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Agricultural Diversity of Kashmir Valley

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Abstract: Kashmir valley is located between the Pir-Panjal and the Karakoram Range in the India. The valley is encircled by mountain ranges characterized by snow covered high mountain peaks. Kashmir is known for its scenic beauty throughout the world named as "paradise on earth." One of the main factors backing to this fame of Kashmir is its rich biodiversity corresponding with a wide variety of habitats. Agricultural growth is essential for any region to alleviate rural poverty, ensure food security and create job opportunities for people living in rural and urban areas. Traditionally, agriculture has been practicable and sustainable industry in the Kashmir. By tradition it has been the predominant sector in the Kashmir valley which supports around above 70 per cent of its population directly or indirectly is associated with agriculture and allied activities. The important features like topography, physiographic feature, diversity of habitat especially Karewas and elevation are the key elements which creates the difference between hill and plain areas. Hilly areas as generally offer a vast scope for the growers and cultivation of mixed crops like, cereals, pulses, oilseeds, Saffron, maize, vegetables. The most important and dominant feature of hill farming is the small holding, sloping marginal lands. This region has its own specific geo-climatic condition, which determine the cropping pattern and its productivity allied activities like horticulture, dairy development, fisheries, livestock and sericulture also play significant role in the agriculture sector.

Keywords: Agriculture, allied sectors, Cereals, Oilseeds, mountains, Tradition, Farming

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1. Introduction

Agriculture is the most important industry of the people of Jammu & Kashmir. Even though, others who are engaged in other sectors also depend on agriculture for raw material (Majeed et al., 2021). The state is occupied mostly by mountainous part in which about only 30% of the reporting area is under cultivation (Romshoo et al., 2020). The hilly and mountain areas differ from plains in topography, elevation and physiographic diversity of habitats for flora and fauna. The hilly areas are generally grown with grass, herbs, shrubs, maize, pulses and wheat to some extent (Jee 2020). Agricultural crops like rice, wheat, pulses, oil seeds, vegetables are grown in plains of valley. Agricultural growth is important for any region to alleviate rural poverty, ensure food security and create job opportunities for people living in rural and urban areas (Dev et.

al., 2010). Kashmir valley is a NW–SE oriented elongated trough located in northwest. Kashmir valley witnessed drastic land use and land cover changes mainly as a result of increase in population size, economic growth, changes in agriculture practices, and execution of different development projects particularly during last three decades (Alam et al., 2020). Agriculture has been predominant sector in this region, providing support to majority of the population. Agricultural growth is essential for any region to alleviate rural poverty, ensure food security and create job opportunities for people living in rural and urban areas Agriculture is the mainstay of our economy as about 70% of the population directly or indirectly is associated with agriculture and allied activities (Ahmad and Farooq 2010). The state Jammu and Kashmir is fundamentally divided into two divisions namely as Jammu division and Kashmir division and each division having their own and distinct geographical outlook for their respective agro climatic zones which in turn determine their cropping pattern and productivity of crops(Dar et. al., 2020). Jammu and Kashmir is well known for its Paddy crop followed by maize, oilseeds, pulses, vegetables fodder and wheat whereas in Jammu region the most grown and eatable crop is wheat which is followed by maize, paddy, pulses, oilseeds, pseudocereals etc (Sheikh and Singh 2013). Jammu and Kashmir has also got the monopoly in terms of Saffron crop (famous all over the world due to its quality) which has been produced in district Pulwama which is 15 km distant from Srinagar (Husaini 2014). The cropping pattern of a region reveals the proportion of area of land under different crops at a point of time, the rotation of crops and the area under double cropping (Ganaie et al., 2019). The cropping pattern changes in space and time. In fact, no cropping pattern can be good and ideal for all times to come. Cropping system is based on the climatic, soil and the water availability has to be evolved for realizing the potential production levels through efficient use of available resources. (Batool et. al.,2019) The main aim of the cropping pattern system is to provide enough food for the family, fodder for the cattle and generate sufficient cash income for demotic and cultivation expenses (Kaloo et.al., 2015) The aim of the present study is to document the Agricultural crops that are gowning in the valley for food, fodder and other purposes.

Study area

Kashmir Himalaya is youngest mountain range owning a dramatic landscape with snow, glaciers gushing drainage basin extending between the Pirpanjal and the Zanskar range. The region falls within the biogeographic province in the northwestern Himalayas, lies between 33° 20′ to 34° 54′ N and 73° 55′ to 75° 35′ E,

covering an area of 15948 km^2 and represents an exclusive biospheric unit (Rodgers and Panwar 1988). The altitude of the valley ranges from 1,600 m to 5,420 m (asl). Topographically, the valley depicts an elliptical bowl-shaped character, bounded by mighty Pir-Panjal range in its south and southwest and the greater Himalayan range in the north and northeast (Romshoo et al., 2020). Within the Himalayas, the Kashmir valley has a discrete geographical and distinct physiographic personality. The valley can be divided into four broad physiographic divisions: the mountains, the foot hills, the *Karewas* and the valley. Climate of the region is distinct by well-defined seasonality, during summer the temperature ranges from an average daily maximum of 31ºC and minimum of 15ºC to 4ºC max. & -4ºC min. during winter. The valley causes precipitation mostly in the form of snow, receives annual precipitation of about 1,050 mm. Because of heterogeneous edapho-climatic and physiographic range including lakes, springs, swamps, orchards, subalpine and alpine meadows, montane slopes and terraces, permanent glaciers etc. (Gupta 1982; Singh et al., 1998). The Kashmir valley consists of ten districts such as Budgam, Bandipora, Anantnag, Baramulla, Ganderbal, Kulgam, Pulwama, Kupwara, Shopian and Srinagar district.

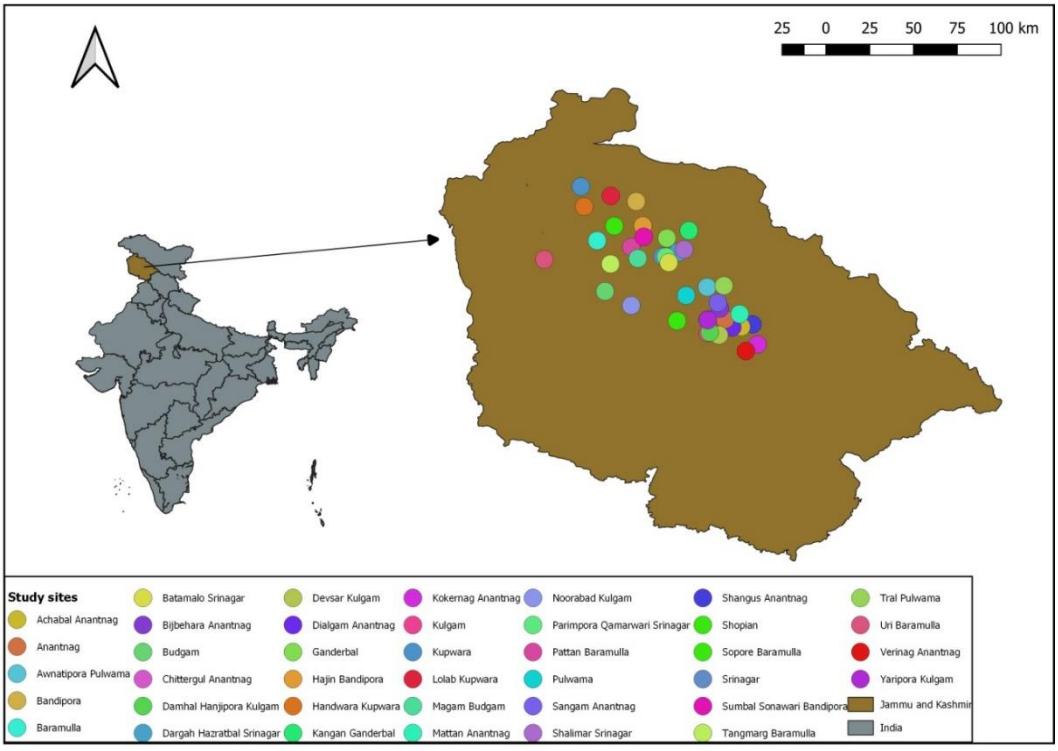

Fig. 1. Map showing selected study sites.

Materials and Methods

During the year 2016-2017, field surveys were carried out in different areas (Fig.1) of Kashmir valley to assess the different parameters (growing season, number of crops etc.) related to different agricultural crops of Kashmir valley. During the field survey various parameters such as habit, fruit type etc. were recorded in field. The part/parts of the crops used for consumption was recorded by interaction with local people. Market surveys were carried out in the market and the information about edible parts of commercially important crops was documented also the peak availability of certain vegetable were assessed. The SKUAST-K and many off-field stations were visited for the data collection pertaining to the current study. Native geographical range of the plant species has been obtained from all possible available sources**;** native geographical range of the plant species has been obtained from all possible available sources (Randall 2002), including the specialized Internet web pages (POWO 2020) and recently published similar works. Following Pysek et al. (2002), we recognized the origin of the species at the continental scale viz., Asia (excluding Indian subcontinent), Europe, Africa, North America, Southern America, and Australia.

Results

This work helps to understand the types of crops, life span, nativity etc. of various agricultural crops growing in Kashmir valley. It also includes an analysis of different parameters related various agriculture crops. Inventory of agricultural biodiversity in Kashmir valley (botanical name, vernacular name, flowering/fruiting, fruit type and nativity) has been prepared as shown in table 1. Present inventorization reveals that the agricultural crops of Kashmir comprised of 75 plant species belonging to 52 genera and 18 families. Largest number of plant species belongs to families of Leguminaceae (18) followed by Brassicaceae (9). The genus with highest number of species is *Brassica* followed by *Amaranthus*. Number of crop species belongs to different families and their life span is shown in Figs. 2 & 3 respectively. Our results showing the highest number of crop species belongs to family Leguminaceae (Fabaceae). Our results also showing the part/parts used for food/fodder by people. Most palatable part is seed and least is inflorescence as shown in Fig. 4. Type of studied crops on the basis of sowing and harvesting period are shown in Fig. 5, revealed that *Kharif* crops comprises of 45, *rabi* with 12 and *zaid* with 7 crop species. Nativity and types of fruits of studied crop species are shown in Fig. 6 & 7 respectively, depicts that Europe is native region of highest number of agriculture crop species and pod (legume) is the prominent fruit type.

Table1: Conspectus of the Agricultural of Kashmir.

Plant Name	Common name	Family	Life cycle	Part/parts used	Crop type	Nativity
Abelmoschus esculentus (L.) Moench	Bhindi	Malvaceae	Annual	Fruit	Kharif	Native
Allium cepa var. aggregatum G.Don	Ganda	Amaryllidaceae	Annual	Stem	Kharif	Africa, Europe
Allium sativum L	Rohan	Amaryllidaceae	Annual	Stem	Kharif	Central Aisa
Amaranthus blitum L.	Ganhar/ lissa	Amaranthaceae	Annual	Leaves	Kharif	Southern America
Amaranthus caudatus L.	*do*	Amaranthaceae	Annual	Leaves	Kharif	Southern America
Amaranthus hybridus L.	*do*	Amaranthaceae	Annual	Leaves	Kharif	Northern America
Amaranthus hypochondriacus L.	*do*	Amaranthaceae	Annual	Leaves	Kharif	Southern America
Atriplex hortensis L.	Wasta-haak	Chenopodiaceae	Annual	Leaves	Kharif	Europe
Avena byzantina K.Koch	Khasel	Poaceae	Annual	Whole plant	Others	Turkey
Beta vulgaris L.	Chokander	Amaranthaceae	Annual	Root and leaves	Kharif	Europe
Brassica oleracea L. Var fimbriata	Multani/Arbi-Haak	Brassicaceae	Annual	Leaves	Kharif	Europe
Brassica oleracea var. acephala DC.	Khanyari haak	Brassicaceae	Biennial	Leaves	Kharif	Native
Brassica oleracea var. botrytis L.	Phhol gobi	Brassicaceae	Biennial	Inflorescence	Kharif	China
Brassica oleracea var. capitata L.	Bandh Gobi	Brassicaceae	Biennial	Leaves	Kharif	China
Brassica oleracea var. gongylodes L.	Khol*rabi*	Brassicaceae	Biennial	Leaves	Kharif	China
Brassica oleracea var. kashmiriana Naqshi & Javeid	Hanz-Haak	Brassicaceae	Biennial	Leaves	Kharif	Native
Brassica rapa subsp. campestris (L) A.R.Clapham	Tilgogal	Brassicaceae	Biennial	Seeds and leaves	Kharif	
Brassica. rapa (Linn) Var. rapa	*do*	Brassicaceae	Biennial	Seed	Rabi	Italy
Cajanus cajan (Linn) Mill.	Arhar	Leguminaceae	Annual	Whole plant	Rabi	Native
Capsicum annuum L.	Punjaeb martswangun	Solanaceae	Annual	Fruit	Kharif	Northern America
Capsicum fructescens L.	Kashur -Martswangun	Solanaceae	Annual	Fruit	Kharif	Northern America

Celosia argentea (Lin) Var. cristata Kuntze	Moual	Amaranthaceae	Annual	Seed	Others	Native
Chenopodium album L.	*do*	Chenopodiaceae	Annual	Whole plant	Others	Europe
Coriandrum sativum L.	Daniwal	Apiaceae	Annual	Leaves and fruit	Kharif	Europe
Crocus sativus L.	Kong	Iridaceae	Annual	Flower	Kharif	Europe
Cucumis sativus L.	Laer	Cucurbitaceae	Annual	Fruit	Zaid	Native
Cucurbita maxima Duchesne	Gol-all	Cucurbitaceae	Annual	Fruit	Zaid	Southern America
Cucurbita moschata Duchesne	Kashir all	Cucurbitaceae	Annual	Fruit	Zaid	Mexico
Cuminum cyminum L.	Zuir	Apiaceae	Annual	Seed	Kharif	Europe
Daucus carota subsp. sativus (Hoffm.) Arcang.	Gazzer	Apiaceae	Annual	Root and leaves	Kharif	Africa, Europe
Fagopyrum esculentum Moench	Trumb	Polygonaceae	Annual	Whole plant	Rabi	Europe
Fagopyrum kashmirianum A.H.Munshi	*do*	Polygonaceae	Annual	Whole plant	Rabi	Native
Fagopyrum tataricum (L.)Gaertn.	*do*	Polygonaceae	Annual	Whole plant	Rabi	East Aisa, Europe
Foeniculum vulgare Mill.	Badiyan	Apiaceae	Annual	Seed	Kharif	Europe
Glycine max (Linn) Merrill	Gabi muth	Leguminaceae	Annual	Seed	Kharif	China
Helianthus annuus L.	Gule aftaab	Asteraceae	Annual	Seed	Kharif	Northern America
Hordeum vulgare L.	Wushka	Poaceae	Annual	Fruit	Rabi	Native
Hydrocharis dubia (Blume) Backer	Bumai posh	Hydrocharitaceae	Perennial	Leaves	Others	Europe
Lagenaria siceraria (Molina) Standl.	Aal	Cucurbitaceae	Annual	Fruit	Zaid	Africa
Lathyrus odoratus L.	*do*	Leguminaceae	Annual	Seed	Rabi	Europe
Lens culinaris Medic.	*do*	Leguminaceae	Annual	Seed	Rabi	Aisa
Linum usitatissimum L.	Masur	Linaceae	Annual	Seed	Rabi	Africa, Europe
Luffa cylindrica (L.) Roem.	Tarela	Cucurbitaceae	Annual	Fruit	Zaid	Europe
Lycopersicon esculentum Mill	Ruwangun	Solanaceae	Annual	Fruit	Zaid	Southern America
Malva sylvestris L.	Baghe sostal	Malvaceae	Annual	Leaves	Kharif	Europe
Malva verticillata L.	*do*	Malvaceae	Annual	Leaves	Kharif	Europe
Medicago sativa L.	Luecurene	Leguminosae	Perennial	Whole plant	Others	Africa, Europe
Melilotus indica (L.). All	*do*	Leguminosae	Perennial	Whole plant	Others	Africa, Europe

Mentha x piperita L	Pudna	Malvaceae	Annual	Leaves	Kharif	Africa,Europe
Momordica charantia L.	Karela	Cucurbitaceae	Annual	Fruit	Zaid	Africa, Europe
Nelumbo nucifera Gaertn.	Nadur	Nelumbonaceae	Perennial	Stem	Others	Africa, East Aisa
Nymphaea alba L.	*do*	Nymphaeaceae	Perennial	Leaves and fruit	Others	Native
Oryza sativa L.	Dhani	Poaceae	Annual	Fruit	Kharif	China
Panicum miliaceum L.	Pingha	Poaceae	Annual	Seed	Kharif	Africa, Europe
Papaver somniferum L.	Kash kash	Papaveraceae	Annual	Seed	Kharif	Europe
Phaseolus lunatus L.	Subaz Razma	Leguminaceae	Annual	Seed	Kharif	Central America
Phaseolus vulgaris L.	Farsh beans	Leguminaceae	Annual	Seed	Kharif	Southern America
Pisum sativum L.	Matar/ Kare	Leguminaceae	Annual	Seed	Kharif	Africa
Raphanus sativus L.	Muj	Brassicaceae	Biennial	Root/Leaves	Rabi	Africa, Europe
Setaria italica (L.) P.Beauv.	Shol	Poaceae	Annual	Seed	Kharif	Africa
Solanum melongena L.	Wangun	Solanaceae	Annual	Fruit	Kharif	Aisa
Solanum tuberosum L.	Aalou	Solanaceae	Annual	Stem	Rabi	Southern America
Spinacia oleracea L.	Palak	Amaranthaceae	Annual	Leaves	Kharif	Aisa
Trachyspermum ammi (L.) Sprague	*do*	Apiaceae	Annual	Seed	Kharif	Southern America
Trifolium alexandrinum L.	Berseem	Leguminaceae	Perennial	Whole plant	Others	Africa, Europe
Trifolium fragiferum L.	*do*	Leguminaceae	Perennial	Whole plant	Others	Africa, Europe
Trifolium pratense L.	Posh Gase	Leguminaceae	Perennial	Whole plant	Others	Africa, Europe
Trigonella foenum graecum L.	Meth	Leguminacaeae	Annual	Seed	Kharif	Africa, Europe
Triticum aestivum L.	Kanak	Poaceae	Annual	Fruit	Rabi	Africa, Europe
Vicia faba L.	Bagla	Leguminaceae	Annual	Seed	Kharif	Africa, Europe
Vigna aconitifolia (Jacq.) Marechal	Muth	Leguminaceae	Annual	Seed	Kharif	Native
Vigna mungo (Linn.) Hepper	Maha/Urd	Leguminaceae	Annual	Seed	Kharif	Native
Vigna radiata (L.) R.Wilczek	Mong	Leguminaceae	Annual	Seed	Kharif	Native
Vigna unguiculata (L.) Walp. Subsp. Sesquipedalis	Asparug	Leguminaceae	Annual	Seed	Kharif	Africa
Zea mays L.	Makai	Poaceae	Annual	Fruit	Kharif	Southern America

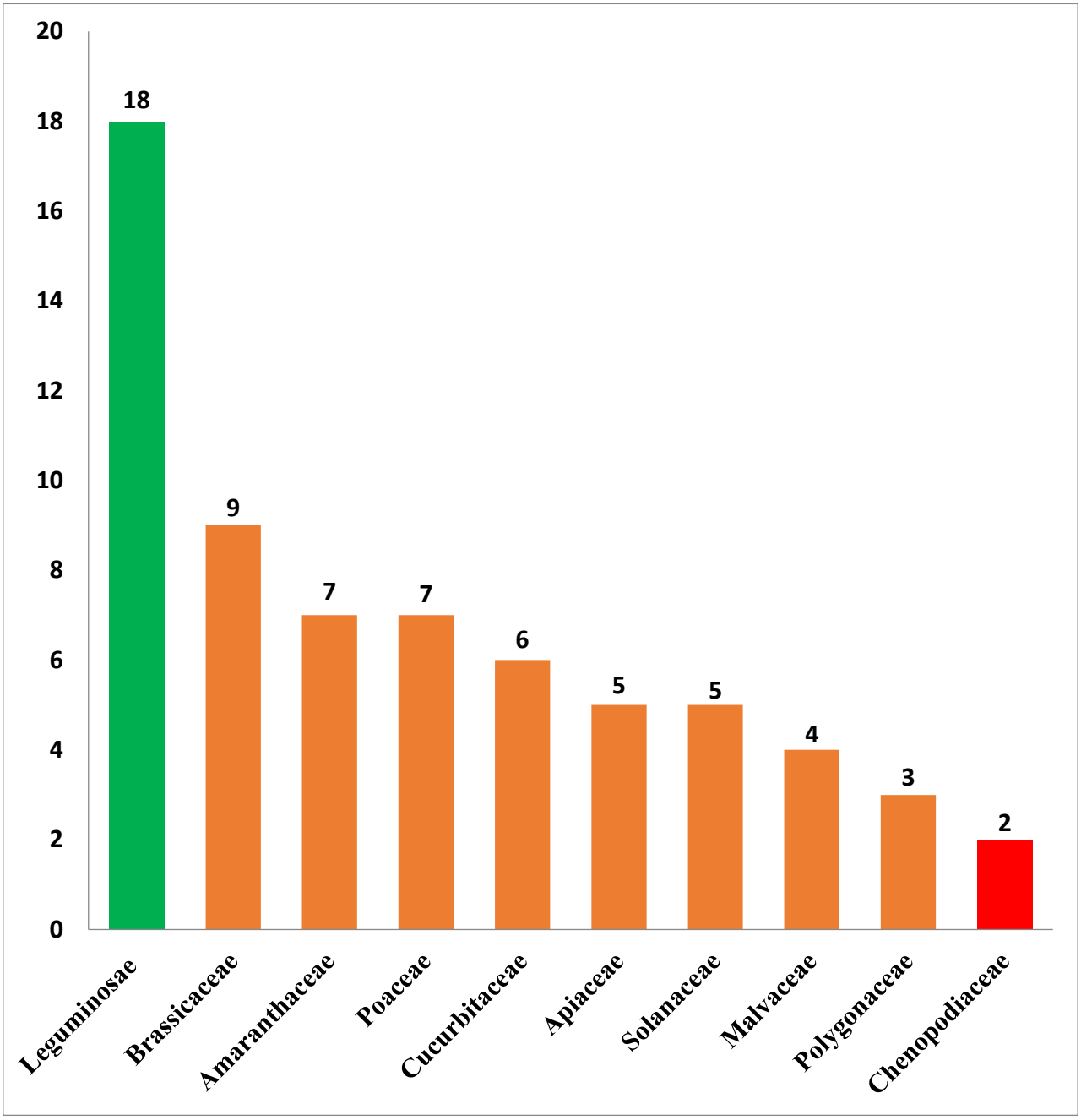

Fig. 2. Bar diagram showing number of species belonging to different families growing as an agriculture crop.

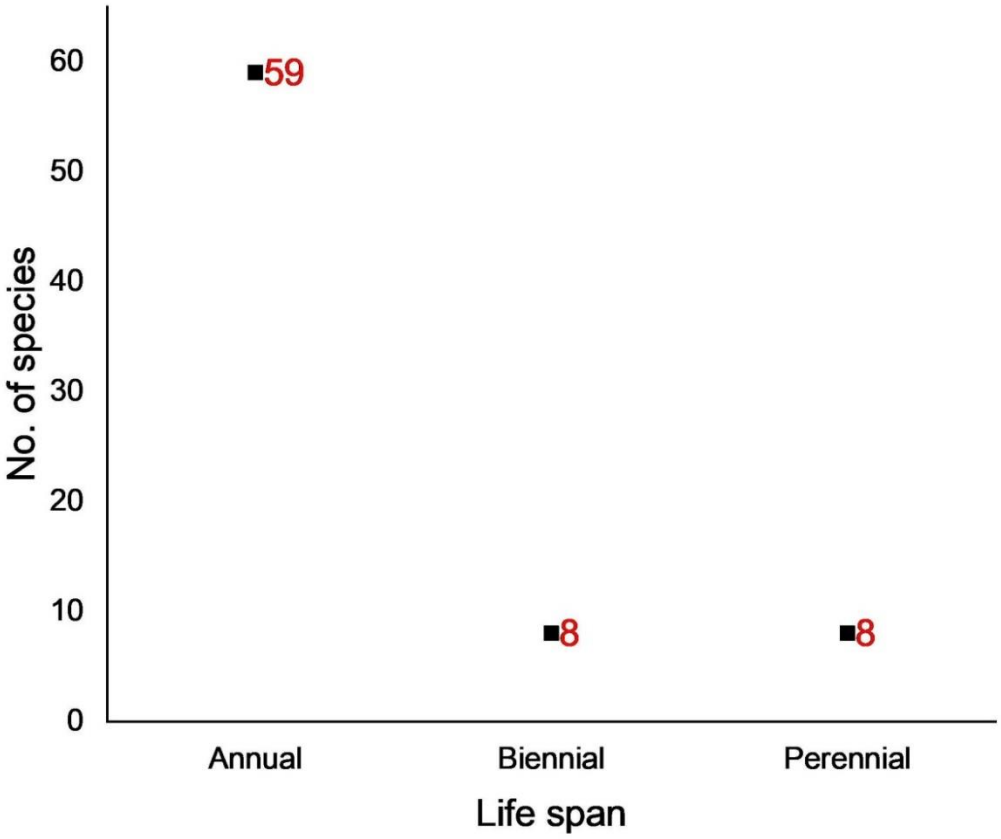

Fig. 3. Life span of various agriculture crops in Kashmir valley.

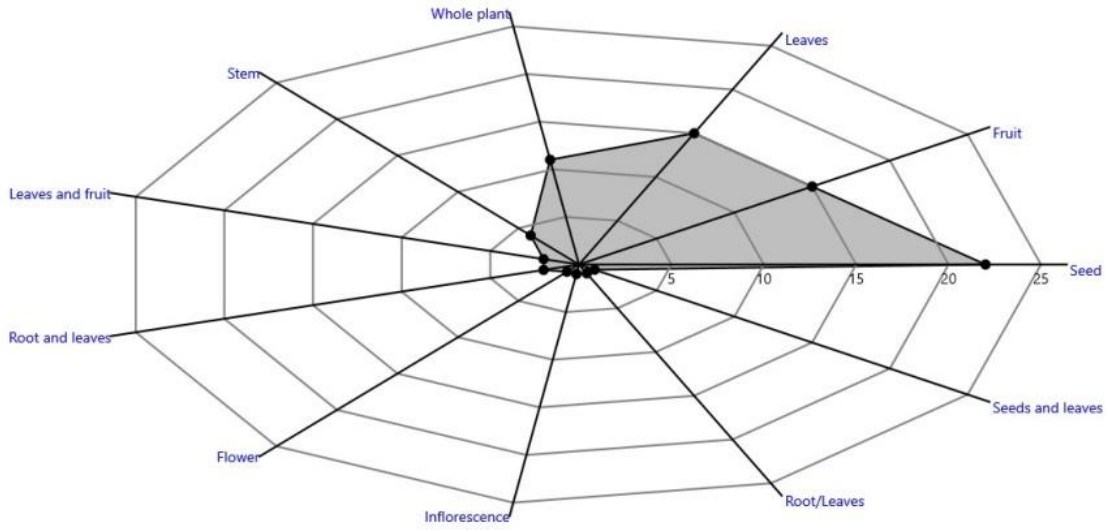

Fig.4. Radar chart showing the parts used for food/fodder.

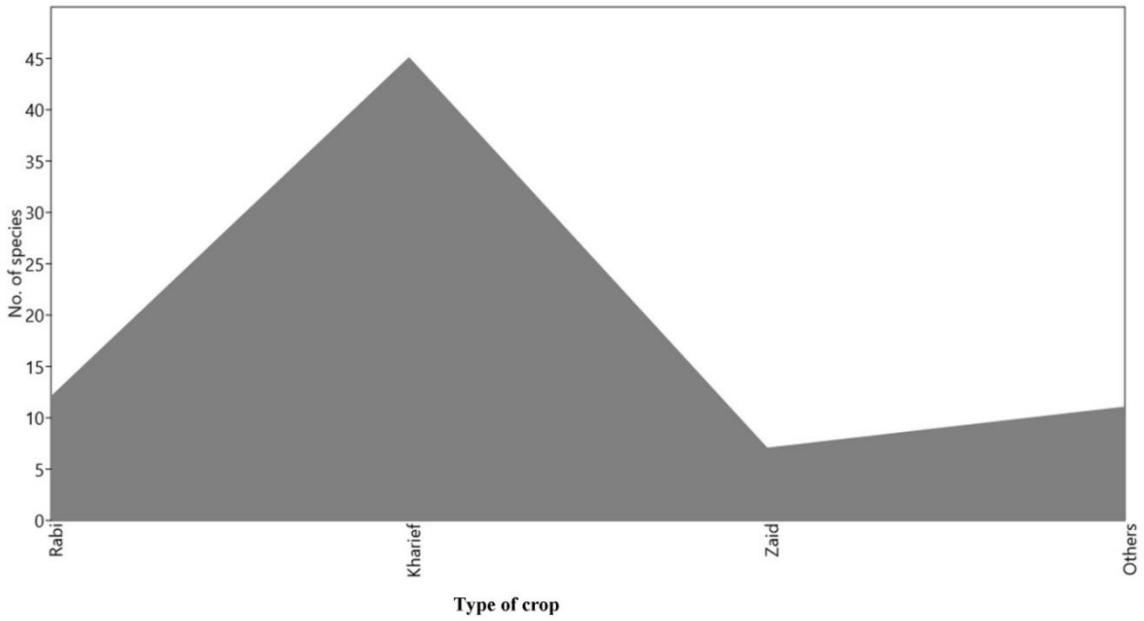

Fig. 5. Line filled plot showing types of different agricultural crops based on their sowing and harvest.

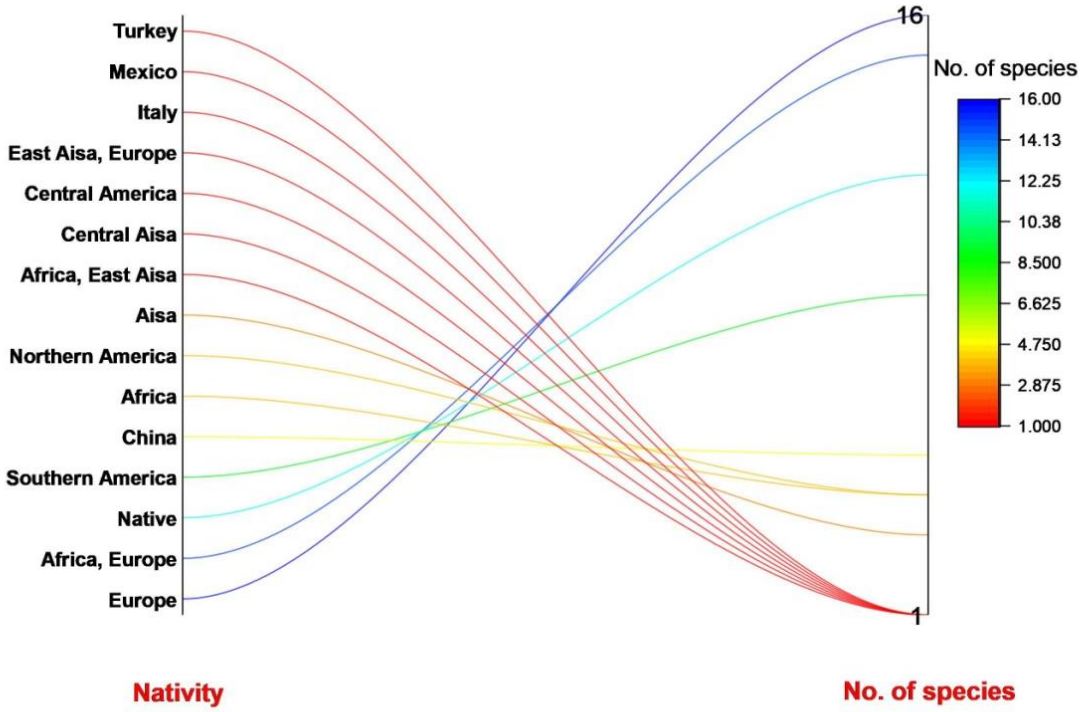

Fig. 6. Parallel plot showing the nativity of different agricultural crops growing in Kashmir valley.

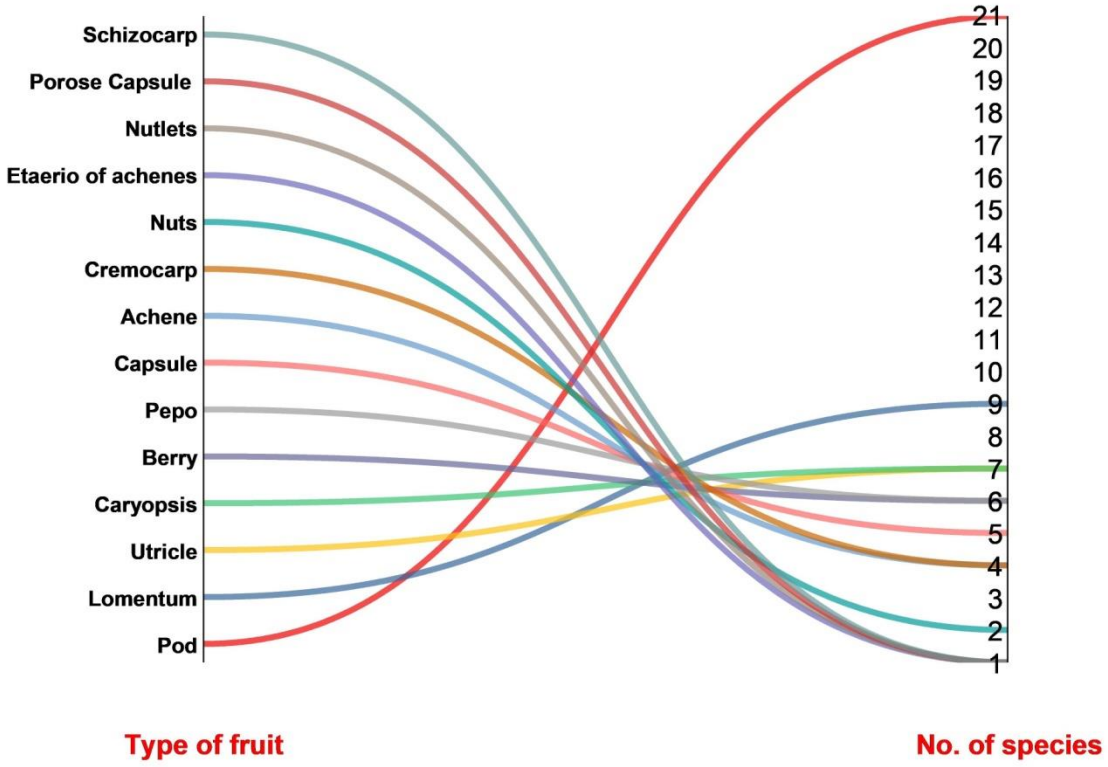

Fig. 7. Parallel plot showing various types of fruits produced from different agricultural crops.

Discussion

The production of three important food crops, namely, rice, maize and wheat contributes a major portion of the food grains in the Kashmir valley. Kashmir region has also got the monopoly in terms of Saffron crop (famous all over the world due to its quality) (Bhat et al., 2017). Although the cropping activity goes on throughout the year in some districts but there are two distinct seasons i.e. *Kharif* season and *Rabi* season. *Kharif* season related to rainfall, if it is good the crop response will be good on the other hand if the rainfall is unfavorable the crop response will be poor e.g., rice, maize, pulses and fodder (Chappell et. al., 2007, Singh et al., 2020). The *rabi* season is marked with the onset of winter which is marked with the temperature starts coming down. Irrigation plays a very important role in this season. In *rabi* season when the temperature is relatively low the crops grown in this region are wheat, pulses (gram, peas, masur), fodder,

mustard, potato and other vegetables (Maqbool 2013). Kashmir is one of the major saffron producing regions of the world. Crown in the *Karewas* of Kashmir it is an important cash crop providing employment to about 5 per cent of the total rural workforce in Valley of Kashmir (Ganaie et al., 2019). This valuable *"golden"* spice is known as *"Kum Kum"* and *"Kesar"* in Sanskrit and *"Koung"* in Kashmiri language. At present, the crop is being cultivated in some areas of adjoining districts like Srinagar, Ganderbal, Budgam, Shopian, Anantnag, Bhaderwah and Kulgam. But, still the main hub of Saffron cultivation is considered as Pampore area of district Pulwama (Ganaie et al., 2019).

Conclusion

To sustain continuous growth in productivity in agriculture, profitability and sustainability is must. There is a need to create general awareness techniques to enhance production, productivity and quality of food grains. This study helps to understand the various characteristics of agricultural crops growing in Kashmir valley. The significant crops important crops are Rice, maize, wheat, barley, pulses etc. Different agricultural crops with their life span, part/parts used are assessed in present study. Kashmir region has also got the monopoly in terms of Saffron crop (famous all over the world due to its quality) which has been produced in the Pampore (Pulwama) and Budgam district. Although the cropping activity goes on throughout the year in some districts but there are two distinct seasons. *Kharif* season related to rainfall, if it is plentitude the crop response and yield will be good, on the other hand if the rainfall is unfavorable the crop response will be poor. However, the *rabi* season is marked with the onset of winter.

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Competing interest

Authors declare that no competing interest exists.

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