



Crop Diversity in Traditional Jhum Cultivated Land Practiced by Ethnic Nocte and Wancho of Eastern Himalaya

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ABSTRACT: Shifting (Jhum) cultivation is a primitive practice of cultivation in States of North-eastern Hill Region of India. Present study was undertaken in the different traditional slash-and-burn farming practice of Nocte and Wancho tribe in Tirap and Longding District of Arunachal Pradesh a part of Eastern Himalaya. Shifting cultivators generally practice mixed or multiple cropping, therefore agricultural diversity tends to be higher in Jhum cultivation systems than on the sedentary farms of the lowlands. A total of 60 species of crop plants belonging to 25 families were found in the present study. The families, Cucurbitaceae (10 species), Poaceae (7 species), Solanaceae (8 species), Apiaceae (3 species) and Dioscoreaceae (3 species) were represented by higher number of species. Cultivation of most of the traditional crops in small population size per household is an important way to conservation.

KEY WORDS: Conservation, Crop rotation, Fallow period, Terrace cultivation.

I. INTRODUCTION

Tropical forests are important natural resources for the livelihoods of many communities and indigenous peoples as a source of food, income, fuel, medicine, and land for farming—which can lead to replacing forests with small-scale agricultural fields. And half of the world population is engaged in agriculture. Agriculture is the main occupation of the people of North-east. Shifting (Jhum) cultivation is a primitive practice of cultivation in States of Northeastern Hill Region of India.

This primitive type of cultivation involves clearance of forest on sloppy land, drying and burning debris and cropping. After harvest, land is left fallow and cultivators repeat the process in a new plot designated for the year for Jhum cultivation. This slash-and-burn system of cultivation is a unique feature of the region, which covers nearly 2 million hectares area (one-fourth of the total cropped area). However, the system faces criticism due to its low productivity and environmental diseconomies, but provides support to about 443 thousand Jhumia households in north-east India (Barah, 2006).[1].

The region receives moderately high rainfall and the average minimum and maximum are 1650 mm and 6320 mm, respectively. High rainfall in the study area favors luxuriant growth of the vegetation. After the cultivation, the fallow land is immediately covered by vegetation. The regeneration is very much fast. Further recent researcher has shown that Jhum help to maintain ecological diversity and does not because widespread destruction of the top soil as was originally perceived [2](Dash, 2006). Shifting cultivation helps to maintain the soil nutrients in the cultivated land. Fallow period is very important character to restore the soil nutrients. However, due to high population growth fallow period has been decreasing day by day. Crop rotation is key in large-scale, long term operations. Jhum practice has some importance as it is environmentally friendly because it is organic farming; it is often a form of weed and pest control. It may also helps in reducing the incidence of soil-borne diseases. The Jhum cultivators, who are locally known as Jhumias are supposed to be self sufficient as far as their food requirement is concerned.

Arunachal Pradesh is one of the Biodiversity Hotspot areas in and harbours a very rich and diverse flora. It may be regarded as emporia of many wild relatives of cultural and economic plants. It is a land of a large number of tribes and sub-tribes with intricate lifestyle. There are about 26 major tribes in Arunachal with more than 100 sub-tribes. The present practice of traditional slash-and-burn agriculture (locally called Jhum kheti) by the ethnic Noctes in



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Tirap district and Wancho tribe of Arunachal Pradesh, India is a part of history of rural landscapes. Even today, in some remote areas the local Jhumias totally depends on this traditional farming system for their livelihood.

Shifting cultivators generally practice mixed or multiple cropping, therefore agricultural diversity tends to be higher in Jhum cultivation systems than on the sedentary farms of the lowlands. The practical use of crop diversity goes back to early agricultural methods of crop rotation and fallow fields, planting and harvesting one type of crop on a plot of land one year, and using a different crop the next based on differences in a plant's nutrient needs.

II. MATERIALS AND METHODS

Study site

Present study was undertaken to know the crop diversity in the different traditional slash-and-burn farming practice of Nocte and Wancho tribe in Tirap and Longding District of Arunachal Pradesh a part of Eastern Himalaya. It lies between the latitudes 26° 38' N and 27° 47' N and the longitudes 96° 16' E and 95° 40' E. The vegetation of the study area largely consists of tropical and subtropical evergreen forest with inter spread grasslands and temperate forests in the high hills. This district is also home to several rare species of flora and fauna. Most of the jungles are not virgin forests.

Methods

Extensive field survey was made in ethnic Nocte and Wancho Jhumia families from December 2013 to April 2014. Total of 10 villages of Tirap and Longding were selected for field study. In Nocte dominated randomly five selected villages namely Old tupi, New tupi, Luthong, Lapnan, Borduria and ten jhumia families were selected from each study village. Similarly, five villages namely Ranglua, Laonu, Russa, Naitong and Kamkuh with eight Jhumia families were selected randomly from Longding district of Arunachal Pradesh.

The data on traditional practices of the indigenous agriculture are collected from published data in addition to primary data collected during December-June 2014 through semi-structured interview schedules and discussions with farmers. Photographs of different stages of Jhum field and crop species were taken. Different crop species found in Jhum field of Tirap and Longding districts were collected and were identified comparing with different herbarium of Department of Botany, USTM, books (Flora of Assam, Kanjillal), internet and available references and the species which were unable to identify were taken to BSI, Shillong.

III. RESULTS AND DISCUSSION

In the present study, it was found that in indigenous ethnic Noctes and Wancho tribes of Tirap and Longding District of Arunachal Pradesh about 70-80% of the populations live in rural villages where agriculture is practiced along traditional lines whilst only about 15-20% is employed. The topography of the districts is undulating mountainous terrain and is unique for its flora and fauna. The indigenous Noctes and Wanchos entirely depend on nature for their livelihood.

Crop diversity

During the survey, the farmers informed that mixed cropping is generally practiced in this traditional system of farming. A huge variety of crops plants are intercropped in a single plot. During the exploration on crop plants in various Jhum field of this two dominating tribe of Tirap and Longding district, 60 species of crop plants belonging to 25 families were collected. The details regarding Family, Habits, Parts used and mode of their used of different crop plants is given in Table 1.

Different forms of crop like cereals, (*Oryza sativa*, *Zea mays* etc), tuberous crops (such as *Colocasia esculentum*, *Ipomoea batatas* etc), vegetables crops (*Solanum macrocarpon*, *Solanum Melongena*, *Cucurbita maxima* etc), and spices (*Zingiber officinale*, *Alleum hookeri*, *Eryngium foetidun* etc) were encountered during the study. The families, Cucurbitaceae (10 species), Poaceae (7 species), Solanaceae (8 species), Apiaceae (3 species) and Dioscoreaceae (3 species) were represented by higher number of species.

Present study presents more in diversity than the different Bhuyan et al. (2012) who reported 39 species of crop plants belonging to 14 Families among 'Adi' tribe in East Siang, Arunachal Pradesh [3]. Similarly Tangjang

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(2009) reported 20 species in the Jhum field of Nocte tribe of Arunachal Pradesh [4]. Asata & Yadav (2004) reported 12 species of Solanum, 9 species of Chillies and 18 species of Cucurbitaceae growing in Jhum field of North-East India [5] and According to Dikshit, 2004 about 22 important crop species are growing in Jhum field of North-East India [6].

This huge crop diversity has been well maintained through a variety of crop compositions, cropping patterns and crop rotations. Cultivation and cropping pattern is not the same and varies from village to village. It has been observed that millets along with vegetables and pulses are grown as a first year crops.

However, it was also informed that in all the villages of the districts, towards the beginning of April, paddy as a second year crop was broadcast as an important crop in pure. Yield also differs in every village depending on local climate factors. Introducing terrace cultivation on Jhum lands, diversification into horticulture, plantation crops (Bamboo, tea, tokopatta etc), agro forestry etc are the causes of treats on crop diversity. Farmers are also interested in commercial crops like Ginger, soybeans and fruits plantation for their economic growth.

Mix cropping pattern in traditional Jhum is converted to mono cropping where more care is taken for their high productivity. Moreover, in Jhum cultivation fertilizers are not used but increase in modern and commercial agriculture practices causing degradation of land quality, soil erosion and also loss of crop diversity.

Shifting cultivation is commonly practiced in tribal areas, which represent rich traditional crop diversity. But due to poor economic, socio-cultural reasons and market forces there is a gradual reduction in area of several traditional crops. Many traditional crops provide low yield and low income. So, villagers are interested to change their pattern of cropping from mixed cropping to monocropping which can provide them good income. A major percentage of the traditional agriculture land in these areas has been brought under cash crops or seasonal vegetables. Rice and Millets are grown in maximum numbers. The crop which has high value in market and public demand farmers prefers those crops. So, indirectly Jhuming is gradually changing to market-oriented agricultural system.

Cultivation of most of the traditional crops in small population size per household is an important way to conservation. Through the Jhum cultivation, having long fallow period and maintenance of mix cropping will help to manage and conserve the crop diversity of this areas. In many Nocte villages (Lapnan, Luthong, Tupi, Borduria villages) and in Wancho villages (Ranglua, Russa, Kamkuh, Laonu) the fallow period has dropped to 5-10 years, especially near roads and areas with high population density. However, it was also found that there are still a few villages where fallow period is well maintained more than ten years.

Table 1. Crop Species Diversity and their uses collected from the Jhum Field of Nocte and Wancho Tribe.

A. Vegetables

Sl. No.	Tribe/Local name		Scientific name	Family	Habit	Parts used	Mode of used
	Nocte	Wancho					
1	Hantow	Anthow	<i>Solanum melongena</i> Linn.	Solanaceae	Shrub	Fruit	The fruit are given as vegetable, and are used in preparation of chutneys.
2	Chamkhah	Kamkhah	<i>Solanum nigrum</i> Linn	Solanaceae	Shrub	Fruit	It is essentially used as food and medicinal uses.
3	Khamkah	Kamkhah	<i>Solanum macrocarpon</i> Linn.	Solanaceae	Shrub	Fruit	The roots, leaves and fruit contain medicinal qualities. The flowers are chewed on to clean teeth. Its roots are used to speed up the healing wounds.
4	Kahgaw	Wow	<i>Banincasa hispida</i> Thunb.	Cucurbitaceae	Creeper	Fruit and tender leaf	When cooked with pork, the resulting soup can help produce more milk for breastfeeding mothers.

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5	Pherat	Phelat	<i>Glycine max</i> (L.) Merr.	Fabaceae	Climber	Fruit	The fruit are used in preparation of fermented beans and is often consumed by simply boiling with meat.
6	Gotyo sui	Tseprow	<i>Luffa cylindrica</i> Roxb.	Cucurbitaceae	Climber	Fruit	The fruit is used as vegetable. And the fibrous material obtained from the dried fruits is used as a substitute for bath-sponges
7	Ophom	Ophum wownu	<i>Chenopodium album</i> Linn.	Chenopodiaceae	Herb	Tender leafs and stem	Growing near other plants, it attracts leaf miners which might otherwise have attacked the crop to be protected. Its leaves and young shoots are eaten as vegetable either steamed or cooked.
8	Ngow	Ngo	<i>Musa acuminata</i> Colla	Musaceae	Tree	Fruit and inner stem	The raw fruit is used as vegetable and ripe fruit is used to prepared banana chips.
9	Kangao	Wum	<i>Cucurbita moschata</i> Poir	Cucurbitaceae	Climber	Fruit	The fruit is used as vegetables
10	Suikah	Suikhah	<i>Momordica charantia</i> Linn.	Cucurbitaceae	Climber	Fruit and young shoots.	Unpeeled bitter melon is boiled and then stuffed with cooked meat and young shoots and leaves can also be eaten as green
11	Sahgao	Tio	<i>Cucurmis sativus</i> Linn.	Cucurbitaceae	Climber	Fruit	The fruits are eaten raw much used in salads
12	Mishi		<i>Lycopersicon esculentum</i> (Mill)	Solanaceae	Herb	Fruit	Fresh ripe fruits are consumed raw in salads or after cooking
13	Mongmut	Mangmuk	<i>Clerodendrum colebrookianum</i> Walp.	Lamiaceae	Shrub	Tender leafs	The leaf juice mixed with garlic extract is given in treating of blood pressure. Roots with bark are useful in cough
14	Kokcheck	Tsaksui	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Fern	Tender leafs	It is an edible fern used as vegetable
15	Suinyan	Suinan	<i>Abelmoschus esculentus</i> (Linn)	Malvaceae	Shrub	Fruit	The fruit are used as vegetable
16	Phesah	Phelaat	<i>Phaseolus vulgaris</i> Linn.	Fabaceae	Climber	Fruit	Its fruit and young leafs are used as vegetable
17	Gotyo		<i>Luffa aculangula</i> (Linn) Roxb.	Cucurbitaceae	Climber	Fruit	The fruit is used as vegetables
18	Gimpo		<i>Langenaria siceraria</i> (Mol) Standl.	Cucurbitaceae	Creeper	Fruit and	The fruit is eaten as fresh vegetable

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						tender leaf	
19	Pherat		<i>Pisum sativum</i> Linn.	Leguminaceae	Climber	Fruit	The fruit is used as vegetable and sometime eaten raw in salads
20	Oyic	Tukri	<i>Pouzolzia hirta</i>	Urticaceae	Herb	Tender leaf	It is popular for their tenderness and preferred to be given to lactating mothers and small children. Especially the leafy vegetables are blended with rice and dishes prepared from local fishes and are given to children and elders for quick energy sources
21	Khahsa	Khahsa	<i>Solanum spirale</i> Roxb.	Solanaceae	Shrub	Fruit	Young leafs and berries are cooked as vegetable
22	Khamkia	Wakakhing	<i>Splilanthus acmella</i> L.	Asteraceae	Herb	Tender leaf	It is an traditional medicine for tooth ache. Its leaves and flowers are used in eco friendly fish harvesting in stagnant water bodies
23	Suichu	Suicho	<i>Brassica campestris</i> Linn.	Brassicaceae	Shrub	Tender leaf	The tender leaves and shoots are used as vegetables
24	Gaosu	Wumkhi	<i>Cucurbita maxima</i> (Duch)	Cucurbitaceae	Creeper	Tender leaf and fruit	The large fruit are used as vegetable. All parts of plants are edible; tender shoots and leaves are eaten as salad; flowers and fruits are cooked as a vegetable
25	Ginmanpan		<i>Crassocephalum crepidioides</i> (Benth)	Asteraceae	Herb	Tender leaves and stem	Its fleshy leaves and stems are eaten as a vegetable, and many of its parts have medicinal uses
26	Sui	Okhap-tadingo	<i>Momordica dioica</i> Roxb.ex Willd	Cucurbitaceae	Climber	Fruit	It is commonly used as vegetables and is easily available
27	Khusi	Suisi	<i>Hibiscus sabdariffa</i> L.	Malvaceae	Shrub	Fruit	The heated leaves are applied to cracks in the feet and on boils to speed maturation
28	mikohh	Mikoh	<i>Citrullus lanatus</i> Schrad.ex Eckl.	Cucurbitaceae	Creeper	Fruit	The red pulp of the fruit is eaten
29	Thagyak	Sui	<i>Lactuca sativa</i> (Linn)	Asteraceae	Herb	Leaves	The leaves are eaten as vegetable and salad
30	Khansa	Khannsa	<i>Solanum tuberosum</i> Linn.	Solanaceae	Herb	Tender leaf and	The tubers are used as vegetable

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						tubers.	
31	Pherat	Phesa	<i>Dolichos lablab</i> L.	Fabaceae	Climber	Fruit	The fruit is boiled and are eaten as vegetable. Their flower can be eaten raw or streamed

B. Spices

32	Owchih	Othehteht ho	<i>Alleum hookeri</i> Linn.	Liliaceae	Herb	Leave s and bulb	It is highly used as spices and vegetables; Its bulbs are used in curing snakebites
33	Chikat	Otheh	<i>Allium stivum</i> Linn.	Alliaceae	Herb	Bulb	Its bulbs are used as spices and these plants are said to repel rabbits and moles
34	Katsag	So-othey	<i>Allium cepa</i> Linn.	Alliaceae	Herb	Leave s, shoot s and bulb	Its shoots and bulbs are used as vegetable or eaten raw or used to make pickles and chutneys
35	Ginyui	Boganhi	<i>Capsicum annum</i> Linn.	Solanaceae	Shrub	Fruit	Its fruit is used to prepare chutney and is good for gastric problems
36	Ginsa	Hingbu	<i>Capsicum frutescens</i> Linn.	Solanaceae	Shrub	Fruit	Used in preparing chutney and pickles
37	Chehnyan	Doo-nan	<i>Cucurma longa</i> Linn.	Zingiberaceae	Shrub	Rhizo me	It is used for treatment for various infections and as an antiseptic
38	Gintho	So- suingan	<i>Coriandrum sativum</i> Linn.	Apiaceae	Herb	Leave s and stem	Highly used as spices
39	Ginthosak	Suingan	<i>Eryngium foetidun</i> Linn.	Apiaceae	Herb	Leave s	Its leaves are highly used in preparing chutney and added in curry for its aroma
40	Chehsui yang	Gutisaluk	<i>Piper mullesua</i> Linn	Piperaceae	Climber	Seeds	The powdered seed is used as home remedy for relief from sore throat and cough etc.
41	Nam	Nam	<i>Sesamum indicum</i> Linn.	Pedaliaceae	Shrub	Leave s and seeds	The grind leaves mixed with water is useful in treatment of dysentery
42	Nam	Nam	<i>Perilla ocymoides</i> (L) Britton.	Lamiaceae	Shrub	Seeds	Its seeds are used in making chutney with other leafy ethnobotanicals. Seeds sometimes are fermented and used. It is often prescribed by elder women to be eaten by the pregnant

							ladies
43	Chehsui	Thasuikoh	<i>Zanthoxylum rhetsa</i> Mill.	Rutaceae	Shrub	Tender leaf	Leaves are used while preparing special dish for its pleasant smell and are also used as biopesticides
44	Chehyui	Tsey	<i>Zingiber officinale</i> Rose.	Zingiberaceae	Herb	Rhizome	It is used as hot, fragrant kitchen spice and it is also used in stopping bleeding
45	Suinam	Runam	<i>Houttuynia cordata</i> Thunb	Saururaceae	Herb	Leaves and shoot	It is used in preparing chutneys and is good for gastric control

C. Tuberous crops

46	Tuh	Toh	<i>Colocasia esculenta</i> (L) Schott	Araceae	Herb	Leaves and roots	Corms are peeled and boiled for vegetables and the tender leaves are collected, dried and preserve for further use
47	Gajor	Gajur	<i>Daucas carota</i> Linn	Apiaceae	Herb	Tuberous roots	They are eaten raw as salad or cooked
48	Khanthow	Kahntho	<i>Dioscorea deltoida</i> Wall ex Kunth.thunb	Dioscoreaceae	Climber	Tuberous roots	Grown for their large tubers and are boiled and eaten as vegetables
49	Khan	Khan	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Climber	Tuberous roots	It is used as folk remedy to treat conjunctivitis, dysentery
50	Khanyak	Khannak	<i>Dioscorea alata</i> L.	Dioscoreaceae	Climber	Tuberous roots	The tuberous roots are used as vegetable
51	Chowpakhan	Khanti	<i>Ipomoea batatas</i> (L) Laurk.	Convolvulaceae	Creepers	Tender leaves and tubers	It is eaten raw, boiled and roasted. They are not

							only a vegetable, but they are used for flour preparation and for curry preparation
52	Punkhan	Pankhan	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Small tree	Leaves and roots	Rhizome is used to prepare beer and decoctions of the leaves are applied on skin
53	Chehyui	Tsey	<i>Zingiber officinale</i> Linn.	Zingiberaceae	Herb	Rhizome	It is used as hot, fragrant kitchen spice and it is also used in stopping bleeding

D. Cereals

54	Sahthow	-----	<i>Oryza sativa</i> Linn.	Poaceae	Shrub	Grains	The chief use of rice is as food, and more people use it than any other cereals
55	Simoi	Mawam	<i>Triticum</i> sp. Linn.	Poaceae	Shrub	Grains	It makes a good food for livestock. It is also used in preparation of local alcoholic beverages
56	Chuila	Chula	<i>Jobstear</i> L.	Poaceae	Shrub	Seeds	It has soft shell, and is used as folk medicine and source of food
57	Hunai	Ramlao	<i>Setaria italica</i> Linn.	Poaceae	Shrub	Grains	They are used for human food and fodder. When used for food, the grains are boiled. It is used as diuretic and astringent and

							used externally for rheumatism
58	Phongong	Sowam	<i>Zea mays</i> Linn.	Poaceae	Shrub	Grains	The chief use of rice is as food. It is boiled and serves as breakfast meal
59	Manson	Tsahjan	<i>Eleusine corocana</i> Linn	Poaceae	Shrub	Grains	Its grains can be made into cakes, porridge. A beer is brewed from this grain. It is a grain of great nutritive value, and is considered more sustaining for people doing hard physical work than any other grains. The grains are tonic and astringent, specially recommended for diabetics as a wholesome food
60	Sahyu	Hingkah	<i>Pennisetum glaucum</i> (Burm.) Stapf. & Hubbard.	Poaceae	Shrub	Grains	Grains are used for porridge, or eaten after parching

Figure 1: Total number of vegetables species per Family.

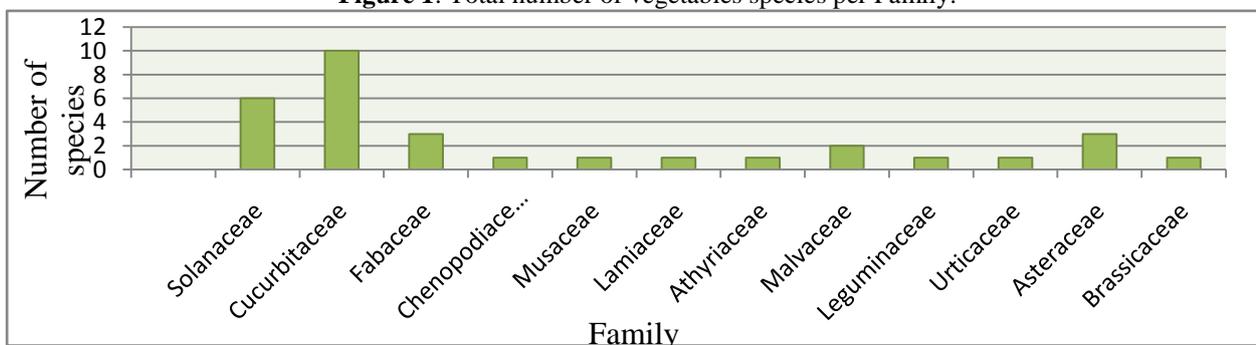


Figure2: Different habits of vegetables species.

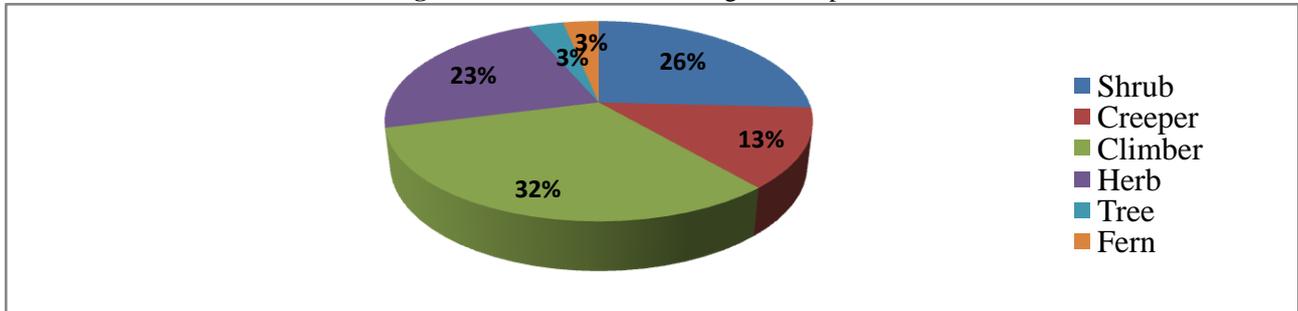


Figure3: Different Parts used of Vegetables species.

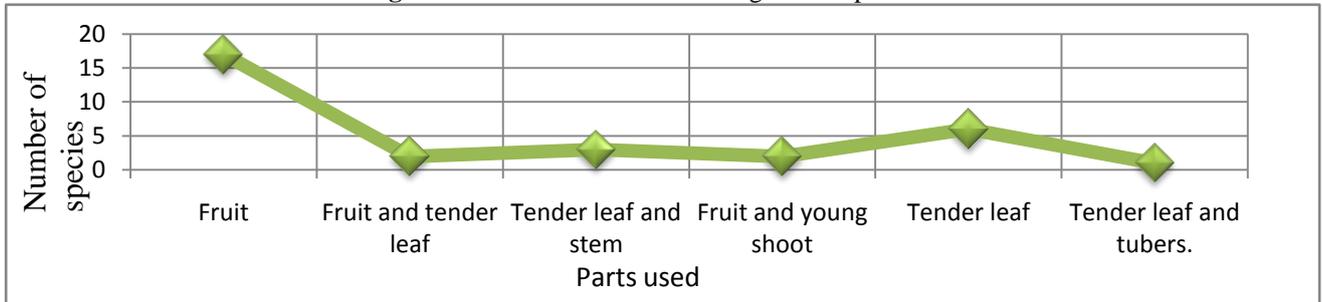


Figure 4: Total number of different spices per Family.

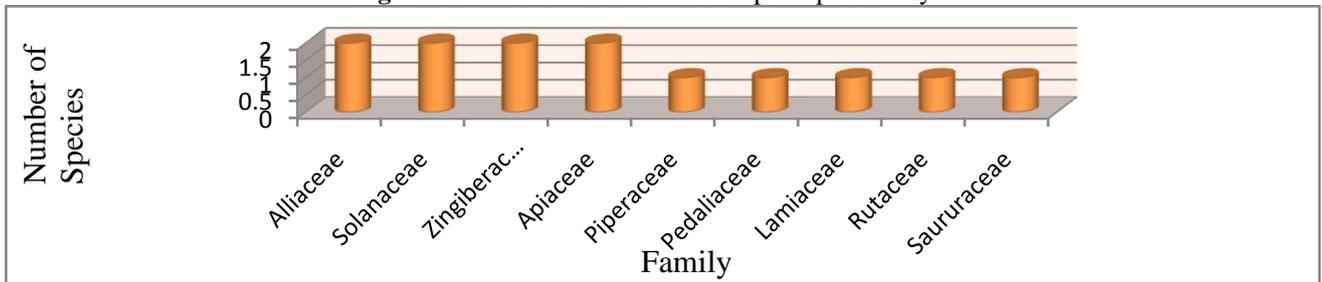


Figure 5: Different Habit of Spices crops

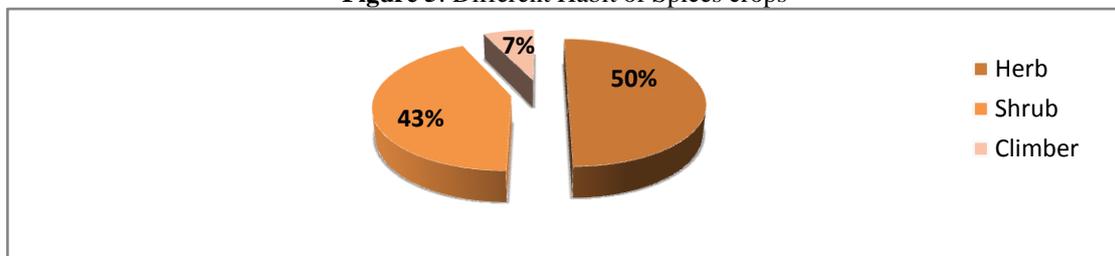
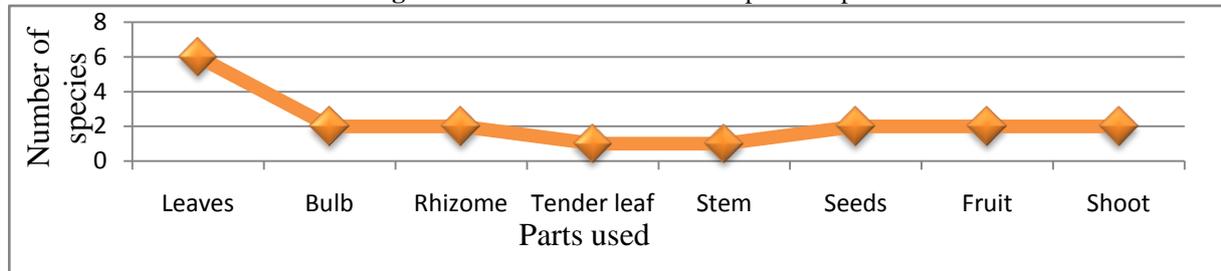


Figure 6: Different Parts used of spices crops**REFERENCES**

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