

Taxonomic Study of Wild Plants in The Great Zab Area, The Borders of Bakhma Dam (Miro), Kurdistan Region, Iraq

Shaaban Karasul Abbas

Department of Biology/Collage Education of Shaqlawa/Salahaddin University-Erbil

[Email: Shahban.Abbas@su.edu.krd](mailto:Shahban.Abbas@su.edu.krd)

Abstract

The Identification and naming of plants has attracted a lot of attention throughout history. The science that investigates, identifies, describes, naming of the plant and classifies all plants. Plant taxonomy includes the description of the variation of plants, the observation of the characters like morphological, anatomical and phylogenic characters of the plants, variation, comparison and the manipulation of the data obtained from the previous information/ data is useful to arrange plants in a system of classification. Botanical survey has been conducted in this investigation in the Great Zab area, the borders of Bakhma dam (MRO) region, this survey includes many types of vascular wild plants, which are distribute on the mountain and adjacent area. Field survey duration was from beginning of spring season at March of 2025 to November of the same year. From the studied area Wild plants include 216 species were identified in 55 families and 170 genera. It seems that about 188 (87.03%) of the whole plants are herbs which comprise the majority of plants, trees about 6 (2.7%) species, the shrubs are 13 (6%), sub shrubs about 6(2.7%) species, and the ferns are the least number of 3 (1. 3%) species. All plant species were determined are new record according to surveyed area.

Keywords: Taxonomy, Bakhma, wild plants, species.

Introduction

Plant taxonomy is the branch of botanical science that deals with naming, describing, and classifying plants based on shared characteristics. These collections provide critical reference material for taxonomic research, allowing comparisons across regions and generations. Plant taxonomy provides the structural framework for understanding and organizing plant diversity [1]. Bekhme Dam is

an unfinished multi-purpose rock-fill dam on the Great Zab 60 km northeast of Erbil, Iraq. Construction on the dam began in the 1979 and was halted during the Iran-Iraq War, and in 1990, prior to the Gulf War. The Greater Zab river basin originates from the mountainous area of south-eastern Turkey where it springs is at an altitude of 4,168 m above sea level [2]. Classifying plants helps at ensuring the

protection and survival of all natural life [3]. The science that explores, describes, names, and classifies all plants is called 'Taxonomy', [4]. The main objectives of plant taxonomy are to describe the Vegetable Kingdom and to classify it in distinguishable unities (taxa, taxon) [5].

This old classification only based on morphology is now called "classical" classification [6]. An analysis of the distribution of species by physiographic regions and districts shows that the northern regions are the most species rich, with the mountain region containing 40% of the total flora [7]. The present study was aimed to document the present flora of the studied area contribute to the updating of Sudan's flora. Plant surveying is the process of recording and collection of all plants which can be seen of the study area, survey intensity needs to reflect the circumstances of the study site, including development plans, habitat conditions, vegetation density, terrain, physiognomy, size of the area, and the expected visibility of rare plant [8]. Objectives for surveys may be to detect new invaders early, to locate the maximum number of species, to locate the most populations of a single (known) species, or to gather landscape-level data [9]. In order to collect sufficiently robust data should be an entire survey season encompassing spring, summer,

autumn and winter periods will need to be available, surveys should be conducted during the fruiting and flowering season of the particular species of interest.

Study Area

The study area is considered to be a part of Arabian plate, located within High Folded Zone of the Zagros Fold-Thrust Belt in the Iraqi Kurdistan Region. The yet unfinished Bekhme Dam on the Great Zab river has located 100 km from Erbil city in Khalifan district boundary and Duhok Governorate, Beckma Dam District and Khalifan sub district is a town of Soran city in Erbil Governorate in Kurdistan Region, Iraq. Study area is part of the mountain region Rowanduz district (MRO), according to Guest division (1966). The northern mountains of Iraq in Kurdistan are an extension of the alpine system that runs eastward from the Balkans through southern Turkey, northern Iraq, Iran and Afghanistan, eventually reaching the Himalayas, in Iraq the mountains in the Amadiyah, Rowanduz and Sulimaniyah districts have the highest number of endemic and near endemic species [10]. Study area is part of the mountain region Rowanduz district (MRO), according to Guest division (1966). Classified as low rainfall woodland savanna in clay [11], The Greater Zab river basin originates from the

mountainous area of south-eastern Turkey [12].

The river is 407 km long (290 in Iraq), it is one of the main tributaries of the Tigris river and flows into the Iraqi Kurdistan, north of the Erbil plain between latitudes 36° and 38°N and longitudes 43°18' and 44°18'E, (Figure 1). Most of the study area is dissected by many seasonal watercourses. Annual rainfall concentrates in a relatively short summer season extends from June to September [13].

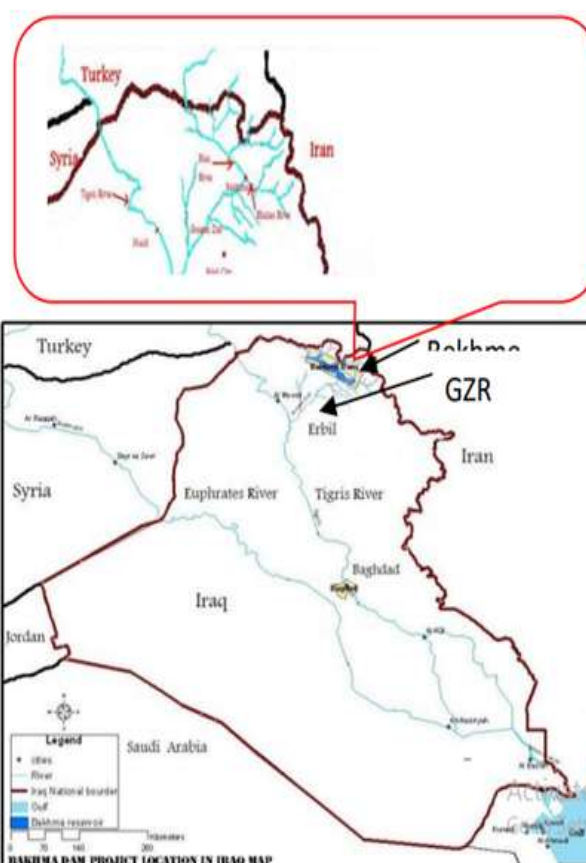


Illustration Bakhma Dam location

Materials and Methods

The Materials

Plant samples are the work's materials, which were gathered and dried using typical herbarium techniques [14]. Through the field trips about 300 plant specimens were collected from the studied area. All specimens collected during the field study were identified, numbered, classified, and deposited in the laboratory of Shaqlawa Education College - Biology department, Salahaddin University-Erbil/Iraq. Field trips were conducted from beginning of spring season at March of 2025 to November of the same year. Plant taxa were collected from various habitat types and photographed

The Methods

All plant samples or parts (for tree and shrubs) were collected from the fields and pressed in wooden trellis and most of the taken species were photographed in their habitat and then morphologically identified using the following references.

As the main flora works: Flora of Iraq by [15] vol 3, [16] vols 1, 2, 3, 4, 8, 9, [17], 2016), [18], [19], Flora of Iranica by [20] and Flora of Turkey by [21] were used intensely.

Results and Discussion

Systematic Plant List

The families, genera and species which found in this study represented in alphabetical order, as follow;

Families/Species	Life form
1. ACERACEAE	
1. <i>Acer monspessulanum</i> L.	Tree
2. ADIANTACEAE	
1. <i>Adiantum capillus-veneris</i> L.	Fern-Herb
2. <i>Cheilanthes persica</i> (Bory) Mett. Kuhn.	Fern-Herb
3. ALLIACEAE	
1. <i>Allium ampeloprosom</i> L.	Herb
2. <i>Allium stamineum</i> Boiss.	Herb
4. ANACARDIACEAE	
1. <i>Pistacia eurycarpa</i> Yalt.	Tree
2. <i>Pistacia khinjuk</i> Stocks.	Shrub
3. <i>Rhus coriaria</i> L.	Shrub
5. APIACEAE (UMBELLIFERAE)	
1. <i>Ainsworthia trachycarpa</i> Boiss.	Herb
2. <i>Ammi majus</i> L.	Herb
3. <i>Anthriscus cerefolium</i> (L.) Hoffm.	Herb
4. <i>Eryngium campestre</i> L.	Herb
5. <i>Lagoecia cuminoides</i> L.	Herb
6. <i>Lisaea strigosa</i> (Banks & Sol.) Eig.	Herb
7. <i>Scandix pecten-veneris</i> L.	Herb
8. <i>Scandix stellata</i> Banks & Sol.	Herb
9. <i>Smyrniium cordifolium</i> Boiss.	Herb
10. <i>Torilis leptophylla</i> (L.) Rchb. f.	Herb
11. <i>Turgenia latifolia</i> (L.) Hoffm.	Herb
6. APOCYNACEAE	
1. <i>Nerium N. oleander</i> L.	Shrub
7. ARACEAE	
1. <i>Arum</i> sp. (Arum lilies).	Herb
2. <i>Biarum carduchorum</i> (Schott) Engl.	Herb
3. <i>Eminium spiculatum</i> (Blume) Schott.	Herb
8. ARISTOLOCHIACEAE	
1. <i>Aristolochia bottae</i> Jaub. & Spach.	Herb
9. ASPARAGACEAE	
1. <i>Bellevalia kurdistanica</i> Feinbrun.	Herb
2. <i>Bellevalia longipes</i> post.	Herb
3. <i>Muscari longipes</i> Boiss.	Herb
5. <i>Ornithogalum kurdicum</i> Bornm.	Herb
10. ASPLENIACEAE	
1. <i>Cetarach officinarum</i> DC.	Fern-Herb
11. ASTERACEAE (COMPOSITAE)	
1. <i>Anthemis haussknechtii</i> Boiss. & Reut.	Herb
2. <i>Anthemis pseudocotula</i> Boiss.	Herb
3. <i>Callendula arvensis</i> .	Herb
4. <i>Carduus pycnocyephalus</i> L.	Herb
5. <i>Carlina corymbosa</i> L.	Herb

6. <i>Carthamus oxyacantha</i> M. Bieb.	Herb
7. <i>Carthamus dentatus</i> (Forssk.)	Herb
8. <i>Centaurea behen</i> L.	Herb
9. <i>Centaurea iberica</i> Trev. ex Spreng.	Herb
10. <i>Centaurea solstitialis</i> L.	Herb
11. <i>Cichorium intybus</i> L.	Herb
12. <i>Conyza bonariensis</i> (L.) Cronquist.	Herb
13. <i>Crepis foetida</i> L.	Herb
14. <i>Crepis pulchra</i> L.	Herb
15. <i>Crupina</i> <i>crupinastrum</i> (Moris) Vis.	Herb
16. <i>Echinops</i> . sp.	Herb
17. <i>Echinops</i> <i>spinosissimus</i> L.	Herb
18. <i>Gundelia tournefortii</i> L.	Herb
19. <i>Hedypnois</i> <i>rhagadioloides</i> (L.) F.W.Schmidt.	Herb
20. <i>Lactuca serriola</i> L.	Herb
21. <i>Lapsana grandiflora</i> M.Bieb.	Herb
22. <i>Matricaria aurea</i> (Loefl.) Sch.Bip.	Herb
23. <i>Notobasis syriaca</i> L.	Herb
24. <i>Onopordum</i> <i>carduchorum</i> Bornm. & Beauverd.	Herb
25. <i>Picnomon acarna</i> (L.) Cass.	Herb
26. <i>Rhagadiolus stellatus</i> (L.) Gaertn.	Herb

27. <i>Scorzonera pseudolanata</i> Grossh.	Herb
28. <i>Senecio vernalis</i> Waldst. & Kit.	Herb
29. <i>Senecio vulgaris</i> L.	Herb
30. <i>Silybum marianum</i> (L.) Gaertn.	Herb
31. <i>Sonchus asper</i> (L.) Hill.	Herb
32. <i>Xanthium strumarium</i> L.	Herb
12. BERBERIDACEAE	
1. <i>Bongardia chrysogonum</i> (L.) Spach.	Herb
13. BORAGINACEAE	
1. <i>Anchusa azurea</i> Mill.	Herb
3. <i>Echium italicum</i> L.	Herb
4. <i>Onosma alborosea</i> Fisch. & C. A. Mey.	Herb
5. <i>Onosma rostellatum</i> Lehm.	Herb
14. BRASSICACEAE (CRUCIFERAE)	
1. <i>Alyssum strigosum</i> Banks & Sol.	Herb
2. <i>Biscutella didyma</i> L.	Herb
3. <i>Brassica nigra</i> L.	Herb
4. <i>Capsella bursa-pastoris</i> (L.) Medik.	Herb
5. <i>Clypeola jonthlaspi</i> L.	Herb
6. <i>Isatis</i> L.	Herb
7. <i>Lepidium draba</i> L.	Herb
8. <i>Nasturtium officinale</i> R.Br.	Herb
9. <i>Sinaps arvensis</i> L.	Herb
10. <i>Sisymbrium irio</i> L.	Herb
11. <i>Sisymbrium officinale</i> L.	Herb
12. <i>Thlaspi perfoliatum</i> L.	Herb

15. CAMPANULACEAE	
1. <i>Campanula erinus</i> L.	Herb
2. <i>Michauxia nuda</i> A.DC.	Herb
16. CAPPARIDACEAE	
1. <i>Capparis spinosa</i> L.	Shrub
17. CAPRIFOLIACEAE	
1. <i>Cephalaria syriaca</i> (L.) Schrad. ex Roem. & Schult.	Herb
2. <i>Pterocephalus kurdicus</i> Vaill. ex Adans.	Sub shrub
3. <i>Scabiosa palaestina</i> L.	Herb
18. CARYOPHYLLACEAE	
1. <i>Arenaria Leptoclados</i> (Rchb.) Guss.	Herb
2. <i>Cerastium glomeratum</i> Thuill.	Herb
3. <i>Dianthus strictus</i> Banks et Sol.	Herb
4. <i>Gypsophila pilosa</i> Huds.	Herb
5. <i>Holosteum umbellatum</i> L.	Herb
6. <i>Minuartia hamate</i> (Hausskn.) Mattf.	Herb
7. <i>Silene conoidea</i> L.	Herb
8. <i>Silene dichotoma</i> Ehrh.	Herb
9. <i>Vaccaria hispanica</i> Mill.	Herb
19. CISTACEAE	
1. <i>Helianthemum ledifolium</i> (L.) Mill.	Herb
20. CONVOLVULACEAE	
1. <i>Convolvulus arvensis</i> L.	Herb

2. <i>Cuscuta</i> sp.	Herb
21. CRASSULACEAE	
1. <i>Umbilicus horizontalis</i> (Guss.) DC.	Herb
22. CUCURBITACEAE	
1. <i>Bryonia multiflora</i> Boiss. & Heldr.	Herb
2. <i>Citrullus colocynthis</i> (L.) Schrad.	Herb
23. CYPERACEAE	
1. <i>Carex pachystylis</i> J.Gay.	Herb
2. <i>Cyperus rotundus</i> L.	Herb
3. <i>Schoenus nigricans</i> L.	Herb
4. <i>Scirpoides holoschoenus</i> (L.) sojak.	Herb
24. EUPHORBIACEAE	
1. <i>Andrachne telephoides</i> L.	Herb
2. <i>Chrozophora tinctoria</i> (L.), Raf.	Herb
3. <i>Euphorbia aleppica</i> L.	Herb
4. <i>Euphorbia chamaesyce</i> L.	Herb
5. <i>Euphorbia helioscopia</i> L.	Herb
6. <i>Euphorbia macroclada</i> Boiss.	Herb
7. <i>Euphorbia petiolata</i> Banks & Sol.	Herb
27. FABACEAE (LEGUMINOSAE)	
1. <i>Alhagi graecorum</i> Boiss.	Sub shrub
2. <i>Astragalus spinosus</i> (Forssk.) Muschl.	Sub shrub
3. <i>Glycyrrhiza glabra</i> L.	Sub shrub
4. <i>Hippocrepis unisiliqua</i> L.	Herb

5. <i>Hymenocarpus circinnatus</i> (L.) Savi	Herb
6. <i>Lathyrus annus</i> L.	Herb
7. <i>Medicago constricta</i> Durieu.	Herb
8. <i>Medicago lupulina</i> L.	Herb
9. <i>Medicago minima</i> (L.) L.	Herb
10. <i>Medicago orbicularis</i> (L.) Bartal.	Herb
11. <i>Medicago radiata</i> L.	Herb
12. <i>Onobrychis crista-galli</i> (L.) Lam.	Herb
13. <i>Prosopis farcta</i> (Banks & Sol.) J.F.Macbr.	Shrub or Sub shrub
14. <i>Scorpiurus muricatus</i> L.	Herb
15. <i>Trifolium cherleri</i> L.	Herb
16. <i>Trifolium fragiferum</i> L.	Herb
17. <i>Trifolium hirtum</i> L.	Herb
18. <i>Trifolium pilulare</i> Boiss.	Herb
19. <i>Trifolium stellatum</i> L.	Herb
20. <i>Trifolium tomentosum</i> L.	Herb
21. <i>Vicia narbonensis</i> L.	Herb
22. <i>Vicia palaestina</i> Boiss.	Herb
23. <i>Vicia sativa</i> L.	Herb
26. FAGACEAE	
1. <i>Quercus aegilops</i> L.	Tree
2. <i>Quercus infectoria</i> Oliv.	Tree
27. GERANIACEAE	
1. <i>Erodium cicutarium</i> (L.) L'Hér.	Herb
2. <i>Erodium malacoides</i> (L.) L'Hér.	Herb

3. <i>Geranium molle</i> L.	Herb
28. HYPERICACEAE (GUTTIFERAE)	
1. <i>Hypericum triquetrifolium</i> Turra. Farsetia nov.	Herb
29. IRIDACEAE	
1. <i>Gladiolus italicus</i> Mill.	Herb
2. <i>Gynandris sisyrinchium</i> (L.) Parl.	Herb
30. JUNCACEAE	
1. <i>Juncus bufonius</i> L.	Herb
2. <i>Juncus inflexus</i> L.	Herb
31. LAMIACEAE (LABIATAE)	
1. <i>Ajuga chamaepitys</i> (L.) Schreb.	Herb
2. <i>Clinopodium vulgare</i> L.	Herb
3. <i>Lamium amplexicaule</i> L.	Herb
4. <i>Mentha longifolia</i> (L.) Huds.	Herb
5. <i>Molucella laevis</i> L.	Herb
6. <i>Phlomis kurdica</i> Rech.f.	Sub shrub
7. <i>Salvia spinosa</i> L.	Herb
8. <i>Vitex agnus-castus</i> L.	Shrub
9. <i>Ziziphora capitata</i> L.	Herb
32. LINACEAE	
1. <i>Linum strictum</i> L.	Herb
33. MALVACEAE	
1. <i>Alcea kurdica</i> Alef.	Herb
2. <i>Malva neglecta</i> Wallr.	Herb

34. MORACEAE	
1. <i>Ficus carica</i> L.	Shrub
35. MYRTACEAE	
1. <i>Myrtus communis</i> L.	Shrub
36. ORCHIDACEAE	

1. <i>Ophrys schulzei</i> Bornm. & Fleischm.	Herb
2. <i>Orchis collina</i> Banks & Sol. ex Russell.	Herb
37. OROBANCHACEAE	
1. <i>Orobanche kurdica</i> Boiss. and Hausskn.	Herb
2. <i>Parentucellia latifolia</i> (L.) Caruel.	Herb
38. PAPAVERACEAE	
1. <i>Fumaria asepalae</i> Boiss.	Herb
24. <i>Papaver rhoeas</i> L.	Herb
39. PLANTAGINACEAE	
1. <i>Linaria chalepensis</i> (L.) Miller.	Herb
2. <i>Plantago afra</i> L.	Herb
3. <i>Plantago cretica</i> L.	Herb
4. <i>Plantago lanceolata</i> L.	Herb
5. <i>Veronica anagallis aquatic</i> L.	Herb
40. POACEAE (GRAMINEAE)	
1. <i>Aegilops ovata</i> L.	Herb
2. <i>Avena barbata</i> Pott ex Link	Herb
3. <i>Avena fatua</i> L.	Herb
4. <i>Bromus danthoniae</i> L.	Herb
5. <i>Bromus lanceolatus</i> Roth.	Herb
6. <i>Bromus scoparius</i> L.	Herb
7. <i>Catapodium rigidum</i> (L.) C.E.Hubb.	Herb
8. <i>Chrysopogon gryllus</i> (L.) Trin.	Herb
9. <i>Cynodon dactylon</i> L. Pers.	Herb
10. <i>Echinochloa colonum</i> L.	Herb
11. <i>Hordeum bulbosum</i> L.	Herb

12. <i>Hordeum glaucum</i> Steud.	Herb
13. <i>Imperata cylindrica</i> (L.) P.Beauv.	Herb
14. <i>Lolium rigidum</i> Gaud.	Herb
15. <i>Lolium temulentum</i> L.	Herb
16. <i>Phalaris minor</i> Retz.	Herb
17. <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Herb
18. <i>Poa annua</i> L.	Herb
19. <i>Poa bulbosa</i> L.	Herb
20. <i>Polypogon monspeliensis</i> (L.) Desf.	Herb
21. <i>Setaria glauca</i> (L.) P.Beauv.	Herb
22. <i>Sorghum halepense</i> (L.) Pers	Herb
23. <i>Taeniatherum asperum</i> (Simonkai) Nevski.	Herb
25. <i>Vulpia ciliata</i> Link.	Herb
41. POLYGONACEAE	
1. <i>Rhuem ribes</i> L.	Herb
2. <i>Rumex crispus</i> L.	Herb
42. PORTULACEAE	
1. <i>Portulace oleracea</i> L.	Herb
43. PRIMULACEAE	
1. <i>Anagallis arvensis</i> L.	Herb
44. RANUNCULACEAE	
1. <i>Adonis microcarpa</i> DC.	Herb
2. <i>Ranunculus arvensis</i> L.	Herb
45. RHAMNACEAE	
1. <i>Paliurus spina-christi</i> Mill.	Shrub
46. ROSACEAE	
1. <i>Crataegus azarolus</i> L.	Large shrub
2. <i>Prunus L.arabica</i> (Oliv.) Meikle.	Shrub
3. <i>Prunus microcarpa</i>	Shrub

(Bornm.') Meikle.	
4. <i>Rubus sancta</i> Schreb.	Shrub
47. RUBIACEAE	
1. <i>Galium setaceum</i> Lam. subsp.	Herb
2. <i>Galium tricornutum</i> Dandy.	Herb
3. <i>Theligonium cynocrambe</i> L.	Herb
478. SALICACEAE	
1. <i>Salix alba</i> L.	Tree
49. SCROPHULARIACEAE	
1. <i>Verbascum sinuatum</i> L.	Herb
50. SOLANACEAE	
1. <i>Physalis angulata</i> L.	Herb
2. <i>Solanum nigrum</i> L.	Herb
51. TAMARICACEAE	
1. <i>Tamarix ramosissima</i> Ledeb.	Shrub
52. TYPHACEAE	
1. <i>Typha lugdunensis</i> P. Chab.	Herb
53. ULMACEAE	
1. <i>Celtis tournefortii</i> Lam.	Tree
54. URTICACEAE	
1. <i>Urtica pilulifera</i> L.	Herb
55. ZYGOPHYLACEAE	
1. <i>Tribulus terrestris</i> L.	Herb

Floristic Composition and Taxonomic Diversity

The following list includes all vascular plant distribution of wild plants in the Great Zab area, the borders of Bakhma. For easy referencing and reading, an alphabetic arrangement of all taxa was used from family to the variety ranks.

A total of 216 plant species from 55 families and 170 genera were identified. Of these, all of the species belonged to Spermatophyta, which included 3 taxa from Pteridophyta and 213 plant species from Angiospermae. As there showed from See (Table 2). The five largest families given as follow;

Asteraceae with 32 plant species, Poaceae with 25 plant species, Fabaceae with 23 plant species, Brassicaceae with 15 plant species, and Apiaceae 11 plant species. The largest life cycle of identified 216 vascular

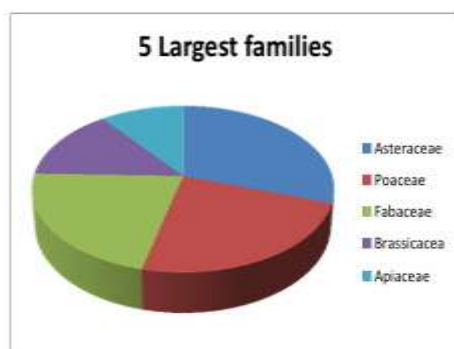
plant species are herbs with 188(%87) plant species, 13 shrubs (%6), 6 are sub shrub (%2.7), 6 trees (%2.7) and 3 ferns (%1.3), (Table 5) and (Table 6). See list of the flora in the supplement.

Table 1 Plant groups according to their taxa;

	Number of Families	Number of Genera	Number of species
Pteridophyta	2	3	3
Spermatophyta	53	167	213
Total	55	170	216

Table 2 Ratio of 5 largest families with their species number:

Family	species number	Ratio(Total flora) (for present study)%	Ratio (5 largest family)%
Asteraceae	32	14.8	32
Poaceae	25	11.5	25
Fabaceae	23	10.6	23
Apiaceae	11	5	11
Lamiaceae	9	4.1	9
Totally	100	46	100.0



Figur 2: Ratio of the 5largest plant families (Total flora)

Table 3 Habit and number of plants species;

Plant habit	species number	Ratio%
Herb	188	87%
Shrub	13	6%
Sub shrub	6	2.7%
Tree	6	2.7%
Fern	3	1.3%
Total	216	100.0%

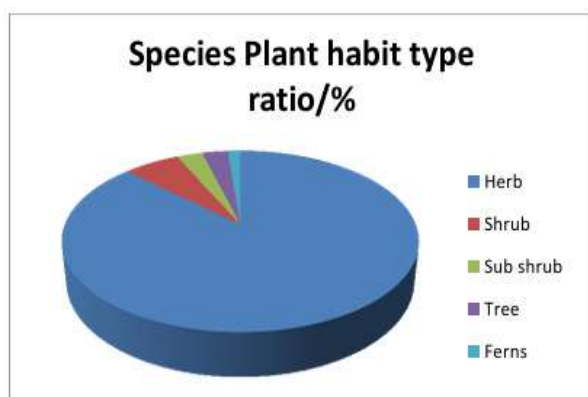


Figure 3: Ratio of plant species habit

The largest genus is *Trifolium* with 6 species (2.7%) among the identified 216 vascular plant species. Second rank belongs to *Euphorbia* with 5 species (2.3%), and *Medicago*, and *Centaurea* (2.3, 1.3%, respectively, (Table: 8).

Table 4 Comparison of species number according to 4 largest genera;

Latin Name	Number of Species	Ratio for 4 largest%	Ratio for the total flora%
<i>Trifolium</i>	6	31.5	2.7
<i>Euphorbia</i>	5	26.3	2.3
<i>Medicago</i>	5	26.3	2.3
<i>Centaurea</i>	3	15.7	1.3
Totally	19	100.0	8.6

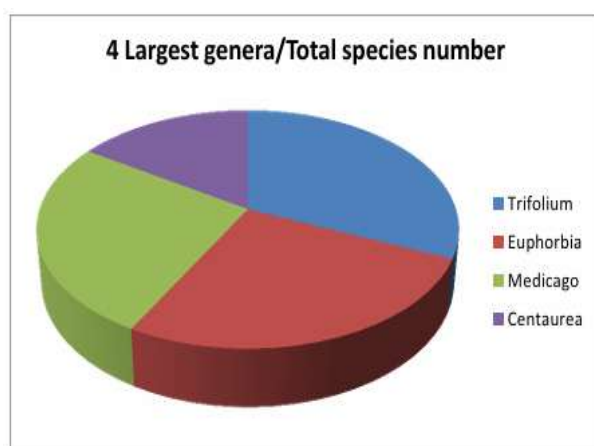


Figure 4: Plant species number according to 4 largest genera.

References

- [1] **Lawrence, G. H. (1955).** *An Introduction to Plant Taxonomy*. Central Book Depot.
- [2] **Ahmed, K. H. (2010).** *Vascular Plants of Gomaspan Strait and Their Around-Erbil/Iraq*.
- [3] **Elhariri, E., El-Bendary, N., & Hassanien, A. E. (2014).** Plant classification system based on leaf features. In *2014 9th International Conference on Computer Engineering & Systems (ICCES)* (pp. 271–276).
- [4] **Haider, N. (2018).** A brief review on plant taxonomy and its components. *The Journal of Plant Science Research*, 34(2), 277–292.
- [5] **Brandenburg, W. A., & Schneider, F. (1985).** The implications of plant taxonomy for agricultural research. *Chronica Horticulturae*, 25(1), 1–3.
- [6] **Youssef, S., Galalaey, A., Mahmood, A., Mahdi, H., & Véla, E. (2019).** Wild orchids of the Kurdistan Region areas: A scientific window on the unexpected nature of the North-Western Zagros. Online published at <https://hal.archives-ouvertes.fr/hal-02048904>
- [7] **Zohary, M. (1973).** *Geobotanical Foundation of the Middle East* (Vols. I–II). Guestav Fischer Verlag, Stuttgart.
- [8] **Nelson, J. R. (1985).** Rare plant surveys: Techniques for impact assessment. *Natural Areas Journal*, 18–30.
- [9] **Allard, G., & Moore, B. (2011).** *Invasive Species Survey Techniques: Plant Survey*. Protection and Health, Beijing.
- [10] **Ghazanfar, S. A., & McDaniel, T. (2016).** Floras of the Middle East: A quantitative analysis and biogeography of the flora of Iraq. *Edinburgh Journal of Botany*, 73(1), 1–24.
- [11] **Faris, Y. S. (1983).** *The Vascular Plants of Pira Magrun Mountain* (M.Sc. Thesis). University of Salahaddin. (In Arabic).
- [12] **Ahmed, A. H., & Akrawy, D. T. (2005).** Measurement of natural radioactivity in soil samples from Bekhma, Kurdistan Region, Iraq. *International Journal of Recent Research and Review*, 8(4).
- [13] **Ahmed Khoshnaw, A. R., & Karpuzcu, M. (2018).** Optimisation of multipurpose reservoir operation-Bekhme Dam Greater Zab River Basin, Erbil Governorate and Duhok Governorate-Iraq. *Polytechnic Journal*, 8(1), 6.
- [14] **Bridson, D., & Forman, L. (1998).** *Herbarium Handbook*. Royal Botanic Gardens, Kew.
- [15] **Townsend, C. C., Guest, E., & Al-Rawi, A. (1966).** *Flora of Iraq* (Vols. 1, 2, 3, 4, 8, 9). Ministry of

Agriculture & Agrarian Reform,
Baghdad.

[16] Townsend, C. C., & Guest, E. (1966–1985). *Flora of Iraq* (Vols. 1–8). Baghdad: Ministry of Agriculture, Iraq.

[17] Fatah, H. (2003). *The Vascular Plants of Haibat Sultan Mountain and the Adjacent Areas* (M.Sc. Thesis). University of Sulaimani, Sulaimaniya, Iraq.

[18] Khalaf, M. K. (1980). *The Vascular Plants of Sinjar Mountain* (M.Sc. Thesis). Baghdad University. (In Arabic).

[19] Ahmed, K. H. (2010). *Vascular Plants of Gomaspan Strait and Their Around-Erbil/Iraq*.

[20] Rechinger, K. H. (1965–1977). *Flora Iranica*. Akademische Druck-u Verlagsanstalt.

[21] Davis, P. H. (1972). *Flora of Turkey* (Vol. 4). Edinburgh University Press, Edinburgh.**