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Cultural Homogenization Has Affected Palula Traditional Plant Foraging in Multilingual Chitral, Hindukush, NW Pakistan

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Abstract

We recorded local knowledge of wild food plants (WFPs) among the Palula minority in the Chitral region of northwest Pakistan through semi-structured interviews with 25 elderly participants. Data were compared with the previously published food ethnobotanical studies conducted in NW Pakistan. A total of 45 plant taxa were recorded, mainly used as cooked vegetables and raw snacks. A cross-cultural comparison of the foraging practices among the different ethnolinguistic groups revealed that the Palula shared more than two-thirds of the recorded WFPs with the other groups. This homogeneity may suggest that ecocultural homogenization occurred after the group migrated into the study area many decades ago and adapted to the more common and dominant socioecological patterns characterizing the Chitral area of the Hindukush region. We found that the original WFP nomenclature and reports among the Palula were likely affected by Kho and Pashto cultures, whose languages are widely spoken as *lingua francas* in Chitral. Thus, Palula foraging heritage might have been blended and osmotically mixed with that of the majority groups. The current study underscores the urgent need for policymakers to pay more attention to protecting ecocultural diversity and promoting the resilience of minority groups.

Keywords Ethnobotany · Wild food plants · Minorities · LEK · Biocultural diversity · Palula · Chitral · North Pakistan

Introduction

Lower Chitral, in the Hindukush region of Northern Pakistan, is one of the most multilingual regions of Asia. The region has a system of shared values, social structures, and cultural identities (Cacopardo & Cacopardo, 2001). However, the region's *lingua franca* Khowar has possibly challenged the vitality of the other local minority languages including Kalasha, Yidgha, Wakhi, Palula, Nuristani, Dameli, Gawar-Bati, Gujjari, and Pashto (Morgenstierne, 1941). In the study area, the language shift towards the *lingua franca* among the smaller ethnic groups (Decker, 1992) has primarily been triggered by a cultural adaptation towards the dominant cultures, possibly enhanced by frequent social exchanges and intermarriages. Research conducted in different parts of the Hindukush range has shown that the local ecological knowledge (LEK) associated with linked to wild food plants (WFP) among minority groups is being impacted as minority groups adopt dominant practices leading to the loss of their eco-cultural identities, or what we refer to as "ecocultural homogenization" (Aziz et al., 2020a, b, 2022a). It is important to note that ecology has an important role in shaping local cultural practices (Milstein & Castro-Sotomayor, 2020). Studies have shown that for the last three decades the cultural landscape of the Chitral region, as well as its natural resource management, has undergone significant transformations (Nüsser, 2001), and we presume that these changes have not only affected local ecological

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practices or changed the human-nature relationship, but they have also led to the homogenization of local cultural practices across the region.

We focus on the Palula speaking community. Palula (variously spelled Phalura, Palola, Phalulo), also known as Ashreti (Aćharêtâ′) or Dangarikwar (used by Khowar speakers), is an Indo-Aryan language spoken in the valleys of Ashret and Biori, as well as the village of Puri (Purigal) in the Shishi Valley and by a portion of the population in the village of Kalkatak, in the Chitral District of Khyber Pakhtunkhwa in NW Pakistan. In some of the smaller villages such as Ghos, Palula has either ceased to be spoken or its speakers are largely shifting to the more widely spoken Khowar. As Maffi (2002) noted cultural, linguistic, and biological diversity are inextricably linked and equally threatened. For instance, in the nearby Kalasha Valley of Chitral, the dominant Kho people have greatly influenced the cultural and socioecological traditions of the minority Kalasha community, especially their traditional land and resource management practices (Aziz et al., 2020b). We presume that cultural interactions among the majority and minority groups have impacted LEK in the study area (cf. Aziz et al., 2020a, b, 2022a; Sõukand and Pieroni, 2019).

We investigate the LEK linked to plant foraging practices among the previously unstudied Palula linguistic minority in the Ashret Valley of Chitral, Pakistan. Our specific objectives are:

a) To record phytonyms and local WFP uses among the Palula linguistic minority group;
b) To compare the recorded food ethnobotany with other cultural groups in Chitral to understand the historical sociocultural stratification of the region and the relationship between biocultural diversity and the retention of local ecological knowledge among linguistic minorities.

Materials and Methods

Study Area and Community

Ashret (Asherate, Asherat) is a small valley located (35°28′N 71°53′E) in the south of Chitral District. The valley lies on the route to the Lowari Pass and Dir District and is close to the border of Afghanistan (Fig. 1). Ashret Valley is principally associated with speakers of Palula, a Dardic language spoken by approximately 10,000 people. Palula speakers in other locations across Chitral, such as Biori, the village of Puri (Purigal) in the Shishi Valley, and Kalkatak (Liljegren, 2009). In the main Palula settlements of Biori and the Ashret Valley the population is increasing and the language is almost universally spoken.[1] Palula speakers likely migrated to Ashret over 500 years ago and spoke a variety of Shina, an Indo-Aryan language that is the major language in Gilgit-Baltistan (North Pakistan), spoken by more than one million people, including small communities in India, in the Guraiz Valley of Jammu and Kashmir, and in Kargil District of Ladakh, Pakistan.

Data Collection

We conducted our field ethnobotanical survey in May 2021 in the Ashret Valley using semi-structured interviews with 25 elderly population of the Palula speaking community. We adopted a mixed approach for selecting the informants, starting with participants identified through random sampling according to their familiarity with their environment and length of residence in the study area. Once we became familiar with the study area we adopted the snowball technique. Prior to each interview, we obtained consent from each participant and assigned them a code to guarantee anonymity. The duration of the interviews varied between 20 min and several hours. We conducted interviews in public meeting places, local shops, and fields, mainly after prayers near mosques where both linguistic groups gather and interact.

The first part of the semi-structured interviews recorded demographic characteristics, i.e., age, language, profession, and education, while the second part addressed culinary or other uses of WFPs. For each of the recorded plants, we solicited its local name and food use. We also investigated the use of mushrooms. It is important to note that we did not attach or supplement a specific questionnaire to this article as we approached our participants with general questions which were part of the interview. The interviews were led and guided step by step by the first author, and a lot of qualitative information emerged after long discussions with the participants that could not beobtain through the semi-structured questionnaire. Additionally, we recorded ethnographic information gathered through interviews and direct observation. The data obtained in this study were compared with our previous food ethnobotanical research conducted in the three adjacent valleys of Chitral District: the Kalasha Valley among the Kalasha and Khowar communities, the Lotkoh Valley among the Yidgha and Kamkata-vari communities;

[1] The language is close to Sawi, spoken in Afghanistan and to Kalkoti, spoken in Dir District and locally regarded as the ancestral language of today's Palula speakers who migrated from the Indus Valley (Cacopardo & Cacopardo, 2001; Liljegren, 2009). The ethnolinguistic literature and some local historical sources have revealed that Palula speakers may have arrived from Gilgit-Baltistan and their language could be a sub-branch of the Shina language (Morgenstierne, 1941; Strand 2000–2001).

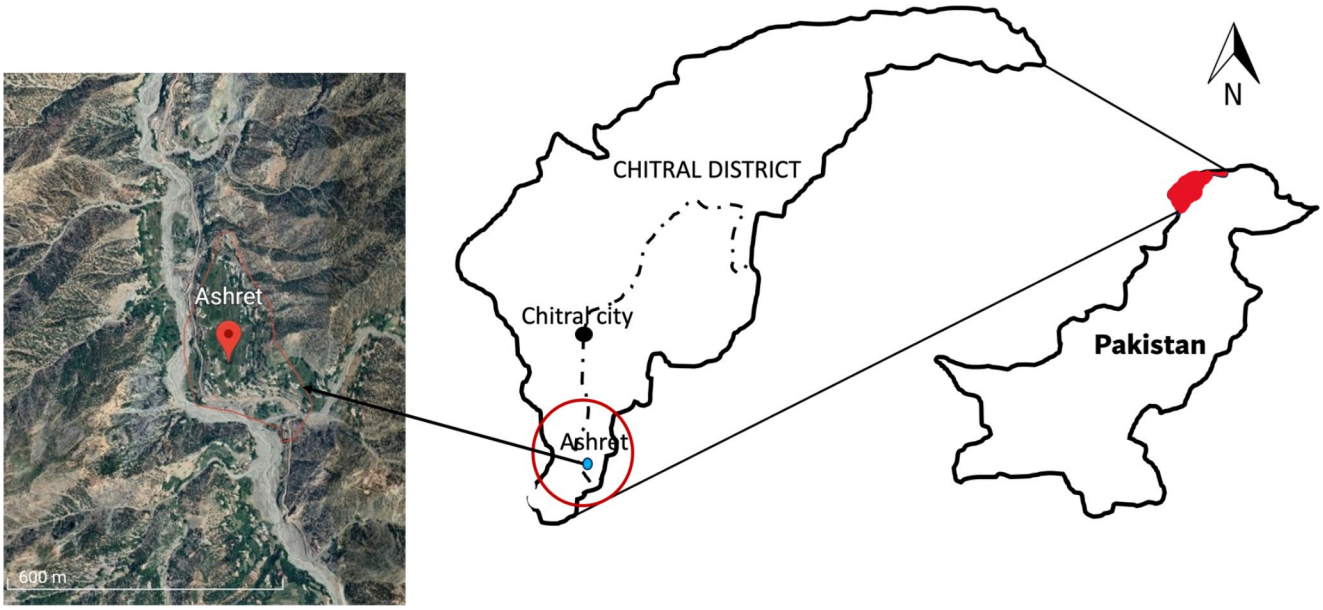

Fig. 1 Map of the study area

and the Broghil Valley among the Wakhi and Sarikoli. From among each of these groups, we recruited 25 participants, and then we subjected the different sets of data to cross-cultural comparison. At the end of each individual survey, group discussions were arranged to verify the local phytonyms of the recorded plant taxa. It is important to note that we did not gather data through focus group discussions as it was difficult to accurately record the data. Therefore, we only used semi-structured individual interviews for data collection; however, the local phytonyms were verified through group discussions because in many cases the local names were ambiguous. We collected the available plant specimens after completing the survey. We recruited a local translator to guide us in the valley. The interviews were conducted in Urdu, but we noticed that nearly all the participants were multilingual, i.e., they could speak Khowar, Pashto, and Urdu, and therefore we did not encounter any problems in communicating with the interviewees. Plant nomenclature was verified through The Plant List (2013). Plant family assignments were consistent with the Angiosperm Phylogeny Website (Stevens, 2017). The plants were identified by the third author who is a taxonomist at the Center for Plant Sciences and Biodiversity, University of Swat, Pakistan. Plants were identified using the Flora of Pakistan (Ali and Qaiser 1993–2009; Nasir and Ali 1980–1989; Nasir and Ali 1989–1992; Nasir and Ali 1970–1979). We deposited all the specimens in the Herbarium of the University of Swat, Pakistan. We identified the few wild plants for which it was not possible to collect vouchers by their folk names with a detailed plant description, comparing them with those recorded in previous field studies. We also took photographs with the consent of the local inhabitants (Fig. 2).

Data Analysis

Data were entered in MS Excel and use reports were counted for each of the reported plant taxa. We also tabulated and compared the data with our previous food ethnobotanical studies conducted in Chitral region, providing a detailed account of each plant taxon used by the different communities across the region. In addition, to identify novel food uses, we conducted a literature survey of Pakistani food ethnobotanical studies (Aziz et al., 2020a, b, 2021a, b; Abbas et al., 2020; Ahmad et al., 2019; Abbasi et al., 2013; Shad et al., 2013; Khan et al., 2015, 2021; Shah et al., 2015; Ahmad & Pieroni, 2016; Tareen et al., 2016; Majeed et al., 2021; Abdullah et al., 2021), including the few investigations carried out among Shina speakers in Gilgit Baltistan, North Pakistan (Aziz et al., 2020a).

Use Value

Use value was calculated for each reported WFP taxon using the following formula:

$$\mathrm{UV} = \sum \mathrm{Ui}/\mathrm{n}.$$

where Ui = the number of uses mentioned by each informant for a given species, and n = the total number of informants.

Informant Consensus Factor

Informant consensus factor was calculated using the following formula:

Fig. 2 An interview with a local elderly individual in the Ashret Valley

$$\mathrm{ICF} = \mathrm{Nur} - \mathrm{Nt}/(\mathrm{Nur} - 1).$$

where Nur = the total number of use reports for each disease cluster, and Nt = the total number of species used for that cluster.

For cross-cultural analysis on the use of the reported WFPs, we created a heatmap, using a free online software program (https://molbiotools.com/listcompare.php) that provides a detailed account of the similarities in plant use among the seven different ethnolinguistic communities in the Chital region.

Results and Discussion

WFPs and Their Uses

We recorded a total of 45 taxa belonging to 28 botanical families including four unidentified taxa. The reported plants belonged to Rosaceae (5 taxa), Polygonaceae (4 taxa), Amaranthaceae (3 taxa), Apiaceae (2), Asteraceae (2), Brassicaceae (2), and Moraceae (2), with the remaining families represented by only one taxon (Table 1).

Most of the recorded taxa were consumed as snacks (20 taxa, 44%) and used as cooked vegetables (18 taxa, 40%). Four taxa were used in salads, and three were reported to be used in lactic acid fermentation. Leaves were the dominant plant parts (25 taxa) followed by fruits (16 taxa). Among the 45 reported taxa, 31 plants were mentioned by more than 50% of the participants. Some of the most cited plants used as cooked vegetables are *Allium* spp., *Amaranthus hybridus*, *Angelica glauca*, *Capparis spinosa*, *Chenopodium album*, *Convolvulus arvensis*, *Eremurus stenophyllus*, *Malva neglecta*, *Nasturtium officinale*, *Portulaca quadrifida*, *Rumex* spp., and *Urtica dioica*. These plants were also frequently reported in other studies across the region (Aziz et al., 2020a, b, 2021a, b). We observed that some plants had a higher use value compared to other taxa, including *Capparis spinosa* (0.72), *Chenopodium album* (0.72), *Pinus gerardiana* (0.72), *Quercus baloot* (0.64), *Rumex dentatus* (0.68), *Rumex hastatus* (0.68), and *Trifolium repens* (0.68) (Fig. 3).

Plants were gathered from fields, along the banks of water bodies, in forests, and in high mountains. We also reviewed the literature on Pakistani food ethnobotany (see the data analysis section for references) and observed that

Table 1 WFP uses among the Palula speaking people in Chitral District

Botanical taxon, family, and voucher specimen code	Local name	Parts used	Local food utilizations	Use Reports	Use Value	Previously reported in Pakistan
Allium spp.; Amaryllidaceae	Paloonrh	Leaves Bulb	Cooked Salad	13	0.52	Yes
Amaranthus hybridus L.; Amaranthaceae; SWAT005470	Kashgandaree	Leaves	Cooked	16	0.64	Yes
Angelica glauca Edgew.; Apiaceae; SWAT005963	Raso	Leaves Stem	Cooked Stem is peeled and eaten raw	12	0.48	Yes
***Artemisia brevifolia* Wall. ex DC.; Asteraceae; SWAT005972**	Neurhon	Leaves	Powdered and mixed with salt, and eaten with bread, also used in seasoning. It produces cooling or warming effects.	10	0.40	No
Berberis lycium Royle; Berberidaceae; SWAT004744	Kuray	Fruit	Snack	13	0.52	Yes
Capparis spinosa L.; Capparaceae; SWAT005965	Kaveer	Fruit	Cooked	18	0.72	Yes
Carum carvi L.; Apiaceae; SWAT005966, SWAT005981	Zeero	Fruit	Seasoning	16	0.64	Yes
Celtis australis L.; Cannabaceae; SWAT005474	Bem	Fruit	Snack	3	0.12	Yes
Chenopodium album L.; Amaranthaceae; SWAT005499	Konrho	Leaves	Cooked	18	0.72	Yes
***Chenopodiastrum murale* (L.) S.Fuentes, Uotila & Borsch; Amaranthaceae**	Gujarsha	Leaves Fruit	Cooked Snack	16	0.64	
Cirsium arvense (L.) Scop.; Asteraceae; SWAT000728	Jenchi	Root	Snack	1	0.04	Yes
***Convolvulus arvensis* L.; Convolvulaceae; SWAT005968; SWAT005966**	Haaluri/ Mishk	Leaves	Cooked	13	0.52	Yes
Cotoneaster nummularius Fisch. & C.A.Mey.; Rosaceae; SWAT005485	Menrho	Fruit	Snack	14	0.56	Yes
***Decaspermum blancoi* S.Vidal; Myrtaceae**	Manrhu	Leaves	Tea	7	0.28	
***Duchesnea indica* (Jacks.) Focke;Rosaceae; SWAT005974**	Grosa	Fruit	Snack	13	0.52	Yes
Elaeagnus angustifolia L.; Elaeagnaceae; SWAT005806, SWAT005808	Shijin	Fruit	Snack	14	0.56	Yes
Eremurus stenophyllus (Boiss. & Buhse) Baker; Xanthorrhoeaceae; SWAT005967	Shili	Aerial parts	Cooked	15	0.60	Yes
Ficus palmata Forssk.; Moraceae; SWAT000729	Phag	Sap	Fermentation	14	0.56	No
***Malva neglecta* Wallr.; Malvaceae; SWAT006043**	Panairak	Leaves	Cooked	13	0.52	Yes
Mentha longifolia (L.) L.; Lamiaceae; SWAT005792, SWAT005790	Pembil	Leaves	Salad, used in bread	13	0.52	Yes
Morchella esculenta (L.) Pers.; Morchellaceae; SWAT000733	Gotchi	Aerial parts	Cooked	15	0.60	Yes
***Morus*spp.; Moraceae**	Maroch	Leaves	Cooked	10	0.40	No
Nasturtium officinale R.Br.; Brassicaceae; SWAT005482	Chulur	Leaves	Cooked, salad	13	0.52	Yes
Olea europaea L.; Oleaceae; SWAT000735	Kuv	Leaves, fruit	Tea	13	0.52	Yes
Oxalis corniculata L.; Oxalidaceae; SWAT000736	Jogia trok	Leaves	Snack	1	0.04	Yes
Pinus gerardiana Wall. ex D.Don; Pinaceae; SWAT004752	Shat / Jalghoza	Kernels	Snack	18	0.72	Yes

Table 1 (continued)

Botanical taxon, family, and voucher specimen code	Local name	Parts used	Local food utilizations	Use Reports	Use Value	Previously reported in Pakistan
***Polygonum aviculare* L.; Polygonaceae;** SWAT005979	Bandakai	Leaves	Cooked	7	0.28	Yes
Portulaca quadrifida L.; Portulacaceae; SWAT005970	Pichili	Leaves	Cooked	15	0.60	Yes
Prunus dulcis (Mill.) D.A.Webb; Rosaceae; SWAT005480	Kando	Gum	Snack	4	0.16	Yes
***Quercus balloot*Griff.; Fagaceae; SWAT004748**	Cha'mut/ Pasha-rut (fruit)	Kernels	Snack	16	0.64	Yes
Rheum ribes L.; Polygonaceae; SWAT004749	Chuntiyal	Leaf stalks	Snack, fermentation	15	0.60	No
Rubus fruticosus G.N. Jones; Rosaceae; SWAT006044	Anrhcho	Fruit	Snack, herbal drink	14	0.56	Yes
Rumex dentatus L.; Polygonaceae; SWAT005468	Chukriworhn	Leaves	Cooked	17	0.68	Yes
Rumex hastatus D. Don; Polygonaceae; SWAT005801	Chukree	Leaves	Fermentation, snack	17	0.68	No
Silene conoidea L.; Caryophyllaceae; SWAT005481, SWAT005514	Hupupu	Leaves	Cooked	7	0.28	Yes
Sisymbrium irio L.; Brassicaceae; SWAT005462	Khalakhal	Leaves	Cooked	5	0.20	Yes
Solanum americanum Mill.; Solanaceae; SWAT005503, SWAT005803	Kamachuk	Fruit	Snack	15	0.60	Yes
Sorbus aria (L.) Crantz; Rosaceae; SWAT004747	Kishpool	Fruit	Snack	3	0.12	Yes
***Trifolium repens* L.;Leguminosae**;	Shabrhiki	Leaves	Snack	17	0.68	Yes
Urtica dioica L.; Urticaceae; SWAT005501	Jhunrhi	Leaves	Cooked	15	0.60	Yes
Viscum cruciatum Sieber ex Boiss.; **Santalaceae**	Shokormaishee	Fruit	Snack	13	0.52	Yes
Unidentified taxon	Inchatoonto	Bulb	Snack	14	0.56	-
Unidentified taxon	Moshong	Leaves	Cooked, salad	7	0.28	-
Unidentified taxon	Gulgulaiti	Leaves	Cooked	13	0.52	-
Unidentified taxon	Thunta	Bulb	Snack	6	0.42	-

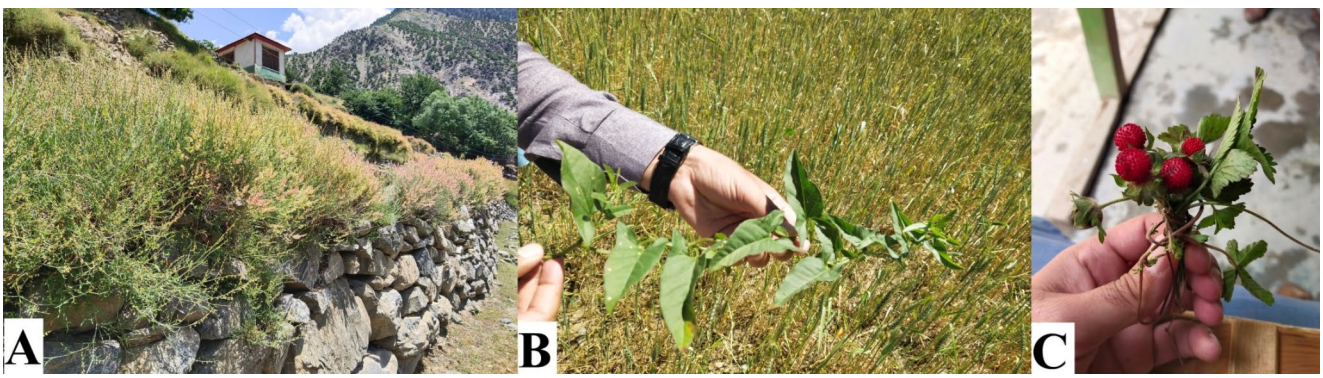

Fig. 3 Photos of some WFPs: **a**) *Rumex hastatus*, **b**) *Convolvulus arvensis*, and **c**) *Duchesnea indica* (Photo credits: M.A. Aziz & S. Ali)

there were certain plant uses new to the Pakistani food ethnobotanical literature. For instance, the leaves of *Morus* spp. were reported to be used as cooked vegetables. The leaves of *Artemisia brevifolia* are ground and mixed with salt and eaten with bread; they are also used in seasoning and have medicinal uses, such as a cooling agent. The leaves of *Decaspermum blancoi* are used in tea. The leaf stalks of *Rheum ribes* and the leaves of *Rumex hastatus* are used in lactic acid fermentation. There were certain plant taxa that have disappeared from the traditional food system, such as *Convolvulus arvensis*, *Malva neglecta*, *Nasturtium officinale*, *Rumex* spp., and *Urtica dioica*. We obtained high ICF values for the different food categories (Table 2) indicating

Table 2 Informant consensus factor for the major food categories

Category	Nur	Nt	Nur-Nt	(Nur-1)	ICF
Cooked	258	20	238	257	0.92
Salad	46	4	42	45	0.93
Snack	239	21	218	238	0.91
Fermented	46	3	43	45	0.95
Seasoning	26	2	24	25	0.96
Herbal drink	34	3	31	33	0.93

that local inhabitants have a deep and shared knowledge of local plants and their uses.

Participants confirmed that the foraging of WFPs has been abandoned except for a few taxa, and the use of WFPs in their local food system has been not only affected by the availability of cultivated food plants in their gardens and the local market, but also impacted by their availability in the surrounding environment. Studies have shown that environmental change in the Hindukush and Himalayan region has greatly impacted the local natural resources. The availability of commercialized food ingredients and the commodification of cultivated vegetables have also played a central role in reducing reliance on local food resources. We conclude that LEK on the use of WFPs is only retained by elderly community members and lost to younger generations.

Measuring the LEK in West Pakistan, Abbas et al. (2020) concluded that cultural knowledge of WFPs was partially eroded because most of cited plants were mentioned by only one third of their participants. However, the LEK of WFPs is still alive in both the memory and current practices of the local inhabitants; for example, communities living around Takht-e Sulaiman Hills, NW Pakistan (Ahmad & Pieroni, 2016) and the Hindukush mountains in North Pakistan (Aziz et al., 2020a, b) have retained important local knowledge of WFPs. We observed that even among elderly individuals, some informants had difficulty recalling their past experiences and reporting the use of WFPs, clearly revealing erosion of foraging practices in the study area. Some participants perceived foraging practices as outdated. Some highly valued plants, for instance *Allium* spp. and *Eremurus stenophyllus*, are still gathered from high mountains and sometimes sold in local markets, but in general only people who graze animals at higher altitudes do so, for example the Gujjars, a mountain pastoralist community who live with their herds in higher pastures.

Cross-Cultural Analysis

For cross-cultural analysis, we compared Palula uses of WFPs to those of other linguistic groups[2] across the region based on our previous research (Aziz et al., 2020b, 2022a) (Table 3).

We found that among the 45 taxa reported among the Palula community, the food uses of 34 (75%) were commonly shared with other cultural groups. These results suggest a significant homogenization of foraging practices across the groups that could indicate a convergence of local ecological practices, possibly as a result of a history of frequent and regular social contact and kinship networks among these communities. Previous studies in the region have generally reported high similarity indexes among the different groups, demonstrating that LEK is becoming homogenized (see Aziz et al. 2020 a, b). For example, in the Broghil Valley of the Upper Chitral region we observed that the WFPs of Wakhi and Sarikoli communities have completely homogenized as the Sarikoli have adopted the practices of the Wakhi (Aziz et al., 2022a). However, we also found examples of linguistic minorities retaining specific ethnobotanical practices, as the Yidgha in the Lotkoh Valley of Chitral, who reported certain WFPs, such as *Heracleum candicans*, *Matricaria chamomilla*, *Seriphidium brevifolium*, and *Sisymbrium irio*, not reported among any other group (Aziz et al., 2020b). Also, in Waziristan, we found that the Ormur community retained some specific uses of certain WFPs that clearly indicate it has retained a distinct body of LEK that may have evolved over time (Aziz et al., 2021a, 2022b, c; Aziz, 2023).

A combined matrix of Jaccard indexes among the different ethnolinguistic groups for the cited WFPs revealed moderate homogeneity in local food plant knowledge and indicate high similarity among those groups who live in the same ecological environment (Fig. 4), suggesting that ecology also has an important role in shaping local ecological practices and subsequently the associated local plant knowledge among these communities. Moreover, the sharing of plant knowledge may reflect cultural assimilation and standardization to the dominant culture. It is important to state that intermarriage among the various ethnolinguistic groups in the study area may have resulted in homogenization of kinship relations and oral transmission of LEK (Aziz et al., 2020a, b; Kalle & Sõukand, 2016; Pieroni et al., 2020; Pieroni & Sõukand, 2019; Sõukand and Pieroni, 2019).

Chitral is considered one of the most important mountainous cultural hotspots in Asia, where different ethnolinguistic groups have co-existed for a long time and have possibly negotiated some common practices, which has led newcomers to adopt similar ecological practices within the same local landscape (Liljegren & Akhunzada, 2017). We also believe that the multicultural cohabitation of different ethnic groups and their sociocultural contact historically made it possible to share and horizontally transmit LEK (Aziz et al., 2020a, b). It is worth mentioning that the moderate heterogeneity in the food ethnobotany of the Palula and the

[2] Kalasha, Kho, Yidgha, Kamkatka-vari, and Wakhi speakers.

Table 3 Presence-absence index for the WFPs reported among the seven researched groups in Chitral

Plant taxa	Khowar	Kalasha	Kamkatawari	Palula	Sarikoli	Wakhi	Yidgha
Allium spp.	+	+	+	+	+	+	+
Amaranthus spp.	+	+	+	+	+	+	+
Angelica glauca	-	-	+	+	-	-	+
Artemisia brevifolia	-	-	-	+	-	-	+
Berberis lyceum	+	+	+	+	+	+	+
Capparis spinosa	+	+	-	+	-	-	-
Carum carvi	+	+	+	+	+	+	+
Celtis australis	+	+	-	+	-	-	+
Chenopodium album	+	+	+	+	+	+	+
Chenopodiastrum murale	-	-	-	+	-	-	-
Cirsium arvense	+	+	+	+	-	-	+
Convolvulus arvensis	+	-	-	+	-	-	-
Cotoneaster nummularius	+	+	+	+	+	+	+
Duchesnea indica	-	-	-	+	-	-	-
Elaeagnus angustifolia	+	+	+	+	-	-	+
Eremurus spp.	+	+	+	+	+	+	+
Ficus palmate	-	-	-	+	-	-	-
Malva neglecta	+	-	-	+	-	-	-
Mentha longifolia	+	+	+	+	+	+	+
Morus spp.	-	-	-	+	-	-	-
Decaspermum blancoi	-	-	-	+	-	-	-
Nasturtium officinale	+	+	-	+	-	-	+
Olea europaea	-	-	-	+	-	-	-
Oxalis corniculata	-	-	-	+	-	-	-
Pinus gerardiana	+	+	-	+	-	-	-
Polygonum spp.	-	-	-	+	+	+	-
Portulaca spp.	+	+	+	+	+	+	+
Prunus dulcis	+	+	+	+	-	-	+
Quercus spp.	+	+	-	+	-	-	
Rheum spp.	+	+	+	+	+	+	+
Rubus fruticosus	+	+	-	+	-	-	+
Rumex spp.	+	+	+	+	+	+	+
Silene conoidea	+	+	+	+	-	-	+
Sisymbrium irio	-	-	-	+	-	-	+
Solanum americanum	+	+	+	+	-	-	+
Sorbus aria	+	+	-	+	-	-	-
Trifolium repens	-	-	-	+	-	-	-
Urtica dioica	+	+	+	+	-	-	+
Viscum cruciatum	-	-	-	+	-	-	-

"+" = presence; "-" = absence

other groups could be due to minor variations in floristic composition since the flora of Lower Chitral differs from that of Upper Chitral. Several recent studies have addressed the homogenization of LEK as a global issue. For example, Sõukand et al. (2022) report that centralized knowledge distribution during the Soviet era and over the last 30 years has remarkably changed place-based LEK and eroded biocultural diversity in Eastern Europe, highlighting the need to pay attention to place-based local knowledge systems to protect not only cultural diversity but its links to the natural environment as crucial to ecosystem management.

Complex Interplay between Language and LEK Shifts

As noted, the Palula language has a very small distribution and is spoken in a transitional zone, with a high level of bilingualism or multilingualism, and a preference for Khowar in the northern area and Pashto in the southern area of Chitral District (Liljegren, 2019). For Palula speakers, learning a new language is undertaken to ensure social cohesion with mainstream society and to effectively negotiate with

Fig. 4 Matrix of Jaccard indexes for the use of WFPs among the different ethnolinguistic groups in the study region

other cultures, especially the Kho and Pathans, on either side of their geographical region. Intra-language interaction is a complex phenomenon; however, here we focus only on LEK. Ethnolinguists have found that LEK is encoded in grammatical morphemes that often cannot stand alone as vocabulary items; for example, languages use various kinds of functional morphemes to classify nouns referring to things in the world (Stringer, 2016). In addition, Stringer underlines that in mainstream linguistics the mental lexicon is generally considered to be more than merely a memorized vocabulary list but contains free morphemes, bound morphemes, constructions (e.g., the more [I read], the more I understand]), and idioms (e.g., to spill the beans) (ibid.). We strongly believe that the language shift towards either Khowar or Pashto has an important role in affecting LEK. For instance, some local plant names used by Palula speakers, such as *Malva neglecta* and *Berberis lyceum*, were originally Pashto, reflecting longstanding sociocultural connections through intermarriage and a shared Islamic heritage, as well as geographic proximity. In addition, the construction of the Lowari Tunnel provides a crucial link that facilitates cultural connections among the various groups residing in Chitral and that might have affected LEK (see Fig. 1).

Our comparison of current Palula data with data from Shina speakers of Gilgit-Baltistan (from which this linguistic group may have originated) we found several names of local taxa that matched Shina plant nomenclature, including *Allium* spp., *Ficus palmate*, *Mentha longifolia*, *Rheum ribes*, and *Rumex* spp. We also found that most plant names matched Khowar nomenclature. Sociolinguistic studies have shown that most Palula men, regardless of dialect, speak Khowar with native Khowar speakers as well as with speakers of any of the other languages where Khowar is the *lingua franca*, while many choose to speak Pashto with native Pashto speakers and with speakers of Gawarbati and Dameli (Liljegren & Akhunzada, 2017). It has been argued that homogenization is a threat to biocultural diversity (Rozzi, 2013), raising concerns over the socio-environmental sustainability of mountain communities. Moreover, biodiversity loss and increased cultural homogenization because of globalization make the future sustainability of the planet uncertain, and especially for vulnerable communities such as those in mountain environments (Harmon, 1996).

Ecocultural Diversity and Maintenance of Ecosystems

The term ecocultural refers to role of humans in the complex interplay between culture and ecology. The human-centeredness intrinsic to dominant understandings of

intercultural relations tends to undermine, or even ignore, the ecological dimension of humans and the environmental conditions in which identities arise (Castro-Sotomayor, 2020). The inextricable relationship between humans and nature, and the significance of the relationships among language and culture and management of the ecosystem, has led to an important debate on biocultural diversity (see Maffi, 2001) .

An ecocultural perspective sees sociocultural identity as inseparable from ecology (Milstein & Castro-Sotomayor, 2020) and recognizes that local knowledge and memories of the dynamic link between the non-human component of landscapes and human culture shape ecocultural identities and promote resilience (Zedler & Stevens, 2018; Dahake, 2020; Hoffmann, 2020). Chitral, is home to ethnolinguistic minority groups that are constantly challenged by mainstream practices that could threaten ecocultural diversity. We presume that cultural standardization could have compelled small ethnic groups to homogenize their LEK (see Franco, 2022). It is important to note that not only do mainstream practices represent a threat to local ecocultural diversity, but global interconnectedness and easy access to commodified goods and services also impact socio-environmental practices in even peripheral and remote mountain areas. Some research has suggested that such ecological crises could lead to cultural crises (Dahake, 2020), and this could have reciprocal relationships as well. A remarkable change has occurred in value perception regarding LEK that has led communities to regard it as inferior to western scientific knowledge (Nared 2004; Gómez-Baggethun et al., 2010; Hernández-Morcillo et al., 2014; Benyei et al., 2020). Our field observations suggest that younger generations are unaware of the value linked to LEK, and their difficulty in recognizing the importance of local resources represents a possible indicator of cultural transition and confusion that could lead to further socio-environmental collapse if not addressed. In the study region, threats to ecocultural diversity are multilayered. For instance, the Palula socio-ecological identity is under pressure from the Kho communities to their west and by Pathans to their east. We observed that most study participants were trilingual and we believe that if ongoing social changes continue in the near future the Palula language and its associated heritage could disappear, as we have observed among the Sarikoli in Upper Chitral who have been completely absorbed into the majority Wakhi culture (Aziz et al., 2022a).

A more diversified body of local knowledge could be a better tool to enhance the ability of mountain communities to resist the potential negative impacts of environmental change. The promotion of sustainable foraging practices could play a vital role in providing healthy food and could be used to manage the local ecosystem in the current ecological crisis. Landscape homogenization, which is a major concern in ecology, could also be prevented (Van der Plas et al., 2016). To ensure a better future, however, all study area stakeholders would need to come together to address this issue. It is encouraging that linguists have started to endorse language revitalization projects in many peripheral areas.

LEK Revitalization – Possible Local Strategies

The erosion of local plant knowledge, particularly among minority groups and underprivileged communities, is a global phenomenon as younger generations adopt westernized lifestyles, making protection and promotion of local plant knowledge through environmental educational programs a priority. State authorities should engage with ethnobotanists, who could play an important role in revitalizing local plant knowledge and WFP-based cultural heritage through educational programs and agricultural outreach programs. Conservation activities can be carried out in many forms, such as formal education in schools, informal education through public awareness campaigns, and on-the-ground conservation training for local communities.

The UN Agenda 2030 clearly calls for the preservation of cultural heritage for social sustainability and environmental sustainability. Ecological transition is a timely call and for that we need to equip local communities to become independent economically, and prioritizing LEK would have enormous economic impacts on local economies in rural contexts and would play a positive role in alleviating poverty.

Conclusion

We recorded LEK on WFPs among the Palula, an important linguistic minority group in the mountainous Chitral area of NW Pakistan. Our results suggest that their LEK has remarkably assimilated that retained by nearby cultural groups, reflecting the prevalence of strong social exchanges among the different regional linguistic groups during the past decades. The heterogeneous local plant nomenclature among Palula speakers has been significantly influenced by the Kho to their west people and, to some extent, by the Pathans to their east. Based on our findings, we conclude that the long-standing multicultural environment across the region has provided a baseline for the homogenization of cultural practices, which in turn has impacted the LEK and food ethnobotanies of our studied communities. We believe that the minority linguistic groups lost their socio-ecological identities during their migrations across the Hindukush and began to start to adapt to follow the dominant regional ecological practices decades ago and forgot their own

socio-ecological identities during their migrations across practices.

We hope that the promotion of the foraging practices recorded in this study will not only help minority groups to maintain their cultural identity but also help them to counter the negative impacts of possible future food insecurity and instability. Our results indicate that if the erosion of bio-cultural diversity in peripheral mountain areas continues, in the future, local communities could encounter major problems coping with managing their environment in the face of ongoing environmental changes and disturbances. We strongly advocate that the relevant governmental authorities and international organizations engage with local. Therefore, stakeholders should design and implement sustainable community-based mountain conservation programs to preserve and revitalize LEK among minorities for their future rural development and cultural resilience.

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Author Contributions MAA designed the project and collected the data. AU helped in data compilation. ZU help in identifying botanical taxa. MAA wrote the first draft of the MS and interpret the data. AP then commented on the draft and improved the draft manuscript. All the authors have read and approved the final draft of the manuscript.

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Declarations

Consent for Publication All coauthors have read and agreed to submit the manuscript.

Competing Interests The authors declare no competing interests.

Conflict of interest The authors have no conflicts of interest.

Ethics Approval Not applicable.
During the study, the recommendations of the International Society of Ethnobiology (ISE 2008) were strictly followed; we always obtained verbal permission to take photographs of the informants and the local landscape.

Consent to Participate Not applicable.

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