

## NEW RECORD FOR IRAQI FLORA OF THE GENUS AND SPECIES *MORETTIA PHILAEANA* (CRUCIFERAE) IN IRAQ

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### ABSTRACT

This study was aimed to record new genus and species (*Morettia philaeana*). Through field survey trips to collect the wild plants from specific places at Western Desert District of Iraq, during the year 2022 and near the Rutba Dam on Wadi Houran at Jaffalah region (28km. south west of Rutba), the species *Morettia philaeana* (Delile) DC. was collected as a plants of the Cruciferae family, after confirming the identification as a new species in the country depending on the Flora of the neighboring countries of Iraq, the study included the morphological description of all floral and vegetative organs, as well as the anatomy of stem and the study of some characteristics of the stomatal complex in cauline leaves . These results were confirmed by microscopic and image with a map of distribution of species individuals. In order to document the genera and species recorded process for the first time in Iraq, some of the plant samples were deposited in the Iraqi National Herbarium with numbers 60411, 60412, 60413, and Anbar University Herbarium with numbers 5791, 5792 and 5793. A general review of Iraqi Universities Herbaria was previously conducted, as confirmed to us new species in Iraq.

**Key words:** plant taxonomy, western desert plants, brassicaceae, wild plants, life on land

\* Part of M.Sc. thesis of the 1<sup>st</sup> auther.

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تسجيل جديد للفلورا العراقية للجنس والنوع *Morettia philaeana* من العائلة الصليبية Cruciferae في العراق

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باحث

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### المستخلص

من خلال جولات المسح الميداني لجمع النباتات البرية من أماكن محددة في منطقة الصحراء الغربية من العراق، وخلال العام 2022 وعلى مقربة من سد الرطبة على وادي حوران في منطقة جفالة (28 كم جنوب غرب مدينة الرطبة)، تم جمع النوع *Morettia philaeana* (Delile) DC. كأحد نباتات العائلة الصليبية، وبعد تشخيصه كنوعاً جديداً على القطر اعتماداً على الموسوعات النباتية للدول المجاورة للعراق، وشملت الدراسة الوصف المظهري لكافة الأعضاء الخضرية والزهرية وصفاً شاملاً، فضلاً عن المقطع المستعرض للساق وتحديد بعض صفات المعقد الثغري في الأوراق . وقد تم تعزيز هذه النتائج بالصور المجهرية والعينية مع خريطة توزيع أفراد النوع . ومن أجل توثيق عملية تسجيل الجنس والنوع لأول مرة في العراق فقد تم إيداع بعض من العينات النباتية للنوع في المعشب الوطني العراقي وتحت الأرقام 60411 و 60412 و 60413 ومعشب جامعة الأنبار بالأرقام 5791 و 5792 و 5793، وسبق ذلك مراجعة عامة لكافة معاشب الجامعات العراقية إذ تأكد لنا عدم وجود أي عينة نباتية تعود للنوع المسجل جديداً في العراق.

الكلمات المفتاحية: تصنيف نبات، نباتات الصحراء الغربية، العائلة الخردلية، النباتات البرية، الحياة في البر

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## INTRODUCTION

Cruciferae family is one of the largest plant families with number of species. Which was called by this name according to the shape of the corolla that consists of four distinct and cruciform petals (10). It is also known as the Brassicaceae family according to the modern scientific nomenclature, which is derived from the *Brassica* genus as one of the important economic genera (13). This family includes about 338 genera and more than 3709 species distributed worldwide (9). The main center for the distribution of family species is the Irano-Turanian Region, then the Mediterranean Region, and finally the Saharo-Sindian Region (11). The *Morettia* DC. is a small genus belonging to Cruciferae Family, which includes 4 species distributed in Saharo-Sindian Region, especially African countries and Arabian Peninsula (19). One of these species is *Morettia philaeana* which grows at Sudan (18), Egypt (14), Jordan (28), Saudi Arabia (14) and Syria, Palestine and Sinai (25). One of the common names for the species *Morettia philaeana* is Thagher or Thaghir at some African countries (33). This species has an economic importance represented in its high protein content, so it is considered as a fodder sources for sheep in Egypt and Sudan, far superior to other fodder crops (20). In addition to its chemical content such as phenols, flavonoids and 13 essential amino acids, it is considered one of the antioxidant plants (1). Modern taxonomic studies in Iraq are few, especially in Western Desert District (DWD), with the exception of some studies (2, 3, 7), some of which included recording of new species in Iraq (4, 22). This research was aimed to study conduct a taxonomic study of the new species.

## MATERIALS AND METHODS

During field trips to specific and safe places in the late winter and spring of 2022 for the Western Desert District of Iraq (Figure 1), specifically the Al-Rutba Dam region on Wadi Houran (Jaffalah), 28 km. Southwest of Al-Rutba town (Plate 1), the species belonging to the Cruciferae Family was collected and accurately diagnosed depending on the Flora of neighboring countries (5,14,15), some samples have been deposited in the Iraqi National Herbarium (Plate 2) and the new

recording of the species has been confirmed, the morphological, anatomical and pollen studies were carried out in the laboratories of the Department of Biology, College of Education for Pure Science, University of Anbar. Data on the floral and vegetative parts were tabulated (Table 1) with illustrations. The anatomical study of the stem relied on the method of direct manual cutting successfully, as well as safranin stain for pollen grains and stomatal complexes.

## RESULTS AND DISCUSSION

### New species recording

*Morettia philaeana* (Delile) DC., Syst. Nat. 2:427 (1821); Post, Fl. Syr. Pal. Sin. 1:54 (1932); Boulos, Fl. Egy. 1:199 (1999); Taifour and El-Oqlah, Annot. Check. Vas. Pl. Jordan 1:59 (2016); Hamad *et al.*, Check. Fl. Sudan 21 (4): 27-40 (2020).

**Syn.:** *Sinapis philaeana* Delile, Egy. His. Nat. 2 (Mem.) : 243 (1813). The important result in this research recording of the genus *Morettia* represented by the species *Morettia philaeana* for the first time in Iraq, after making sure to review the Iraqi Herbaria and scientific references for wild plants, and the last of which is the Flora of Iraq (31). Perennial, herb, height 20-36 cm., densely branched stellate hairs (dendritic), woody tap root, 19.7×1.6 cm. Stem procumbent or ascending, much branched at the base, 12-31×0.5-0.8 cm., yellowish green, redged-cylindrical, covered with densely dendritic hairs. Cauline leaves simple, exstipulate, spiral alternate, petiolate, petiole length 0.1-0.3 cm., with stellate hairs, blade lanceolate or elliptic, margin entire or semi-dentate, apex broadly acute, based cuneate, 2.4-2.7×0.7-1.6 cm. . Inflorescences indeterminate, simple raceme 6.3-8.7 cm., number of flowers 8-13, peduncle stem-like, 1.3-3.3 cm. . Flowers actinomorphic, tetramerous, pedicels short, 0.9-1.2 mm., in the fruiting period it becomes 3.1-3.5 mm., appressed to the rachis. Calyx of 4 polysepalous, narrowly lanceolate, apex acute, tomentose, pale green-dull grey, 8.4×1.3 mm. . Corolla of 4 polypetalous, limb spatulate, white, claw white transparent, 7.3×1.8 mm. . Stamens 6, tetradynamous, filament filiform, transparent, smooth, the short filaments 2.10×0.20 mm., and the long of filaments 4.20×0.20 mm., anthers narrowly ellipsoid,

dull yellow, 3.10×0.45 mm. (Table 1). Pistil 1, bicarpous, ovary superior, 2 locules, ovoid, 2.23×1.35 mm., tomentose, pale white, style solid cylindrical, 0.52×0.35 mm., stigma bilobed divergent, muricate, 1.10×0.71 mm., placentation parietal. Fruit dehiscent silique, narrowly ellipsoid, 11.2×2.6 mm., pale creamy brown, tomentose, fruiting beaked absent, number of seeds 8 or 10, subdiscoid, bright brown, 1.7×1.3 mm., muricate (Plate 3). Pollen grains subspheroidal-subprolate, single, tricolpate, medium, polar axis 23.7-26.1 µm., equatorial axis 21.3-24.7 µm. (Plate 4). The surface ornamentation of pollen grains of the Cruciferae family is characterized by being of the reticulate type (23,34). It has become very easy to isolate a group of species based on pollen and by using a scanning electron microscope (32). Because of the importance of taxonomic pollen, researchers have taken care of it by issuing Flora of pollen such as Pollen Flora of Pakistan (24).

#### **Anatomical study:**

Stomatal complex Anisocytic type, in both epidermis of leaves (Plate 5), less in adaxil, stoma very narrowly elliptic, 14.9×2.8 µm., guard cells narrowly reniform (kidney like), 26-30×5-6 µm., subsidiary cells 3 and rarely 4, different (progressive) in size, 19-90×10-43 µm., stomata frequency rate 27, (number of stomata in one microscopic field at 400X). It is rare to find two patterns of stomatal complex in one plant of species. Transverse section of the stem is ridged-cylindrical, diameter 1750 µm., the cuticle 5 µm., the epidermis is composed of isodiametric cells, covered by dendritic hairs. The cortex consists of 3 layers, which are the chlorenchyma (2 rows), ordinary parenchyma (4 rows) and sclerenchyma (7 rows). The Vascular cylindrical is wide, contains 17-18 vascular bundles, regular distribution, the bundle cap is 2 rows of sclerenchyma. The phloem is 4-5 rows, then the cambium remains. The xylem consists of 4 arms, and each arm has 5 vessels with thickness 91 µm. The pith is very wide, it consists of spherical parenchymatic cells, with thickness 1200-1400 µm. (Plate 6). Anatomical characteristics have a taxonomic importance that lies in their stability within the

individuals of the same species (29,30). These characteristics are often more decisive in the species belonging to different genera of the same family (16).

**Type:** In Egypt (Delil, Schweinfurth, Wiest).

**Specimens studied: DWD:** Jaffalah, 28 km. S. W. of Rutba, 630m. alt, 11/3/2022, Othman M. Othman, 60411 (BAG); Wadi Houran, 28 km. S. W. of Rutba, 670 m. alt., 11/3/2022, Othman M. Othman, 3582 (AUH).

#### **Geographical distribution**

*Morettia philaeana* is the first species (type species) in the genus *Morettia* (17). It seems to have limited distribution in the world, as it belongs to the Sahro-Sindian Region, including Saudi Arabia (6). It is one of the plants growing in the arid lands of Egypt (12). And sand dune areas (29). As well as the desert of eastern Jordan (5). The current study confirmed the absence of the species *Morettia philaeana* in Iran (21), and Turkey (10), which are located within Irano-Turanian Region. Through this regional distribution of species in neighboring countries, it is not difficult for it to spread in new places from nearby lands, especially since environmental factors such as strong winds and torrential rain will have an effective role in the transmission of seeds. The construction of dams on valleys in the deserts has helped in the emergence of a new environment capable of supporting the incoming species to succeed in their new migration. This is confirmed by some recent studies (8) of a change in the nature of plant biodiversity in the region and the emergence of strange species. It has been shown that new recorded species prefers valleys and their branches that flow in winter (26). This is confirmed by the current study. It is also known that the Al- Rutba Dam, which was built on Wadi Houran more than 45 years ago, has resulted in a medium lake of rain and torrential water on an area ranging from 4-7 km<sup>2</sup> and with depths between 1-14 meters has greatly affected the emergence of a new environment for plant biodiversity despite the lack of rain for more than two years, resulting in the recording of new species at the region, including the species *Morettia philaeana*.

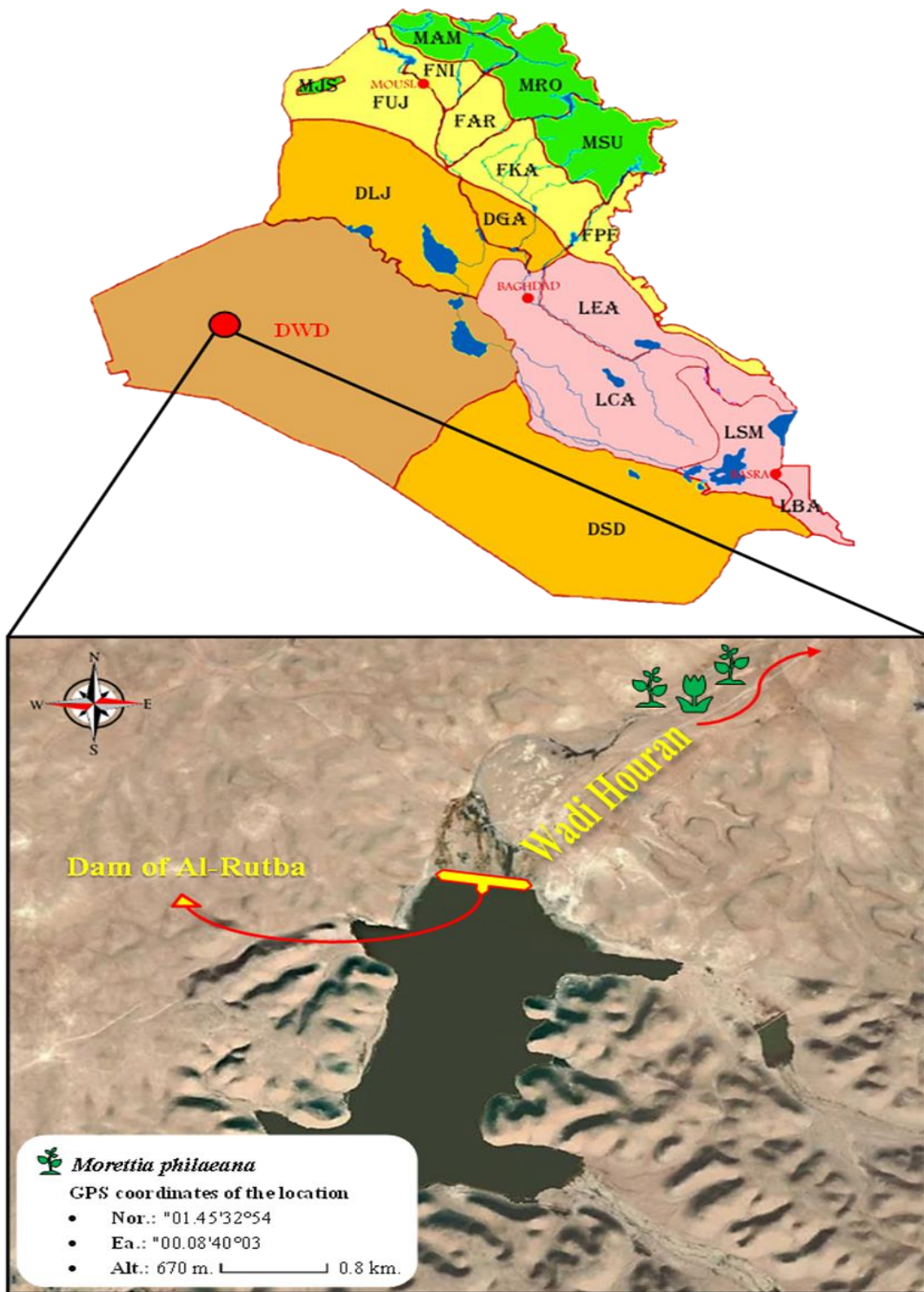


Figure 1. Satellite image of the studied region (Dam of Rutba at Wadi Houran, 28 km. south west of Rutba - Iraq).





Plate 1. Pictures of Al-Rutba dam lake on Wadi Houran - Iraq.



Plate 2. Herbarium plant samples of *Morettia philaeana*.

Table1. Vegetative and floral characters of the studied *Morettia philaeana* \*.

| 1. | Cauline leaves (mm.) | Lower cauline leaves (size) | Shape              | Upper cauline leaves (size) | Shape                |
|----|----------------------|-----------------------------|--------------------|-----------------------------|----------------------|
|    |                      | 27×16                       | Elliptic           | 24×7                        | Lanceolate           |
| 2. | Inflorescences (mm.) | Peduncle length             | Rachis length      | Inflorescences length       | Number of flowers    |
|    |                      | 13-33                       | 63-87              | 76-120                      | 8-13                 |
| 3. | Perianth (mm.)       | Sepal size                  | Petal size         | Colour                      | Shape                |
|    |                      | 8.4×1.3                     | 7.3-1.8            | White                       | Spathulate           |
| 4. | Androecium (mm.)     | Anther size                 | Shape              | Long filaments size         | Short filaments size |
|    |                      | 3.10×0.45                   | Narrowly ellipsoid | 4.2×0.2                     | 2.1×0.2              |
| 5. | Gynoecium (mm.)      | Ovary size                  | Shape              | Style size                  | Stigma size          |
|    |                      | 2.23×1.35                   | Ovoid              | 0.52×0.35                   | 1.10×0.71            |
| 6. | Fruits (mm.)         | Fruit size                  | Type of fruit      | Number of seeds             | Indumentum           |
|    |                      | 11.2×2.6                    | Silique            | 8 or 10                     | Tomentose            |
| 7. | Seeds (mm.)          | Seed size                   | Shape              | Colour                      | Surface              |
|    |                      | 1.7×1.3                     | Sub-discoid        | Bright brown                | Muricate             |
| 8. | Pollen grains (µm.)  | Equatorial size             | Polar size         | Apocolpium size             | Mesocolpium size     |
|    |                      | 21.3-24.7                   | 23.1-26.1          | 8.2                         | 7.2                  |

\* The values represent the mean of measurements taken from 8-10 plant specimens of *M. philaeana*.

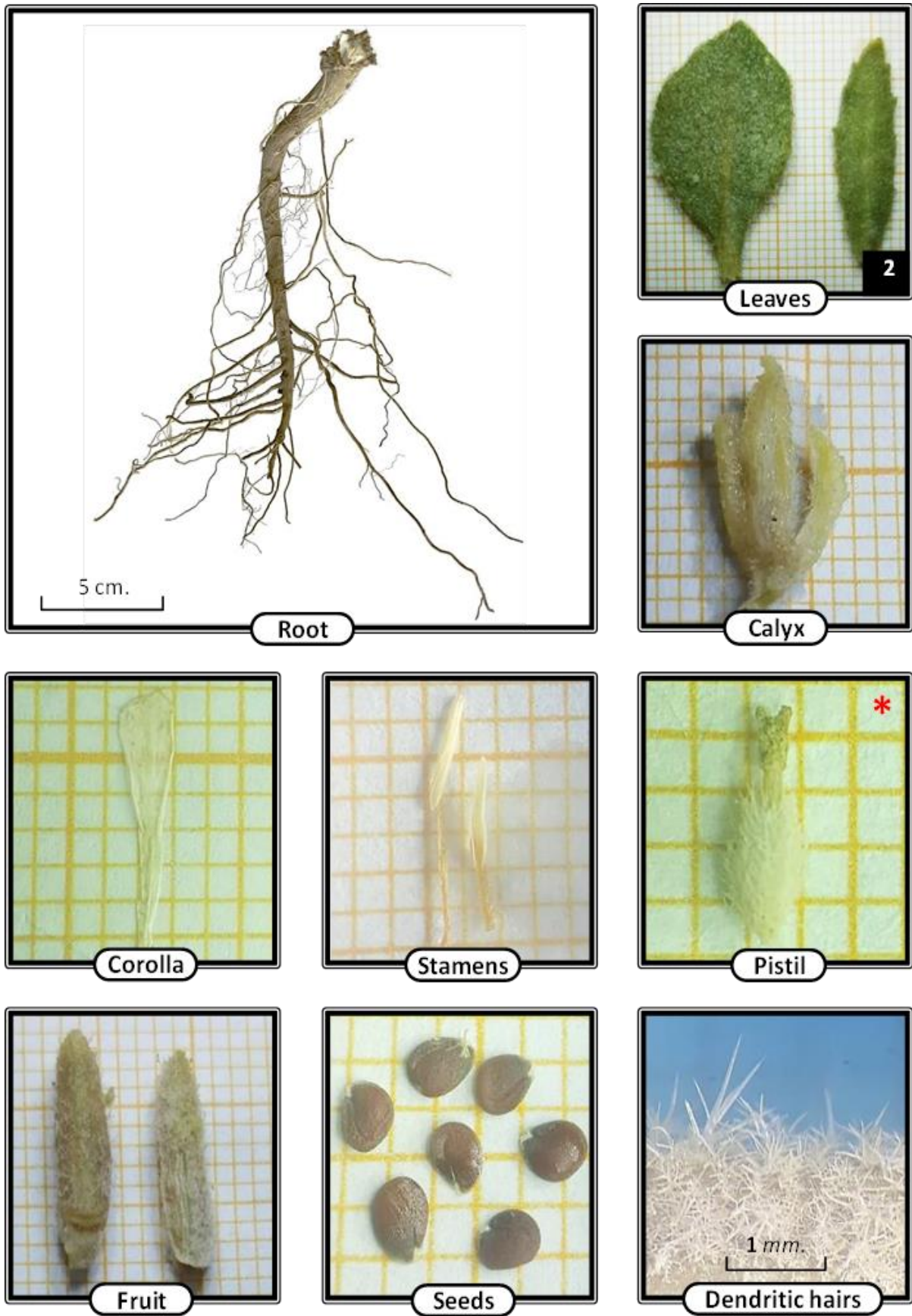


Plate 3. Vegetative and floral parts of *Morettia philaena*.

\* (The side of the smallest square is 1 mm.).



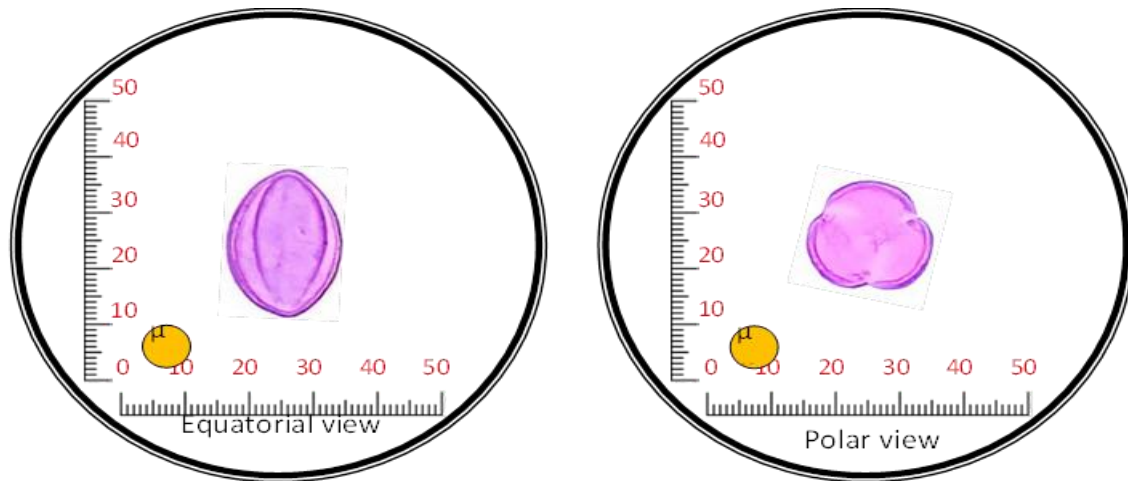


Plate 4. Pollen grains (1000X) of *Morettia philaena*.



Plate 5. Stomatal complex of cauline leaves of *Morettia philaena*.

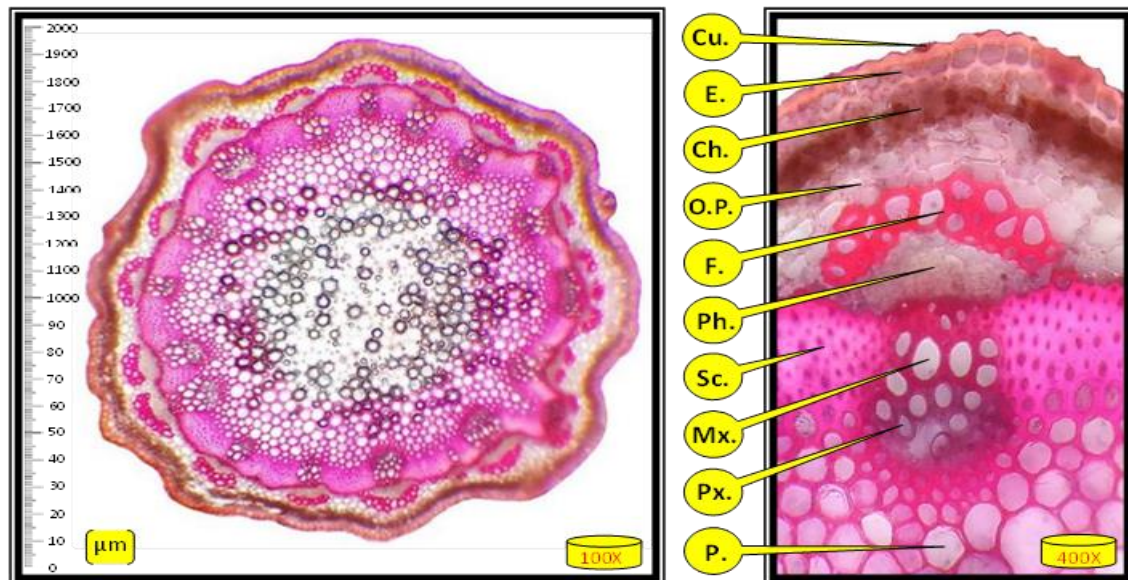


Plate 6. Transverse section of stem of *Morettia philaena*.

|                           |               |                            |
|---------------------------|---------------|----------------------------|
| Whereas: Ch: Chlorenchyma | Cu: Cuticle   | E: Epidermis               |
| F: Fibers                 | Mx: Metaxylem | O. P.: Ordinary parenchyma |
| P: Pith                   | Ph: Phloem    | Px: Protoxylem             |
| Sc: Sclerenchyma          |               |                            |

**REFERENCES**

1. Abu Ziada, M. E., M. A. Al-Shami and M. J. Jalal. 2015. Biological aspects and phytochemistry of three desert plants growing in western desert, Egypt. *Journal of Plant Production*, 6(8):1385-1394.

<https://dx.doi.org/10.21608/jpp.2015.51870>

2. Ahmed, Z. A. and S. A. Aliwy. 2023. Taxonomical study for the species *Chenopodium album* L. and *Chenopodium murale* L. belong to Amaranthaceae (Chenopodiaceae) At Baghdad. *Iraqi Journal*

- of Agricultural Sciences, 54(1), 32-41.  
<https://doi.org/10.36103/ijas.v54i1.1674>
3. Al-Dobaissi, I. A. M. and R. K. H. Al-Masoudi. 2021. Study of fruits morphological features for 33 species belong to cruciferae family in Iraq. Iraqi Journal of Agricultural Sciences, 52(4): 1039-1049.  
<https://doi.org/10.36103/ijas.v52i4.1415>
4. Al-Dobaissi, I. A. M. 2023. Chemical analysis of new recorded species *Acalypha australis* L. at Iraq. Iraqi Journal of Agricultural Sciences, 54(3), 674-681.  
<https://doi.org/10.36103/ijas.v54i3.1745>
5. Al-Eisawi, D. 2016. Taxonomic synopsis of Brassicaceae for the flora of Jordan. Webbia, 71(2): 219-226.  
<https://doi.org/10.1080/00837792.2016.1184393>
6. Al-Gifri, A. N., W. T. Kasem, R. S. Shehata and M. M. Eldemerdash. 2019. The African paleotropical influence on the biogeography of the flora of Jazan, KSA. Asian J. Soil Sci. Plant Nutr. 4(1): 1-10.  
<https://doi.org/10.9734/AJSSPN/2019/46160>
7. Aliwy, S. A., G. A. Lobab and H. R. Al-Newani. 2023. Comparative taxonomical study for reproductive part of eight species belong to Brassicaceae family in Iraq. Iraqi Journal of Agricultural Sciences, 54(1): 25-31.  
<https://doi.org/10.36103/ijas.v54i1.1673>
8. Al-Munqedhi, B. M., M. A. El-Sheikh, A. H. Alfarhan, A. M. Alkahtani, I. A. Arif, R. Rajagopal and S. T. Alharthi. 2022. Climate change and hydrological regime in arid lands, impacts of dams on the plant diversity, vegetation structure and soil in Saudi Arabia. Saudi Journal of Biological Sciences, 1(29):3194-3206.  
<https://doi.org/10.1016/j.sjbs.2022.01.043>
9. Al-Shehbaz, I. A., M. A. Beilstein, and E. A. Kellogg. 2006. Systematics and phylogeny of the Brassicaceae (Cruciferae), an overview. Plant Systematics and Evolution, 259(2): 89-120.  
<http://dx.doi.org/10.1007/s00606-006-0415-z>
10. Al-Shehbaz, I. A., B. Mutlu and A. A. DÖNMEZ. 2007. The Brassicaceae (Cruciferae) of Turkey, updated. Turkish Journal of Botany, 31(4): 327-336.  
<https://doi.org/10.15468/rb7kky>
11. Al-Shehbaz, I. A., and G. Barriera. 2019. Typification of Edmond Boissier's Cruciferae (Brassicaceae) Names Enumerated in Flora Orientalis. Boissiera, 72, 5-192.  
<http://doi.org/10.5281/zenodo.7630433>
12. Amro, A., F. M. Salama, M. M. Abd El-Ghani, A. M. El-Zohary and R. M. El-Shazoly. 2021. Variations in community structure and plant species diversity with soil properties in A Hyper-Arid Coastal Desert of Egypt. JAPS, Journal of Animal and Plant Sciences, 31(6):1686-1698.  
<http://dx.doi.org/10.36899/JAPS.2021.6.0372>
13. Boufford, D. E., C. C. Freeman, K. Gandhi, M. J. Hill, R. W. Kiger, J. M. Poole and J. L. Zarucchi. 2010. Flora of North America, North of Mexico. Vol. 7: Magnoliophyta, Salicaceae to Brassicaceae. pp: 797.  
<https://doi.org/10.1590/2175-7860201566416>
14. Boulos, L. 1999. Flora of Egypt, Vol. 1. Azollaceae to Oxalidaceae, Al-Hadara publishing, Cairo, Egypt, pp: 419.  
<https://dx.doi.org/10.21608/taec.2015.12216>
15. Chaudhary, S. A. 1999. Flora of the kingdom of Saudi Arabia. Vol. 1. Ministry of Agriculture and Water, Riyadh, pp: 523.  
<https://doi.org/10.5897/IJBC2014.0773>
16. El-Shaht, S., S. F. El-Hefnawy, M. K. Hamza and M. M. Zayed. 2022. Histological studies of some brassicaceous samples and the genetic variability analysis using SCOT Markers. Journal of Agricultural Chemistry and Biotechnology, 13(1): 9-19.  
<https://dx.doi.org/10.21608/jacb.2022.221283>
17. Govaerts, R., E. Nic Lughadha, N. Black, R. Turner and A. Paton. 2021. The world checklist of vascular plants, a continuously updated resource for exploring Global Plant Diversity. Scientific Data, 8(1): 1-10.  
<https://doi.org/10.6084/m9.figshare.15035046>
18. Hamad, M. S., F. S. M. Ali, S. A. A. Mohammed, and M. A. Kordofani. 2020. Checklist of the flora of Tutti Island, Khartoum Province, Sudan. Journal of Agriculture and Ecology Research International, 21(4): 27-40.  
<https://doi.org/10.9734/jaeri/2020/v21i430139>
19. Hedge, I. C., and R. A. King. 1983. Cruciferae of the Arabian Peninsula: a checklist of species and a key to genera. Arab Gulf Journal of Scientific Research, 1(1): 41-66.
20. Ibrahim, M. A., M. M. Ramadan, N. N. Abd-Al-Gader, and H. H. El-Kamali. 2021.



Total proteins, total phenol and flavonoid contents and antioxidant activities of *Morettia philaeana* aerial parts extract. Journal of The Faculty of Science and Technology, 8 (1): 17-23.

<https://doi.org/10.52981/jfst.vi8.1957>

21. Mirzadeh Vaghefi, S. S., and M. Mahmoodi. 2022. Brassicaceae family in Iran. Iran Nature, 6(6): 51-63.

<https://doi.org/10.22092/irn.2022.355013.1368>

22. Mousa, M. O. and S. S. Shahatha. 2021. Taxonomic Study for The New Record *Ogastemma Pusillum* (Boraginaceae) In Iraq. Iraqi Journal of Agricultural Sciences, 52(3): 724-735.

<https://doi.org/10.36103/ijas.v52i3.1364>

23. Othman, O. M. and R. M Hamad. 2022. Pollen Micromorphological Study of Ten Genera of Brassicaceae in West Iraq Desert. In IOP Conference Series: Earth and Environmental Science (Vol. 1060, No. 1, p. 012103). IOP Publishing.

<https://doi.org/10.1088/1755-1315/1060/1/012103>

24. Perveen, A., M. Qaiser, and R. Khan. 2004. Pollen Flora of Pakistan-XLII. Brassicaceae. Pakistan Journal of Botany, 36(4): 683-700.

25. Post, G. E. 1932. Flora of Syria, Palestine and Sinai. Vol. 1. American Press, Beirut, pp: 658.

26. Salama, F. M., M. M. Abd El-Ghani, N. A. El-Tayeh, H. K. Galal and S. El-Naggar. 2018. Vegetation analysis and species distribution in the lower tributaries of Wadi Qena in the Eastern Desert of Egypt. Jordan Journal of Biological Sciences, 11(4): 407-418.

<https://doi.org/10.1111/j.1365-2028.2011.01313.x>

27. Salama, F. M., M. M. Abd El-Ghani, M. Gadallah, T. Ramadan, H. K. Galal and A. Gaafar. 2018. Vegetation patterns and floristic composition along elevation gradient on Jabal

Musa, South Sinai, Egypt. *Catrina*, 17 (1): 41-57.

<https://doi.org/10.21608/cat.2018.14307>

28. Taifor, H., and A. El-Oqlah. 2016. Annotated Checklist of the Vascular Plants of Jordan. Kew publishing, Royal Botanic Gardens, pp: 162.

<https://doi.org/10.15468/6h8ucr>

29. Tantawy, M. E., M. I. Husein, M. M. Mourad and U. K. Abdel- Hameed. 2021. Comparative Floral Anatomy of Some Species of Brassicaceae and its Taxonomic Significance. *Adansonia*, 43(20): 223-234.

<https://doi.org/10.5252/adansonia2021v43a20>

30. Tekin, M. 2022. A morphological, anatomical and palynological study of *Aethionema lepidioides* (Brassicaceae) an Endangered Species Endemic to Turkey. *Acta Botanica Croatica*, 81(1): 1-15.

<https://doi.org/10.37427/botcro-2022-003>

31. Townsend, C. C. and E. Guest. 1980. Flora of Iraq. Vol. 4. (2) Cornaceae to Rubiaceae. Ministry of Agriculture and Agrarian Reform, Baghdad. pp: 627.

32. Umber, F., M. Zafar, R. Ullah, A. Bari, M. Y. Khan, M. Ahmad and S. Sultana. 2021. Implication of light and scanning electron microscopy for pollen morphology of selected taxa of family Asteraceae and Brassicaceae. *Microscopy Research and Technique*, 85(1): 373-384.

<http://dx.doi.org/10.1002/jemt.23912>

33. Willis, J. C. 1973. A Dictionary of Flowering Plants and Ferns. ed. 8 Cambridge Univ. Press. Cambridge, pp: 1207.

<https://doi.org/10.5962/bhl.title.1428>

34. Yildirim, B., H. Dural and B. Y. Citak. 2021. Morphological, anatomical, palynological, and micromorphological study on *Diploaxis tenuifolia* (Brassicaceae). *Biyolojik Cesitlilik ve Koruma*, 14(3): 365-371.

<https://doi.org/10.46309/biodicon.2021.897954>