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Spores of the form-genus *Laevigatosporites* from Oligocene leaf imprint of *Cyclosorus dalmaticus*

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Димитър А. Иванов. 1997. *Спори на форма-род Laevigatosporites от олигоценски листен отпечатък на Cyclosorus dalmaticus. Rev. Bulg. Geol. Soc., 58,* 2, 111–114.

Абстракт. Ботаническата принадлежност на редица фосилни таксони спори и полен в много случаи е неизвестна. Ето защо находките на фертилни растителни останки са от особен интерес за палинолозите, поради възможностите за установяването на връзката между фосилните и съвременните таксони. Тези данни са особено ценни при палеоекологичните интерпретации на палинологичните данни.

Изолираните от спорангиите на *Cyclosorus dalmaticus* (Heer) Palam. et Petk. спори на фосилния род *Laevigatosporites* Ibrahim показват несъмнената връзка на този таксон със сем. Thelypteridaceae Pic.-Ser., и по-конкретно с род *Cyclosorus* Link. Род *Cyclosorus (s. l.)* обхваща 20 подрода и около 650 съвременни вида (Tryon, Lugardon, 1990; Smith, 1990), разпространени главно като компоненти на хигрофитните горски съобщества от субтропичните и тропичните области на Америка, Африка, Южна и Югоизточна Азия, Малайзия, Австралия и Тихоокеанските острови.

Key words: spores, *Laevigatosporites*, Thelypteridaceae, Oligocene, Bulgaria

Introduction

For many fossil pollen and spores taxa the botanical affinity is unclear. That's why fossil finds of fertile plant remains are of special interest, because of the possibilities to establish the relationships between fossil and recent taxa, and use these data in paleoecological interpretation of palynological data. The present find of fertile leaf imprint of *Cyclosorus dalmaticus* (Heer) Palamarev et Petkova, 1975 permits us to conclude that the botanical affinity of the genus *Laevigatosporites* Ibrahim, 1933 (p. p.) is with the fam.Thelypteridaceae Pichi-Sermolli, 1970, and genus *Cyclosorus* Link, 1833. The family Thelypteridaceae comprises almost one thousand species, distributed mainly in the wet parts of the tropics (Holttum, 1983). The genus *Cyclosorus* (s. l.) is the largest one of five genera in this family, with 20 subgenera, and ca. 650 extant species (Smith, 1990; Tryon, Lugardon, 1990). The extant species of the genus are widely distributed in tropical and subtropical regions of Old and New World — in the neotropics from Florida to Argentina, and the Antilles; tropical and subtropical Africa and adjacent islands; from India and South-East Asia throughout Malasya to Qeensland, and in the Pacific Islands (Ohwi, 1965; Holttum 1954; Smith, 1990; Tryon, Lugardon, 1990). They are widespread in or at the edges of humid forests (occasionally swamps) at low to middle elevation; along streams, river banks and ditches.

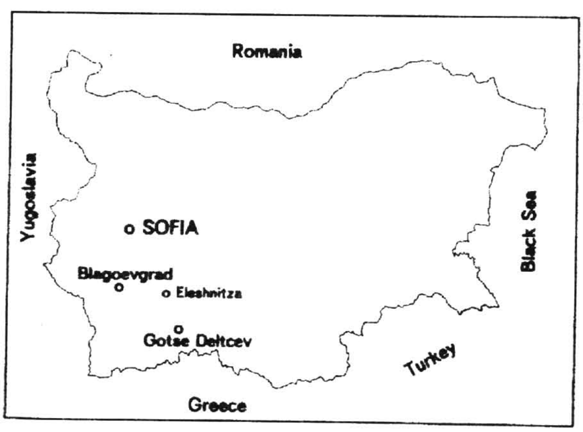

Fig. 1. Sketch-map of Bulgaria and locality of the village of Eleshnitza
Фиг. 1. Схематична карта на България с местоположението на с. Елешница

Material and methods

The material under study came from Paleogene rocks in Western Rhodopes Mountains (SW Bulgaria). The locality is situated near the village of Eleshnitza (Fig. 1). According to Иванов, Чернявска (1972) the age of the flora bearing layers is Early Oligocene.

The fossil spores were isolated from sporangia of fertile leaf imprint (Pl. I, figs. 1, 2, 3) of *Cyclosorus dalmaticus* (Heer) Palamarev et Petkova (N Bl E-358, Paleobotanical collection of the Institute of Botany, BAS). The sporangia are rounded (Pl. I, fig. 2, 3), situated in two rows on the secondary leaf parts. The description of the leaf imprints is presented by Паламарев, Петкова (1975, 1990).

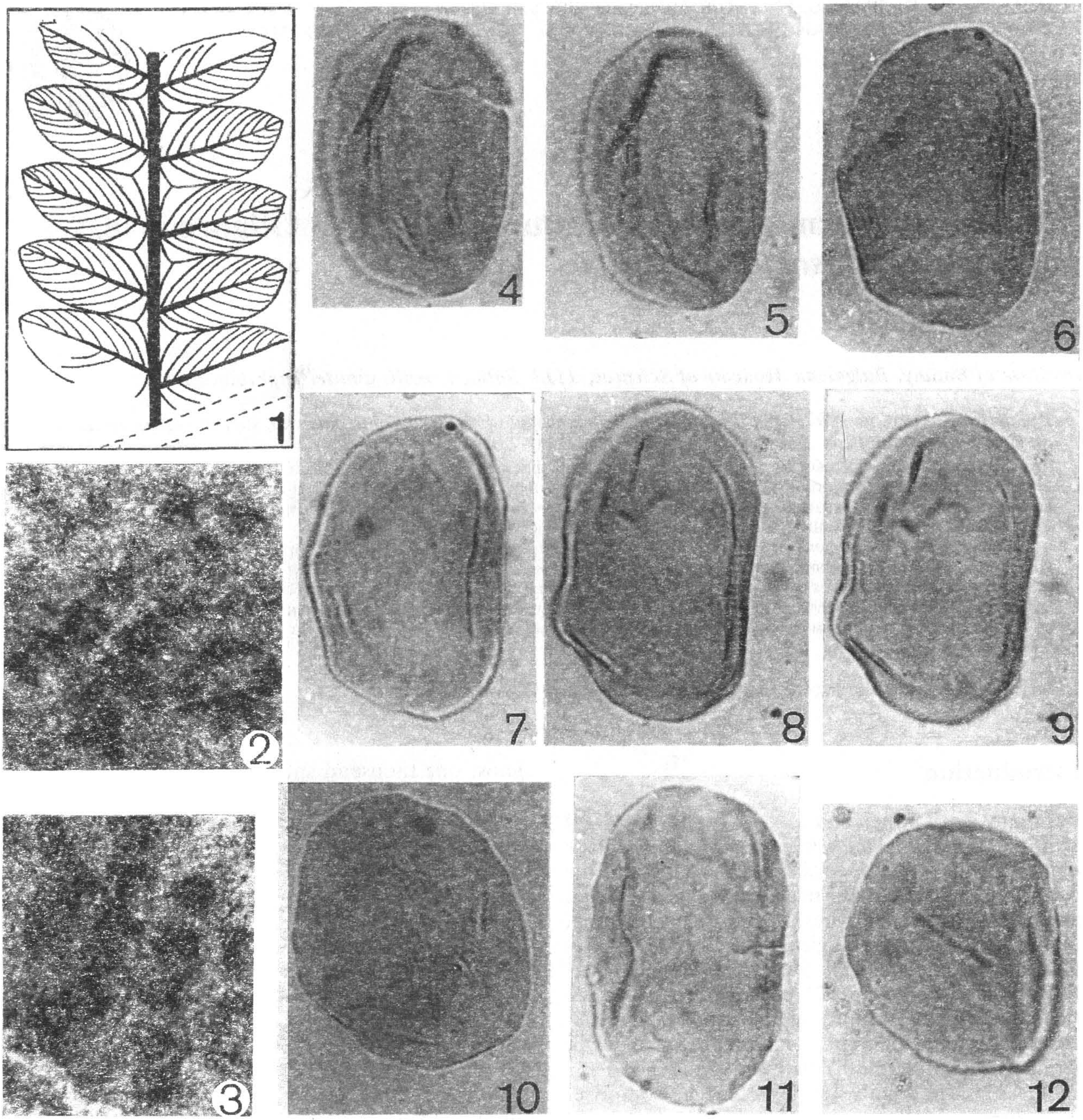

PLATE I

1. Cyclosorus dalmaticus (Heer) Palam. et Petk. (from Паламарев, Петкова, 1975), (x 2)
2,3. Sporangia of *Cyclosorus dalmaticus* (Heer) Palam. et Petk. (photos by Prof. E. Palamarev), (x 5)
4-12. Laevigatosporites sp. from sporangia of *Cyclosorus dalmaticus* (Heer) Palam. et Petk. - Spores in different position and focus level, (x 1000)

ТАБЛИЦА I

1. Cyclosorus dalmaticus (Heer) Palam. et Petk. (от Паламарев, Петкова, 1975), (x 2)
2,3. Sporangia of *Cyclosorus dalmaticus* (Heer) Palam. et Petk. (микроснимки на Проф. Е. Паламарев), (x 5)
4-12. Laevigatosporites sp. от спорангии на *Cyclosorus dalmaticus* (Heer) Palam. et Petk. - Спори в различно положение и оптично ниво, (x 1000)

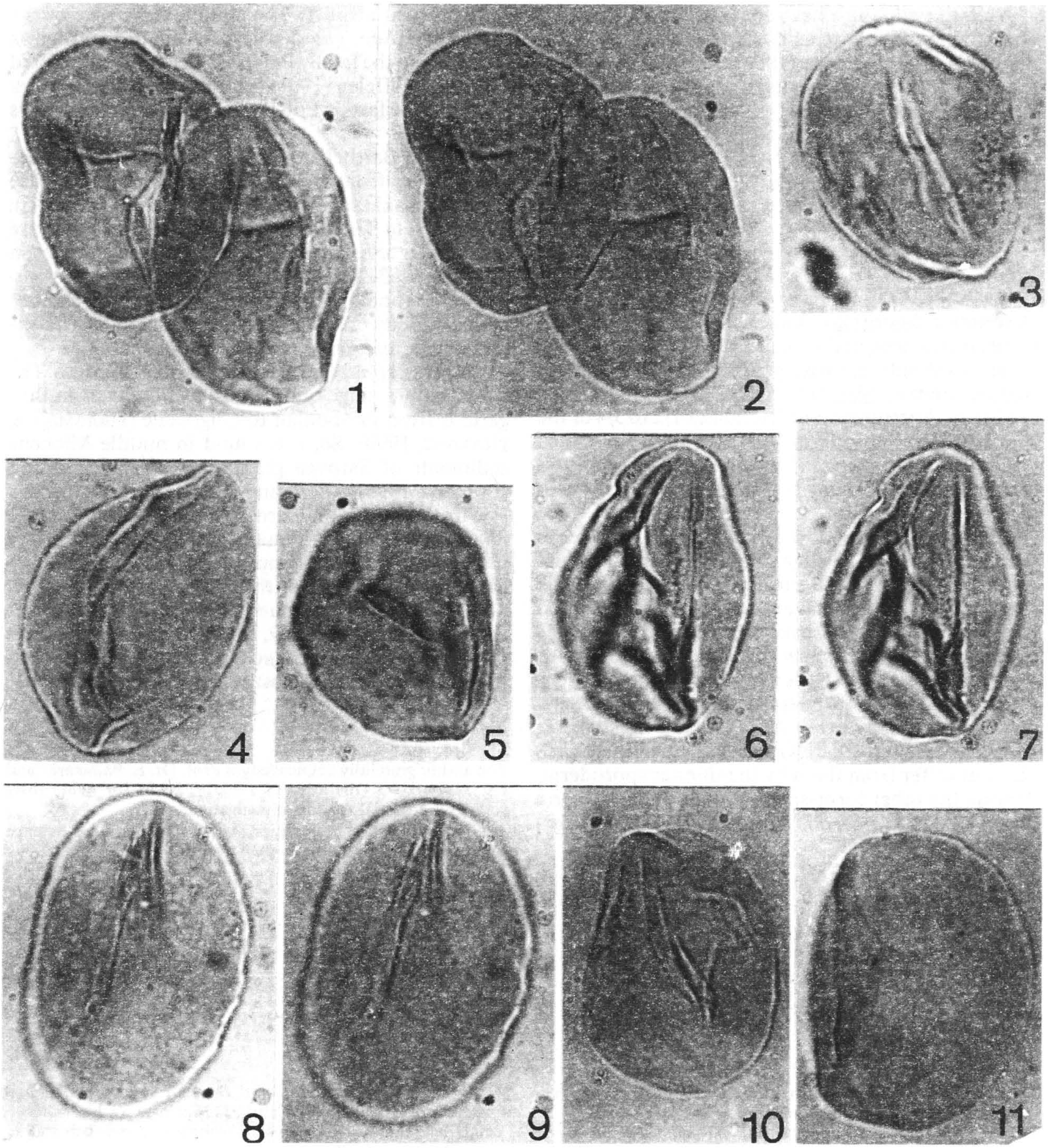

PLATE II

1-11. Laevigatosporites sp. from sporangia of *Cyclosorus dalmaticus* (Heer) Palam. et Petk. - Spores in different position and focus level, (x 1000)

ТАБЛИЦА II

1-11. Laevigatosporites sp. от спорангии на *Cyclosorus dalmaticus* (Heer) Palam. et Petk. - Спори в различно положение и оптично ниво, (x 1000)

Isolated sporangia have been successively treated with 10% hydrochloric acid, 5% potassium base and acetolysis after Erdtman (1966). Morphological description and measurements of the spores are based on 30 specimens.

Results and discussion

Laevigatosporites sp.

Pl. I, figs. 3-12, Pl. II, figs. 1-11

Description. Spore class: monolete. Outlines: elliptical in distal and proximal view, ± bean-shaped in lateral view; distal side convex, proximal side straight to slightly concave. Sizes: (31.6) 35.2 (37.5) x (43.8) 48.7 (54.2) µm. Aperture: monolete, about 1/2 to 3/4 of the spore length. Sporoderm: (0.6) 0.9 (1.3) µm thick. Ornamentation: psilate (laevigate), at the apertural area sporoderm is finely perforate, perforations with diameter up to 0.4 µm.

Remarks. Spores of the extant Thelypteridaceae species are bilateral, with a monolete scar, and generally range from 25-60 µm long x 10-35 µm wide (Smith, 1990). They have a variously ornamented perispore, which is destroyed during fossilization. The isolated fossil spores show variability in its morphological features, and that's why they can not be identified with a single form-species of the genus *Laevigatosporites*. They are within the size-class of *L. nutidus* (Mamzar, 1960) Krutzsch, 1967 subfsp. *nutidus,* but differ from them by the thinner sporoderm. Among the other form-species some similarities are observed with *L. haardti-* group and *L. pseudodiscordatus* Krutzsch, 1959.

Botanical affinity: The sporae disperssae of the form-genus *Laevigatosporites* are usually regarded as belonging to the family Polypodiaceae. As it is pointed out by van Uffelen (1991) ascribing *Laevigatosporites* spores to the family Polypodiaceae (s. s.) may always be doubtful.

In 1976 Barthel also found spores of genus *Laevigatosporites* from sori of *Cyclosorus stiriacus* (Unger) Ching & Takhtajan (p. 456; Taf. LXXIX, Fig. 4-6). According to Thiele-Pfeiffer (1980) these spores are very similar to *L. haatdti* (Potonie & Venitz) Thomson & Pflug, 1953. Thus, the present finding of *Laevigatosporites* spores is another evidence about the botanical affinity of this form-genus with family Thelypteridaceae, and genus *Cyclosorus* (s.l.).

Stratigraphic and geographic distribution. The stratigraphic range of *Cyclosorus dalmaticus* in Bulgaria is from Priabonian to Oligocene (Паламарев, Петкова, 1990). So, it is found in middle Miocene sediments of Satovca graben, Western Rhodopes (Бозуков, 1996). According to Паламарев, Петкова (1990) the geographic areal of the species includes Spain, Switzerland, Germany, Hungary, Bulgaria and Georgia; and its stratigraphic range is Priabonian — Pontian. The species of the genus *Laevigatosporites* are one of the most frequent spore species in the European Tertiary. Usually, they are more frequent in coal-bearing sediments and are more significant from palaeoecological than biostratigraphical point of view.

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