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PLANT DIVERSITY, STRUCTURE AND USES OF THE PLANTS IN HOME GARDEN OF JHARKHAND, INDIA

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ABSTRACT: Present study documents the plant diversity, structure and uses of plants of 100 home gardens in Gumla district of Jharkhand, India. A total of 116 species representing 50 families and 102 genera were documented. Dominating family recorded in the gardens was Fabaceae with 20 species. The plant species in home garden were classified as four strata in which the first strata consist of annuals and herbaceous plants (vegetables, medicinal and ornamental). Out of the total documented species, leaves of the 44 species were used followed by fruits (31 species), flowers (25 species) and least one species each for bulb, culm, bark, pods and stem. Majority of the plant species were used as vegetables (51 species) followed by traditional medicines (30 species) and least with two species each for house construction, furniture and agricultural implements. This study presented the baseline data about plant diversity in the home gardens, uses of plants and arrangement of the plants in the home gardens.

Keywords: Diversity, home garden, family, strata, Jharkhand

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Home-gardens are a part of agriculture and food production system in tropical countries as a remedy to alleviate hunger and malnutrition (Johnson *et al.*, 2000). These man-made gardens provide multiple goods to satisfy social, cultural and economic needs of the owners such as food, medicines, ornamental and spiritual wellbeing, fodder, fuel wood and products that generate monetary income (Caballero, 1992) and act as a bridge between biological and social components conserving species and genetic diversity (Sthapit *et al.*, 2004; Perrault-Archambault and Coomes, 2008). The garden reflects the wisdom of traditional culture and ecological knowledge that have evolved over the years. Such valuable traditional ecological knowledge systems are based on strong socio-cultural and traditional beliefs confounded by the economic status of the people (Okigbo, 1990). This study was undertaken at Gumla district of Jharkhand state to understand the rural community's sensitivity about how home gardens function and what are the different benefits they provide to the users, through analyzing both socio economic and diversity of plants in the home gardens.

MATERIAL AND METHODS

Study Area

The present study was conducted in Gumla district of Jharkhand state of India during May, 2014 to May, 2016.

The district with 5, 327 km² areas is located between latitudes 23.19° N and longitudes 84.52° E and having a total population of 10, 25, 656. Out of the total area 62.24% is under agriculture, 25.61 % under forest cover and rest under waste and non cultivable land.

Methodology

Data was collected from three different areas of Gumla district (Basia, Paalkot and Gumla) in which 100 respondents (home garden owners) were randomly selected for survey from each site through providing both open and close ended questionnaire, direct observation and by a face to face interview. The data thus collected was analysed for socio economic status of the owners, plant diversity and traditional utilization of the plants maintained in the home gardens.

Socio economic status

Structured questionnaires were used to document respondent's profile such as person's occupation, education, family size, no. of domestic animals, agriculture land (ha), area under home garden, agriculture crops and horticulture crops.

Plant inventory survey and utilization

The plant inventory survey was performed by using an open ended format which included common name and botanical name of plants, parts used and their uses. The survey was carried out with participatory observations, plants identification with local names and necessary

photographs for further identification. Data pertaining to the diversity and arrangement of plant species was done strata wise in the selected home gardens.

RESULTS AND DISCUSSION

Socio-economic

The socio-economic status of the selected home garden owners was presented in Table 1. Farming was the major occupation in Basia and Paalkot whereas in Gumla was is contrary (i.e. maximum people were from business sector). Apart from farming the other occupations was business, service and manual labourer. Family size in Basia and Paalkot consists of 4.5 and 4.3 members per family, respectively and in Gumla city the family size was 3.83. The area under home garden was highest in Paalkot (0.046 ha) followed by Basia (0.043 ha) and it was lowest in Gumla city (0.022 ha). Galluzzi et al., (2010) also reported different socio-economic conditions that determine significant variations across agroeco-systems in terms of its size. In contrast Gaston et al. (2005) reported the gardens in cities were larger. However, in cities there are fragmented resources due to scares land area

available (Ninez, 1884; Vase, 1985; Linares, 1996). In both the villages maximum number of domestic animals were recorded which consist of cattle, goat and poultry which ranged from 1-10 but in Gumla city only goats and hens (1-4/household) were reared. There was no land under cultivation for agricultural crops in Gumla city but some of the horticultural crops were found grown in home gardens.

Strata in home gardens

The plant species in home garden were layered into four strata. The first strata consist of annuals and herbaceous plants (vegetables, medicinal and ornamental). The second strata commonly included Papaya, Lemon, Banana, Ornamental shrubs (hibiscus and bougainvillea) and medicinal plants. Third strata included Jack fruit, Litchi, Beal and timber species such as Karanja and Kachnar and last strata consist taller fruit and timber yielding species like Mango, Jamun, Shisham, Teak, Neem, Simul (Table 2). Home gardens exhibit complex arrangement of plants both vertically and horizontally. Vertical arrangement is as a result of variation in total height of the plants at their maturity and

Table 1: Socio-economic status home garden owners in Gumla district of Jharkhand

	Basia	Paalkot	Gumla city
Occupation (%)			
- farmer	70	58	0
- business	12	24	54
- service	10	6	26
- labourer	8	12	20
Family size	4.5	4.3	3.83
Education (%)			
- 0-5 th	42	66	14
- 6-8 th	26	18	26
- 10 th	20	10	16
- 12 th & above	12	6	44
Average land under homegarden (ha)	0.043	0.046	0.022
Domestic animals (average count per house hold)			
- Cow			
- buffalo	2.0	1.0	00
- bulls	1.0	2.0	00
- calves	2.0	2.0	00
- goats	2.0	2-3	00
- hens	5.0	4-6	1-2
	7.0	5-10	2-4
Average agriculture land holding (ha)	1.23	1.51	0.00
Agriculture crops	Paddy, potato, vegetable, wheat	Paddy, potato, vegetable, wheat	Nil
Horticulture crops	Mango, Litchi, Guava, Ber, Papaya, Chilli,	Mango, Litchi, Guava, Ber, Chilli	Litchi, Guava, Papaya, Ber, Chilli

horizontal arrangement is because of intermixing of the species and individuals. The gardens are designed and managed on indigenous knowledge. These gardens harbours a wide diversity of local crops suited to social and traditional significance and are most promising and ecologically feasible option for the community. The indigenous knowledge used by the communities after repeated trial and error is now being regarded as an invaluable resource of a agri-diversity (Collins and Qualls et, 1998). It is believed that traditional home garden practices depend on the type of human community, tradition, needs and beliefs (Tangjang and Arunachalam, 2009). Home gardens are the sites that have long been considered as signs of prestige and pride (Zemedede and Ayele, 1995; Zemedede, 1997). They are complex, multi-storied environments with very high species diversity and a wide range of varied ecological micro-niches (Galluzzi et al., 2010) traditionally integrated within a larger surrounding ecosystem (Eyzaguirre and Linares, 2004). The choice of plant species, their arrangement and management varies between and within tropical home gardens in the same community (Mendez et al., 2001). Medicinal plants are planted in the lower strata of multistrata systems such as home gardens (Rao et al., 2004).

Plant diversity in home gardens

The diversity of various plant species with their local name, botanical name and family were given in table 3. Altogether 116 species represented by 102 genera and 50 families were recorded from the home gardens. Dominating family recorded in the gardens was Fabaceae with 20 species. Genera *Ficus* and *Solanum* was represented by three species each while *Allium*, *Hibiscus*, *Jasminium*, *Limnophila* and *Luffa* were

represented by two species each. Similarly many studies across the world also have reported wide diversity in home gardens (Rico-Gray et al., 1991; Mendez and Somarriba, 2001; Shastri et al., 2002; Das and Das, 2005; Panwar and Chakravarty, 2010; Jagamohan et al., 2013). Species diversity, size, shape and plant density vary from place to place depending on cultural ecological and socio-economic factors (Rico Gray et al., 1990). Although the farmers and land owners integrate a variety of woody perennials in their crop and livestock enterprises, most of these practices are highly location specific and information on these in India are mostly anecdotal (Nair and Dagar, 1991). Species diversity of perennial plants was reported higher in home gardens located in slopes while diversity of annuals were greater in home gardens at flat land (Senanayake et al., 2009). Predominance of trees is common especially the fruit species particular when these are crucial for the diet of household members in terms of vitamins and fibres. Other edible species, wild or domesticated are the next most represented category (Nuberg et al., 1994; Egodawatta and Warnasooriya, 2014).

Utilization

Utilization of the recorded plant species and their parts used is presented in Table 3 and Figure 1 - 2. Out of the total documented species, leaves of the 44 species were used followed by fruits (31 species), flowers (25 species) and least one species each for bulb, culm, bark, pods and stem. (Figure 1). Majority of the plant species were used as vegetables (51 species) followed by traditional medicines (30 species) and least with two species each for house construction, furniture and agricultural implements (Figure 2). Medicinal plant

Table 2: Arrangement and diversity of species (component) in Home gardens

Sl. No.	Strata	Plant component	Animal component
1	First	Vegetables Potato, pumpkin, bottle gourd, bitter gourd, brinjal, lady's finger, bean, cucumber, radish, carrot, water melon, pea; medicinal/aromatic like tulsi, aloe vera, mint, garlic, onion, chilli, coriander and flowers like rose, chrysanthemum, marigold	Cow, buffalo, goat, hen, bullocks
2	Second	Fruits like lemon, banana, papaya; flowers like hibiscus, bougainvillea, and medicinal/fencing like <i>Jatropha</i> , <i>Moringa</i>	
3	Third	Fruit/fodders like jackfruit, litchi, bael, and timbers like <i>Karanja</i> , <i>Kachnar</i>	
4	Fourth	fruits like mango, jamun; timber/fodder, etc. like, <i>Shisham</i> , <i>semul</i> , <i>neem</i> , <i>siris</i> , <i>teak</i> , <i>neem</i> , <i>Eucalyptus</i> and <i>bamboos</i>	

species was identified as one of the key characteristics of traditional home gardens (Ninez, 1987). Medicinal plants in home gardens are either deliberately cultivated or they come up spontaneously as wild and weedy species (Gao *et al.*, 2012; Schaffert *et al.*, 2012). These gardens are not only important sources of food, fodder, fuel, medicines, spices, construction materials and income in many countries around the

world, but are also important for *in situ* conservation of a wide range of plant genetic sources (Galluzzi *et al.*, 2010). In terms of composition, high diversity of species with an immediate use in the home is the most prominent feature of home gardens (Hoogerbrugge and Fresco, 1993).

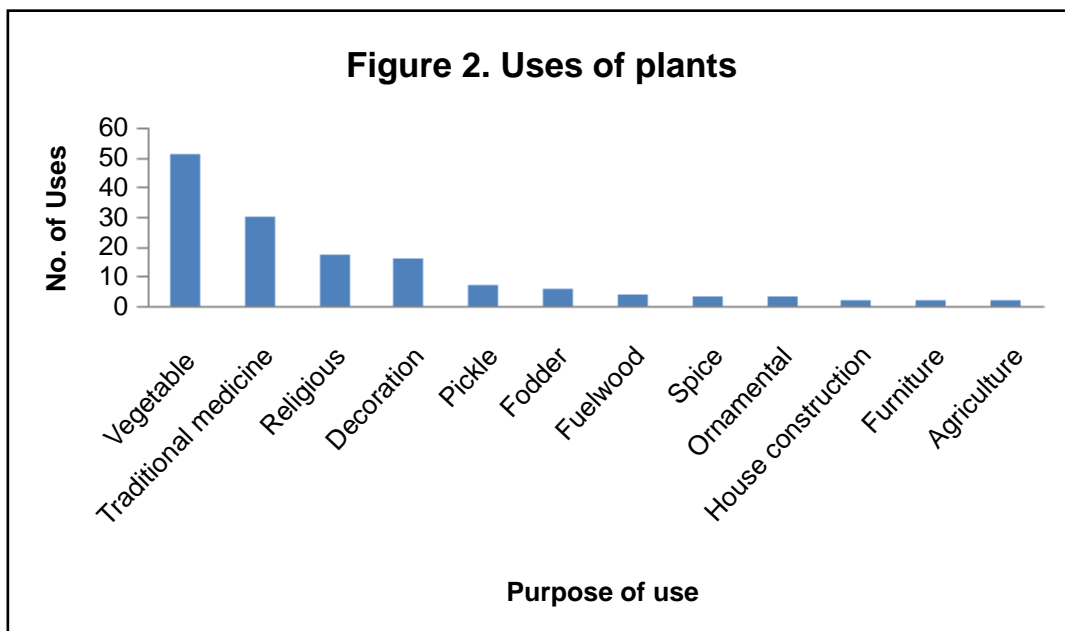
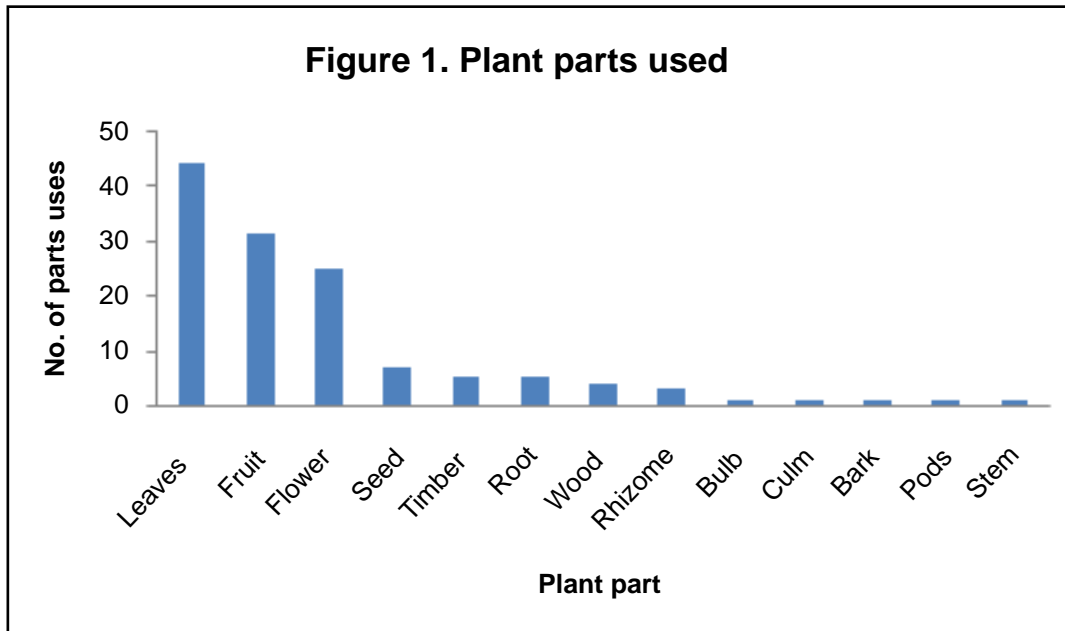


Table 3: Details of plant species are present in home gardens in Gumla district of Jharkhand

Sl. No	Local Name	Botanical Name	Family	Part Used	Uses
1	Vasak	<i>Adhatoda vasica</i>	Acanthaceae	Leaves	Leaves are boiled in water with sugar and salt and used during cold and cough
2	Khaprasaag	<i>Trientema monogyna</i>	Aizoaceae	Leaves	Vegetable
3	Chulai	<i>Amaranthus tricolour</i>	Amaranthaceae	Leaves	Vegetable
4	Palak	<i>Spinacia oleracea</i>	Amaranthaceae	Leaves	Vegetable
5	Pyaj	<i>Allium cepa</i>	Amaryllidaceae	Bulb	Prevent sun stroke
6	Lehsun	<i>Allium sativum</i>	Amaryllidaceae	Rhizome	Allergy
7	Aam	<i>Mangifera indica</i>	Anacardiaceae	Fruit	Unripe fruit as pickle and ripe fruit as table purpose
8	Sharifa	<i>Annona reticulate</i>	Annonaceae	Fruit	Ripe fruit used as table purpose
9	Champa	<i>Michelia champaca</i>	Annonaceae	Flower	Flower used for decoration
10	Beng Sag	<i>Centella asiatica</i>	Apiaceae	Leaves	Vegetable
11	Dhania	<i>Coriandrum sativum</i>	Apiaceae	Seed	Spice
12	Gajar	<i>Daucus carota</i>	Apiaceae	Root	Vegetable, pickle
13	Sadabahaar	<i>Cathranthus roseus</i>	Apocynaceae	Flower	Flower used for decoration and religious purpose
14	Gurmar	<i>Gymnema sylvestre</i>	Apocynaceae	Leaves	Leaf juice in diabetes
15	Caner	<i>Nerium indicum</i>	Apocynaceae	Flower	Flower used for decoration and religious purpose
16	Chandini	<i>Tabernaemontana divaricata</i>	Apocynaceae	Flower	Flower used for decoration and religious purpose
17	Kaner	<i>Thevetia peruviana</i>	Apocynaceae	Flower	Ornamental
18	Oal	<i>Amorphophallus paeoniifolius</i>	Araceae	Leaves	Vegetable
19	Pekchi sag	<i>Colocasia esculanta</i>	Araceae	Leaves	Vegetable
20	Khajur	<i>Phoenix dactylifera</i>	Arecaceae	Fruit	Ripe fruit used as table purpose
21	Bhringraj	<i>Eclipta prostrate</i>	Asteraceae	Leaves	Improving the memory and hair growth
22	Surajmukhi	<i>Helianthus annuus</i>	Asteraceae	Flower	Flower used for decoration and religious purpose
23	Poi	<i>Basella Alba</i>	Basellaceae	Leaves	Vegetable
24	Begonia	<i>Begonia oblique</i>	Begoniaceae	Flower	Flower used for decoration and religious purpose
25	Mayurhati	<i>Heliotropium indicum</i>	Boraginaceae	Leaves	wounds
26	Sarson	<i>Brassica nigra</i>	Brassicaceae	Leaves	Leaves as vegetable and seed for oil

Sl. No	Local Name	Botanical Name	Family	Part Used	Uses
27	Phoolgobhi	<i>Brassica oleracea</i>	Brassicaceae	Flower	Vegetable, pickle and dried for using in rainy season
28	Bandhgobhi	<i>Brassica oleracea</i>	Brassicaceae	Flower	Vegetable, pickle and dried for using in rainy season
29	Muli	<i>Raphanus sativus</i>	Brassicaceae	Root	Vegetable, pickle
30	Koinar	<i>Bauhinia variegata</i>	Caesalpiniaceae	Leaves and Flowers	Vegetable
31	Genda	<i>Calendula officinalis</i>	Calenduleceae	Leaves, flower	Leaf juice used during ear pain. Flower are used for decoration as well as for religious purpose
32	Bhatua	<i>Chenopodium album</i>	Chenopodiaceae	Leaves	Vegetable
33	Kenna	<i>Comelina bengalensis</i>	Commelinaceae	Leaves	Vegetable
34	Kanda Sag	<i>Ipomea batatas</i>	Convolvulaceae	Leaves	Vegetable
35	Koddu	<i>Cucurbita pepo</i>	Cucurbitaceae	Fruit	Vegetable
36	Louki	<i>Lagenaria ceraria</i>	Cucurbitaceae	Fruit	Vegetable
37	Tori	<i>Luffa acutangula</i>	Cucurbitaceae	Fruit	Vegetable
38	Kali Tori	<i>Luffa aegyptiaca</i>	Cucurbitaceae	Fruit	Vegetable
39	Karela	<i>Momordica charantia</i>	Cucurbitaceae	Fruit	Vegetable, pickle
40	Ratanjyoti	<i>Jatropha curcas</i>	Euphorbiaceae	Whole plant	Tooth stick and fencing around home garden
41	Sij	<i>Pedilanthus tithymaloides</i>	Euphorbiaceae	Leaves	Malaria
42	Babool	<i>Acacia nilotica</i>	Fabaceae	Wood	Fuel wood
43	Palash seed	<i>Butea monosperma</i>	Fabaceae	Leaves	Boils, pimples
44	Arhar	<i>Cajanus cajan</i>	Fabaceae	Leaves, seed	Leaves anaemia, diabetes and Seeds for flour
45	Amaltas	<i>Cassia fistula</i>	Fabaceae	Flower	Ornamental purpose
46	Chakod	<i>Cassia tora</i>	Fabaceae	Leaves	Vegetable
47	Chana	<i>Cicer arietinum</i>	Fabaceae	Leaves	Leaves as vegetable and seeds for other various purpose
48	Sanai phool	<i>Crotolaria juncea</i>	Fabaceae	Leaves	Vegetable
49	Shisham	<i>Dalbergia sissoo</i>	Fabaceae	Timber	Furniture
50	Jirhul phool	<i>Indigophera tinctoria</i>	Fabaceae	Leaves	Vegetable
51	Sem	<i>Lablab purpureus</i>	Fabaceae	Fruit	Vegetable
52	Subabul	<i>Leucaena leucocephala</i>	Fabaceae	Wood	Fuel wood
53	Karanj	<i>Millettia pinnata</i>	Fabaceae	Leaves, wood	Fuel wood and leaves as fodder
54	Lajwanti	<i>Mimosa pudica</i>	Fabaceae	Root	Leprosy, dysentery

Sl. No	Local Name	Botanical Name	Family	Part Used	Uses
55	Kachnar	<i>Phanera variegata</i>	Fabaceae	Flowers	Ornamental purpose
56	Sem	<i>Phaseolus vulgaris</i>	Fabaceae	Fruit	Vegetable
57	Matar	<i>Pisum sativum</i>	Fabaceae	Fruit	Vegetable, pickle
58	Methi	<i>Trigonella foenum graecum</i>	- Fabaceae	Leaves	Leaves as vegetable and seeds as spice
59	Mung	<i>Vigna radiate</i>	Fabaceae	Seed	Food
60	Bodi	<i>Vigna unguiculata</i>	Fabaceae	Seed	Food
61	Gulmohar	<i>Delonix regia</i>	Fabaceae	Flower, wood	Ornamental purpose, fuel wood
62	Murwa	<i>Marjorana hortensis</i>	Lamiaceae	Leaves	Essentialoil, improve appetite
63	Pudina	<i>Mentha arvensis</i>	Lamiaceae	Leaves	Leaves used during summer for preventing sun stroke
64	Tulsi	<i>Ocimum sanctum</i>	Lamiaceae	Leaves	Plant is the symbol of religious and leave are used with black pipper during cold & cough.
65	Teak	<i>Tectona grandis</i>	Lamiaceae	Timber	Furniture
66	Vitex	<i>Vitex negundo</i>	Lamiaceae	Leaves, fruit	Leaf juice for reducing fat and ulcers. Flowers are useful in fever and diarrhea
67	Anar	<i>Punica granatum</i>	Lythraceae	Fruit	Ripe fruit used as table purpose
68	Bhindi	<i>Abelmoschus esculentus</i>	Malvaceae	Fruit	Vegetable
69	Semal	<i>Bombax cieba</i>	Malvaceae	Seed	Seed as a concentrate for animal and fiber
70	Phalsa	<i>Grewia asiatica</i>	Malvaceae	Fruit	Pickle
71	Gudhal	<i>Hibiscus rosa-sinensis</i>	Malvaceae	Flower	Flower used for decoration and religious purpose
72	Kudrum	<i>Hibiscus sps.</i>	Malvaceae	Leaves	Burns, boils
73	Neem	<i>Azadirachta indica</i>	Meliaceae	Leaves, bark, timber	Hut construction & agriculture implements. Leaf and bark are used as medicinal purpose. Leaf of the plant also used as goat fodder.
74	Amrita	<i>Tinospora cordifolia</i>	Menispermaceae	Root	Root extract helps in stomachache
75	Siris	<i>Albizia lebbeck</i>	Mimosaceae	Timber	Hut construction & agriculture implements.
76	Kathal	<i>Artocarpus hetrophyllus</i>	Moraceae	Fruit and vegetable	Unripe fruit as pickle and vegetable
77	Barhar	<i>Artocarpus lakoocha</i>	Moraceae	Fruit	Unripe fruit as pickle & vegetable and ripe fruit used as table purpose
78	Rubber	<i>Ficus elastic</i>	Moraceae	Leaves	Leaf as fodder and religious purpose

Sl. No	Local Name	Botanical Name	Family	Part Used	Uses
79	Phutkal	<i>Ficus geniculata</i>	Moraceae	Leaves	Vegetable
80	Pipal	<i>Ficus religiosa</i>	Moraceae	Leaves	Leaf as fodder and religious purpose
81	Shetoot	<i>Morus alba</i>	Moraceae	Fruit	Leaf of the plant used as fodder. Fruit as table
82	Sajana	<i>Moringa olifera</i>	Moringaceae	Pods, leaves and flower	Pods, tender leaves and flower used as vegetable
83	Kela	<i>Musa acuminata</i>	Musaceae	Fruit	Vegetable, unripe fruit as pickle and ripe fruit as table purpose
84	Eucalyptus	<i>Eucalyptus globules</i>	Myrtaceae	Leaves, timber	Agricultural implements and leaf as medicinal purpose.
85	Amrud	<i>Psidium guajava</i>	Myrtaceae	Fruit	Ripe fruit used as table purpose
86	Jamun	<i>Syzygium cumini</i>	Myrtaceae	Fruit and seed	Fruit and seed are used for diabetic purpose. Leaf of the plant used as fodder
87	Punarnava	<i>Boerhavia diffusa</i>	Nyctaginaceae	Leaves and root	Leaves and root extract helps in jaundice
88	Bouganvillea	<i>Bouganvillea glabra</i>	Nyctaginaceae	Flower	Flower used for decoration and religious purpose
89	Charbajia	<i>Mirabilis jalapa</i>	Nyctaginaceae	Flower	Flower used for decoration and religious purpose
90	Beli	<i>Jasminum officinale</i>	Oleaceae	Flower	Flower used for decoration and religious purpose
91	Netho sag	<i>Oxalis corniculata</i>	Oxalidaceae	Leaves	Vegetable
92	Til	<i>Sesamum indicus</i>	Pedaliaceae	Seed	Acne
93	Bhuiamla	<i>Phyllanthus niruri</i>	Phyllanthaceae	Leaves	Leaves extract helps in constipation
94	Baans	<i>Bambusa vulgaris</i>	Poaceae	Culms	Fencing, agriculture implements
95	Ber	<i>Ziziphus mauritiana</i>	Rhamnaceae	Fruit	Leaf of the plant used as fodder and religious purpose. Fruit as table
96	Aru	<i>Prunus persica</i>	Rosaceae	Fruit	Ripe fruit used as table purpose
97	Nashpati	<i>Pyrus communis</i>	Rosaceae	Fruit	Ripe fruit used as table purpose
98	Gulab	<i>Rosa rubrifolia</i>	Rosaceae	Flower	Flower used for decoration and religious purpose
99	Gandhraj	<i>Gardenia jasminoides</i>	Rubiaceae	Flower	Flower used for decoration and religious purpose
100	Chameli	<i>Jasminium oleaceae</i>	Rubiaceae	Flower	Flower used for decoration and religious purpose
101	Sarla sag	<i>Vangueria spinosa</i>	Rubiaceae	Leaves	Vegetable

Sl. No	Local Name	Botanical Name	Family	Part Used	Uses
102	Bael	<i>Aegle marmelos</i>	Rutaceae	Fruit	Juice during summer season
103	Kamini	<i>Murraya paniculata</i>	Rutaceae	Flower	Flower used for decoration and religious purpose
104	Litchi	<i>Litchi chinensis</i>	Sapindaceae	Fruit	Ripe fruit used as table purpose
105	Mahuwa	<i>Madhuca longifolia</i>	Sapotaceae	Fruit, flower and leaves	Leaf of the plant used as fodder. Local bear prepared from the fruit.
106	Muchari Sag	<i>Limnophila conferta</i>	Scrophulariaceae	Leaves	Vegetable
107	Mirch	<i>Capsicum annum</i>	Solanaceae	Fruit	Spices, pickle and dried for using in rainy season
108	Mircha	<i>Capsicum annum</i>	Solanaceae	Fruit	Vegetable, pickle
109	Rat ki rani	<i>Cestrum nocturnum</i>	Solanaceae	Flower	Flower used for decoration and religious purpose
110	Tomato	<i>Solanum lycopersicum</i>	Solanaceae	Fruit	Vegetable and sauce
111	Baingan	<i>Solanum melongana</i>	Solanaceae	Fruit	Vegetable
112	Alu	<i>Solanum tuberosum</i>	Solanaceae	Tuber and tender leaves	Vegetable, chips and paste is used for burn
113	Hadjod	<i>Cissus quadrangularis</i>	Vitaceae	Stem	Stem paste used in bone fracture
114	Aloe vera	<i>Aloe barbandensis</i>	Xanthorrhoeaceae	Leaves	Leaves jell applied on burn
115	Haldi	<i>Curcuma longa</i>	Zingiberaceae	Rhizome	Powder of turmeric used with milk as a antibiotic
116	Adrak	<i>Zingiber officinalis</i>	Zingiberaceae	Rhizome	Paste of ginger with sugar, salt and black piper are used during cold and cough

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