ISSN: 2663-2187

https://doi.org/10.48047/AFJBS.6.Si4.2024.2676-2686

African Journal of Biological Sciences

Quantitative Analysis of Common Spices and their use in Traditional Medicinal System of Ethnic Groups of Rampachodavaram Agency Division, Andhra Pradesh, India

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Article History
Volume 6, Issue Si4, July 2024
Received: 10 May 2024
Accepted: 15 June 2024
Doi:
10.48047/AFJBS.6. Si4.2024.2676-2686

Abstract: This investigation reports on most commonly used spices and their utility in traditional medicinal system based on household surveys in Rampachodavaram agency division. A total of 17 plant species have been recorded which are being used to cure 17 diseases in traditional system, mainly for Paralysis (2 species), Cough (2 species), Earache (2 species), Urinary disorder (2 species), Scabies, Fever, Jaundice, Poxes, Infertility, Ringworm, Menstrual disorder, Snake bite and many other diseases. The production potential of cultivated spices was fairly good for *Allium sativum*, *Coriandrum sativum, Zingiber officinale*. It is emphasized that these species should be protected in natural habitats, and multiplied for large scale use at household level to avoid pressure in wild areas.

Keywords: Spices, Rampa agency traditional medicinal uses, Productivity, Conservation.

1. Introduction

There has been a growing interest in exploiting as well as conserving gene pools of economically important species which include wild foods, medicinal and other useful plants (Gentry1993; Johnston and Colquhoun 1996; Plotkin and Famolare 1990). Aromatic plants constitute a major source of natural organic compounds widely used in medicine, spices, food products and flavor and are of paramount importance in everyday life (Anonymous 1998). Spices form an important ingredient of Indian food system. A large quantity of spices is used in India during 1997-1998 and the total export of spices from India was 2,18,750 tons valued at 363.62 million US$ (Anonymous 1998). There are still several spices having high potential in the wild which are in regular use by tribal societies for diverse purposes but less known to rest of the world.

The people of Rampachodavaram (Rampa) agency division using a good number of spices from the wild habitats and also grow a few of them in the kitchen gardens for daily consumption as

well as selling in local markets for cash needs, some of the spices used in traditional medicine. A few ethnobotanical studies have been done in Rampachodavaram agency in recent years emphasizing on wild vegetables, medicinal plants and biofolkore (Pullaiah *et al.*, 2007; S. B. Padal *et al.*, 2022) but they hardly cover the plants which are used as spice. For judicious and sustainable utilization of natural resources, a thorough knowledge of its utility by the locals is a vital prerequisite. The present paper attempts to screen the potential spices of Rampachodavaram agency division and document their uses in traditional medicine system. It is expected that this investigation will highlight a few potential spices for their large-scale production through cultivation and thus help in economic upliftment of the people. It is also expected that pharmaceutical companies for their large-scale use will possibly adopt a few spices with medicinal properties.

2. Materials and methods

2.1 Study area

Rampachodavaram agency division is situated between 17⁰ 17' 30" - 17⁰ 48' 05" N latitude and 81⁰ 44' 26" - 82⁰ 13' 10" E longitude (**Fig.1**) and covers an area of 6,431.63 sq. km. It consists of 66% forest area of 4,260.97 sq. km. with high species diversity having heavy North-East monsoon rainfall during June-Dec. With an approximate annual rainfall of 208.2 mm. Rampachodavaram agency division comprises 7 ethnic communities like Konda Reddy, Konda Kapu, Konda, Konda Dora, Koya, Valmiki, Parang Proja with a total population of more than3.50 lakhs peoples (Census 2011) whereas Konda Reddy and koyas are the major tribes which mostly inhabit the hilly areas and foothills. The people collect a large number of food items, medicine and other household requirements from natural habitat. They are closely associated with the surrounding plant resources and have a fair knowledge about its uses, propagation and conservation. The local people have faith in herbal medicinal practitioners who provide cure for a large number of diseases. Each tribe has its own herbal medical practitioners.

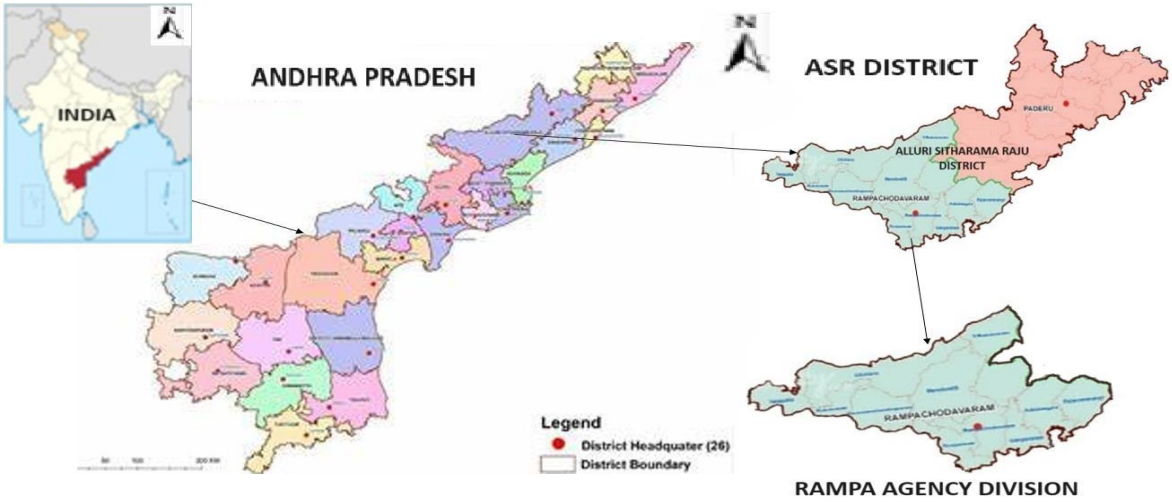

Fig. 1. Location Map of Rampa agency division, ASR District, Andhra Pradesh, India.

2.2 Ethnobotanical investigations

2.2.1 Data collection

The study is based on frequent ethnobotanical surveys of different localities and a total of 11mandals 55 villages (5 in each village) surrounding the forest during the year 2022-23, several field trips were undertaken to different villages. Formal and informal interviews were conducted from 275 households and a prior informant consent was obtained from local healers, village chiefs,

old folks, Housewives etc., more details of different age groups are given in **Table1.** The method of collection of voucher specimens, herbaria preparation and technique for the collection of ethnomedicinal information was followed (Jain and Rao 1977). Plant species were identified with the help of flora (Gamble and Fisher 1957; Pullaiah *et al.*,2018). These plant specimens were carefully and critically studied and identified in the laboratory. The voucher specimens were deposited in the herbarium of Department of Botany, Sri Krishnadevaraya University, Ananthapuramu-515003, Andhra Pradesh, India.

A few cultivated spices were also evaluated for their production potential using standard methods (Plotkin M & Famolare L 1990; Martin G J 1995). Plant density was calculated by counting the number of plantlets on per unit area basis. Productivity was estimated by harvesting the plants on unit area basis (n=5) for each species and presented on fresh weight basis for all usable parts. All the data were compiled and are presented in this paper.

Table 1: Break-wise tabulation data of Informants of Rampa agency division, Andhra Pradesh.

Parameter	Informant group	Number
Gender	Male	186
	Female	89
Age	Young (<_40 years)	164
	Senior (>_40 years)	111
Educational status	Literate	78
	Illiterate	197
Informants	Key informant's	10
	General informants	265

2.3 Data analysis

The data collected were analyzed using quantitative value analysis [i.e. Use report, use value (UV), Informant Consensus Factor (F_{ic}), Fidelity Level (FL)] that include most commonly used indices in quantitative ethnobotanical investigations.

Disease categories: The documented data of medicinal plants was grouped into 18 disease categories based on Cook (1995).

Table 2: Ailments categories based on Cook (1995)

Ailment Categories	Biomedical terms
Liver problems (LP)	**Jaundice**, hepatic complaint
Circulatory System Disorders (CSD)	**Paralysis**, blood purification, blood pressure
Antidote (Ad)	**Snake bite**, Dog bite, bee sting
Endocrinal Disorder (ED)	Diabetes
Respiratory System Disorders (RSD)	Asthma, bronchitis**, cough, cold, Tuberculosis (Tb)**
Fever (Fr)	**Fever**
Skeleton Muscular System Disorders (SMSD)	Bone fracture, body ache, swellings, **headache**
Gastro intestinal disorders (GID)	Dysentery, diarrhea, indigestion, **stomach ache**, constipation, ulcer, intestinal worm
Ear, Nose, Throat problem (ENT)	Sinusitis, **earache**, epistaxis (Nose bleeding), eye diseases, tonsillitis, sore throat
Dermatological infection (DI)	Boils, **scabies, rashes**, inflammation & burns, **Eczema** (ringworm)
Kidney Stone (KS)	Kidney stone
Genito- urinary disorders (GUD)	**Urinary bladder stone**, **menstrual disorder**, leucorrhea, abortion, **infertility**
Oral Care (OC)	**Toothache,** gum complaints, mouth ulcer
Oncogenes (Og)	Cancer, tumors
Piles (P)	Piles
Deworming (DW)	Worm Expulsion
Smallpox's (SP)	**Poxes**
General Health (GH)	Blood tonic

Use Report: -

When a plant was claimed to be effective in curing a particular ailment it was recorded as one Use-report. A multiple Use-reports can be recorded when more than one informant claimed the same plant for the same ailment.

Use – Value (UV): -

Use-Value or UV demonstrates the relative importance of species known locally (Phillips *et al.*, 1994) which is based on the number of uses of a particular plant species and the number of informants that claimed the uses of the given plant. UV is calculated using the formula:

$$UV = \Sigma U/N$$

where UV is the use value of a species, U is the number citations per species; N is the number of informants. High UVs signify the importance of the particular plant to the community and recorded when there many use reports for the plant while low UVs are recorded when there is few use-reports.

Informant Consensus factor (F_{ic}): -

Informant Consensus factor or Ficwas employed to identify the uniformity of the informants on the reported cures for the group of ailments. This method was based along the Informant Agreement Ratio (IAR) of Trotter and Logan (1986) and consequently known today as Informant Consensus factor. It was calculated using the following formula:

$$F_{ic} = Nur - Nt/ (Nur - 1)$$

where 'Nur' is the number of use citations in each category and 'Nt' is the number of species used. Ficillustrates the degree of agreement among the informants to the use of a particular plant species and ranges between 0 and 1. This criterion can effectively sort out interesting plants for the search of novel drugs (Canales *et al.*, 2005). High Fic values approaching to 1 was obtained when the documented plants are used by a wide proportion of the informants for a selective disease category while low Fic shows disagreement among the informants which may be due to lack of knowledge sharing (Heinrich *et al.*, 1998; Grazzaneo *et al.*, 2005).

Fidelity Level (FL): -

The percentage of informants claiming the use of a certain plant for the same major purpose was calculated for the most frequently reported diseases by the Fidelity Level. It was developed by Friedman *et al.*, (1986) and calculated using the following formula:

$$FL (\%) = Np/N \times 100$$

where 'Np' is the number of informants claiming a use of a plant species to treat a particular disease and 'N' is the number of informants that use the plants as a medicine to treat any given disease. Fidelity level is accounted as highest when the value nearly approaches 100 % where the particular plant species are reported as the most preferred for a certain ailment while low FLs denotes the usage of the plants in many different ailments and are least preferred by the informants.

3. Results and discussion

3.1 Diversity and Use categories

The data was collected and the plants were identified, documented and analyzed critically from various sites of Rampa agency division of ASR district of Andhra Pradesh. The study of 2 Trees, 10 Herbs, 4 Shrubs and 1 Climber were recorded which were used as spices as well as medicine by the

ethnic groups belong to 10 family's categories across 17 ailments. The family Zingiberaceae, Lamiaceae with 3 species; Liliaceae, Solanaceae, Apiaceae with 2 species; Lauraceae, Rutaceae, Cleomaceae, Rubiaceae, Piperaceae with 1 species under use. The number of species being used under different plant families is presented in **Fig.2.** Considering various uses mentioned by the inhabitants, the identified species can be grouped in to two general use categories (**Table3&4**). 17 spices were either cultivated or collected from the wild habitat. Most of the spice plants are available in the markets throughout the year. Interestingly, the market prices are more or less same in all the seasons. Among all of the screened species of spices, 17 are used to cure 17 types of diseases in the traditional medicine systems (**Table 4**). These species are also extensively used in vegetable food items.

3.2 Relative Importance of Plants

Highest use-value was recorded from *Cinnamomum zeylanicum* with 11 use reports by 10 informants giving the value of 1.10. *Cinnamomum zeylanicum* has been well recognized as Respiratory System Disorders (RSD) controlling plant in the study area and also in the treatment of various other diseases and it was consumed in different forms of either raw or cooked. Lowest use value was recorded from *Capsicum annum* with 02 use reports by 10 informants with a UV of 0.20 and the particular informant was regularly using this plant for Oral Care (OC). The major agreements within the ailments categories highlighting the most important species were listed in the **Table 5.** The Informant Consensus Factor or F_{ic} values ranges from 1.00 to 0.84 in the present findings cures the ailments such as skeleton muscular system disorder (SMSD), Oral care (OC), Fever (Fr), Smallpox (SP), Antidote (AD) and Dermatological infection (DI) respectively (**Table 6,2**). These indicates that there is lack of knowledge sharing and miscommunication among the informants of the study area on the treatment of these particular ailment categories (Rokaya *et al.*, 2010).

The major agreement to determine the most important plants in each ailment category was analyzed using fidelity level (FL). Seventeen spices were selected for all the categories which were used in the treatment of single or more than one ailment with multiple informants. The plants with less than three use reports were not considered for the analysis. The plant species with highest fidelity of 90% in single ailment were *Cleome gynandra* (**Table 7**). Some species may have high F_{ic} and UV while others have low values (**Fig 3**). The plants with the highest fidelity level, use value and high informant consensus factor from the present findings indicates the possibility of high rate of occurrence of potential phytochemical compounds and therefore priority should be given to these plants to carry out phytochemical assays to study its efficacies.

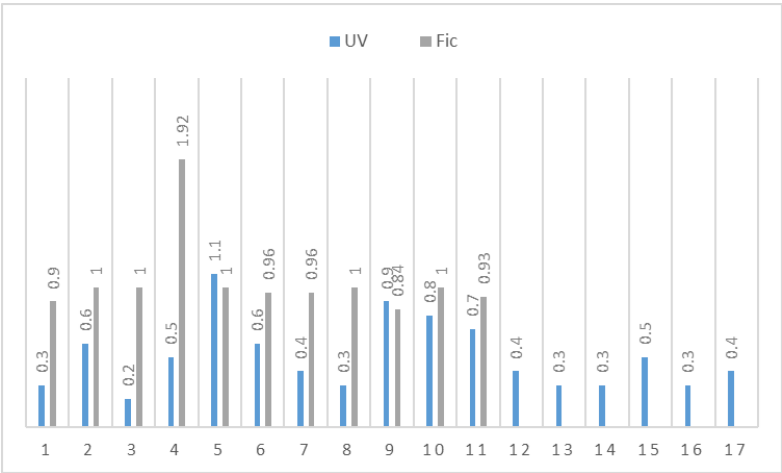

Fig. 3. Associations between Use value (UV) and Informant consensus factor (F_{ic}).

Table 3: Various spices used as medicine by different ethnic communities of Rampachodavaram agency division, Andhra Pradesh

Species/Families	Local name	Habit	Source	Parts used	Use frequency	Propagation
Allium cepa L. /Liliaceae	Ulli gadda	Herb	C	Wp	E	Bl
Allium sativum L. /Liliaceae	Tella gadda	Herb	C	Lf/Bl	E	Bl/Sd
Capsicum frutescens L. /Solanaceae	Seema mirapa	Shrub	W	Fr	E	Sd
Capsicum annum L. /Solanaceae	Mirapa	Shrub	C	Fr	E	Sd
Cinnamomum zeylanicum Gare.Ex Bl./Lauraceae, Dalchina	Cheka, Tree		C/W	Bk	O	Sd/Cl
Citrus aurantifolia Swingle/Rutaceae	Narinja	Tree	C/W	Fr	E	Sd/Cl
Coriandrum sativum L. /Apiaceae	Dhaniyalu	Herb	C	Wp	E	Sd
Cleome gynandra L. /Cleomaceae	Vaminta	Herb	C/W	Lf/Fr	O	Sd
Curcuma amada Roxb. /Zingiberaceae	Mamidi allam	Herb	C	Rh/In	O	Rh
Curcuma longa L. /Zingiberaceae	Pasupu	Shrub	C/W	Rh/Lf	E	Rh
Foeniculum vulgare Mill. /Apiaceae	Sompu	Herb	C	Sd/Lf	O	Sd
Knoxia sumatrensis DC. /Rubiaceae	Adivi Kandi	Herb	W	Sh	O	Sd
Leucas aspera Link. /Lamiaceae	Thunika	Herb	W	Sh	O	Sd
Mentha spicata L. /Lamiaceae	Pudina	Shrub	C/W	Sh/Lf	O	Sd/St
Ocimum basilicum L. /Lamiaceae	Sabja	Herb	W/C	Sd/Sh	O	Sd
Piper nigrum L. /Piperaceae	Miriyalu	Climber	C/W	Fr	E	Sd
Zingiber officinale Rose. /Zingiberaceae	Allamu, Sonti	Herb	C	Rh/Lf	E	Rh

Table 4: Spices used as medicine in Traditional System of Rampachodavaram agency division, Andhra Pradesh.

Species	Parts used	Ailments	Mode of use	Dose suggested
Allium cepa	Bulb	Paralysis	Decoction paste applied externally	2-3 bulbs
Allium sativum	Bulb	Paralysis, Jaundice	Decoction paste applied externally	Taken with vegetables every day
Capsicum frutescens	Leaf	Headache	Leaf paste applied externally	Daily once for 2 days
Capsicum annum	Fruit	Toothache	Fruit paste applied on jaw	Twice a day
Cinnamomum zeylanicum	Bark	Cold, Cough, Tb	Dried powder eaten with vegetables	One spoonful a day
Citrus aurantifolia	Leaf	Scabies	Dried ash+ Coconut oil applied external	Twice for 3 days
Coriandrum sativum	Shoot	Earache	Hot fomentation juice as ear drops	4 drops Thrice a day
Cleome gynandra	Leaf	Earache	Leaf juice is instilled in to the ear	2 drops twice for 2 days
Curcuma amada	Rhizome	Fever, Cough	Decoction juice drunk	5g in 1glass of water in a day
Curcuma longa	Rhizome	Jaundice, poxes	Eaten with vegetables	10g a day for a week
Foeniculum vulgare	Fruit	Eczema	Fruit paste applied on the affected areas	Twice for 3 days
Knoxia sumatrensis	Shoot	Urinary disorder	Boiled soup drunk	3 glasses a day
Leucas aspera	Shoot, Leaf	Urinary disorder	Boiled soup drunk	3 glasses a day
Mentha spicata	Shoot, Leaf	Infertility	Eaten with vegetables	4g a day regularly
Ocimum basilicum	Leaf	Eczema, rashes	Leaf paste+ cheese is applied	Twice for 3 days
Piper nigrum	Fruit	Menstrual disorder	Taken with vegetables	1-2g a day
Zingiber officinale	Rhizome	Snake bite	Paste applied externally	12-15g on the bite spot

Note: - C=cultivated, W=wild, Wp=whole plant, Rh=rhizome, Bl=bulb, Sh=shoot, Lf=leaf, Vb=vegetative bud, Bk=bark, Fr=fruit, Sd=seed, In=inflorescence, E=everyday, O=occasionally, Cl=cloning, St=stolon, Tb=Tuberculosis.

Table 5: Number of Use report (citation), Use-value (UV) of the spices used as medicine in Traditional System of Rampachodavaram agency division, Andhra Pradesh.

Scientific Name	Ailments category: No. of Use-report	Use- value (UV)
Allium cepa	Paralysis: 3	0.30
Allium sativum	Paralysis: 4, Jaundice: 2	0.60
Capsicum annum	Toothache: 2	0.20
Capsicum frutescens	Headache: 5	0.50
Cinnamomum zeylanicum	Cold:4, Cough: 6, Tuberculosis: 1	1.10
Citrus aurantifolia	Scabies: 6	0.60
Coriandrum sativum	Earache: 4	0.40
Cleome gynandra	Earache: 3	0.30
Curcuma amada	Fever: 4, Cough: 5	0.90
Curcuma longa	Jaundice: 2, Poxes: 6	0.80
Foeniculum vulgare	Eczema: 7	0.70
Knoxia sumatrensis	Urinary disorder: 4	0.40
Leucas aspera	Urinary disorder: 3	0.30
Mentha spicata	Infertility: 3	0.30
Ocimum basilicum	Eczema: 3, Rashes:2	0.50
Piper nigrum	Menstrual disorder:3	0.30
Zingiber officinale	Snake bite: 4	0.40

Table 6: Informant consensus factor of the spices used as medicine in Traditional System of Rampachodavaram agency division, Andhra Pradesh.

Ailments categories	No. of use report/citations (Nur)	Number of taxa/species (Nt)	Informant Consensus Factor (Fic)
Circulatory System Disorders (CSD)	12	02	0.90
Skeleton Muscular System Disorders (SMSD)	26	01	1.00
Oral Care (OC)	45	01	1.00
Respiratory System Disorders (RSD)	41	04	0.92
Fever (Fr)	56	01	1.00
Ear, Nose, Throat problem (ENT)	31	02	0.96
Liver problems (LP)	29	02	0.96
Smallpox (SP)	10	01	1.00
Dermatological infection (DI)	20	04	0.84
Antidote (AD)	09	01	1.00
Genito-urinary disorders (GUD)	50	04	0.93
Total	329	23	

Table 7: Fidelity level (FL) value of the spices used as medicine in Traditional System of Rampachodavaram agency division, Andhra Pradesh

Ailment category	Most preferred species	N_p	N	FL (%)
Paralysis	*Allium cepa* *Allium sativum*	4 6	9 12	44.44 50
Tuberculosis	*Cinnamomum zeylanicum*	8	14	57.14
Headache	*Capsicum frutescens*	12	20	60
Toothache	*Capsicum annum*	14	19	73.68
Cold	*Cinnamomum zeylanicum*	8	13	61.53
Cough	*Curcuma amada* *Cinnamomum zeylanicum*	9 6	20 9	45 66.66
Fever	*Curcuma amada*	9	20	45
Scabies	*Citrus aurantifolia*	6	8	75
Earache	*Cleome gynandra* *Coriandrum sativum*	18 10	20 20	90 50
Jaundice	*Allium sativum* *Curcuma longa*	6 5	12 9	50 55.55
Poxes	*Curcuma longa*	4	11	36.36
Eczema	*Foeniculum vulgare* *Ocimum basilicum*	6 5	17 20	35.29 25
Rashes	*Ocimum basilicum*	4	16	25
Menstrual disorder	*Piper nigrum*	3	12	25
Snake bite	*Zingiber officinale*	8	20	40
Infertility	*Mentha spicata*	6	8	75
Urinary disorder	*Knoxia sumatrensis* *Leucas aspera*	10 6	20 20	50 30

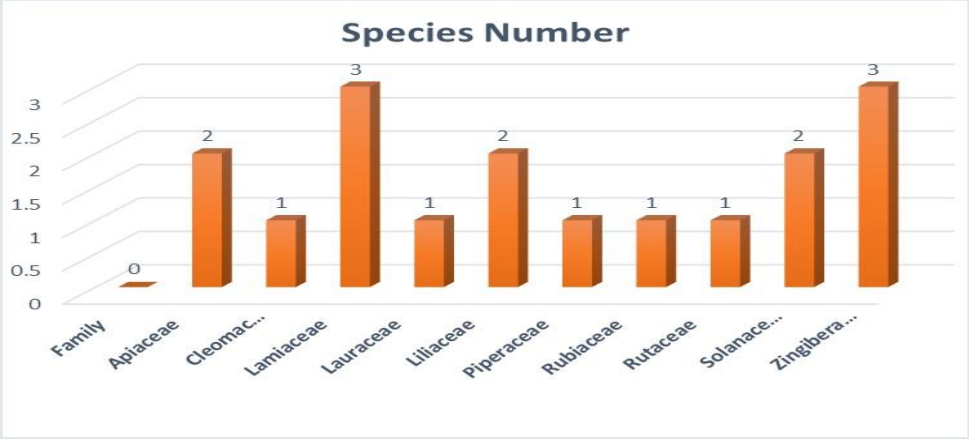

Fig. 2. Diversity of useful spices in different plant families.

3.3 Propagation and productivity

More than 70% of the spice plants are propagated through seed while rest by rhizome (13%), bulb (4%), stolon (17% each) and by vegetative buds (25%) **Table 3, Fig 4**. The annual

production of the 12 most commonly cultivated spices is presented in **Table 8**. These spices have high production potential. *Coriandrum sativum* can be cultivated 4 times in a year with a highest plant density of 2000-2400 individuals per $m^2$with an annual production potential of 3.25 kg m^2. Species of *Allium* can be harvested thrice in a year, while *Zingiber* and *Curcuma* are harvested once in a year.

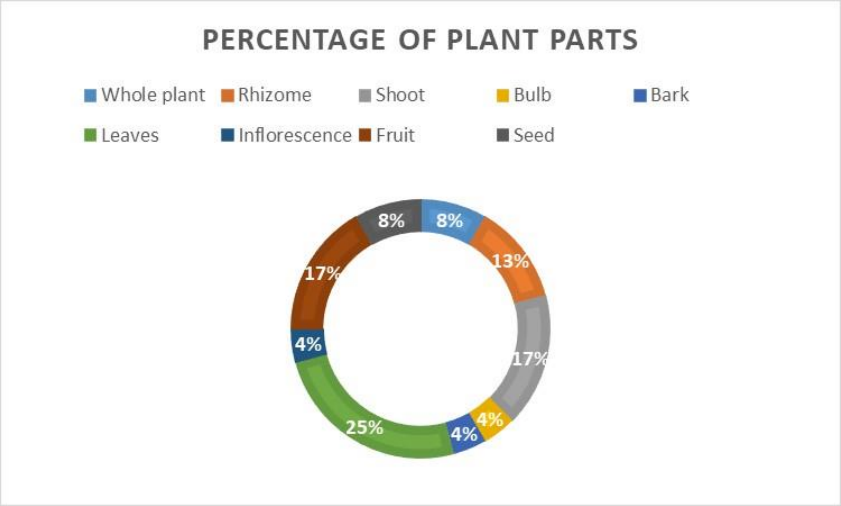

Fig. 4. Percentage of plant parts used as medicine by different ethnic communities of Rampachodavaram agency division, Andhra Pradesh.

Table 8: Productivity of important cultivated spices in Rampachodavaram agency division, Alluri Sitharama Raju District, Andhra Pradesh.

Species	Density (plantlet/m^2)	*Productivity (kg/m^2/annum)
Allium cepa	100-120	2.25[1]
Allium sativum	150-180	2.00[1]
Capsicum frutescens	80-100	1.25[2]
Capsicum annum	80-100	1.00[2]
Coriandrum sativum	2000-2400	3.25[1]
Cleome gynandra	70-90	1.00[2]
Curcuma amada	20-30	2.75[3]
Curcuma longa	20-30	2.60[3]
Foeniculum vulgare	80-100	1.25[1]
Mentha spicata	60-80	0.75[4]
Ocimum basilicum	70-90	1.00[2]
Zingiber officinale	20-30	2.75[3]

***Based on fresh weight basis: [1]Whole plant (both aboveground and belowground), [2]Fruit, Seed, [3]Rhizome, [4]Leaves and shoot.**

Conclusion

Result of the present investigation advocates on the sustainable utilization of the spices so as to conserve the plant resources and also to blend the traditional knowledge with scientific findings. Such investigation needs to be conserved as there are no written records and is passed

On from their forefathers through orally. Further priority should be given to the plants with high use-value and fidelity level in developing novel drugs through detail clinical study.

Acknowledgements

The author is indebted to the local tribal villagers and herbal practitioners for sharing their valuable ethnomedicinal knowledge, without their co-operation the work is not possible.

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