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Determination of the usability of some ethnobotanically used wild plant species as forage crops

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A B S T R A C T

Eastern Anatolia Region is located in an area where three phytogeographical regions intersect. Many of the plants known by the public and used as food in human and animal nutrition or for therapeutic purposes in traditional medicine are found in the natural flora, especially in meadows, pastures and cultivated areas. This study aimed to determine the potential of the plants found in the natural flora, which are still used for different purposes, as alternative forage crops on Kop Mountain where pasture-based stock farming is continued. The study identified 85 plant species, which are ethnobotanically used for food and medicinal purposes, from 25 families. From these genetic resources, cluster analysis was performed on 39 species from 15 families, which have alternative forage crop value. Firstly, *B. corolliflora, B. lomatogona, P. cognatum, P. aviculare, P. major, Sinapis arvensis, Rapistrum rugosum, P. lanceolata, C. transsylvanica, C. syriaca, Chenopodium album, Capsella bursa pastoris, Asparagus persicus* and *Atriplex nitens* species were found to be available as alternative forage crops. The data obtained suggests that it is possible to expand the genetic resources of forage crops with plants from different families and species and to increase the diversity of forage crops by means of such studies.

1. INTRODUCTION

A total of eight origin centres, which are the origin of plants grown all over the world, including Turkey (Near East, Iran-Turan and Mediterranean), were determined. Our country is the gene center of many plant species. Some of the characteristic species belonging to the Iran-Turan region, which covers the largest area among the three phytogeographical regions, include *Acantholimon* sp., *Achillea* sp., *Artemisia* sp., *Astragalus* sp., *Bromus* sp., *Crataegus orientalis, Euphorbia tinctoria, Juniperus excelsa, Medicago* sp., *Noaea mucronata, Onobrychis* sp., *Poa bulbosa, Prunus* sp., *Pyrus* sp., *Quercus* sp., *Stipa* sp., *Teucrium orientale* (Sehirali et al., 2005). The number of plant taxa in Turkey is shown as 12,476 and 1/3 of these plant species (4,080) is said to be growing only in our country, namely endemic (Karagoz et al., 2010). Eastern Anatolia Region is a very rich area that contains genetic resources of cereals, forage, medicinal, aromatic, dye, and garden, industrial and ornamental plants along its pastures. In the region, where the economy is based on stock farming and stock farming based on pastures, animals are pastured as long as the climatic conditions allow. Animals that feed on plants from different families in pastures become

healthier and produce better quality products. Although pastures are used for a long time and intensively, they are still the gene pool of many forage crops. This gene pool also includes shruby and shrubs, which have an important place in nutrition of small cattle such as goat and sheep on the edges of the pastures or on the waterside thickets. This gene pool constitutes the most important source for resistant varieties to be developed against the climate change we currently face (Ozpinar et al., 2017). Decrease or aridification of pastures for different reasons is an important problem for our livestock farming. Besides, according to the data of the Turkish Statistical Institution; the cultivation area of high-quality roughage plants (alfalfa, sainfoin, vetch, silage corn, animal beet, fodder turnip, wheat, barley, rye, forage pea, vetch, clover, oat, sorghum, triticale, grass pea, Italian grass) in our country accounts for 13.5% of the total cultivated area, so it covers a small part of the planted areas (TUIK, 2020). Furthermore, the pattern of cultivated forage plants seems to consist of usual products. However, some plants found in nature and used for different purposes, especially for human nutrition, are also used by the public to feed animals. When the species with economic value are examined in the flora inventory studies conducted in our country, it is seen that medicinal and aromatic plants (MAP) are in the first place with 2.852 taxa, followed by forage plants with 1.797 species (UBENIS, 2019). Different uses of MAPs are recorded by a lot of ethnobotanical studies conducted in Turkey. Pass zones are very important in terms of biodiversity, genetic richness and endemic plants, so they should be protected. Wild forms of cultivated plants are extremely valuable to plant breeders. In plant breeding, it is very important to protect the plant genetic resources that constitute the main material and evaluate them in breeding studies (Tan, 2010). Kop Mountain Pass, where the study was conducted, is a transition zone that has vegetation specific to its ecology and has a significant potential in terms of plant gene resources. This region is already home to a rich plant diversity due to its phytogeographical features (Erdem Guzel et al. 2019). Local community intensively uses natural plants for food, medicinal and aromatic purposes in addition to animal feeding. In this study, which was carried out with the aim of evaluating the plants in the region as genetic resources and detecting the species with high availability as forage, the species currently used by the public in the Kop Mountain Pass were identified and their usage patterns and possible usability as alternative forage crops were investigated.

2. MATERIAL AND METHODS

The study was conducted in totally 14 villages, namely Taşağıl, Musadanışman, Kapıkale, Bozburun, Saptıran, Sale, Dumanköy villages of Aşkale district of Erzurum province, and Akduran, Başçımagil, Demirkaş, Sığırcı, Örence, A.Y. Kopköy, Çalıderehanları villages of the central district of Bayburt province. The villages were visited according to the schedule between March and November every year during the study (2012-2015). Interviews were made with the knowledgeable people in each settlement to record information on the plants used. Plants and information were compiled and the scientific classification of plants was made using Turkey Vascular Plants List and Turkish Plant Data Services (TUBIVES, 2020) records, especially the Flora of Turkey and the East Aegean Island (Davis, 1965-85). The identifications made were compared with the herbariums of Ataturk University Faculty of Agriculture, Departments of Field Crops and Plant Protection, and technical support was received. Traditional information was recorded by asking questions to the interviewees. In the interview form; there are questions about the user, the plant and the use of the plant. The data set was created by scoring 39 species found to be usable as forage crops among the plants, which are used for different purposes, according to the observations and literature, from 1 to 5 according to their feed value, flowering date, lifetime, height, flatness and leafiness. The data were subjected to hierarchical and non-hierarchical cluster analysis depending on the similarity or distance measures. Cluster analysis, which is a multivariate statistical method, is a technique that helps divide the set of observations into a limited number of unknown groups or clusters. Thus all observations within the group are similar, while observations in different groups will be different from each other (Ingram and Margetis, 2010). Cluster analysis is based on similarities or differences between variables. In the analysis, the similarities of the units are calculated by using the distance or similarity matrix. To calculate distance or similarity, Ward's Method and Euclidean Distance, which is a measure that indicates the distance between variables without being affected by measurement units, was used (Cakmak et al., 2005). In the process of data clustering, it is up to the analyser to determine the meanings of the clusters formed according to the similarities of the data to each other (Vatansever, 2008).

3. RESULTS AND DISCUSSION

According to the results of the research, 61% of the people who use the plants for different purposes are women. Traditional information was taken from women and men, who are 55 years of age or older, and field studies were typically conducted with male participants. Although the plants that continue to be used are generally consumed for nutritional purposes, it was noted that they are also being used for medicinal and other purposes. Considering the local names of the plants in the region, it is seen that most of the plants are used as food, shelter, medicine, paint, ornament, cosmetics, fuel, goods and forage (Tuzlaci, 2012; Ertug, 2014).

Cultivated crops for food production in the research area are *Triticum aestivum, Solanum tuberosum, Brassica oleraceae, Phaseolus vulgaris, Pisum sativum, Lens esculanta, Beta vulgaris, Helianthus annuus,* and *Helianthus tuberosum*. Besides, it was noted that there is a small amount of vegetable and fruit production the above-ground parts or roots of many natural plants are used as vegetable. They are eaten raw or cooked as well as dried, salted or pickled. 28 taxa are used for food purposes, 31 taxa for medical purposes and 26 taxa for food and medical purposes. Plants used for both food and medicinal purposes: *Atriplex nitens, Eremurus spectabilis, Beta corolliflora, Caltha polypetala, Cerinthe minor, Eryngium billardieri, Ferula orientalis/Prangos ferulacea, Gundelia tournefortii, Nepeta racemosa/N.betonicifolia, Malva sylvestris, Plantago major, Pimpinella nudicaulis, Rheum ribes, Linum nevrusum, Rumex patientia /R. crispus / R.scutatis/ R.acetosella, Thymus fallax, Tragopogon aureus/ T. buphthalmoides, Tussilago farfara, Urtica diocia/U. urens*. Plants, which were also used intensely in studies conducted in the 90's and 2000's include *Eremurus spectabilis* M. Bieb., *Ferula rigidula* Fisch. Ex DC., *Rheum ribes* L., *Rumex crispus* L., *Falcaria vulgaris* Bernh., *Lathyrus tuberosus* L., *Plantago major* L., *Urtica dioica* L., and *Sinapis arvensis* L. (1996; Baytop 1999, Aksakal and Kaya, 2008). Ethnobotanical studies conducted in Eastern Anatolian provinces shows that the same plants are commonly used as food (Polat et al., 2012).

The fact that most of the natural plants consumed consisted of edible plants shows the natural flora has not yet been abandoned for nutritional and health purposes. While these plants are still picked from nature and consumed, plants such as *Rumex* sp., *Ferula* sp., *Rheum ribes, Eremurus spectabilis* are also sold in local markets (Bulut, 2005; Kadioglu et al. 2021). The family with the most species in the study is the Asteraceae family. Many studies state that this family is represented by a large number of species in the flora of our country (Aksakal and Kaya, 2008; Doğan et al. 2014; Han and Bulut, 2015). Asteraceae family takes the first place since it is richest family in the world and in Turkey in terms of number of species and their species' easy spreading feature.

In the study, it was determined that plants picked from nature are used mostly for intestinal disorders, hemorrhoids, diabetes, skin, rheumatism, and joint pains (Table 1). Many studies report same disorders in general (Baytop, 1999; Polat et al. 2012; Tuzlaci, 2012). Plants are the leading natural resources used to treat diseases. The variety of traditionally used household remedies is quite high even today. In this context, the richness of the flora is a very significant factor. For centuries, plants have been used for medicinal purposes in treatment of various diseases and enteritis (Essawi and Srour, 2000; Ozer et al. 2001). Three plants from the Fabaceae family, namely *Vicia canescens, Trifolium repens,* and *Lathyrus tuberosus* are used for nutritional purposes. The area is rich in flora including different forage crops (Table 2).

Cultivated plants used as forage include *Medicago sativa, Onobrychis sativa, Vicia sativa, Hordeum vulgare, Tritico secale, Avena sativa, Secale cereale,* and *Vicia ervilia*. Forage crops that have cultivated species but are found naturally (wild plants) in the area and used as food for human nutrition are *Trifolium repens* (tut), *Lathyrus tuberosus* (goçkoz), *Vicia canescens* (külür). Flower-heads of *Trifolium*, tubers of *Lathrus*, and grains of *Vicia* are eaten. During the field studies, legume and grass forage crops, which called kulus/hulus by people, are recorded as *Astragalus microcephalus, A. longifolius, A. declinatus, Bromus tectorum, Coronilla orientalis, C. varia, Dactylis glomerata, Hedysarum syriacum, H. nitidum, Lathyrus tuberosus, Lotus corniculatus, Medicago minima, Onobrychis armena, Poa bulbosa, Trifolium pratense, T. repens, Vicia canescens, V. dadianorum,* and *V. villosa*. The plants used by the people for different purposes in the study are wild plants in terms of character. These plants, many of which are found by the side of roads and fields, in ruins, meadows and pastures, are natural plants of the local ecology. They have the superior characteristics required to be cultivated or evaluated as genetic material. Especially, they are more resistant to extreme conditions such as drought, cold and salinity. Therefore, our study determined that there are many species belonging to other families than Poaceae and legume families. Some of these plants, which are rich in vitamins and minerals and also used in human nutrition and treatment, are included in the species of *Amaranthus, Atriplex, Beta, Chenopodium, Polygonum, Cephalaria, Fumaria, Malva, Plantago, Rumex, Sinapis, Sonchus*. Animals fed on these plants will be healthier and produce better quality products, because these plants are high in nutrients, and many of them also have antioxidant, antifungal, anti-inflammatory and antimicrobial elements. Most of the studies state that the Poaceae plants in the natural flora are rich in carbohydrate, the legume plants are rich in protein, and the plants belonging to other families are rich in mineral substances (Gur et al., 2017). However, they should also be tasty and preferred by animals, and they should not be toxic or harmful. Since the plants with different uses, such as *Anchusa* sp. *Caltha* sp. *Tussilago* sp. *Echium* sp. *Teucrium chamaedrys* pirolizidin or *Rumex* accumulate oxalate in their structure, poisoning may occur when overfed (Balabanli et al. 2006; Gokkus et al. 1995).

These species, belonging to other families, which are richer in many nutrients and can grow easily in unfavourable soil conditions, can be improved in breeding studies by the elimination of negative characteristics and as a result, many alternative forage crops can be developed.

Table 1. Plants with ethnomedicinal use in Kop Pass

Scientific name	Local name	Plant parts	Diseases
Alkanna orientalis/Onosma bornmuelleri	Havaciva, emzik	Root, seed, flower	Burn, wound
Alchemilla pseudocartalinica	Aslanpençesi	Leaf	Menstrual cramps, wound
Alchillae biebersteini/A. millefolium	Kılıçotu, çiçek, civanperçemi	Flower	Bleeding, diets, hemorrhoids
Althaea cannabia/Alcea calvertii	Mukim gül, hasgül	Flower	Throat ache
Anthemis cretica	Papatya	Flower	The common cold, sedative
Arctium minus	Kalagan	Leaf	Rheomatic pains
Artemisia absinthium	Yavşan	Plant	Toothache
Atriplex nitens	Kızılca, eşgi, eşki	Leaf	Diabetes
Beta corolliflora	Evelik, yabani pazı	Leaf, seed	Thyroid disease, shortness of breath
Caltha polypetala	At ayağı, lulipar	Leaf	Rheomatic pains
Centaurea depressa	Mavi çiçek, mavuş	Flower, leaf	Eye and skin diseases
Cephalaria transylvanica	Gevrek/düllük	Stem, latex	Wounds and cuts
Cerinthe minor	Hışhış	Leaf, stem	Gum and palate ailments
Ecballium elaterium	Eşşekhıyarı, acıkelek	Fruit	Sinusitis
Echium italicum	Engere otu/pişikguyruği	Leaf	Diuretic
Equisetum romosissimum	Atkuyruğu, kırk kilitotu	Leaf	İnfertility, asthma, bronchitis
Eremurus spectabilis	Çiriş	Plant	All kinds disease
Eryngium billardieri	Boğa dikeni	Stem, root	Diuretic, urinary tract, inflammation
Euphorbia virgata	Sütlegen	Stem, latex	Bleeding
Ferula orientalis/Prangos ferulacea	Çaşır, çaşur	Stem	Diabetes
Fumaria officinalis	Şahtere	Seed	İnfertility
Galium verum	Madavur otu	Herb	Wounds
Gundelia tournefortii	Kenger, kengel	Root, stem, latex	Stomache ache, indigestion
Helichrysum arenarium/ H. plicatum	Sarıçiçek, ölmez çiçek	Flower	Kidney, stomache ailments
Hyoscyamus niger	Delibatbat	Seed	Toothache
Hypericum perforatum/ H. scabrum	Kantaron	Leaf, Flower	Hemorrhoids
Linum nevrusum	Navruz	Flower/ root	Hemorrhoids
Malva sylvestris	Ebemkömeği, gagalaekmek	Plant	Abdominal bloating, throat ache and gynecological diseases
Muscari armeniacum	Kurtsoğanı	Leaf	Wound, wart treatment
Nepeta racemosa/N. betonicifolia	Pisik nenesi	Leaf	Shortness of breath
Pimpinella nudicaulis	Ezerte	Seed	Abdominal pain, abdominal gas reliever
Plantago major/ P. lanceolata	Bağa yarpağı, Boğaotu	Leaf, seed	Wounds, hemorrhoids
Potentilla argentae	Beşbarmak otu	Root	Diarrhea
R. scutatis, R.acetosella	Kızılca eşgi, kuzukulağı	Leaf	Diabetes
Ranunculus repens	Mayıs çiçeği	Flower	Rheumatism
Rheum ribes	Işgın, eşğın	Root	Diabetes and hemorrhoids
Rumex patientia/R. crispus	Evelik	Leaf, seed	Kidney stones, bronchitis, hemorrhoids
Teucrium orientale	Basur otu	Leaf	Hemorrhoids
Thymus fallax	Anık	Leaf, flower	Asthma
Tragopogon aureus/ T. buphthalmoides	Yemlik, yelmik	Leaf	Stomache ache
Tussilago farfara	Yaryaprağı, katırtırnağı	Leaf, flower	The common cold
Urtica diocia/U. urens	Isırgan	Leaf, seed	Rheumatism,cancer,inflammation, stomache ache
Verbascum macrocarpum	Sığır guyruği	Flower	Hemorrhoids
Lamium orientale	Patpat	Flower	Diarrhea
Xeranthemum annuum	Hanım süpürgesi	Flower	Wound

Table 2. Variance analysis results in non-hierarchical cluster analysis

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Feed value	24.678	3	.444	35	55.526	.000
Flowering date	17.096	3	.356	35	48.040	.000
Leafiness	4.323	3	.742	35	5.829	.002
Longevity	4.206	3	.696	35	6.045	.002
Plant height	4.384	3	.623	35	7.031	.001

The taxa included in the results of the study were transformed into data that would reveal their usage as forage plant genetic resources and clustered according to their similarities by means of hierarchical and non-hierarchical cluster analysis. During the hierarchical cluster analysis, the clusters were examined according to the number of observations, and since the observations tend to be clustered within, the ideal number of clusters was required to be four and non-hierarchical cluster analysis was performed. Four clusters were determined according to the values of qcl-1 (in which cluster each observation is in) and qcl-2 (distance from the center of each observation) located next to the plant column in the data set. According to the cluster analysis results, it was seen that the variables are different from cluster to cluster ($p \leq 0.01$). It is natural that the difference between clusters is different at 1% significance level, because cluster analysis made the differences among clusters maximum (Table 2).

Table 3. Plant taxa forming the four clusters and their proximity distances according to the cluster analysis

Cluster	Plant	Distance	Cluster	Plant	Distance
1	*Sonchus asper* L. Hill.	2.43	2	*Tragopogon aureus* Boiss.	2.15
	Malva sylvestris L.	2.40		*Silene vulgaris* (Moench) Garcke	1.85
	Geranium tuberosum L.	2.18		*Pimpimpinella nudicaulis* Trautv.	1.79
	Tragopogon buphthalmoides (DC.) Boiss.	1.91		*Muscari armeniacum* Leichtlin ex Baker	1.55
	Fumaria officinalis L.	1.78		*Achillea arabica* Kotschy	1.49
	Falcaria vulgaris Bernh.	1.76		*Alchemilla pseucartalinica* Juz.	1.49
	Prangos ferulacea L. Lindl.	1.68		*Eyngium billardieri* Delar.	1.49
	Teucrium orientale L.	1.62		*Alchillea millefolium* L.	1.10
	Potentilla argantea L.	1.56		*Rumex patientia* L.	1.10
	Centaurea depressa Bieb.	1.45		*Artemisia absinthium* L.	0.46
	Centaurea iberica Trev. ex Spreng.	1.45			
	Zosima absinthifolia (Vent.) Link	1.33			
	Amaranthus retroflexus L.	1.23			
	Cerinthe minör L. subsp. *auriculata* (Ten.) Domac.	1.05			
	Thymus fallax Fısch & Mey.	0.80			
3	*Sinapis arvensis* L.	2.09	4	*Polygonum aviculare* L.	1.95
	Rapistrum rugosum L. All.	1.89		*Beta corolliflora* Zosimovic ex Buttler	1.68
	Plantago lanceolata L.	1.84		*Beta lomatogona* Fisch. &C.A.Mey.	1.68
	Cephalaria transylvanica L.	1.66		*Polygonum cognatum* Meissn.	1.35
	Cephalaria syriaca (L.) Schrad.	1.60		*Plantago major* L.	1.15
	Chenopodium album L.	1.33			
	Capsella bursa pastoris L. Medik.	1.25			
	Asparagus persicus Baker.	1.08			
	Atriplex nitens Schkuhr	0.98			

The plants that can be used as alternative forage crops according to the clustering are given in the Table 4 on the basis of clusters. The clusters with the highest average in terms of feed value and flowering date were determined as 3rd and 4th clusters. The clusters with highest average in terms of plant height were determined as the 3rd cluster. And the clusters with appropriate plant species in terms of leafiness and longevity were determined as the 2nd and 4th clusters. The plants in the first cluster were found to be the clusters that form alternative forage crops by plant height, leafiness and flowering date (Table 3).

Table 4. Taxons of Kop Mountain Pass natural plants that can be used as alternative forage crops

***Amaranthaceae family: Amaranthus retroflexus* L. :** In *Amaranthus*, where more than 2 tons of roughage can be obtained in different species and varieties, because of its very good regrowth feature, it can be obtained twice a year. Organic material production per unit area is quite high. A significant portion of the herb (34-47%) consists of leaves and its nutritional value is also high. The crude protein content was found to be 14.75% (Tan and Yolcu, 2001). 80% of it can be consumed by sheep in the early stages (Marten and Anderson, 1975). ***Atriplex nitens* Schkuhr :** *A. nitens*, which can be used as roughage, has a high adaptability and has no soil selectivity. It is resistant to heat, cold and drought Christman, 2003). It is located in natural areas of Central and Eastern Anatolia. It is stated that salty areas can also be used (Acar and Güncan, 2002), it can be used as human feed in early stages and animal feed in late stages (Acar et al., 2017). ***Beta corolliflora* Zosimavic ex Buttler/ *Beta lomatogona* Fisch. Et. Mey.:** Fodder beet is a fodder plant preferred by delicious animals due to its high sugar ratio. It increases the quality of milk by increasing the fat and protein, and at the same time strengthens digestion and saves concentrated feed (Acar and Mulayim, 2001). ***Chenopodium album* L.:** It is an annual herbaceous plant that is frequently seen in barren areas, brooks and fields. Although its potential to be used as roughage is low, it is stated that it is a plant with high plant weight, abundant leaves and crude protein content among annual foreign plants (Acar and Guncan, 2002).
Asparagaceae Family : ***Asparagus persicus* Baker.** Shrub is a herbaceous perennial plant found in moist grasslands. Fresh shoots are very tasty.
Asteraceae Family: ***Sonchus asper* (L.) Hill.:** Its single or two-year-old, 30-100 cm tall, erect stem and branched leaves are light blue-green. Despite its low feed value, it is eaten and loved especially by camels. ***Tragopogon aureus* Boiss./*Tragopogon bupholmoides* (DC.) Boiss.:** It is especially seen in meadow and field areas. It is eaten with love while it is fresh and green (Gokkus et al., 1995).
Brassicaceae *Family: Sinapis arvensis* L.: It is a weed that is consumed by humans and animals extensively. It is a good feed for cattle until the beginning of flowering in the early stages. It should be used with caution due to the sinigrin glycoside it contains ((Bhargava et al., 2003). ***Rapistrum rugosum* (L.) All.:** It is an annual herbaceous weed that is usually cultivated in cultivated areas. Since it has plenty of leaves, is spreading and rich in minerals, its possibility of roughage is high. ***Capsella bursa pastoris* (L.) Med.:** It is a small, herbaceous, upright, one-year, cosmopolitan species. This plant, which can be used as a source of ascorbic acid when eaten fresh, can easily grow almost anywhere. It is resistant to drought and cold.
Caryophyllaceae Family: *Silene vulgaris* (Moench) Garcke.: Young shoots and leaves of the plant are popularly consumed and have many branches and grow up to 80 cm. Its elongation is steep and hairless. It is a herbaceous perennial plant found in shrubs, slopes and open spaces. The Eastern Black Sea and Eastern Anatolia Region is rich in the distribution of the Silene species (Akgoz, 2013).
Caprifoliaceae Family: *Cephalaria syriaca* (L.) Schrader./*Cephalaria transsylvanica* (L.) Roem. &Schult.: This type of annual, which can rise up to one meter, is a hairy stem and flowers are magenta blue. Its seeds contain 14-20% protein, 21-26% fixed oil. Its body is used as animal feed (Yapıcı et al., 2009).
Geraniaceae Family: *Geranium tuberosum* L.: Perennial, tuberous herbaceous structure. It has a height close to the ground, reaching a maximum of 40 cm.
Malvaceae *Family: Malva sylvestris* L.: It is an annual plant whose body grows upright or flat. Those that grow upright can grow up to 1 m. It contains 17% crude protein. Medium feed value *M. sylvestris* used in sheep or poultry pastures (Tan and Yolcu, 2001).
Plantaginaceae Family: *Plantago major* L. subsp. intermedia (Gılıb.) Lange/*Plantago lanceolata* L.: *P. major* can be found almost everywhere in the world in watery places even up to 2500 m altitude in grasslands. The feed value is medium. It is resistant to pressure. *P. lanceolata* is a perennial plant that contains 23% protein and can endure drought with lots of leaves. It can yield 6 tons of green grass per decare. *Plantago lanceolata* has varieties developed in New Zealand, with high seedling power, resistant to diseases and pests and suitable for sheep pastures (Stewart, 1996).
Polygonaceae Family: *Polygonum cognatum* Meissn./*Polygonum aviculare* L.: *Polygonum cognatum* is pressure resistant, its stems are completely inclined and have wide dark green leaves. *P. aviculare* is a flat creeper. It is found on roadsides that are too chewed in empty lands. Sheep and cattle are fond of grazing. They are important in terms of covering the soil surface. Stubble are the species that animals graze fondly. This plant, which has delicious, soft and nutrient-rich leaves, has been accepted as a feed in the *Amaranthus* setting (Acar and Guncan, 2002; Polygonum, 2021).
Rosaceae Family: *Potentilla argentea* L.: It has a perennial herbaceous structure with yellow flowers and can grow up to 50 cm in length. It grows on rocky slopes and grasslands. This genus, which has approximately 325 species in the world, has 60 species in our country (TUBIVES, 2020).

The Table 4 shows the 21 taxa included in the clusters preferred in terms of feed value, which can be used alternative forage crops, from 39 plant species belonging to 15 families (Amaranthaceae, Apiaceae, Asparagaceae, Asteraceae, Boraginaceae, Brassicaceae, Caryophyllaceae, Caprifoliaceae, Geraniaceae, Lamiaceae, Malvaceae, Papaveraceae, Plantaginaceae, Polygonaceae, Rosaceae) especially used for nutritional and medicinal purposes.

4. SONUÇ

The possibility of the plants determined to be used for medicinal and food purposes in the study area as alternative forage plants was investigated. In the study, 39 species that

could be an alternative forage plant genetic source were identified. According to the cluster analysis, among these plants gathered under four clusters, "*Beta corolliflora, Beta lomatogona, Polygonum cognatum, Polygonum aviculare, Plantago major*" are pasture-type forage crops suitable for grazing. These plants formed the first cluster with their large, green and very leafness. Due to their size and large growth, the plants "*Plantago lanceolata, Cephalaria transsylvanica, Cephalaria syriaca, Chenopodium album, Capsella bursa-pastoris, Asparagus persicus, Atriplex nitens*" formed the second suitable cluster. In the other two clusters, "*Amaranthus retroflexus, Silene vulgaris, Malva sylvestris, Potentilla argentea*" plants in terms of leafiness and flowering (late flowering). It has been determined that the clustered plants with their characteristics can be grown as an alternative forage crop. It is predicted that these plants can be used as a gene source in breeding studies. As a result, it is recommended that some of these species which are used as food and medicinal plants should be cultivated, and used in forage crop breeding. Taking these plants into culture and in breeding activities are important in terms of adding new plants to the forage crop profile.

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Compliance with Ethical Standards

Author Contributions

SK: Project management, Data collection, Analysis, Writing; MT: Data evaluation, Writing; BK: Data collection and evaluation; KKS: Data collection

Conflict of Interest

The authors do not have any conflicts of interest to declare.

Ethical Approval

For this type of study, formal consent is not required.

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