Research Article

Dicot Flora of Malakand Pass Hills, Khyber Pakhtunkhwa, Pakistan

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Abstract | In the taxonomic study of dicot of Malakand Pass Hills a total of 113 species belonging to 54 families of Angiosperms, were recorded. Maximum genera and species were in case of Lamiaceae i.e 9 genera being (9.782%) and 11 species (9.734%) of the total genera and species followed by Asteraceae comprising 8 genera (8.695 %) and 10 species (8.849 % followed by Papilionaceae comprising 6 genera (6.521%) and 7 species (6.194 %). It was again followed by Euphorbiaceae and Solanaceae having 4 genera (4.347%) and 7 species (6.194 %) each, which were followed by Zygophyllaceae and Asclepiadaceae, consisting of 3 genera (3.260 %) and 3 species (2.654 %) followed by Moraceae comprising 2 genera (2.173%) and 4 species (3.539%). It was then followed by Mimosaceae having 2 genera (2.173%) and 3 species (2.654 %). Thus the largest dicot family in Malakand Pass Hills was Lamiaceae having 9 genera and 11 species which was followed by the largest family Asteraceae, comprising 8 genera and 10 species which was followed by Papilionaceae having 6 genera and 7 species. It was again followed by Euphorbiaceae and Solanaceae comprising 4 genera and 7 species each. The families Berberidaceae, Fumariaceae, Papaveraceae, Malvaceae Tilliaceae, Oxalidaceae, Geraniaceae, Simaroubaceae, Meliaceae, Celastraceae, Sapindaceae, Rosaceae Platanaceae, Anacardiaceae, Myrtaceae, Thymelaeaceae, Cactaceae, Ulmaceae, Cannabaceae, Cuscutaceae, Caryophyllaceae, Rubiaceae, Sapotaceae, Myrsinaceae, Convolvulaceae, Fagaceae, Plumbaginaceae, Boraginaceae, Scrophulariaceae, Vitaceae, Violaceae, Saliaceae and Acanthaceae, were represented by single genus and single specie. Ranunculaceae, Brassicaceae, Apiaceae, Uriticaceae, Nyctiginaceae, Polygonaceae, Amaranthaceae, Chenopodiaceae, Oleaceae, Verbenaceae and Plantaginaceae were represented by 2 species each. Zygophyllaceae, Rhamnaceae, Mimosaceae, and Asclepiadaceae are represented by 3 species each. Moraceae is represented by 4 species. Euphorbiaceae, Solanaceae, Papilionaceae were represented by 7 species each. Asteraceae and Lamiaceae were represented by 10 and 11 species, respectively.

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Introduction

Malakand is a district of Khyber Pakhtunkhwa province of Pakistan. It was formed in 1970 as provincially administrated tribal area known as Malakand protected area. The name Malakand was originally derived from the word Mlakandao which means curved like the backbone of human body. It

is also said that the name Malakand was coined due to its steep nature. The visitors climbing the hills of Malakand would complain of backache and thus ask for a local tonic named kund which was used against backache i.e the visitor used to say Malakund. In pushto the word mala means I need or for me and kund is that tonic used against backache. In this way the name Malakand was coined to this area. Whatever the origin of the word Malakand is, it is clear from the name that Malakand would be a steep place which would be difficult to climb on.

Flora and fauna

The area is floristically rich and the vegetation is characteristically sub-tropical. The flora of Malakand include *Morus* sp (Toot), *Melia azerdarach* (Bakaian), *Dalbergia sissoo* (Shesham), *Allenthus altissima* (Shandia), *Popolus* sp. (Sufaida), *Pinus* sp. (Nakhtar), *Acacia modesta* (Palosa), *Acacia nilotica* (Kekar), *Eucalyptus camaldulenses* (Lachi), *Olea ferruginea* (Khona) *Dodonea viscose* (Gwalarsky), *Pistacia integrrima*, *Carrisa spinarum*, *Zizyphus mauritiana*.

The vegetation of the area is disturbed mainly by human activities. The increasing population and demand for fire wood and timber purpose reduced tree cover severely.

The fauna of Malakand includes Hare, Wolf, Deer, Monkey, Leopard, and Jackal. However with deforestation the fauna has become scare.

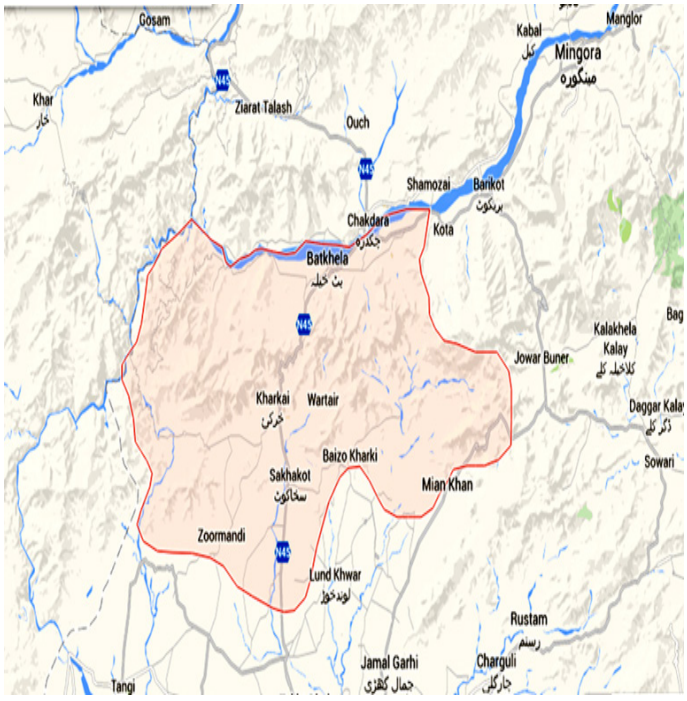

Figure 1: *Map of the research area.*

Dicot or dicotyledon

The dicot also known as dicotyledon is one of the two groups into which all the flowering plants are divided. The name refers to one of the typical characteristics of the group, namely that the seed typically has two cotyledons. There are around 200,000 species in this group. Most common garden plants, shrubs, trees and broad-leafed flowering plants such as magnolias, roses, geraniums, and hollyhocks are dicots.

Largely from 1990 onwards, molecular phylogentic research confirmed what had already been suspected, namely that dicotyledons are not a monophyletic group. Rather a number of lineages such as the magnolids and groups now collectively known as the basal angiosperms diverged earlier than the monocots did. The traditional dicots are thus a paraphyletic group. The largest clade of the dicotyledons is known as eudicots. They are distinguishing from all other flowering plants by the structure of their pollen. Other dicotyledons have monosulcate pollen or forms derived from it, whereas eudicots have tricolpate pollen, or derived forms, the pollen having three or more pores in furrows called colpi.

Common features of the dicots

Dicots have two seed leaves inside the seed coat. They are usually rounded because they contain the endosperm to feed the embryo. When a dicot germinates, it produces two seed leaves. They contain the food for the new plant so they are usually fatter than the true leaves. Leaves of the dicot come in many different shapes and sizes. The leaves are net-veined in most, which means the vessels that conduct water and food show a meshlike pattern i.e the veins go from the central midrib to the edge of the leaf, crossing and joining to form a netted pattern all over the leaf. The stomata on the leaf surfaces are scattered and are in various orientation. In the stem the vessels are usually arranged in a continous ring near the stem surface. The stems of the dicots are usually tough. About 50 percent of all dicot species are woody, they show an annual increase in the stem diameter as a result of the production of new tissue by the cambium, a layer of the cells that remain capable of division throughout the life of these plants. The vascular bundles are arranged in concentric circles in the stem. They sometime have stipules at the base of the leaf. The root is often a single long tap root with smaller roots growing from it. The flowers of the dicots usually have flowers parts in fours (tetramerous) or fives (pentamerous) are

multiples there of, although there are exception. The calyx is a separete ring of sepals under the corolla and is usually green. The seed pod or fruits and the seeds of dicots are very variable in size, shape and texture. The seed can have any number of chambers, from none to many. There are often more seeds in a seed pod than in monocot seed pod.

Materials and Methods

Regular study trips were arranged to the research area during 2013-14. Plants specimens were collected carefully with their full structure (stem, leaves, flowers etc) from Malakand Pass Hills. During the process of collection photographs were also taken. After collection specimens were placed in folded news paper, dried and pressed for about two weeks to get them more preserved and dried. At same time, the plants were numbered and marked with data, location and other characteristics of species.

The plants samples were mounted on herbarium sheets. Plants were identified with the help of literature i-e catalogue, various volume of Flora of Pakistan, (Nasir and Ali, 1971-1994; Ali and Qaiser, 1995-2010). Wild flowers of Pakistan and herbarium specimens of Peshawar University Herbarium (PUH).

Results and Discussion

Taxonomic description

Table 1: *Key to the families.*

1a. Flowers with both calyx and corolla, petals free	2
b. Flowers with both calyx and corolla, petals united	31
2a. Carpels many and free (apocarpous)	3
b. Carpels many and fused	4
3a. Carpels few to many but the receptacle not elongated	Rosaceae
b. Carpels numerous on a elongated receptacle	Ranunculaceae
4a. Fruit a 3-valved capsule	Violaceae
b. Fruit follicles or achenes	Ranunculaceae
5a. Placentation parietal or ovules along ventral suture	6
b. Placentation basal, axile or apical	9
6a. Carpel several fruit a capsule	Papaveraceae
b. Carpel 1, Fruit berry or follicle	Ranunculaceae
7a. Flowers actinomorphic	Brassicaceae
b. Flowers zygomorphic	8
8a. Leaves alternate, pinnately divided, exstipulate; stamens 6, united into 2 tripartite groups	Fumariaceae
b. Leaves opposite, stipulate; stamens 5, united to form a cone round the stigma	Violaceae
9a. Sepals imbricate in in the bud, leaves exstipulate	Zygophyllaceae
b. Sepals valvate, leaves stipulate	10
10a. Stamens monoadelphous, united at the base with petals anthers one locular	Malvaceae
b. Stamens free or connate at the base only free from the petals anthers two locular	Tilliaceae
11a. Monocarpellary	Berberidaceae
b. Bicarpellary	12
12a. Placentation basal or free central bearing 2-many ovules ovary unilocular	Caryophyllaceae
b. Placentation axile, ovary 2-many. Locular	13
13a. Stipules absent, leaves usually alternate	Oxalidaceae
b. Stipules present, leaves opposite or whorled	14
14a. Receptacle elongated and tapering into a point, the five 1-seeded carpels coalescent round it	Geraniaceae
b. Receptacle not greatly elongated	Zygophyllaceae
15a. Leaves compound	16
b. Leaves simple	20

Table continued on next page.....

16a. Climbing by means of tendrils	Vitaceae
b. Not climbing by tendrils	Meliaceae
17a. Ovary deeply lobed	8
b. Ovary entire	19
18a. Ovary 3-lobed, flowers bisexual, fruit indehiscent	Sapindaceae
b. Ovary 2-5 lobed, flowers polygamous, fruit of 1-5 samaras	Simaroubaceae
19a. Leaves exstipulate, pinnate or 3-foliate; flowers in dense or loose terminal	Anacardiaceae
b. Leaves stipulate, decompounds; flowers in leaf opposed corymb	Vitaceae
20a. Leaves opposite	21
b. Leaves alternate	22
21a. Stamens alternate with petals; style short, not lobed	Celastraceae
b. Stamens opposite the petals; style lobed or cleft	Rhamnaceae
22a. Stamens alternate with the petals	23
b. Stamens opposite to the petals	24
23a. Ovary 3 celled, fruit a capsule	Euphorbiaceae
b. Ovary 1 celled or stamens 10	Anacardiaceae
24a. Flowers axillary or in axillary clusters; leaves stipulate, simple	Rhamnaceae
b. Flowers in leaf opposed cymose corymbs; leaves palminerve	Vitaceae
25a. Flowers zygomorphic; stamen 10 diadelphous; fruit legume	Papilionaceae
b. Flowers actinomorphic	31
26a. Petals usually valvate; fruit a legume	.Mimosaceae
b. Petals imbricate; fruit adrupe, follicle or achene	Rosaceae
27a. Placentation parietal	Cactaceae
b. Placentaion axile, basal or apical	28
28a. Leaves compound	Apiaceae
b. Leaves simple	29
29a. Leaves stipulate	Rosaceae
b. Leaves exstipulate	.Myrtaceae
30a. Ovary inferior	31
b. Ovary superior	32
31a. Flowers bisexual	Myrtaceae
b. Flowers unisexual	Fagaceae
32a. Leaves compound, pinnate	Oleaceae
b. Leaves simple or merely lobed	33
33a. Leaves palmatey 3-9 lobed petiole dilated basally	Platanaceae
b. Leaves not as above	34
34a. Perianth absent	Salicaeae
b. Perianth present	35
35a. Ovary 2-3 celled	Euphorbiaceae
b. Ovary 1 celled	36
36a. Latex watery, stipules usually deciduous	Ulmaceae
b. Latex milky, stipules persistent	Moraceae
37a. Inflorescence cyathium	Euphorbiaceae
b. Inflorescence not so	38
38a. Sepals and bracts scarious	Amaranthaceae
b. Sepals and bracts herbaceous	39
39a. Plants provided with stinging hairs, seeds with straight embryo ovules erect	Urticaceae

Table continued on next page.....

b. Plants not provided with stinging hairs, seeds with curved embryo, ovules pendulous	Cannabaceae
40a. Stamens inserted on calyx tube (perigynous)	38
b. Stamens inserted below the ovary	42
41a. Ovary 1 celled	Thymeleaceae
b. Ovary 2 or more celled	Ulmaceae
42a. Stipules forming tubular ochrea around the stem	Polygonaceae
b. Stipules absent or not forming an ochrea	43
43a. Perianth tubular, petaloid, fruit glandular	Nyctiginaceae
b. Perianth not so	44
44a. Flowers ebracteate, calyx herbaceous or fleshy	Chenopodiaceae
b. Flowers with scarious bracts and calyx	Amaranthaceae
45a. Ovary superior	46
b. Ovary inferior	55
46a. Stamens opposite the corolla lobes	47
b. Stamens alternate with the corolla lobes	49
47a. Corolla appendaged with petaloid scales inside	Sapotaceae
b. Corolla without scales inside	48
48a. Trees or shrubs, fruit a berry	Myrsinaceae
b. Herbs, fruit a capsule or one seeded utricle	Plumbiginaceae
49a. Carpels 2, free, united by their style or stigma	Asclepediaceae
b. Carpels united to form a single ovary	Boraginaceae
50a. Acaulescent herbs or rarely with leafy stem, corolla scarious	Plantiginaceae
b. Caulescent herbs and shrubs, petals colored	51
51a. Fruit of 2-4 nutlets or drupaceous	Verbenaceae
b. Fruit a few to many seeded capsule or a berry	52
52a.Sepals free, if united only at the base, style more than one, ovules 1-2 in each cell	Convolvulaceae
b. Sepals united to form a cup or a tube, style more than one, ovule numerous	Solanaceae
53a. Ovary cells many ovuled, all leaves opposite or upper alternate	Scrophulariaceae
b. Ovary cells 1-2 ovuled, leaves mostly opposite	55
54a. Ovules superposed normally supported on hard retinacula	Acanthaceae
b. Ovules lateral not supported on retinacula	Lamiaceae
55a. Inflorescence capitulum, anthers united and ovary one celled	Asteraceae
b. Inflorescence otherwise, anthers not united, ovary more than 1 celled	Rubiaceae

Conclusions and Recommendations

A total of one hundred and thirteen species (113) of dicots belonging to fifty four families (54) of Angiosperms, were recorded from Malakand Pass Hills, K.P. Maximum genera and species were in case of Lamiaceae i.e 9 genera being (9.782%) and 11 species (9.734%) of the total genera and species followed by Asteraceae comprising 8 genera (8.695 %) and 10 species (8.849 % followed by Papilionaceae comprising 6 genera (6.521%) and 7 species (6.194 %). It was again followed by Euphorbiaceae and Solanaceae having 4 genera (4.347%) and 7 species (6.194 %) each, which were followed by Zygophyllaceae and Asclepiadaceae, consisting of 3 genera (3.260 %) and 3 species (2.654 %) followed by Moraceae comprising 2 genera (2.173%) and 4 species (3.539%). It was then followed by Mimosaceae having 2 genera (2.173%) and 3 species (2.654 %). Thus the largest dicot family in Malakand Pass Hills was Lamiaceae having 9 genera and 11 species which was followed by the largest family Asteraceae, comprising 8 genera and 10 species which was followed by Papilionaceae having 6 genera and 7 species. It was again followed by Euphorbiaceae and Solanaceae comprising 4 genera and 7 species each (Table 1).

Asteraceae and Lamiaceae were represented by 10 and 11 species, respectively. The rest of the families having either 2 or 3 species each as in Table 2.

Table 2: *Distribution of genera and species in various families of dicotyledons.*

S. No	Family	No. of genera	No. of species	%age of genera	%age species
1	Acanthaceae	1	1	1.086%	0.884%
2	Amaranthaceae	2	3	2.173%	2.654%
3	Anacardiaceae	1	1	1.086%	0.884%
4	Apiaceae	2	2	2.173%	1.769%
5	Asclepiodaceae	3	3	3.260%	2.654%
6	Asteraceae	8	10	8.695%	8.849%
7	Berberidaceae	1	1	1.086%	0.884%
8	Boraginaceae	1	1	1.086%	0.884%
9	Brassicaeae	2	2	2.173%	1.769%
10	Cactaceae	1	1	1.086%	0.884%
11	Cannabaceae	1	1	1.086%	0.884%
12	Caryophyllaceae	1	1	1.086%	0.884%
13	Celastraceae	1	1	1.086%	0.884%
14	Chenopodiaceae	1	2	1.086%	1.785%
15	Convolvulaceae	1	1	1.086%	0.884%
16	Cuscutaceae	1	1	1.086%	0.884%
17	Euphorbiaceae	4	7	4.347%	6.194%
18	Fagaceae	1	1	1.086%	0.884%
19	Fumariaceae	1	1	1.086%	0.884%
20	Geraniaceae	1	1	1.086%	0.884%
21	Lamiaceae	9	11	9.782%	9.734%
22	Malvaceae	1	1	1.086%	0.884%
23	Mayrtaceae	1	1	1.086%	0.884%
24	Meliaceae	1	1	1.086%	0.884%
25	Mimosaceae	2	3	2.173%	2.654%
26	Moraceae	2	4	2.173%	3.539%
27	Myrsinaceae	1	1	1.086%	0.884%
28	Nyctaginaceae	2	2	2.173%	1.769%
29	Oleaceae	2	2	2.173%	1.769%
30	Oxalidaceae	1	1	1.086%	0.884%
31	Papaveraceae	1	1	1.086%	0.884%
32	Papilionaceae	6	7	6.521%	6.194%
33	Plantaginaceae	1	2	1.086%	1.769%
34	Platanaceae	1	1	1.086%	0.884%
35	Plumbaginaceae	1	1	1.086%	0.884%
36	Polygonaceae	2	2	2.173%	1.769%
37	Ranunculaceae	1	2	1.086%	1.769%
38	Rhamnaceae	1	3	1.086%	2.654%
39	Rosaceae	1	1	1.086%	0.884%
40	Rubiaceae	1	1	1.086%	0.884%
41	Saliaceae	1	1	1.086%	0.884%
42	Sapindaceae	1	1	1.086%	0.884%
43	Sapotaceae	1	1	1.086%	0.884%
44	Scrophulariaceae	1	1	1.086%	0.884%
45	Simaroubaceae	1	1	1.086%	0.884%
46	Solanaceae	4	7	4.347%	6.194%
47	Thymelaeaceae	1	1	1.086%	0.884%
48	Tiliaceae	1	1	1.086%	0.884%
49	Ulmaceae	1	1	1.086%	0.884%
50	Urticaceae	2	2	2.173%	1.769%
51	Verbenaceae	2	2	2.173%	1.769%
52	Violeceae	1	1	1.086%	0.884%
53	Vitaceae	1	1	1.086%	0.884%
54	Zygophyllaceae	3	3	3.260%	2.654%

Table continued on next column.....

1. ***Ranunculus sceleratus*** Linn.

2. ***Ranunculus muricatus*** Linn.

3. ***Berberis lyceum*** Royle

4. ***Fumaria indica*** (Hausskn.)

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13. ***Geranium rotundifolium*** L.

14. ***Fagonia indica*** Burm.

15. ***Tribulus terrestris*** Linn.

16. ***Melia azedarach*** Linn.

33. ***Opuntia dillenii*** (Ker Gawler) Haworth.

34. ***Scandix pecten*-veneris** Linn.

39. ***Urtica dioica*** Linn.

40. ***Debregeasia saeneb*** (Forsskål)

Novelty Statement

This study provides a comprehensive overview of the Dicot flora of Malakand, including detailed species descriptions, distribution maps, and habitat information. The study also identifies several new records for the region and provides insights into the conservation status of the Dicot flora. The findings of this study have several implications for the conservation of the Dicot flora of Malakand. The study provides a valuable baseline for future monitoring and research efforts. The study also identifies several threatened species that need urgent conservation action.

Author's Contribution

Siraj ud Din: Selection of area and selection of the study which should be carried out, designed methodology of research.
Muddasir Khan: Data collection from the site, plants identification, plants specimens preservation on herbarium sheet.
Muhammad Farooq and Sanam Zarif: Description of the collected plants, analysis and review.

Conflict of interest
The authors have declared no conflict of interest.

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