

Asian Journal of Research in Biological and Pharmaceutical Sciences

Journal home page: www.ajrbps.com

<https://doi.org/10.36673/AJRBPS.2020.v08.i04.A19>



MORPHOLOGY, PALYNOLOGY, NUTLET AND SEED MICROMORPHOLOGY OF REPORTED *SALVIA VIRIDIS* (LAMIACEAE) IN LIBYA

Ghalia Thabet Al Rabiai*¹ and Khatria K. Elfaidy¹

¹*Department of Botany, Faculty of Science, Benghazi University, Libya.

ABSTRACT

Salvia viridis L. was first collected from (Telmayta) Libya. The species is an annual herb usually distributed at the field road sides. Morphological characteristics of leaves, calyxes, corollas and types of stamens are useful for sectional and specific delimitation in *Salvia*. In this study, micromorphological characteristics of the pollen and the nutlet of this species have been investigated using Scanning Electron Microscopy (SEM). The pollen grains are hexacolpate, radially symmetrical, isopolar and suboblate. Their exine sculpturing is bireticulate. In addition, size, shape and ornamentation of nutlets and seeds are diagnostic.

KEYWORDS

Salvia viridis, Lamiaceae, Morphology, Palynology, Nutlet, Seed and Libya.

Author for Correspondence:

Ghalia Thabet Al Rabiai,

Department of Botany,

Faculty of Science, Benghazi University, Libya.

Email: ghalia.thabet2016@gmail.com

INTRODUCTON

The genus *Salvia* L. from Lamiaceae is one of the largest genera in this family (Wang 2013¹, Cvetkovikj *et al*, 2015)². The plant name *Salvia* (sage) comes from the Latin word *salvare*, which means healer (Topcu *et al*, 2013)³. The genus *Salvia* L. belongs to the Mentheae tribe within the Nepetoideae subfamily (Kharazian 2014)⁴. Includes around 1000 species that have almost cosmopolitan distribution (Walker and Sytsma, 2007⁵, Salehi *et al*, 2014⁶, Saravia *et al*, 2018)⁷; In Libya, it is represented by 10 species; out of which 3 are cultivated (Jafri 1985)⁸. Some of these species are annual, perennial, herbaceous, suffruticose, fruticose and subshrubby (Kharazian 2014)⁴. The main speciation centers of these taxa are considered to be the eastern Mediterranean region; the southwestern,

western, eastern and central regions of Asia; Southern Africa and Central and South America (Esra *et al*, 2011⁹, Kahraman *et al*, 2010¹⁰, Kharazian 2014⁴). Saravia *et al*, 2018)⁷. Numerous species of the *Salvia* genus are economically important since they are used as spices and flavouring agents in the field of perfumery and cosmetics (Wang, 2013)¹ and some species of *Salvia* have been cultivated worldwide for use in folk medicines (Tohamy *et al*, 2012)¹¹.

Salvia species are used in traditional medicines all around the world, possessing antioxidant, anti-diabetic, antibacterial, antitumor and anti-inflammatory features. Annual, with white hairs and sessile glands, sometimes scabrous or glabrescent. Stem erect, simple or branched from base or above. Leaves 1.2-4.2cm in length while, it 0.5-2cm in width, ovate to oblong, obtuse, crenate, crenate or rounded to cordate at base; petioles length of both basal and upper leaves 0.3-4cm with short hairs; floral leaves bract-like, sessile, ovate, broad, acute, about as long as calyx or longer; terminal leaves sterile, violet, membranous, elliptic to obovate, or with spikes devoid of tuft of coloured sterile floral leaves, Verticillasters 4-6 flowered, generally remote. Calyx 6-8mm, corolla 10-14 mm, purplish-pink, rarely white (Odeh 2014)¹².

Annual or biennial herb, 20-50cm tall, erect simple or branched, with short to long eglandular hairs intermixed with capitate glandular hairs. Leaves 5×2.5cm, petiolate, ovate or oblong, with cordate or rounded base, obtuse, regularly crenate, covered with short and eglandular hairs on both sides. Verticils 4-8 flowered, with or without bracts, lowermost 1-7cm apart; bracts linear, up to 15×0.5mm. calyx tubular 7mm, accrescent in fruit, up to 10mm with 13 nerves; upper lip with two, 1.5mm lateral and cusp like median teeth; lower lip with 2, acuminate, 3mm teeth. Corolla pink or violet, 14-18mm. Nutlets oblong-trigonous, 3×1.5mm, pale orange brown (Jafri 1985)⁸.

The genus *Salvia* was studied by several investigators (Yildiz *et al*, 2009, Doaigey *et al*, 2018)¹³ who reported the pollen characters of species were useful for their identification. (Celenk *et al*, 2008)¹⁴. Kahraman and Doghan (2010)¹⁰ and Al-Watban *et al*, 2015¹⁵ reported that the pollen size, shape and exine ornamentation in the genus *Salvia*

are important in distinguishing between the species. In general, the shape of pollen grains is specific to the taxonomic ranks, such as family, genus and species (Myoung and Yuon, 2012). Studies on nutlet micromorphology within Lamiaceae showed that nutlets features e.g. shape and surface sculpturing, were potentially useful at different taxonomic level (Moon *et al*, 2009)¹⁶, Khosroshahi and Salmaki, 2018)¹⁷. Seed surface micromorphology was found to have a systematic value at the generic and specific levels (Marin *et al*, 1996)¹⁸, Hedge 1970)¹⁹.

The studied plant reported from El Merj as *S.horminum* L. var. *viridis* (L.) Briquet by Keith (1.c.) (Jafri *et al*, 1985)⁸. The macro-micromorphological and palynological properties of the *Salvia* species found in Libya have been poorly studied. Therefore, the main objectives of the present study are to provide a detailed account of the properties of for this species, using LM and SEM.

MATERIAL AND METHODS

Plant material were collected from one location only in Libya (Telmayta), it is distributed at the field road sides. Specimens collected from Libya between February and March, 2020, located in Telmaita district. Samples were fixed in FAA and kept in alcohol 70% for morphological and palynological studies. Pollen was sampled from the flowers at the beginning of anthesis. Pollen grains were compared in terms of their morphological characters by determining their size, shape, and exine sculpture. Transverse section preparations of leaves, petioles and stems were prepared manually. Size measurements for the pollen grains were taken according to Erdtman (1971).

RESULTS AND DISCUSSION

Annual herbs, 8.5-32.5cm long. Stem 1-15.5cm, erect, simple, much branched below or upper and unbranched, quadrangular, solid, glandular and eglandular hairy, retrorse (Figure No.1.A and B) Leaves simple, petiolate but upper leaves sessile, exstipulate, decussate opposite, ovate or oblong or elliptic, attenuate to rounded at base, retuse to obtuse, regularly crenate, with little short eglandular hairs on both sides and oil globules on lower surface, 4-5.5×1.7-3cm, petiole 3-4.6cm; rosette leaves 3-4×1.4-3cm, petiole 2.7-5cm; sessile leaves 3-5×1.5-

2.6cm. Verticils up to 11; 2-6 flowered; Flowers are at the base of bracts. Peduncle 8-30cm. Bracts 12-21 × 8-15mm, sessile to sub-petiolate, acuminate-acute, dentate-crenate, ovate at base; upper violet-lower green, with eglandular and glandular hairs on both sides and oil globules on lower surface (Figure No.2. D and E) Calyx tubular, 12×3-4mm, accrescent in fruit, 8-10×2.5-3mm in flowering, with 13 nerves; upper lip with two, c.1mm lateral and cusp like median teeth; lower lip with 2, acuminate, 4-4.5mm teeth. Pedicels erect or suberect, 3-5mm in fruit; 2.5-3 in flowering. Corolla 11-12mm, pink or violet, with hairs and oil globules (Figure No.2 D and E). Another 2×0.25mm; pollen yellow, longitudinal, versatile, diandrous, filament 4-4.5mm with hairs. Style 10mm; stigma 1.5mm, bifurcate, pink or violet (Figure No.1).

Pollen Morphology

The pollens of *S. viridis* are monad, suboblate shape and 6-zonocolpate. Polar axis (P) is 29µm, equatorial axis (E) 37.6µm, and P/E rate 0.77. The ornamentation is biretulate type of exine sculpturing, with 1-2 large central secondary lumina per primary lumen.

Nutlets and Seed Morphology

Nutlets length 3-3.5mm, width 2mm, oblong shape and brown color. Nutlets surface ornamentation are regular prominences in chain form with tangled strands on the surface. The seed 3×1.5mm, obovate shape with acute apex and dark brown color, reticulate, Anticlinal wall narrow and depress.

Discussion

Morphological characteristics such as leaf size and corolla characteristics are taxonomically significant to identify the species. *S. viridis* morphologically differs from the other members of *Salvia* in terms of plant length, leaves, bracts and corolla. Although the present results usually correspond with the description recorded in the Flora of Libya (Jafri, 1985)⁸ several differences were found here. It was reported that the leaf was to 5 x 2.5cm, the number of flowers in verticils was 4-8, the bract was c. 15 x 0.5mm, the corolla was 14-18mm and the nutlet was 3 x 1.5mm in size. According to our study, the plant length was 8.5-32.5cm, the bract was 12-21 x 8-15mm, the corolla was 11-12mm, the petiole was 3-4cm, the pedicel 3-5mm was in length and number of

verticillasters was 2-6 flowered, the nutlet was 3.5-4.5 x 3-3.5mm in size. We also measured other morphological characters of the species. Research findings reveal that the morphological characteristics of *S. viridis* provide some additional information to those data reported in Flora of Libya. Cantino *et al*, (1992)²⁰ revised the classification of all genera in Labiatae and placed *Salvia* within the subfamily Nepetoideae as the genus *Salvia* has hexa colpate pollen grains. The pollens of *S. viridis* are hexacolpate, radially symmetrical and isopolar. Its shape is suboblate. The ornamentation is biretulate type of exine sculpturing, with 1-2 large central secondary lumina per primary lumen. The shape of the pollen and the sculpturing of the exine in the genus *Salvia* may be significant in separating the species (Kahraman, *et al*, 2010)¹⁰. Nutlets length 3-3.5mm, width 2mm, oblong shape and brown color. Nutlets surface ornamentation are regular prominences in chain form with tangled strands on the surface. Kahraman *et al*, (2009)²¹ pointed the size, shape and ornamentation of *S. ballsiana*, *S. macrochlamys* and *S. hedgeanaare* diagnostic.

The seed 3×1.5mm, obovate shape with acute apex and dark brown color, reticulate, Anticlinal wall narrow and depress. Seed surface micromorphology was found to have asystematic value at the generic and specific levels (Marin *et al*, 1996¹⁸, Hedge 1970¹⁹).

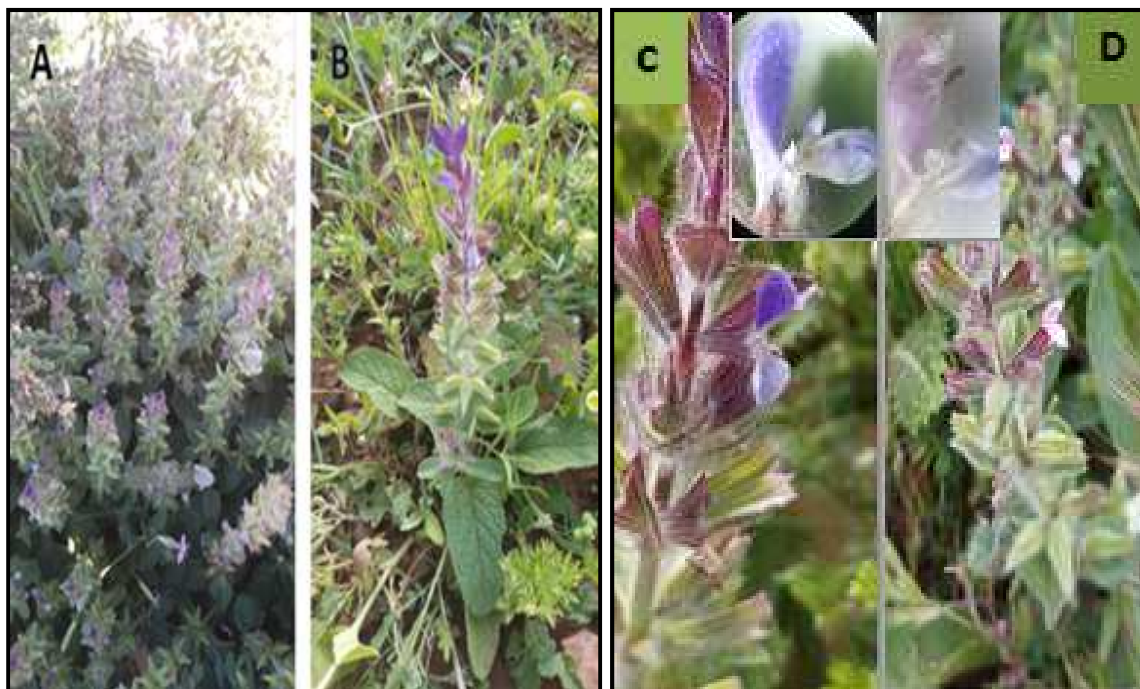


Figure No.1: Whole plant of *Salvia viridis* L.: A) Branched plant; B) Unbranched plant; C) Show inflorescence with violet flowers; D) Show inflorescence with pink flowers

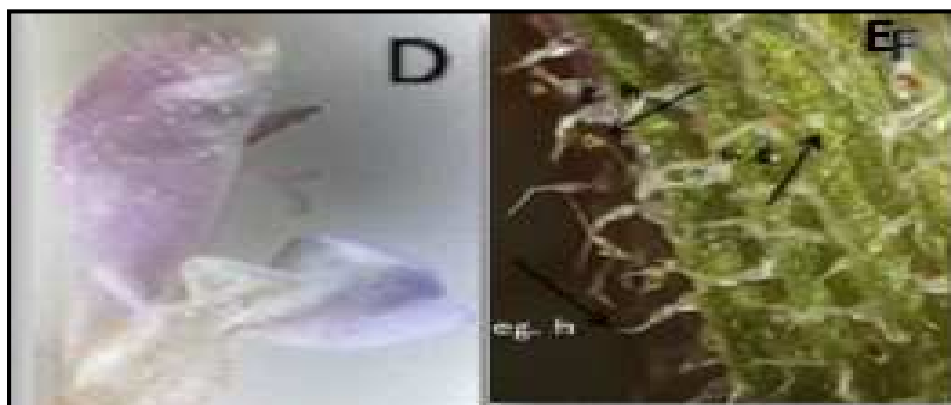


Figure No.2: A) Mature Nutlet; B) lower lip with two teeth; C) upper lip with two lateral and cusp like median teeth; D) Oil globules on the corolla; E) showing glandular, eglandular hairs and oil globules on the calyx

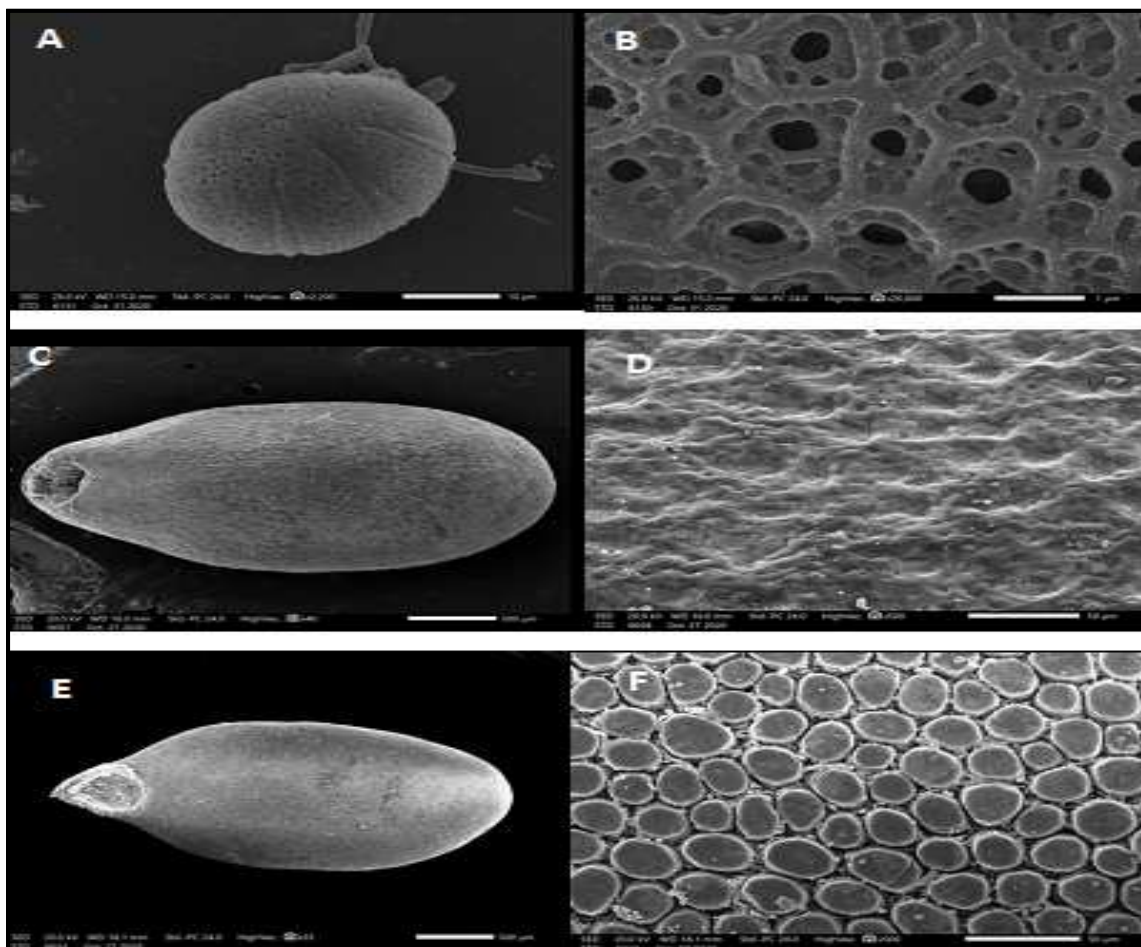


Figure No.3: Scanning electron micrographs of *Salvia viridis*: A-Pollen grain shape; B- Pollen grain ornamentation; C- Nutlet shape; D- Nutlet surface ornamentation; E-Seed shape; F- Seed ornamentation

CONCLUSION

This study will be convenient for other investigations about this species, because it is the first morphological, palynological and micro-morphological study of nutlets and seeds of this taxon in Libya. We concluded that it is important to recommend anatomical and chemical studies about the studied taxon and other related species to show the differences and its importance.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Botany, Faculty of Science, Benghazi University, Libya for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Fu Z, Wang H, Hu X, Sun Z, Han C. The pharmacological properties of salvia essential oils, *Journ of Appli Pharmaceutic Scien*, 3(7), 2013, 122-127.
2. Cvetkovikj I, Stefkov G, Karapandzova M, Kulevanova S. Essential oil composition of *Salvia fruticosa* Mill, populations from Balkan Peninsula, *Macedoni Pharmaceutic Bulleti*, 61(1), 2015, 19-26.
3. Topcu G, Ozturk M, Kusman T, Demirkoz A B, Kolak U, Ulubelen A. Terpenoids, essential oil composition, fatty acid profile, and biological activities of Anatolian *Salvia fruticosa* Mill, *Turkish Journal of Chemistry*, 37(4), 2013, 619-632.

4. Kharazian N. Chemotaxonomy and flavonoid diversity of *Salvia* L. (Lamiaceae) in Iran, *Acta Botanica Brasiliensis*, 28(2), 2014, 281-292.
5. Walker J B, Sytsma K J. Staminal evolution in the genus *Salvia* (Lamiaceae): Molecular phylogenetic evidence for multiple origins of the staminal lever, *Annals of Botany*, 100(2), 2007, 375-391.
6. Salehi S, Golparvar A R, Hadipanah A. Identification of the chemical components of (*Salvia spinosa* L.) in Isfahan climatic conditions, *Journal of Herbal Drugs*, 5(2), 2014, 105-108.
7. Saravia A, Pinto C. Pollen morphology of four species of *salvia* genus (Lamiaceae) in periurban areas of Sucre, Bolivia, *Revista Ciencia, Tecnologia e Innovacion*, 16(17), 2018, 1013-1017.
8. Jafri S M H, El-Gadi A. Flora of Libya, (Lamiaceae), Al-faateh University, Faculty of science, Department of Botany, Tripoli-Libya, *World Cat*, 118, 1985, 37.
9. Esra M, Cetin O, Kahraman A, Celep F, Dogan M. A cytological study in some taxa of the genus *Salvia* L. (Lamiaceae), *Caryologia*, 64(3), 2011, 272-287.
10. Kahraman A, Celep F, Dogan M. Anatomy, trichome morphology and palynology of *Salvia chrysophylla* Stapf. (Lamiaceae), *South African J. Bot*, 76(2), 2010a, 187-195.
11. Tohamy A A, Ibrahim S R, Moneim A E A. Studies on the effect of *Salvia aegyptiaca* and *Trigonella foenum graecum* extracts on adult male mice, *Journal of Applied Pharmaceutical Science*, 2(5), 2012, 36-43.
12. Odeh M I A A. Systematic study of the genus *Salvia* L. (Labiatae) in West Bank/Palestine (Doctoral dissertation), 2014.
13. Doaigey A R, El-Zaidy M, Alfarhan A, Milagy A E S, Jacob T. Pollen morphology of certain species of the family Lamiaceae in Saudi Arabia, *Saudi Journal of Biological Sciences*, 25(2), 2018, 354-360.
14. Celenk S, Dirmenci T, Malyer H, Bicakci A. A palynological study of the genus *Nepeta* L. (Lamiaceae), *Plant Syst. Evol*, 276(1), 2008, 105-123.
15. Al-Watban A A, Doaigey A R, El-Zaidy M. Pollen morphology of six species of subfamily Stachyoideae (Lamiaceae) in Saudi Arabia, *African Journal of Plant Science*, 9(5), 2015, 239-243.
16. Moon H K, Hong S P, Smets E, Huysmans S. Micromorphology and character evolution of nutlets in tribe Menthae (Nepetoideae, Lamiaceae), *Systematic Botany*, 34(4), 2009, 760-776.
17. Khosroshahi E and Salmaki Y. Nutlet micromorphology and its systematic implications in *Phlomis* Moench(Lamiaceae), *Nova Biologica Reperta*, 5(1), 2018, 82-94.
18. Marin P D et al. Nutlet ornamentation in selected *Salvia* L. species (Lamiaceae), *Flora Medit*, 6, 1996, 203-211.
19. Hedge I C. Observations on the mucilage of *Salvia* fruits, *Notes R. Bot. Gard. Edinburgh*, 30, 1970, 79-95.
20. Cantino P D et al. Genera of Labiatae: Status classification, In: Harley, R. M. and Reynolds, T. (eds), *Adv. Labiatae Sci. R. Bot. Gard. Kew*, 1992, 511-522.
21. Kahraman A, Celep F, Dogan M. Anatomy, Trichome morphology and palynology of *Salvia chrysophylla* Stapf. (Lamiaceae), *South African J. Bot*, 76(2), 2009b, 187-195.
22. Kahraman A, Celep F, Dogan M. Morphology, anatomy and palynology of *Salvia indica* L. (Labiatae), *World Appl Sci*, 6(2), 2009c, 289-296.

Please cite this article in press as: Ghalia Thabet Al Rabiai et al. Morphology, palynology, nutlet and seed micromorphology of reported *salvia viridis* (Lamiaceae) in Libya, *Asian Journal of Research in Biological and Pharmaceutical Sciences*, 8(4), 2020, 162-167.