ISSN 2226-3063 e-ISSN 2227-9555
Modern Phytomorphology 15: 35–37, 2021

RESEARCH ARTICLE

Micromorphology of the flower of *Zephyranthes lindleyana* (Amaryllidaceae)

O. Fishchuk

Lesia Ukrainka Volyn National University, Pr. Voli. 13, Lutsk, 43025, Ukraine;*Dracaenaok@ukr.net

Received: 12.03.2021 | **Accepted:** 26.03.2021 | **Published:** 03.04.2021

Abstract

In connection with the search for new morphological features, useful for the taxonomy of plants was studied the structure of the flowers of the *Zephyranthes lindleyana* Herb. (Mexico), as modern molecular taxonomy does not always consider the morphological and anatomical features of the flower, and the vertical zonality of the gynoecium does not take into account at all. The morphometric parameters and micromorphology of the ovary were described by using flower transverse sections. 10 flowers of *Z. lindleyana* were sectioned using standard methods of Paraplast embedding and serial sectioning at 20 mkm thickness. Sections were stained with Safranin and Astra Blau and mounted in Eukitt. We investigated the presence of three vertical zones in the *Z. lindleyana* gynoecium: synascidiate, symplicate and hemisymplicate. Asymplicate zone is absent. The data we obtained helped deepen the knowledge on micromorphological peculiarities of flowers of *Z. lindleyana* and will help to compare the received morphological and anamomical features with features studied earlier for representatives of the Amaryllidaceae family for use them in the taxonomy in the future.

Keywords: *Zephyranthes lindleyana*, ovary, vertical zones, gynoecium, micromorphology, septal nectary

Introduction

The integration of molecular phylogenetic data and evolutionary comparative morphology of a flower is a promising direction for the construction of a modern evolutionary system of orders, families, subfamilies and genera. The study of vascular anatomy and micromorphology of monocotyledonous flowers is a current way in the study of evolutionary morphology (Skrypec and Odintsova 2020; Fishchuk and Odintsova 2017). The object of our study was selected *Z. lindleyana*, which is widely grown as an ornamental flowering plant. Genus *Zephyranthes* Herb. belongs to the subtribe Hippeastrinae Walp tribes Hippeastreae Sweet., subfamily Amaryllidoideae s.s., family Amaryllidaceae (Chase et al. 2016). The alkaloids study of *Zephyranthes* is presented (Centeno-Betanzos et al. 2021), the endosperm development and the variations of structures of embryo sacs was studied (Chengqi 2019). The purpose of our study is to clarify the features of floral morphology and internal gynoecium structure, the structure of septal nectaries and to determine the vertical zonality of gynoecium in family members of the family Amaryllidaceae.

Materials and Methods

Plant material was collected in the A.V. Fomin Botanical garden of Taras Shevchenko National University of Kyiv and fixed in 70% alcohol. For light microscope observations, 10 flowers *Z. lindleyana* were sectioned using standard methods of Paraplast embedding and serial sectioning at 20 mkm thickness by Barykina et al. (2004). This is about 200 slides and about 7200 serial sections. Sections were stained with Safranin and Astra Blau and mounted in Eukitt. Digital photomicrographs were made using a microscope AMSCOPE T490B-10M (USA) and microscope digital camera AMSCOPE 10MP MU1000 (USA). The height of the gynoecium vertical zones was obtained after the calculation of the transverse sections of the pistil. We used the concept of vertical zonation of gynoecium by W. Leinfellner (Leinfellner 1950) to analyze the internal structure of the gynoecium, which takes into consideration only the congenital fusion of the carpels. The methodological basis of the vertical zonation gynoecium study was formulated by W. Leinfellner, later the method was elaborated for monocots (Odintsova 2013).

Results

Z. lindleyana flowers are up to 6.6 cm-7 cm long, slightly zygomorphic, pink. The scape is 12.5 cm-13 cm long and 0.4 cm-0.5 cm in diameter, flowers are solitary. Two bracts are conical, fused into one, forming a two-keel structure about 4 cm long, 1.3 cm wide and 0.9 cm at the base, leathery, brown. The pedicel is up to 1.8 cm long, about 0.3 cm in diameter (Fig. 1A-B). Perigonium is simple with linear members. The flower is tube funnel-shaped, the flower tube is about 2.4 cm long, 0.4 cm in diameter at the base and 0.8 cm above the base (Fig. 1G). The outer tepals are wider than the inner tepals. The outer tepals are 5.2 cm, 5 cm, 5.2 cm long and 1.9 cm, 1.8 cm, 1.9 cm wide, and the inner tepals are 4.9 cm, 4.9 cm, 5 cm in length and 1.4 cm, 1.5 cm, 1.4 cm wide, respectively. The androecium is characterized by the presence of 6 stamens, which are attached to the base of the flower tube. The length of the inner stamens is 3.3 cm, and the length of the outer stamens is 3 cm. The stamens are straight, tapering to the top, the stamens of the outer circle are 2.3 cm, and the length of the stamens of the inner circle is 2.6 cm, 0.1 cm are the stamens in diameter. Anthers bent at the apex, introse, dorsifixed (Fig. 1H). Anthers of external and internal stamens are 1.3 cm long. But the filaments are attached at different heights to the anther in the external and internal stamens (Fig. 1H). Anthers, 0.1 cm in diameter, are attached just below the middle of the anther height.

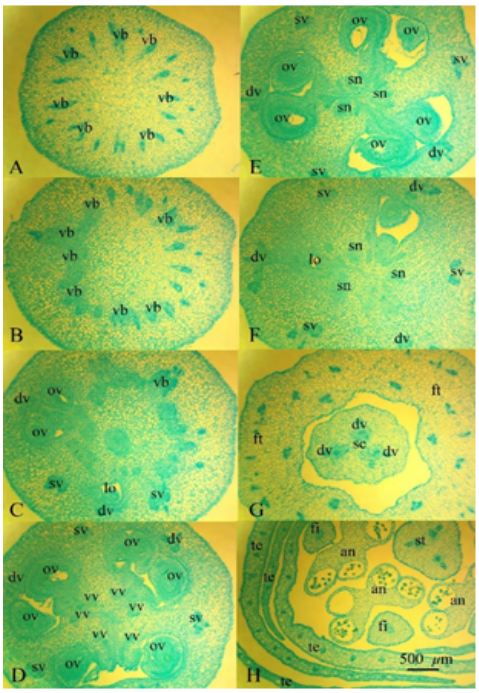

Figure 1. Ascending series of transversal sections of the flower *Zephyranthes lindleyana*. Scale bar 500 µm; A, B: Pedicel; C, E: Inferior ovary; C, D: Symplicate zone; E,F: Hemysymplicate zone; G: Flower tube and style; H: Free tepals, filaments and style; dv: dorsal vein; fi: filament; lo: ovary locule; ft: flower tube; ov: ovule; sc: style channel; sv: septal vein; st: style; te: tepal; vb: vascular bundle; vv: ventral vein.

The gynoecium is represented by three growing carpels. The length of the gynoecium is 6 cm, the ovary is ovoid, bright green 0.8 cm high and 0.4 cm in diameter (Fig. 1D), which turns into a slightly zygomorphic, green at the base, and above the white, s-shaped style 5 cm long and 0.1 cm in diameter (Fig. 1H). Stigma is three-lobeles, with widely curved lobeles 0.2 cm long and 0.1 cm in diameter. The fruit is a capsule with flattened black seeds.

In *Z. lindleyana* gynoecium we distinguish the following structural zones: synascidiate structural zone, height about 360 µm and fertile symplicate structural zone, the height of which is about 2080 µm (Fig. 1C-1D) and hemisymplicate zone is about 2500 µm (Fig. 1E-1F). Septal nectaries appear in the hemisymplicate zone and open with nectary slits at the base of the style, the total height of the septal nectary is 2900 µm (Fig. 1F). The roof of the ovary is 400 microns.

Discussion

Characteristic features of the genus *Zephyranthes* is a hollow scape, terete, rarely retained entirely inside the bulb, single-flowered, spathe bracts fused and tubular below the middle (Meerow and Snijman 1998). According to E. Daumann (Daumann 1970), the genus Zephyranthes has an internal septal nectary. He established the presence of epidermal septal nectaries in *Z. lindleyana*. We found three vertical zones in the ovary of the studied species: synascidiate, symplicate and hemisymplicate. Septal nectaries appear in the hemisymplicate zone. In Hippeastrum striatum gynoecium were found synascidiate, symplicate and hemisymplicate vertical zones (Fishchuk 2021).

Conclusion

The study of the micromorphology of *Z. lindleyana*, showed the presence of three vertical zones in the ovary synascidiate, symplicate and hemisymplicate, lengthy septal nectary that appear at the hemisymplicate zone and are continued by nectary cavities. Flower morphology and gynoecium structure will help us to differentiate the studied species and their morphological and anatomy features from other members of the Amaryllidaceae family.

References

Barykina R.P., Veselova T.D., Deviatov A.G., Djalilova H.H., Iljina G.M., Chubatova N.V. (2004). Handbook of the botanical microtechniques. Moscow: Izd-vo MGU.

Centeno-Betanzos L.Y., Reyes-Chilpa R., Pigni N.B., Jankowski C.K., Torras-Claveria L., Bastida J. (2021). Plants of the 'Libellus de Medicinalibus Indorum Herbis' from Mexico, 1552. Zephyranthes fosteri (Amaryllidaceae) Alkaloids. *Chem Biodiversity* **18:** e2000834. https://doi.org/10.1002/cbdv.202000834

Chase M.W., Christenhusz M.J.M., Fay M.F., Byng J.W., Judd W.S., Soltis D.E., Stevens P.F. (2016). An update of the angiosperm phylogeny group classification for the orders and families of flowering plants: APG IV. *Botan J Linnean Soc* **181:** 1-20. https://doi.org/10.1111/boj.12385

Ao C. (2019). The endosperm development and the variations of structures of embryo sacs: unravelling the low fecundity of Zephyranthes candida (Amaryllidaceae). Plant Biosyst Internat J Dealing Aspects Plant Biol **153:** 673-678. https://doi.org/10.1080/11263504.2018.1539044

Daumann E. (1970). Das Blütennektarium der Monocotyledonen unter besonderer Berücksichtigung seiner systematischen und phylogenetischen Bedeutung. *Feddes Repertorium* **80:** 463-590.

Fishchuk O. (2021). Comparative flower morphology in Hippeastrum striatum (Lam.) HE Moore (Amaryllidaceae). *Ukr J Ecol* **11:** 273-278. https://doi.org/10.15421/2021_240

Fishchuk O.S., Odintsova A.V. (2020). Micromorphology and anatomy of the flowers of Galanthus nivalis and Leucojum vernum (Amaryllidaceae). *Regulat Mech Biosyst* **11:** 463-468. https://doi.org/10.15421/022071

Leinfellner W. (1950). Der Bauplan des synkarpen Gynözeums. *Österreichische Botanische Zeitschrift* **97:** 403-436.

Meerow A.W., Snijman D.A. (1998). Amaryllidaceae In K. Kubitzki [ed.], Families and genera of vascular plants. *Springer* pp: 83-110. https://link.springer.com/chapter/10.1007/978-3-662-03533-7_11

Odintsova A. (2013). Dva osnovnyx typy septalnyx nektarnykiv odnodolnyx. Visnyk Lvivskogo universytetu. Seriya biologichna **61:** 41-50.

Odintsova A., Fishchuk O. (2017). The flower morphology in three Convallariaceae species with various attractive traits. *Acta Agrobotanica* 70.