Intracultural Cognizance of Medicinal Plants of Warangal North Forest Division, Northern Telangana, India

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Research

Abstract

Differences in the traditional botanical knowledge of Koya communities inhabiting Eturnagaram Wildlife Sanctuary (Warangal North Forest Division) are investigated. Eighteen villages (16 within the wildlife sanctuary and two outside it) were selected to test the null hypothesis that there exist no cognitive differences among the ethnic inhabitants in their ability to recognize the plants and recall the vernacular names and medicinal uses since they are recipients of the same dry deciduous forest ecosystem services. The Koyas were found to use as medicine 237 species in 66 angiosperm families. Analyses of data gathered from villagers showed that there is significant intracultural diversity in terms of taxonomic groups and growth forms in regard to utilizing the proximate plant resource for their primary healthcare and disease treatment of pets.

Introduction

Biocultural diversity is a source of adaptive capacity since it represents the range of possibilities for humans to sustain communities in dynamic landscapes (Harmon 2002). The survival of a particular community may depend on diversity at local scales (Kassam 2009). Indigenous knowledge systems are therefore increasingly appreciated for their ability to anticipate, recognize, and respond to change (Ruelle & Kassam 2011, Turner & Clifton 2009). Moreover, while communities may rely on variation in knowledge to adapt to social and ecological changes, there has been meager attention paid to differences within cultural groups (Ruelle & Kassam 2011).

It is the common experience of traditional knowledge gatherers all over the globe that the consumption or utilization of non-cultivated plants has declined because younger generations are not learning how to gather them for treating and preventing diseases or ailments in their communities (Ruelle & Kassam 2011). Therefore, intracultural cognizance should be studied at local, regional, and global scales to determine knowledge loss. There are few studies on intracultural cognizance of ethnic communities in India, let alone Koya community of southern India.

The objectives of this study are: (i) documentation of the medicinal plant knowledge of the Koya communities native to Godavari River Valley; (ii) analyses of the medicinal plants used by Koyas in terms of taxonomic diversity, growth forms, and nativity; and (iii) realization of, if any, intracultural differences in medicinal plant knowledge.

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Study site

The North Forest Division of Warangal (Northern Telangana, Andhra Pradesh, India) lies between 17°29'16" and 18°36'20"N and 78°49'49" and 80°40'13"E (Figure 1). The division has a geographical area of 8,687.81 km^2 which is 67.6% of the total area of the district (12,847 km^2). Elevation is between 266 and 518 m, with a general SE slope along which surplus waters drain into the river Godavari. The climate is tropical, generally dry with temperature ranging from 15°C to 45°C and annual rainfall of 1182 mm, received mainly through south-west monsoon. Soils are primarily black cotton, loamy, sandy, and red chalaka. The population of the division is 2.57 million with a population density of 296 individuals per km^2 (Anonymous 2011a). The area under forest cover is 2,310 km^2, 27% of the total geographical area of the division. The forest canopy density categories are moderately dense forest (953 km^2), open forest (1015 km^2), scrub (91 km^2), and non-forest (244 km^2). Water bodies occupy 6.7 km^2 whereas reserved, protected, and un-classed forest categories cover 1,579 km^2, 709 km^2, and 22 km^2, respectively (Anonymous 2011b). The forest division has six ranges: Bhupalapally North, Eturnagaram, Tadvai, Pasra, Mulugu, and Warangal. The study site is in Tadvai and Eturnagaram ranges which include Eturnagaram Wildlife Sanctuary (Figure 1).

Demography of study site

The state of Andhra Pradesh, India, has 33 (+2) scheduled tribes. Of these, Koyas are endemic to Godavari Valley and are descendants of Gonds of central India (Sreeramulu 2009). They constitute a major endemic ethnic community whose medicinal plant knowledge is documented for intracultural study in the reserve forest area along the southern bank of the Godavari River, which lies between 18°10' and 18°26' N and 80°09' to 80°33' E (Figure 1). Land cover of the region supports two types of economic activity, namely seasonal agriculture (including podu [shifting] cultivation) and harvesting of forest produce (non-timber forest products).

Research motivation

An impetus to conduct ethnobotanical research in India was provided by the Ministry of Environment and Forests through the sanction of "All India Coordinated Research Project on Ethnobiology (AICRPE 1992–1998)." The project began with states starting with "A" such as Andhra Pradesh, Arunachal Pradesh, Andaman and Nicobar islands, etc. (Raju 2013). It paved the way for the first scientific and authentic work on ethnobotany of Eastern Ghats of Andhra Pradesh through the doctoral work by Rao (1988), whose findings were later published as a book (Rao & Henry 1996). Rao (1988) visited Thupakulagudem village, which is part of Eturnagarm Wildlife Sanctuary, to document Koya ethnobotanical knowledge as part of intercultural study across the Eastern Ghats. Another intercultural study in the district was that of Reddy *et al*. (1998) on the ethnoveterinary phytomedicines. Later, Reddy *et al*. (2008) reported the phytotherapy practiced by Gonds, and Murthy *et al*. (2007) listed the plants used in ethnovet-

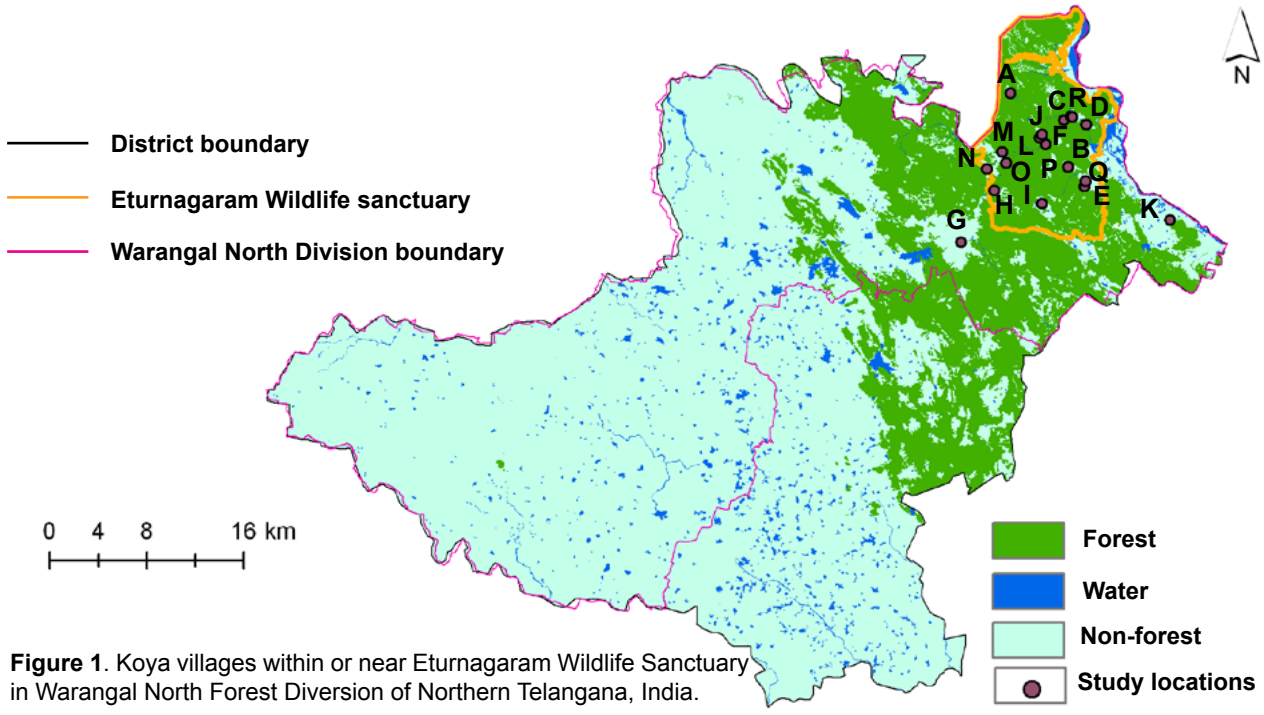

Figure 1. Koya villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Diversion of Northern Telangana, India.
Koya villages: **A**. Ailapur, **B**. Allamvari Ghanpur **C**. Banojibandam, **D**. Chalpaka, **E**. Chinnaboinapally, **F**. Dodla, **G**. Gandhinagar, **H**. Gonepally, **I**. Kamaram, **J**. Kondai, **K**. Mallur, **L**. Malyala, **M**. Medaram, **N**. Narlapur, **O**. Oorattum, **P**. Shapally, **Q**. Venkatapuram, and **R**. Yelishettipally.

erinary practices by Koyas of Pakhal Wildlife Sanctuary, which is part of the Warangal South Forest Division in the district. Recently, Sreeramulu (2009) compared the TBK of the local people of neighboring Nalgonda and Warangal districts in the region and demonstrated that those of the latter district are more knowledgeable of ethnobotanical plants. The present study adds to this body of knowledge by highlighting the medicinal plant usage of Koyas from villages near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division.

Methods

Ethnic villages

Within the study area, 18 villages (Table 1) were chosen based on landscape heterogeneity, predominance of Koya inhabitants, and current use of local plants for medicinal purposes. The villagers are more or less equally impacted by village remoteness (proximity to the highway and developed towns with modern hospital facilities) and social and ecological changes. Mallur is one of two villages selected from outside the wildlife sanctuary to the southeast (18°13'08.4"N, 80°33'29.9"E). Although Mallur enjoys an almost similar physical environment, it is more culturally mixed (non-ethnic people) than other villages. Moreover, Mallur village is also a medicinal plants conservation area (MPCA) and has a sacred grove (a non-ethnic [Hindu] temple) on a hill following the Chinthamani stream. Gandhinagar is the other control village located outside the wildlife sanctuary (18°10'30.1"N, 80°09'25.4"E) but is relatively far from the Godavari River in the southwest direction. An open degraded forest surrounds this village (Figure 1).

A premise of this study is that the ability to find and recognize medicinal plants is need-based and could be the same among villages but still vary with ethnic group and nature of forest habitat. The plants in a given habitat can be "apparent" (perennial and woody) or "non-apparent" (herbaceous which disappear at the end of the season; geophytes). The present study ensured that the sites (villages) compared are similar and there is minimal temporal difference in the data gathered. It is against this background that the levels of medical aid available and economic status of the ethnic peoples are the same for the villages. Therefore, it was presumed that the medicinal plant knowledge of the local people is homogeneous as well.

Ethnic interviews and informants

Ethnobotanical/ethnomedicinal data were collected through household surveys, questionnaires, and semi-

Table 1. Demographic information of Koya informants from 18 villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division of Northern Telangana, India. Number of informants (#). Gender: male (M), female (F).

Village	Gender	#	Age (yrs)	Village	Gender	#	Age (yrs)
Mallur	M	6	52, 55, 72, 64, 45, 38	Yelishettipally	M	5	50, 53, 57, 41, 44
	F	4	45, 32, 38,43		F	3	37, 46, 57
Kamaram	M	4	63, 59, 41, 48	Banojibandam	M	2	44, 53
	F	3	41, 37, 44, 55		F	1	54
Venkatapuram	M	4	52, 59, 64, 51	Chalpaka	M	5	51, 57, 59, 65, 48
	F	2	48, 42		F	4	64, 53, 48, 52
Chinnaboinapally	M	5	70, 84, 79, 68, 55	Allamvari Ghanpur	M	6	55, 48, 66, 45, 68, 76
	F	2	53, 57		F	2	58, 63
Shapally	M	6	40, 65, 50, 48, 70, 62	Narlapur	M	3	40, 77, 50
	F	2	55, 48		F	4	46, 38, 65, 45
Dodla	M	5	64, 58, 54, 62, 48	Medaram	M	6	60, 65, 40, 48, 64, 65
	F	3	35, 42, 57		F	4	48, 70, 55, 58
Malyala	M	7	55, 40, 44, 64, 39, 51, 56	Oorattum	M	3	68, 46, 55
	F	5	48, 69, 58, 49, 54		F	2	42, 49
Kondai	M	8	58, 48, 46, 53, 42, 55, 66, 63	Gonepally	M	2	70, 64
	F	2	49, 56		F	2	55, 40
Ailapur	M	3	42, 39, 45	Gandhinagar	M	2	68, 55
	F	3	48, 54, 52		F	1	48

structured and open-ended interviews. The interviews held for each village included a minimum of three informants (both genders) of the Koya community who were requested to gather in the village commons or one of their homes. The same questions were put to all informants selected for the study. Repeated (common or shared) uses and unique uses for plant species or disease categories were documented. Informants were shown plant specimens or pictures of species listed by other villages. To avoid variation in seasonal availability of medicinal plants, the study was conducted in the same season for all the sites. The 131 informants were all 32–84 years of age (Table 1). The criteria for informant selection were: (i) village residents for at least two decades, with a family hierarchy; (ii) podu cultivators or settled agriculturists; (iii) cattle owners; (iv) midwives; and (v) local healers (vaidyas or healthcare practitioners).

Data collection and PIC

The study of indigenous knowledge usually relies on interactions with a few members of the community to represent the knowledge held by the entire community. Many ethnobotanists adopt the cultural consensus model developed by Romney *et al*. (1986). Although this model has some limitations, it devalues differences in knowledge and focuses on consensus and was thus adopted for the present study.

Prior informed content (PIC) is an important concern underlying the philosophical and political environment of bioprospecting research involving indigenous societies (Rosenthal 2006). A scientific approach towards traditional botanical knowledge (TBK) holders began in Kakatiya University when the Government of India, through University Gants Commission, New Delhi, sanctioned a Special Assistance Program (SAP) in 2004. In compliance with the convention on biological diversity (CBD), PIC was established after relevant discussions between the university and the Koya community regarding the intended use of their knowledge. The mutual understanding was that any benefit derived from research pursued after their medicinal plant knowledge shall belong to them. Since TBK is a community knowledge and the purpose of the present survey is non-monetary, the Koya agreed to disclose information for the purposes of documenting their ability to recognize plant species by vernacular name and medicinal use. They readily consented because a prior survey in some of their villages helped to establish the Medicinal Plant Conservation Area (MPCA) at Mallur.

In India, there is a general and urgent need to pattern the process of PIC after educating the local ethnic groups in different regions of IPR, as per a standard scale. Furthermore, the majority of the local people in India are of the opinion that the knowledge could be displayed in full text for non-commercial and academic purposes (Singh 2008), as is the present case. However, something sophisticated that has happened on medicinal plant research in Guinea in regard to PIC and benefit-sharing in compliance with CBD (Carlson *et al*. 2001) should happen for India.

Plant collections and identification

Majority of plant species were identified either with the botanical name or local (vernacular/trivial) name by the authors in the field on the basis of their past taxonomic knowledge about these plants in the study area. The specimens of the unidentified species in the field were brought to the laboratory and identified with help of local floras (e.g. Gamble & Fischer 1915–1935), eFloras (www.efloras.org), and recent taxonomic monographs. The currently accepted names of plant species are after www.ipni.org, www.plantlist.org, and www.tropicos.org. Voucher specimens were pressed, processed, and preserved at Kakatiya University Herbarium (KUW), Warangal.

Data analysis

The medicinal plant knowledge documented from Koyas across 18 villages was analyzed by plant species and family. The data were further classified as per the plant divisions and classes, growth forms (trees, shrubs, herbs, and climbers), ethnomedicine (human and veterinary), and nativity (indigenous and exotic). Analysis of variance was performed to determine presence of intervillage differences for the above categories.

The Family-Use Value (FUV) was calculated for top five families. It is based on sum of the species used within a given family (ΣUVs) in all 18 villages divided by the number of species that are used (ns) in the whole study area as per Hoffman & Gallaher (2007).

Results

Intracultural cognizance

Overall the Koyas in the study area difffered village-wise in both the number and kinds of species exploited. Analysis of variance showed significant intervillage differences relative to plant taxonomy (dicots versus monocots; F = 30.247), growth form (trees, shrubs, herbs, climbers; F = 11.496), medicinal target (humans, veterinary, both; F = 25.827), and plant nativity (F = 23.835). All species reported by informants are listed in Table 2 along with their vernacular names, habit, parts used, and medicinal use.

Trees typically dominated the species list except in villages Chinnaboinapally and Allamvari Ghanpur where herbs are used more than the trees or climbers. These two villages are surrounded by secondary forests. The analysis of medicinal plant knowledge of Koyas in terms of growth forms revealed that 43% are trees, 30% herbs, 18% climbers, and 9% shrubs (Table 3). Patterns of growth form use are indicative of certain trends: (i) local people still primar-

Table 2. Names, families, habit, parts used, and ethnomedicinal use of plant species reported by Koya informants from 18 villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division of Northern Telangana, India. Habit: climber (C), epiphyte (E), fern (F), herb (H), shrub (S), straggler (St), tree (T), twiner (Tw). Parts used: bark (B), flower (Fl), fruit (Fr), gum (G), latex (La), leaf (L), root (R), seed (Se), tender sticks (TS), tuber (T), whole plant (W).

Botanical Names		**Voucher Number**	**Habit**	**Part(s) used**	**Ethnic use**
Scientific	**Vernacular**				
ACANTHACEAE					
Andrographis paniculata (Burm.f.) Wall. ex Nees	**Nelavemu**	307	H	W	Dyspepsia
Barleria cristata L.	**Neeli gorinta**	643	H	R	Abortifacient
Barleria montana Nees	**Nilambaram**	881	S	R	Skin disease
Barleria prionitis L.	**Mulla gorinta**	201	H	R	Scorpion bite
Hemigraphis latebrosa (Roth) Nees	**Akkala**	819	H	R	Anti-alcoholic agent
Hygrophila auriculata (Schumach.) Heine	**Gorimidi**	533	H	L	Dropsy
Justicia betonica L.	**Pedda nilambaram**	119	S	R	Mental disorders
Lepidagathis cristata Willd.	**Nakka peetirigadda**	644	H	R/W	Fever, fits
Peristrophe paniculata (Forssk.) Brummitt	**Chebura**	287	H	L	Skin disease
AMARANTHACEAE					
Achyranthes aspera L.	**Uttareni**	63	H	R	Scorpion bite
Aerva lanata (L.) Juss.	**Pindi kura**	19	H	L	Wounds
Aerva sanguinolenta (L.) Blume	**Konda pindi**	1400	H	W	Urinary troubles
Amaranthus spinosus L.	**Mulla thotakura**	280	H	L	Appetite stimulant
Celosia argentea L.	**Gunugu**	64	H	L	Cuts
Pupalia lappacea (L.) Juss.	**Gundu uttareni**	620	H	L	Insect bite
ANACARDIACEAE					
Buchanania axillaris (Desr.) Ramamoorthy	**Pedda morli**	329	T	B/G	Veterinary, skin disease, back pain
Buchanania cochinchinensis (Lour.) M.R.Almeida	**Morri, Morli**	259	T	G	Back pain, laxative
Lannea coromandelica (Houtt.) Merr.	**Dumpena, Dumpidi**	863	T	B	Antiseptic, appetite stimulant
Mangifera indica L.	**Konda mamidi**	1012	T	B/Fr	Appetite stimulant, tonic
Semecarpus anacardium L.f.	**Nalla jeedi**	261	T	Se	Wounds
ANNONACEAE					
Miliusa tomentosa (Roxb.) J.Sinclair	**Barre duddi**	853	T	B	Veterinary
Polyalthia cerasoides (Roxb.) Bedd.	**Chiluka duddi**	321	T	B	Veterinary
APOCYNACEAE					
Anodendron paniculatum A.DC.	**Athukudu teega**	1631	C	B	Bone fracture
Calotropis gigantea (L.) Dryand.	**Jilledu**	12	S	R	Snake bite

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
Cyptolepis dubia (Burm.f.) M.R.Almeida	**Budda pala**	304	C	R	Veterinary
Hemidesmus indicus (L.) R.Br. ex Schult.	**Sugandhi pala**	331	C	R	Blood purifier, sugar control
Hemidesmus indicus var. *pubescens* (Wight & Arn.) Hook.f.	**Barre sugandhi pala**	55	C	R	Diabetes
Holarrhena pubescens Wall ex G.Don	**Istari pala**	269	T	B	Dysentery
Pergularia daemia (Forssk.) Chiov.	**Dustapu teega**	121	C	W	Respiratory disease
ARACEAE					
Pistia stratiotes L.	**Antara thamara**	558	H	W	Baldness
ARECACEAE					
Phoenix loureiroi Kunth	**Jittetha**	1650	T	Fr	Laxative
ARISTOLOCHIACEAE					
Aristolochia indica L.	**Nalleswari**	145	C	R	Snake bite
ASPARAGACEAE					
Asparagus gonoclados Baker	**Guddelugu bochu**	316	C	T	Aphrodisiac
Asparagus racemosus Willd.	**Pilli teegalu**	1624	C	T	Aphrodisiac
ASTERACEAE					
Blumea bifoliata (L.) DC.	**Kukka pogaku**	968	H	R	Cough
Blumea virens DC.	**Adavi pogaku**	945	H	L	Skin disease
Pentanema indicum (L.) Ling	**Adavi chamanti**	815	H	R	Abortifacient
Sphaeranthus indicus L.	**Bodasaram**	50	H	W	Kill lice in domestic fowl
Tridax procumbens (L.) L.	**Nalla alam**	31	H	L	Hemorrhage, cuts
Vernonia cinerea (L.) Less.	**Garita kamma**	80	H	R	Fever
Vernonia cinerea var. *parviflora* (Reinw. ex Blume) DC.	**Adavi garita kamma**	1652	H	R	Fever
BIGNONIACEAE					
Millingtonia hortensis L.f.	**Boda malle**	125	T	B	Bronchitis
Oroxylum indicum (L.) Kurz	**Dundilam**	708	T	B	Rheumatism
Stereospermum chelonoides (L.f.) DC.	**Kalagoru**	597	T	B	Veterinary
BOMBACACEAE					
Bombax ceiba L.	**Buruga**	213	T	B	Cough
BORAGINACEAE					
Coldenia procumbens L.	**Cheppu tattaku**	200	H	W	Wounds
Cordia dichotoma G.Forst.	**Iriki**	640	T	Fr	Dyspepsia
Cordia macleodii Hook.f. & Thomson	**Botuku**	704	T	B	Veterinary
Ehretia laevis Roxb.	**Pala danthi**	888	T	Fr	Dyspepsia
Trichodesma indicum (L.) Lehm.	**Gabba**	56	H	L	Wounds
BURSERACEAE					

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
Boswellia serrata Roxb. ex Colebr.	**Anduga**	354	T	B	Fever, tonic
Garuga pinnata Roxb.	**Garugu**	978	T	B	Veterinary
CAPPARACEAE					
Capparis sepiaria L.	**Uppi**	941	St	B	Veterinary
Capparis zeylanica L.	**Aadonda**	373	C	R/Fr	Dyspepsia, tonic
CARYOPHYLLACEAE					
Polycarpaea corymbosa (L.) Lam.	**Gaddi puvvu**	116	H	R	Snake bite
CELASTRACEAE					
Cassine glauca (Rottb.) Kuntze	**Bhutankush**	606	T	B	Dyspepsia
Gymnosporia emarginata (Willd.) Thwaites	**Danthi**	257	T	B	Skin disease
CLEOMACEAE					
Cleome viscosa L.	**Vaminta**	2	H	W	Skin disease
COMBRETACEAE					
Anogeissus acuminata (Roxb. ex DC.) Wall. ex Guillem. & Perr.	**Pasi**	1639	T	L	Cough
Combretum albidum G.Don	**Yada teega**	338	C	B	Veterinary
Combretum roxburghii Spreng.	**Yadaku**	878	C	B	Veterinary
Combretum latifolium Blume	**Yada teega**	1547	C	B	Veterinary
Getonia floribunda Roxb.	**Bontha**	264	C	B	Veterinary
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	**Yeru maddi, Tella maddi**	337	T	B	Wounds, heart disease
Terminalia bellirica (Gaertn.) Roxb.	**Tani**	879	T	Fr	Cough
Terminalia chebula Retz.	**Karakkaya**	978	T	Fr	Cough
CONVOLVULACEAE					
Ipomoea coptica (L.) Roth ex Roem. & Schult.	**Suvarchala**	900	C	L	Mouth wash
Ipomoea eriocarpa R.Br.	**Elika chevi**	397	C	R	Stomach-ache
Ipomoea hederifolia L.	**Kashiratnam**	594	C	R	Tonic
Ipomoea obscura (L.) Ker Gawl.	**Macha aku**	453	C	L	Insect bite
Merremia hederacea (Burm.f.) Hallier f.	**Talantu teega**	885	C	Fr	Hair wash
Rivea hypocrateriformis Choisy	**Boddi kura**	596	C	R	Snake bite
CORNACEAE					
Alangium salviifolium (L.f.) Wangerin.	**Ooduga**	1004	T	B	Snake bite
CUCURBITACEAE					
Diplocyclos palmatus (L.) C.Jeffrey	**Linga donda**	84	C	Fr	Diarrhea
Momordica charantia L.	**Kakara**	158	C	Fr	Diabetes
Momordica dioica Roxb. ex Willd.	**Boda kakara**	579	C	Fr	Diabetes
CYPERACEAE					
Cyperus rotundus L.	**Thunga**	27	H	T/R	Tonic, scorpion bite
Scleria levis Retz.	**Ashta medha**	1316	H	R	Blood purifier

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
DILLENIACEAE					
Dillenia pentagyna Roxb.	**Kalinga**	1028	T	B/Fr	Tonic, fever, veterinary
DIOSCOREACEAE					
Dioscorea bulbifera L.	**Chenna gadda**	1100	C	T	Arthritis, fever
EBENACEAE					
Diospyros chloroxylon Roxb.	**Illinda**	616	T	B	Veterinary
Diospyros malabarica (Desr.) Kostel.	**Konda tuniki**	54	T	B	Bronchitis
Diospyros melanoxylon Roxb.	**Tuniki**	335	T	Fr	Dyspepsia, laxative
Diospyros montana Roxb.	**Muchi tuniki**	894	T	B/Fr	Veterinary
ERYTHROXYLACEAE					
Erythroxylum monogynum Roxb.	**Deva daru**	1029	T	Fr	Tonic
EUPHORBIACEAE					
Acalypha indica L.	**Penta puti**	22	H	W	Skin disease
Euphorbia hirta L.	**Reddivari nanubalu**	23	H	L	Wounds
Euphorbia nivulia Buch.-Ham.	**Aku jemudu**	1640	T	La	Bone fracture
Mallotus philippensis (Lam.) Müll.Arg.	**Kunkuma**	1700	T	Se	Leucoderma
Microstachys chamaelea (L.) Müll.Arg.	**Isaka**	954	H	R	Skin disease
Tragia involucrata L.	**Dula gondi**	953	C	R	Scorpion bite
FABACEAE					
Abrus precatorius L.	**Gurija**	5	C	Se	Abortifacient
Acacia chundra (Rottler) Willd.	**Sandra**	613	T	B	Appetite stimulant
Acacia nilotica (L.) Willd. ex Del.	**Nalla tumma**	236	T	B	Burns
Albizia odoratissima (L.f.) Benth.	**Chinduga**	731	T	B	Leucoderma
Bauhinia malabarica Roxb.	**Puli are**	1651	T	B	Dyspepsia
Bauhinia racemosa Lam.	**Are**	87	T	B	Leucoderma
Bauhinia semla Wunderlin	**Goddeti are**	1490	T	B	Tonic
Butea superba Roxb.	**Teega moduga**	328	C	B	Urinary troubles
Canavalia cathartica Thouars	**Adavi tamba**	732	C	Se	Scorpion bite
Cassia fistula L.	**Rela**	132	T	Fr	Diarrhea, diuretic
Crotalaria albida B.Heyne ex Roth	**Adavi janumu**	1222	H	R	Scorpion bite
Crotalaria ramosissima Roxb.	**Tella janumu**	865	H	L	Wounds
Crotalaria verrucosa L.	**Tella janumu**	41	H	R	Snake bite
Dalbergia lanceolaria subsp. *paniculata* (Roxb.) Thoth.	**Porla pachari**	359	T	B	Baldness
Dalbergia volubilis Roxb.	**Teega pachari**	1340	C	B	Skin disease
Derris scandens (Roxb.) Benth.	**Chakali teega**	346	C	B	Veterinary
Desmodium gangeticum (L.) DC.	**Konda saru**	260	H	R	Scorpion bite
Desmodium triflorum (L.) DC.	**Munta mandu**	378	T	R	Hemorrhage
Desmodium velutinum (Willd.) DC.	**Teega velga**	654	H	R	Scorpion bite

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	Vernacular				
Dichrostachys cinerea (L.) Wight & Arn.	**Veluthuru**	582	S	B	Skin disease
Erythrina suberosa Roxb.	**Muli moduga**	1405	T	B	Veterinary, appetite stimulant
Flemingia macrophylla (Willd.) Merr.	**Err puvvu**	1625	S	R	Skin disease
Flemingia strobilifera (L.) W.T.Aiton	**Adavi chappa**	1339	S	R	Skin disease
Hardwickia binata Roxb.	**Narepa**	1031	T	B	Veterinary
Indigofera cassioides Rottler ex DC.	**Karu kandi**	609	S	R	Scorpion bite
Mimosa hamata Willd.	**Magadadi**	615	S	B	Aphrodisiac
Mucuna pruriens (L.) DC.	**Dula gondi**	868	C	Se	Abortifacient, aphrodisiac
Paracalyx scariosus (Roxb.) Ali	**Adavi tella kandi**	1635	C	R	Skin disease
Phyllodium pulchellum (L.) Desv.	**Sarivi**	1381	H	R	Scorpion bite
Pongamia pinnata (L.) Pierre	**Kanuga**	133	T	B	Skin disease
Pueraria tuberosa (Willd.) DC.	**Nela gummadi**	567	H	T	All diseases
Rhynchosia suaveolens (L.f.) DC.	**Adavi kandi**	1098	S	Se	Dysentery
Senna alata (L.) Roxb.		715	H	L	Skin disease
Senna occidentalis (L.) Link	**Adavi chennangi**	149	H	Fr	Appetite stimulant
Senna tora (L.) Roxb.	**Tagarisa**	8	H	L	Insect bite
Sophora velutina Lindl.	**Adavi kanuga**	870	T	B	Appetite stimulant
Tamarindus indica L.	**Chinta**	156	T	B	Scorpion bite
Tephrosia purpurea (L.) Pers.	**Vempali**	6	H	R	Easy delivery
Xylia xylocarpa (Roxb.) Taub.	**Bojja**	273	T	B	Skin disease
FERN AND FERN ALLIES					
Ceratopteris thalictroides (L.) Brongn.	**Medha**	1213	F/S	W	Memory
Cyclosorus parasiticus (L.) Farw.	**Hamsa padu**	655	F/H	W	Mental disorders
Lygodium flexuosum (L.) Sw.	**Dayyapu jeda**	982	F/C	R	Skin disease
Selaginella bryopteris (L.) Baker	**Pittakalu**	1653	H	W	Memory
GISEKIACEAE					
Gisekia pharnaceoides L.	**Iska rasi**	1427	H	W	Pains
HYPOXIDACEAE					
Curculigo orchioides Gaertn.	**Nela thadi**	603	H	T	Aphrodisiac
LAMIACEAE					
Anisomeles malabarica (L.) R.Br. ex Sims	**Dayyam chettu**	646	H	W	Fever
Gmelina arborea Roxb.	**Gummadi teku**	354	T	B	Anti-inflammatory, veterinary
Leucas aspera (Willd.) Link	**Thummi**	72	H	L	Healing power
Leucas decemdentata (Willd.) Sm.	**Konda tummi**	1213	H	L	Skin disease
Ocimum americanum L.	**Kukka tulasi**	17	H	L	Antiseptic
Plectranthus mollis (Aiton) Spreng.	**Nela marri**	600	H	R	Scorpion bite

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
Symphorema involucratum Roxb.	**Konda takkali**	697	C	B	Veterinary
Tectona grandis L.f.	**Teku**	308	T	B	Abortifacient
LAURACEAE					
Litsea glutinosa (Lour.) C.B. Rob.	**Narra mamidi**	567	T	B	All diseases
LECYTHIDACEAE					
Barringtonia acutangula (L.) Gaertn.	**Nir kanki**	301	T	B	Veterinary
Careya arborea Roxb.	**Budadharmi**	1360	T	Fr/B	Cough, appetite stimulant
LINDERNIACEAE					
Lindernia ciliata (Colsm.) Pennell	**Nela rampi**	1108	H	W	Skin disease
LOGANIACEAE					
Strychnos nux-vomica L.	**Visha mushti**	270	T	B	Snake bite, antiseptic
Strychnos potatorum L.f.	**Chilla**	332	T	Se	Eye disease
LORANTHACEAE					
Dendrophthoe falcata (L.f.) Ettingsh.	**Vadanica**	850	H	W	Fever
LYTHRACEAE					
Lagerstroemia parviflora Roxb.	**Chennangi**	265	T	B	Veterinary
Woodfordia fruticosa (L.) Kurz	**Jaji**	1033	T	B	Tonic
MALVACEAE					
Abutilon indicum (L.) Sweet	**Mudra benda**	3	H	R	Aphrodisiac
Eriolaena hookeriana Wight & Arn.	**Bothuku**	607	T	B	Veterinary
Grewia hirsuta Vahl	**Jibilika**	350	S	Fr	Laxative
Grewia damine Gaertn.	**Adavi jana**	608	S	Fr	Laxative
Grewia rothii DC.	**Jana, Chinna jana**	836	S	Fr	Laxative
Grewia tiliifolia Vahl	**Tada**	326	S	B	Veterinary
Helicteres isora L.	**Nulthada**	276	S	B	Veterinary
Hibiscus panduriformis Burm.f.	**Adavi benda**	842	S	R	Skin disease
Kavalama urens (Roxb.) Raf.	**Tabsi**	322	T	B	Appetite stimulant
Kydia calycina Roxb.	**Konda patti**	1234	T	B	Dyspepsia
Pterospermum xylocarpum (Gaertn.) Santapau & Wagh	**Lolugu**	1591	T	B	Veterinary
Sida acuta Burm.f.	**Chilka parre**	34	H	R	Mental disorders
Sida cordata (Burm.f.) Borss. Waalk.	**Gaya paku**	253	H	R	Tonic
Sida cordifolia L.	**Chiru benda**	401	H	R	Appetite stimulant
Thespesia lampas (Cav.) Dalzell & A.Gibson	**Adavi patti**	489	H	R	Fever, diuretic
Triumfetta rhomboidea Jacq.	**Marla benda**	36	H	R	Galactogogue
Waltheria indica L.	**Nalla benda**	35	H	L	Insect bite
Urena lobata L.	**Pedda benda**	508	H	R	Skin disease
MELASTOMATACEAE					
Memecylon umbellatum Burm.f.	**Alli**	1034	T	R	Diuretic

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
Osbeckia stellata Buch.-Ham. ex Ker Gawl.	**Adavi gulabi**	1125	S	R	Abortifacient
MELIACEAE					
Azadirachta indica A.Juss.	**Vepa**	484	T	B	Stomach-ache
Soymida febrifuga (Roxb.) A.Juss.	**Somi**	859	T	B	Tonic, diuretic
MENISPERMACEAE					
Cissampelos pareira L.	**Bodhi**	322	C	R	Cardiac stimulant
Cocculus hirsutus (L.) W.Theob.	**Shibbi teega**	1	C	R	Veterinary
MORACEAE					
Ficus benghalensis L.	**Marri**	309	T	La	Wounds
Ficus hispida L.f.	**Bomma medi**	114	T	L	Bone fracture
Ficus microcarpa L.f.	**Juvvi**	974	T	B	Leucoderma
Ficus racemosa L.	**Medi**	565	T	L	Bone fracture
Ficus tinctoria subsp. *gibbosa* (Blume) Corner	**Adavi barrenka**	936	T	B	Veterinary
Ficus virens Aiton	**Banda juvvi**	955	T	B	Rheumatism
Streblus asper Lour.	**Barrenka**	171	T	TS	Tooth brush
MORINGACEAE					
Moringa pterygosperma Gaertn.	**Munaga**	92	T	B	Aphrodisiac
MYRTACEAE					
Syzygium cumini (L.) Skeels	**Neredu**	580	T	B/Fr	Tonic, diabetes
NYCTAGINACEAE					
Boerhavia diffusa L.	**Atika mamidi**	18	H	W/R	Fever, tonic
OCHNACEAE					
Ochna obtusata DC.	**Sonnari**	781	T	B	Veterinary
OLEACEAE					
Nyctanthes arbor-tristis L.	**Karise**	227	T	B	Bone fracture
Schrebera swietenioides Roxb.	**Mokkam**	1405	T	B	Veterinary
ORCHIDACEAE					
Vanda tessellata (Roxb.) Hook. ex G.Don	**Kodikalla chettu**	1161	E	R	Fever
PAPAVARACEAE					
Argemone mexicana L.	**Mulu puccha**	140	H	W	Skin disease
PHYLLANTHACEAE					
Breynia retusa (Dennst.) Alston	**Purugudu**	1214	S	R	Aphrodisiac
Bridelia montana (Roxb.) Willd.	**Panchotkam**	310	T	B	Veterinary
Bridelia retusa (L.) A.Juss.	**Korra maddi**	772	T	B	Veterinary
Cleistanthus collinus (Roxb.) Benth. ex Hook.f.	**Nalla kodisa**	601	T	All parts	Homicide, fish stupifying
Glochidion zeylanicum (Gaertn.) A.Juss.	**Neeralli**	1047	T	B	Veterinary
Phyllanthus amarus Schumach. & Thonn.	**Nela usiri**	24	H	W	Jaundice

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	**Vernacular**				
Phyllanthus emblica L.	**Usiri**	602	T	W	Tonic
Phyllanthus urinaria L.	**Yerra usiri**	1852	H	W	Jaundice
PLANTAGINACEAE					
Scoparia dulcis L.	**Oosari**	519	H	W	Menstrual pains
PLUMBAGINACEAE					
Plumbago zeylanica L.	**Chitramulam**	682	H	R	Boils
POACEAE					
Bambusa bambos (L.) Voss	**Kanka bongu**	521	T	Se	Food
Cymbopogon flexuosus (Nees ex Steud.) W.Watson	**Adavi nimma gaddi**	425	H	R	Tonic
PUTRANJIVACEAE					
Putranjiva roxburghii Wall.	**Putranjiva**	1048	T	B	Bronchitis
RHAMNACEAE					
Ventilago maderaspatana Gaertn.	**Galivana teega**	849	C	B	Anthrax
Ziziphus oenopolia (L.) Mill.	**Pariki**	256	S	Fr	Diuretic
Ziziphus rugosa Lam.	**Enugu pariki**	1643	C	L	Bone fracture
Ziziphus xylopyrus (Retz.) Willd.	**Gotte**	347	T	L	Skin disease
RUBIACEAE					
Catunaregam spinosa (Thunb.) Tirveng.	**Manga**	303	T	Fr	Laxative
Ceriscoides turgida (Roxb.) Tirveng.	**Kukka elka**	358	T	B	Cough
Gardenia latifolia Aiton	**Pedda karinga**	1224	T	B	Rheumatism, veterinary
Gardenia resinifera Roth	**Karinga**	764	S	B	Neck pains
Haldina cordifolia (Roxb.) Ridsdale	**Bandaru**	422	T	B	Veterinary
Ixora arborea Roxb. ex Sm.	**Korivi**	1034	T	B	Appetite stimulant
Mitragyna parvifolia (Roxb.) Korth.	**Batta ganapa**	852	T	B	Veterinary
Morinda pubescens Sm.	**Togara mogili**	267	T	B	Appetite stimulant, anthrax
Paederia foetida L.	**Savirela**	1634	C	L	Skin disease
Tamilnadia uliginosa (Retz.) Tirveng. & Sastre	**Guvvenka**	450	T	B	Veterinary
RUTACEAE					
Aegle marmelos (L.) Corrêa	**Maredu**	370	T	L/Fr	Skin disease, digestive
Atalantia monophylla DC.	**Adavi nimma**	858	T	R	Paralysis
Chloroxylon swietenia DC.	**Bilugu**	1046	T	B	Skin disease
Limonia acidissima L.	**Velaga**	741	T	Fr	Tonic
SALICACEAE					
Casearia nigrescens Tue.	**Kanmeswaram**	534	T	B	Fish poison
Flacourtia indica (Burm.f.) Merr.	**Kanregu**	854	T	L	Scorpion bite
SAPINDACEAE					
Sapindus emarginatus Vahl	**Kunkudu**	39	T	Fr	Hair wash
Schleichera oleosa (Lour.) Merr.	**Pusuku**	1367	T	B	Dyspepsia

Botanical Names		Voucher Number	Habit	Part(s) used	Ethnic use
Scientific	Vernacular				
SAPOTACEAE					
Madhuca longifolia var. *latifolia* (Roxb.) A.Chev.	**Ippa**	268	T	Fl/Se	Dyspepsia, hair oil
Manilkara hexandra (Roxb.) Dubard	**Pala**	576	T	Fr	Laxative
SIMAROUBACEAE					
Ailanthus excelsa Roxb.	**Peda manu**	519	T	B	Piles
SMILACACEAE					
Smilax perfoliata Lour.	**Nageti dumpa**	1601	C	T	Abortifacient
SOLANACEAE					
Solanum virginianum L.	**Vakudu**	124	C	Fr	Laxative
ULMACEAE					
Holoptelea integrifolia Planch.	**Nemali nara**	340	T	L	Skin disease
VIOLACEAE					
Hybanthus enneaspermus (L.) F.Muell.	**Nela kobbari**	97	H	W	Aphrodisiac
VITACEAE					
Cissus vitiginea L.	**Adavi draksha**	734	S	Fr	Healing power
Leea asiatica (L.) Ridsdale	**Velama sandi**	1094	S	R	Skin disease
ZINGIBERACEAE					
Curcuma pseudomontana J.Graham	**Adavi pasupu**	956	H	T	Antiseptic

ily use “apparent” species (trees and their climbers) which are wild and abundant in the adjoining forests, and (ii) the relatively infrequent use of herbs or “non-apparent” species is reflective of their limited distribution to open areas or secondary forest patches tending towards therophytic phytoclimate.

The number of medicinal plant species reported per village (Table 4) ranged from 15 (Oorattum) to 167 (Mallur). Eighty-two plant species were reported only in one village while 30 species were reported in 9 or more villages (i.e., ≥50%). Each of the 237 plants was scored for shared use (common citation) among the 18 villages. Plants were grouped into shared-use batches that reflected the extent of common plant knowledge (1–3 villages, 4–6 villages,…16–18 villages) (Figure 2). Results from this analysis show that (i) plant knowledge among the different villages is not uniform but is rather shared by an average of 1 to 3 villages, and (ii) shared knowledge declines over an increasing number of villages, with no single plant species being shared by 16 or more of the 18 villages.

Floristic cognizance

A total of 237 different plant species were listed as phytomedicines for Koyas across all 18 villages. These were predominantly angiosperms (233; 98.3%) and a few ferns (4; 1.7%), the latter of which were used only in one village (Mallur). Amongst the angiosperms, far more Dicotyledonae species were mentioned (220 species; 94.4%). The species used are almost all indigenous (219; 92.4%) with the few exotics being either planted or naturalized.

The present study found the local people using both indigenous and exotic species, the latter of which are cultivated or naturalized for economic purposes. Some exotic weeds, however, appear inadvertently as escapees in natural forests in areas of biotic disturbance and land-use change (**podu** [shifting] cultivation). The exotics are normally light-demanding and unacceptable as graze or forage as they are expected to bear more diverse secondary metabolites which aid in herbivory defense. In the present survey, the indigenous flora formed the basis (92.4%; 219 species) of ethnobotanical practices of Koyas. The ethnomedicine practiced by Koyas in northern Telangana includes phytomedicines applied to both humans and their pets (Table 3) with 84% of plant species used as human medicine, 13% as veterinary, and just 3% for both.

Family-use index

An index was prepared to investigate the top five plant families which offer the most to the medicinal plants cognitive domain of the ethnic inhabitants of the 18 villages

Table 3. Breakdown of plant taxonomy, habit, ethnomedicinal use, and nativity by village. All villages are in Warangal North Forest Division of Northern Telangana, India. Villages denoted with an asterisk (*) are outside the Eturnagaram Wildlife Sanctuary while all others are located within it. Taxonomic groupings: ferns (F), dicots (D), monocots (M), genera (G), species (S). Growth forms: trees (T), shrubs (S), herbs (H), climbers/lianas/epiphytes/stragglers (C). Ethnomedicine: human (H), veterinary (V), both human and veterinary (H/V). Nativity: indigenous (I), exotic (E).

Villages	Taxonomic groupings					Growth forms				Ethnomedicines			Nativity	
	F	D	M	G	S	T	S	H	C	H	V	H/V	I	E
Mallur*	4	153	10	133	167	72	12	51	32	144	19	4	155	12
Kamaram		19		18	19	15	1	2	1	16	1	2	17	2
Venkatapuram		28		26	28	18	1	5	4	22	5	1	26	2
Chinnaboinapally		41	1	39	42	11	1	22	8	37	4	1	36	6
Shapally		102	5	92	107	50	8	34	15	97	8	2	97	10
Dodla		101	4	94	105	45	6	38	16	93	11	1	93	12
Malyala		33	1	33	34	19		8	7	31	3		31	3
Kondai		65	3	60	68	34	3	22	9	59	8	1	63	5
Ailapur		57	2	56	59	23	2	22	12	51	8		53	6
Yelishettipally		19	2	21	21	12	2	6	1	18	2	1	17	4
Banojibandam		21		21	21	8	4	5	4	19	1	1	20	1
Chalpaka		24	1	25	25	14		6	5	23	2		24	1
Allamvari Ghanpur		36		34	36	11		19	6	32	3	1	30	6
Narlapur		100	5	94	105	49	7	35	14	91	11	3	95	10
Medaram		40		37	40	27	2	8	3	30	7	3	37	3
Oorattum		15		15	15	10	1		3	14	1		14	1
Gonepally		81	5	80	86	36	5	28	18	78	7	1	80	6
Gandhinagar*		21		19	21	11	1	6	3	17	3	1	18	3

Table 4. Reports of plant species usage as Koya ethnomedicine for each of 18 villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division of Northern Telangana, India. Villages: (1) Mallur; (2) Kamaram; (3) Venkatapuram; (4) Chinnaboinapally; (5) Shapally; (6) Dodla; (7) Malyala; (8) Kondai; (9) Ailapur; (10) Yelishettipally; (11) Banojibandam; (12) Chalpaka; (13) Allamvari Ghanpur; (14) Narlapur; (15) Medaram; (16) Oorattum; (17) Gonepally; (18) Gandhinagar. Villages 1 and 18 are outside the Eturnagaram Wildlife Sanctuary.

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ACANTHACEAE																		
Andrographis paniculata (Burm.f.) Wall. ex Nees	X			X	X	X	X	X	X			X	X	X			X	
Barleria cristata L.	X				X									X			X	
Barleria montana Nees	X																	
Barleria prionitis L.	X																	
Hemigraphis latebrosa (Roth) Nees	X																	
Hygrophila auriculata (Schumach.) Heine				X		X		X					X					
Justicia betonica L.	X				X	X		X						X			X	
Lepidagathis cristata Willd.	X				X	X			X					X			X	
Peristrophe paniculata (Forssk.) Brummitt	X				X	X												
AMARANTHACEAE																		
Achyranthes aspera L.	X			X	X	X		X	X				X	X			X	

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Aerva lanata (L.) Juss.	X			X	X	X		X	X	X			X	X			X	
Aerva sanguinolenta (L.) Blume	X			X	X	X		X	X									
Amaranthus spinosus L.	X				X	X				X				X				
Celosia argentea L.						X			X									
Pupalia lappacea (L.) Juss.	X																	
ANACARDIACEAE																		
Buchanania axillaris (Desr.) Ramamoorthy			X											X	X		X	
Buchanania cochinchinensis (Lour.) M.R.Almeida	X	X			X	X		X						X			X	
Lannea coromandelica (Houtt.) Merr.	X	X		X	X	X		X	X				X	X	X			
Mangifera indica L.	X	X			X	X			X					X			X	X
Semecarpus anacardium L.f.	X		X		X	X		X							X			
ANNONACEAE																		
Miliusa tomentosa (Roxb.) J.Sinclair			X												X			
Polyalthia cerasoides (Roxb.) Bedd.	X				X	X			X					X			X	
APOCYNACEAE																		
Anodendron paniculatum A.DC.	X																	
Calotropis gigantea (L.) Dryand.						X				X								
Cyptolepis dubia (Burm.f.) M.R.Almeida			X												X			
Hemidesmus indicus (L.) R.Br. ex Schult.	X	X	X	X	X	X	X	X	X			X	X		X			X
Hemidesmus indicus var. *pubescens* (Wight & Arn.) Hook.f.																	X	
Holarrhena pubescens Wall ex G.Don	X	X	X		X	X	X	X	X	X	X	X		X	X			
Pergularia daemia (Forssk.) Chiov.			X											X	X		X	
ARACEAE																		
Pistia stratiotes L.																		X
ARECACEAE																		
Phoenix loureiroi Kunth	X				X	X								X			X	
ARISTOLOCHIACEAE																		
Aristolochia indica L.	X				X	X					X			X			X	
ASPARAGACEAE																		
Asparagus gonoclados Baker					X													
Asparagus racemosus Willd.	X																	
ASTERACEAE																		
Blumea bifoliata (L.) DC.	X				X									X			X	
Blumea virens DC.	X				X													
Pentanema indicum (L.) Ling	X																	
Sphaeranthus indicus L.	X			X	X	X	X	X	X			X	X	X			X	
Tridax procumbens (L.) L.	X								X									
Vernonia cinerea (L.) Less.	X			X	X	X		X	X				X	X			X	
Vernonia cinerea var. *parviflora* (Reinw. ex Blume) DC.	X					X												

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BIGNONIACEAE																		
Millingtonia hortensis L.f.	X																	
Oroxylum indicum (L.) Kurz	X																	
Stereospermum chelonoides (L.f.) DC.	X														X			
BOMBACACEAE																		
Bombax ceiba L.		X																
BORAGINACEAE																		
Coldenia procumbens L.														X			X	
Cordia dichotoma G.Forst.	X																X	
Cordia macleodii Hook.f. & Thomson	X																	
Ehretia laevis Roxb.	X																	
Trichodesma indicum (L.) Lehm.				X		X		X	X				X					
BURSERACEAE																		
Boswellia serrata Roxb. ex Colebr.	X				X	X	X	X		X	X			X		X		
Garuga pinnata Roxb.														X				
CAPPARACEAE																		
Capparis sepiaria L.																	X	
Capparis zeylanica L.	X				X	X					X			X		X	X	
CARYOPHYLLACEAE																		
Polycarpaea corymbosa (L.) Lam.	X					X								X			X	
CELASTRACEAE																		
Cassine glauca (Rottb.) Kuntze	X				X									X				
Gymnosporia emarginata (Willd.) Thwaites	X				X	X			X	X				X				
CLEOMACEAE																		
Cleome viscosa L.	X				X	X			X					X			X	
COMBRETACEAE																		
Anogeissus acuminata (Roxb. ex DC.) Guill., Perr. & A.Rich.						X												
Combretum albidum G.Don	X																	
Combretum roxburghii Spreng.	X			X	X		X	X	X				X	X			X	X
Combretum latifolium Blume	X																	
Getonia floribunda Roxb.				X		X		X	X				X					
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	X				X	X		X						X				X
Terminalia bellirica (Gaertn.) Roxb.	X				X	X	X	X	X			X				X		
Terminalia chebula Retz.					X													
CONVOLVULACEAE																		
Ipomoea coptica (L.) Roth ex Roem. & Schult.	X																	
Ipomoea eriocarpa R.Br.	X																	

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ipomoea hederifolia L.	X																	
Ipomoea obscura (L.) Ker Gawl.	X																	
Merremia hederacea (Burm.f.) Hallier f.	X				X	X			X					X				
Rivea hypocrateriformis Choisy	X			X			X					X				X		X
CORNACEAE																		
Alangium salviifolium (L.f.) Wangerin.	X			X	X	X	X	X	X			X	X	X		X	X	
CUCURBITACEAE																		
Diplocyclos palmatus (L.) C.Jeffrey						X												
Momordica charantia L.						X												
Momordica dioica Roxb. ex Willd.																X		
CYPERACEAE																		
Cyperus rotundus L.	X			X	X	X		X	X					X			X	
Scleria levis Retz.	X																	
DILLENIACEAE																		
Dillenia pentagyna Roxb.	X													X	X			
DIOSCOREACEAE																		
Dioscorea bulbifera L.	X																X	
EBENACEAE																		
Diospyros chloroxylon Roxb.	X		X		X	X		X	X					X	X		X	
Diospyros malabarica (Desr.) Kostel.	X																	
Diospyros melanoxylon Roxb.	X		X		X	X	X	X	X			X		X	X			X
Diospyros montana Roxb.		X																X
ERYTHROXYLACEAE																		
Erythroxylum monogynum Roxb.																	X	
EUPHORBIACEAE																		
Acalypha indica L.										X	X				X			X
Euphorbia hirta L.	X		X	X	X	X		X	X				X	X	X		X	
Euphorbia nivulia Buch.-Ham.					X													
Mallotus philippensis (Lam.) Müll.Arg.	X				X	X												
Microstachys chamaelea (L.) Müll.Arg.	X																	
Tragia involucrata L.	X																	
FABACEAE																		
Abrus precatorius L.	X			X	X	X		X	X	X	X			X			X	
Acacia chundra (Rottler) Willd.																X		
Acacia nilotica (L.) Willd. ex Del.														X				
Albizia odoratissima (L.f.) Benth.	X				X	X								X			X	
Bauhinia malabarica Roxb.	X				X									X				
Bauhinia racemosa Lam.	X				X									X			X	
Bauhinia semla Wunderlin	X																	
Butea superba Roxb.	X			X	X	X	X	X				X	X	X			X	

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Canavalia cathartica Thouars	X																	
Cassia fistula L.	X			X	X	X	X	X	X			X	X	X			X	X
Crotalaria albida B.Heyne ex Roth	X																	
Crotalaria ramosissima Roxb.						X												
Crotalaria verrucosa L.																	X	
Dalbergia lanceolaria subsp. *paniculata* (Roxb.) Thoth.	X		X		X	X		X		X				X	X		X	
Dalbergia volubilis Roxb.	X																	
Derris scandens (Roxb.) Benth.	X				X	X			X					X			X	
Desmodium gangeticum (L.) DC.	X				X	X												
Desmodium triflorum (L.) DC.	X				X									X			X	
Desmodium velutinum (Willd.) DC.	X																	
Dichrostachys cinerea (L.) Wight & Arn.					X									X			X	
Erythrina suberosa Roxb.	X	X			X						X							
Flemingia macrophylla (Willd.) Merr.	X										X							
Flemingia strobilifera (L.) W.T.Aiton	X																	
Hardwickia binata Roxb.														X				
Indigofera cassioides Rottler ex DC.	X				X	X			X									
Mimosa hamata Willd.											X						X	
Mucuna pruriens (L.) DC.	X			X	X	X		X	X		X		X	X		X	X	
Phyllodium pulchellum (L.) Desv.	X				X						X			X			X	
Pongamia pinnata (L.) Pierre	X					X				X				X			X	
Pueraria tuberosa (Willd.) DC.	X										X			X				
Senna alata (L.) Roxb.		X				X				X	X				X			
Senna occidentalis (L.) Link	X			X	X	X	X	X					X	X				X
Senna tora (L.) Roxb.	X			X	X	X	X	X					X	X				X
Sophora velutina Lindl.	X																	
Tamarindus indica L.	X				X	X								X			X	
Tephrosia purpurea (L.) Pers.			X												X			X
Xylia xylocarpa (Roxb.) Taub.	X		X		X	X	X	X	X		X			X	X		X	
FERNS AND FERN ALLIES																		
Ceratopteris thalictroides (L.) Brongn.	X																	
Cyclosorus parasiticus (L.) Farw.	X																	
Lygodium flexuosum (L.) Sw.	X																	
Selaginella bryopteris (L.) Baker	X																	
GISEKIACEAE																		
Gisekia pharnaceoides L.				X		X		X			X							
HYPOXIDACEAE																		
Curculigo orchioides Gaertn.	X				X	X		X		X				X			X	
LAMIACEAE																		
Anisomeles malabarica (L.) R.Br. ex Sims	X													X				

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Gmelina arborea Roxb.	X													X				
Leucas aspera (Willd.) Link						X			X						X			
Leucas decemdentata (Willd.) Sm.	X																	
Ocimum americanum L.	X			X	X	X							X					
Plectranthus mollis (Aiton) Spreng.	X				X	X					X			X				
Symphorema involucratum Roxb.																	X	
Tectona grandis L.f.						X	X	X				X						
LAURACEAE																		
Litsea glutinosa (Lour.) C.B. Rob.	X				X	X												
LECYTHIDACEAE																		
Barringtonia acutangula (L.) Gaertn.						X					X						X	
Careya arborea Roxb.			X												X			X
LINDERNIACEAE																		
Lindernia ciliata (Colsm.) Pennell	X																	
LOGANIACEAE																		
Strychnos nux-vomica L.	X			X	X	X	X	X	X			X	X	X			X	X
Strychnos potatorum L.f.			X												X		X	
LORANTHACEAE																		
Dendrophthoe falcata (L.f.) Ettingsh.																	X	
LYTHRACEAE																		
Lagerstroemia parviflora Roxb.	X		X		X	X		X	X					X	X			
Woodfordia fruticosa (L.) Kurz	X				X									X			X	
MALVACEAE																		
Abutilon indicum (L.) Sweet	X				X	X			X					X			X	
Eriolaena hookeriana Wight & Arn.															X			
Grewia hirsuta Vahl	X		X	X	X	X		X	X					X	X			
Grewia damine Gaertn.	X																	
Grewia rothii DC.	X													X				
Grewia tiliifolia Vahl	X				X									X				
Helicteres isora L.		X																X
Hibiscus panduriformis Burm.f.	X				X	X								X				
Kavalama urens (Roxb.) Raf.	X													X				
Kydia calycina Roxb.	X																	
Pterospermum xylocarpum (Gaertn.) Santapau & Wagh	X									X				X				
Sida acuta Burm.f.	X			X	X	X		X					X	X				
Sida cordata (Burm.f.) Borss. Waalk.	X			X	X	X		X	X				X	X			X	
Sida cordifolia L.						X			X									
Thespesia lampas (Cav.) Dalzell & A.Gibson		X			X									X			X	X
Triumfetta rhomboidea Jacq.	X			X	X	X	X	X	X			X	X	X			X	

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Urena lobata L.	X			X	X	X	X	X	X			X	X	X			X	
Waltheria indica L.	X		X	X	X	X		X	X	X			X	X	X		X	
MELASTOMATACEAE																		
Memecylon umbellatum Burm.f.					X													
Osbeckia stellata Buch.-Ham. ex Ker Gawl.	X																	
MELIACEAE																		
Azadirachta indica A.Juss.		X																
Soymida febrifuga (Roxb.) A.Juss.	X																	X
MENISPERMACEAE																		
Cissampelos pareira L.	X				X	X			X					X			X	
Cocculus hirsutus (L.) W.Theob.			X			X			X									
MORACEAE																		
Ficus benghalensis L.	X				X									X				
Ficus hispida L.f.	X	X	X	X	X	X	X	X	X	X			X	X	X		X	X
Ficus microcarpa L.f.		X																
Ficus racemosa L.								X										
Ficus tinctoria subsp. *gibbosa* (Blume) Corner	X																	
Ficus virens Aiton	X																	
Streblus asper Lour.																	X	
MORINGACEAE																		
Moringa pterygosperma Gaertn.														X			X	
MYRTACEAE																		
Syzygium cumini (L.) Skeels	X				X	X	X	X				X		X		X	X	
NYCTAGINACEAE																		
Boerhavia diffusa L.	X			X	X	X		X	X				X	X			X	
OCHNACEAE																		
Ochna obtusata DC.	X							X										
OLEACEAE																		
Nyctanthes arbor-tristis L.	X																	
Schrebera swietenioides Roxb.						X		X		X								
ORCHIDACEAE																		
Vanda tessellata (Roxb.) Hook. ex G.Don	X				X	X	X	X	X			X		X			X	
PAPAVARACEAE																		
Argemone mexicana L.														X			X	
PHYLLANTHACEAE																		
Breynia retusa (Dennst.) Alston					X													
Bridelia montana (Roxb.) Willd.	X			X	X	X	X	X				X	X	X				
Bridelia retusa (L.) A.Juss.	X														X			

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Cleistanthus collinus (Roxb.) Benth. ex Hook.f.	X	X		X	X	X	X	X	X			X	X	X			X	
Glochidion zeylanicum (Gaertn.) A.Juss.	X																	
Phyllanthus amarus Schumach. & Thonn.	X			X	X	X	X	X				X	X	X				
Phyllanthus emblica L.	X		X		X	X		X						X	X	X	X	
Phyllanthus urinaria L.	X		X		X	X								X	X		X	
PLANTAGINACEAE																		
Scoparia dulcis L.	X				X									X				
PLUMBAGINACEAE																		
Plumbago zeylanica L.														X			X	
POACEAE																		
Bambusa bambos (L.) Voss										X				X			X	
Cymbopogon flexuosus (Nees ex Steud.) W.Watson	X																	
PUTRANJIVACEAE																		
Putranjiva roxburghii Wall.	X																	
RHAMNACEAE																		
Ventilago maderaspatana Gaertn.	X				X	X	X	X	X					X			X	
Ziziphus oenopolia (L.) Mill.																	X	
Ziziphus rugosa Lam.	X																	
Ziziphus xylopyrus (Retz.) Willd.	X		X		X	X	X	X	X			X		X	X		X	
RUBIACEAE																		
Catunaregam spinosa (Thunb.) Tirveng.			X												X			X
Ceriscoides turgida (Roxb.) Tirveng.					X									X			X	
Gardenia latifolia Aiton	X		X		X	X		X							X	X	X	
Gardenia resinifera Roth	X			X	X	X		X		X			X		X			
Haldina cordifolia (Roxb.) Ridsdale	X				X	X			X					X				
Ixora arborea Roxb. ex Sm.	X		X		X	X	X	X	X	X				X	X		X	
Mitragyna parvifolia (Roxb.) Korth.						X		X										
Morinda pubescens Sm.	X	X	X	X	X	X	X	X	X			X	X	X	X		X	
Paederia foetida L.	X																	
Tamilnadia uliginosa (Retz.) Tirveng. & Sastre	X																	
RUTACEAE																		
Aegle marmelos (L.) Corrêa	X	X			X	X		X	X		X			X		X	X	
Atalantia monophylla DC.															X			
Chloroxylon swietenia DC.	X			X	X	X	X	X	X		X	X	X	X			X	
Limonia acidissima L.		X																
SALICACEAE																		
Casearia nigrescens Tue.	X				X	X												
Flacourtia indica (Burm.f.) Merr.	X				X									X			X	X

Scientific name	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SAPINDACEAE																		
Sapindus emarginatus Vahl																X		
Schleichera oleosa (Lour.) Merr.	X																X	
SAPOTACEAE																		
Madhuca longifolia var. *latifolia* (Roxb.) A.Chev.	X	X		X	X	X	X	X	X			X	X	X	X		X	
Manilkara hexandra (Roxb.) Dubard					X													
SIMAROUBACEAE																		
Ailanthus excelsa Roxb.																X		
SMILACACEAE																		
Smilax perfoliata Lour.	X																	
SOLANACEAE																		
Solanum surattense Burm.f.	X			X	X	X	X	X	X			X	X	X			X	
ULMACEAE																		
Holoptelea integrifolia Planch.	X				X	X	X	X	X	X	X			X	X			
VIOLACEAE																		
Hybanthus enneaspermus (L.) F.Muell.	X		X	X	X	X	X	X	X			X	X	X	X		X	
VITACEAE																		
Cissus vitiginea L.						X		X								X		
Leea asiatica (L.) Ridsdale										X	X				X			
ZINGIBERACEAE																		
Curcuma pseudomontana J.Graham	X																	
TOTAL SPECIES RICHNESS	167	19	28	42	107	105	34	68	59	21	21	25	36	105	40	15	86	21

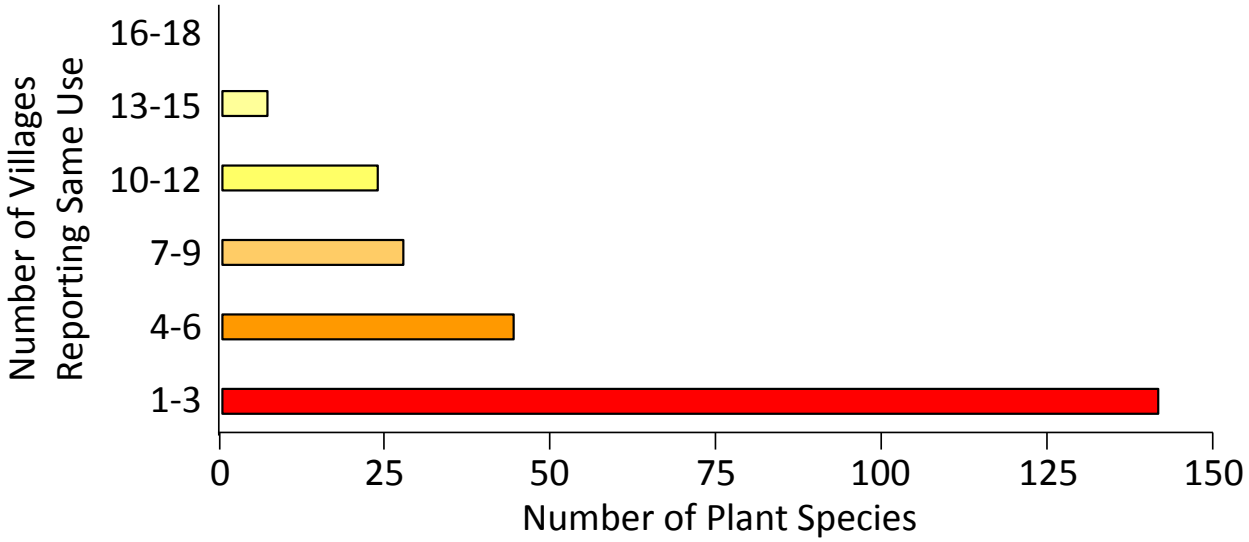

Figure 2. Knowledge sharing among inhabitants of 18 Koya villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division of Northern Telangana, India. Note that no shared plant species were reported by 16 or more villages.

(Table 5). The plant families, in the order of their utility, are Fabaceae, Malvaceae, Euphorbiaceae s.l., Rubiaceae, and Acanthaceae. Of these, Fabaceae (39 species) is the only family which is put to use in all 18 villages. It is followed by Malvaceae (18 species), Euphorbiaceae s.l. (15 species), Rubiaceae (10 species), and Acanthaceae (9 species). When the total family-use values of villages are viewed, three of them (Shapally, Dodla, and Narlapur) form a triangle within the sanctuary, with high top five family-use values totaling 2.43, 2.24, and 2.16, respectively. The least family-use value among the 16 villages in Eturnagaram Wildlife Sanctuary is Oorattum, with the value 0.15. The two villages located outside the sanctuary and used here to compare have the dominant five family-use values totaling 3.44 for Mallur, which is high, and 0.35 for Gandhinagar, which is very low compared to both the mean value of all villages (1.17) and the within-sanctuary mean (1.08).

Discussion

The dominant families of ethnic use reported are all dicots, supporting the assertion by Gottlieb *et al*. (2002) that dicotyledonous families possess more medicinal properties. Differential use of plant taxa according to class rank may be due to knowledge of the prevalence of bioactive compounds and/or the simple preponderance of these taxa in the foraging area. Obviously, the ethnic knowledge of medicinal plants of Koya community is variable and is not uniformly spread amongst either the informants/inhabitants or the floristic groups.

Another observation, though not experimentally demonstrated here, is that the local people knew of more medicinal plants than they actually used. When local people were asked to mention names and uses other than those listed; they recalled some species but declared that they no longer use them. The village-wise difference in number of plant species used by the Koyas living in the same habitat vouches for this. The intracultural differences in the knowledge domain could be due to other available medical options or erosion of traditional pharmacological knowledge.

The patterns of medicinal plant use by local people are considered to vary as a function of plant habitat diversity, cultural changes, ecological, and biochemical aspects (Stepp 2004). Besides, the diversity in the ecological knowledge held by individuals within indigenous communities, as in Koyas, may be fundamental to community adaptation. For example, Standing Rock elders (Ruelle & Kassam 2011) themselves challenged that their knowledge is not homogeneous within their community. The variables that have been found to pattern the intracultural variation of ethnobotanical knowledge are age (Phillips & Gentry 1993), gender, kinship (Boster 1986), acculturation (Zent 2001), and level of integration with the market economy (Reyes-Garcia 2001). The conscious perception of cognitive signals, together with the individual cultural history of different ethnic groups, assert that these signals may be connected and interpreted in culture-specific ways.

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Table 5. Family-use values of the five most ethnomedicinally important plant families as reported by Koya inhabitants of 18 villages within or near Eturnagaram Wildlife Sanctuary in Warangal North Forest Division of Northern Telangana, India. Villages 1 and 18 are outside the sanctuary. Villages: 1 = Mallur; 2 = Kamaram; 3 = Venkatapuram; 4 = Chinnaboinapally; 5 = Shapally; 6 = Dodla; 7 = Malyala; 8 = Kondai; 9 = Ailapur; 10 = Yelishettipally; 11 = Banojibandam; 12 = Chalpaka; 13 = Allamvari Ghanpur; 14 = Narlapur; 15 = Medaram; 16 = Oorattum; 17 = Gonepally; 18 = Gandhinagar. *The family Euphorbiaceae here includes Phyllanthaceae and Putranjivaceae.

Family	Villages																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Fabaceae	0.73	0.05	0.08	0.15	0.44	0.40	0.13	0.21	0.12	0.10	0.21	0.05	0.13	0.49	0.10	0.05	0.41	0.10
Malvaceae	0.72	0.14	0.11	0.33	0.47	0.50	0.11	0.33	0.39	0.08	0.00	0.11	0.28	0.67	0.14	0.00	0.33	0.08
Euphorbiaceae s.l.*	0.50	0.07	0.07	0.17	0.37	0.23	0.10	0.17	0.13	0.07	0.07	0.10	0.17	0.17	0.37	0.00	0.13	0.07
Rubiaceae	0.60	0.10	0.30	0.25	0.60	0.55	0.20	0.50	0.25	0.25	0.00	0.10	0.25	0.40	0.40	0.10	0.40	0.10
Acanthaceae	0.89	0.00	0.00	0.22	0.56	0.56	0.11	0.33	0.22	0.00	0.00	0.11	0.22	0.44	0.00	0.00	0.44	0.00
TOTAL	3.44	0.36	0.55	1.13	2.43	2.24	0.65	1.54	1.11	0.50	0.27	0.47	1.04	2.16	1.01	0.15	1.72	0.35

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