



## Research Article

# Ethnobotanical Profile of Diverse Weed Flora in Maize and Wheat Crops of Tehsil Sarai Naurang, Khyber Pakhtunkhwa, Pakistan

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**Abstract** | The aim and objectives of this study was to conduct an ethnobotanical survey of the diverse weed flora found in maize and wheat crops of Tehsil Sarai Naurang, Khyber Pakhtunkhwa, Pakistan. Wheat and maize are staple crops that form the backbone of global food systems, providing essential nutrition for billions of people worldwide. The ethnobotanical survey was conducted by interviewing local people and farmers to document traditional knowledge on weed species in maize and wheat crops. A semi-structured questionnaire along with group discussion and interviews were used to gather ethnobotanical data. A total of 93 weed species were collected from wheat and maize crops which belonged to 31 families and 77 genera. Among these 31 families 29 families were of Dicots and only 2 families were of monocots. The 71 (76%) species collected were dicots whereas, 22 (24%) species belonged to monocots. Among the Dicots, Asteraceae were the dominant family having 9 weed species followed by, Solanaceae 8 species, Amaranthaceae 7 species, Euphorbiaceae 6 species and Chenopodiaceae with 5 species. The remaining families have less than 5 species each. Among the monocots Poaceae family has 20 weed species whereas, Cyperaceae family has 2 weed species. The present study conducted revealed that 46 (49.46%) species were used as fodder followed by, 30 (32.27%) weed species were used as medicinal and 17 (18.27%) species were utilized as vegetables. The collection and documentation of weed flora from the area highlights the rich weed diversity in maize and wheat agroecosystems.

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## Introduction

The study area Tehsil Sarai Naurang, district Lakki Marwat is located in the southern region

of Khyber Pakhtunkhwa, Pakistan. It has a rain-fed area with little irrigated portions. Tehsil Sarai Naurang consists of many towns and villages (Khan *et al.*, 2013) and located in the south about 22 km

away from Bannu. It is the main center of trade and commercial spot for the people of Lakki Marwat (Calvino-Cancela, 2011). During summer season, the level of humidity is very low, and the temperature is measured up to 45°C, while in winter, it falls up to 0°C. The average rain recorded is 82 mm usually in July and August (GOP, 1998).

The undesired plant species grow everywhere, particularly in crop fields (Dangwal, 2011). Weeds cause increase in farming practices, disturb fertility, and even disturb the water flow in canals during irrigation practices (Iqbal *et al.*, 2015). Weeds compete with crops for available water, nutrients, light, and soil resources (Rajcan and Swanton, 2001; Khan *et al.*, 2004) by reducing harvest and deterioration. They reduce the market value of many crops. They cause crop failure in huge areas (Arif *et al.*, 2006).

The Maize crop is essential to human food and is used as fodder for livestock (Kumar and Jharia, 2013). Weeds have been a problematic cause in maize fields and have decreased the production of maize yield up to a tremendous level (Khan *et al.*, 2009). Due to their short span of life, rapid germination, and adaptation to every environment, weeds compete with crops for many reasons, such as moisture and soil (Iqbal *et al.*, 2015). Weed invasion can affect the global production of crops and also the economy of Pakistan (Ghanizadeh *et al.*, 2014). Controlling weeds has a direct effect on the development and growth of maize crops (Baghestani and Zand, 2007), where the maize crop is usually characterized by diverse flora of weeds as broad-leaved plants and grasses (Kolarova *et al.*, 2014; Pannacci and Tei, 2014; Lehoczy *et al.*, 2014). The maize crop is sensitive to weeds flora, and the water supply also determines the composition of weeds (Ma, 2005).

Wheat is the major crop worldwide (Qureshi *et al.*, 2009). It is produced in a very large area, and about 2% of the worldwide wheat stock is due to Pakistan (Harrington *et al.*, 1992). In rice-wheat fields, weeds cause crucial yield loss (Waheed *et al.*, 1992; Hassan and Marwat, 2004). In Pakistan, weeds reduce the yield of wheat crops to a tremendous level and also reduce the market price of wheat harvest (Suryavanshi *et al.*, 2011).

Traditionally, plants are still used locally for various traditional purposes (Khan *et al.*, 2004). Wild

plants are dangerous, but some of the weeds are very important in nature, and local people use them and have medicinal value. They are used for the treatment of many diseases. These are required for the pharmaceutical industries as raw materials for ayurvedic production. Thus, weeds identification is very important, farmers may organize to collect weeds from fields to get traditional benefits. So, for the ethnobotany, the first step is to identify and then document the medicinal weeds in an area (Razzaq *et al.*, 2013). Weeds have been used by local people since ancient times as vegetables, medicine, and fodder (Ullah and Rashid, 2007; Ibrar, 2003). In District Abbottabad different weed species were utilized and used locally to treat various diseases (Nasir and Ali 2003).

While ethnobotanical studies have focused on traditional uses of wild plants in various regions, there is a lack of comprehensive documentation on the diverse weed flora found in Tehsil Sarai Naurang, district Lakki Marwat, Khyber Pakhtunkhwa, Pakistan. Existing studies have primarily concentrated on the agricultural and ecological aspects of weeds, overlooking their cultural significance and potential uses. This knowledge gap hinders the appreciation and utilization of these plant resources, potentially leading to the loss of valuable traditional knowledge and cultural heritage.

The primary objectives of this study are to conduct an ethnobotanical survey of the diverse weed flora found in maize and wheat crops, the traditional uses and cultural significance and to identify and prioritize weed species with potential uses for food, medicine, fodder and other purposes in Tehsil Sarai Naurang, district Lakki Marwat, Khyber Pakhtunkhwa, Pakistan.

## Materials and Methods

### *Fieldwork, collection, identification and preservation of weeds:*

Nine localities with landscape variations were selected to collect weed species in maize and wheat crop fields in tehsil Sarai Naurang, Lakki Marwat. Ninety-three weed species were collected from the fields of maize and wheat crops. These specimens were shade dried and fixed on standard herbarium sheets and deposited at the herbarium of Centre of Plant Biodiversity, University of Peshawar for future reference. The

collected weed species were identified with the help of Flora of Pakistan and available literature (Ali and Nasir, 1989-1991; Ali and Qaiser, 1993-2021; Khan *et al.*, 2019-2020).

### *Ethnobotanical profile of weed flora*

The ethnobotanical data about weed flora were collected from the local people mostly farmers. Plant species were enlisted into different classes according to their local uses based on their utilization values, and such data were collected through a semi-structured questionnaire. Nine localities were visited for the data collection in the research area where 100 respondents of different age groups including both men and women were interviewed. The interviewed respondents were primarily farmers and local people (Ullah, 2014; Bajwa *et al.*, 2016).

## Results and Discussion

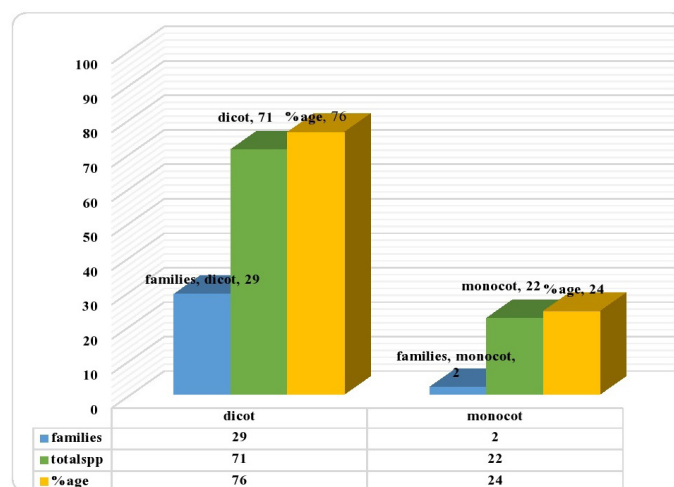
### *Floristic composition of weed flora*

A total of 93 angiosperms weed species were collected in the study area of Tehsil Serai Naurang, in which 22 (24%) species were monocots and 71 (76%) species were dicots. Monocots have two families with 22 species, and dicots have 29 families and 71 species. Among monocots the leading family was Poaceae with 20 weed species, followed by Cyperaceae with 2 weed species. The leading family among dicots was Asteraceae with 9 weed species, followed by Solanaceae with 8 species, Amaranthaceae 7 species, Euphorbiaceae with 6 species, Chenopodiaceae with 5 species, Papilionaceae and Polygonaceae with 4 species each. Aizoaceae, Apocynaceae, Apiaceae, Asclepiadaceae, Brassicaceae, Boraginaceae, Caryophyllaceae, Capparidaceae, Convolvulaceae, Cucurbitaceae, Fumariaceae, Lamiaceae, Malvaceae, Mimosaceae, Oxalidaceae Plantaginaceae, Primulaceae, Ranunculaceae, Scrophulariaceae, Tiliaceae, Verbenaceae and Zygophyllaceae have less than 3 species each as shown in (Table 1, Figure 1).

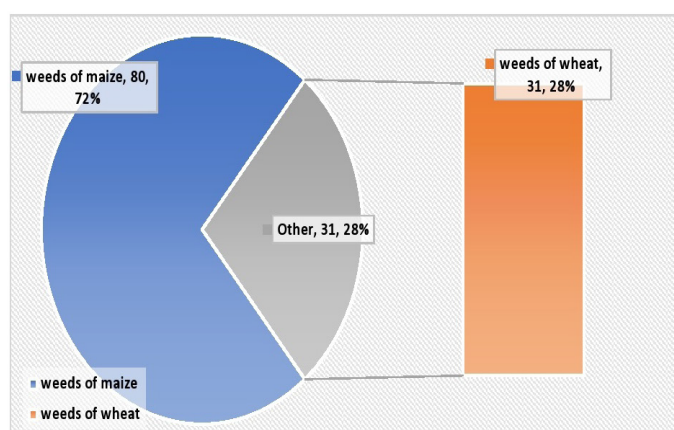
### *Weeds in maize fields*

In maize fields a total of 80 weed species which belonged to 60 genera were collected. The leading family was Poaceae with 19 weed species followed by, Asteraceae was represented by 8 species, Amaranthaceae and Solanaceae have 7 species each, Euphorbiaceae has 6 species, Chenopodiaceae has 5 species, Polygonaceae has 4 species, Zygophyllaceae has 3 species whereas, the rest of the families

such as Aizoaceae, Apocynaceae, Asclepiadaceae Boraginaceae, Brassicaceae, Capparidaceae, Convolvulaceae, Cucurbitaceae, Cyperaceae, Malvaceae, Tiliaceae, Lamiaceae, Mimosaceae, Oxalidaceae, Papalioneaceae, Plantaginaceae and Verbenaceae have less than 3 species each.



**Figure 1:** Total plant species collected in the study area tehsil Sarai Naurang.



**Figure 2:** Weed plants in the fields of maize and wheat crops collected from tehsil Sarai Naurang, Pakistan.

### *Weeds in wheat fields*

In the wheat fields a total of 31 weed species were collected which belonged to 29 genera. The leading families were Poaceae and Papilionaceae, with 4 species each followed by Asteraceae and Solanaceae having 3 species each. Apiaceae, Asclepiadaceae, Brassicaceae, Caryophyllaceae, Convolvulaceae, Chenopodiaceae, Euphorbiaceae, Fumariaceae, Lamiaceae, Plantaginaceae, Polygonaceae, Primulaceae, Ranunculaceae, Scrophulariaceae and Tiliaceae were represented by less than 3 species each (Figure 2).

**Table 1:** *Ethnobotanical profile of weed flora collected from maize and wheat crops in tehsil Sarai Naurang, Pakistan.*

| S. No. | Family/ species names                             | Maize | Wheat | Local names         | Part used                      | Ethnobotanical uses |   |   |
|--------|---------------------------------------------------|-------|-------|---------------------|--------------------------------|---------------------|---|---|
| A.     | Monocots                                          |       |       |                     |                                | 1                   | 2 | 3 |
| 1.     | Cyperaceae                                        |       |       |                     |                                |                     |   |   |
| 1      | <i>Cyperus rotundus</i> L.                        | +     | -     | Deelai              | Whole plant                    | -                   | + | - |
| 2      | <i>Cyperus esculentus</i> L.                      | +     | -     | Deelai              | Whole plant                    | -                   | + | - |
| 2.     | Poaceae                                           |       |       |                     |                                |                     |   |   |
| 3      | <i>Acrachne racemosa</i> (Roxb.) Lindl. ex Chiov. | +     | -     | Khwar               | Whole plant                    | -                   | + | - |
| 4      | <i>Avena fatua</i> L.                             | -     | +     | Karyanna            | Whole plant                    | -                   | + | - |
| 5      | <i>Brachiaria remosa</i> (L.) Stepf.              | +     | -     | Babarghwaxai        | Whole plant                    | -                   | + | - |
| 6      | <i>Brachiaria reptans</i> L.                      | +     | -     | Babarghwaxai        | Whole plant                    | -                   | + | - |
| 7      | <i>Cenchrus ciliaris</i> L.                       | +     | -     | Khwar               | Whole plant                    | -                   | + | - |
| 8      | <i>Cenchrus longispinus</i> (Hack.) Fern.         | +     | -     | Spiny burr grass    | Leaves and stem                | -                   | + | - |
| 9      | <i>Cymbopogon citratus</i> (DC.) Stapf            | +     | -     | Lemon grass         | Whole plant                    | +                   | + | - |
| 10     | <i>Cymbopogon martini</i> (Roxb.) Wats.           | +     | -     | Palm rose grass     | Whole plant                    | +                   | + | - |
| 11     | <i>Cynodon dactylon</i> (L.) Pers.                | +     | +     | Drabb               | Whole plant                    | -                   | + | - |
| 12     | <i>Desmostachya bipinnata</i> (L.) Stepf.         | +     | -     | Sarmal              | Whole plant                    | -                   | + | - |
| 13     | <i>Dichanthium annulatum</i> (Forssk.) Stapf      | +     | -     | Marvel grass        | Whole plant                    | -                   | + | - |
| 14     | <i>Dactyloctenium aegyptium</i> (L.) Willd.       | +     | -     | Crow foot grass     | Whole plant                    | -                   | + | - |
| 15     | <i>Echinochloa colonum</i> (L.) Link.             | +     | +     | Dandy samokhai      | Whole plant                    | -                   | + | - |
| 16     | <i>Eragrotus minor</i> (L.) Wolf.                 | +     | -     | Little love grass   | Whole plant                    | -                   | + | - |
| 17     | <i>Imperata cylindrica</i> (L.) P. Beauv.         | +     | -     | Deely               | Whole plant                    | -                   | + | - |
| 18     | <i>Leptochloa panacea</i> (Retz.) Ohwi.           | +     | -     | Watani samokha      | Whole plant                    | -                   | + | - |
| 19     | <i>Paspalum dilatatum</i> Poir.                   | +     | -     | Dalla grass         | Whole plant                    | -                   | + | - |
| 20     | <i>Phalaris minor</i> Retz.                       | +     | +     | Khwar               | Whole plant                    | -                   | + | - |
| 21     | <i>Phragmites karka</i> (Retz.) Trin. ex Steud.   | +     | -     | Nall                | leaves and newly emerged parts | -                   | + | - |
| 22     | <i>Sorghum halepense</i> (L.) Pers.               | +     | -     | Johnson grass       | Whole plant                    | -                   | + | - |
| B.     | Dicots                                            |       |       |                     |                                |                     |   |   |
| 3.     | Aizoaceae                                         |       |       |                     |                                |                     |   |   |
| 23     | <i>Portulaca oleracea</i> L.                      | +     | -     | Warkhari Saag       | Whole plant                    | -                   | + | + |
| 24     | <i>Trianthema portulacastrum</i> L.               | +     | -     | Pandrawosh          | Whole plant                    | -                   | + | + |
| 4.     | Amaranthaceae                                     |       |       |                     |                                |                     |   |   |
| 25     | <i>Achyranthes aspera</i> L.                      | +     | -     | Babr ghwxai         | Whole plant                    | -                   | + | - |
| 26     | <i>Aerva javanica</i> (Burm.f.) Shult.            | +     | -     | Kharh botai         | Whole plant                    | -                   | + | - |
| 27     | <i>Alternanthera sessilis</i> (L.) R. Br. ex Dc.  | +     | -     | sessile joyweed     | Whole plant                    | -                   | - | + |
| 28     | <i>Amaranthus spinosus</i> L.                     | +     | -     | Sarma saag          | Whole especially leaves        | -                   | + | + |
| 29     | <i>Amaranthus viridis</i> L.                      | +     | -     | Sarma, Ranjaka      | Whole especially leaves        | -                   | + | + |
| 30     | <i>Bassia indica</i> All.                         | +     | -     | Shurakai, Kharbotai | Whole plant                    | -                   | - | - |
| 31     | <i>Digera muricata</i> (L.) Mart.                 | +     | -     | Sor gullai          | Whole plant                    | -                   | + | - |
| 5.     | Apiaceae                                          |       |       |                     |                                |                     |   |   |
| 32     | <i>Foeniculum vulgare</i> Mill.                   | -     | +     | Sperkai             | Whole plant                    | +                   | - | - |
| 6.     | Asclepiadaceae                                    |       |       |                     |                                |                     |   |   |
| 33     | <i>Calotropis procera</i> (Alton.) W.T Alton.     | +     | +     | Spalmaka            | Especially latex, leaves       | +                   | - | - |
| 7.     | Apocynaceae                                       |       |       |                     |                                |                     |   |   |
| 34     | <i>Nerium oleander</i> L.                         | +     | -     | Ganderai, Zerawonai | Seeds and leaves               | +                   | - | - |

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| S. No.     | Family/ species names                                              | Maize | Wheat | Local names                                      | Part used                                | Ethnobotanical uses |   |   |
|------------|--------------------------------------------------------------------|-------|-------|--------------------------------------------------|------------------------------------------|---------------------|---|---|
|            |                                                                    |       |       |                                                  |                                          | 1                   | 2 | 3 |
| <b>8.</b>  | <b>Asteraceae</b>                                                  |       |       |                                                  |                                          |                     |   |   |
| 35         | <i>Cirsium arvense</i> (L.) Scop.                                  | +     | +     | Creeping thistle                                 | Leaves                                   | -                   | + | + |
| 36         | <i>Conyza canadensis</i> L.                                        | +     | -     | Horseweed                                        | Arial parts                              | +                   | - | - |
| 37         | <i>Eclipta erecta</i> (L.) L.                                      | +     | -     | False daisy                                      | Dried whole plant                        | +                   | - | - |
| 38         | <i>Parthenium hysterophorus</i> L.                                 | +     | +     | Gharbotai                                        | Whole plant                              | +                   | + | - |
| 39         | <i>Sonchus arvensis</i> L.                                         | +     | -     | Payo derawonai                                   | Whole plant                              | -                   | + | - |
| 40         | <i>Symphotrichum subulatum</i> (Michx.) G.L. Nesom.                | +     | -     | Aster subulatus                                  | Whole plant                              | +                   | - | - |
| 41         | <i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg.                | -     | +     | Maasala                                          | Whole plant                              | -                   | + | - |
| 42         | <i>Verbesina encelioides</i> (Cav.) Benth. and Hook.f. ex A. Gray. | +     | -     | Zer gullai, wild sunflower                       | Arial parts, Crushed leaves              | +                   | - | - |
| 43         | <i>Xanthium strumarium</i> L.                                      | +     | -     | Babr aghzai                                      | Seeds and leaves                         | +                   | - | - |
| <b>9.</b>  | <b>Boraginaceae</b>                                                |       |       |                                                  |                                          |                     |   |   |
| 44         | <i>Heliotropium europaeum</i> L.                                   | +     | -     | Hathi sundh                                      | Extract of whole plant                   | +                   | - | - |
| <b>10.</b> | <b>Brassicaceae</b>                                                |       |       |                                                  |                                          |                     |   |   |
| 45         | <i>Brassica campestris</i> L.                                      | +     | -     | Wairai                                           | Whole arial parts                        | +                   | + | + |
| 46         | <i>Coronopus didymus</i> L.                                        | -     | +     | Kaxbeerai, Deedam                                | Whole plant                              | -                   | + | - |
| <b>11.</b> | <b>Caryophyllaceae</b>                                             |       |       |                                                  |                                          |                     |   |   |
| 47         | <i>Stellaria media</i> (L.) Vill.                                  | -     | +     | Chick weed                                       | Whole plant                              | -                   | + | + |
| <b>12.</b> | <b>Chenopodiaceae</b>                                              |       |       |                                                  |                                          |                     |   |   |
| 48         | <i>Chenopodium album</i> L.                                        | +     | +     | Speena sarma, Ranjaka saag                       | Whole plant                              | -                   | + | + |
| 49         | <i>Chenopodium vulvaria</i> L.                                     | +     | -     | Tora saarma, ranjaka                             | Whole plant                              | -                   | + | + |
| 50         | <i>Chenopodium murale</i> L.                                       | +     | +     | Ranjaka saag                                     | Whole plant                              | -                   | + | + |
| 51         | <i>Chenopodium ambrosioides</i> L.                                 | +     | -     | Ranjaka                                          | Whole plant                              | -                   | + | + |
| 52         | <i>Suaeda aegyptica</i> (Hassen). Zohry                            | +     | -     | Zamai                                            | Whole plant                              | -                   | + | - |
| <b>13.</b> | <b>Capparidaceae</b>                                               |       |       |                                                  |                                          |                     |   |   |
| 53         | <i>Cleome viscosa</i> L.                                           | +     | -     | Thick weed                                       | Leaves, seeds and roots                  | +                   | - | - |
| <b>14.</b> | <b>Convolvulaceae</b>                                              |       |       |                                                  |                                          |                     |   |   |
| 54         | <i>Convolvulus arvensis</i> L.                                     | +     | +     | Perkhatai, Perkhatonai                           | Whole plant                              | +                   | + | + |
| <b>15.</b> | <b>Cucurbitaceae</b>                                               |       |       |                                                  |                                          |                     |   |   |
| 55         | <i>Citrullus colocynthis</i> (L.) Schrad.                          | +     | -     | Maraghona                                        | Whole plant but specially fruits         | +                   | + | - |
| <b>16.</b> | <b>Euphorbiaceae</b>                                               |       |       |                                                  |                                          |                     |   |   |
| 56         | <i>Euphorbia prostrata</i> Aiton.                                  | +     | +     | Perwata, Daal                                    | Whole plant                              | -                   | + | - |
| 57         | <i>Chrozophora tinctoria</i> (L.) A.Juss.                          | +     | -     | Turnsole                                         | Fruit, leaves, root ashes                | +                   | - | - |
| 58         | <i>Euphorbia indica</i> Lam.                                       | +     | -     | Parparai                                         | Whole plant                              | +                   | + | - |
| 59         | <i>Croton bonplandianum</i> L.                                     | +     | -     | Rushfoil or coroton                              | Whole plant                              | +                   | - | - |
| 60         | <i>Ricinus communis</i> L.                                         | +     | -     | Arand, false castor oil bean or castor oil plant | Whole plant but specially seeds extracts | +                   | - | - |
| 61         | <i>Euphorbia helioscopia</i> L.                                    | +     | -     | Parprai                                          | Arial parts                              | +                   | - | - |
| <b>17.</b> | <b>Fumariaceae</b>                                                 |       |       |                                                  |                                          |                     |   |   |
| 62         | <i>Fumaria indica</i> L.                                           | -     | +     | Lewanai gazara                                   | Whole plant                              | +                   | + | - |
| <b>18.</b> | <b>Lamiaceae</b>                                                   |       |       |                                                  |                                          |                     |   |   |
| 63         | <i>Mentha longifolia</i> (L.) Huds.                                | +     | +     | Welanai                                          | Whole plant                              | +                   | + | + |

Table continued on next page.....

| S. No.     | Family/ species names                          | Maize | Wheat | Local names               | Part used                            | Ethnobotanical uses |   |   |
|------------|------------------------------------------------|-------|-------|---------------------------|--------------------------------------|---------------------|---|---|
|            |                                                |       |       |                           |                                      | 1                   | 2 | 3 |
| <b>19.</b> | <b>Malvaceae</b>                               |       |       |                           |                                      |                     |   |   |
| 64         | <i>Malvastrum coromandelianum</i> (L.) Garcke. | +     | -     | Three lobe false mallow   | Leaves                               | +                   | - | - |
| 65         | <i>Malva parviflora</i> L.                     | +     | -     | Poskai                    | Whole plant body                     | -                   | + | + |
| <b>20.</b> | <b>Mimosaceae</b>                              |       |       |                           |                                      |                     |   |   |
| 66         | <i>Prosopis juliflora</i> (Sw.) DC.            | +     | -     | Kikrai                    | Paste, gum and smoke from leaves     | +                   | + | - |
| <b>21.</b> | <b>Oxalidaceae</b>                             |       |       |                           |                                      |                     |   |   |
| 67         | <i>Oxalis corniculata</i> L.                   | +     | -     | Tharwakai                 | Whole plant                          | +                   | + | - |
| <b>22.</b> | <b>Papilionaceae</b>                           |       |       |                           |                                      |                     |   |   |
| 68         | <i>Albegi marrurum</i> Medik.                  | +     | +     | Thandu                    | Soft terminal parts                  | -                   | + | - |
| 69         | <i>Lathyrus aphaca</i> L.                      | -     | +     | Lewanai matar             | Whole plant                          | -                   | + | - |
| 70         | <i>Medicago polymorpha</i> L.                  | -     | +     | Malkunda                  | Whole plant                          | -                   | + | + |
| 71         | <i>Vicia sativa</i> L.                         | -     | +     | Vetch or garden vetch     | whole plant                          | -                   | + | - |
| <b>23.</b> | <b>Plantaginaceae</b>                          |       |       |                           |                                      |                     |   |   |
| 72         | <i>Plantago lanceolata</i> L.                  | +     | +     | Chapar panrhai            | Whole plant                          | -                   | + | - |
| <b>24.</b> | <b>Polygonaceae</b>                            |       |       |                           |                                      |                     |   |   |
| 73         | <i>Polygonum barbatum</i> (Michx.) Small.      | +     | +     | Swamp smartweed           | Seeds and Leaf extract               | +                   | - | - |
| 74         | <i>Rumex crispus</i> L.                        | +     | -     | Patawar, Saag             | Leaves                               | -                   | + | + |
| 75         | <i>Polygonum aviculare</i> L.                  | +     | +     | Common knot grass         | Whole plant                          | +                   | - | - |
| 76         | <i>Rumex dentatus</i> L.                       | +     | -     | Tharwakai, curly dock     | Leaves                               | -                   | + | + |
| <b>25.</b> | <b>Primulaceae</b>                             |       |       |                           |                                      |                     |   |   |
| 77         | <i>Anagallis arvensis</i> L.                   | -     | +     | Shinstargai khwar         | Whole plant                          | +                   | + | - |
| <b>26.</b> | <b>Ranunculaceae</b>                           |       |       |                           |                                      |                     |   |   |
| 78         | <i>Ranunculus muricatus</i> L.                 | -     | +     | Rough fruited buttercup   | Whole plant                          | -                   | + | - |
| <b>27.</b> | <b>Scrophulariaceae</b>                        |       |       |                           |                                      |                     |   |   |
| 79         | <i>Veronica biloba</i> L.                      | -     | +     | Speedwell, bird's eye     | Whole plant                          | +                   | - | - |
| <b>28.</b> | <b>Solanaceae</b>                              |       |       |                           |                                      |                     |   |   |
| 80         | <i>Datura innoxia</i> Mill.                    | +     | +     | Barbaka                   | Seeds and juice of fruits            | +                   | - | - |
| 81         | <i>Datura stramonium</i> L.                    | +     | -     | Barhbaaka                 | Fruit and seeds                      | +                   | - | - |
| 82         | <i>Nicotiana plumbaginifolia</i> Viv.          | +     | -     | Tasawonai botai           | leaves                               | +                   | - | - |
| 83         | <i>Physalis peruviana</i> L.                   | +     | -     | Koti lal                  | Fruits                               | +                   | - | - |
| 84         | <i>Solanum sarrachoides</i> Sendtn.            | -     | +     | Lewanai guguray           | Extract of roots and fruits          | +                   | - | - |
| 85         | <i>Solanum xanthocarpum</i> L.                 | +     | -     | Yellow fruit nightshade   | Extract of roots and juice of fruits | +                   | - | - |
| 86         | <i>Withania coagulans</i> (Stocks) Dunal.      | +     | -     | Shapyanga, khamazora      | Fruit                                | +                   | - | - |
| 87         | <i>Withania somnifera</i> (L.) Dunal.          | +     | +     | Kotilal, skand, tamarakai | Fruits and root powder               | +                   | - | - |
| <b>29.</b> | <b>Tiliaceae</b>                               |       |       |                           |                                      |                     |   |   |
| 88         | <i>Corchorus olitorius</i> L.                  | +     | -     | Jute mallow               | Seeds and leaves                     | +                   | - | + |
| 89         | <i>Corchorus hirtus</i> L.                     | +     | +     | Lewanai kunzal            | Leaves                               | -                   | + | - |
| <b>30.</b> | <b>Verbenaceae</b>                             |       |       |                           |                                      |                     |   |   |
| 90         | <i>Verbena officinalis</i> L.                  | +     | -     | Common verbena            | Leaves                               | +                   | - | - |
| <b>31.</b> | <b>Zygophyllaceae</b>                          |       |       |                           |                                      |                     |   |   |
| 91         | <i>Fagonia indica</i> L.                       | +     | -     | Spelaghazai               | Whole plant                          | +                   | - | - |
| 92         | <i>Peganum harmala</i> L.                      | +     | -     | Spelanai, Spanda          | Whole plant especially fruits        | +                   | - | - |
| 93         | <i>Tribulus terrestris</i> L.                  | +     | -     | Dre kundai Aghzai         | Leaves and stem                      | -                   | + | + |

Key: 1= Medicinal, 2=Fodder, 3=Vegetable.

**Table 2:** *Ethnomedicinal uses of weeds collected from maize and wheat crops in tehsil Sarai Naurang, Pakistan.*

| S. No. | Plant species                                  | Part used                         | Ethnomedicinal uses                                                                                                                                                        |
|--------|------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | <i>Anagallis arvensis</i> L.                   | Whole plant                       | Dropsy, Skin infections                                                                                                                                                    |
| 2      | <i>Brassica campestris</i> L.                  | Whole arial parts                 | Inflammation, skin allergic diseases, worm infestation                                                                                                                     |
| 3      | <i>Calotropis procera</i> (Alton.) W.T Alton.  | Latex, leaves                     | Snacke bite, burn injuries, body pain, mumps, sinus fistula                                                                                                                |
| 4      | <i>Chrozophora tinctoria</i> (L.) A. Juss.     | Fruit, leaves, root powder        | Fever, cough, cathartic and emetic                                                                                                                                         |
| 5      | <i>Citrullus colocynthis</i> (L.) Schrad.      | Whole plant but specially fruits  | Gestroenteritis, indigestion, intestinal parasites, diabetes, obstruction, weak bowel movement, liver problem                                                              |
| 6      | <i>Cleome viscosa</i> L.                       | Leaves, seeds and roots           | Rheumatic arthritis, hypertension, neurasthenia, wound healing and malaria,                                                                                                |
| 7      | <i>Convolvulus arvensis</i> L.                 | Whole plant                       | Fever, fungal infection, intestinal and uterine pain                                                                                                                       |
| 8      | <i>Conyza canadensis</i> L.                    | Arial parts                       | Bronchitis, sore throat, inflammation, fever, bleeding from uterus, diarrhea, UTI                                                                                          |
| 9      | <i>Corchorus olitorius</i> L.                  | Seeds and leaves                  | Gonorrhea, dysuria, cystitis,                                                                                                                                              |
| 10     | <i>Croton bonplandianum</i> L.                 | Whole plant                       | Cancer, skin infection, wounds, dysentery, constipation, diabetes, digestive problems, fever.                                                                              |
| 11     | <i>Cymbopogon citratus</i> (DC.) Stapf         | Whole plant                       | Fever, gastrointestinal disorders, cough, stomachache.                                                                                                                     |
| 12     | <i>Cymbopogon martini</i> (Roxb.) Wats.        | Whole plant                       | Joint pain, respiratory disorders, intestinal worms.                                                                                                                       |
| 13     | <i>Datura innoxia</i> Mill.                    | Seeds. Leaves and juice of fruits | Toothache, fever, dandruff and falling hairs.                                                                                                                              |
| 14     | <i>Datura stramonium</i> L.                    | Leaves, Fruit and seeds           | Ulcer, fever, asthma, bronchitis, inflammation, wound healing.                                                                                                             |
| 15     | <i>Eclipta erecta</i> (L.) L.                  | Dried whole plant                 | Skin diseases, hair fall, stomach problems.                                                                                                                                |
| 16     | <i>Euphorbia helioscopia</i> L.                | Arial parts                       | Cough, edema, malaria, dysentery, osteomyelitis, cancer.                                                                                                                   |
| 17     | <i>Euphorbia indica</i> Lam.                   | Whole plant                       | Breathing disorders, digestive problems, dengue fever.                                                                                                                     |
| 18     | <i>Fagonia indica</i> L.                       | Whole plant                       | Skin diseases, snake bite, small pox and swelling of neck.                                                                                                                 |
| 19     | <i>Foeniculum vulgare</i> Mill.                | Whole plant                       | Digestive problems, intestinal gas, colic in infants, cough, cholera.                                                                                                      |
| 20     | <i>Fumaria indica</i> L.                       | Whole plant                       | Skin diseases, diarrhea, and fever.                                                                                                                                        |
| 21     | <i>Heliotropium europaeum</i> L.               | Extract of whole plant            | Inflamation, skin diseases, poisonous bites, wound healing.                                                                                                                |
| 22     | <i>Malvastrum coromandelianum</i> (L.) Garcke. | Leaves                            | Bacterial infections, inflammation                                                                                                                                         |
| 23     | <i>Mentha longifolia</i> (L.) Huds.            | Whole plant                       | Colic, indigestion, coughs, pulmonary infections, headaches, fever, urinary tract infections, menstrual disorders.                                                         |
| 24     | <i>Nerium oleander</i> L.                      | Seeds and leaves                  | Asthma, epilepsy, painful menstrual periods, leprosy, cancer, malaria.                                                                                                     |
| 25     | <i>Nicotiana plumbaginifolia</i> Viv.          | leaves                            | Wounds, inflammation, toothache.                                                                                                                                           |
| 26     | <i>Oxalis corniculata</i> L.                   | Whole plant                       | Influenza, fever, urinary tract infections, diarrhea, traumatic injuries, sprains, poisonous bites, enteritis.                                                             |
| 27     | <i>Parthenium hysterophorus</i> L.             | Whole plant                       | Malaria, fever, diarrhoea, neurologic disorders, urinary tract infections, dysentery, urinary tract infections.                                                            |
| 28     | <i>Peganum harmala</i> L.                      | Whole plant especially fruits     | Pain, skin and hair deseases, inflammation, cardiovascular, gasterointestinal diseases, nervous, neoplasm and tumors, diabetes, respiratory infections, ulcers, arthritis. |
| 29     | <i>Physalis peruviana</i> L.                   | Fruits                            | Malaria, asthma, dermatitis, malaria, asthma, hepatitis, hepatitis, Rheumatic diseases, cancer.                                                                            |
| 30     | <i>Polygonum aviculare</i> L.                  | Whole plant                       | Cough, gum disease (gingivitis), bronchitis, sore mouth and throat.                                                                                                        |

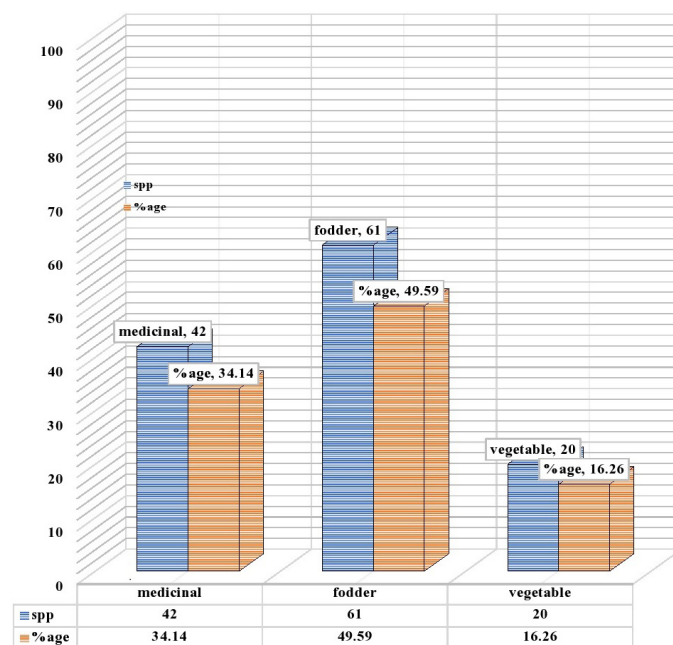
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| S. No. | Plant species                                                      | Part used                                | Ethnomedicinal uses                                                                                                                                                     |
|--------|--------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31     | <i>Polygonum barbatum</i> (Michx.) Small.                          | Seeds and Leaf extract                   | Ulcer and griping pains of colic.                                                                                                                                       |
| 32     | <i>Prosopis juliflora</i> (Sw.) DC.                                | Paste, gum and smoke from leaves         | Painkiller, asthma and cough, galactagogue, expectorant, body tonic, eye inflammation, kidney stones, toothache, breast cancer.                                         |
| 33     | <i>Ricinus communis</i> L.                                         | Whole plant but specially seeds extracts | Abdominal disorders, arthritis, backache, expulsion of placenta, bilharziasis, chronic backache, sciatica, constipation, gall bladder pain, menstrual cramps, insomnia. |
| 34     | <i>Solanum sarrachoides</i> Sendtn.                                | Extract of roots and fruits              | stomach irritation, pain, psoriasis, cramps, spasms, nervousness,                                                                                                       |
| 35     | <i>Solanum xanthocarpum</i> L.                                     | Extract of roots and juice of fruits     | cough, fever, heart diseases                                                                                                                                            |
| 36     | <i>Symphyotrichum subulatum</i> (Michx.) G.L. Nesom.               | Whole plant                              | Fever, Inflammation                                                                                                                                                     |
| 37     | <i>Verbena officinalis</i> L.                                      | Leaves                                   | Cough, sore throat, respiratory diseases, depression, and inflammation.                                                                                                 |
| 38     | <i>Verbesina encelioides</i> (Cav.) Benth. and Hook.f. ex A. Gray. | Arial parts, Crushed leaves              | Skin problems, gum sores, cancer, spider bites, gastro-intestinal diseases, hemorrhoid,                                                                                 |
| 39     | <i>Veronica biloba</i> L.                                          | Whole plant                              | Respiratory diseases, stomach and intestinal diseases, bladder and kidneys infections.                                                                                  |
| 40     | <i>Withania coagulans</i> (Stocks) Dunal.                          | Fruit                                    | Dyspepsia, skin diseases, insomnia, asthma, wasting diseases, abdominal pain, intestinal diseases                                                                       |
| 41     | <i>Withania somnifera</i> (L.) Dunal.                              | Fruits and root powder                   | Asthma, diabetes, arthritic diseases, hypertension, cancer.                                                                                                             |
| 42     | <i>Xanthium strumarium</i> L.                                      | Seeds and leaves                         | Headache, rhinitis, gastric ulcer, bacterial and fungal infections, arthritis, urticarial, nasal sinusitis.                                                             |

### Ethnobotanical profile

The present ethnobotanical study revealed that 42 (34.14%) species were used as medicinal herbs by the local people of research area such as *Mentha longifolia*, which was used for indigestion and cough treatments. Similarly, *Calotropis procera* weed was used to cure snake bites. *Brassica campestris* oil was used to treat skin allergies. *Citrullus colocynthis* was used for intestinal parasites and diabetes. *Cymbopogon citratus* were used to cure fever and cough as shown in (Table 2). The 61 (49.59%) plant species or weeds were used as fodder for cattles such as *Avena fatua*, *Amaranthus viridis*, *Brachiaria reptans*, *Cyperus rotundus*, *Dactyloctenium aegyptium*, *Eragrotus minor* and *Taraxacum officinale*. Similarly, 20 (16.26%) weed species were used as vegetables in the study area by the local people which includes *Amaranthus viridis*, *Chenopodium vulvaria*, *Chenopodium album*, *Medicago polymorpha* and *Portulaca oleracea* as shown in (Table 1, Figure 3).

The current study conducted was similar and analogous to previous studies performed in other research regions. The results obtained in the present study are parallel and compatible with previous



**Figure 3:** Ethnobotanical uses of weeds in Maize and wheat crops collected from Tehsil Sarai Naurang, Pakistan.

research studies on weeds. The results of this current study were found to be in agreement with the findings and outcomes of other studies such as those of (Khan *et al.*, 2018, 2020; Bano *et al.*, 2016; Hayat *et al.*, 2019).



Likewise, the floristic composition and ecological study were conducted on weeds in Tehsil Razar, district Sawabi where 165 weed species were reported from such fields (Hussain *et al.*, 2020). A similar study like this on weeds was carried out by (Anjum *et al.*, 2020) from the said range and recorded 654 species. Similarly, (Haq and Badshah, 2021) carried out the research study on the floristic description and ecological characteristics of the plants of Pashat Valley, Pak-Afghan border, district Bajaur, Pakistan.

From the maize crop 29 weed species were also collected by (Khan *et al.*, 2018). Similarly, fifty two (52) weeds species from wheat crops were collected and the dominant families reported were Asteraceae, Papilionaceae, and Poaceae, respectively by (Shuaib *et al.*, 2019) from district Dir, tehsil Timergara, Khyber Pakhtunkhwa, Pakistan.

Similar and parallel to the present study an ethnobotanical study was carried out in Tehsil Timergara district Dir Lower Khyber Pakhtunkhwa Pakistan, and weed plants were recorded that were used in the treatment of different diseases by the local people of the area (Amjad *et al.*, 2020). A study of 150 medicinal plants belonging to 98 genera and 60 families was conducted in Azad Jammu and Kashmir (Iqbal *et al.*, 2021). An ethnobotanical study which listed 143 species of plants which were used as fodder, vegetables, for medicinal purposes and other ethnobotanical uses were conducted by (Khan *et al.*, 2018).

The traditional practices and cultural significance of local medicinal weeds include traditional medicines, spiritual and ritual uses and association with ancestors and supernatural powers, passed down through generations and are deeply connected to indigenous knowledge, land, place and identity highlighting their importance beyond just their medicinal value.

These results emphasize the need to reconsider our perception of weeds as solely pests and recognize their multifaceted benefits. By integrating traditional knowledge with modern agricultural practices, we can develop more sustainable and inclusive approaches to weed management.

Furthermore, this research underscores the importance of preserving traditional knowledge and promoting ethnobotanical research to uncover the hidden values

of weeds. By doing so, we can ensure the conservation of biodiversity, support local livelihoods and foster a more holistic understanding of agroecosystems.

## Conclusions and Recommendations

In conclusion, this study highlights the significance of weeds in wheat and maize crops, not only as competitors for resources but also as valuable resources themselves. The ethnobotanical survey revealed that local people have been utilizing these weeds for centuries as medicines, vegetables and fodder, showcasing their importance in traditional knowledge systems.

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## Novelty Statement

This study reveals the unprecedented impact of weed diversity on maize and wheat crop yields, highlighting the need for tailored management strategies to optimize productivity.

## Author's Contribution

**Mushtaq Ahmad:** Performed Research.

**Hikmat Ullah Jan:** Technical review.

**Kanwal Raina:** Helped in research.

**Nazara Shafiq:** Helped in paper research.

**Syed Mukarram Shah:** Supervisor.

**Muhammad Ibrahim:** Wrote the manuscript.

**Shaha Buddin:** Helped in statistics and graph making.

**Gulnaz Parveen:** Provided technical support.

### Availability of data

The datasets generated and analyzed during the current study are available from the first author upon reasonable request.

### Conflict of interest

The authors declare that they have no conflict

of interest. They have no financial, personal or professional interests that could influence the design, execution or interpretation of the study.

## References

- Afridi, R.A. and Khan, M.A., 2015. Comparative effect of water extract of *Parthenium hysterophorus*, *Datura alba*, *Phragmites australis* and *Oryza sativa* on weeds and wheat. *Sains Malaysiana*, 44(5): 693-699. <https://doi.org/10.17576/jsm-2015-4405-08>
- Ali, S. I. and Nasir, Y.J., 1989-1991. Flora of Pakistan. Department of Botany, University of Karachi, Karachi 1989-1991, Vol. 191-193.
- Ali, S.I. and Qaiser, M., 1993-2021. Flora of Pakistan: Department of Botany, University of Karachi 1993-2021, Vol. 194-221.
- Amjad, M.S., Zahoor, U., Bussmann, R.W., Altaf, M., Gardazi, S.M. and Abbasi, A.M., 2020. Ethnobotanical survey of the medicinal flora of Harighal, Azad Jammu and Kashmir, Pakistan. *J. Ethnobiol. Ethnomed.*, 16: 1-28. <https://doi.org/10.1186/s13002-020-00417-w>
- Anjum, S., Hussain, F., Durrani, M.J., Masood, A., Mushtaq, A., Rizwan, S. and Behlil, F., 2020. Floristic composition, ecological characteristics and ethnobotanical profile of protected and open grazing land of Karkhasa, Balochistan. *Pak. J. Anim. Plant Sci.*, 30: 420-430. <https://doi.org/10.36899/JAPS.2020.2.0036>
- Arif, M., Khan, M.A., Akbar, H., Sajjad, S. and Ali, S., 2006. Prospects of wheat as a dual purpose crop and its impact on weeds. *Pak. J. Weed Sci. Res.*, 12: 13-17.
- Baghestani, M.A., Zand, E., Soufizadeh, S., Eskandari, A., PourAzar, R., Veysi, M. and Nassirzadeh, N., 2007. Efficacy evaluation of some dual purpose herbicides to control weeds in maize (*Zea mays* L.). *Crop Prot.*, 26: 936-942. <https://doi.org/10.1016/j.cropro.2006.08.013>
- Bajwa, A.A., Chauhan, B.S. and Farooq, M., 2016. Effect of soil moisture regimes on growth and seed production of two Australian biotypes of *Sisymbrium thellungii* O. E. Schulz, 244: 39.
- Bano, S., Khan, S.M., Alam, J., Alqarawi, A.A., Ullah, A., Ahmad, Z., Rahman, I.U., Ahmad, H., Aldubise, A., Hashem, A. and Saudi, J., 2016. Weed species composition and distribution pattern in the maize crop under the influence of edaphic factors and farming practices: A case study from Mardan, Pakistan. *Saudi J. Biol. Sci.*, 23(6): 741-748. <https://doi.org/10.1016/j.sjbs.2016.07.001>
- Calvino-Cancela, M., 2011. Seed dispersal of alien and native plants by *Vertebrate herbivores*. *Biol. Invasions*, 13: 895-904. <https://doi.org/10.1007/s10530-010-9877-6>
- Dangwal, L.R., 2011. Common weeds of kharif crops of Block Sunderbani District Rajouri (Jammu and Kashmir). *Pak. J. Weed Sci. Res.*, 17(1): 9-15.
- Ghanizadeh, H., Lorzadeh, S. and Ariannia, N., 2014. Effect of weed interference on *Zea mays*: Growth analysis. *Weed Biol. Manage.*, 14: 133-137. <https://doi.org/10.1111/wbm.12041>
- GOP, 1998. District census report of district Lakki Marwat; Population census organization statistic division Government of Pakistan: Islamabad, 109: 2-5.
- Haq, A. and Badshah, L., 2021. Floristic description and ecological characteristics of the plants of Pashat Valley, Pak-Afghan border, district Bajaur, Pakistan. *Acta Ecol. Sin.*, 41: 524-536. <https://doi.org/10.1016/j.chnaes.2021.03.010>
- Harrington, L.W., Fujisaka, S., Morris, M.L., Hobbs, P.R., Sharma, H.C., Singh, R.P., Dhiman, S.D., 1992. Wheat and rice in Karnal and Kurukshetra Districts, Haryana, India: Farmers practices, problems, and an agenda for action. *Explorat. Surv.*, 1992, 22-29 Mar and 27 Sep-2 Oct, (No. 338.14 HAR WHE. CIMMYT.).
- Hassan, G. and Marwat, K.B., 2001. Integrated weed management in agricultural crops. National workshop on technologies for sustainable agriculture 2001, pp. 24-26.
- Hayat, S.A., Hussain, F., Zhu, H. and Asad, F., 2019. Floristic composition and ecological characteristics of plants of Tehil Razar, Swabi district, Pakistan. *Silva*, 20: 2.
- Hussain, W., Badshah, L., Hussain, F. and Ali, A., 2020. Floristic configuration and ecological characteristics of plants of Koh-e-Safaid range, northern Pakistani-Afghan borders. *Acta Ecol. Sin.*, 40(3): 221-236. <https://doi.org/10.1016/j.chnaes.2020.04.006>
- Ibrar, M., 2003. Ethnobotanical study of the weeds of five crops in district Abbottabad, N-W Pakistan. *Pak. J. Weed Sci. Res.*, 9(3-4): 229-240.
- Iqbal, M.S., Ahmad, K.S., Ali, M.A., Akbar, M.,

- Mehmood, A., Nawaz, F. and Busmann, R.W., 2021. An ethnobotanical study of wetland flora of Head Maralla Punjab Pakistan. PLoS One, 16(10): e0258167. <https://doi.org/10.1371/journal.pone.0258167>
- Iqbal, M., Khan, S., Khan, M.A., Rahman, I.U., Abbas, Z., 2015. Exploration and inventorying of weeds in wheat crop of the district Malakand, Pakistan. Pak. J. Weed Sci. Res., 21(3): 435-452.
- Khan, H., Marwat, K.B., Hassan, G. and Khan, M.A., 2013. Socio-economic impacts of Parthenium (*Parthenium hysterophorus* L.) in Peshawar Valley, Pakistan. Pak. J. Weed Sci. Res., 19(3): 275- 293.
- Khan, I., Hassan, G., Khan, M.I. and Khan, A.I., 2004. Efficacy of some new herbicidal molecules on grassy and broadleaf weeds in wheat-II. Pak. J. Weed Sci. Res., 10(1-2): 33-38.
- Khan, M.A.; Kakar, S., Marwat, K.B. and Khan, I.A., 2009. Differential response of *Zea mays* L. in relation to weed control and different macronutrient combinations. Sains Malaysiana, 42(10): 1405-1411.
- Khan, M., Razzaq, A., Hadi, F., Khan, N., Basit, A., Farman, U. and Nasir, A., 2018. Ethnobotanical profile of weed flora of district Charsadda, Khyber Pakhtunkhwa. RADS J. Biol. Res. Appl. Sci., 9(1): 14-23. <https://doi.org/10.37962/jbas.v9i1.117>
- Khan, N., Badshah, L., Shah, S.M., Khan, S., Shah, A.A., Muhammad, M. and Ali, K., 2019-2020. Ecological, ethno botanical and phytochemical evaluation of plant resources of Takht Bhai, District Mardan, KP, Pakistan. Turk. J. Physiother. Rehabil., 32: 3.
- Kolařova, M., Tyšer, L. and Soukup, J., 2014. Weed vegetation of arable land in the Czech Republic: Environmental a management factors determining weed species composition. Biologia, 69(4): 443-448. <https://doi.org/10.2478/s11756-014-0331-6>
- Kumar, D. and Jhariya, A.N., 2013. Nutritional, medicinal and economical importance of corn: A mini review. Res. J. Pharm. Sci., 2319; 555X.
- Lehoczy, É., Kamuti, M., Mazsu, N., Radimszky, L. and Sándor, R., 2014. Composition, density and dominance of weeds in maize at different nutrientsupplylevels. Crop Prod., 63(1): 287-290.
- Ma, Y., 2005. Allelopathic studies of common wheat (*Triticum aestivum* L.). Weed Bio. Manage., 5(3): 93-104. <https://doi.org/10.1111/j.1445-6664.2005.00164.x>
- Nasir, E. and Ali, S.I., 2003. Flora of Pakistan; Pakistan Agriculture Research Council. pp. 1-190.
- Pannacci, E. and Tei, F., 2014. Effects of mechanical and chemical methods on weed control, weed seed rain and crop yield in maize, sunflower and soyabean. Crop Prot., 64: 51-59. <https://doi.org/10.1016/j.cropro.2014.06.001>
- Qureshi, R., Waheed, A. and Arshad, M., 2009. Weed communities of wheat crop in District Toba Tek Singh, Pakistan. Pak. J. Bot., 41(1): 239-245.
- Rajcan, I. and Swanton, C.J., 2001. Understanding maize-weed competition: Resource competition, light quality and the whole plant. Field Crops Res., 71(2): 139-150. [https://doi.org/10.1016/S0378-4290\(01\)00159-9](https://doi.org/10.1016/S0378-4290(01)00159-9)
- Razzaq, A., Rashid, A., Islam, M. and Iqbal, A., 2013. Medicinal biodiversity of weeds and livelihood security of District Shangla, Pakistan. J. Med. Plants Res., 7(16): 1039-1042.
- Shah, S.M., Ullah, A. and Hadi, F., 2014. Ecological characteristics of weed flora in the wheat crop of Mastuj valley, district Chitral, Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res., 20(4).
- Shuaib, M., Ahmed, S., Ali, K., Ilyas, M., Hussain, F., Urooj, Z. and Hussain, F., 2019. Ethnobotanical and ecological assessment of plant resources at district Dir, tehsil Timergara, Khyber Pakhtunkhwa, Pakistan. Acta Ecol. Sin., 39(1): 109-115. <https://doi.org/10.1016/j.chnaes.2018.04.006>
- Suryavanshi, R., Bachulkar, M. and Apate, S.A., 2011. Medicinal weeds of jowar and pomegranate fields from Solapur District, Maharashtra. Nat. Env. Poll. Technol., 10(1): 123-125.
- Ullah, A., 2014. Biodiversity and ethnobotanical study of vascular plants in Malakand valley, Hindukush Range, Pakistan. Ph.D. thesis, Department of Botany, University of Peshawar 2014.
- Ullah, A. and Rashid, A., 2007. Weeds and livelihood in Mankial Valley, Hindukush Range, Pakistan. Pak. J. Weed Sci. Res., 13(1-2): 27-32.
- Waheed, A., Qureshi, R., Jakhar, G.S. and Tareen, H., 1992. Weed community dynamics in wheat crop of district Rahim Yar Khan, Pakistan. Pak. J. Bot., 41(1): 247-254.