academicJournals

Vol. 8(2), pp. 92-102, February 2014
DOI: 10.5897/AJPS12.169
ISSN 1996-0824 ©2014 Academic Journals
http://www.academicjournals.org/AJPS

African Journal of Plant Science

*Full Length Research Paper*

# Seasonal availability and palatability of native flora of Santh Saroola Kotli Sattian, Rawalpindi, Pakistan

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Accepted 5 February, 2014

**The purpose of this study was to document the palatable indigenous flora of Santh Saroola Kotli Sattian, Rawalpindi. A total of 169 plant species belonging to 126 genera and 56 families have been identified during 2009-2010. Of them, 106 species are noted as highly palatable with the percentage of 62.72%, followed by moderately palatable plants (37 species; 21.89%), whereas, only small proportion was found as are less palatable species (26 species; 15.3%). Poaceae family contributed good forage grasses (21 species, 12.42%), followed by Asteraceae (19 species; 11.24%), Fabaceae (15 species; 8.87%), Euphorbiaceae, Lamiaceae (7 species; 4.14% each). With reference to plant parts, leaves were fairly used as fodder/forage purpose (68 species; 41.97%), followed by whole plants (61 species; 37.65%) and aerial parts (33 species; 20.37%). During the month of April, most of the forage was available (110 species; 65.09%), followed by May and March (99 and 96 species, respectively). Maximum species (103 species, 44.98%) were found palatable to all domesticated animals such as goat, sheep, cows and donkey. Goat was found best suited to the climatic conditions which preferred 64 species (60.95%). Sheep was found attached with 34 species (37.87%), whereas, cows alone utilized 24 species (20.12%).**

**Key words:** Kotli Sattian, **Santh Saroola**, palatable, Rawalpindi, animal preference, palatable.

## INTRODUCTION

The total land area of Pakistan is 88 million hectare (ha) and about 65% of the area is marked as rangelands. The country is divided into five different ecological zones (Khan and Mohammad, 1987). These rangelands are providing major feed source to the domesticated animals as well as wildlife. Pakistan being an agricultural country has 154.7 million heads of livestock that contribute about 11.3% GDP (Anonymous, 2008a).

Different zones are endowed with peculiar vegetation and unique floral diversity for feeding livestock of the area in question. Therefore, there is need to identify and document this natural plant wealth which serve the livestock of local communities. Previously, few studies were carried out in Pakistan to report native fodder/forage species and their palatability. Wahid (1990) carried a survey and reported that sheep and goats diet comprised 53 to 81% shrubs from different rangelands of Balochistan. Hussain and Mustafa (1995) recorded 131 species of 42 families in pastures of Nasirabad Valley, Hunza, Pakistan during summer season. They reported that 27 species were found to be highly palatable, 68 species moderately palatable, 20 less palatable and 4 species rarely palatable. Seasonal pattern of forage production was evaluated by Omer et al. (2006) who

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reported that forage species was high during spring in dry temperate rangeland in Northern areas of Pakistan. Likewise, Hussain and Durrani (2009) studied the seasonal availability, palatability and animal preferences of forage plants from Harboi arid rangeland, Kalat, Pakistan. They documented 129 palatable species including 50.4% (65 species) highly palatable, 41.1% (53 species) mostly palatable, 4.65% (6 species) less palatable and 3.87% (5 species) rarely palatable species in the area. Few other studies include that of Hussain and Chughtai (1984), Khan (1996), Hussain and Durrani (2007, 2008).

The study area is recently included in the National Park (Murree-Kotli Sattian-Kahuta National Park) and no study is previously reported in documenting palatable plant species, therefore it was worthwhile to carry out such type of study that can be used in management and planning for fodder species. The purpose of this study was to document the palatable indigenous flora of Santh Saroola Kotli Sattian, Rawalpindi.

## MATERIALS AND METHODS

### Study area

Santh Saroolais located between 33°-04° and 34°- 01°north latitude and 72°-38° and 73°-37° east longitude. This is a hilly area and transitional zone in between subtropical to temperate resulting in unique floral biodiversity. The environment of the area is severe in winter and mild in summer. The area receives 990 mm annual rainfall. The temperature ranges were 117-25°F (Anonymous, 2008b). The livelihood of local community is dependent on livestock rearing; therefore there is a trend to increase livestock population. This rangeland is full of nutritious and palatable species of grasses, herbs, shrubs and trees. Keeping in view, it was felt worthwhile to document inventory of palatable species, their seasonal availability and animal preference from the study area.

### Seasonal availability of forage species

The whole study area was surveyed from October, 2009 to May, 2010 to document data of forage species. During the period, plant growth of species such as grasses, herbs, shrubs and trees were identified. The biennial and perennial species and their seasonal availability were also noted.

### Differential palatability of plant parts and animal preference

The degree of palatability for each plant species was noted in the field and the local people and shepherd involved in livestock keeping were asked. The palatable species were further categorized by animal preference (goats, sheep, cow and camel) and parts grazed (whole plant, leaves, aerial parts, etc.). Based on frequency use, the documented plants were grouped as: 1). Highly palatable (HP), species highly preferred by the most grazing animals; 2) moderately palatable (MP), species with an average likeness by the livestock; 3) Less palatable (LP), species with less preference. Likewise, plants were classified by animal preferences, parts used and seasonal availability.

### Specimen collection and identification

Plant specimens were collected, pressed, dried and identified with the help of various floras (Nasir and Ali, 1970-1989; Ali and Nasir 1990-1991; Ali and Qaiser, 1993-2009).

## RESULTS AND DISCUSSION

During the survey, a total of 169 plant species belonging to 126 genera and 56 families were identified as forage source in the study area (Table 1). The palatability of all species is summarized in Figure 1 which reveals that highest number of species were found highly palatable (106 species; 62.72%), followed by moderately palatable plants (37 species; 21.89%), whereas, only small proportion was found as less palatable species (26 species; 15.3%).

The least palatable species include *Ajuga bracteosa, Adaintum capillus-veneris, Berberis lyceum, Calotropis procera*, *Carissa opaca, Coniogramme rosthornii, Rubus fruticosus, Tagetes minuta* and *Verbascum thapsus*. These species have less palatability and mostly avoided by the livestock, resultantly dominating large area. Overgrazing has reduced the populations of palatable and desired species, ultimately resulting in the replacement with non-preferred species. Many studies concluded that over grazing reduces pala-table cover and species diversity (Khan, 1996; Liu et al., 1996; Hickman et al., 1996; Makulbekova, 1996; Hussain and Chughtai, 1984; Hussain and Durrani, 2007, 2008).

Poaceae family (Table 2) contributed good forage grasses (21 species; 12.42%), followed by Asteraceae (19 species; 11.24%), Fabaceae (15 species; 8.87%), Euphorbiaceae, Lamiaceae (7 species; 4.14% each). Three plant parts such as whole plant, aerial parts and leaves were selected by the individual animals for grazing/browsing. Different plant parts were preferred by individual animals and shown in Figure 2. Out of these, leaves were fairly used as fodder/forage purpose (68 species; 41.97%), followed by whole plants (61 species; 37.65%) and aerial parts (33 species; 20.37%).

The study area is located in humid climate and forage species were found available in different months. Month-wise data of forage species is provided in Figure 3. Maximum species were available during the month of April (110 species; 65.09%), followed by May (99 species; 58.58%), June (76 species; 44.97%), August (74 species; 43.79%), September (72 species; 42.60%), whereas, December and January months were noted as drier in terms of providing forage to the cattle. During these months, people utilized stored forage for feeding their livestock. In this season, most of the livestock were forced to graze/browse less palatable as well as dried plants. Our results are in agreement with that of Hussain and Durrani (2009) who reported decreased productivity of rangelands during winter in the Harboi rangeland, Kalat (Pakistan).

**Table 1.** Inventory of native flora along with local names, family, part used, palatability, availability and animal preference.

| Plant species | Local name | Growth form | Family | Parts used | | | Palatability | | | Availability | | | Animal preference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | WP | AP | Lv | LP | MP | HP | C | VC | R | |
| *Abutilon bidentatum* Hochst. ex Rich. | Kanghi Buti | Sh | Malvaceae | X | √ | X | X | √ | X | X | X | √ | Goat |
| *Arabis himalaica* (Edgew.) O.E. Schulz | | H | Brassicaceae | X | √ | X | X | X | √ | X | X | √ | Goat, cow |
| *Acacia modesta* Wall. | Phulai | T | Mimosaceae | X | X | √ | X | X | √ | √ | X | X | Goat, sheep |
| *Achyranthus aspera* L. | Put Kanda/Kanda | Sh | Amaranthaceae | √ | X | X | X | X | √ | X | √ | X | Goat, sheep, cow |
| *Adiantum capillus-veneris* L. | Persiaon shan | H | Adiantaceae | √ | X | X | X | X | √ | X | √ | X | Goat |
| *Ailanthus altissima* (Mill.) Swingle | Durawia | T | Simarubaceae | X | X | X | √ | X | X | √ | X | X | Goat |
| *Ajuga bracteosa* Wall. ex Bth. | Guchi | H | Lamiaceae | √ | X | X | √ | X | X | √ | X | X | Goat, sheep |
| *Ajuga parviflora* Bth. | Kauri Buti | H | Lamiaceae | √ | X | X | √ | X | X | √ | X | X | Goat, sheep |
| *Albizzia lebbeck* (L.) Benth. | Shirin | T | Mimosaceae | X | X | √ | √ | X | X | X | X | √ | All |
| *Alternanthera pungens* Kunth. | Lundri | H | Amaranthaceae | X | X | √ | X | √ | X | X | X | √ | Goat, cow, donkey |
| *Amaranthus hybridus* L. | Choleri | H | Amaranthaceae | √ | X | X | X | X | √ | √ | X | X | Goat, sheep, cow |
| *Amaranthus spinosus* L. | Khardar Cholai | H | Amaranthaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Amaranthus viridis* L. | Cholai | H | Amaranthaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Anagalis arvensis* L. | Billi buti | H | Primulaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Argyrolobium helleborifolium* Sonott. | | H | Fabaceae | √ | X | X | X | X | √ | X | X | √ | All |
| *Argyrolobium roseum* (Camb.) Jaub & Spach | | H | Fabaceae | X | √ | X | X | X | √ | X | X | √ | All |
| *Aristida cyanatha* Nees ex Steud. | | G | Poaceae | X | √ | X | X | √ | X | √ | X | X | All |
| *Arundo donax* L. | Narra, Sukna, Kana | G | Poaceae | X | X | √ | X | √ | X | X | X | √ | Goat, sheep, donkey |
| *Asphodelus tenuifolius* Cavan. | Bhagat/Piazi | H | Liliaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Astragalus squarrosus* Bunge | Kikri | Sh | Fabaceae | X | X | √ | X | √ | X | X | X | √ | Goat, sheep |
| *Avena fatua* L. | Jangli Jai | G | Poaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Barleria acanthoides* Vahl | | H | Acanthaceae | X | √ | X | X | √ | X | X | X | √ | All |
| *Barleria cristata* L. | Bansa Siah | H | Acanthaceae | X | X | √ | X | √ | X | X | X | √ | All |
| *Berberis lyceum* Royle. | Sumbulu | Sh | Berberidaceae | X | X | √ | √ | X | X | X | √ | X | Goat |
| *Boerhavia procumbens* Banks ex Roxb. | Itsit | H | Nyctaginaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Calotropis procera* (Willd.) R. Br. | Aak, Madar | Sh | Asclepiadaceae | X | X | √ | √ | X | X | X | X | √ | Goat |
| *Cannabis sativa* L. | Bhang | H | Cannabinaceae | X | √ | X | √ | X | X | X | √ | X | Goat |
| *Capsella bursa-pastoris* (L.) Medik | Shepherd's Purse | H | Brassicaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Cardiospermum halicacabum* L. | Kan Phuti | C | Sapindaceae | X | √ | X | X | √ | X | X | X | √ | Goat |
| *Carissa opaca* Stapf ex. Haines | Granda | Sh | Apocynaceae | X | X | √ | √ | X | X | √ | X | X | Goat |
| *Carthamus oxycantha* M. Bieb | Pholi | H | Asteraceae | X | √ | X | X | √ | X | X | X | √ | All |
| *Cenchrus ciliaris* L. | Barshok | G | Poaceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Cenchrus pennisetiformis* Hochst. & Steud. | | G | Poaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Cenchrus setigerus* Vahl | | G | Poaceae | X | √ | √ | X | X | √ | √ | X | X | All |
| *Chenopodium album* L | Bathu | H | Chenopodiaceae | X | X | X | X | X | √ | √ | X | X | All |

**Table 1.** Contd.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Chenopodium ambrosioides* L. | Chandan Bathu | H | Chenopodiaceae | X | X | √ | X | X | √ | √ | | | Goat |
| *Chrysopogon aucheri* (Boiss.) Stapf | | G | Poaceae | X | X | √ | √ | X | X | X | X | √ | All |
| *Cirsium arvense* (L.) Scope. | Leh | H | Asteraceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Clematis montana* Buch. | | C | Rananculaceae | X | X | √ | √ | X | X | X | X | √ | Cow, goat, sheep |
| *Clematis napaulensis* Royle | | C | Rananculaceae | X | √ | X | √ | X | X | X | X | √ | Cow, goat, sheep |
| *Colchicum aitchisonii* (Hook. f.) E. Nasir | Suranjan | H | Liliaceae | X | X | √ | X | X | √ | √ | X | X | Goat |
| *Colebrookia oppositifolia* Sm. | Shakar Dana | Sh | Lamiaceae | X | X | √ | √ | X | X | √ | X | X | Goat |
| *Coniogramme rosthornii* Hieron. | Fern | H | Coniogrammaceae | √ | X | X | √ | X | X | √ | X | X | Goat |
| *Convolvulus arvensis* L. | Lehli | C | Convolvulaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Conyza aegyptica* Ait. | Gider buti | H | Asteraceae | X | X | √ | X | √ | X | √ | X | X | Goat, sheep, cow |
| *Conyza bonariensis* L. | Gider buti | H | Asteraceae | X | X | √ | X | √ | X | √ | X | X | Goat, sheep, cow |
| *Conyza canadensis* L. | Gider buti | H | Asteraceae | X | X | √ | X | √ | X | √ | X | X | Goat, sheep, cow |
| *Coronopus didymus* (L.) Sm. | Jangli Haloon | H | Brassicaceae | √ | X | X | X | √ | X | √ | X | X | Goat, sheep, cow |
| *Crotolaria medicagnea* Lam. | | H | Fabaceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Cuscuta reflexa* Roxb. s | Akash Bail/ Baleri | P | Cuscutaceae | √ | X | X | X | X | √ | √ | X | X | Goat, sheep, cow |
| *Cyperus rotundus* L. | Dela | Se | Cyperaceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Dactyloctenium aegyptium* L. | Gandeel | G | Poaceae | X | X | √ | X | X | √ | X | X | √ | All |
| *Debregeasia salicifolia* (D. Don) Rendle | 0 | Sh | Rhamnaceae | X | √ | X | √ | X | X | √ | X | X | Cow, goat |
| *Desmostachya bipinnata* (L.) *S*tapf | Dab Ghaa | G | Poaceae | X | X | √ | X | √ | X | √ | X | X | All |
| *Dicanthium annulatum* (Forssk.) Stapf | Murgha Ghaas | G | Poaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Dicliptera roxburghiana* Nees | Somni | H | Acanthaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Dioscorea deltoides* Wall. ex Kunth | 0 | H | Dioscoreaceae | X | X | √ | X | X | √ | √ | X | X | Goat |
| *Diospyros lotus* L. | Amlok | T | Ebenaceae | X | X | √ | X | X | √ | √ | X | X | Goat |
| *Echinochloa crus-galli (L.) P. Beauv.* | Bara sawank | G | Poaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Echinops echinatus* Roxb. | Kandiara | H | Asteraceae | X | √ | X | X | √ | X | √ | X | X | All |
| *Eclipta prostrate* (L.) L. | Bhangra | H | Asteraceae | X | X | X | X | X | √ | X | X | √ | All |
| *Eragrostis ateroviens* (Desf.) Trin. ex Nees | | G | Poaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Eragrostis minor* Host. | Kusum | G | Poaceae | X | √ | X | X | X | √ | X | √ | X | All |
| *Eruca sativa* L. | Tara Meera | H | Brassicaceae | X | X | √ | X | √ | X | X | X | √ | All |
| *Euphorbia clarkeana* Hkf. | Dudhi | H | Euphorbiaceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Euphorbia granulates* Forssk. | Sheer Bar | H | Euphorbiaceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Euphorbia helioscopia* Mewski. | Chattri dodak | H | Euphorbiaceae | X | X | √ | X | X | √ | X | √ | X | All |
| *Euphorbia hirta* L. | Dudhi | H | Euphorbiaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Euphorbia indica* (Lam.) | Dudhi Kalan | H | Euphorbiaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Euphorbia prostrata (*L.) Ait | Dudhi | H | Euphorbiaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Euphrasia himalayica* Wettst. | | H | Scrophulariaceae | X | √ | X | X | √ | X | X | √ | X | All |
| *Ficus carica* L. | Anjeer/Phuwari/Phagwari | T | Moraceae | X | X | √ | X | √ | X | X | √ | X | Goat |

**Table 1.** Contd.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ficus palmate* Forssk. | Phagwara | T | Moraceae | X | X | √ | X | √ | X | X | X | √ | Goat |
| *Ficus roxburghii* Wall. ex Brand. | Dusi | T | Moraceae | X | X | √ | X | √ | X | X | X | √ | Goat |
| *Flacourtia indica* (Burm. f.) Merrill | Kakoh | T | Flacourtiaceae | X | X | √ | X | X | √ | √ | X | X | Goat |
| *Foeniculum vulgare* Miller | Soonuf | H | Apiaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Fumaria indica* (Hausskn.) H.N. Pugsley | Shahtrah | H | Fumariaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Gallium aparine* L. | | H | Rubiaceae | X | √ | X | X | √ | X | √ | X | X | All |
| *Geranium rotundifolium* L. | | H | Geraniaceae | X | √ | X | X | X | √ | √ | X | X | Cow, Goat, Sheep |
| *Grewia optiva* Drum. ex Burret. | Taman | T | Tiliaceae | X | √ | X | X | X | √ | X | √ | X | All |
| *Heliotropium crispum* Stocks | | H | Boraginaceae | X | X | √ | √ | X | X | X | X | √ | Goat, Sheep |
| *Imperata cylindrical* (L) Raeuschel | Dab Ghaa | G | Poaceae | √ | X | X | X | √ | X | √ | X | X | All |
| *Indigofera himalayensis* Ali | | B | Fabaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Indigofera linifolia* (L. f.) Retz. | Torki | H | Fabaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Indigofera sessiliflora* DC. | | H | Fabaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Ipomoea hederacea* (L.) Jacq. | | C | Convolvulaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Ipomoea nil* (L.) Roth | | C | Convolvulaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Kickxia ramosissima* (Wall.) Janchen | | H | Scrophulariaceae | X | X | √ | X | X | √ | X | X | √ | Goat, Sheep |
| *Lactuca auriculata* (Wall. ex Dc.) | | H | Asteraceae | X | X | X | X | X | √ | √ | X | X | All |
| *Lactuca dissecta* D. Don. | | H | Asteraceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Lactuca serriola* L. | | H | Asteraceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Lathyrus aphaca* L. | Jangali matar | H | Fabaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Launaea procumbens* (Roxb.) Ram. & Rajgo. | Dodak | H | Asteraceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Lepidium sativum* L. | Haleon | H | Brassicaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Lotus corniculatus* (Wald. & Kit. ex Willd.) Briq. & Rech. F. | | H | Fabaceae | X | √ | X | X | X | √ | X | √ | X | All |
| *Mallotus philipensis* (Lam.) Muell. | Kamela | T | Euphorbiaceae | X | X | √ | X | √ | X | X | √ | X | Goat, Sheep, Cow |
| *Malva neglecta* Waller. | Sonchal | H | Malvaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Malvastrum coromendelianum* L. | Yard Sonchal | H | Malvaceae | √ | X | X | X | √ | X | √ | X | X | All |
| *Maytenus royleanus* (Wall. ex Lawson) Cufodontis | Patakhi | Sh | Celastraceae | √ | X | X | X | X | √ | √ | X | X | Goat, Sheep |
| *Medicago denticulate* Willd. | Maina | H | Fabaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Medicago laciniata* (L.) Mill. | Maina | H | Fabaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Medicago polymorpha* L. | Maina | H | Fabaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Melilotus indica* Lour. | | H | Fabaceae | X | X | X | X | X | X | √ | X | X | All |
| *Mentha longifolia* (L.) Huds. | Sufaid Poodina | H | Lamiaceae | X | X | √ | X | X | √ | √ | X | X | Goat |
| *Micromeria biflora* (Ham.) Bth. | | H | Lamiaceae | X | √ | X | X | √ | X | X | X | √ | All |
| *Morus alba* L. | Shehtoot | T | Moraceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Morus nigra* L. | Tut | T | Moraceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Myrsine africana* L. | Khokhal/Khokhan | Sh | Myrsinaceae | √ | X | X | X | X | √ | √ | X | X | Goat |

**Table 1.** Contd.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Olea europaea* L. | Koh | T | Oleaceae | X | X | √ | X | √ | X | √ | X | X | All |
| *Olea ferruginea* Royle | Kahu | T | Oleaceae | X | X | √ | X | √ | X | √ | X | X | All |
| *Origanum vaulgare* L. | | H | Lamiaceae | X | X | √ | √ | X | X | √ | X | X | Goat |
| *Otostegia limbata* (Benth.) Boiss. | Chitti Bui | Sh | Lamiaceae | √ | X | X | X | √ | X | X | X | √ | Goat, Sheep |
| *Oxalis corniculata* L. | Khati Buti | H | Oxalidaceae | X | X | √ | X | X | √ | X | √ | X | Goat, Sheep |
| *Parthenium hytserophorus* L. | | H | Asteraceae | X | X | X | √ | X | X | √ | X | X | Goat, Sheep |
| *Phalaris minor* Retz. | Dumbi sitti | G | Poaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Physalis minima* L. | Wild cherry | H | Solanaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Plantago lanceolata* L. | Ispaghol | H | Plantginaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Plantago major* L. | Ispaghol | H | Plantginaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Plantago ovate* Frossk. | Ispaghol | H | Plantginaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Polygonum barbatum* L. | | H | Polygonaceae | X | √ | X | X | √ | X | X | X | √ | Goat, Sheep, Cow |
| *Polygonum plebejum* R. Br. | | H | Polygonaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Polypogon fugax* Nees ex Steud. | | G | Polygonaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Populus deltoides* Bartram ex Marsh. | Sufaid poplar | T | Salicaceae | X | X | √ | √ | X | √ | √ | X | X | Goat, Sheep, Cow |
| *Pteridium aquilinum* (L.) Kuhn | | H | Pteridaceae | √ | X | X | X | X | √ | X | X | √ | Goat, Sheep, Cow |
| *Punica granatum* L. | Druna/Druni | T | Punicaceae | X | X | √ | X | X | √ | X | √ | X | Goat, Sheep, Cow |
| *Quercus dilatata* Lindl. | Barungi | T | Fagaceae | X | X | √ | √ | X | X | X | X | √ | All |
| *Quercus incana* Roxb. | Rein, Shah0e0baloot | T | Fagaceae | X | X | √ | √ | X | X | X | X | √ | All |
| *Rananculus sceleratus* L. | Jal Dhania | H | Rananculaceae | X | √ | X | √ | X | X | √ | X | X | All |
| *Ranunculus arvensis* L. | | H | Rananculaceae | X | √ | X | √ | X | X | √ | X | X | All |
| *Rhynchosia minima* (L.) DC. | | H | Fabaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Rosa brunonii* Lindll. | Jangli gulab | Sh | Rosaceae | X | √ | X | X | √ | X | X | X | √ | Goat |
| *Rubia cordifolia* L. | Surkh Majeth | C | Rubiaceae | X | √ | X | X | √ | X | X | √ | X | Goat |
| *Rubus ellipticus* Smith | Aakhra | C | Rubiaceae | √ | X | X | X | √ | X | √ | X | X | Goat |
| *Rumex dentatus* L. | Jangli palak | H | Polygonaceae | X | X | √ | X | X | √ | X | √ | X | All |
| *Rumex hastatus* D. Don | Khatimber/Chuki | H | Polygonaceae | X | X | √ | X | X | √ | X | √ | X | Goat |
| *Rumex nepalensis* Spreng | | H | Polygonaceae | X | X | √ | X | √ | X | √ | X | X | Goat |
| *Saccharum bengalense* Retz. | Kana | G | Poaceae | X | X | √ | X | √ | X | X | X | √ | Cow, Donkey |
| *Saccharum spontaneum* L. | Kanna | G | Poaceae | X | X | √ | X | √ | X | √ | X | X | Cow, Donkey |
| *Saussurea albescens* (DC.) Schr. Bip. | | H | Asteraceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Saussurea atkinsonii* (Clarke) | | H | Asteraceae | X | √ | X | X | X | √ | √ | X | X | All |
| *Saussurea heteromalla* DC. | | H | Asteraceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Setaria glauca* (L.) P. Beauv | Ban0Kangni | G | Poaceae | X | X | √ | X | X | √ | X | X | √ | All |
| *Sida cordata (Burm. f.) Borss.0Waalkes* | | H | Poaceae | X | X | √ | X | X | √ | X | X | √ | Goat, Sheep, Cow |
| *Silene conoidae* L. | | H | Malvaceae | X | √ | X | X | X | √ | √ | X | X | All |

**Table 1.** Contd.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Silybum marianum* (L.) Gaertin | Kandiari | H | Caryophyllaceae | X | X | √ | √ | X | X | X | X | √ | Goat, Sheep, Cow |
| *Sisymbrium irio* L. | Khub Kalan | H | Asteraceae | X | X | X | X | X | √ | X | √ | X | All |
| *Solanum nigrum* L. | Peelan/Kach mach | H | Brassicaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Solanum surattense* Burm.f. | Kandiali | H | Solanaceae | √ | X | X | X | X | √ | √ | X | X | Goat, Sheep |
| *Solanum villosum* (L.) Moench | Peelan/Kach mach | H | Solanaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Sonchus asper* (L.) Hill. | Dodak Machal | H | Solanaceae | X | X | X | X | X | √ | √ | X | X | All |
| *Sorghum bicolor* (L.) Moench. | Jawar/Chari | G | Asteraceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Sorghum halepense* (L.) Bern. | Baru | G | Poaceae | X | X | √ | √ | X | X | X | X | √ | Goat |
| *Stellaria media* (L.) Cyr. | Chickweed | H | Caryophyllaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Taraxacum officinale* Weber. | Dodak | H | Asteraceae | X | X | √ | X | X | √ | X | √ | X | All |
| *Taraxcum wallichii* DC. | | H | Asteraceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Themeda anathera* (Nees) Hack | Loonder, Lunji | G | Poaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Trianthema portulacastrum* L. | It Sit | H | Aizoaceae | √ | X | X | X | √ | X | X | X | √ | All |
| *Tribulus terrestris* L. | Bhakhra | H | Zygophyllaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Trichodesma indicum* (L.) R. Br. | Gao Zeban | H | Boraginaceae | X | X | √ | √ | X | X | X | X | √ | Goat, Sheep |
| *Valeriana wallichii* DC. | | H | Valerianaceae | X | √ | X | X | X | √ | X | √ | X | Goat, Sheep, Cow |
| *Verbascum thapsus* L. | Pahari Tambaku | H | Scrophulariaceae | √ | X | X | X | X | √ | √ | X | X | Goat, Sheep, Cow |
| *Verbena officinalis* L. | | H | Verbenaceae | √ | X | X | X | X | √ | X | √ | X | All |
| *Vicia faba* L. | Rewari | H | Fabaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Viola cancescens* Wall. ex Roxb. | Banafsha | H | Violaceae | √ | X | X | X | X | √ | √ | X | X | All |
| *Withania somnifera* (L.) Dunal. | Asghand/Aksan | Sh | Simarubaceae | √ | X | X | X | X | √ | √ | X | X | Goat |
| *Woodfordia fruticosa* (L.) S. Kurz | Tavi | Sh | Vitaceae | X | X | √ | X | X | √ | X | √ | X | All |
| *Zanthoxylum alatum* Roxb | Timbar/Timar | Sh | Rutaceae | X | X | √ | X | √ | X | X | √ | X | Goat, Sheep |
| *Zizyphus mauritiana* Mill. | Beri | T | Rhamnaceae | X | X | √ | X | X | √ | √ | X | X | All |
| *Zizyphus oxyphylla* Edgew. | Ber maloki | Sh | Rhamnaceae | X | X | √ | √ | X | X | X | X | √ | All |
| | | Sh | | 61 | 33 | 68 | 26 | 37 | 106 | 97 | 34 | 38 | |

**Whole plant (WP), area parts (AP), leaves (Lv), highly palatable (HP), moderately palatable (MP), less palatable (LP), common (C), very common; (VC), rare (R), bush (B), climber (C), grass (G), herb (H), paeasite (P), sadge (Se), shruberb (Sh), tree (T). √ (present), X (absent)**.

In the area, four domesticated animals viz., goat, sheep, cows and donkey were recorded and animal preference for fodder species is given in Figure 4. Maximum species (103 species, 44.98%) were found palatable for all the animals. Besides, goat was found suited to the climatic conditions as browser which preferred 64 species (60.95%) as selective ones. Sheep was found attached to 34 species (37.87%), whereas, cows alone utilized 24 species (20.12%).

With reference to growth form of the native flora, 8 life spans are determined (Figure 5). Herbs were dominating in the area and very frequently used as fodder forage (101 species; 59.41%), followed by grasses (22 species; 12.94%), trees (19 species; 11.18%), shrubs (17 species; 10.00%) and climbers (8 species; 4.71%), whereas rest of the forms were found nominal.

## Conclusion

The present work reported seasonal availability of fodder/forage species, differential palatability by

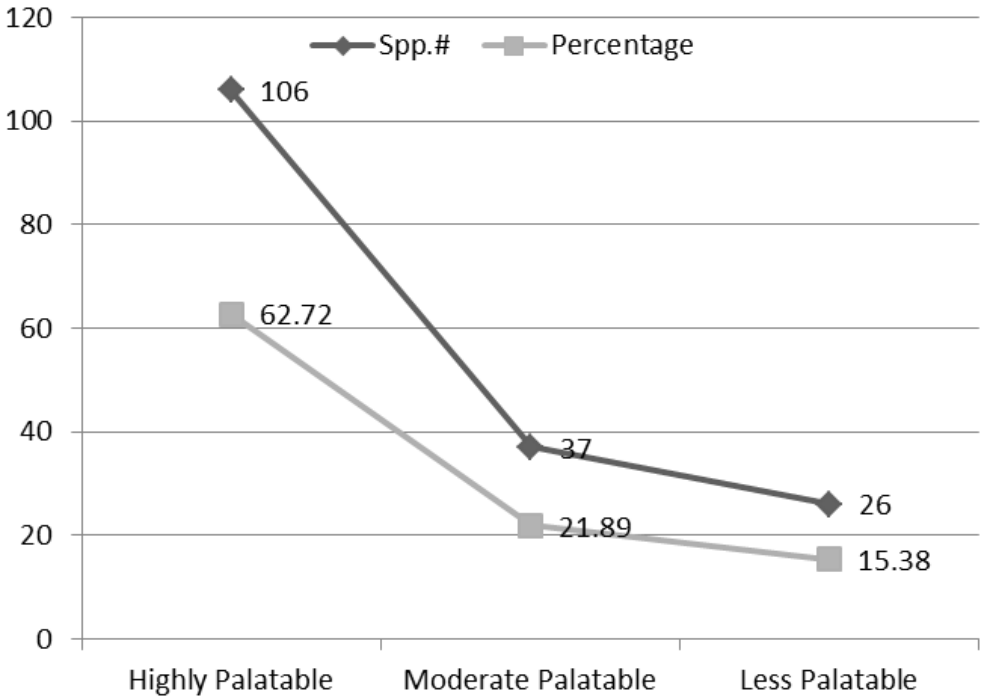


**Figure 1.** Palatability of native plant species.

**Table 2.** Contribution of different families in forage flora of Santh Saroola.

| Family | Species no. | Percentage |
|---|---|---|
| Poaceae | 21 | 12.43 |
| Asteraceae | 19 | 11.24 |
| Fabaceae | 15 | 8.88 |
| Euphorbiaceae | 7 | 4.14 |
| Lamiaceae | 7 | 4.14 |
| Brassicaceae | 6 | 3.55 |
| Polygonaceae | 6 | 3.55 |
| Amaranthaceae | 5 | 2.96 |
| Moraceae | 5 | 2.96 |
| Malvaceae | 4 | 2.37 |
| Rananculaceae | 4 | 2.37 |
| Rutaceae | 4 | 2.37 |
| Solanaceae | 4 | 2.37 |
| Acanthaceae | 3 | 1.78 |
| Convolvulaceae | 3 | 1.78 |
| Plantginaceae | 3 | 1.78 |
| Rhamnaceae | 3 | 1.78 |
| Scrophulariaceae | 3 | 1.78 |
| Boraginaceae | 2 | 1.18 |
| Caryophyllaceae | 2 | 1.18 |
| Chenopodiaceae | 2 | 1.18 |
| Fagaceae | 2 | 1.18 |
| Lamiaceae | 2 | 1.18 |
| Mimosaceae | 2 | 1.18 |

**Table 2.** Contd.

| | | |
|---|---|---|
| Oleaceae | 2 | 1.18 |
| Simarubaceae | 2 | 1.18 |
| Verbenaceae | 2 | 1.18 |
| Adiantaceae | 1 | 0.59 |
| Aizoaceae | 1 | 0.59 |
| Apiaceae | 1 | 0.59 |
| Apocynaceae | 1 | 0.59 |
| Asclepiadaceae | 1 | 0.59 |
| Berberidaceae | 1 | 0.59 |
| Cannabinaceae | 1 | 0.59 |
| Celastraceae | 1 | 0.59 |
| Coniogrammaceae | 1 | 0.59 |
| Cuscutaceae | 1 | 0.59 |
| Cyperaceae | 1 | 0.59 |
| Dioscoreaceae | 1 | 0.59 |
| Ebenaceae | 1 | 0.59 |
| Flacourtiaceae | 1 | 0.59 |
| Fumariaceae | 1 | 0.59 |
| Geraniaceae | 1 | 0.59 |
| Myrsinaceae | 1 | 0.59 |
| Nyctaginaceae | 1 | 0.59 |
| Oxalidaceae | 1 | 0.59 |
| Primulaceae | 1 | 0.59 |
| Pteridaceae | 1 | 0.59 |
| Punicaceae | 1 | 0.59 |
| Rosaceae | 1 | 0.59 |
| Salicaceae | 1 | 0.59 |
| Sapindaceae | 1 | 0.59 |
| Tiliaceae | 1 | 0.59 |
| Violaceae | 1 | 0.59 |
| Vitaceae | 1 | 0.59 |
| Zygophyllaceae | 1 | 0.59 |

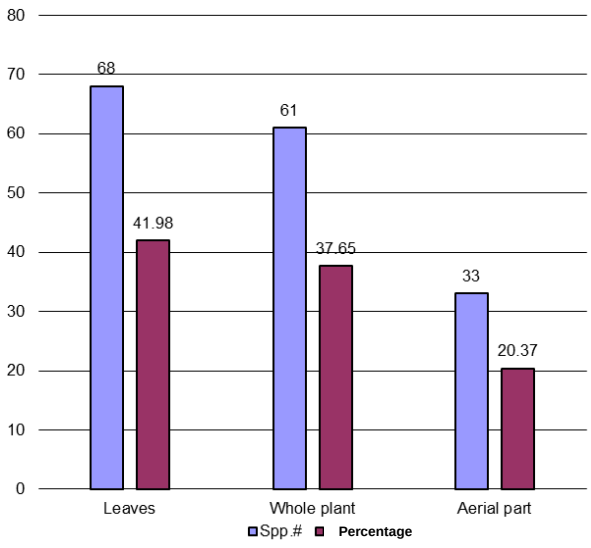


**Figure 2.** Parts used as forage in Santh Saroola Kotli Sattian, Rawalpindi.

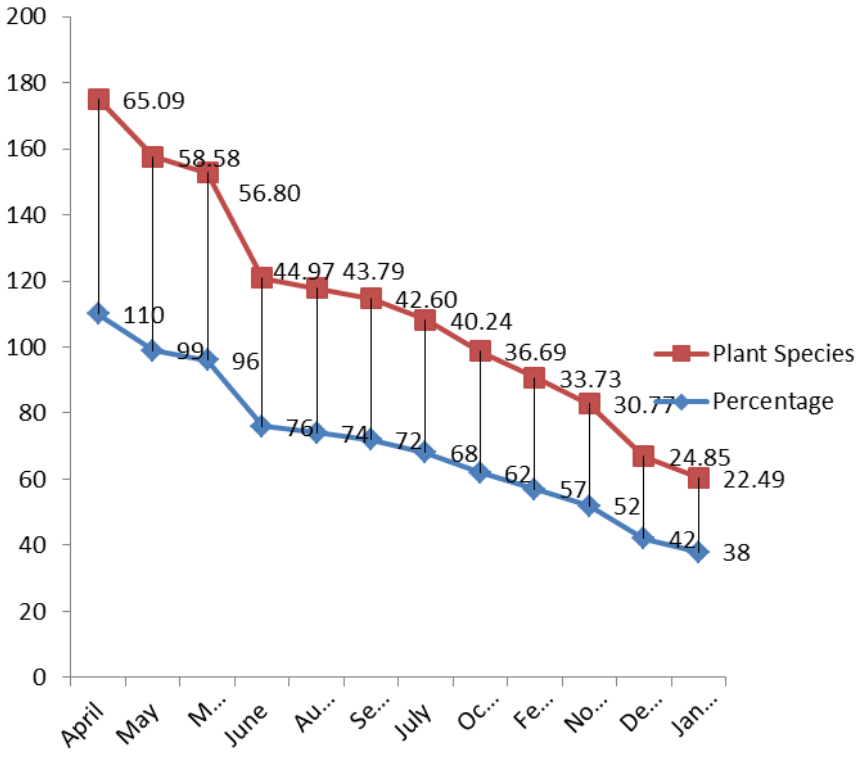


**Figure 3.** Availability of fodder species through out the year.

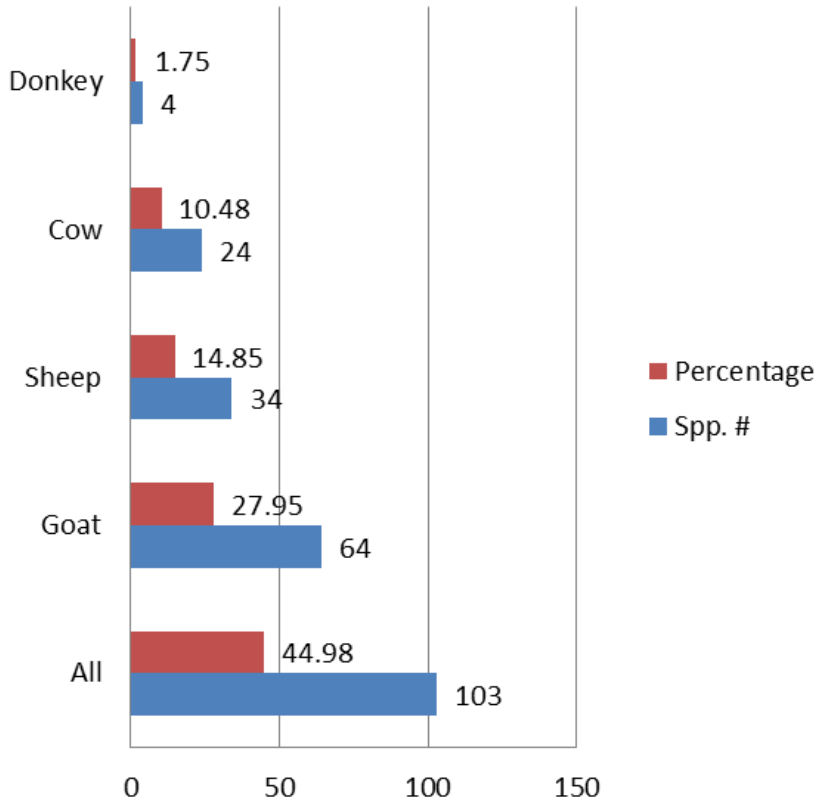


**Figure 4.** Number of plant species preferred by the domesticated animals.

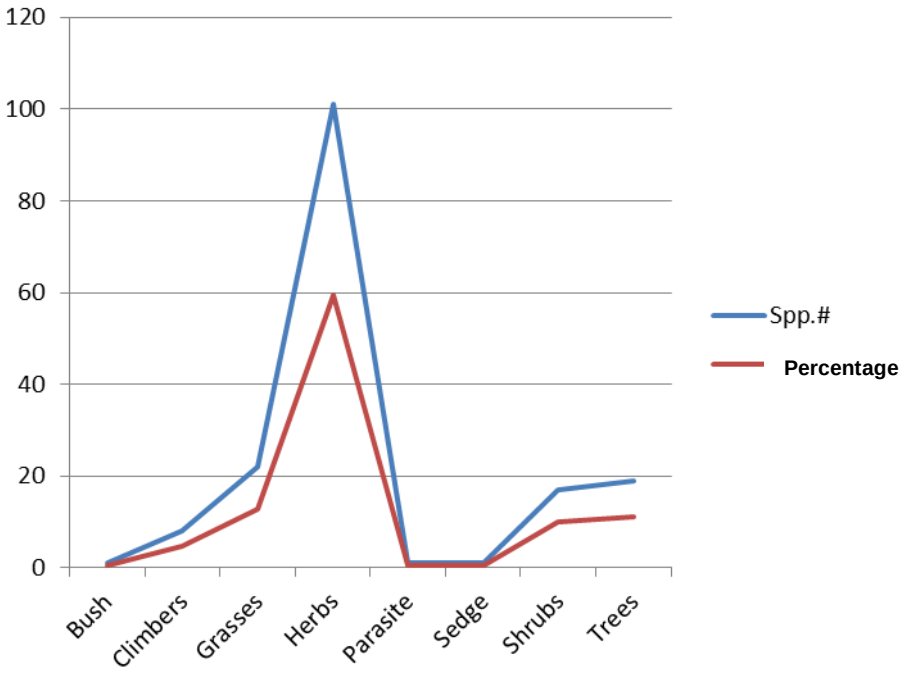


**Figure 5.** Growth form of the palatable flora of the study area.

parts and forage preferences by grazing animals. The area was found to have large amount of forage species which are grazed throughout the year. During the dry period, some of the species are harvested and stored for feeding of the domesticated animals, and stored fodder materials are mostly trees and subshurbs. The findings of this study will serve as benchmark for the development of fodder species and their varieties. The study will be helpful to range ecologists for the rehabilitation ofover-grazed areas of this rangeland. Further study is required to evaluate the nutritional composition and mineral status of the reported plant species.

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