crotalaria verrucosa</i>	Leaves
45	Scorpion bite	<i>Heliotropium indicum</i>	Leaves
		<i>Hybanthus enneaspermus</i>	Fruit
		<i>Adiantum lunulatum</i>	Rhizome
		<i>Kyllinga nemoralis</i>	Rhizome
		<i>Tinospora cordifolia</i>	Tuber
		<i>Wrightia arborea</i>	Stem bark
		<i>Crotalaria umbellata</i>	Whole plant
		<i>Embelia ribes</i>	Fruit

46	Scurvy	<i>Oxalis corniculata</i>	Leaves
		<i>Portulaca oleracea</i>	Whole plant
47	Skin disease	<i>Cipadessa baccifera</i>	Leaves
		<i>Zingiber capitatum</i>	Rhizome
		<i>Cocculus hirsutus</i>	Leaves
		<i>Ageratum conyzoides</i>	Leaf&Root
		<i>Aristolochia bracteolata</i>	Leaves
		<i>Artocarpus heterophyllus</i>	Leaves
		<i>Costus speciosus</i>	Rhizome
		<i>Flacourtia indica</i>	Root
		<i>Leonotis nepetifolia</i>	Whole plant
		<i>Nicotiana tabacum</i>	Leaves
		<i>Nicotiana tabacum</i>	Root
		<i>Physalis minima</i>	Leaves
		<i>Pterocarpus marsupium</i>	Leaves
		<i>Pueraria tuberosa</i>	Tuber
		<i>Rubia cordifolia</i>	Root
		<i>Santalum album</i>	Wood
		<i>Sesamum orientale</i>	seeds
		<i>Sphaeranthus indicus</i>	Whole plant
		<i>Tabernaemontana divaricata</i>	Flower
		<i>Zingiber roseum</i>	Rhizome
		<i>Alangium salvifolium</i>	Root bark
		<i>Artemesia vulgaris</i>	Leaves
		<i>Crotalaria verrucosa</i>	Leaves
48	Smallpox	<i>Rungia pectinata</i>	Leaves
49	Snake bite	<i>Trianthema portulacastrum</i>	Leaves
		<i>Hugonia mystax</i>	Root
		<i>Trichosanthes tricuspidata</i>	Tuber
		<i>Achyranthus aspera</i>	Root
		<i>Annona squamosa</i>	Root bark
		<i>Aristolochia indica</i>	Leaves
		<i>Calotropis gigantea</i>	Root
		<i>Dillenia pentagyna</i>	Stem bark
		<i>Embelia ribes</i>	Fruit
		<i>Gloriosa superba</i>	Tuber
		<i>Murraya paniculata</i>	Root
		<i>Pouzolzia zeylanica</i>	Tuber

		<i>Rauvolfia serpentina</i>	Tuber
		<i>Schleichera oleosa</i>	Root bark
		<i>Strychnos nux-vomica</i>	Root
		<i>Strychnos potatorum</i>	Root
		<i>Tiliacora acuminata</i>	Root
		<i>Tinospora cordifolia</i>	Tuber
		<i>Toddalia asiatica</i>	Root bark
		<i>Vitex altissima</i>	Root
		<i>Wattakaka volubilis</i>	Root
		<i>Zizyphus oenoplia</i>	Root
		<i>Bixa orellana</i>	Root
		<i>Glycosmis mauritiana</i>	Root
		<i>Crotalaria umbellata</i>	Whole plant
		<i>Cassytha filiformis</i>	Stem
		<i>Costus speciosus</i>	Rhizome
		<i>Kyllinga nemoralis</i>	Rhizome
50	Sore ears	<i>Emilia sonchifolia</i>	Leaves
51	Sore eyes	<i>Bidens pilosa</i>	Leaves
52	Sores	<i>Ageratum conyzoides</i>	Leaf&Root
53	Soriasis	<i>Argemone mexicana</i>	seeds
54	Stomach	<i>Ardisia solanacea</i>	Leaves
		<i>Solanum melongena</i>	Root
		<i>Alstonia scholaris</i>	Root bark
		<i>Boerhaavia diffusa</i>	Root
		<i>Pterospermum xylocarpum</i>	Fruit
		<i>Triumfetta rhomboidea</i>	Root bark
		<i>Ventilago madraspatana</i>	Root bark
		<i>Wrightia tinctoria</i>	Leaves
		<i>Cymbopogon citrates</i>	Leaves
		<i>Dillenia pentagyna</i>	Bud
		<i>Acorus calamus</i>	Root
		<i>Cocculus hirsutus</i>	Leaves
55	Swellings	<i>Dalbergia paniculata</i>	Leaves
56	Syphilis	<i>Agave americana</i>	Leaves
57	Throught Problems	<i>Acacia nilotica</i>	Leaves
58	Toothache	<i>Bidens pilosa</i>	Leaves
59	Tuberculosis	<i>Barleria strigosa</i>	Root
60	Typhoid	<i>Thespesia lampas</i>	Root

61	Ulcer	<i>Bidens pilosa</i>	Leaves
		<i>Albizia odoratissima</i>	Root bark
		<i>Pedaliium murex</i>	Leaves
		<i>Pouzolzia zeylanica</i>	Leaves
		<i>Sansevieria roxburghiana</i>	Whole plant
		<i>Sida cordifolia</i>	Leaves
		<i>Tamarindus indica</i>	Seeds
		<i>Terminalia chebula</i>	Fruit
		<i>Waltheria americana</i>	Whole plant
		<i>Zizyphus mauritiana</i>	Root
62	Urinary discharges	<i>Tribulus terrestris</i>	Seeds
		<i>Xanthium indicum</i>	Root
		<i>Acacia nilotica</i>	Leaves
		<i>Physalis minima</i>	Fruit
63	Vomiting	<i>Cymbopogon citrates</i>	Leaves
		<i>Ruellia tuberosa</i>	Whole plant
		<i>Tarenna asiatica</i>	Stem bark
		<i>Zingiber roseum</i>	Rhizome
64	Whooping cough	<i>Pterolobium hexapetalum</i>	Stem bark
65	Wound	<i>Ageratum conyzoides</i>	Leaf&Root
		<i>Scindapsus officinalis</i>	Stem
		<i>Argyrea nervosa</i>	Leaves
		<i>Artocarpus heterophyllus</i>	Leaves
		<i>Cleome viscosa</i>	Leaves
		<i>Clerodendrum infortunatum</i>	Leaves
		<i>Semecarpus anacardium</i>	Root bark
		<i>Solanum nigrum</i>	Leaves
		<i>Stachytarpheta urticaefolia</i>	Leaves
		<i>Terminalia chebula</i>	Fruit
		<i>Tridax procumbens</i>	Leaves
		<i>Waltheria americana</i>	Whole plant
		<i>Zingiber roseum</i>	Rhizome
		<i>Zizyphus mauritiana</i>	Root
		<i>Zizyphus oenoplia</i>	Root bark

4. Conclusion

The present study was conducted to document the ethnomedicinal plant resources of Hukumpeta Mandal, Alluri Sitharama Raju district of Andhra Pradesh, India as well as to explore the traditional knowledge or belief of these plants used by the village people for their primary health care needs. The new generation is not very much interested in the

indigenous methods of treating diseases. They are even not very concerned about the importance of these herbal plants and their medicinal value. The growing disinterest in the use of folk medicinal plants and their significance among the younger generation of primitive tribals will lead to the disappearance of this practice.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they hold no competing interests.

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