Documentation of ethnomedicinal orchids from Jammu and Kashmir, India

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Abstract. Orchids are a group of plants famous for their showy and beautiful flowers. Besides their aesthetic value, these are also used traditionally for their ethnomedicinal properties. In Jammu and Kashmir, India, 21 orchid species from 17 different genera have been documented for their utilization as ethnomedicinal plants. Rhizomes and tubers of these orchids are the main plant parts to be used to cure many disorders like gastro-intestinal, skeleton-muscular, neurological and others.

Keywords: Orchidaceae; ethnomedicine; rhizome; medicinal use; conservation

1. Introduction

Orchidaceae being most ecologically and morphologically diverse family comprises nearly 800 genera and around 25,000 species. It is most advanced and second largest family of flowering plants (Singh et al., 2019a&b). Orchids occur in diverse type of habitats but still are very much sensitive to ecological disturbances and habitat change. Orchids are greatly admired ornamental plants renowned for their stunning, vibrant flowers and are also recognized for their medicinal applications, particularly in traditional medicinal practices (Jalal et al., 2008). These particular flowering plants are experiencing the world attention because of their horticultural, medicinal and aesthetic values. People throughout the world are eager to work on different dimensions of this particular group of plants like taxonomy, cytology, chemistry, evolution, cultivation, hybridization and ethnobotany etc. Medicinal properties of orchids are known to mankind since ancient era.

Since orchids are mentioned in several ancient writings, including "Nighantu" and "Amarkosha," authored by Sushruta and Vagbhata, respectively, the use of orchids in Indian medicine dates back to the vedic period (250–300 BC) (Agrawala et al., 2014).

Orchids are widely distributed in the world and are also richly present in Himalaya and Indo-Malaysian biodiversity hotspots (Kant and Chander, 2004). Globally, there are approximately 25,000 orchid species, with India accounting for 1,256 species across 155 genera. (Singh et al., 2019a&b; Govaerts et al., 2017). In the western Himalaya region, there are records of 238 types of orchids across 68 different genera in Uttarakhand, 84 species spanning 43 genera in Himachal Pradesh, and 46 species from 24 genera in Jammu and Kashmir (Singh et al., 2020).

Being second largest country in tribal population, India has a wealthy history of using plants in traditional folk medicines. Jammu and Kashmir in Western Himalaya supports about 948 plant taxa as ethnomedicinal species being used by the local people to treat various disorders (Bhatia et al.; 2014; Gairola et al., 2014; Thakur et al., 2020; Dutt et al., 2015). More specifically a little attempt on ethnobotany of orchid species has been made from Jammu and Kashmir, wherein 14 species are discussed from Jammu province and 7 species from Kashmir to be used as traditional medicine (Kant and Chander, 2004; Shapoo et al., 2013). Given this context, the primary goal of this study is to address the knowledge gaps regarding orchid species in the region and to encourage farmers to cultivate them commercially. When complemented and validated with the latest scientific insights, this valuable indigenous knowledge can provide new holistic models of sustainable development that are economically viable, environmentally friendly and socially acceptable (Shinwari and Gilani 2003).

2. Materials and methods

2.1 Study area

Union territory of Jammu and Kashmir is situated in Western Himalayan region from 32.31° N to 35.95° N latitude and 73.42° E to 76.75° E longitude and has an altitudinal range from 247 to 7135 meters above msl (Figure 1). Both Jammu and Kashmir regions possess mountainous tracks of Himalaya wherein all the three strata of Himalaya i.e. Shivaliks, Lesser Himalaya and Greater Himalaya are found in Jammu. Besides, some parts of the northern plains are also flanked and famous for paddy cultivation. Kashmir region majorly has mountains of Lesser Himalaya and Greater Himalaya. Ranging from sub-tropical to temperate climates, Jammu and Kashmir possesses extreme cold winters (0 to 10 ˚C) to scorching hot conditions from 30-40 ˚C in summers. Natural corridors of the region are the geographical features for migration of diverse type of organisms from other parts to South-East Asia.

2.2 Data collection and analysis

Extensive surveys were conducted in the study area between March 2022 and December 2023 in which 37 individualas were interviewed about the ethnomedicinal uses of orchids. The interviews were carried out through semi-structured questionnaires with village heads, elderly people and traditional healers aged between 30 to 65 years (Table 1). The participants were selected based on their recognized expertise in traditional plant folk knowledge and were categorized into three age brackets: Group I, aged 30 to 40 years; Group II, aged 41 to 50 years; and Group III, aged 51 to 65 years. Ethical approval was obtained from the participants before conducting the interview through declaration section in the questionnaire. To ensure accuracy, the interviews were repeated multiple times. Each plant material was identified by botanical name, habit, part used, ethnomedicinal uses, altitudinal range and nativity. To ensure accurate species nomenclature and identification of their natural habitats, we referred to an online database, "POWO" (Plants of the World Online), along with local floras (Hooker, 1875-1997; Sharma and Kachroo, 1983; Swami

and Gupta, 1998). The assessment of threat status was conducted using the IUCN Red List. The plant specimens were collected, photographed and processed to form herbarium sheets as per Das (2021). Herbarium sheets so prepared were deposited in Herbarium of University of Jammu (HBJU).

This data underwent quantitative analysis employing measures such as use value (UV) and informant consensus factor (Fic).

2.2.1 Use value (UV):

Use Value represents the relative importance of the species and is calculated through UV index as per the below given formula (Philips et al., 1994).

$UV=\Sigma UR/n$ [Where; UV=Use value, UR= total use reports submitted by all informants for different ailments cured by a particular species, where n is the total number of informants.]

UV values close to zero (0) suggest that a species is less important to the informants; high UV values indicate great importance. If a plant is employed for one purpose or several, its Use Value does not indicate this.

2.2.2 Factor informant consensus (Fic): Researchers used Factor Informant Consensus (Fic) to assess the homogeneity of traditional knowledge about medicinal orchids among the informants (Heinrich et al., 1998). Ailments treated by informants were categorised as proposed by Heinrich et al. (1998). Few modifications in the list of categories were made as per the gathered data. The below given formula was used to calculate *Fic*:

$Fic= n_{ur}– n_t/ n_{ur}– 1$ [Where; Fic= Factor information consensus, n_{ur}= nt represent the number of taxa utilized for a specific use

category, while number of use reports for a given use category].

When the Fic values are close to zero, it suggests that the selection of plants for treating a particular ailment is random or that there's limited knowledge about their usage among researchers and local tribes. As the value approaches one, it indicates a more defined selection criterion within the research community (Gazzaneo et al., 2005).

3. Results and discussion

Traditional system of medication includes diverse approaches to prevent, diagnose and treat various ailments of both human and livestock. Broadly, the traditional practices were classified into four different systems (a) traditional folk medicine using a methodical, systematize such as pharmacopoeias or old texts; (b) traditional medicine or folk medicine that is not codified; (c) spiritual or shamanic medicine; and (d) related fields of health knowledge (Dutt et al., 2015). Out of these four different systems the non-codified system varies with culture, flora and geography of the area (Upadhya et al., 2014). The present research involved interviewing a collective of 37 individuals (comprising 32 males and 5 females) to record their traditional wisdom regarding the utilization of orchids for ethnomedicinal purposes (Table 1). According to the informants, 21 orchid species belonging to 17 genera are used as medicinally important plants in Jammu and Kashmir (Table 2; Figure 2). Shapoo et al. (2013) has reported 7 orchids from Kashmir Himalaya to be used traditionally in the treatment of various illness disorders. Twelve and seventeen species of orchids, respectively, have been documented to be utilized in traditional medicine from Uttrakhand by Jalal et al. (2008) and Joshi et al. (2009). According to Dash et al. (2008), Orissa is home to 20 orchid species of medicinal importance that are used to treat 33 distinct disorders. Thirteen distinct kinds of ailments are treated using fifteen different orchid species in Madhya

Pradesh (Tiwari et al., 2012). Likewise 4 orchid species are reported to be used as ethnomedicine by Khamti tribe of Lohit district of Arunachal Pradesh (Chowlu et al., 2017). Nongdam (2014) has reported 30 orchids to be used in therapeutic medicines in Nagaland, India. In present study all the reported medicinal orchids are terrestrial except *Rhynchostylis retusa* (L.) Blume which is epiphytic. On the basis of the calculated use value (*UV*) *Dactylorhiza hatagirea* (D.Don) Soó (UV=1.70), *Goodyera repens* (L.) R.Br. (UV=1.22) and *Malaxis muscifera* (Lindl.) Kuntze (UV=1.16) are relatively the most important orchid species among the traditional healers of the region (Table 2). A number of ailments were grouped into 11 categories which were found to be treated by 21 medicinal orchid species in the explored area (Table 3). The maximum orchid species i.e. 11 (52.4%) were reported to cure some unclassified disorders like general weakness, body cooling etc. followed by 10 (41.67%) species each to treat gastrointestinal & liver problems and skeleto-muscular & skin problems. Through *Fic*, it is determined that the informants have a strong consensus in the treatment of cardiovascular and blood diseases (Fic=0.95) followed by skeleton-muscular and skin problems (Fic=0.92), cold & fever and throat & respiratory problems (Fic=0.90 each) and diabetes (Fic=0.80) etc. using the medicinal orchids (Table 3). High Fic values for the aforementioned illnesses attest to the fact that these conditions are common in the research areas and those informants have tried a wide variety of orchid species to treat them. Further there is good transfer of traditional knowledge through generations. In contrary Yineger et al. (2008) reported that traditional knowledge is at great verge of extinction either because of loss of knowledgeable persons or minimum transmittance of knowledge through generations. The erosion of traditional knowledge through any means could result in an irreplaceable gap in the healthcare systems of developing nations, as over 70% of the world population primarily depends on traditional herbal remedies. (Pei, 2001; Quinlan and Quinlan, 2007). Rhizome and tubers were found to be the most

favored plant parts (70.8%) in terms of percentage consumption, followed by the entire plant (16.67%), leaves (8.33%), and flower (4.16%) (Figure 3). Shapoo et al. (2013) also reported tubers as the most preferred part of the orchids plant as per treatment of various ailments is concerned in Kashmir Himalaya.

According to IUCN red list *Malaxis muscifera* (Lindl.) Kuntze is vulnerable orchid and some others like *Cephalanthera longifolia* (L.) Fritsch, *Epipactis helleborine* (L.) Crantz, *Spiranthes sinensis* (Pers.) Ames, *Goodyera repens* (L.) R.Br., *Neottia ovate* (L.) Bluff & Fingerh., and *Zeuxine strateumatica* (L.) Schltr. are described as least concerned. Out of total 21 orchids described in current study 10 are common, 3 are sparsely present, 2 each are occasional and very rare and occurrence status of remaining 4 is not described in Western Himalaya (Table 2). Due to high degree of exploitation pressure on medicinal orchids, these plant species are facing a risk of being extinct in near future. In Ural mountains of Russia, orchids growing there are showing their habitat specialist strategy with wide range of habitat adaptability and plant-pollinator interaction to overcome extinction threat (Kirillova et al., 2023). According to Rewicz et al. (2015), 13 orchid species out of 26 in Central Poland are reported as threatened and included in the Red data book of Lodz Voivoship. In present study, out of all plant parts utilized for treatment, 87.47% are obtained through a destructive method involving the harvesting of tubers and rhizomes, resulting in the death of the plant and presenting a significant sustainability risk, especially for these slowly propagating medicinal orchids.

Hence, to meet sustainability objectives, it is essential to enact conservation programs in the region. These initiatives may take the form of in-situ or ex-situ strategies, workshops, awareness campaigns, conferences and the cultivation of medicinally important plants in household gardens and other publicly accessible spaces (Kumar et al., 2015; Njoroge et al., 2010).

Due to the unique life cycle of orchids, their conservation poses distinct challenges but also offers new opportunities. For instance, many orchid species have highly specialized interactions with pollinators and fungi, which remain effective even in small populations. Given evidence from other organisms showing persistence through small genetic bottlenecks and the potential for genetic rescue, conservation biologists should not be discouraged from working with orchid species that have small population sizes, as orchids produce a large number of seeds per capsule. With proper horticultural practices, these seeds can serve as essential resources for both conservation programs and scientific research, even in extremely rare species (e.g. Reiter et al., 2019).

4. Conclusion

Traditional knowledge is an old age tried and tested knowledge among local residents regarding usage of medicinal plants. They have developed this expertise throughout time through experimentation and customization to meet the needs of the person. A crucial element of sustainable growth is this kind of knowledge. Such knowledge is an essential component of sustainable development. From last few decades the traditional knowledge among ethnic groups is diminishing down at an alarming rate and in many cases the system is at the verge of extinction. During current investigation it was concluded that traditional healers in Jammu and Kashmir are using 21 orchid species to treat various ailments which is a very poor figure. Calculated UV indicates that about out of 21 orchid species people use only 9 species (UV<0.50) very often. The traditional healers in Jammu and Kashmir have homogeneity in the folk knowledge and possess considerable transfer of knowledge from generation to generation.

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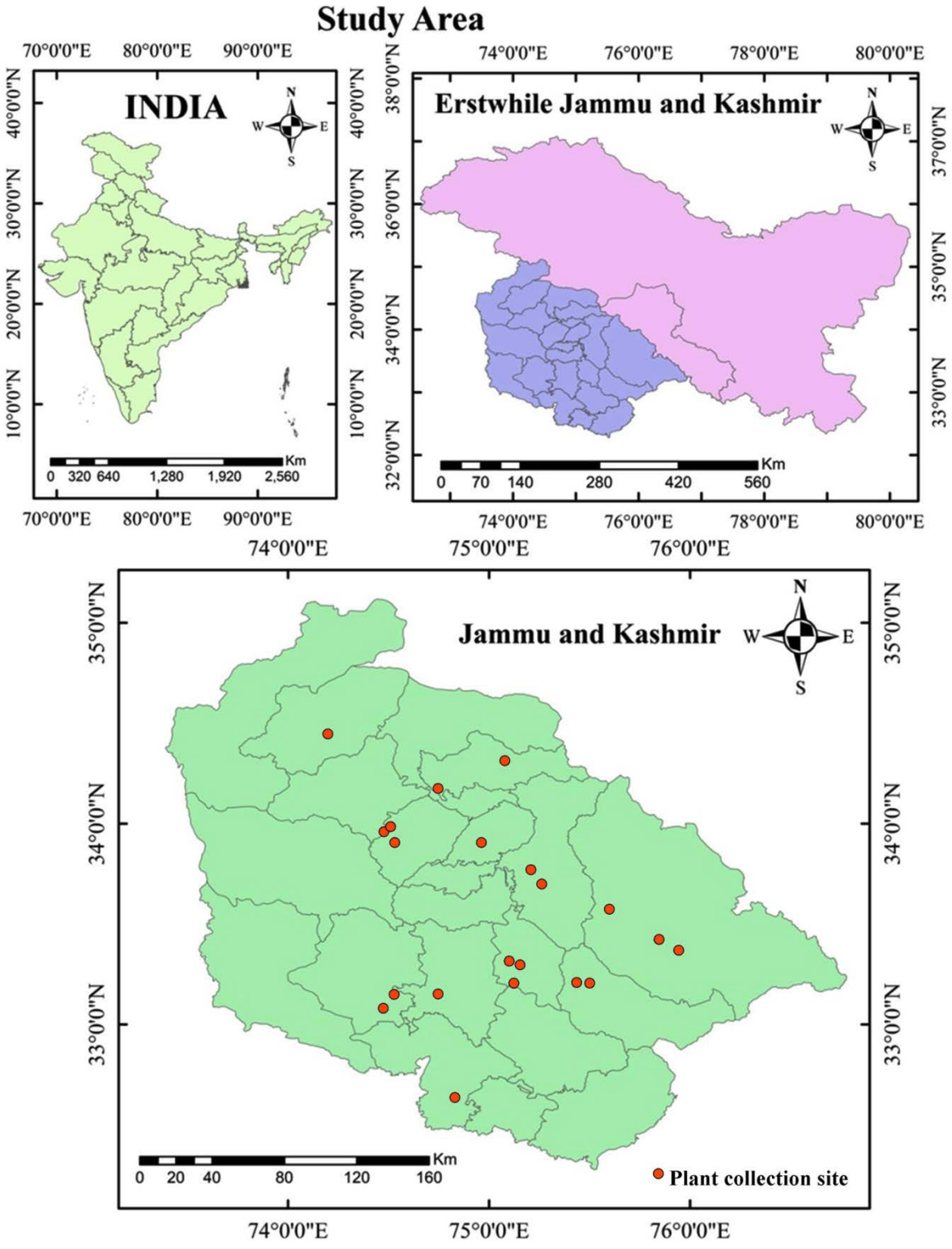

Figure 1: Study area map

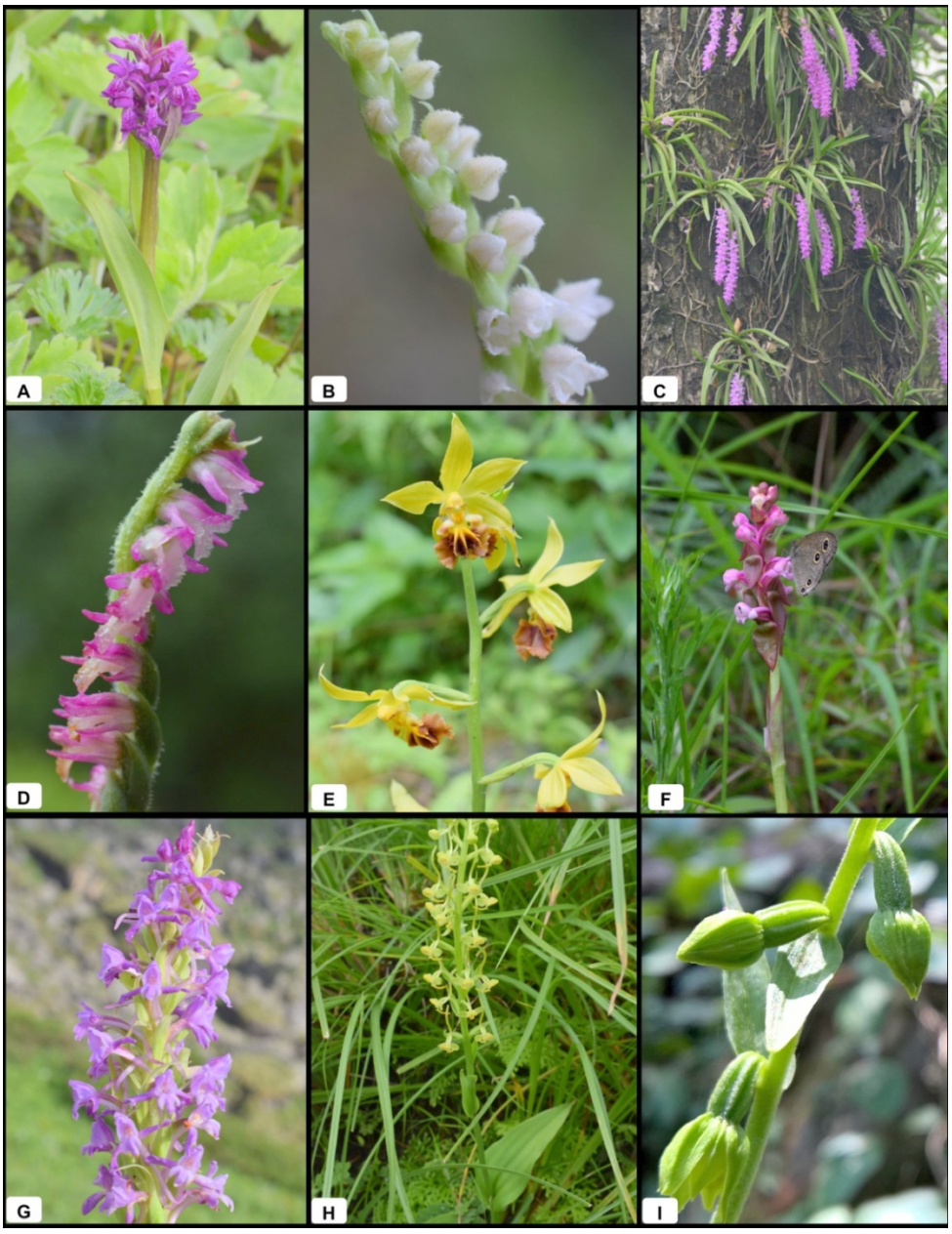

Figure 2: Ethnomedicinal orchid species used by locals in Jammu and Kashmir: (A) *Dactylorhiza hatagirea* (D.Don) Soó, (B) *Goodyera repens* (L.) R.Br., (C) *Rhynchostylis retusa* (L.) Blume, (D) *Spiranthes sinensis* (Pers.) Ames, (E) *Calanthe tricarinata* Lindl., (F) *Satyrium nepalense* D.Don, (G) *Gymnadenia orchidis* Lindl., (H) *Habenaria edgeworthii* Hook.f. ex Collett and (I) *Epipactis helleborine* (L.) Crantz. Photo courtesy: Dr. Sunit Singh (3rd Author) & Dr. Sajan Thakur (Corresponding and 1st Author)

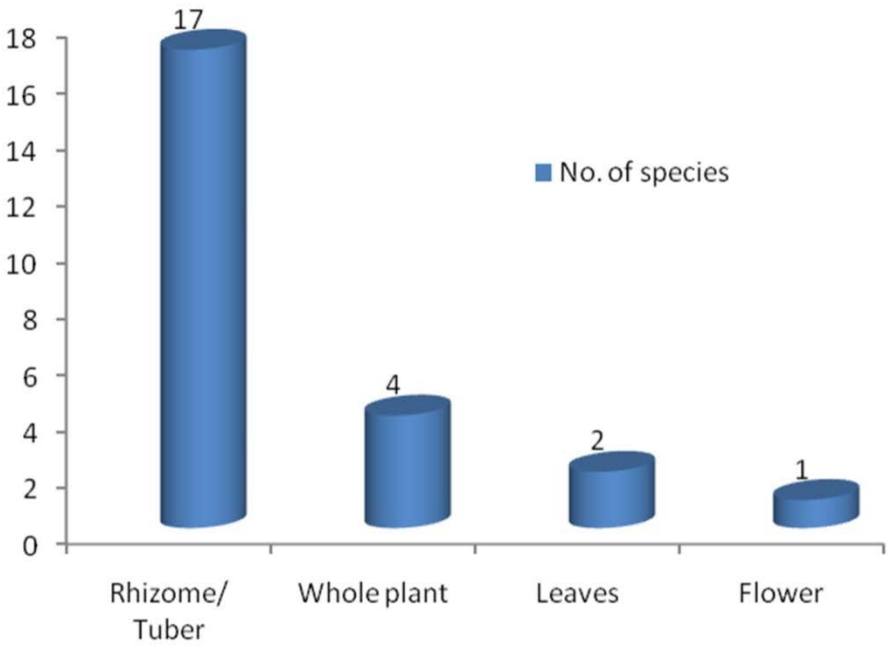

Figure 3: Representation of plant parts of orchids with respect to number of species

Table 1: Demography of informants

Informants	**Number**		
Male	32 (86.48 %)		
Female	5 (13.51 %)		
Total	37		
Age group (years)	**Male**	**Female**	**Total**
Group I (30-40)	9 (28.12%)	1 (20.0%)	10 (27.02%)
Group II (41-50)	11 (34.37%)	1 (20.0%)	12 (32.43%)
Group III (51-65)	12 (37.5%)	3 (60.0%)	15 (40.54%)

Table 2: Ethnomedicinal uses of Orchid species used in Jammu and Kashmir

S.No.	Name of plant	Habit & habitat	Altitudinal range (meters amsl)	Native range	Occurrence in Western Himalaya	IUCN threat status	Ethnomedicinal uses	URs	UV
1.	*Calanthe tricarinata* Lindl.	Terrestrial, near moist soils	2000-3000	North Pakistan to Temperate East Asia	Common	NA	Whole plant has cooling property and its decoction is taken to relieve general weakness.	15	0.41
2.	*Cephalanthera longifolia* (L.) Fritsch	Terrestrial, in shady areas	1800-2500	Europe, Mediterranean to Central China, Taiwan, Japan	Common	LC	Decoction of rhizome in milk is taken twice a day to relieve body pain and general weakness.	18	0.49
3.	*Dactylorhiza hatagirea* (D.Don) Soó	Terrestrial, along with grasses in moist area	3000-4500	Mongolia to Himalaya	Occasional	NA	Tubers are used to cure stomach ache, headache, cough, cold, fever, throat infection, diarrhea, intestinal worms, seminal debility and general weakness. Paste of tubers and leaves is applied on wounds and bone fractures.	63	1.70
4.	*Dienia cylindrostachya* Lindl.	Terrestrial, in moist area	2200-3500	Pakistan to Tibet and Myanmar	Occasional	NA	Decoction of rhizome is taken as body tonic.	10	0.27
5.	*Epipactis helleborine* (L.) Crantz	Terrestrial, near water streams	1000-4000	North West Africa, Europe to China	Common	LC	Rhizome paste is applied externally on boils. Deccoction of rhizome is taken twice a day to cure chronic fever and it also act as aphrodisiac and nerve tonic. Whole plant is used to treat malignancy and skin disorders.	26	0.70
6.	*Epipactis royleana* Lindl.	Terrestrial, in shady area		East Afghanistan to Central Asia and Himalaya	NA	NA	Rhizome paste is used to treat wounds and its decoction is taken to treat general weakness and seminal debility.	10	0.27
7.	*Eulophia dabia* (D.Don) Hochr.	Terrestrial, in shady area	300-2000	Afghanistan to South China and	Sparsely present	NA	Decoction of tubers is taken daily to purify blood and treat stomach and heart problems.	17	0.46

				Nicobar islands					
8.	*Goodyera repens* (L.) R.Br.	Terrestrial, preferably in moist area	2000-3600	Temperate northern hemisphere	Common	LC	Decoction of leaves and rhizome is taken twice daily to treat urinary irritation and menstrual irregularity and loss of appetite. Paste of leaves is applied on wounds, tooth cavities and it act as an antidote against snake bite. Leaf juice is used to treat eye infections.	45	1.22
9.	*Gymnadenia orchidis* Lindl.	Terrestrial, in shady area	3000-4500	Pakistan to Central China	Sparsely present	NA	Tubers are chewed raw to treat indigestion, diarrhea and liver problems.	15	0.41
10.	*Habenaria edgeworthii* (Hook.f. ex Collett) X.H.Jin, Schuit., Raskoti & Lu Q.Huang	Terrestrial, near water streams	1500-2800	Pakistan to Himalaya	NA	NA	Decoction of tubers acts as blood purifier and rejuvenator.	21	0.57
11.	*Habenaria intermedia* D.Don	Terrestrial, near water streams	2000-2700	Pakistan to Myanmar and South Tibet	Common	NA	Tubers are used as general tonic.	7	0.19
12.	*Habenaria commelinifolia* (Roxb.) wall. ex Lindl.	Terrestrial, near water bodies	1000-1200	Indian subcontinent to China	Very rare	NA	Tuberous roots are eaten raw to keep digestive system healthy	4	0.11
13.	*Herminium edgeworthii* (Hook.f. ex Collett) X.H.Jin, Schuit., Raskoti and Lu Q.Huang	Terrestrial, in shady area		Pakistan to Himalaya	NA	NA	Tubers are aphrodisiac in action and have rejuvenating properties.	6	0.16
14.	*Herminium lanceum* (Thunb. Ex Sw.) Vuijk	Terrestrial, in shady area	1200-2700	Mongolia to Tropical Asia	NA	NA	Tubers are aphrodisiac in action.	7	0.19
15.	*Malaxis muscifera* (Lindl.) Kuntze	Terrestrial, in moist area	1800-3500	Pakistan to South Central China	Common	VU	Pseudobulbs are used to treat leprosy, diabetes, blood infections, oral infections and act as febrifuge and cooling agent.	43	1.16
16.	*Neottia ovata* (L.) Bluff & Fingerh.	Terrestrial, in moist area along	2100-2500	Europe to Himalaya	Very rare	LC	Decoction of leaves is taken twice a day to treat stomach pain and indigestion. Paste	14	0.38

		with grasses					of rhizome is applied on skin to treat skin disorders.		
17.	*Nervilia plicata* (Andrews) Schltr.	Terrestrial, in moist area along with grasses	600-1000	Tropical and subtropical Asia to North Australia	Sparsely present	NA	Decoction of whole plant is taken to cure colic, urinary calculi, cough, asthama and poison. Tubers are used to treat vomiting, epilepsy, jaundice, diarrhea and diabetes.	23	0.62
18.	*Rhynchostylis retusa* (L.) Blume	Epiphyte, grows on tree trunks	500-1000	China to tropical Asia	Common	NA	Whole plant is used to treat rheumatic diseases and act as emollient.	35	0.95
19.	*Satyrium nepalense* D.Don	Terrestrial, in moist area	1500-3000	Indian subcontinent to East Central China	Common	NA	The dried tubers are used as tonic and also used to treat malaria and dysentery.	21	0.57
20.	*Spiranthes sinensis* (Pers.) Ames	Terrestrial, in shady area	1600-3500	Assam to South Central Japan and New Caledonia	Common	LC	Flower powder mixed in mustard oil is applied on skin eruptions. Paste of tubers is applied on wounds and swellings and decoction of tubers is taken to cure sour throat, cough, cold, fever and general weakness.	43	1.16
21.	*Zeuxine strateumatica* (L.) Schltr.	Terrestrial, in moist area along with grasses	300-1200	Iran to Central Asia	Occasional	LC	Roots are eaten raw to keep gastrointestinal system healthy.	10	0.27
LC = Least Conceened; VU = Vulnerable; NA = Not Available.									

Table 3: Ailment categories and their factor informant consensus values of Orchid species from Jammu and Kashmir

Ailment category	**Number of taxa used (n_t)**	**Total use reports (n_{ur})**	**Factor information consensus (Fic)**
Cardiovascular and blood related diseases	3	42	0.95
Cold and fever	4	31	0.90
Diabetes	2	10	0.89
Gastrointestinal and liver diseases	10	78	0.88
Neurological disorders	3	9	0.75
Oral and eye disorders	3	11	0.80
Reproductive and urinary problems	7	53	0.88
Skeleto- muscular and skin problems	10	110	0.92
Stings and poison	2	7	0.83
Throat and respiratory problems	3	21	0.90
Others (General weakness, body tonic, cooling and rejuvenating)	11	81	0.88