Contemporary Knowledge of Dye Plant Species and Natural Dye Use in Kurdish Autonomous Region, Iraq[1]

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Contemporary knowledge of dye plant species and natural dye use in Kurdish Autonomous Region, Iraq In Kurdistan, natural dyes once played an important role in the life of nomads as they wild-crafted and traded natural dyes for their survival. They learned from their family how to find, harvest, process, and dye with natural dyes. Abandonment of weaving and the nomadic life, and recent changes in the economy have contributed to significant changes in the natural dyeing culture. Traditional knowledge of natural dyeing plants is no longer common among weavers. This study documents the surviving knowledge of dye plant species and assesses the transmission of knowledge between elderly weavers and a younger generation of weavers' apprentices. Information on dyeing and dyeing plants was elicited through a species recognition task using picture cards, a pile-sorting task, and through in-depth interviews with nomads in the mountains of the Soran district as well as weaving teachers and students in the city of Erbil, Kurdish Autonomous Region, Iraq. Consensus analysis of pile-sorting data supports the hypothesis that informants belong to a single culture. The results confirm the erosion of natural dyeing culture in Kurdistan and stress the need to stimulate knowledge transfer from the elderly, empirical generation to the younger, learning generation. The study also uncovered the existence of a keen interest among the student informants in traditional herbal medicine. If this trend is true for Kurdish urban youth in general, then it could lead to a revival and perpetuation of traditional plant knowledge.

زانیاری هاوچەرخ دەربارەی جۆری ڕووەکی ڕەنگ وبەکارهێنانی ڕەنگی سروشتی لە هەرێمی کوردستان/ عێراق
جاران لە کوردستان ڕەنگە سروشتیەکان دەورێکی گرنگیان لە ژیانی ڕەوەندەکان دەبینی، لە بەر ئەوەی کە ئەوان ڕەنگی سروشتیان بەرهەم دەهێنا بۆ بژێوی ژیانی خۆیان ، بۆ بازرگانی بەکاریان دەهێنا.
ئەوان دۆزینەوەو پەرەپێدان و ڕەنگ کردن بە ڕەنگە سروشتیەکان لە بنەماڵەکانیانەوە فێر بوون وازهێنان لە چنین وڕستن و ژیانی ڕەوەندایەتی لەگەڵ گۆڕانکاری ئابووریەکانی ئەو دواییە هەموویان بەشدار بوون لە گۆڕانکاری لە کولتووری ڕەنگ کردنی سروشتی.
کەڵک وەرگرتن لە زانینی نەریتی ڕەنگەکانی گیای سروشتی ئێستا لە نێوان بەرهەم هێنەرانی ڕستن و چنین باوی نەماوە.
ئەو لێکۆڵینەوە زانیاریە بەجێماوەکانی جۆرەکانی ڕووەکی ڕەنگ دۆکۆمێنت دەکات و گواستنەوەی زانیاری لە نێوان چنین کەرە بە تەمەنەکان و چنین کەرە لاوە فێرخوازەکان هەڵدەسەنگێنێ .
زانیاری لەسەر ڕەنگ کردن و ڕووەکی ڕەنگ کردن لە ڕێگای کاری ناسینەوەی جۆرەکان بە بەکارهێنانی کارتی وێنەو هاوپۆلکردنی بە کۆمەڵ هەروەها چاوپێکەوتنێکی تیرو تەسەل لەگەڵ ڕەوەندەکان لە چیاکانی ناوچەی سۆران کۆکراوەتە وە ، هەروەها لە ڕێگای چاوپێکەوتن لەگەل مامۆستا و قوتابیانی ئەم بوارە لە شاری هەولێر لە هەرێمی کوردستان . تەواوی شیکرد نەوەی پۆلینکردن پشتگیری ئەو گریمانە دەکات کە زانیاری پەیوەندیدار هەموویان بۆ یەک کولتوور دەگەڕێنەوە .
ئەنجامەکان جەخت لەسەر نەمانی کولتووری ڕەنگ کردنی سروشتی لە کوردستان دەکەنەوە ، هەروەها جەخت لەسەر پێویستی بوژانەوەی گواستنەوەی زانیاری دەکات لەنەوە ی بەتەمەن و کرداریەوە بۆنەوەی فێرخواز. هەروەها ئەو لێکۆڵینەوەیە دەریخست کە حەزێکی زۆر لە ناو قوتابیە زانیار پیندەرەکان هەیە بۆ پزیشکی کۆن
ئەگەر ئەم ڕەوتە سەبارەت بە لاوانی شارنشینی کورد بە گشتی ڕاست بێت دەتوانێت ببێتە هۆی زیندوو کرد نەوەو بەردەوام بوونی زانستی نەریتی .

Key Words: Natural dyes, Kurdish Autonomous Region, Iraq, weaving, dyeing plants, traditional ecological knowledge, ethnobotany.

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Background

Natural Dyes

Mankind has known about natural dyes for millennia. Pigment fragments found in Egyptian tombs show the use of natural plant dyes to be more than 5,000 years old, and descriptions of dye extraction procedures are found in hieroglyphs (Zollinger 2004). Throughout time, weaving cultures around the world have used plant and mineral dyes to dye yarn (Opie 1992), and natural products were, for a long time, the only source of coloring. Rug weaving has mainly been the work of women in nomadic tribes (Gunter 2004; Middleton 1996). It became an integral part of a woman's life and reflected her social status (Hull and Luczyc-Wyhowska 1993). Dyeing recipes were kept as guarded secrets (Allane 1995; Hull and Luczyc-Wyhowska 1993), passed down matrilineally through the generations, together with the weaving techniques. The discovery of synthetic dyes in 1856 by William Henry Perkin gave way to a range of new synthetics that spread throughout the world. The ease of use, availability, and bright colors of synthetic dyes (Nassiri 1966) led almost total replacement of natural dyes in the Middle East by the beginning of the twentieth century (O'Bannon 1995).

Nomadic Tribes and Kurdistan

The inaccessible mountain habitat of Kurdistan allowed limited penetration of outside influences (Hull and Luczyc-Wyhowska 1993), making it possible for nomads to retain the use of natural dyes (Yassavoli 2000) longer than in most Middle Eastern countries. It was not until the 1950s that synthetic dyes had almost completely replaced natural dyes in Kurdistan (Opie 1992). Eagleton (1988:7) writes that "the Kurdish nomads were probably one of the last groups to abandon the use of natural dyes, and among the peoples producing tribal and village rugs in traditional ways, the Kurds are the best." Nomadic culture has been a Kurdish way of life for centuries (McDowall 2007), and nomadic tribes formed a great part of the contemporary Kurdish population (Izady 1992). The majority of Kurds today live scattered throughout parts of Iraq, Turkey, Iran, and Syria, and maintain a rich weaving tradition in all these countries (O'Bannon 1995). Tragic events in the last decades, like the Barzani Revolts (1960–1975), the Iran-Iraq war (1980–1988), and the Al-Anfal campaign (1986–1989), the infamous Kurdish genocide, led to the destruction of around 4,000 villages, the deaths of 180,000 people, and the displacement of over a million people in Kurdistan (Gunter 2004; McDowall 2007; Yildiz 2007). In addition, the forced relocation of nomadic and settled tribes and the closing of borders, which impeded transhumance, have both contributed to the devastation of weaving culture (McDowall 2007).

The fall of the Saddam Hussein regime in 2003 resulted in economic and social change for the Iraqi Kurds. Connections and communication with outside countries grew, and international trade with the Kurds could start for the first time. Kurdistan today is a rapidly-changing society moving toward modern marketing and technology (KRG 2009), and this threatens the persistence of traditional Kurdish weaving. Over time the size of the remaining nomadic population in Kurdistan has declined (Stanzer 1988). Its folk have gone from being fully nomadic to becoming semi-nomads that only move between summer and winter pastures each year. The nomadic population in Iraqi Kurdistan is presently facing extinction, with only 750 nomadic and semi-nomadic families left (L. Sipan, pers. comm.).

The Kurdish Textile Museum

An attempt to preserve the cultural weaving heritage of the Kurdish nomads was made with the establishment of a Kurdish Textile Museum (http://www.kurdishtextilemuseum.com) in the ancient citadel of Erbil. Kurdish anthropologist Lolan Sipan founded the museum in 2004 and started the "Women's Income Generation Training Project." Its objective is to create job opportunities for women, while reviving the traditional Kurdish weaving culture by giving old tribal master weavers the chance to teach their skills to younger women and, at the same time, create textiles for commercialization.

Objectives

This study documents the remaining traditional knowledge of natural dyeing and dyeing plants of the nomadic tribes of Iraqi Kurdistan. It assesses the transmission of traditional dyeing knowledge from the older generation of master weavers at the Kurdish Textile Museum to the younger generation of weavers' apprentices. It

combines a quantitative approach using picture cards for species recognition and pile-sorting tasks with qualitative data on natural dyeing plant species, their identification, collection, harvesting, extraction, and use. This study presents the first data on Kurdish contemporary natural dye knowledge and use and some of the first data on plant use by the Kurdish minority in Iraq.

Materials and Methods

Study Sites

Field work was carried out in Erbil province, Kurdish Autonomous Region, Iraq, in October–December 2008. Work was done at the Kurdish Textile Museum, in the citadel in the center of Erbil, and in the Balakî tribe villages of Balekîyan, Macîdawe, and Bêlêngir in the Soran district situated to the northeast of Erbil (Fig. 1).

Interviews

Informant interviews were carried out individually in a separate room within the museum and in the home of each Balakî tribe member. The interviews were conducted by the first author with his mother, Ann Mati, as an assistant, and carried out in Sorani Kurdish. Sorani Kurdish can be written in both Arabic script and alphabet, but in order to facilitate proper pronunciation of phonemes it uses additional accent marks on the letters. Interviews consisted of a short conversational prelude in which the background of the research was explained, and prior informed consent was obtained before proceeding with data collection. Personal data on the informant was gathered at the end of each session. All interviews were recorded using a digital video camera. The recordings are retained for reference at the Department of Systematic Biology, Uppsala University.

To determine the cultural domain (Borgatti 1994) of dyeing plants and what species to include in this study, a key informant was identified using snowballing among the weaving teachers at the museum, with whom in-depth interviews were conducted. Based on these data, 13 picture cards were created: 12 of dyeing plants

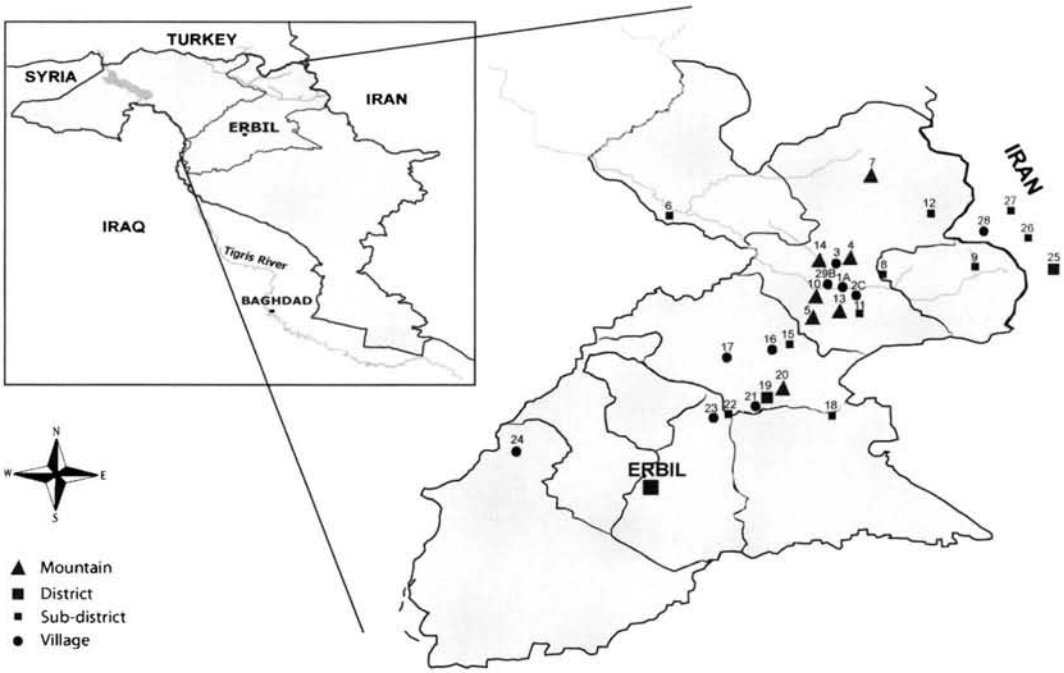

Fig. 1. Map of the Kurdish Autonomous Region in Iraq. Letters refer to study sites: A. Balekîyan; B. Macîdawe; C. Bêlêngir. Numbers refer to collection locations of dyeing plants from Table 2: 1. Balekîyan; 2. Bêlêngir; 3. Hornî Balekîyan; 4. Sure Zewî; 5. Gelî Alî Beg; 6. Barzan; 7. Bradost; 8. Diyane; 9. Hacî Omran; 10. Hendrên; 11. Riwandiz; 12. Sîdekan; 13. Hesen Beg; 14. Zrauk; 15. Herîr; 16. Batas; 17. Graw; 18. Xoşnaw; 19. Şeqlawe; 20. Sefîn; 21. Korê; 22. Mesîf (Selahedîn); 23. Bestore; 24. Kelek; 25. Şino; 26. Xane; 27. Nexede; 28. Mehabad; 29. Macîdawe.

and one of potassium-alum, a common mordant. Each picture card consisted of photographs of different parts of the plants, displaying the characteristics needed to identify the species. In addition, samples of each plant were purchased in the nearby Qaysari market in Erbil and were displayed together with each picture card. The samples were later stored at the Uppsala University Herbarium (UPS) as botanical references for identification.

A species recognition task with the picture cards was carried out with each informant. They were asked to identify the plants they knew, and then to sort the identified plants using an unconstrained pile sort (Martin 2004). In addition to the arrangement of the piles, the criteria for sorting were also noted.

These tasks were followed by open-ended, semistructured interviews regarding each plant (Martin 2004). These interviews consisted of questions on local names, uses, plant parts used, use instructions, where they grow, how to collect them, best collection time, from whom the informant learned about the plant, as well as the commercial value of the species.

Data Analysis

Anthropac 4.98 (Borgatti 1996) was used for analysis of the pile-sorting data. Consensus analysis (Romney et al. 1986) was used to test the underlying "one-culture hypothesis." Data were plotted using nonmetric multidimensional scaling, in which Euclidian distances between all the points in the similarity matrix are computed and the data are represented in a 2-dimensional space in an optimal way (Kruskal and Wish 1976; Puri and Vogl 2005). Data were further analyzed using Property Fitting (PROFIT) analysis and quadratic assignment procedure (QAP) regression (Hubert and Schultz 1976; Puri and Vogl 2005). Dependent variables were the agreement matrices from the consensus analysis for the pile sorting of the dyeing plants. The attribute matrix consisted of social data on the following: number of species recognized; knowledge (from the consensus analysis); age; gender; knowledge source (learned from mother, grandmother, aunt, parents, female relatives, female relatives-in-law, here and there, teacher(s), or felt makers); educational background (number of years of education); informant type (villager, teacher, or student); occupation (housewife, teacher, shepherd, student, or felt-maker); language ability (Kurdish, Kurdish and Arabic, or Kurdish and Arabic and Turkmen); marital status (patrilocal residence, matrilocal residence, neolocal residence, or unmarried); family (nuclear or extended); residence size (number of people in residence); tribe (Balakî, Kheilani, Gerdi, Sian, Khoshnaw, Balak, Shekhan); and nomadic status (active nomad, abandoned nomadic lifestyle, or not nomad). Quantitative attribute variables were normalized and regressed using PROFIT analysis. Categorical attribute variables were independently converted to matrices by scoring for matches in a single variable similarity matrix (Puri and Vogl 2005) and regressed using QAP regression.

Results

Species Recognition

Recognition of dyeing plant species using the picture cards was perceived as difficult by some informants, and augmentation with material samples facilitated recognition considerably (Table 1). Species recognition focused on whether the informant identified the plant species depicted on the card and not whether it was recognized as a dyeing plant species. In some cases, the students did not identify the plants in the picture cards as natural dyes. Weaving teachers, on the other hand, identified all species recognized by the students, as well as some other, additional natural dyes. The Balakî tribe informants in the Soran district scored best in this task and recognized on average 12 species out of 13, whereas the students in Erbil recognized only 8.2 on average, and often did not know the dyeing properties of the species, but recognized other uses, such as in traditional medicine. The average recognition by all informants was 10.9 out of 13, which gives an indication of their everyday level of species familiarity.

Quercus aegilops L., *Rhus coriaria* L., *Punica granatum* L., and *Juglans regia* L. were recognized by all informants, followed by *Beta vulgaris* L., Potassium-alum, *Indigofera tinctoria* L., *Quercus infectoria* Oliv., *Rumex* spp. and *Curcuma longa* L. that were recognized by 19, 18, 17, 17, 14, and 12 informants, respectively. Poorly-recognized species were some of the most common dye plant species, including *Reseda lutea* L. (9) and *Rubia tinctorum* L. (11).

Species recognition differed between the three informant groups. The Balakî tribal people recognized almost all picture cards, although some did not recognize *R. lutea*, *R. tinctorum*, *C. longa,* and *Rumex* spp. The teachers also

TABLE 1. DYEING PLANT SPECIES RECOGNIZED BY INFORMANTS.

	Teacher 1	Teacher 2	Balaki 3	Balaki 4	Balaki 5	Balaki 6	Balaki 7	Balaki 8	Balaki 9	Balaki 10	Teacher 11	Student 12	Student 13	Student 14	Student 15	Student 16	Teacher 17	Teacher 18	Teacher 19	Teacher 20	Sums
Quercus aegilops L. (Fagaceae)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
Punica granatum L. (Punicaceae)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
Rhus coriaria L. (Anacardiaceae)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
Vitis vinifera L. (Vitaceae)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
Juglans regia L. (Juglandaceae)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
Rubia tinctorum L. (Rubiaceae)	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	11
Indigofera tinctoria L. (Fabaceae)	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	17
Beta vulgaris L. (Chenopodiaceae)	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	19
Quercus infectoria Olivier (Fagaceae)	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	17
Reseda lutea L. (Resedaceae)	0	0	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	1	0	1	9
Curcuma longa L. (Zingiberaceae)	0	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1	0	0	1	0	12
Rumex sp. (Polygonaceae)	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	1	1	14
Potassium-Alum	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	18
Sums	11	12	11	13	12	12	12	13	12	11	13	8	7	8	8	10	9	12	11	12	

recognized the majority of the species, but had trouble identifying *R. lutea* (3 out of 7), *C. longa* (3 out of 7), and *R. tinctorum* (5 out of 7). The students had the least thorough knowledge and could not identify *R. lutea* and *R. tinctorum*, and infrequently recognized *Rumex* spp. (1 out of 5), *I. tinctoria* (2 out of 5), and *Q. infectoria* (2 out of 5). The poor recognition of the important dye species, *R. lutea* and *R. tinctorum*, might be due to the limited alternative uses that these species have (Table 2). Many people may never have seen the entire plant, or even the parts in trade. In addition, *R. tinctorum* is mainly imported as dried or powdered roots from Iran, and *R. lutea* is only wild-crafted but not cultivated. *C. longa,* on the other hand, is used for dyeing food instead of cloth, and is imported from outside the region. Some of the teachers and Balakî people did not recognize the species, which could be explained by its limited availability outside the major urban centers and a possible confusion based on the aberrant dyeing use within the species recognition task.

PILE SORTING

Visual evaluation of the pile-sorting data allows for rapid recognition of species clusters through repeated co-occurrence. Informants identified four sorting categories: dye, food, medicine, and texture/appearance. The Balakî and the teachers pile-sorted the species either by their dyeing or food properties, 7 and 8, respectively. One of the teachers even sorted the species for their use as adjacent colors in rug weaving. Pile sorting among teachers and Balakî was similar regardless of the pile-sorting criteria, and they commonly grouped the following together: *Q. aegilops* and *Q. infectoria* (11 times out of 15 informants), *B. vulgaris* and *Rumex* spp. (7), *P. granatum* and *V. vinifera* (7), *P. granatum* and *J. regia* (7), *R. tinctorum* and *I. tinctoria* (6), and *R. lutea* and Alum (5). The students did not sort the piles for their dyeing properties, but rather for food, medicinal, or texture/appearance, and their piles were notably different from the others. Three of the students piled *Q. aegilops* and *J. regia* together, and another two put *Q. infectoria* and alum in the same piles. The former are both tree species in which part of the fruit is used. These include the cupules of *Q. aegilops* and the shells of *J. regia*. In the latter group, *Q. infectoria* galls are put with alum because they are used together medicinally to treat oral ulcers (see Table 2).

TABLE 2. COMPILED DATA ON PLANTS FROM IN-DEPTH INTERVIEWS WITH ALL INFORMANTS[a].

Kurdish and scientific name	Dye use[b]	How to collect	Where it grows[c]	Other uses
Beru *Quercus aegilops* L. (Fagaceae)	**Brown**[1,4,17,20]. NDP[1,4,17,20] Dry acorn cupules, grind, boil, let cool, add yarn, leave overnight, dry yarn, dye with synthetic dye[1,4,17,20]. Collected in autumn[2,4,6,10,11] before rainfall[1,2].	When fallen, pick from ground[1,2,3,4,5,6,10,11]. Climb and pick or throw rocks at tree[3]. Use long stick to grab branch, and pick acorns[4,18].	Wild in hills and mountains[1,2,3,4,5,6,10,17,20], *Sefîn*[2], *Sidekan*[2], *Şeqlawe*[2], *Bradost*[10], *Barzan*[10], *Zrauk*[10], *Bêlêngir*[10], *Hendrên*[10] and *Hesen Beg*[10].	**Medicine**[3,15]. Eat acorns to treat stomach ache[3], diarrhea[15]. **Food**[ALL]. Collected after rainfall; otherwise bitter[1,2]. Roast, peel, and eat seed[1,2,3,4,6,11]. Grind, and use as flour for bread[6]. Remove testa, boil, then eat[3]. Leather[1,2,3,4,5,6,10,11,18,19,20]. Skin goat or cow, soak hide in water overnight, scrape inside with a sharp knife until clean, then apply decoction of dried and ground acorn cupules to skin, twist skin, and leave 1 day[20] (alt. fill skin with the water, leave 8–9 days[11]), add skin, cool overnight, goatskin becomes hard and thick (for making shoes[10]) (fill with sand so that it takes shape[4]), dry in shadow, tie leg and arm holes with rope, wash repeatedly with water; storage bag for rice, cheese, wheat, or other items; Hembane, also to churn butter; Meşke, bag also used to store water; Kunde[1,2,3,4,5,6,10,11,18,19,20]. **Fuel**[2,8,10]. Wood and acorns used as charcoal[2,10]; *Reju*. Emergency fuel[8]. **Fodder**[2,3,4,5,6,8,9]. **Construction**[10]. Wood and branches[10].
Henar *Punica granatum* L. (Punicaceae)	**Yellow**[1,2,3,4,5,6,8,9,11,18,20]. NDP[1,2,3,4,5,6,8,9,11,18,20]. Peel is removed by hand, and used to dye[1,3,5,6,8,9,11,18,20]. Combine with *J. regia*[18] or synthetic dyes[2].	Harvest fruit by picking or using a knife[1,2,3,4].	Cultivated[3,4,6,11,17,18]. Wild[1,2,5] in mountains[2].	**Medicine**[1,3,4,10,11,12,13,15,16]. Eat exocarp to treat stomach ache[1,3,11,12,13], stitching[4]. Apply exocarp to oral ulcers[15,16]. See *Q. infectoria*[16]. Rub on hands; dry and cracked skin[15]. **Food**[ALL]. Collected after rainfall; otherwise no taste[2]. Eat fresh or make *Rubahenar* or *Birman* (syrup) or *Sirka*(vinegar)[1,2,3,4,5,6,8,11]. **Leather**[3,4,10,19]. Dry exocarp, boil with *Q. aegilops* (see *Q. aegilops*); gives strength to leather[3,4,10,19], for making shoes[10]. **Hair Dye**[4,11,13,14]. Dry exocarp, grind, mix into henna, dye hair[4,11,13,14].
Sumaq *Rhus coriaria* L. (Anacardiaceae)	**Red**[1,2,3,4,5,6,8,11,18,19,20]. NDP[3,4,8,18,20]. Dry, remove seeds, and grind testa in mortar; *Destar*[1,2]. Put seeds in water, run through with hand; seeds separate from testa[8]. Boil with alum (size of a walnut) then use *R. tinctoria*[1,2,11], or synthetics[6,8], or *R. luteola*[5].	Cut infructescence[1,3,4,6,8,19]. Hold steam below infructescence, pull all seeds upwards[3,4,8,18,20].	Cultivated[1,8,11,17,20]. Wild[5,10,18] in mountains[2,3,4,19], plains[6], *Xoşnaw*[19], and *Riwandiz*[19].	**Medicine**[9,10,12,13,14,15,16,18]. Apply testa on skinburns[9]. Put in mouth of animal; oral ulcers[10], humans[15]. Boil, drink; stomach ache[12,18] and diarrhea[13,14], with garlic[15,16]. Lowers the blood pressure[15]. **Food**[ALL]. Collected before rainfall; otherwise no taste[2,4]. Separate testa from seed and eat[1,2,4,5,20]. **Fodder**[10]. **Leather**[19]. Dry, boil with *Q. aegilops* (see *Q. aegilops*); gives strength to leather[19]. **Hair dye**[4].
Trê *Vitis vinifera* L. (Vitaceae)	**Green**[1]. NDP[1]. Collect and dry leaves[1].	Cut infructescence and pick leaves by hand[1,4].	Cultivated[1,4,8,11,17].	**Medicine**[6,12,13,15,16,19]. Eat grapes to lower blood pressure[6]. Anemia[12,13,15,16,19]. **Food**[ALL]. Leaves used in Kurdish dish; *Dolma*[1,2,3,4,5,14]. Fruit

				eaten raw or sun dried; *Mewij* (raisins),and *Doşaw* (Syrup) [1,2,3,4,6,10,11,12,18,19]; boil fruit, pour decoction in cloth, then in basket, and press sap by stamping; subsequently boil down until it thickens to syrup[1].
Cuz *Juglans regia* L. (Juglandaceae)	**Black**[1,2,3,4,5,6,9,11,17,18,20]. NDP[1,3,4,5,6,9,11,18,20]. Remove peel (exocarp) and use fresh (dry[4,9,11]). Collected unripe, before peel has cracked[1]. Mordant dye and direct color[1,2,3,4,5,6,9,11,17,18,20]. With *P. granatum*[18]. With synthetics[2]. Leave 1–2 h[6] or a few days[4].	Climb tree, hit fruit with long stick, collect from ground[2,4,5,9,11].Climb, use long stick with hook to grab branch and shake.[18]	Cultivated[3,4,5,6,9,11,18,20], in *Bestore*[1], *Mesif Selahedin*[1]. Wild[5,11,17] in mountains along streams[2,5,6,17,18], *Xoşnaw* and *Balekiyan*[1], and *Geli Ali Beg*[6].	**Medicine**[3,4,5,6,9,10,13,14,15,16,19]. Eat nut; lowers blood fat and blood pressure[4,5,14], stomach ache[3], anemia, and also see *Q. infectoria*[16], for strength[13,15,16], for strong bones[19]. Apply fresh peel on skinburn[6] or rash and eczema[10]. Dry peel, grind, mix with little water, apply on head; headache[9]. **Food**[ALL]. Crack shell, dry, break, eat[1,2,3,4,5,6]. **Hair dye**[2,3,4,6,11,12,14]. Dry, boil, mix little of the water into henna[2,3,4], with *P. granatum*[4]. Dry, grind, mix into henna[6,11,12,14]. **Carpentry**[1,2]. Use wood to make *Dari Qend*; to break big sugar blocks on, place block in center, crush with axe, sugar falls down into cavity[1,2]. **Cosmetic**[10]. Rub fresh peel on lips as lipstick[10].
Runas *Rubia tinctorum* L. (Rubiaceae)	**Red**[1,2,3,4,5,6,7,8,11,18,20]. NDP[3,5,18]. Grind root[1,2,3,4,5,6,7,8,11,18,20] with *Coni* (mortar), use *Hêling* (fine sieve) to strain powder[2]. Leave a few days[4]. Boil with alum[5,18,20] and *R. coriaria*[11] and synthetics[2]. Soak yarn in hot water, take out, apply madder powder on yarn, put yarn in hot water, leave overnight, dry yarn[8], first treat with *R. coriaria* and alum[6], first treat with *P. granatum* and alum[1]. Collected in spring[5,18], autumn[4,8] (before rain[3]).	Pull out plant from ground, cut off roots[4,5]. Use shovel[8].	Bought[2,11,20] from Iran[1,3,6] in *Şino*, *Nexede*, *Mehabad*[4], or from dealers returning from Iran[5,8]. Cultivated[1,18] in *Xoşnaw*[1], *Bestore*, *Mesif Selahedin*, *Graw*[1,18]. Wild[3,4,5,8,18], in *Geli Ali Beg* and *Hornî Balekiyan*[3], *Sure Zewî*[5], *Korê*[18], mountains[5,8,18], meadows[4], and vineyards[18].	**Medicine**[1,6,18]. Grind, mix with egg yolk, apply on wound, sore, bone fracture, swollen area, leave a few days[1,18]. Grind, add little water, apply on forehead; headache or eye pain[6].
Xim *Indigofera tinctoria* L. (Fabaceae)	**Blue/Black**[1,2,3,4,5,6,8,9,11,12,17,18,19,20]. Boil, add yarn or clothes, leave 15–60 min, depending on shade, dry, wash; Dyeing colorful clothes black, e.g., death in family[9,12,18]. With *P. granatum* and salt[8], with alum[17].		Yarn sent to *Ximxanşî* (indigo dye workshops) in towns for dyeing[1,4,5,6,11,19,20]. Bought dye[1,8,9] in *Herir*[1], *Batas*[1], *Diyane*[8], and *Xane*[3].	*Ximşî* (black dyers) were Jewish, and had 4–6 shops in Erbil (1960)[1,17,18]. After leaving, none left to dye with Indigo[19,20], and instead people dyed with synthetics or *P. granatum* or *J. regia*[18].
Silqesor *Beta vulgaris* L. (Chenopodiaceae)	**Red**[11]. NDP[11]. Slice root, use fresh for dyeing[11].	Pull up from ground[1,2,11]	Cultivated[1,3,4,11].	**Medicine**[16]. Boil, drink; kidney pain and gives energy[16]. **Food**[ALL]. *Turşî* (pickles); [1,4,6,11,14,18] slice, boil, put in jar, add vineger, salt,vegetables, store 1 week.[1] *Dolme*[14], *Kifte*[1,4,6,17].
Mazî *Quercus infectoria* Olivier (Fagaceae)	**Beige**[4,10,18,20]. NDP[20]. Galls used to dye textiles used for traditional kurdish men clothing[4,10,18]. Collected in autumn[6,11,18] before rainfall[3,4,8].	Climb and pick galls from tree[1,3,4,8,11,18]. Use long stick to fetch branch[4] or hit tree[5].	Wild in hills and Mmountains[1,2,3,9,10,11,17,18], sopes[6], *Bradost*[3,8], and *Hesen Beg*[11].	**Medicine**[1,2,3,4,6,9,10,11,15,16,17,18,19]. Collected before midsummer, when galls are dark; better medicine[3,4,6,8]. Dry, grind, sieve with fine cloth, apply on wound, cover[1,2,9,11], with egg yolk, on wounds, swellings, broken body part, leave 2 weeks[18], psoriasis and skinburn[6,10,17], oral ulcers[3]; with alum[15,19],

TABLE 2. (CONTINUED).

Kurdish and scientific name	Dye use[b]	How to collect	Where it grows[c]	Other uses
				with *P. granatum* and *J. regia*[16]. Eat; stomach pain[1]. **Leather**[1,20]. Use with *Q. aegilops*[20], both *Mazisk* (big red gall, with pointy outgrowths) and *Guring* (big yellow-red gall, no pointy outgrowths), can be used with *Q. aegilops*[1]. **Fodder**[2,3,4,11]. **Fuel**[2,10]. **Construction**[10]. Wood and branches[10].
Sender *Reseda lutea* L. (Resedaceae)	**Yellow**[1,2,4,5,6,8,9,10,11,18,20]. NDP[4,5,6,8,9,10,11,18,20]. Leaves used[4,5,6,8,9], sometimes picked dry[4,6,8]. All aerial parts used[10,11,18]. Direct dye[5]. Leave few days[4]. First treat with alum and *R. coriaria*[6] . *R. luteola* is better but use *P. granatum* if not avilable[1]. Collected between[8,10,11] spring[4,5] and summer[6,9].	Pull plant from ground[1,4,6,18]. Pick leaves[8].	Wild in mountains[5,6,8,9,18], meadows[4,11], near water[9]. Border of Turkey and Iran, *Haci Omran*[20], *Hornî Balekîyan*[5].	
Zerde Çewe[3,4,8,9,14,16,19], Beharat[12,13,14], Derman Biryanî[2,11,14] *Curcuma longa* L. (Zingiberaceae)	**Yellow**[2,3,4,11]. Food dye[2,3,4,11]. Powdered root added to water when making rice; yellow colored rice[2], used in various dishes[4].	Bought[2,3,4,11].	Bought, Imported[2,3,4,11].	
Tirşoke *Rumex* sp. (Polygonaceae)	**Light red**[4,10,11]. NDP[4,10,11]. Leave leaves a few days[4]. Boil with alum[11]. Collected any time[8], before flowering[11].	Pick leaves[1] / Pull from ground[2,4,18].	Wild along streams[2,10,11], mountains[1,4], slopes near fields[18], bushy and shady areas[9], meadows in sandy soil[18], *Geli Ali Beg* waterfall, *Kelek*[1], and *Hendrên*[4].	**Medicine**[2,4,9,10,18]. Apply leaves on sore, cover, leave 1 day; cleans and removes pus[2,9,10,18]. Boil flowers, wash genital with water; vaginal infection[4]. **Food**[1,2,4,5,6,8,9,10,11,18,19,20]. Eat fresh[1,2,10,18]. Boil[8]. Used with *V. vinifera* in *Dolme*[1,2,8,11,20].
Şeb Potassium-Alum	**Mordant**[1,2,3,4,5,8,10,11,18,19,20]. NDP[3,4,5,8,11,18,19,20]. Mordant yarn prior to dyeing, or add mordant to dye-yarn mixture.		Bought in shops[1,2,3,4,19,20].	**Medicine**[3,10,13,15,16,17,19]. Grind, mix with milk, apply externally to relieve body pain, stiffness, tiredness[3]. Grind with *Q. infectoria* galls, add salt, mix into oil, apply on wound[10]. See *Q. infectoria*[15,16,19]. Apply to wounds (or after shaving) as hemostatic and astringent[13], skinburns[17]. **Food**[1,2,3,4,5,6,8,9,10,18]. For cheese making: Grind, add to container, add water, clean by scraping the inside of goat, cow or sheep abomasum, and cut it into small pieces, dry; *Şilk*, add to container, cover, leave for 2–3 days until layer forms on bottom; *Hewên* (natural yeast), add layer to boiled milk, stir; cheese[1,3,4,5,6,8,9,18]. Add yogurt and salt to *Şilk*, leave overnight, dry in sun, can be used when needed, add little hot water, grind alum and add to mixture, add water; *Hewên*, add to hot milk; cheese[2]. **Water purification**[3,5,10]. Add alum to water, stir, wait; filth will sink to bottom of container[3,5,10]. **Cosmetic**[13]. Apply under arm, as deodorant[13].

[a] Quote numbers refer to informants (Table 1). Statements mentioned by all 20 informants are marked ALL. [b] NDP (Normal dyeing procedure): dry plant material, boil, let it cool, add yarn, leave overnight, dry yarn in sun. [c] Followed by plant locations in Kurdish (for location on map, see Fig. 1).

Consensus analysis in Anthropac applied to the pile-sorting data of the dyeing species recognized in the species recognition task argues strongly in favor of the hypothesis that our informants belong to one culture, with an eigenvalue ratio of 11.977 (pseudo-reliability 0.970). However, correlating the variation by either Property Fitting or QAP regression with informant attributes (gender, age, status, knowledge source, educational background, informant type, occupation, language ability, marital status, family, residence size, tribe, nomadic lifestyle, or the reported pile-sorting criteria) was difficult, with either little variation explained (low R-squared) or little probability (low p-value). "Learned from," occupation, and reported pile-sorting criterion were all significant, but explained little of the variation. Focusing specifically on the Erbil master weavers and their pupils, we find strong support for a single culture (pseudo-p 0.940, eigenvalue ratio 8.974). Nonmetric multidimensional scaling in two dimensions has a moderate Kruskal stress of 0.175. Property Fitting of normalized quantitative attributes shows that both position (teacher or student) (R^2 0.653, p 0.010) and age (R^2 0.611, p 0.018) explain variation in the pile sorting (Fig. 2). The relatively strong support for the one-culture hypothesis is probably influenced by the limited number of species in the pile sort, whereas the significance of the informant's age and position is probably a combination of homogeneity in the weaving teachers' knowledge opposed to limited species knowledge among the students and alternative sorting criteria such as herbal medicine or appearance. At the same time, these results confirm the importance of knowledge transfer from the elderly, more experienced generation to the younger, learning generation.

Plant Use and Ecology

The interviews following the quantitative tasks resulted in the recording of a wealth of information on the current and traditional use of the dyeing plant species. Data collection did not focus exclusively on dyeing use, but also on other uses, harvesting, the source of the material, and exact use instructions for each purpose (Table 2). The place names mentioned as sources of the dyeing plant species were identified using maps of the regions, and they range over the Kurdish region in Iraq and Iran (Fig. 1). The quotations in the ethnobotanical data enable the identification of the separate informants, and allow for the assessment of variation in knowledge between the three main groups of informants: weaving students, weaving teachers, and Balakî tribal weavers.

Knowledge of natural dyeing plant species agrees with other studies of natural dye knowledge in the region. Doğan et al. (2004), in a broad study of contemporary dye plant knowledge in Turkey, describe similar uses of all species

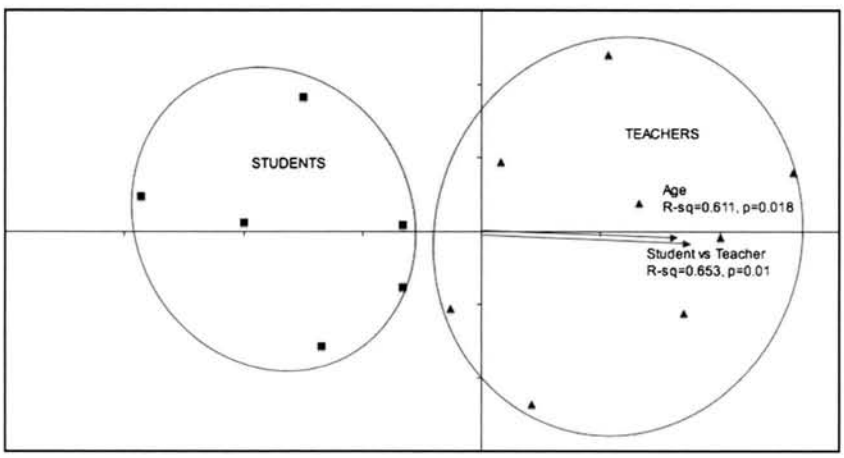

Fig. 2. Pile sorting of dyeing plant species by weaving teachers and apprentices in Erbil plotted using nonmetric multidimensional scaling (MDS). Students are marked by squares and teachers by triangles. The plot is the optimal representation of the Euclidean distances between the informants' knowledge based on the similarity matrix, and the axes are the two dimensions in which the data can be represented with the least Kruskal stress (0.175). The clusters of students and teachers are encircled. The vectors are based on property fitting of attributes using multiple regressions (PROFIT). Arrows point in the direction of increasing attribute values.

except *I. tinctoria*, *B. vulgaris,* and *Q. infectoria*. Özgökçe and Yilmaz (2003) describe similar dyeing uses from Eastern Anatolia (Turkey) for the following species: *V. vinifera*, *J. regia*, *R. tinctorum*, *R. lutea,* and *Rumex* spp. Hooper and Field (1937) describe the use of *P. granatum*, *R. coriaria*, *R. tinctorum*, *Q. infectoria*, *I. tinctoria*, and *C. longa* as dye plant species traded in the medinas of Isfahan (Iran), Tehran (Iran), and Baghdad (Iraq), and in addition mention the use of *Q. infectoria* and *R. coriaria* as important sources of tannin for dyeing.

The majority of the ethnobotanical data is given by the Balakî informants, as well as almost all of the ecological data. The remainder of the data is mainly from the weaving teachers, who often have had first-hand experience with these species when living as nomads in the mountains in their youth. Weaving students often have limited or only indirect knowledge of plant ecology, but frequently knew of the uses of certain species first-hand, especially traditional medical uses of these species. The qualitative interviews also revealed that many of the informants recognized species based on uses other than solely dyeing. The most striking example is the common grape (*V. vinifera*), which all informants recognized, but none recognized primarily as a dyeing species (Table 2). Some informants (see 2, 3, 4, and 5 in Table 1) also mentioned the use of minerals for dyeing: *Qure Reş* (black mud), from a river or mountainside, resulting in a black dye, and *Qure Şîn* (blue mud), found underwater close to Balakîan, resulting in a bluish dye. Both were used in the following manner: mix mud with cold water, add yarn, leave overnight, dry; or alternatively boiled with yarn; or used with yarn pretreated with *R. lutea* and *R. tinctorum* and then left to dye for 3–4 weeks.

Discussion

Balakî Tribe

Natural dyeing plants have played an important role in the livelihoods of the nomadic tribes in Kurdistan. These plants have been essential components in nomadic weaving culture, which has long been a major source of income. Dyeing knowledge is transmitted matrilineally, and not solely from mothers and grandmothers, but, significantly, also from aunts, mothers-in-law, older women, and female neighbors. For centuries nomads have been dependent on the wild-crafting and barter-trade of these plants for their sustenance. The invention and spread of synthetic dyes provided a preferred alternative, as they were inexpensive, easy to process, and stable. Even though synthetic dyes have been available for over a century, these have not always been obtainable by nomadic weavers during the last century, and elderly weavers learned first-hand to locate, harvest, process, and dye with natural dyes. Nomadic master weavers' dyeing knowledge, based on extensive empirical practice, has declined as it has fallen into disuse with the abandonment of weaving and their nomadic livelihoods.

The Balakî have extensive knowledge of dyeing and tanning, what species can be used, where these species occur, how to harvest them, and how to use them sustainably. Cross-border trade with neighboring Kurdish people occurs: *Rubia tinctorum* L., a dyeing plant reported as far back as Pliny the Elder in the 1st century C.E. (Bostock and Riley 1855), is reported to be bartered with Kurdish nomads from Iran, often for locally-produced white and blue cheeses, by eight of the informants, and one mentioned specifically the towns of Şino, Nexede, and Mehabad. Dyeing with *Indigofera tinctoria* L. by *Ximşi*, Jewish black dyers, is reported to have been common before 1960 in Erbil and other Kurdish towns. And *Reseda lutea* L. is collected in the border region of Turkey and Iran.

Erbil Weavers

Analysis of the pile-sorting data for Erbil informants showed strong support for the one-culture hypothesis. The criteria informants use when sorting piles are likely to be related to their perception of the world around them; age and firsthand experience over time gives knowledge of additional properties and gives rise to more ways to sort; and also their occupation clearly has an influence on the way people perceive similarities in dyeing plants. Weaving teachers are likely to sort according to matching dye colors, whereas students may sort by other criteria, such as shape, plant part, or medicinal properties. When analyzing the Erbil informants alone, we also find strong support for one-culture. The cultural differences between teachers and students are reflected in the MDS plot and the way the two groups sorted the species. The variation can be explained by both position and age using Property Fitting. The teachers are members of an older generation who have lived a substantial part of

their lives as nomads roaming the harsh mountainous terrain of Kurdistan and were taught dyeing as children by older generations of nomads. The students, on the other hand, have lived all their life in the city and are far removed from the old nomadic ways of life, and are learning traditional crafts as young adults.

Conclusion

The Kurdish Autonomous Region is currently experiencing political stability and economic growth, but the area inhabited by the Kurds in Iraq has long been poorly accessible, and few studies exist of the flora and ethnobotany of the region. Natural dyes have long played an important role in the livelihoods of the nomadic tribes, and traditional weaving has long been a major source of income. However, dyeing yarn with natural dyes as well as the tradition of weaving has been abandoned, and dyeing vats and looms have long been put to other uses. Nevertheless, knowledge of natural dyeing species is widespread. Many of the species that have been used for dyeing in the past occur in the mountains up to this day, either cultivated or in the wild, and have multiple other uses. Vertical transmission of knowledge of these species in the mountains is effective as these species are used actively, whereas, on the contrary, dyeing use is transmitted largely anecdotally. Knowledge of species that are mainly used for dyeing, such as *R. tinctorum*, *R. lutea*, and *I. tinctoria*, is disappearing more rapidly, and few of the informants recognized these species. Nevertheless the people in the mountains are closer to nature and everyday use of plants, and dyeing plant knowledge is likely to be sustained as a byproduct of more active plant use.

Migration to urban settings, such as Erbil, has an erosive effect on dyeing knowledge and on traditional ethnobiological knowledge in general. People who migrated to Erbil as adults generally have first-hand experience of pastoral life and broad traditional ethnobiological knowledge. The younger generation of urbanites, who moved to Erbil as children, or were born there, have little knowledge of plants and their useful properties. The weaving project organized by the Kurdish Textile Museum gives experienced weavers the opportunity to revive their knowledge and pass it down to a new generation of weaving students. Not only does this project revive weaving culture, it also empowers young women through learning an ancient and neglected trade. The weaving students know fewer plants and know less about their use and application than their teachers. Surprisingly, however, this study uncovered the existence of a keen interest among these students in traditional herbal medicine, and many of the medicinal uses recorded in this study originate from them. If this trend continues and is true for Kurdish urban youth in general, then it could lead to a genuine revival and perpetuation of traditional knowledge.

This study confirms the presence of a natural dyeing culture, which is mainly inactive today, but whose empirical knowledge persists among informed people both in the countryside and in Erbil. Although first-hand experience is largely restricted to the older generation, younger people in the cities have some anecdotal knowledge of natural dyeing species. The study also confirms the importance of knowledge transfer between the elderly, empirical generation to the younger, learning generation. Recent changes in the economy of the Kurdish people have been a major contributing factor in cultural change. A shift of focus in the younger generations to medicinal uses of plants was observed, as traditional herbal medicine is gaining popularity in Kurdish society, and young people know the dye properties of species secondarily after their other uses in traditional medicine.

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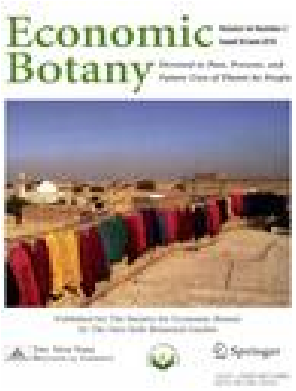

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