Journal of Agriculture Sustainability and Environment ISSN: 2997-271X
https://doi.org/10.56556/jase.v3i1.1123

RESEARCH ARTICLE

Quantitative Ethnobotany of the Plants of District Swabi, Tehsil Razar, Khyber Pakhtunkhwa, Pakistan

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Received: 14 May, 2024, Accepted: 24 June, 2024, Published: 29 June, 2024

Abstract

The present study presents first tentative attempt to determine the quantitative ethnobotanical profile of plants of Tehsil Razar, District Swabi. Relative frequency citation (RFC) and Use value (UV) of plant resources were calculated. Pearson correlation coefficient (PCC) was calculated to find any significance between RFC and UV. A total of 60 plants from 37 families had ethnobotanical importance in the investigated area. It included 1 pteridophyte, 13 monocots and 46 dicots. Quantitative results showed that 24 species with the highest RFC value of 1, were important in the area in terms of their uses. *Acacia modesta*, *Acacia nilotica sub sp. nilotica* and *Ailanthus altissima* were popular and common medicinal plants in the study area with highest use value of 6.07, 5.60 and 3.40 respectively. The Pearson correlation coefficient (PCC) between RFC and UV was 0.01 with P value well below than 1% which demonstrate a highly significant correlation between RFC and UV.

Keywords: Quantitative ethnobotany; Pearson correlation; Swabi; Razar

Introduction

Plant species have long played important roles for humanity. The formal study of these plants has proven to be a powerful tool in understanding how different indigenous communities relate to natural resources, notably for medical and pharmaceutical applications (de Albuquerque and Hanazaki, 2009). Ethnobotany is a multidisciplinary science which is defined as the relation between plants and people. It explores the usage of plants in every aspect of life (Shinwari, 2010). Indeed, ethnomedicinal study has been a fundamental source for the discovery of natural and synthetic drugs (Fabricant and Farnsworth,

2001). Ethnobotanical knowledge continues to provide a starting point for many successful drug screening projects in recent years (Heinrich and Bremner,2006). The increased dependence of anthropogenic activities over the plants may also lead to alarming situation in vegetation. The link between plants and human cultures is not restricted to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation, health care and sports (Schultes, 1992). Ethnobotany is important in the production of modern drugs by exploring the traditional usage of locally important plants. Wild resources of medicinal plants had been used by the native people since time immemorial in conventional healing systems (Adnan et al., 2014). According to data from the World Health Organization (WHO), about 80% of the world's population, especially the rural people of developing countries, still primarily rely on traditional medicines (Islam, 2006). On the other hand, the origins of over 50% of all pharmaceutical drugs could be traced back to ethnomedicine (Van Wyk et al., 1997) District Swabi is located between 34°7' N 72°28' E. It is bounded in the north by District Buner, on the east by District Haripur, in the south by District Attock and on the west by District Nowshera and Mardan (Fig. 1). The altitude varies from 300 to 650 meters having average elevation about 321m (Khan, 2009; Hussain et al., 1993). There are four Tehsils in District Swabi namely: Topi, Swabi, Lahor and Razar. Tehsil Razar was established on 10th September, 2009. It is located between 34°14' N and 72°20' E. About 90% population depends on agriculture and utilizes maximum land for this purpose. Tehsil Razar has extreme climate. Temperature rises sharply in the months of May and June that remains almost persistent during the months of July, August and September. Maximum temperature is observed during the month of June which is 41.5°C. The minimum temperature of 2°C is recorded in the month of January. A number of ethnobotanical studies have been conducted in Pakistan to strengthen the prevailing ethnobotanical knowledge. Barkatullah et al. (2009) assessed 100 plants distributed over 49 families from Charkotli Hills, Batkhela District, Malakand, Pakistan. Sher et al. (2011) collected ethnobotanical knowledge of 216 plant species belonging to 87 families from Chagharzai Valley, District Buner, Pakistan. Hadi et al. (2013) conducted ethnobotanical survey at Rech Valley, District Chitral, Hindu-Kush range, Pakistan. Khan et al. (2015 a) documented ethnoveterinary medicinal plant for curing various animal diseases in District Peshawar. Khan et al. (2015 b) explored ethnobotanical knowledge of Tehsil Barawal, District Dir (Upper). Ali et al. (2015) gathered the ethnobotanical knowledge about 86 plant species of Mahaban and Malka of District Buner. Qasim et al. (2015) reported 24 ethnomedicinal plants from Swabi, Pakistan. Adequate documentation of such knowledge, and especially of traditional ethnomedicinal practices, is important because ethnomedicinal healers have a long association with herbs and their medicinal properties (Kabir et al., 2014). Notably, ethnomedicinal knowledge is usually passed verbally from one generation to the next through family members (Nadembega et al., 2011), and most of this knowledge has not been formally documented (Asase et al., 2008). However, in recent years, there has been a continuous decline in traditional medicinal practices, because of reduced interest in the younger generation toward traditional treatment systems, coupled with rural depopulation, mass deforestation, and migrations of traditional medicinal healers to other jobs. These factors have contributed to the rapid loss of this rich knowledge (Kadir et al., 2013). In contrast, ethnomedicinal research has gained interest among the scientific community (Heinrich, 2000).

However the review of literature suggests that there is no work done in Tehsil Razar on the exploration of quantitative ethnobotanical information. Therefore, the present work is aimed to classify plants ethnobotanically on quantitative basis.

Materials and method

Study Area

Razzar is a Tehsil located in Swabi District, Khyber Pakhtunkhwa, Pakistan. Its administrative seat is located in Shewa Adda near Kalu Khan. At Latitude of 34.21398234406986 and Longitude of 72.31581968961575. It consists of different villages and union councils, including, Sheikh Jana ,Yaqubi, Yar Hussain, Sudhir, Sardcheena, Babo Dehri, Dobian, Kalukhan, Shewa, Kernal Sher Kallay (Naudeh), Adina, Ismaila, Turlandi, Naranji, and Farmoli.Villages Dagai,Taraki and Rashaki are also parts of Razzar Tehsil. The name Razzar is based on the forefather of razzar clan of mandhanr tribe mubarak khan razzar.

Plant Collection, Identification, and Preservation

Ethnobotanical uses from 20 villages of Tehsil Razar were reported. Plant specimens were collected, preserved and mounted properly on standard herbarium sheets. Identification of plant was done through flora of Pakistan.

Field Study and Data Collection

In each village interviews were carried out with respondents and informants including farmers, herbalists, shepherds, pansaries (medicinal plant sellers), and elders including both male and females old over 45 years. Each village was visited in summer, winter and spring season in order to record diverse ethnobotanical information of the area. Ethnobotanical information were quantitatively computed by using frequency citation (FC), relative frequency citation (RFC) and use value (UV) along with Pearson correlation coefficient (PCC) following Bano et al. (2014).

Relative frequency citation (RFC)

RFC demonstrates the local importance of the species. It is calculated by dividing frequency of citation (FC, the number of informants mentioning the use of the species) to the total number of participated informants.

$RFC = FC/N \ (0 < RFC < 1)$

Use value

The Use Value (UV) shows the relative importance of locally known plants. It was calculated as follows:

UV=∑ Ui /N

Where Ui is the number of uses mentioned by each informant for a particular species and N is the total number of informants.

Pearson correlation coefficient

It represents the linear relationship between two numerically quantified variables. It is the ratio of the covariance between two variables to their standard deviations. It is calculated as follows:

$$r = \frac{COV(X,Y)}{SD(X) \times SD(Y)}$$

Where r is the Pearson correlation coefficient, COV is the covariance, X and Y are the variables for which the relationships is going to explore and SD is the standard deviation for the same variables.

Result and Discussion

Demography of Informants

A total of 170 informants were interviewed. Out of these, 129 were male and 41 were female.

Documented Plant Species and Their Taxonomy

The ethnobotanical survey identified 60 plant species from 37 families, there were 35 herb species, 18 tree species and 6 shrub species (Fig. 4) demonstrating the rich plant biodiversity of the region. Similar findings have been reported in ethnobotanical studies conducted in various regions, highlighting the role of diverse flora in traditional knowledge systems (Abbasi et al., 2022; Ghorbani et al., 2021). The dominance of dicots (46) over monocots (13) and pteridophyte (1) aligns with global trends in ethnobotanical inventories, as dicotyledonous species typically constitute the majority of ethnobotanically significant plants (Sharma et al., 2020) (Table. 3). The dominance of the Poaceae family, with 10 species, is consistent with its wide ecological adaptability and economic importance globally (Kaur et al., 2021). Families like Amaranthaceae (4), Mimosaceae, Euphorbiaceae, and Asteraceae, 3 species each. Rest of families had 2 or less species, are commonly reported in ethnobotanical studies due to their high utility in traditional medicine and other practices (Kumar et al., 2019). The presence of families with fewer species but significant uses, such as those contributing to construction, fuel, and medicinal applications, indicates the functional diversity of plant species in rural livelihoods (Bibi et al., 2023). The multifunctionality of plants identified in the study resonates with similar findings from rural and indigenous communities worldwide. Medicinal uses 35 (58.33%) dominated, reflecting the heavy reliance on traditional herbal remedies in regions with limited access to

modern healthcare facilities (Iqbal et al., 2023). Fodder Twenty six species (41.67%), fuelwood Sixteen species (26.67%), and other uses such as construction, furniture, and edible applications, underline the integrative role of plant resources in subsistence economies (Ahmad et al., 2021). Thirteen species (21.67%) were utilized as construction and building materials, reflecting their importance in traditional architecture and rural livelihoods. Similar studies in other regions have reported the use of species such as *Acacia modesta* and *Acacia nilotica* in construction due to their durable wood and resistance to pests (Sharma et al., 2020; Ahmad et al., 2022). These species have been historically preferred for constructing homes, fences, and agricultural tools. The use of 12 species (20%) for furniture-making is consistent with traditional practices, where locally available timber species are prioritized for their affordability and sustainability. Species like *Morus alba* and *Ailanthus altissima* are commonly documented in ethnobotanical research for their sturdy wood, which is used to craft furniture, agricultural implements, and other household items (Kumar et al., 2021). The identification of 12 edible species (20%) emphasizes the role of wild plants in local diets, particularly in rural and semi-urban areas. Edible plants, including fruits, leaves, and seeds, often serve as supplementary food sources, particularly during times of food scarcity. For instance, *Morus alba* is widely recognized for its edible fruits and leaves used as fodder (Abbasi et al., 2022). Fourteen species were noted for their use in making hedges, mats, ropes, miswak (tooth-cleaning sticks), and dyes. These uses underscore the ingenuity of local communities in utilizing plant materials for daily needs. For example, *Acacia nilotica* is traditionally used for making ropes and hedges, while its bark and pods are sources of tannins for dye production (Bibi et al., 2023). Such practices demonstrate the role of ethnobotanical knowledge in resource optimization and reducing reliance on synthetic materials. Only three species were identified as having ornamental value, suggesting that the primary focus of plant use in the area is utilitarian rather than aesthetic. This aligns with findings from similar rural contexts where ornamental use is secondary to subsistence needs (Choudhary et al., 2023). Species such as *Acacia modesta*, *Acacia nilotica subsp. nilotica*, *Morus alba*, and *Ailanthus altissima* were noted for their multiple uses. These species are not only crucial for construction and furniture-making but also serve as sources of fuelwood, fodder, and medicine. The multifunctionality of these species highlights their ecological and economic importance in rural systems. Studies by Ahmed et al. (2021) and Hussain et al. (2023) similarly emphasize the critical role of multipurpose trees in meeting the diverse needs of local communities while supporting sustainable resource management. *Acacia modesta, Acacia nilotica subsp. nilotica,* and *Ailanthus altissima emerged* as the most valued species, consistent with their widespread use in ethnobotanical and agroforestry systems. These species' high use values (UV) and relative frequency of citation (RFC) suggest their cultural and practical importance (Sahoo et al., 2020). Their multifunctionality across categories such as medicine, construction, and fuelwood has been documented in similar contexts, reaffirming their role in rural resource management (Hussain et al., 2023).

Table 1. Frequency citation (FC), relative frequency of citation (RFC) and use value (UV) of ethnobotanical plants of Tehsil Razar, Swabi

S.No.	Voucher No.	Botanical Name	FC	RFC	∑Ui	UV	Part used	Uses
1.	HBKU-423	*Acacia modesta* Wall.	15	1.00	91	6.07	Gum, wood, leaves and roots	Tonic, healing agent, pain killer, use in cough, jaundice, backache, fodder, furniture, building, hedges and miswak
2.	HBKU-424	*Acacia nilotica sub sp. nilotica* (L.) Delile	15	1.00	84	5.60	Gum, wood and leaves	Used for healing, headache, hiccup, sexual weakness, fodder, furniture, agriculture tools, honey bee species.
3.	HBKU-425	*Ailanthus altissima* (Mill.) Swingle.	15	1.00	51	3.40	Whole plant	Used for dysentery, curing of fever, fodder fuel, building, furniture.
5.	HBKU-426	*Morus nigra* L.	15	1.00	47	3.13	Fruit, leaves, wood	Used for curing tonsils, cough and throat infections also used in fodder, furniture, timber wood, making baskets.
6.	HBKU-427	*Cannabis sativa* Linn**.**	15	1.00	44	2.93	Shoots	Sedative, narcotic, analgesic and used for wound healing and in hallucination.
7.	HBKU-428	*Morus alba* L.	15	1.00	42	2.80	Fruit, leaves, wood	Used for curing tonsils, cough and throat infections also in fodder, furniture, timber and making baskets.
8.	HBKU-429	*Phoenix dactylifera* Linn.	15	1.00	40	2.67	Fruit and leaves	Laxative, used in making ropes and mats. Fruits are also helpful for sexual weakness
9.	HBKU-430	*Saccharum spontaneum* L	14	0.93	40	2.67	Shoots	Used in making brooms and baskets, winnowing trays, and writing pen locally called as Qalm

	HBKU-431		15	1.00	39	2.60	Bark, leaves and wood	Used for curing abdominal pain, backache, furniture, agriculture tools. Timber, fuel and fodder
10.		*Dalbergia sissoo* Roxb.						
	HBKU-432		15	1.00	37	2.47	Fruit, latex, leaves	Used for curing stomachache and body pain, wound healing, fever antidote for snake and scorpion bites
11.		*Calotropis procera* (Ait.) Ait.f.						
	HBKU-433		15	1.00	37	2.47	Leaves, fruit, wood	Used for piles relief, diabetes, wound healing, physical injuries, fodder, furniture, timber, fire wood
12.		*Melia azedarach* L.						
13.	HBKU-434	*Dodonaea viscosa* (L.) Jacq.	15	1.00	32	2.13	Shoots	Anthelmintic, used in roofs, fuel and making brooms
14.	HBKU-435	*Albizia lebbeck* (L.) Benth.	15	1.00	32	2.13	Leaves, fruits and wood	Used for diabetic disorders, fodder. timber, furniture and firewood
15.	HBKU-436	*Populus euphratica* Olivier.	15	1.00	31	2.07	Wood, young shoots, leaves	Used for fodder, timber, furniture, fire wood and making baskets
	HBKU-437		14	0.93	31	2.07	Leaves and oil	Used for constipation, muscle relaxation and delivery cases, wound healing and for abortion purposes.
16.		*Ricinus communis* L.						
17.	HBKU-438	*Salix tetrasperma* Roxb	15	1.00	30	2.00	Wood	Used for furniture, timber, firewood, making sports items and control erosion.
	HBKU-439		15	1.00	29	1.93	Whole plant	Laxative, latex is poisonous. It causes irritation and swelling of skin. It may cause death of animals
18.		*Euphorbia helioscopia* L.						
19.	HBKU-440	*Cynodon dactylon* (Linn.) Pers.	15	1.00	26	1.73	Shoots	Growing in lawn and used as a fodder
20.	HBKU-441	*Desmostachya bipinnata* (Linn.) Stapf	15	1.00	25	1.67	Shoots	Used as mats in Masjids and as a fodder
21.	HBKU-442	*Eucalyptus lanceolatus* Honey	15	1.00	25	1.67	Wood	Used for furniture, timber and fuel wood

22.	HBKU-443	*Phragmites karka* (Retz.) Trin. ex steud.	14	0.93	24	1.60	Shoots	Use as thatching material in mud houses; making kites, also in paper industry and fuel
23.	HBKU-444	*Tribulus terrestris* Linn.	13	0.87	23	1.53	Shoot	Used for kidney stone and curing backache.
24.	HBKU-445	*Chenopodium album* L.	15	1.00	20	1.33	Whole plant	Used for curing animal diarrhea also in vegetable and fodder.
25.	HBKU-446	*Mentha longifolia* (L.) Huds.	15	1.00	20	1.33	Leaves	Used to cure stomachache, indigestion, carminative and as a flavoring agent
25.	HBKU-447	*Asparagus adscendens* Roxb.	14	0.93	19	1.27	Shoots	Young shoots are used as vegetable and fire wood
26.	HBKU-448	*Broussonetia papyrifera* (L.) L'Herit. ex Vent.	14	0.93	19	1.27	Leaves and wood	Used as fodder, firewood. It causes allergies.
27.	HBKU-449	*Saccharum griffithii* Munro ex Boiss.	13	0.87	19	1.27	Shoots	Used as fodder and for Roofs thatching of mud houses
28.	HBKU-450	*Cymbopogan jawarancusa* (Jones) Schult.	12	0.80	19	1.27	Shoots	Used foe fodder and laid on floors in masjids
29.	HBKU-451	*Verbascum thapsus* L.	12	0.80	18	1.20	Shoots	Analgesic,used fordiarrhea, wound healings and dysentery of cattle
30.	HBKU-452	*Oxalis corniculata* L.	15	1.00	17	1.13	Whole plant	used for stomachache and as fodder
31.	HBKU-453	*Citrus limon* (L.) Osbeck	14	0.93	17	1.13	Fruits	Regulate blood circulation, cure sexual weakness and for burning of belly fats
32.	HBKU-454	*Otostegia limbata* (Benth.) Boiss.	11	0.73	17	1.13	Flower and branches	Used to cure eye irritation, also for making fences and fuel wood
33.	HBKU-455	*Amaranthus viridus* L.	15	1.00	16	1.07	Whole plant	Used as vegetable and fodder
34.	HBKU-456	*Chenopodium ambrosioides* Linn.	14	0.93	16	1.07	Whole plant	Used as vegetable and fodder

35.	HBKU-457	*Bauhinia variegata* Linn.	12	0.80	16	1.07	Fruit, wood	Used as vegetable also in timber wood and fuel wood
36.	HBKU-458	*Nerium oleander* Linn.	12	0.80	16	1.07	Leaves	Used for curing dental problems. cultivated as ornamental. It is honey bee species
37.	HBKU-459	*Cyperus rotundus* Linn.	11	0.73	16	1.07	Whole plant	Used to cure mild fever and as fodder
38	HBKU-460	*Fumaria indica* (Hausskn.) Pugsley.	11	0.73	16	1.07	Whole plant	Used as blood purifier also for itching and diuretic
39.	HBKU-461	*Justicia adhatoda* L.	11	0.73	16	1.07	Leaves	Used to cure wounds, cough, dysentery and diarrhea
40.	HBKU-462	*Xanthium strumarium* L	15	1.00	15	1.00	Shoots	Used as fuel wood
41.	HBKU-463	*Parthenium hysterophorus* Linn.	15	1.00	15	1.00	Whole plant	Used as fuel wood
42.	HBKU-464	*Datura innoxia* Miller.	14	0.93	15	1.00	Leaves	It is poisonous. Used for poxes to remove the pus
43.	HBKU-465	*Amaranthus spinosus* Linn.	14	0.93	15	1.00	Whole plant	Young leaves are used as vegetable and fodder
44.	HBKU-466	*Mallotus philippensis* (Lam.) Müll. Arg.	13	0.87	15	1.00	Fruits	Fruits are used to extract red dye. decoction is helpful against pimples
45.	HBKU-467	*Canna indica* L.	11	0.73	15	1.00	Whole plant	Cultivated as ornamental
46.	HBKU-468	*Echinochloa colona* (L.) Link	14	0.93	14	0.93	Shoots	Fodder for cattle
47.	HBKU-469	*Olea ferruginea* Wall. ex Aitch.	14	0.93	14	0.93	Seeds	Used to relieve backache also in making various tools
48.	HBKU-470	*Sonchus asper* (L.) Hill.	13	0.87	14	0.93	Whole plant	Used as fodder which help in production of milk

49.	HBKU-471	*Tamarix aphylla* (L.) Karst.	13	0.87	14	0.93	Bark	Used to cure toothache and wound healing
50.	HBKU-472	*Adiantum caudatum* L.	9	0.60	14	0.93	Frond	Used as expectorant, emetic and diuretic
51.	HBKU-473	*Achyranthes aspera* Linn.	12	0.80	13	0.87	Whole plant	Used as blood purifier and as an antidote agent.
52.	HBKU-474	*Cuscuta reflexa* Roxb.	12	0.80	13	0.87	Whole plant	Used against teeth and gums problems. Helpful in mild fever.
53.	HBKU-475	*Dichanthium annulatum* (Forssk.) Stapf	12	0.80	12	0.80	Shoots	Uses as good source of fodder
54.	HBKU-476	*Aerva javanica* (Burm.f.) Juss. ex Schult.	12	0.80	12	0.80	Whole plant	Used as fire wood plant.
55.	HBKU-477	*Boerhavia procumbens* Banks ex Roxb	12	0.80	12	0.80	Whole plant	Used for curing lever disorders and fodder
56.	HBKU-478	*Arthraxon prionodes* (Steud.) Dandy	11	0.73	11	0.73	Whole plant	Used as fodder
57.	HBKU-479	*Capsella bursa-pastoris* (L.) Medik.	10	0.67	11	0.73	Shoots	Young leaves are used as vegetable and fodder
58.	HBKU-480	*Convolvulus arvensis Linn.*	9	0.60	11	0.73	Shoot	Used for curing skin disorder also as a fodder
59.	HBKU-481	*Heliotropium strigosum* willd.	10	0.67	10	0.67	Shoots	Used against diabetics and to regulate blood pressure
60.	HBKU-482	*Apluda mutica* L.	9	0.60	9	0.60	Whole plant	Used as fodder

Table. 2. Pearson correlation coefficient

	Correlation index	RFC	UV
RFC	Pearson Correlation	1	.540**
	Sig. (2-tailed)		.000
	N	60	60
UV	Pearson Correlation	.540**	1
	Sig. (2-tailed)	.000	
	N	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

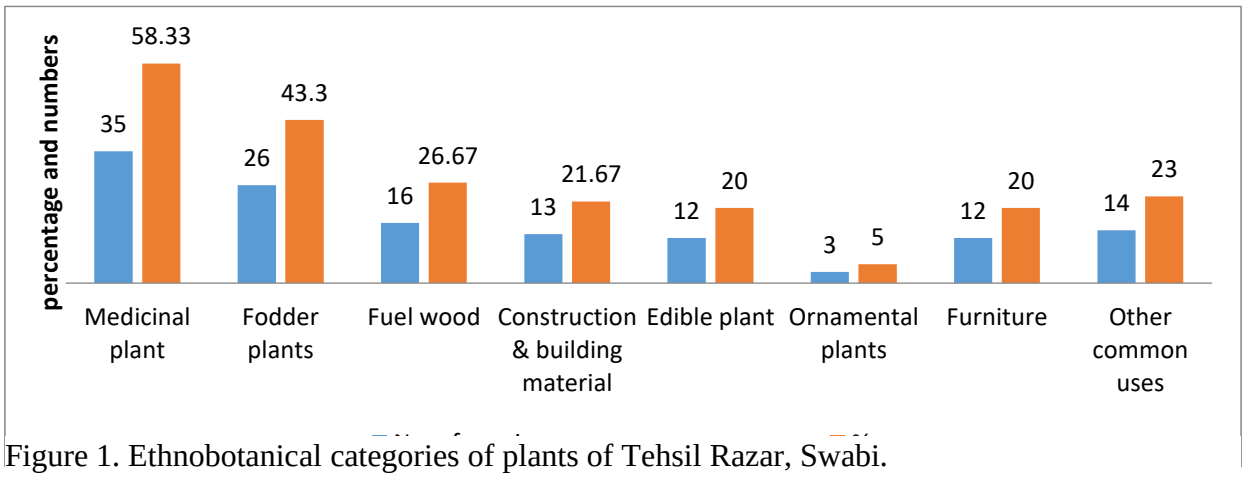

Figure 1. Ethnobotanical categories of plants of Tehsil Razar, Swabi.

Table.3. Categories of plants used ethnobotanically in Tehsil Razar, Swabi

S. No.	Category	No. of species	Percentage
1	Pteridophytes	01	1.7
2	Monocot	13	21.7
3	Dicot	46	76.7

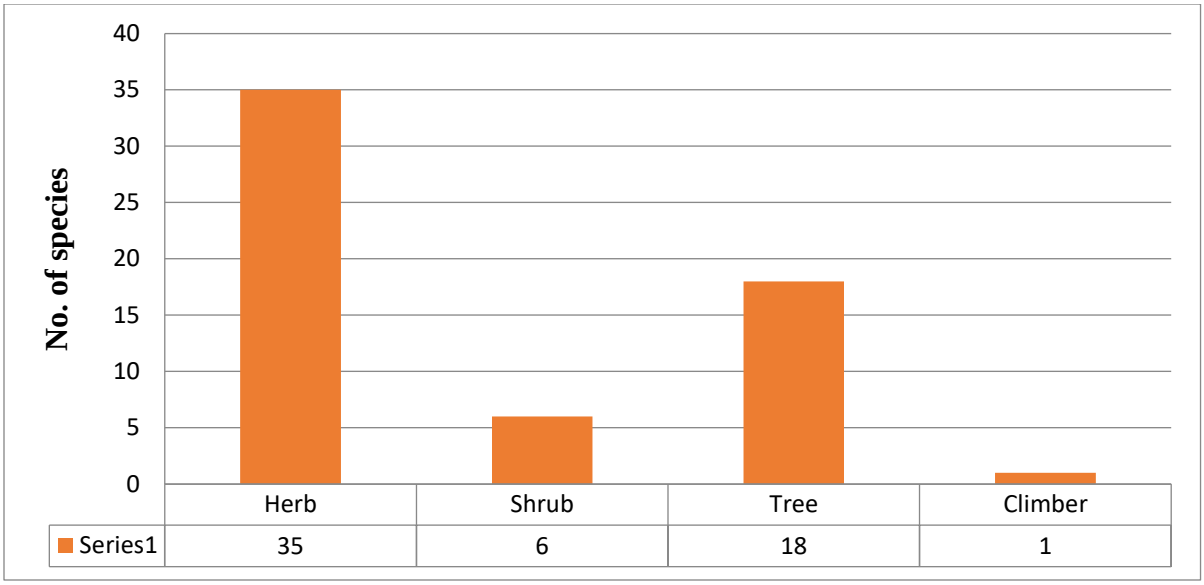

Figure 2. Herb, shrub and tree used ethnobotanically in Tehsil Razar, Swabi

Quantitative Relationships: RFC and UV

The strong correlation between RFC and UV (PCC = 0.01, $p < 0.01$) provides robust evidence of the concordance between local knowledge and species utility. This finding aligns with studies demonstrating that plants with high community knowledge often exhibit greater ethnobotanical value (Rai et al., 2022). However, the increase in UV of popular species could be a warning for overexploitation, as higher utilization pressure can lead to resource depletion (Mehmood et al., 2023). The increased use values for certain species highlight the need for sustainable harvesting practices and conservation strategies. Overexploitation of culturally and economically significant species, such as Acacia spp., could lead to their decline, affecting local ecosystems and livelihoods. Promoting awareness and integrating ethnobotanical knowledge into conservation policies are essential steps to ensure sustainable use of these resources (Ahmed et al., 2022). The high reliance on specific species for multiple purposes could lead to overexploitation, threatening their availability and ecological balance. This calls for integrated conservation strategies that involve the local community, aiming to sustainably manage these species while preserving their traditional knowledge (Mehmood et al., 2023).

Conclusion

This ethnobotanical study underscores the cultural and ecological importance of 60 plant species across 37 families, revealing their extensive use in medicine, fodder, construction, and other domains. The dominant families, including Poaceae and Amaranthaceae, contribute diverse resources, with *Acacia modesta*, *Acacia nilotica subsp. nilotica*, and *Ailanthus altissima* standing out due to their high use values and multifaceted applications. The strong correlation between Relative Frequency of Citation (RFC) and Use Value (UV) emphasizes the community's reliance

on these plants, necessitating targeted conservation strategies to sustain their availability and ecological roles.

Declaration

Acknowledgment: The author expressed his deepest gratitude and appreciation to the Director General and Director Journal of Agriculture Sustainability and Environment for providing administrative and financial support in this research.

Funding: This research work did not receive any specific grant from funding agency

Conflict of interest: The author declared no conflict of interest

Ethics approval/declaration: Not applicable

Consent to participate: Not applicable

Consent for publication: All the authors agreed that the manuscript can be published

Data availability: All the eleventh date included in the manuscript

Authors contribution: Siraj Ud Din design the pojrct and Writing –original draft, Syed Adil Hayat and Pukraj Ud Din collect and analyzed the data, , Abdul Qadir, Mohib Shah, Tabassum Yaseen, Farrukh Hussain and Ibrahim Khan are review the data. All authors have read and agreed to the published version of the manuscript.

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