

Comparative Study of Palynological Features of Five Species of Euphorbia Genus with Helioscopia Specie Studied Earlier

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ABSTRACT: In this study were analysed morphological features of pollen grains of five species of Euphorbia genus respectively glabriflora, myrsinites, paralias, peplus and characias compared to helioscopia specie. Based on aperture feature, the five species of Euphorbia genus, palynomorphologic features of which were described for the first time, varied from tricolporate at glabriflora, myrsinites, paralias and characias species, tricolpate at peplus specie and apertoid tricolpate at helioscopia specie. The pollen grains of 5 studied species compared to helioscopia specie had similarities in terms of shape, which was spheroidal in polar position and oval in equatorial one, their monad grouping and exine, which appeared with two layers. The main differences appeared in the exine feature, which varied from reticulate in Euphorbia characias, E. glabriflora and E. myrsinites, with equal and visible reticules in the glabriflora specie, fine reticules in the myrsinites specie, reticulate-perforate in E. paralias and E. peplus to granular in E. helioscopia and margo, which was present in the four species: myrsinites, paralias, characias and helioscopia. The smallest dimensions were identified at Euphorbia myrsinites for the majority of studied features, while the length of porus was identified simultaneously at species: myrsinites, characias and paralias, the width of porus at glabriflora specie and the width of furrow at peplus specie. The largest dimensions were identified at Euphorbia characias for the majority of palynomorphologic features except for the length of porus, which was identified at Euphorbia glabriflora, the width of furrow at Euphorbia paralias and the exine thickness at

helioscopia specie.

KEYWORDS: Pollen grains, palynomorphological features, exine, monad, furrow, porus, margo, Euphorbia etc.

I. INTRODUCTION

Referred to Flora of Albania, Volume II (Qosja et al., 1992), Euphorbiaceae family is represented by 4 genus and specifically by 38 species of Euphorbia genus. Euphorbia is one of the three most species-rich genus of flowering plants with more than 2000 species found in all tropical and temperate regions (Pahlevani, 2017). Also, this genus is the biggest genus of succulent plants with almost 800 species (Walker, 2023). They occupy a wide range of habitats and exhibit great diversity in growth forms (Pahlevani, 2017).

Regarding the literature sources (Kürşat, 2023), pollen grains of 24 different species of Euphorbia genus were tricolporate, whereas three other species of this genus specifically: denticulata, esula subsp. tommassiniana and orientalis had tricolpate and tricolporate pollen grains. The exine appeared perforate, but it also appeared reticulate and rugulate.

The purpose of this study was the similarities and differences evidention of palynomorphological features in pollen grains of five Euphorbia genus species (paralias, peplus, glabriflora, myrsinites and characias) compared to helioscopia species of this genus studied earlier by local palynologist (Kapidani, 1996).

II. MATERIALS AND METHODS

The five plants studied for the palynomorphological characteristics were collected in fresh conditions in these locations: Vilë Bashtovë, Krastë-Elbasan, Gjonç-Ersekë, Rrajcë Skëndërbe and Porto Palermo.

Morphological features of pollen grains were studied using three analytical methods as follows:

- Acetolysis of Erdtman metjös (Erdtman, 1960);
- Acetolysis of Avetisjan method (Avetisjan, 1950);
- Basic fuchsin of Smoljaninova & Gollubkova method (Smoljaninova & Gollubkova, 1953).

The first two methods of acetolysis were used to obtain better results of sporoderme elements, while the basic fuchsin method was used for the study of shape and dimensions of pollen grains.

There were prepared 5-6 microscope slides for each plant and they were studied with optical Motic Images Plus 2.0 ML B1 Series microscope. The microscopic photos of pollen grains of studied plants with magnification X400 and X1000 were taken by Blerina Pupuleku and Klea Trokoliçi.

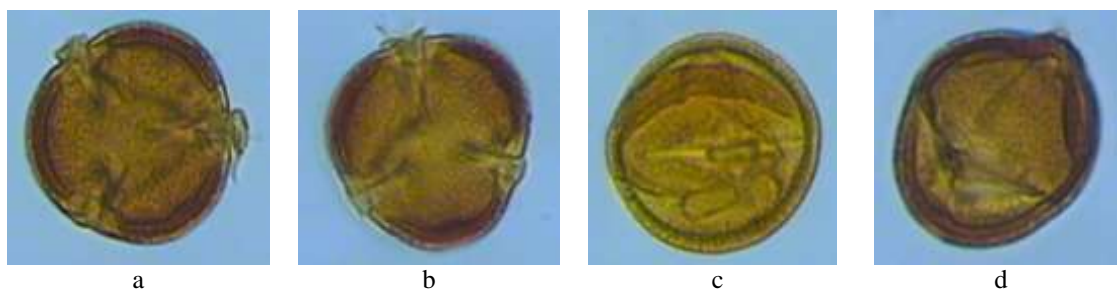


Figure 1. Pollen grains of *Euphorbia paralias* a, b: Polar view X1000; c, d: Equatorial view X1000

3.2 *Euphorbia peplus* L. - Petty spurge

Therophyte. Annual plant with height 40 cm. In grassy areas, ruins, cultivated lands etc. Flowering: January - December. Eurosiberian, cosmopolite. Chenopodietalia. Poisonous plant. (Qosja et al., 1992). The plant was collected in fresh conditions in Krastë-Elbasan.

The pollen grains were monads, tricolpate with spheroidal oval contours. Their shape appeared with circular contours in polar view and with oval contours in equatorial one.

III. RESULTS

3.1 *Euphorbia paralias* L. - Sea spurge

Geophyte. Perennial plant, usually with heaps of stems. In coastal sandbanks, dunes more or less movable. Flowering: May-August. Mediterranean-Atlantic (Qosja et al., 1992). The plant was collected in fresh conditions in Vilë Bashtovë.

The pollen grains were tricolporate. Their shape appeared spheroidal in polar view and oval in equatorial one.

The furrows were conical, had sharp ends and went near the center. Their length varied from 12 to 16,5 (14,55) μ , while their width varied from 7,5 to 13,5 (10,65) μ . The length of mezocolpus varied from 16,5 to 21 (19,2) μ . The pori were inside the contours of colpus but disrupted the exine forming margo. Also, their membrane was accompanied by ornamentals. The length of pori varied from 3 to 4,5 (3,75) μ , whereas their width varied from 6 to 7,5 (6,45) μ .

The exine was reticulate-perforate. Its thickness varied from 1,2 to 1,5 (1,35) μ . The pollen grains length varied from 28,5 to 31,5 (30,45) μ , while their width varied from 28,5 to 31,5 (30,15) μ .

The colpi were smooth and did not go very deep inside the pollen grains. Also, those appeared too oval. The length of colpi varied from 8,2 to 11,6 (10) μ , while their width varied from 1,5 to 1,9 (1,8) μ .

The length of pollen grains varied around 24-27 (24,8) μ . The width of pollen grains varied around 24-25,6 (23,4) μ . The exine was double-layered with reticulate-perforate sculpture. Its thickness varied from 1,2 to 1,6 (1,5) μ .



Figure 2. Pollen grains of *Euphorbia peplus* a: Polar view X1000;b: Equatorial view X400

3.3 *Euphorbia glabriflora* Vis.

Chamaephyte. Small bush with thick underground stem part with 10-20 cm stem, woody in the lower part, with thin annual flower-keeper branches. In stony slopes of mountainous areas. Flowering: May-July. Balkan (Qosja et al., 1992). The plant was collected in fresh conditions in Gjonç-Ersekë.

The pollen grains were tricolporate. Their shape appeared spheroidal in polar view and oval in equatorial one.

The furrows were conical with pointed end and did not went to the center of pollen grains. Their length varied from 7,5 to 9 (8,25) μ , whereas

their width varied from 4,5 to 5,4 (4,83) μ . The length of mesocolpium varied from 13,5 to 15 (14,7) μ . The pori were inside the colpi contours, but did not form margo. The length of pori varied from 6 to 7,5 (6,75) μ , while their width varied from 3 to 4,8 (3,98) μ . The cytoplasm was granular.

The exine appeared reticulate with visible equal reticulate cells. The ectexine was a bit thicker than endexine. The exine thickness varied from 1,2 to 1,5 (1,28) μ . The length of pollen grains varied from 24 to 27 (25,49) μ , whereas their width varied from 22,5 to 26,25 (24,83) μ .

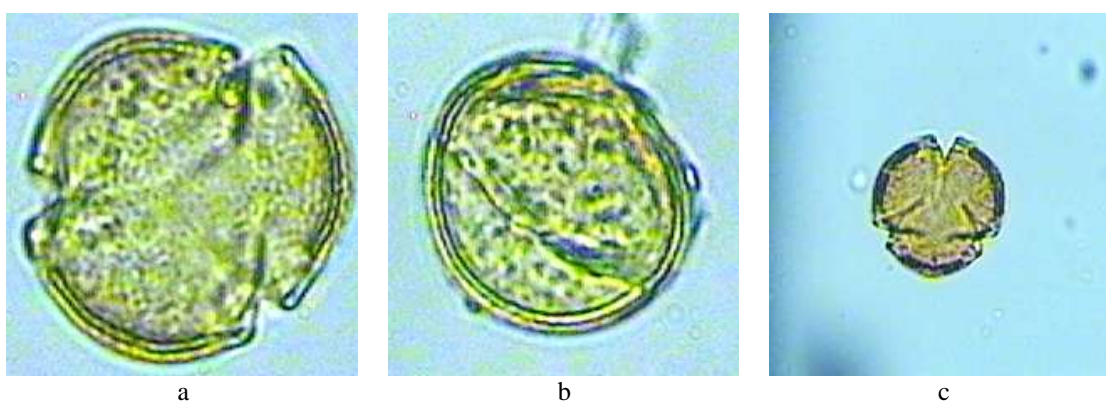


Figure 3. Pollen grains of *Euphorbia glabriflora* a: Polar view X1000;b: Equatorial view X1000; c: Polar view X400

3.4 *Euphorbia myrsinites* L. - Myrtle spurge

Perennial plant, till 40 cm. Geophyte. In rocky areas or with stones. Flowering: May-August. South European-Pontiac (Qosja et al., 1992). The plant was collected in fresh conditions in Rajcë Skëndërbe.

The pollen grains were tricolporate. Their shape appeared spheroidal in polar view and oval in equatorial one.

The colpi had sharp tips and were boat-shaped. They were to the center. The length of colpi varied from 4,5 to 6 (4,99) μ , whereas their width varied from 3 to 5,25 (3,66) μ . The length of

mesocolpium varied from 6 to 7,5 (6,65) μ . The pori go out visibly forming typical margo. The length of pori varied from 3 to 4,65 (3,59) μ , while their width varied from 3,75 to 5,25 (4,46) μ . The cytoplasm was granular.

The exine appeared reticulate with uniform fine reticulate cells and was thin. Its thickness varied from 0,75 to 0,9 (0,79) μ . The length of pollen grains varied from 15 to 18 (16,1) μ , while its width varied from 15 to 17,7 (16,28) μ .

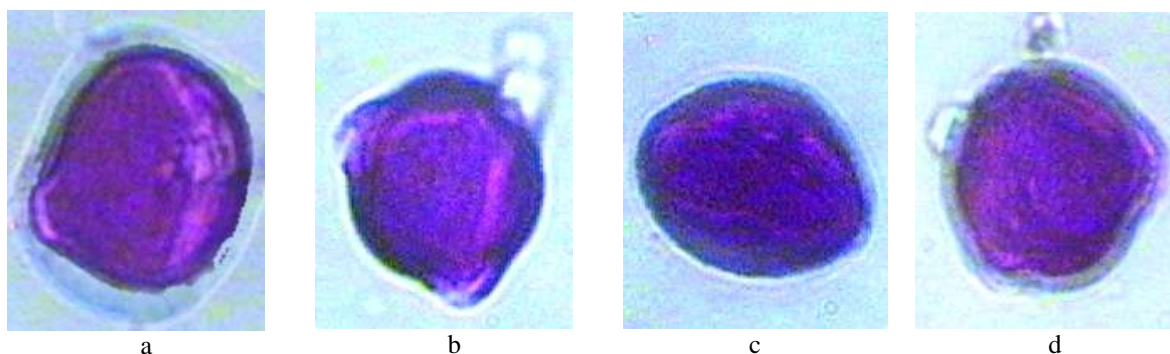


Figure 4. Pollen grains of *Euphorbia myrsinites* a, c: Equatorial view X400; b, d: Polar view X400

3.5 *Euphorbia characias* L. (*Euphorbia melapetala* Gasparr.) - Mediterranean spurge

Geophyte. Perennial plant, densely fluffy. In dried lands, mountainous slopes, rocky areas. Flowering: February-May. Steno-Mediterranean (Qosja et al., 1992). The plant was collected in fresh conditions in Porto Palermo.

The pollen grains were tricolporate. Their shape appeared spheroidal in polar view and oval in equatorial one.

The colpi had sharp tips and they went to the center. The length of colpi varied from 7,5 to 16,8 (12,78) μ , whereas their width varied from 3,3

to 8,85 (5,66) μ . The length of mesocolpium varied from 25,35 to 42,15 (30,29) μ . The pori were inside the contours of colpus but disrupted the exine forming margo. The length of pori varied from 3 to 5,85 (4,13) μ , while their width varied from 3,3 to 8,85 (5,66) μ . The cytoplasm was granular.

The exine appeared reticulate. The intine was thick, which looked like it had the same thickness as the exine. Its thickness varied from 1,65 to 2,7 (2,21) μ . The length of pollen grains varied from 31,5 to 39,3 (36,11) μ , while their width varied from 33,15 to 40,05 (37,14) μ .

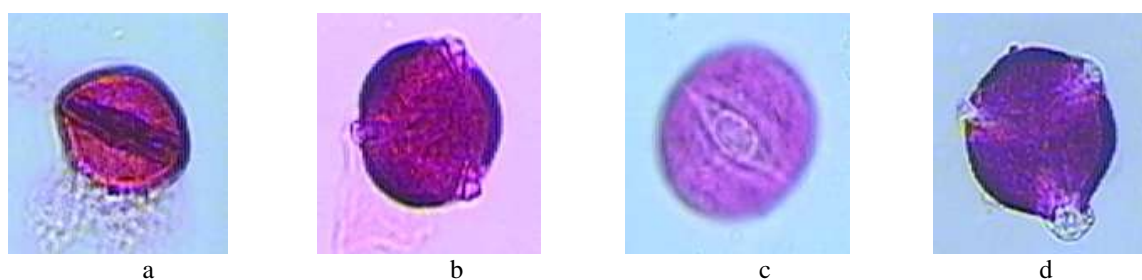


Figure 5. Pollen grains of *Euphorbia characias* a, c: Equatorial view X400; b, d: Polar view X400

IV. DISCUSSION

After we finished the pollen grains micrometric measurements of five studied plants: *Euphorbia paralias*, *Euphorbia peplus*, *Euphorbia glabriflora*, *Euphorbia myrsinites* and *Euphorbia characias*, we prepared the table (table 1) and respective comparative charts (figure 6, figure 7, figure 8) between them and the *helioscopia* specie

studied earlier, where we identified similarities and differences in their palynomorphological features.

Palynological study of five *Euphorbia* genus species (*paralias*, *peplus*, *glabriflora*, *myrsinites* and *characias*)

compared to *Euphorbia helioscopia* highlighted some similarities, which consisted of furrows presence in all species, shape which was spheroidal

in polar view and oval in equatorial one, monad grouping of pollen grains and double-layered exine conform literature information (Moore & Webb, 1978; Erdtman, 1980; Faegri & Iversen, 1989; Ricciardelli D’Albore, 1998; Pupuleku, 2002; Kapidani, 2005; Kürşat, 2023).

Furthermore, there were differences between pollen grains of studied plants based on:

- Aperture, which varied from tricolporate in glabriflora, myrsinites, paralias and characias species, tricolpate in peplus specie to apertoid tricolpate in helioscopia specie;
- Exine sculpture, which varied from reticulate at characias, glabriflora and myrsinites species, with visible equal reticulate cells at glabriflora specie, with fine cells at myrsinites specie,

reticulate accompanied by perforations at paralias and peplus species to granulate at E. helioscopia, where grains are united at the base giving really wavy lines, which look like open cells;

- Colpi, which were sharp tips in four species: characias, myrsinites, glabriflora and paralias, look like a boat in two species specifically glabriflora and paralias, were oval in peplus specie, were long trying for the center of pollen grains in all species except in glabriflora specie and had smooth membrane in helioscopia and peplus species;
- Margo, which was not present at: glabriflora and peplus species;
- Intine, which appeared with almost the same thickness as exine in Euphorbia characias.

Table 1. Minimum, average and maximum dimensions of pollen grains of five Euphorbia genus species (glabriflora, myrsinites, paralias, peplus and characias) compared to helioscopia specie of literature

Features Species	Dimensions	Length of pollen grains	Width of pollen grains	Length of pori	Width of pori	Length of colpi	Width of colpi	Mesocolpium	Exine thickness
Euphorbia paralias	Minimum	28,5	28,5	3	6	12	7,5	16,5	1,2
	Average	30,45	30,15	3,75	6,45	14,55	10,65	19,2	1,35
	Maximum	31,5	31,5	4,5	7,5	16,5	13,5	21	1,5
Euphorbia peplus	Minimum	24	24	-	-	8,2	1,5	-	1,2
	Average	24,8	23,4	-	-	10	1,8	-	1,5
	Maximum	27	25,6	-	-	11,6	1,9	-	1,6
Euphorbia glabriflora	Minimum	24	22,5	6	3	7,5	4,5	13,5	1,2
	Average	25,49	24,83	6,75	3,98	8,25	4,83	14,7	1,28
	Maximum	27	26,25	7,5	4,8	9	5,4	15	1,5
Euphorbia myrsinites	Minimum	15	15	3	3,75	4,5	3	6	0,75
	Average	16,1	16,28	3,59	4,46	4,99	3,66	6,65	0,79
	Maximum	18	17,7	4,65	5,25	6	5,25	7,5	0,9
Euphorbia characias	Minimum	31,5	33,15	3	3,3	7,5	3,3	25,35	1,65
	Average	36,11	37,14	4,13	5,66	12,78	5,66	30,29	2,21
	Maximum	39,3	40,05	5,85	8,85	16,8	8,85	42,15	2,7
Euphorbia helioscopia	Minimum	29,8	29,8	-	-	-	4	-	-
	Average	32,2	32,2	-	3	10	-	-	3
	Maximum	35,5	35,5	-	-	-	5	-	-

Based on fig. 6, the Minimum dimensions were found in Euphorbia myrsinites for the most of palynomorphological features, whereas the length of pori was identified to be smaller simultaneously at

myrsinites, characias and paralias, the width of pori was identified at glabriflora specie and about the width of colpi, the dimensions were smaller at peplus specie.

Fig. 7 gives us data about average dimensions of studied species compared to helioscopia specie, which were smaller at Euphorbia myrsinites for the most of studied palynomorphological features except the width of pori, which appeared smaller at Euphorbia glabriflora and the width of colpi, which was smaller at Euphorbia peplus. Bigger average dimensions appeared at Euphorbia characias for the dimensions of pollen grains and mesocolpium, at

Euphorbia glabriflora for the length of pori, at Euphorbia paralias for the width of pori, dimensions of colpi and at Euphorbia helioscopia for exine thickness.

As shown in the fig. 8, Maximum dimensions were found at Euphorbia characias for the most of palynomorphological characteristics except the length of pori, which was identified at Euphorbia glabriflora, width of colpi at Euphorbia paralias and exine thickness at helioscopia specie.

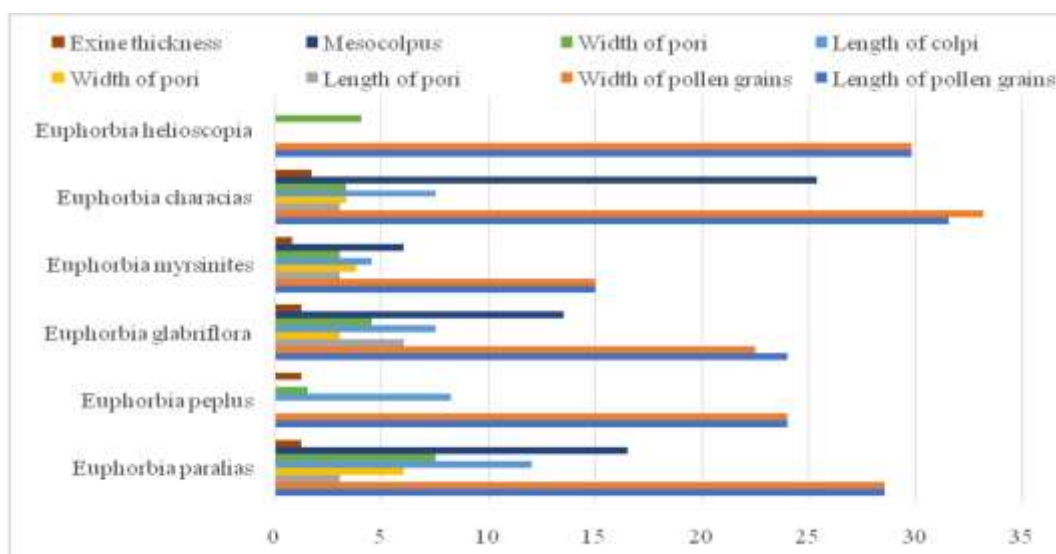


Figure 6. Minimum dimensions of pollen grains of five Euphorbia genus species (glabriflora, myrsinites, paralias, peplus and characias) compared to helioscopia specie of literature

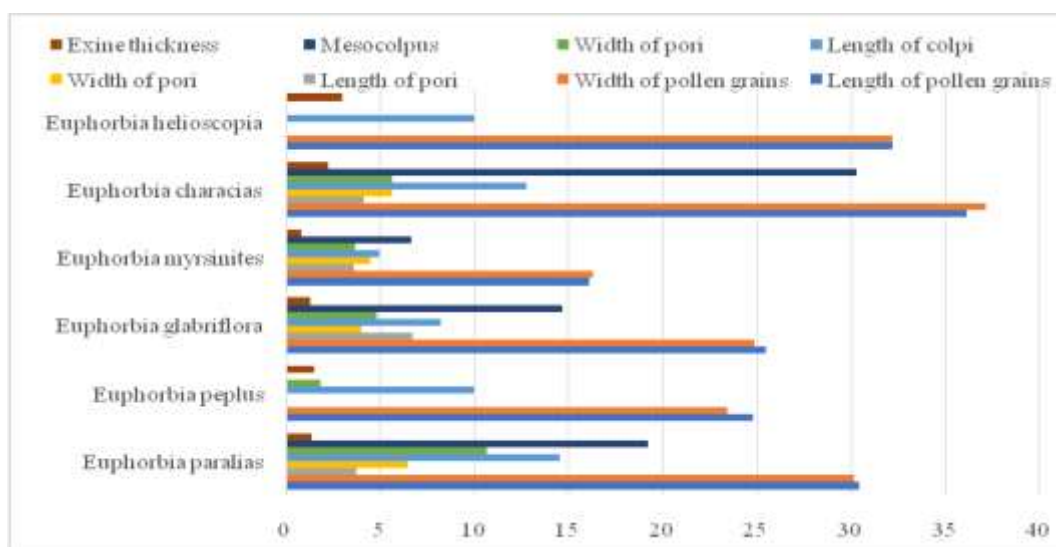


Figure 7. Average dimensions of pollen grains of five Euphorbia genus species (glabriflora, myrsinites, paralias, peplus and characias) compared to helioscopia specie of literature

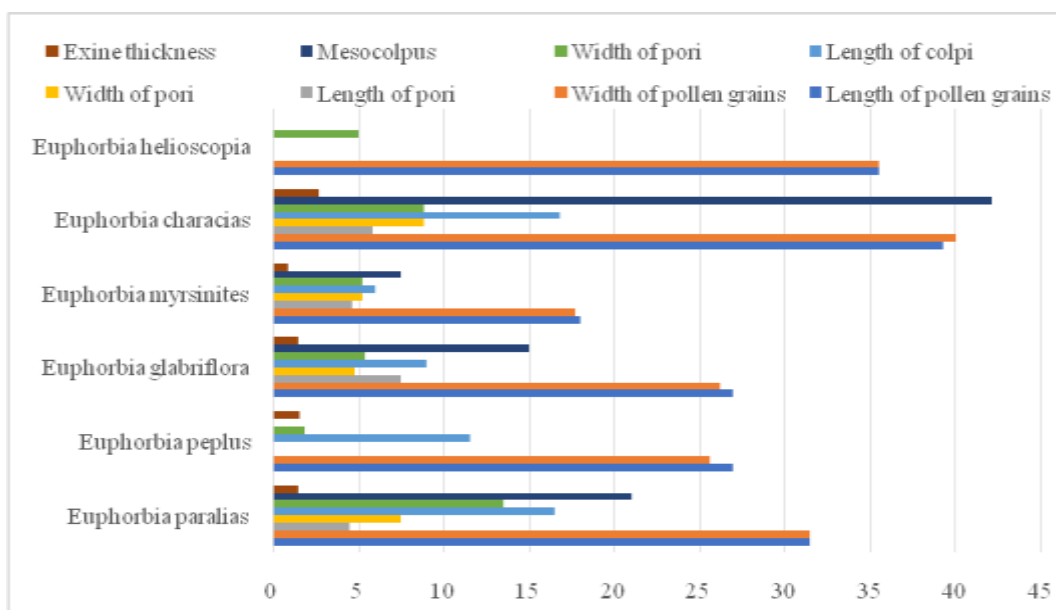


Figure 8. Maximum dimensions of pollen grains of five Euphorbia genus species (glabriflora, myrsinites, paralias, peplus and characias) compared to helioscopia specie of literature

V. CONCLUSION

Based on the aperture feature, pollen grains of studied Euphorbia genus (paralias, peplus, glabriflora, myrsinites and characias) compared to Euphorbia helioscopia will be classified in three groups:

1. Tricolporate at glabriflora, myrsinites, paralias and characias species;
2. Tricolpate at peplus specie;
3. Apertoid tricolpate at helioscopia specie.

The palynomorphological study of five species compared to helioscopia specie showed that the pollen grains had similarities in terms of:

- Shape, which appeared spheroidal in polar view and oval in equatorial one;
- Monad grouping of pollen grains;
- Double-layered exine.

This study highlighted some differences as follows:

- Exine sculpture, which varied from reticulate at characias, glabriflora and myrsinites species, with visible equal reticulate cells at glabriflora specie, with fine cells at myrsinites specie, reticulate-perforate at paralias and peplus species to granulate at E. helioscopia;
- Colpi, which had sharp tips in four species: characias, myrsinites, glabriflora and paralias, boat-shaped in two species specifically glabriflora and paralias, were oval in peplus specie and had smooth membrane in helioscopia and peplus species;

- Colpi went to the center in all species except at Euphorbia glabriflora;
- Presence of margo in myrsinites, paralias, characias and helioscopia species;
- Intine, which appeared thick and almost equal to exine, only in characias specie.

Average dimensions of five studied species compared to helioscopia specie were smaller at Euphorbia myrsinites for the most of studied palynomorphological indicators except the width of pori, which appeared smaller at Euphorbia glabriflora and the width of colpi, which was smaller at Euphorbia peplus.

The largest average dimensions were found at Euphorbia characias for length and width of pollen grains and the space between the furrows, at Euphorbia paralias for the width of pori and furrows and the length of furrows, at Euphorbia glabriflora for the length of pori and at Euphorbia helioscopia for exine thickness.

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