

STUDIES ON THE CHARACTER VARIABILITY IN THE
RAMSBOTTOMIA CREC'HQUERAULTII COMPLEX (PEZIZALES)B. KULLMAN¹ & J. VAN BRUMMELEN²

The variability of the margin of the apothecium and the spore ornamentation of the *Ramsbottomia crec'hqueraultii* complex has been studied by light microscopy and scanning electron microscopy (SEM) to estimate their taxonomic value.

The taxonomic value of the structure of the apothecial margin is a controversial issue in the systematics of Pezizales. The most important distinguishing characters of the genera are the presence or absence of hairs and their structure and colour.

The genus *Ramsbottomia* W.D. Buckley emend. Benkert & Schumacher (1985) is especially interesting in this respect since the apothecium of its *R. crec'hqueraultii* complex has been described as 1) externally smooth, with an indistinct margin of *textura porrecta* by Boudier (1904–1911), Seaver (1928), Rifai (1968), and Gamundi (1975) for *Lamprospora crec'hqueraultii* (Crouan) Boud. and by Eckblad (1968) for *L. ovalispora* (Svrček & Kub.) Eckbl., as well as 2) covered with hairs by Seaver (1928) for *Sphaerosporella perplexa* Seav., by Gamundi (1975) for *L. crec'hqueraultii* (Crouan) Boud. var. *modesta* (P. Karst.) Gamundi, by Dennis (1978) for *L. crec'hqueraultii* (Crouan) Boud., and by Caillet & Moyne (1980) for *Octospora crec'hqueraultii* (Crouan) Caillet & Moyne. This character has also been described as 3) somewhat intermediate between both possibilities mentioned: "... apothecia ... smooth or with hardly visible light brownish hyphal element at the thick margin" by Moravec (1978) for *L. crec'hqueraultii* (Crouan) Boud. var. *modesta* (P. Karst.) Gamundi. Benkert (1976) described *Lamprospora crec'hqueraultii* (Crouan) Boud. as having hair-like hyphae at the margin of the apothecium. The hyphae are hyaline, more or less brown and wavy, varying within the specimen, but Benkert wrote: "Man kann diese Hyphen zwar nicht als echte Haaren bezeichnen."

Buckley (1923), however, described *Ramsbottomia lamprosporoidea* as having a margin covered with pale brown hairs 160–285 µm long and 11–18 µm wide.

In the present paper the main attention is paid to the variability of the margin of the apothecium and of the spore ornamentation in order to estimate the taxonomic value of these characters.

MATERIALS AND METHODS

In the course of this study 30 specimens of the *Ramsbottomia crec'hqueraultii* complex in the herbarium of the Institute of Zoology and Botany of the Academy of Sciences of

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Estonia (TAA) were studied. Another part of the material had been obtained from other herbaria (Benkert's Herbarium, CO, CUP, H, L, NY, O, and PC). The following specimens were examined.

WEST EUROPE. France: Finistère, s. loc., on soil of banks of brooks, IX and X.1858, *Crouan* (lectotype of *Ascobolus crec'hqueraultii*, PC); Finistère, Marais de Pontanéven, on moist ground, 18.V.1865, *Crouan* (as *Ascobolus crec'hqueraultii*, CO). — The Netherlands: prov. N.-Brabant, Nuenen, among mosses, 4.VI.1991, *H. Huijser* (TAA, L); Urkhoven, among mosses, 9.VI.1991, *H. Huijser & B. Kullman* (TAA).

CENTRAL EUROPE. Germany: near Suhl, Hargrund, Friedberg, on the ground, 17.IX.1981, *D. Benkert 543011* (as *Ramsbottomia crec'hqueraultii*, TAA); Rostock, Mooskuhler by Neuhirsberg, on moist sand, 19.IX.1985, *D. Benkert* (as *R. crec'hqueraultii*, TAA); Potsdam, Fresdorf bog, on the ground, 29.X.1969, *D. Benkert* (as *R. crec'hqueraultii*, TAA); Zechengrund bei Oberwiesental, on moist ground among *Pnelia*, 23.IX.1986, *D. Benkert* (as *R. crec'hqueraultii*, TAA).

NORTH EUROPE. Norway: Hedmark, Os, Tufsinga, Straumvollen, on silt among *Carex aquacilis*, 22.VII.1976, *T. Schumacher 134176* (as *Lamprospora ovalispora*, TAA ex O). — Russian Rep.: Karelia, Kalevala, Mikkola, among *Pinetum myrtillosum* on the ground, 9.VIII.1965, *E. Parmasto* (TAA 18143). — Sweden: Torne Lappen, Jukkasj rvi s:n, Abisko, on the ground among mosses, path to Njakajure, 26.VII.1927, *J.A. Nannfeldt & H. Smith* (as *Peziza modesta* P. Karst., det. J.A. Nannfeldt; *Lamprospora crec'hqueraultii* det. R.P. Korf; CUP 49535). — Finland: Mustiala, 1876, *P.A. Karsten* (as *Humaria modesta* P. Karst., det. P.A. Karsten, H; as *L. exapetala*, NY).

EAST EUROPE. Estonia: Dist. Võru, Vana-Kasaritsa, on silt among *Carex* sp., 8.VI.1986, *B. Kullman* (TAA 116172); Dist. Tartu, Ahunapalu, Apnasaar, on the ground, 19.VIII.1990, *K. Kalamees* (TAA 144733). — Russian Rep.: Komi, Cherdynsk, Visay, on the ground among mosses, 9.IX.1988, *B. Kullman* (TAA 117118).

WEST SIBERIA. Russian Rep.: Yamal-Nenets A. Okr., Krasnosel'kup, river Taz, on the ground among *Laricetum ledosum*, 31.VII.1964, *E. Parmasto & I. Maasik* (as *R. ovalispora*, TAA 17003); Gavotuy, Polar Urals, on the ground, 5.VII.1966, *A. Sirko* (TAA); Shurush, Ovgort, on the ground, 27.VII.1976, *M. Murdvee* (TAA 110047).

ARCTIC. Russian Rep.: Yamal-Nenets A. Okr., Slantsevaya, Krasny Kamen, Polar Urals, on the ground, 11.VIII.1966, *A. Sirko* (TAA).

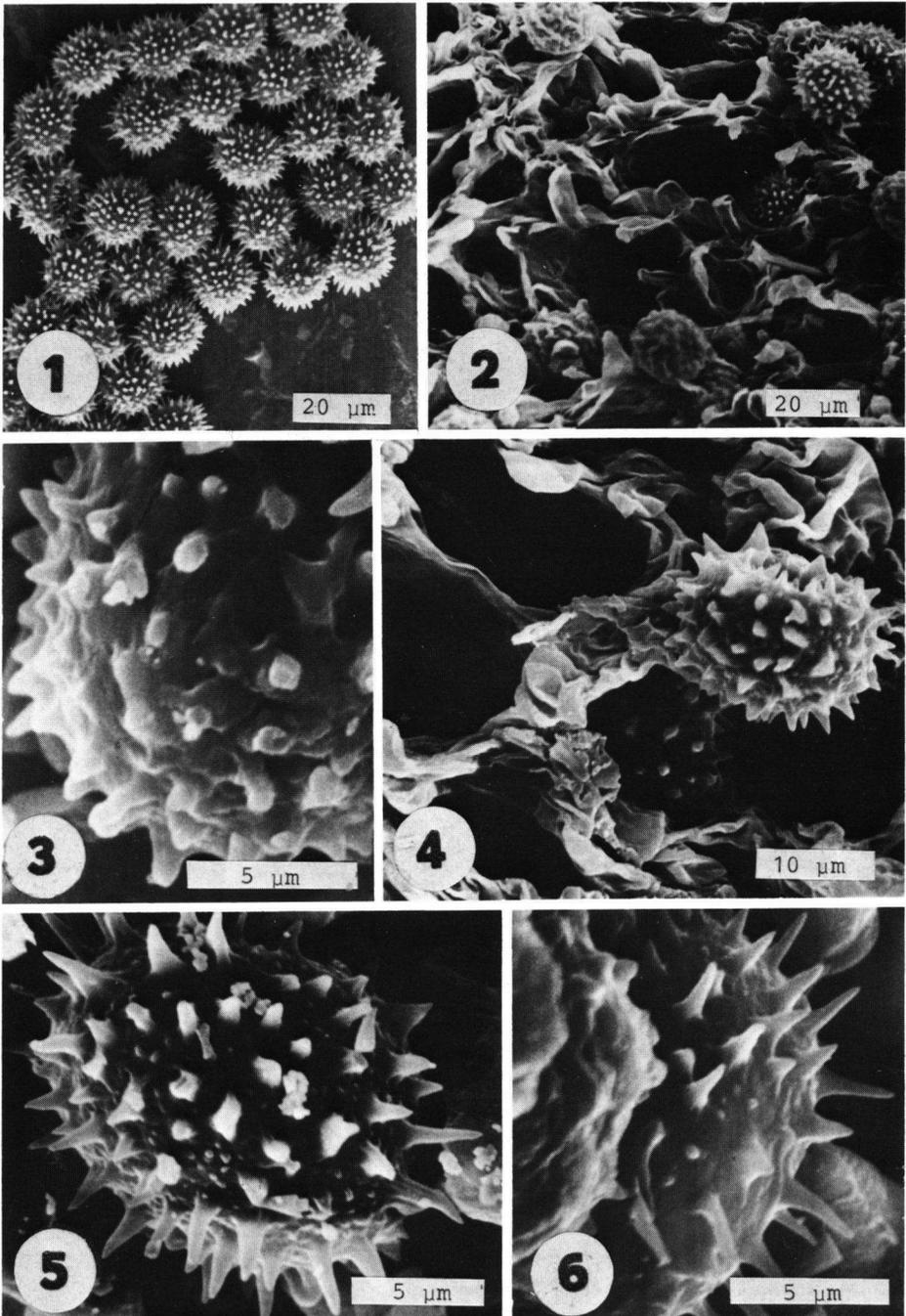
THE FAR EAST. Russian Rep.: Amur Dist., Dzeltulaskiy Region, Mogot, 200–400 m high, on the ground of a forest path, 27.VII.1961, *A. Raitviir* (TAA 42026); Mogot, on the ground, 29.VII.1961, *A. Raitviir* (TAA 42079); Svobodny, on the ground, 15.VIII.1959, *B. Tomilin* (TAA); Khabarovsk Dist., Oblutse Region, on sandy ground in a wood of *Picea abies*, 8.VIII.1961, *A. Raitviir* (TAA 42165); Selikhino, on the ground in a birch wood, 22.VII.1961, *A. Raitviir* (TAA 42355); Yuzny, Sikhote-Alin' mountains, near the river Matay, on the ground, 14.VII.1973, *B. Kullman* (TAA 66495); Primor'ye Dist., Partisanskiy, Sikhote-Alin' mountains, on the ground in the wood, 16.VIII.1986, *I. Parmasto* (TAA 125955); Reservation Lazo, Amerika, near a river, on the ground among mosses, 9.VIII.1986, *B. Kullman* (TAA 116338); on the ground, 12.VIII.1986, *B. Kullman* (TAA 116403); Kamchatka Dist., Reservation Kronokskiy, Uzon Caldera, Pineto-Alnetum, on the ground, 22.VIII.1978, *K. Kalamees* (TAA 120188).

NORTH AMERICA. U.S.A.: New York, near Yonkers, on the ground in the wood, 2.X.1919, *F.J. Seaver* (as *Sphaerospora perplexa* Seav., NY).

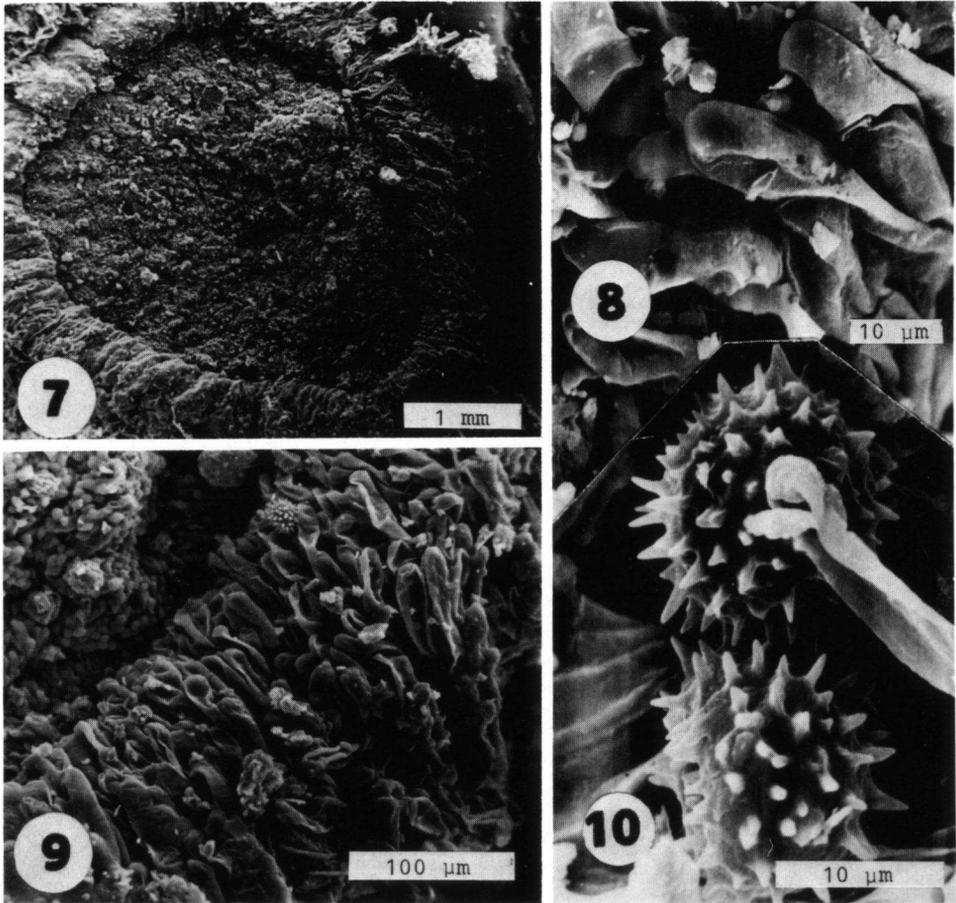
Light and scanning electron microscopy (SEM)

The fungal fruit-bodies were observed and measured with an 'Amplival' microscope. A watery solution of 2% potassium hydroxide (KOH) was used as an observation medium for fruit-bodies. The spore wall markings were stained in a solution of cotton blue in lacto-phenol and the spores were measured using the immersion objective HI 100. At least ten spores were measured in each specimen.

The ornamentation of the spores was studied and scanning electron micrographs were taken with a Tesla BS 301.



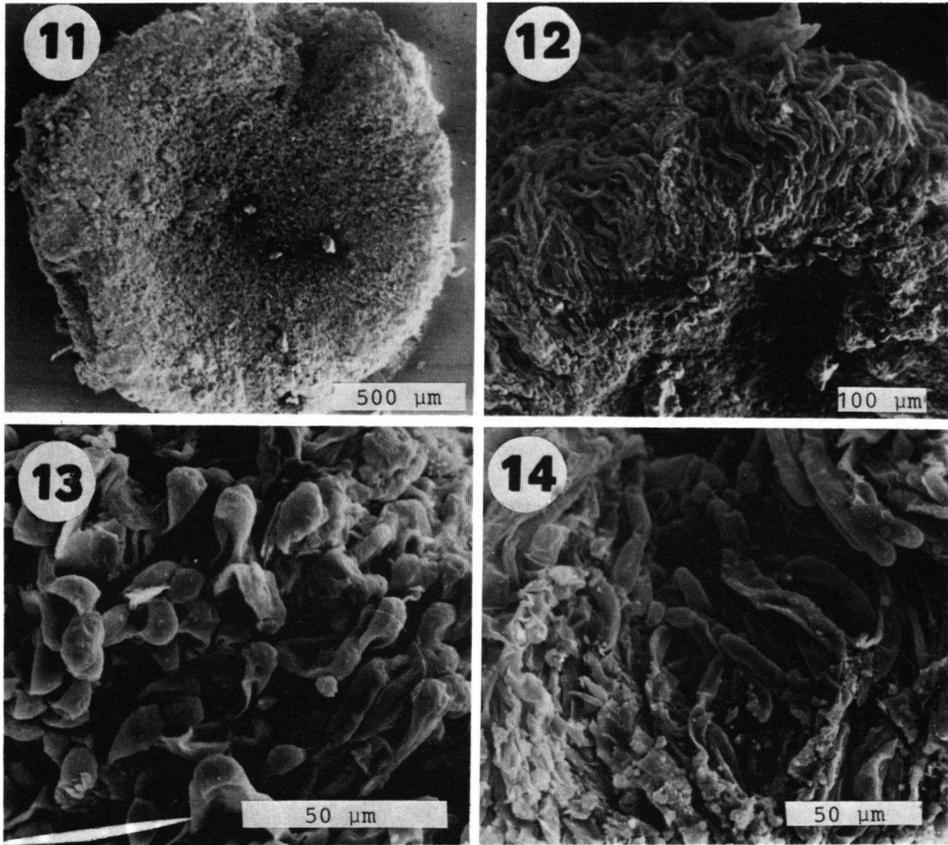
Figs. 1–6. *Ramsbottomia crec’hqueraultii*: 1, spores (TAA 117118); 2, 4, spores (TAA 110047); 3, 5, 6, spores (*T. Schumacher*, 134/76; TAA ex O).



Figs. 7–10. *Ramsbottomia crec'hqueraultii*: 7, apothecium and 9, margin (TAA 116338); 8, hairs and 10 spores (TAA 66495).

RESULTS AND DISCUSSION

Rifai (1968) wrote that “it might well be necessary to uphold *Ramsbottomia* for the reception of *Lamprospora crec'hqueraultii* and its related species now classified as *Lamprospora* or *Octospora*, which should be distinguished from the last two genera by the difference in the structure of its excipular tissue, especially in the absence of a thin and compact prosenchymatous layer on the outer surface of the receptacle.” Taking this into account, Benkert & Schumacher (1985) have described *Ramsbottomia* W.D. Buckley emend. Benkert & T. Schumacher. In addition, they stress two important circumstances, viz. differently from the genus *Lamprospora* De Not. the genus *Ramsbottomia* is not bryo-parasitic and it has prominent, brownish, hyphoid hairs towards the margin, arising from outermost excipular cells.



Figs. 11–14. *Ramsbottomia crec'hqueraultii*: 11, apothecium (TAA 110047); 12, margin and 14, hairs (TAA 125955); 13, hairs (*B. Tomilin*, 15.VIII.1995; TAA).

In the opinion of the present authors it is the latter morphological character that seems to be the most important. The margin may be more or less distinct (Figs. 7, 11) but the presence of the hairs similar to those of the genera *Aleuria* or *Melastiza* is obligatory (Figs. 7–9, 11–14).

The statistical test applied to the variability of hair length dimensions shows that it may be homogeneous in the investigated material.

The spore ornamentation of the whole studied materials is relatively uniform and does not vary notably in different geographical populations (Figs. 1–6, 10), when we take into account that the spores in a single apothecium can already be rather different.

The shape of the spores varies from a perfect sphere to subglobose. A more detailed account of the variability of spores in *Ramsbottomia crec'hqueraultii* will be presented in a forthcoming paper.

On the basis of comparative morphological study the authors consider all specimens studied to belong to the same species. It is a holarctic arcto-boreo-temperate species (Fig. 15) which has evidently been distributed from its centre of diversity in the Far East (Sikhote Alin' mountains), where the variability of its characters is remarkably larger than that of its neighbouring populations, to Europe during the late-glacial period and the Lower Holocene, like the Polyporaceae (Laasimer, 1965). *Ramsbottomia crec'hqueraultii* has quite a wide ecological amplitude.

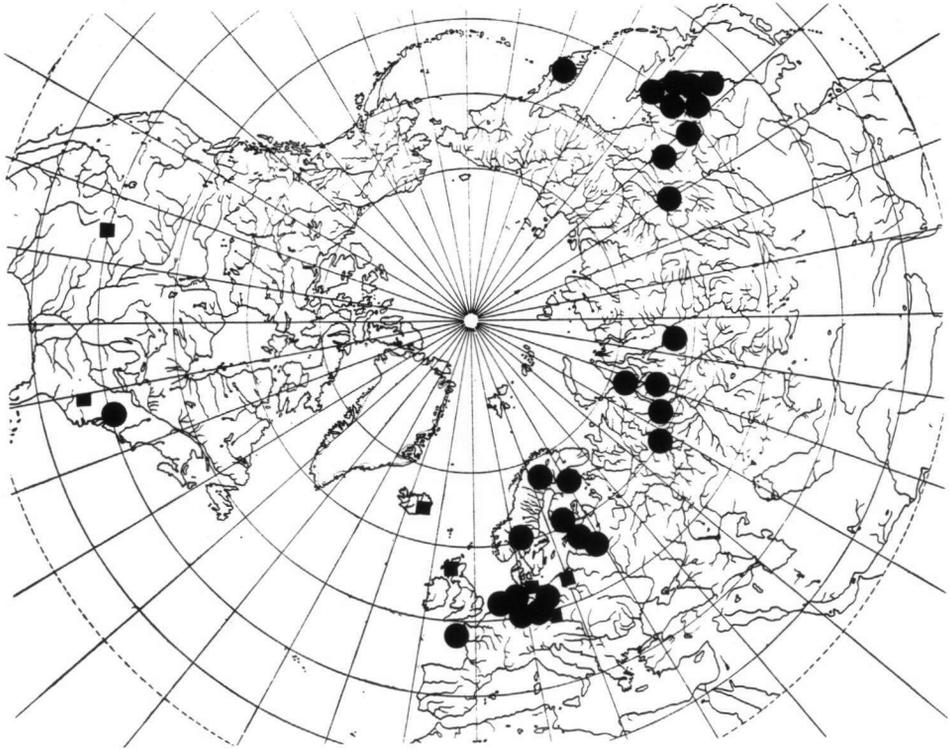


Fig. 15. Holarctic arcto-boreo-temperate distribution of *Ramsbottomia crec'hqueraultii* (● = according to the specimens examined during this study; ■ = taken from literature).

Ramsbottomia crec'hqueraultii (Crouan) Benkert & T. Schumach.

Ascobolus crec'hqueraultii Crouan, Anns Sci. nat. (Bot.) IV, 10 (1858) 194, pl. 130 figs. 12–16. — *Lamprospora crec'hqueraultii* (Crouan) Boudier, Icon. mycol., Sér. I, livr. 2 (1904), Liste préliminaire, unnumbered page. — *Ramsbottomia crec'hqueraultii* (Crouan) Benkert & T. Schumach., Agarica 6 (12) (1985) 33.

Peziza asperior Nyl., Obs. Peziz. fenn. (1868) 21. — *Ciliaria asperior* Boud., Hist. class. Discom. Eur. (1907) 62. — *Ramsbottomia asperior* (Nyl.) Benkert & T. Schumach., Agarica 6 (12) (1985) 35.

Peziza modesta P. Karst., Not. Sällsk. F. Fl. fenn. Förh. 10 (1869) 122. — *Lamprospora crec'hqueraultii* (Crouan) Boud. var. *modesta* (P. Karst.) Gamundi, Fl. cript. Tierra del Fuego 10 (3) (1975) 130.

Sphaerospora perplexa Seaver, The North American Cup-Fungi (Operculates) (1928) 45.

Apothecia 1–6 mm in diameter. Disc orange to orange-yellow, flat to convex. Receptacle saucer-shaped; margin even, rather thick, sometimes exceeding the hymenial level; often with more or less evident hyphoid hairs arising from the excipulum towards the margin. Ectal excipulum of textura globulosa. Hairs hyphoid, cylindrical, obtuse, thick-walled, 2–4-celled, subhyaline or pale brownish, 64–260 μm long and 6.4–22.4 μm wide. Hymenium 230–350 μm thick. Asci clavate, cylindrical, 8-spored. Ascospores uniseriate when dried, with many small oil drops when fresh, hyaline, subglobose or globose, (14.5–)14.8–18.4(–19.5) \times (12.0–)13.8–16.0(–16.4) μm , ornamented with sharply pointed spines, 1.3–3.5 μm long, up to 1.7 μm wide, sometimes with fine warts between the spines. Paraphyses enlarged to 5.0–6.3 μm wide at the tip, septate, straight.

Habitat. From June to October, on the ground, sometimes among mosses or species of *Carex*; North America, Europe, and Asia.

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