



Traditional Uses and Sustainable Collection of Ethnobotanicals by Aboriginal Communities of the Achanakmaar Amarkantak Biosphere Reserve of India

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Abstract: In the due course of study, focus was prearranged on the traditional use of trees, herbs and shrubs (ethnobotanicals) which are little or unknown to modern societies. Through questionnaire and interviews, the present study was attempted to collect the information about the people who still live in traditional world. A total 40 tree species, 94 herbs including tubers, grasses, climbers and 13 shrubs utilize by aboriginal communities of Achanakmaar Amarkantak Biosphere Reserve (AABR), were renowned/ explored for different utilization pattern. The most important tree species collected from the forests and nearby village areas by the local people are *Madhuca indica*, *Buchanania lanzan*, *Diospyrus melanoxylon*, *Mangifera indica*, *Shorea robusta* and *Terminalia tomentosa* etc. Similarly, herbs collected are *Eclipta alba*, *Panicum antidotale*, *Smithia conferta*, *Phyllanthus nodiflorus*, *Dioscorea bulbifera*, *Curculigo orchoides*, *Oxalis corniculata*, *Portulaca oleracea*, *Echinochloa colona*, *Solanum nodiflorum*, *Achyranthus aspera*, *Leucas aspera*, *Corchorus trillularis*, *Cassia tora* etc. The most common reported shrubs of these areas are *Phoenix sylvestris*, *Randia dumetorum*, *Ziziphus zilopyrus* and *Lantana camara*. The reported botanicals have variety of uses like vegetable, fruit, furniture, religious use, rituals use, and for handloom preparation. Besides the consumption value, forest also source of subsistence for this hidden and marginalized society of the world. The current study confirmed that there is a vital necessity for documentation of traditional knowledge associated to the Bagia aboriginals and others insubstantial cultural inheritance regarding traditional plant uses. Further, it can provide a baseline ethnobotanicals utilization pattern data that may be guiding parameter for the prioritization and conservation of these natural resources along with bio-prospecting indigenous traditional knowledge.

Keywords: Aboriginals, Forests, Sustainable, Aabr, Ethnobotanicals

1. Introduction

The human beings are closely associated with forest for their existence and civilization. The relationship between human being and forest has been important for the development of society (Riter *et al.* 2013). The development of society is based on various function of forest like productive, ecological, social and cultural etc.

The aboriginals /indigenous people continuously (generation to generation) associated with forest and often possess a broad knowledge base about the complex ecological behavior of forest in their own localities (Gadgil *et al.* 1993). Most of people live in and around forest belongs to tribal communities. These forest dwellers collect different type of forest produce from forest either for their own consumption or for sale in the market. The collection intensity of forest produces mainly dependent

on availability, knowledge and easily accessibility of it (Kala, 2009). Millions of people, particularly tribal and rural communities in many developing countries still collect and consumed a wide variety of wild plant resources to meet their food requirements (FAO, 2004; Balemie *et al.* 2006; Bharucha *et al.* 2010, Dobriyal, *et al.* 2015). Forest is an important source of highly nutritive value food for tribes. Intensive studies concerning its nutritional role have also been highlighted in many surveys around the world (Tanji *et al.* 1995; Ogle *et al.* 2001; Bonet *et al.* 2002; Guarrera *et al.* 2003; Ogoye-Ndegwa *et al.* 2003; Ertug, 2004; Tardio *et al.* 2005; Javier *et al.* 2006). These wild plants provide balance diet by supplementing essential nutrients and minerals for human being. The wild plants have been recognized as potential source of nutrition than conventionally eaten crops (Grivetti *et al.* 2000). Due to modernization in society (advanced communication, transportation and technology) there is a mixing of culture and customs of these forest dwellers, but still they have endowed with many traditional rituals, beliefs, norms and practices which are highly associated with forest. Tribal communities have strong cultural, spiritual and livelihood link with forest. The Achanakmaar Amarkantak Biosphere reserve (AABR) in Central India is known to home of several Non Timber Forest Produce (NTFPs), rare and endangered medicinal aromatic plant and different type of forest ranging from subtropical to dry deciduous, which greatly contribute to livelihoods of inhabited tribal communities. The inhabited tribes in AABR are mostly belonging to Baiga, Gond, Kol, Kanwar, Pradhan and Panka communities. Every plant on earth has utility but bio-prospecting this resource is a big task. These forest dwellers have vast knowledge about appropriate uses of forest products. They are very well aware that plants play very important role in generating the ecological services and natural resources on which they depend. They consider every part of environment from trees to rivers as very important part of their life as they are the only means of human survival as per their understanding (Pandey, 1997). Forest dependent communities are usually located far from cities and fertile agriculture areas, so these communities fulfill their almost day to day need from forest (Yeo-Chang, 2009). Most of the basic needs of these tribe's like food (leafy vegetables, fruit, and kodo, kutki, sama grains), shelter (Bamboo, grasses and leafs) and income (by selling leaf of bahunia, mushroom and mahua flowers etc.) are fulfilled through forest. Tribal communities have symbiotic relation with forest they (forest and tribe) depend on each others. The tribal communities have extensive knowledge about the traditional uses of these natural resources which are little or unknown to modern societies. The knowledge remained just with the people who are acquainted with these uses and has rarely been documented otherwise (Burgi *et al.* 2013). There is a real need for field-level research, synthesis and collection of information on tribal-forest

association. With this background, a need was felt to collect in-depth information on the tree species growing in AABR and used by tribal groups in view of documenting the knowledge which may be under threat due to the influence of modernization. This paper thus aims to highlight and record in detail the traditional knowledge of tribal groups on the use of various tree species growing in AABR.

2. Methodology

2.1. Study Area

The AABR lays between $21^{\circ} 15'$ to $22^{\circ} 58'$ N latitude and $81^{\circ} 25'$ to $82^{\circ} 5'$ E longitude. The Achanakmar Amarkantak Biosphere Reserve is spread over an area of 383551.0 ha in Deccan Peninsula bio-geographic zone of Chhattisgarh and Madhya Pradesh and comprises of tropical moist deciduous to tropical dry deciduous forests. The total geographical area of AABR is 383551.0 ha of which 55155.0 ha is under the core zone and remaining 28396.889 ha comprises the buffer zone. The zonation in AABR makes clear the ecological and socio-economical independence between each zone of AABR. The core region of the AABR is situated in Chhattisgarh state whereas the buffer and transition zones lie partly both in Madhya Pradesh and Chhattisgarh. The AABR possessed rich plant and animal diversity. It is similarly known for its cultural diversity, as it is colonized by number of tribal and non-tribal group of people.

2.2. Survey Methods

The present study was carried out in buffer zone and core zone's villages of AABR. A total of 7 villages in buffer zone namely Aamadoab, Kewanchi, Piper Khuti, Kachhra tola, Roopan dand, Pattar con, Madna dipo and 5 villages of core zone namely Lamni, Birar pani, Chhiritra, Atariyaa and Ranchaki were selected for intensive study of traditional knowledge on the use of flora of AABR (Table 1). The location map of study area is depicted in Fig 1. The selected villages of core zone were dominated by tribal communities while buffer zone has both tribal and non tribal communities. The randomly selected tribals hamlets and families from different communities were questionnaire survey in the selected villages of AABR. The important part of the questionnaire were discussed with 60 to 70 years villagers because they have great experience regarding the use of forest products. The females provided the information mainly regarding the wild vegetables. Through questionnaire survey and interviews the information was collected on the indigenous uses of tree species, their processing techniques, consumption pattern, plant part use, local name of tree species and their occurrence in AABR. The questions were also asked on the role of forest products on the economy of tribal community and non tribal communities reside in and around the biosphere reserve. Apart from questionnaire

survey, the local people were encouraged to give their ideas and perceptions on various uses of herbs, shrubs and tree species. Information was collected on ethnobotanicals by participating in various cultural activities of the local tribal people. Efforts were made to scrutinize the tree species used in various socio-cultural practices of the local people including childbirth, death and marriage ceremony.

The related cultural practices and norms for collection of a variety of forest produce and parts of particular tree species were also documented through group discussion. The experienced local people were also requested to escort during the forest survey for identification of tree species and related indigenous knowledge.

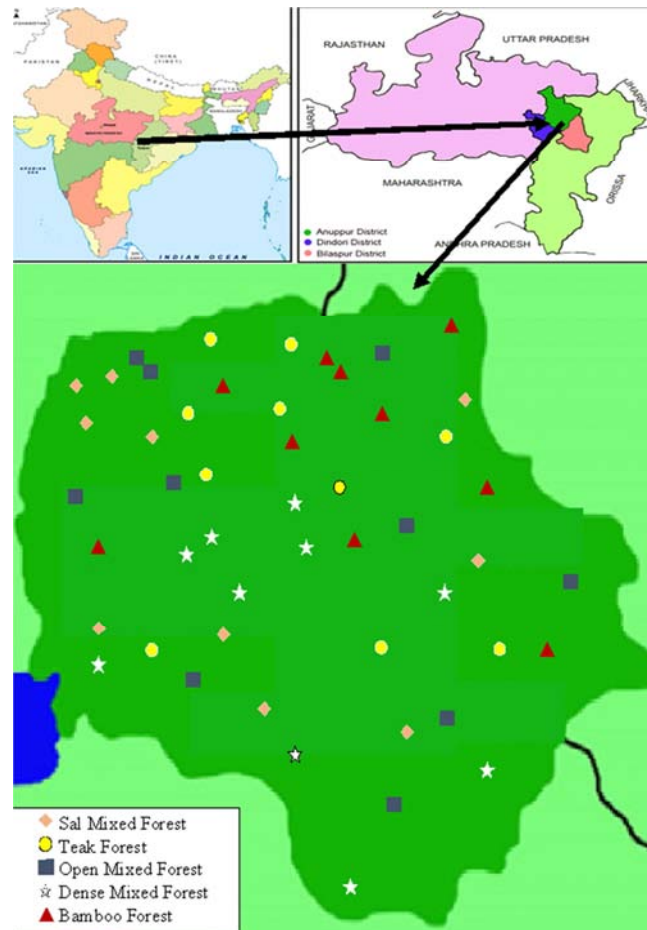


Figure 1. Study area and location of field study of achanakmaar amarkantak biosphere reserve.

Table 1. List of villages, surveyed in aabr.

Core zone						
S. N	Village Name	GPS Location	Elevation MSL (m)	Informants	Localities	Population (2011 census)
1.	Lamni	N-22°32'32.53" E-81°44'37.20"	569	18	4	634
2.	Birar pani	N-22°32'36.30" E-81°38'36.70"	781	13	3	75
3.	Chhirhatta	N-22°31'23.50" E-81°41'46.60"	446	11	3	94
4.	Atariya	N-22°34'08.07" E-81°45'12.71"	598	17	5	668
5.	Ranchaki	N-22°34'.445" E-81°41'.553"	701	15	3	342
Buffer Zone						
S. N	Village Name	GPS Location	Elevation MSL (m)	Informants	Localities	Population (2011 census)
1.	Aamadob	N-22°37'17.68" E-81°44'10.77"	656	21	4	1208
2.	Kewanchhi	N-22°37'17.73" E-81°46'44.82"	578	23	6	846
3.	Pipar Khuti	N-22°39'36.33" E-81°52'08.80"	596	27	8	786
4.	Kachhra tola	N-22°40'47.45" E-81°52'59.82"	600	11	2	332
5.	Roopan dand	N-22°41'52.17" E-81°53'31.51"	591	13	3	1003
6.	Paterkoni	N-22°42'55.83" E-81°53'48.02"	594	09	2	787
7.	Madana	N-22°43'42.82" E-81°54'07.54"	604	23	5	861

Parts used by local people were cross-checked with other people and evaluate the result from personal interview and discussions in group with local people

provide much valuable and specific information regarding the traditional uses of plants.

3. Results and Discussion

The present study brought it in to the light that there are many traditional uses of forest which are well known by indigenous communities meanwhile the modern society have very limited or insufficient knowledge on these uses. In the same way various plants used by the local people of AABR are such type of distinctive uses of the plants. A total 40 tree species, 94 herbs including tubers, grasses, climbers and 10 shrubs utilize by local people of AABR, were renowned during the present study (Table 2, 3 and 4). The most important tree species collected from the forests and nearby village areas by the local people are *Madhuca indica*, *Buchanania lanzan*, *Diospyrus melanozylon*, *Mengifera indica*, *Phyllanthus emblica*, *Syzygium cumini*, *Terminalia chebula*, *Terminalia bellirica*, *Shorea robusta* and *Terminalia tomentosa*. The local people have multiple uses of ethnobotanical plants, of these 13 uses are recognized during the present study (Figure 2) and The informants revealed that different morphological plant parts were used by local people (Figure 3) and their distribution of recorded ethnobotanical plants into families are depicted in figure 4. The most common herbs collected from forest or nearby village areas by the local people are *Eclipta alba*, *Panicum antidotale*, *Smithia conferta*, *Euphorbia heterophylla*, *Phyla nodiflora*, *Dioscorea bulbifera*, *Curculigo orchoides*, *Oxalis corniculata*, *Portulaca*

oleracea, *Echinochloa colona*, *Solanum nodiflorum*, *Achyranthes aspera*, *Leucas aspera*, *Corchorus trilloularis*, *Cassia tora* etc. These herbs mostly used for vegetable and medicinal purpose and some time also used for fruit and grain. The most common reported shrubs of these areas are *Phoenix sylvestris*, *Randia dumetorum*, *Zizipus zilopyrus* and *Lantana camara*. The reported shrubs have variety of uses like vegetable, fruit and for handloom preparation. Most of species are used as food (38%) and medicine (54%). Besides, the plant species are used to execute cultural practices (6.9%), for fuel wood (5.5%), house construction (6.9%), making agriculture tools and instruments (4.1%), furniture (3.5%), as fish poison (1.3%), fodder, oil making, liquor preparation, rope, cup and plate making, and bio-fencing. Seed, dye, leaf, tubers, mushrooms, gum, resin, root, fruit, flower and twig of plants are also used and collected from the forests. The gum mainly collected from *Shorea robusta*, *Anogeissus latifolia*, *Boswellia serrata* and *Sterculia urens*. The species which used for day to day needs like house construction, making agricultural implements, fuel wood, fodder purpose, and manufacturing boundary wall are cut down around the year as per needs. However, there are a few tree species, such as, *Ficus religiosa*, *Aegle marmelos*, *Syzygium cumini*, *Madhuca indica* and *Shorea robusta*, having socio-cultural importance to local people are harvested/felled after performing some local rituals or prayer practices.

Table 2. Herbaceous flora of aabr with local name, scientific name and family name along with their uses.

S. No	common name	Scientific name	Family	Habit	uses
1.	Katua shak	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	<i>Amaranthaceae</i>	H	V
2.	Kubbi	<i>Ageratum conyzoides</i> (L.) L.	<i>Asteraceae</i>	H	M
3.	Kurie	<i>Bidens pilosa</i> L.	<i>Asteraceae</i>	H	M
4.	Safed murga	<i>Celosia argentea</i> L.	<i>Amaranthaceae</i>	H	M & V
5.	Bhrangraj	<i>Eclipta alba</i> (L.) Hassk.	<i>Asteraceae</i>	H	M
6.	Kutki	<i>Panicum antidotale</i> Retz.	<i>Poaceae</i>	G	F
7.	Grass lily	<i>Iphigenia indica</i> (L.) A.Gray ex Kunth	<i>Poaceae</i>	G	Fo
8.	Meethi buti	<i>Scoparia dulcis</i> L.	<i>Plantaginaceae</i>	H	M
9.	Naichi bhaji	<i>Smithia conferta</i> Sm.	<i>Fabaceae</i>	H	V
10.	Kanghi	<i>Blainvillea acmella</i> (L.) Philipson	<i>Asteraceae</i>	H	M
11.	Khal muriya	<i>Tridax procumbens</i> (L.) L.	<i>Asteraceae</i>	H	M
12.	Dudhali	<i>Sopubia delphinifolia</i> G.Don	<i>Scrophulariaceae</i>	H	M
13.	Akarkara	<i>Spilanthes paniculata</i> Wall. ex DC.	<i>Asteraceae</i>	H	M
14.	Chauli	<i>Alysicarpus monilifer</i> (L.) DC.	<i>Fabaceae</i>	H	M
15.	Doodhi	<i>Euphorbia heterophylla</i> DesF.	<i>Euphorbiaceae</i>	H	M
16.	Pulpuli grass	<i>Arthraxon hispidus</i> (Thunb.) Makino	<i>Poaceae</i>	G	Fo
17.	Babui	<i>Eulaliopsis binata</i> (Retz.) C.E.Hubb.	<i>Poaceae</i>	G	Fo
18.	Sauri	<i>Alysicarpus vaginalis</i> (L.) DC.	<i>Fabaceae</i>	H	M
19.	Ghughunia	<i>Crotalaria retusa</i> L.	<i>Leguminosae</i>	H	Fi
20.	Pihri chara	<i>Mecardonia procumbens</i> (Mill.) Small	<i>Scrophulariaceae</i>	H	Fo
21.	Ratolia	<i>Phyla nodiflora</i> (L.) Greene	<i>Verbenaceae</i>	H	V
22.	Kharatti	<i>Sida acuta</i> Burm.f.	<i>Malvaceae</i>	H	M
23.	Kangni	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	<i>Poaceae</i>	G	Fo
24.	Bharbhusi	<i>Eragrostis tenella</i> (L.) P.Beauv. ex Roem. & Schult.	<i>Poaceae</i>	G	Fo
25.	Soli	<i>Aeschynomene americana</i> L.	<i>Leguminosae</i>	H	Gm
26.	Patthar choor	<i>Plectranthus mollis</i> (Aiton) Spreng.	<i>Lamiaceae</i>	H	M
27.	Bariyari	<i>Sida cordata</i> (Burm.f.) Borss.Waalk.	<i>Malvaceae</i>	H	M
28.	Hirankhuri	<i>Emilia sonchifolia</i> (L.) DC. ex DC.	<i>Asteraceae</i>	H	M
29.	Badranj boya	<i>Nepeta cataria</i> L.	<i>Lamiaceae</i>	H	M
30.	Kevkand	<i>Dioscorea bulbifera</i> L.	<i>Dioscoreaceae</i>	C	M
31.	Kali mushli	<i>Curculigo orchoides</i> Gaertn	<i>Agavaceae</i>	T	M

S. No	common name	Scientific name	Family	Habit	uses
32.	Tinpaniya	<i>Oxalis corniculata</i> L.	<i>Oxalidaceae</i>	H	M & V
33.	Maskani	<i>Evolvulus nummularius</i> (L.)	<i>Convolvulaceae</i>	H	M
34.	Chanchu	<i>Corchorus fascicularis</i> Lam.	<i>Tiliaceae</i>	H	Fi
35.	Kena	<i>Commelina diffusa</i> Burm.f.	<i>Commelinaceae</i>	H	M
36.	Kharmor	<i>Rungia pectinata</i> (L.) Nees	<i>Acanthaceae</i>	H	M
37.	Ghuen	<i>Fimbristylis littoralis</i> Gaudich.	<i>Cyperaceae</i>	H	M
38.	Nagar motha	<i>Cyperus gracilis</i> R.Br.	<i>Poaceae</i>	G	Fo
39.	Bufalo grass	<i>Paspalum conjugatum</i> P.J.Bergius	<i>Poaceae</i>	G	Fo
40.	Baiga sikiyab	<i>Digitaria divaricatissima</i> (R.Br.) Hughes	<i>Poaceae</i>	G	Fo
41.	Jangli marua	<i>Eleusine indica</i> (L.) Gaertn.	<i>Poaceae</i>	G	Fo
42.	Dokar bel	<i>Vitis carnosa</i> (Lam.) Wall.	<i>Vitaceae</i>	H	M
43.	Chui mui	<i>Mimosa pudica</i> L.	<i>Fabaceae</i>	H	M
44.	Nuniya bhaji	<i>Portulaca oleracea</i> L.	<i>Portulacaceae</i>	H	V
45.	Kanthkari	<i>Solanum xanthocarpum</i> Schrad. & H. Wendl.	<i>Solanaceae</i>	H	M
46.	Jungli sama	<i>Echinochloa colona</i> (L.) Link	<i>Poaceae</i>	G	Ge
47.	Amti	<i>Solanum nodiflorum</i> Jacq.	<i>Solanaceae</i>	H	V
48.	Chirchita	<i>Achyranthes aspera</i> L.	<i>Amaranthaceae</i>	H	M
49.	Ghooma	<i>Leucas aspera</i> (Willd.) Link	<i>Lamiaceae</i>	H	V
50.	Kaniya kanda	<i>Dioscorea oppositifolia</i> L.	<i>Dioscoreaceae</i>	C	M
51.	Chench	<i>Corchorus trilocularis</i> L.	<i>Tiliaceae</i>	H	V
52.	Chanahur	<i>Marsdenia tenacissima</i> (Roxb.) Moon	<i>Asclepiadaceae</i>	H	V
53.	Van rai	<i>Blumeopsis flava</i> (DC.) Gagnep.	<i>Asteraceae</i>	H	M
54.	Tikhur	<i>Curcuma angustifolia</i> Roxb.	<i>Zingiberaceae</i>	T	M
55.	Bhui amla	<i>Phyllanthus niruri</i> L.	<i>Euphorbiaceae</i>	H	M
56.	Salparni	<i>Desmodium gangeticum</i> (L.) DC.	<i>Fabaceae</i>	H	M
57.	Satawar	<i>Asparagus racemosus</i> Willd.	<i>Liliaceae</i>	H	M
58.	Haddi mushli	<i>Chlorophytum borivilianum</i> Santapau & R.R.Fern.	<i>Asparangaceae</i>	T	M
59.	Datura	<i>Datura metel</i> L.	<i>Solanaceae</i>	H	M, Ru
60.	Gajar ghas	<i>Parthenium hysterophorus</i> L.	<i>Asteraceae</i>	H	M
61.	Badi dudhi	<i>Euphorbia hirta</i> L.	<i>Euphorbiaceae</i>	H	M
62.	Chhoti dudhi	<i>Euphorbia macrophylla</i> Pax	<i>Euphorbiaceae</i>	H	M
63.	Bara	<i>Flemingia chappar</i> Benth.	<i>Fabaceae</i>	H	Lac
64.	Bedarikand	<i>Coccinia grandis</i> (L.) Voigt	<i>Cucurbitaceae</i>	C	E
65.	Jungli san	<i>Crotalaria spectabilis</i> Roth	<i>Fabaceae</i>	H	M
66.	Kalihari	<i>Gloriosa superba</i> L.	<i>Colchicaceae</i>	C	M
67.	Kheksa	<i>Momordica dioica</i> Roxb	<i>Cucurbitaceae</i>	C	V
68.	Karmata	<i>Ipomoea aquatica</i> Forssk.	<i>Convolvulaceae</i>	H	V
69.	Jungle kevanch	<i>Mucuna pruriens</i> (L.)DC	<i>Papilionaceae</i>	H	M
70.	Jangli pyaj	<i>Urginea indica</i> (Roxb.) Kunth	<i>Liliaceae</i>	H	M
71.	Chirula	<i>Aerva lanata</i> (L.) Juss.	<i>Amaranthaceae</i>	H	M
72.	Chirinya	<i>Peristrophe roxburghiana</i> (Roem. & Schult.) Bremek.	<i>Acanthaceae</i>	H	M
73.	Garundi	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	<i>Amaranthaceae</i>	H	M
74.	Jungli rye	<i>Sisymbrium nigrum</i> (L.) Prantl	<i>Cruciferae</i>	H	V
75.	Jangli Tulsi	<i>Ocimum gratissimum</i> L.	<i>Lamiaceae</i>	H	M
76.	Chirpoti	<i>Physalis minima</i> L.	<i>Solanaceae</i>	H	Fe
77.	Sarpandha	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	<i>Apocynaceae</i>	H	M
78.	Sadabahr	<i>Catharanthus roseus</i> (L.) G.Don	<i>Apocynaceae</i>	H	M
79.	Brahmi	<i>Bacopa monnieri</i> (L.) Wettst.	<i>Plantaginaceae</i>	H	M
80.	Tulsi	<i>Ocimum sanctum</i> L.	<i>Lamiaceae</i>	H	M, Ru
81.	Chirayta	<i>Swertia alba</i> T.N. Ho & S.W. Liu	<i>Gentianaceae</i>	H	M
82.	Aswagandha	<i>Withania somnifera</i> (L.) Dunal	<i>Solanaceae</i>	T	M
83.	Chand kal	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	<i>Euphorbiaceae</i>	H	M
84.	Chaulai	<i>Amaranthus spinosus</i> L.	<i>Amaranthaceae</i>	H	V
85.	Tiger lily	<i>Belamcanda chinensis</i> (L.) DC.	<i>Iridaceae</i>	H	M
86.	Bisakhpara	<i>Boerhavia procumbens</i> Banks ex Roxb.	<i>Nyctaginaceae</i>	H	V
87.	Mandukparni	<i>Centella asiatica</i> (L.) Urb.	<i>Apiaceae</i>	H	M
88.	Ghuia	<i>Colocasia esculenta</i> (L.) Schott.	<i>Araceae</i>	H	V
89.	Kev kand	<i>Costus speciosus</i> (J.Koenig) Sm.	<i>Zingiberaceae</i>	T	M
90.	Amahaldi	<i>Curcuma amada</i> Roxb.	<i>Zingiberaceae</i>	T	M
91.	jungli dhanja	<i>Eryngium foetidum</i> L.	<i>Apiaceae</i>	H	V
92.	Sitab	<i>Ruta graveolens</i> L.	<i>Rutaceae</i>	H	M
93.	Mameera	<i>Thalictrum foliolosum</i> DC.	<i>Ranunculaceae</i>	H	M
94.	Bathua bhaaji	<i>Chenopodium album</i> L.	<i>Chenopodiaceae</i>	H	V

Legends: F: Food, H: Herb, T: Tuber, C: Climber, G: Grass, M: Medicinal use, V: Vegetable, Fo: Fodder, Fe: Fruit edible, Ru: Religious use, E: Edible, Ge: Grain edible and Gm: Grain edible

Table 3. Traditionally used tree species by local people in aabr.

8	Common name	Scientific name	Family	Parts used	Uses
1.	Bel	<i>Aegle marmelos</i>	<i>Rutaceae</i>	Fruit Leaf	Edible, Medicinal, Religious purpose
2.	Dhabda	<i>Anogeissus latifolia</i>	<i>Combretaceae</i>	Stem Resin	House construction Fuel wood Agriculture implement Selling
3.	Mohline	<i>Bauhinia purpurea</i>	<i>Caesalpiniaceae</i>	Leaf Flower	Cup and plate making Medicinal
4.	Semel	<i>Bombax ceiba</i>	<i>Malvaceae</i>	Fruit Flower	Medicine Edible
5.	Salei	<i>Boswellia serrata</i> Roxb.	<i>Burseraceae</i>	Resin	Medicine
6.	Chironji	<i>Buchanania lanzan</i>	<i>Anacardiaceae</i>	Fruit seed	Edible Edible
7.	Khakra	<i>Butea monosperma</i>	<i>Fabaceae</i>	Leaf	Cup and plate making
8.	Kumbhi	<i>Careya arborea</i>	<i>Lecythidaceae</i>	Bark	Fish poisoning
9.	Amaltash	<i>Casia fistula</i>	<i>caesalpiniaceae</i>	Fruit	Medicinal.
10.	Mahalimb	<i>Cedrela toona</i> Roxb.	<i>Meliaceae</i>	Stem	Furniture
11.	Ghiriha	<i>Chloroxylon swietenia</i>	<i>Rutaceae</i>	Stem Bark	House Construction Agricultural implements Fuel wood Fish poison
12.	Karra	<i>Cleistanthus collinus</i>	<i>Euphorbiaceae</i>	Stem	Furniture
13.	Sita phal	<i>Custard apple</i>	<i>Annonaceae</i>	Fruit Stem	Edible House Construction Agricultural implements Fuel wood
14.	Shisham	<i>Dalbergia sisoo</i>	<i>Leguminosae</i>	Stem Leaf	House Construction Agricultural implements Fuel wood Medicinal
15.	Gulmohar	<i>Delonix regia</i>	<i>Leguminosae</i>	Stem	Fuel wood
16.	Dhoben	<i>Dillenia pentagyna</i> Roxb.	<i>Dilleniaceae</i>	Root	Medicinal
17.	Tendu	<i>Diospyros melanoxylon</i> Roxb.	<i>Ebenaceae</i>	Fruit Leaf	Edible (When ripe) Selling
18.	Bargad	<i>Ficus benghalensis</i>	<i>Moraceae</i>	Fruit	Edible
19.	Peepal	<i>Ficus religiosa</i>	<i>Moraceae</i>	Whole tree Fruit Leaf	Religious Edible Fodder
20.	Kekad	<i>Garugapinnata</i> Roxb.	<i>Burseraceae</i>	Stem	Agricultural implements
21.	Lendia	<i>Lagerstroemia parviflora</i> Roxb.	<i>Lythraceae</i>	Stem	Firewood Boundary wall making
22.	Maida	<i>Litsea sebifera</i>	<i>Lauraceae</i>	Bark	Medicinal
23.	Mahua/ Guli	<i>Madhuca indica</i>	<i>Sapotaceae</i>	Flower Fruit Leaf	Edible after cooking Liquor preparation Oil Religious
24.	Aam	<i>Mangifera indica</i>	<i>Anacardiaceae</i>	Fruit Seed	Edible Edible, medicinal
25.	Kem	<i>Mitragyna parviflora</i>	<i>Rubiaceae</i>	Leafy branch	Cultural uses
26.	Munga	<i>Moringa pterygosperma</i> Gaertn.	<i>Moringaceae</i>	Leaf Fruit	Edible Edible
27.	Amla	<i>Phyllanthus emblica</i>	<i>Euphorbiaceae</i>	Fruit Leaf	Edible and medicinal Cultural and medicinal
28.	Kanji	<i>Pongamia pinnata</i>	<i>Fabaceae</i>	Fruit	Oil extraction
29.	Bija	<i>Pterocarpus marsupium</i> Roxb.	<i>Fabaceae</i>	Stem	House construction Furniture
30.	Kusum	<i>Schleichera trijuga</i> Willd.	<i>Sapindaceae</i>	Fruit	Edible
31.	Bhelwa	<i>Semecarpusanacardium</i>	<i>Anacardiaceae</i>	Fruit	Edible, Medicinal
32.	Sarei	<i>Shorea robusta</i> Gaertn.	<i>Dipterocarpaceae</i>	Stem	House construction Furniture Fuel wood Plough Making Cultural, Tooth brush, oil
33.	Gulhar/kullu	<i>Sterculia urens</i>	<i>Sterculiaceae</i>	Resin Bark Stem Fruit Leaf	Medicinal Rope making Cultural Edible Cultural and medicinal
34.	Jamun	<i>Syzygium cumini</i>	<i>Myrtaceae</i>	Stem Fruit Leaf	Cultural Edible Cultural and medicinal
35.	Emli	<i>Tamarindus indica</i>	<i>Caesalpiniaceae</i>	Fruit	Edible, Pickle preparation, Medicinal, Selling
36.	Sagaun	<i>Tectona grandis</i>	<i>Lamiaceae</i>	Stem Leaf	House construction, Furniture Cultural. Dona making
37.	Arjun	<i>Terminalia arjuna</i>	<i>Combretaceae</i>	Stem	Firewood, House construction
38.	Beheda	<i>Terminalia bellirica</i>	<i>Combretaceae</i>	Fruit	Medicinal (Digestive)
39.	Harra	<i>Terminalia chebula</i>	<i>Combretaceae</i>	Fruit	Medicinal (Digestive)
40.	Saja	<i>Terminalia tomentosa</i>	<i>Combretaceae</i>	Stem	House construction Fuel wood Used during marriage

Table 4. Traditionally used Shrub species by local people in AABR.

S. No.	Common name	Scientific name	Family	Parts used	Uses
1.	Ghughch	<i>Abrus precatorius</i>	<i>Fabaceae</i>	Leaves	Mouth freshener
2.	Bans	<i>Bambusa bamboo</i>	<i>Poaceae</i>	Seeds	mix into flour
3.	Chakor	<i>Cassia tora</i>	<i>Caesalpiniaceae</i>	Pod and seed	Vegetable
4.	Ratan jot	<i>Jathropa curcus</i>	<i>Euphorbiaceae</i>	Seed Whole plant	Substitute of candle Bio-fencing
5.	Lantana	<i>Lantana camara</i>	<i>Verbenaceae</i>	Ripen fruits Whole plant	Edible Bio-fencing
6.	Khajuri	<i>Phoenix sylvestris</i>	<i>Arecaceae</i>	Ripen fruits	Edible.
7.	Mainhar	<i>Randia dumetorum</i>	<i>Rubiaceae</i>	Leaf Root	Vegetable Medicinal
8.	Arandi	<i>Ricinis communis</i>	<i>Euphorbiaceae</i>	Seed	Oil
9.	Nirgundi	<i>Vitex nigundo</i>	<i>Verbenaceae</i>	Leaf	Medicinal
10.	Ber	<i>Zizipus zilopyrus</i>	<i>Rhamnaceae</i>	Fruit	Edible
11.	Aak	<i>Calotropis gagentia</i>	<i>Musaceae</i>	Leaf & flower	Offer to god

S. No.	Common name	Scientific name	Family	Parts used	Uses
12.	Banana	<i>Musa paradisca</i>	Family	Whole tree	Religious use
13.	Mehandi	<i>Lawsonia irnensis</i>	<i>Lythraceae</i>	Leaf	Dye

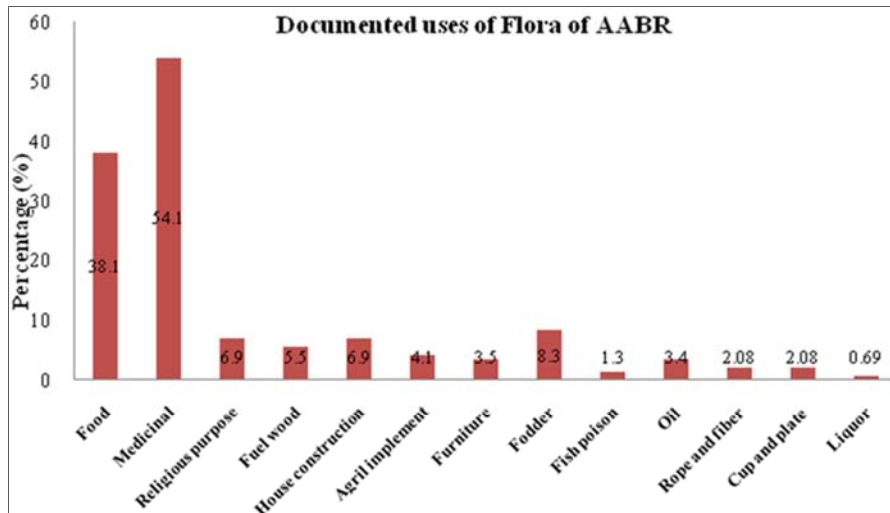


Figure 2. Traditionally used flora of AABR for diverse usufructs by local people.

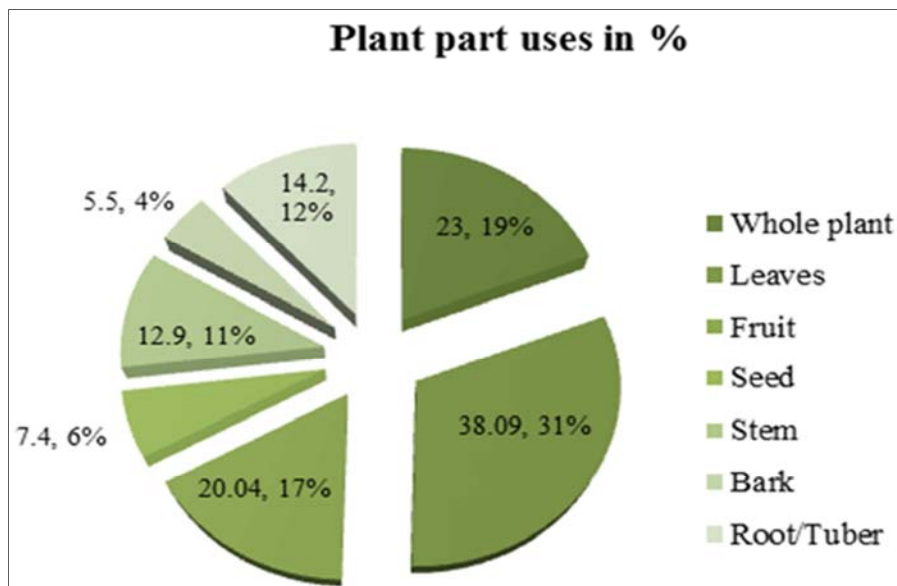


Figure 3. The utilisation pattern of plant part used by local people of AABR.

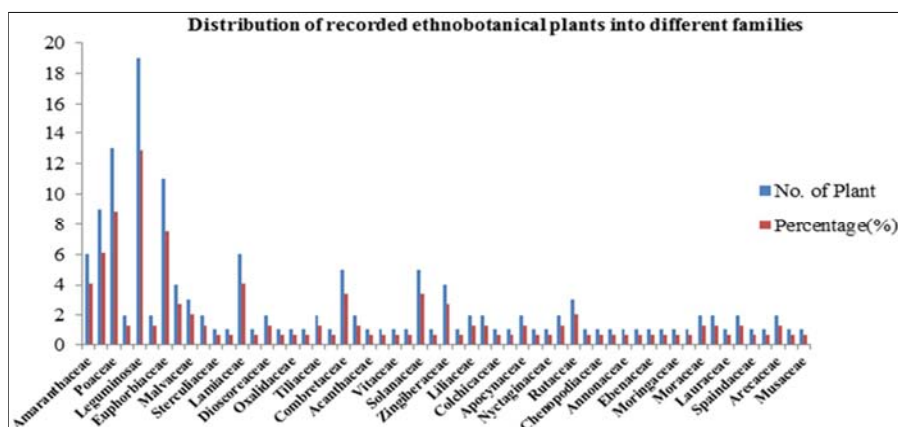


Figure 4. Distribution of recorded ethnobotanical plants into botanical families.

Of the reported growth form of flora used by local people of AABR, tree & herbs make up the highest ratio of locally consumed species comprising 27.2% and 48.9% respectively (Figure 5). The present study on the traditional use of flora support by many earlier workers in India and elsewhere in world (Dlamini *et al.* 2011; Upriety *et al.* 2012; Panda, 2014; Dutta, 2015). Some of the studied floras are also used in Pachmarhi Biosphere Reserve and other parts of country (Sinha *et al.* 2005; Rout, 2007; Kala, 2009). Similar findings were laid by Bharucha *et al.* 2010, Dobriyal, *et al.* 2015. During the study we have observed that the products (forest) consumed or sold by these communities also have same use worldwide however, some of them are unique here, according to their (tribal's) indigenous knowledge and traditional uses like religious use, use of plant according to food habit and medicinal use. During the survey it was also observed that the Baiga is most primitive tribal's group of AABR and have enormous knowledge about the use of forest products. Due to modernization, like agriculture settlement (Pei *et al.* 2009), less interest of young generation (Panda, 2014) a drastic change in food styles (Negi *et al.* 2015) and very few documentation, the traditional knowledge remain in collective memory of the old faces and disappearing after the death of them.

Table 5. Listing of culturally associated flora (CAF) of AABR.

S.N	Local name	Scientific name	Culturally uses
1	Datura	<i>Datura metel</i>	Flower offer to god
2	Tulsi	<i>Ocimum sanctum</i>	Treated Prosperity of home
3	Bel	<i>Aegle marmelos</i>	Leaf offer to god

S.N	Local name	Scientific name	Culturally uses
4	Mahua	<i>Madhuca indica</i> L.	Look like as source of subsistence of life
5	Peepal	<i>Ficus religiosa</i>	Whole tree
6	Jamun	<i>Syzygium cumini</i> (L.)	Leaf used in festival
7	Aak	<i>Calotropis gagentia</i>	Leaf & flower offer to god
8	Aonla	<i>Phyllanthus emblica</i>	Whole tree
9	Banana	<i>Musaparadisiacal</i>	Whole tree
10	Mehandi	<i>Lawsonia irnemis</i>	Leaf dye used in marriage

The traditional knowledge, religious uses and cultural association of these communities with the natural resources serve as a conservation attitude. The same results were found in many earlier studies carried out in India (Pandey, 1997; Kala, 2009; Negi *et al.* 2015) and other parts of world (Gunatilleke *et al.* 1993; Anderson *et al.* 2002; Rist *et al.* 2008; Pie *et al.* 2009). These communities symbiotically linked with these natural resources and have a strong perception that they could not exist without forest in nature. They fulfill their need from forest and other hand they conserve the forest. During the study we have observed luxuriant forest growth in interior areas of biosphere. Several other studies all over the world found same result that the area which have lesser impact of outsider, have well maintained forest (Liu *et al.* 2000; Xu, 2003; Pei *et al.* 2007 & 2009). The persistence of the luxuriant growth of the forest in the interior areas of biosphere are the result of several unknown customs and tradition of these societies. Before collection and consumption of these floras, mainly culturally associated flora (CAF) they perform certain rituals and practices which serve as a conservation ethics for natural resources (Table 5).

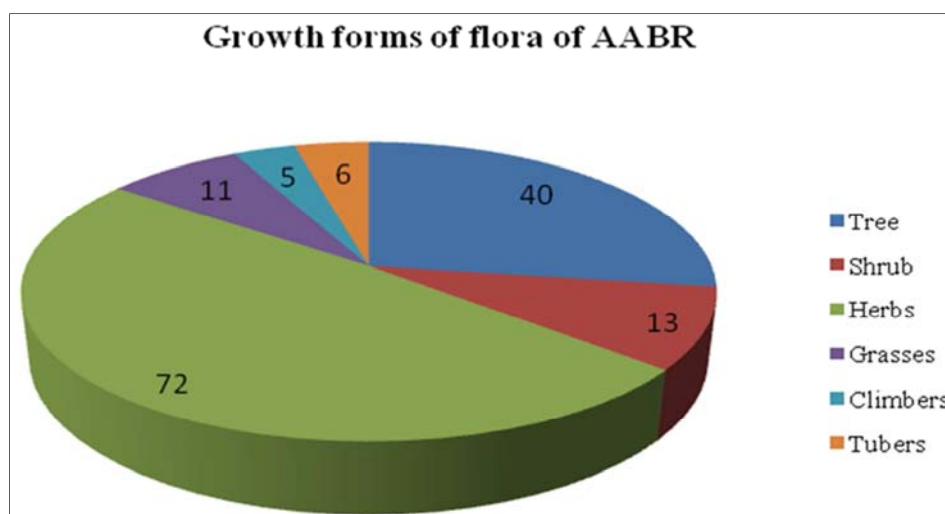


Figure 5. Reported growth forms of flora used by local people of AABR.

3.1. Aboriginals Assist to Biodiversity Conservation and Climate Protection

Tribal communities play leading role in conservation of biodiversity through their vast knowledge about the use of concerned flora and also association of flora with their culture. The conservation specially *in-situ* addressed to climate protection everywhere in the world. Recently

IPCC quoted that these are the communities which are in frontline of climate variability but due to their conservation tactics they easily takeoff from these variability. There are plenty of species which are conserved by them through their ritual association, due to their food habit and traditional value or commercial value of plants and principles of ethnoforestry among these communities (Table 6).

Table 6. List of species conserved on the name of god/goddess, on scared grooves and for edible purpose by tribal communities.

S.No.	Local Name	Scientific name	Family Name	Remark
1	Aam	<i>Mangifera indica</i>	Anacardiaceae	Lord Vidhyadhara
2	Arjun	<i>Terminalia arjuna</i>	Combretaceae	Lord Brhma
3	Nibu	<i>Citrus medica</i>	Rutaceae	Lord Brahaspati
4	Bilva	<i>Aegle marmelos</i>	Rutaceae	Lord Shiva
5	Nimba	<i>Azadiracta indica</i>	Meliaceae	Goddess Sheetla mata
6	Basil	<i>Ocimum sanctum</i>	Lamiaceae	Goddess Lakshmi
7	Baka	<i>Sesbania grandiflora</i>	Fabaceae	Lord Narayan
8	Karavira	<i>Nerium indicum</i>	Apocynaceae	Lord Ganesh
9	Nilapadma	<i>Nelumbi nucifera</i>	Nymphaeaceae	Goddess Ambika
10	Madar	<i>Calotropis gigantean</i>	Asclepiadeceae	Lord Shiva
11	Chirchita	<i>Achyranthus aspera</i>	Amaranthaceae	Tender shoots as vegetable
12	Molian leaf	<i>Bauhinia purpurea</i>	Cesalpiniaceae	Leaves, flower, seeds as vegetable
13	Dudhia aru	<i>Dioscorea alta</i>	Dioscoreaceae	Tubers used as vegetable
14	Palas	<i>Butea monosperma</i>	Fabaceae	Conserved on scared grooves
15	Slai	<i>Boswellia serrata</i>	Burseraceae	Conserved on scared grooves
16	Madar	<i>Calotropis gigantean</i>	Asclepiadeceae	Conserved on scared grooves
17	Bamboo	<i>Bambusa arudinacea</i>	Poaceae	Conserved on scared grooves
18	Sarpchandha	<i>Ravulofia serpentina</i>	Apocynaceae	Conserved on scared grooves
19	Aam	<i>Mangifera indica</i>	Anacardiaceae	Conserved on scared grooves
20	Peepal	<i>Ficus religiosa</i>	Moraceae	Conserved on scared grooves

Source: Jain, S.K. 1996. Ethnobiology in Human Welfare, Deep Publication, New Delhi.

Table 7. Forest products sale locally or in regional market by local people of AABR.

S No	Forest products	Season of collection	Duration (month)	Importance	Market value (in Rs.)	Multiple use of the product	Remark
1	Sal leaf	All season except leaf fall duration	8		Rs.15/1000 plates		5
2	Sal seed	May- June	2		Rs. 12/Kg	X	4
3	Fuel wood	All season	12		Rs. 90/ bundle (4 Kg)		3
4	mushroom	July- September	3		Rs. 150-200/ kg		1
5	Mahua flower	May-June	2		Rs. 30- 40/ kg		2
6	Bamboo kareel	Rainy season	3		Rs. 70-80/kg		2
7	Van karela (<i>Momordica charantia</i>)	Rainy season	3		Rs. 15-20/kg		3
8	mainahar	Rainy season	2		Rs. 10-15/kg		3
9	Uhar kuhar bhaji	All season	12		Rs.15-20/kg		3
10	Munga(<i>morina oliefera</i>)	Late summer to rainy season	3-4		Rs.10-15		3
11	<i>Murraya koenigii</i>	All season	8-12		Rs. 5-7/kg		5
12	Sal dhupa	Rainy season	1-2		Rs. 90-100/kg		1
13	Bahunia leaf	Rainy season	3-4		Rs. 12/kg		3
14	Aonla fruit	Late rainy season	2-3		Rs. 30-40/kg		2
15	Cassia tora	Summer to late rainy season	6-8		Rs.15-20/kg		2

Data Source: Based on Questionnaire Survey of forest villagers of AABR.

*Rank: 1-Highly important, 2- Important 3-Moderately important, 4- Less important, 5- Very less important, according to market price

The forest products collected from forest or nearby village are sale in local or regional market by the local people of AABR (Table 7). The forest products play important role in the viability and survival of tribal and non tribal communities of AABR. Forest dwellers of AABR collected these products from forest or nearby village area for household consumption and also for sale in the local market. Many wild edible plant species are found to be sold in the local markets particularly by poor and economically marginalized families, thereby generating a supplementary income to their household economy (Panda, 2014). Many earlier workers, worldwide also reported that forest is a source of subsistence of these

isolated communities (Chittaranjan, 2005; Colchester *et al.* 2006; Muhammed *et al.* 2010; Khera, 2016). The important role of forest products is not only in meeting the subsistence needs but also in poverty alleviation (FAO, 1995). The forest products are very economically important in point of view of subsistence of local people of BR. In case of these indigenous communities, the major factor of economics such as production, consumption and distribution are closely associated with forest (Chittaranjan, 2005). These hidden societies of the world have great assumption that the natural resources have only means of survival of our lives. Utilization of forest resources is a prerequisite for the

livelihood of remote villagers who do not have many other alternative source of income (Yeo-Chang, 2009). Forest and forest resources, predominantly minor forest products (vegetables, fruit, medicinal, gum, fuel wood, seeds, grasses, and even soil) occupy an important role in continued existence of tribal's life (Aboriginal communities) in AABR or elsewhere in world.

4. Conclusion

The results of this study has revealed that indigenous traditional knowledge on the use of flora like edible food, vegetables and cure to certain diseases is still practiced by the local communities of AABR. Beside, these uses the forest is also source of income, they sale some products in local or regional market. The local communities very well known to the uses of ethnobotanicals which are little known and unexplored to modern societies. So there is a strong need of documentation and conservation of these floras for as a source of food, medicine, and sustained income at a time of scarcity.

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