International Journal of Medical Toxicology & Legal Medicine **Volume 27, No. 3S, 2024**
e-ISSN: 0974-4614
p-ISSN: 0972-0448

Morphological and Palynological Systematic Study of Genus Borage (Borago officinalis L.) Family Boraginaceae in Kurdistan-Iraq

Rupak Towfiq Abdulrazaq

Department of Horticulture, Faculty of Agricultural Engineering sciences, University of Sulaimani, Kurdistan Region-Iraq .
Ph.D. Plant taxonomy, Email: rupak.abdulrazaq@univsul.edu.iq

Received: 15.09.2024 Revised: 19.10.2024 Accepted: 27.11.2024

ABSTRACT
The genus Borago L. with one wild speciesBorago officinalis L. Family Boraginaceae in Kurdistan has beeninvestigated systematicallyabout their morphological and palynological traits. Phytogeographic districts were surveyedto collect plant specimens and know their distribution. Among the morphological characters; the leaf, flower,inflorescence and fruit were important together in the identification of this species ,while the properties of calyx, corolla andpods were the most effective for that. The pollen traits such as shape, diameter and configuration were contributed inidentification of pollens which were found to be colporate.The new findings of this study are that the taxon of thisgenus which was recorded in the flora of Iraq was fully described for their morphological, (LM) palynologicaltraits for the first time.

Keywords: Borage, Systematically, Palynological traits, Colporate.

INTRODUCTION

Borage (Borago officinalis L.) Family (Boraginaceae Juss.) is annual plant and with common names Beebread, Starflower or Burrage (Ghahreman. 1978, Stace. 1984,Stuessy. 1990).Its origin is the west of Mediterranean areas, while it was distributed in the whole Mediterranean region, but has been planted in other areas neighbors such as Iran, Turkey, Spain(Ashwaq. and Maha. 2020) ,Minor Asia and India for beautification and also insect repealing purposes as well as in the Europe and New world. The borage oil and herb have mild effects on the human by using them externally.(Kumariet.al. (2023), Catharine et.al,2000).

Aerial parts have been used in old medicine in Iraq as atonic, tranquillizer, management of cough, pneumonia, sore throat, swelling and inflammatory diseases. The leaves and flower possess biological activities for cancer and heart diseases prevention (Asadi-et.al, 2014)and have antibiotic properties (8), condense cardiovascular diseases (9) and provide benefits for improving healthe due to their various biological events (Ratz-Łyko, et.al., 2014). Results reported by previous studies shown the presences of phenolics acid, flavonoids (Quercetin, Myricetin, Luteolin and Rutin) and isoflavonoid besides, the dominant individual fatty acids of methanolic extract as Oleic acid which is an unsaturated fatty acid (omega-9), linoleic fatty acids (omega-6i) and Hexadecanoic acid. Crozier,et.al.1997, Pieretti,et.al.2004).

Borago has also other medicinal usages as the mucilage from crushed foliage is useful to treat catarrh, rheumatism and some skin diseases, in addition to its benefits to the brain, being used to reduce melancholy and induce euphoria (Farhadi et.al, 2012).

MATERIALS AND METHODS

The specimens of different taxa under study growing in Iraqi Kurdistan region were directly collected from the field, this sample collecting completed in 22 trips throughout 2022 seasons. Each site were visited more than twice, the trips were in Spring and Summer, due tostudy the plants in different growth stages (vegetative growth stage and flowers and fruits).The trips havecovered mountain areas within Iraqi Kurdistan region(Sulaymaniyah District MSU,Rawanduz District MRO and Erbil District FAR). Plant growth study in those areas is wide spread, those trips identified plant environment and what is associated with it.

The specimens were studied in detail and all plant parts by Dissecting Microscope and the Compound Microscope and diagnosed correctly in the laboratory, each sample were given an identity label indicating the scientific name, number and date and place of collection, soil type and height above sea level measured by (GPS) Global positioning system of the type (Garmin Rino 110) and recorded some environmental observations as well as the name of the collector. Through what has collected during field trips as well as herbarium samples,

some Iraqi herbarium installations, flower period growth were set to study. And most of the plants were photographed in the field during trips so as to indicate the type of environment in which they live for the General Authority for plants.

RESULTS AND DISCUSSION

1.Morphological Study:

Habit and Duration: The plants of the genus BoragoL. are herbs, distributed naturally in Mediterranean regions. Europe, Minor Asia ,and South and North America. It has only one species of this genus in Iraq and Kurdistan region distributed as a herb also which is Borago officinalis L.

Root System:The species Borago officinalishas a normal tap root system classification. The root has the least taxonomic value to be depended on it because of difficulty in taking measurements and observing root traitsas it is exposed to damages during taking samples.

Stem: The stem is about 25-50 cm long ,usually branched and covered in rough densely bristly hairs, throw out the leaves and inflorescence also.

Leaves:The leaves are simple, alternate with an obtuse apex andcrenate margin. Basal leaves stalked,broadly elliptic or egg-shaped; uppermost sessile,smaller,narrower. Blade elliptic–ovate, entire, quite fleshy, hairy. The leaves have dark -green upper surface with greyish green lower due to the prickly hairs.5 - 12 cm long, 3 - 7 cm wide.

Stipules: The leaves of this species are estipulate.

Leaf petiole : The upper leaves are sessile or shortly petiolate while the lower ones show a decurrent petiole.

Bract: The bracts are simple, Leafy and green in color,7mm Long and 7mm wide, covered in densely bristly hairs.

Flowers:The flowers of the studied species are usuallyarise along ascorpioid cymeinflorescence.The flower isperfect,pentamerous, actinomorphic, 13–15 mm wide in sizeand blue in color.

Peduncle:The flowers of the studied species in Kurdistan of Iraq have peduncle 10 mm long.

Calyx:The calyx consists of 5 distinct or deeply connate sepals at base, lobes narrow, tapered. Calyx is 17-19 mm long and 3-4 mm wide.deltoid--ovate lobes.The inner surface of the calyx is glabrous and the upper surface is densely tomentose

Corolla:The corolla isblue,rotate, sympetalous, the tube very short, the limb 4.5- 5 mm long withfive imbricated acute lobed, pentamerous,7.5-10 mm long and3.5-4.5mm wideand often has small appendages(fornices) in the throat.

Androecium:The male reproductive organ of this species consists of stamen each of form filament and anther ,five distinct stamens adnate to the corolla tube or perigynous zone in an stack.0.5mm long and 0.5mm wide, and alternate with the corolla lobes.

Filament:Filaments dilated below, narrowed above into a slender appendage 8.5-10mm long.

Anther : Antherof the species B.officinalisis linear, erect, and connivent into a cone 0.5mm long, 0.5mm wide.

Gynoecium: The female reproductive organ of the species under study consists of abicarpellate with four ovules,pistil in 3parts Stigma , Style and Ovary, superior ovary; one long style positioned through center of the anther cone; and one stigma.

Stigma: Stigma capitates and warty surrounding ovary as a crown. The stigma is terminal.

Style:The style is gynobasic and hollow, filiform,style 10-12 mm long.

Ovary: The ovary is superior, bicarpellate with four ovules, The ovary in the studied species isovoid,2.5-3x1-2 mm diameter , densely sericeous, 5 Nectary disk is present.

Fruit: The fruit is 4-parted schizocarp four drupe , ovoid, erect, 8.5 - 11.0 mm long,attached by their bases to the flat receptacle, the scar of attachment large, concave.The colour is orange or bright red at maturity and their shape is sub-globose .While the drupe surface is sericeous.

Seeds: Seed is a mature ovule that forms after the processes of pollination and fertilization. Seeds is drupe 0.5mm in size.

Figure 1: The type of Leave,flower and seed of the species under study

2.Palynological Study

Introduction

The morphological information of pollen is useful for different related sciences such as Aeropalynology, Paleobotany, Paleoecology, Systematic Botany, Criminology, Allergy, some geological aspects like and coal field and , medico-palynology of the drugs and some related sciences of honey improvement such as mellittopalynology and copropalynology,(Muhammed. 2010). The morphology of Pollen is important in separation of the taxa at different levels of hierarchy (Diez, 1983).

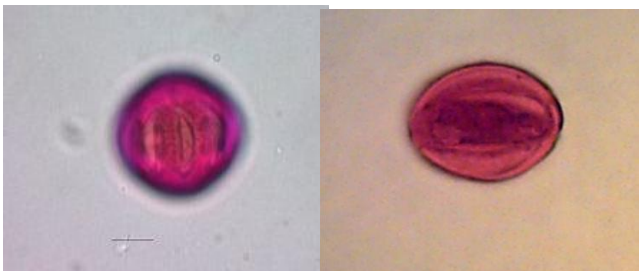
The palynology science was aiding in the answering for complex questions in many taxonomic studies. According to (Gupta, 1971Abdul-Razaq,2008),the significance of palynology as much as that of the morphological characters of different plant parts. Sharma and Sharma ,1972) indicated the role of palynology in detecting and linking the evolutionary and natural relationships between different taxa. Lindley (1830) was the first who's used pollen study in isolating and classifying the genera of family Orchidaceae. In Iraq ,(Al-Mashhadani, 2000)referred tonumerous taxonomic values of the pollen and its important characters, such as the size of pollen grain, apertures or pores, furrows, their numbers in one grain and the type of ornamentation on the surface of grain. While many specialists like(Wodehouse, 1935; Erdtman, 1969)and Davis and Heywood, 1973) in the last century, have considered such characters in studying pollen grains.

MATERIALS AND METHODS

The pollen grains obtained from anthers of mature floral buds have been collected during the field trips of the studied species and preserved in ethanol 70%. Anthers were set in a watch glass and added into it some drops of Glycerin Safrannin pigment as indicated in the procedure by (Al-Mayah, 1983 and Abdul-Razaq, 2008,and Mohamed ,2010). The anthers have been opened by twominute anatomical needles and crushed to extract the pollen and exposed to the pigment. The pollens have been crushed by dropper and put on a clean glass slide, put the cover gently and then examined under the power zoom (40X) of a compound light microscope type Olympus. This study used samples collected previously from different locations of the visited districts of Iraqi Kurdistan in order to take in the consideration variations from different environments, (25-30) pollen grains were studied and the dimensions of each grain in the (P) Polar view and the (E) Equatorial view; and exine thickness were measured and range value was recorded for each measurement using the Ocular micrometer. Pollen shapes were described in detail in (Figures 5 and 6) and pictured using oil lenses of compound light microscope type Olympus.

3. RESULTS AND DISCUSSION

Thepollen grains of this species have been studiedfor the firsttime in Iraq. The results ofthe current study have statedthatpollengrains of the studiedspecies aremonomorphicwhichhaspollen grains in one type or shape,prolate to subprolate spheroidal. Oval-shaped with protrusions at Equatorial view; rounded shaped in polar view, aperture types: pollen grains colporate.With regard tograins sizeandbased on (Erdtman 1971) , it has found that the pollen grain have different sizes , it been divided (Small,Medium and large),it is small when the length of equatorial axis not more than 20 micrometer ,medium when 25 micrometer and large size at 40 micrometer The current study has indicated that the resultshave shown thatthe dimension of polar axis is 30.2-34.4 micrometerand the dimension of equatorialaxis is ranged between 26.3-30.7micrometer respectively .The shape index (P/E) is 0.99. The current study has indicated that the size of pollen grain is in the medium range. Where theshape ofpollen grains is uniformly spheroidaland ,Exine, the thickness ofthe wallofthe pollengrains israngingfrom 0.50-0.70micrometerin the studied species, as it shown in the figure(2).



Polarview (P). Equatorialview (E)

Figure 2. Pollen photomicrograph Borago officinalis. View equatorial (E) and polar (P).

REFERENCES

1. Abdulrazaq,R.T.(2008).A Comparative Systematic Study of Taxa of Subfamily Pomoideae (Rosaceae) in Iraqi Kurdistan. Ph. D. thesis ,Univ.Sulaimanya.
2. Al- Mayah,A.A.(1983). The Taxonomy of Terminalia (Combretaceae) and related genera. Ph. D. thesis ,Univ. ofLeicester . U.K.

3. Al-Mashhadani,A.N.S. and A.H.Al-Musawi.Morphological Characteristics of Pollen Grains of OnosomaL.Species in Iraq.Ibn-AlHaitham Journal for Pure and Applied Sciences.University of Baghdad.13:1.
4. Kumari, A. Jeet ,K and Kumar, S. (2023).Phytochemistry, Ethnobotanical uses and Pharmacology of Borago officinalis Linn: A Review,November2023.
5. Asadi-Samani, M. Bahmani, M and Rafieian-Kopaei, M. (2014). The chemical composition, botanical characteristic and biological activities of Borago officinalis: a review. Asian Pac. J. Trop. Med. 2014;7:22-28.
6. Ashwaq T. Kareem,1 and Maha N. Hamad.(2020) .Separation and Identification of Phenolic Acid from Borago officinalis (F:Boraginaceae) Cultivated in Iraq. Iraqi J Pharm Sci, Vol.29(2).
7. Crozier, A. Jensen, E. Lean, M.E.J and McDonald, M.S. (1997). Quantitative analysis of flavonoids by reversed-phase high-performance liquid chromatography. J. Chromatogr. A,; 761: 315–321.
8. Davis,P.H.and V.H. Heywood (1973).Principles of Angiosperm taxonomy. Robert, E. Krieger Publishing Company, Huntington, New York.558 pp .U.S.A.
9. Diez, M. J. (1983).Pollen morphology of genus Anchusa L. (Boraginaceae)and its taxonomic interest. Pollen Spore 25(3-4)367-382
10. Erdtman, G. (1971) .Pollen Morphology and Plant Taxonomy, Angiosperms an Introduction to Palynology Hafner. New York.Erdtman, G. (1971). Pollen morphology and plant taxonomy , Angiosperms. European. Volume 2 Rosaceae to Umbelliferae, Cambridge University Press. Vol 2: 469 pp.U.K.
11. Farhadi R, Balashahri MS, Tilebeni HG and Sadeghi M.(2012). Pharmacologyof Borage (Borago officinalis L.) medicinal plant. Int J AgronPlant Prod 2012; 3: 73-77.
12. Fritzsch,J.(1832).Beitrage Zur kenntnissdes Pollens. Berlin Stettin und Elbing. (cited by g.Erdtman).
13. Ghahreman A. (1978). Flora of Iran. Tehran Research Institute of Forests and Rangelands; 1978. Persian.
14. Gupta, D.P. (1971). Studies of Indian pollen grains.IV. Boraginaceae, Geophytology 1: 127-134.
15. Lindley, J. (1830). The genera and species of Orchidaceous plants. London. (Cited by Wodehouse. R. P., 1935.
16. Mohammed,Sh.MS.(2010).A Comparative Systematic Study of Genus Vicia L. (Family: Papilionaceae)in Iraqi Kurdistan.Dissertation.College of Agriculture/University of Sulaimani.
17. Pieretti PG, Palmegiano GB and Salamano G. (2004). Quality and fatty acid content of borage (Borago officinalis L.) during the growth cycle. Ital J Food Sci 2004; 16: 177-184.
18. Ratz-Łyko, A. Herman, A. Arct, J and Pytkowska ,K. (2014). Evaluation of antioxidant and antimicrobial activities of Oenothera biennis, Borago officinalis, and Nigella sativa seedcake extracts. Food Sci. Biotechnol.2014; 23(4): 1029–1036 .
19. Sharma, A .K., and A.Sharma (1972) .Chromosome techniques. Theory and Practice 2nd.ed.Butterwoths.London.575 pp.
20. Stace, C .A. (1984) .Plant taxonomy and Biosystematics .Edward Arnold. London, 279 pp.
21. Stuessy, Tod F. (1990). Plant Taxonomy. The systematic evolution of comparative data Columdia University Press New York .
22. Townsend, C. C. and Evan Guest. (1966). Flora of Iraq Vol .2, Ministry of Agriculture, Baghdad, 184 pp.
23. Wodehouse, R. P. (1935). Pollen grains, their structure identification and significance in science and medicine. Hafner Publishing Company. New York & London. 574 pp.