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THE GENUS *HELICOCERAS*

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The members of the genus *Helicoceras* were formerly placed in the genus *Gyroceras*. A study of the literature, however, shows that this latter name cannot be applied to the species other than *Gyroceras ammonis*, and for reasons to be shown shortly that name is not valid because of synonymy.

The genus *Gyroceras*, based on *G. ammonis*, was erected by Corda¹ in 1837. His description of the original species runs as follows: "Acervulis atris, confluentibus, stromatis strato inferiore atro; superiore luteo, hyalino, celluloso; floccis infra atris, supra attenuatis luteis; sporis ovalibus discoideis, depressis." It readily can be seen that the presence of a two-layered stroma sharply sets off Corda's species from the non-stromatic ones that make up the remainder of the genus. These latter are parasitic or weakly so, and their vegetative hyphae, although branching, never aggregate to form a stroma under the sporogenous area. A careful examination of the original figure illustrating *G. ammonis* makes it obvious that the present-day conception of the genus is founded on misinterpretation. The "strato superiore" is definitely a layer of short conidiophores beyond which the curved sterile hyphae project. According to Corda, these sterile hyphae break into ovoid discoid spores, a statement that seems partly to have been the cause of the misconception of his genus, and one that needs confirmation before final acceptance. Even though this doubtful point were settled, Corda's genus is not that of later investigators and, in fact, should be relegated to synonymy, as is done in the

¹ Corda, A. C. I., *Icon. Fung.* 1: 9. *pl. 2, fig. 141.* 1837.

present paper, and the species placed in the genus *Sarcopodium* of Ehrenburg¹ under the subgenus *Tricholeconium* as it was understood by Lindau.²

In 1856, when Montagne and Cesati³ transferred *Monilia Celtidis* (*Celtis*) to *Gyrocerus*, they established the present conception of the genus. Although they did not give a generic description, they did describe the species rather fully. In the description it is stated that "stroma adest tenuissimum, a Bivona praetermissum, e fibrillis exilissimis materiae grumulosae intermixtus constans, pallidum," and further that the spore filaments "tandem in sporas globosas secedentis." The term stroma is obviously misapplied in this instance, so much so that it would appear that the authors were stretching the term so as to make the species fit into the genus. The statement that the spore filament breaks into globose spores can be substantiated neither by the investigations of *Gyroceras Celtidis* by Killian,⁴ nor by the writer's observations on *Helicoceras Oryzae*.

Saccardo⁵ in 1886 accepted Montagne and Cesati's interpretation of Corda's genus, and in his generic description perpetuated the erroneous statement that the conidial filament breaks into spores. At the same time he changed the generic name from *Gyrocerus* to *Gyroceras* for etymological reasons and accredited the genus to Corda.

Despite the fact that Saccardo's interpretation of Corda's genus was accepted by Masee,⁶ Lindau,⁷ and others, according to the rules of nomenclature, when the type species becomes a synonym, the name of the genus also falls into synonymy. The writer therefore proposes the new name *Helicoceras*.

***Helicoceras* Linder, n. nom.**

Gyroceras Corda, Icon. Fung. 1: 9. pl. 2, fig. 141. 1837, of authors, in part.

¹ Ehrenburg, C. G., Silv. Myc. Berol. pp. 12, 23. fig. 24. 1818.

² Lindau, G. in Rabenhorst, L., Kryptog. Fl. 2nd. ed. 1(8): 708. 1906.

³ Montagne and Cesati in Montagne, J. F. C., Syll. Gen. Spec. Cryptogam. p. 308. 1856.

⁴ Killian, Ch., Soc. d'Hist. Nat. Afrique Nord, Bull. 60: 274-281. 1925.

⁵ Saccardo, P. A., Syll. Fung. 4: 266. 1886.

⁶ Masee, G., Brit. Fungus Fl. 3: 365. fig. 11, p. 313. 1893.

⁷ Lindau, G., in Engler & Prantl, Nat. Pflanzenfam. 1**: 459. fig. 273a. 1900; and in Rabenhorst, L., Kryptog. Fl. 2nd ed. 1(8): 605. 1906.

Mycelia sterilia in substrato extensa, ramosa, septata, non in stromatem aggregata; conidiophoris ex mycelio repente, rectis vel curvis, simplicibus vel ad apices breve-ramosis, apicibus inflatis vel non inflatis; conidiis atris, fuscis, vel subfuscis, multiseptatis, ad septa constrictis, irregulariter curvis, recurvis, vel glomeratis, levibus vel echinulatis.

Sterile mycelium extensive in the substratum, not forming a stromatic layer, branched, septate; conidiophores arising as lateral, erect or ascending branches from the creeping mycelium, simple or terminally short-branched, inflated apically or nearly isodiametric; conidia dilute to deep fuscous, multiseptate, constricted at the septa, irregularly bent, strongly recurved, to two times helically coiled, echinulate or smooth.

The type species is *Helicoceras Celtidis* (Biv.-Bernh.) Linder.

As at present constituted, *Helicoceras* contains four species. Of these, three are parasitic or weakly so. Their economic importance is not great since the hosts attacked are of minor value, with the limited exception of cultivated water-lilies which are occasionally severely damaged by *Helicoceras Nymphaearum*. The four members fall into two equal groups, one characterized by relatively smooth, the other by echinulate, conidia. The resemblance between the two groups is so great, however, that the creation of an additional genus for the two echinulate-spored species would add nothing to the ease of classification of so small a group.

KEY TO THE SPECIES OF HELICOCERAS

1. Conidia smooth, cells shorter than wide; conidiophores not conspicuously inflated nor densely branched at the apices.....2
1. Conidia echinulate, cells longer than wide; conidiophores mostly inflated at the apex and often densely short-branched.....3
2. Conidia 5-7.5-(9) μ thick. On *Celtis* spp.....1. *H. Celtidis*
2. Conidia 8-13 μ thick. On *Plantago* spp.....2. *H. Plantaginis*
3. Conidia 60-190 \times 5-18 μ . On *Nymphaea* spp.....3. *H. Nymphaearum*
3. Conidia 64-90 \times 5.4-9 μ . On seeds of *Oryza*.....4. *H. Oryzae*

1. *Helicoceras Celtidis* (Biv.-Bernh.) Linder, n. comb.

Monilia Celtidis (*Celtis*) Bivona-Bernhardi, Stirp. Rar. in Sicilia sponte proven. 3: 18. pl. 3, fig. 6. 1813.

Gyroceras Celtidis (Biv.-Bernh.) Mont. & Ces., in Montagne, J. F. C., Syll. Gen. Spec. Cryptogam. p. 308. 1856.

Gyroceras divergens Peck, Torr. Bot. Club Bull. 36: 155.
1909.

Plate 1, figs. 9-16.

Mycelium light fuscous to fuscous, branched, septate, penetrating through the host tissues. Conidiophores as short branches of the mycelium, simple, little differentiated. Conidia fuscous, curved, circinate, or once-coiled, more conspicuously coiled in dried material, multiseptate, some cells occasionally diagonally or longitudinally septate, constricted at the transverse septa, $50-100 \times 5-8 \mu$, the cells shorter than wide.

Parasitic on leaves of *Celtis* spp., also reported¹ on leaves of *Sponias sinensis*. Europe, North America, and Japan.

Occasionally the outer walls of the spore cells are ruptured and this may give to the spore a false appearance of echinulation. The color of the colonies is fairly constant in all specimens examined. There is, however, in the Sydow Herbarium at Stockholm a form of this species of which the spores are brick-red in color and which is labelled *G. Celtidis* forma *fulvescens*. Excepting for the color of the spores, this material agrees in all details with the typical specimens. *Gyroceras divergens* of Peck is in no way different from the European material.

Specimens examined:

Exsiccati: D. Saccardo, Myc. Ital., 1581; P. A. Saccardo, Myc. Veneta, 276; Kabat & Bubak, Fungi Imp. Exsicc., 395; H. Sydow, Myc. German., 1294; Rabenhorst, Herb. Myc., 275; E. Bartholomew, Fungi Columb., 3525; Seymour & Earle, Econ. Fungi, 147.

United States:

Arkansas: Batesville, *Bartholomew*, in Fungi Columb.

Missouri: Elmwood, *Demetris*, in Kabat & Bubak, Fungi Imp. Exsicc.

Kansas: Manhattan, *Galloway*, 1176, in Seymour & Earle, Econ. Fungi.

Italy: Pedemont, *Cesati*, in Rabenhorst, Herb. Myc. (probably authentic material); Treviso, *P. A. Saccardo*, in Myc. Venet.

Japan: Tokyo, *Shirai*, as *G. Celtidis* forma *fulvescens* (Stockholm).

¹ Lindau, G., in Rabenhorst, L., Kryptog. Fl., 2nd ed. 1(8): 606. 1906.

2. *Helicoceras Plantaginis* (Cda.) Linder, n. comb.

Torula plantaginis Corda, Icon. Fung. 3: 5. fig. 14. 1839.

Gyroceras Plantaginis (Cda.) Saccardo, Michelia 1: 266. 1878.

Plate 1, figs. 17–20.

Mycelium light to deep fuscous, branched, septate, 3–4.5 μ diam. Conidiophores fuscous, as side branches of the vegetative mycelium, occasionally branching terminally (pl. 1, fig. 20), little differentiated. Conidia deep fuscous to almost black, bent or slightly coiled, more pronouncedly coiled in dry material, smooth, simple or branched (pl. 1, fig. 19), multiseptate, constricted at the septa, 50–110 \times 7–10 μ , the cells shorter than wide.

On old living leaves of *Plantago* spp. Widespread in Europe.

This species appears to be a weak parasite that only attacks the senescent leaves of the various species of *Plantago*. It is definitely delimited by the host it infects, and the color and size of the conidia.

Specimens examined:

Exsiccati: Wartmann & Schenk, Schweiz. Kryptog., 617; H. Sydow, Myc. German., 1294; Fuckel, Fungi Rhenan., 65.

France: Lorraine near Forbach, *Ludwig*, in Sydow, Myc. German.

Germany: Munchau, in Fuckel, Fungi Rhenan.

Switzerland: Bern, in Wartmann & Schenk, Schweiz. Kryptog.

3. *Helicoceras Nymphaearum* (Rand) Linder, n. comb.

Helicosporium Nymphaearum Rand, Jour. Agr. Res. 8: 219–232. pl. 67–70. 1917.

Gyroceras Nymphaearum (Rand) Linder, Mo. Bot. Gard. Ann. 16: 294–295. 1929.

Plate 1, figs. 5–8.

Mycelium intercellular, light brown, often hyaline in culture, septate, and branched. Conidiophores slender, 2–3 μ in diameter, of varying length, inflated at the apices, 6–7.5 μ , often becoming much short-branched apically and thus producing conidia in clusters. Conidia 60–170–(190) \times (5)–6.3–14.4–(18) μ , brown, multiseptate, strongly constricted at the septa, the apical cells often subspherical or ovoid, the basal cell rounded-tapering, the

remaining cells longer than wide, minutely echinulate to finely tuberculate.

Parasitic on leaves of *Nymphaea* spp. New York, New Jersey, and Washington, D. C.

In a previous paper (*l. c.*), the writer, through an error, stated that the sclerotia reported by Rand are rounded, subcarbonaceous, and measure 150–190 μ in diameter. The measurements should read 150–900 μ in diameter.

Specimen examined:

United States:

Washington, D. C.: *Rand*, TYPE (U. S. Dept. Agr. and slide in Farlow Herb.).

4. *Helicoceras Oryzae* Linder & Tullis, n. sp.

Plate 1, figs. 1–4.

Mycelium hyalinum vel albido-fuscum, septatum, ramosum, 1.5–5.4 μ diam.; conidiophoris subhyalinis vel hyalinis, laevibus, simplicibus vel ad apices inflatos breve-ramosis, 1.8–5.4 μ diam., ad extremos 5.4–7.4 μ diam.; conidiis echinulatis, subfuscis, multi-septatis, in septis constrictis, curvatis vel subhelicoideis, in basi et apice rotundatis, 64–90 \times 5.4–9 μ .

Vegetative mycelium creeping, hyaline to light fuscous, septate, branched, 1.5–5.4 μ in diameter. Conidiophores subhyaline to hyaline, smooth, simple or short-branched at the inflated apices, of varying length, 1.8–5.4 μ thick, enlarging terminally to 5.4–7.4 μ . Conidia curved or somewhat helically coiled, light fuscous, multi-septate, constricted at the septa, the cells longer than wide, mostly of equal diameter, echinulate, the basal cell abruptly rounded, 64–90 \times 5.4–9 μ .

On kernels of Chinese rice. Texas.

This species was communicated to the writer by Professor E. C. Tullis, of the University of Arkansas, who isolated it from a kernel of Chinese rice sent to him from Texas. There is no information concerning the pathogenicity of this species.

Superficially, *H. Oryzae* resembles *H. Nymphaearum* and, like that species, also produces small sclerotia on certain media. The conidia when viewed under a hand lens appear either fulvous or fuscous, depending upon their age. The spores of this species are

smaller than are those of the related one, not so deeply constricted at the septa, and the cells are more uniform in size.

Specimen examined:

United States:

Texas: *E. C. Tullis*. TYPE (slides in Mo. Bot. Gard. Herb., the Farlow Herbarium, and the writer's herbarium).

EXCLUDED SPECIES

Gyroceras ammonis Corda, Icon. Fung. **1**: 9. *pl. 2, fig. 141*. 1837. = *Sarcopodium* (Tricholeconium) *ammonis* (Cda.) Linder, n. comb.

Gyroceras saxonicum Lindau, in Rabenhorst, L., Kryptog. Fl., 2nd ed. **1**(8): 606. 1906. = *Coremiella saxonicum* (Lindau) Feurich, Isis Budissina Bautzen **11**: 137. 1928.

EXPLANATION OF PLATE

PLATE 1

The drawings are made with the aid of a camera lucida. The magnifications in all cases are $\times 500$.

Figs. 1-4. *Helicoceras Oryzae* Linder & Tullis.

In figs. 1 and 2 are shown the typical spores of the species and also variations in the conidiophores. Fig. 4 illustrates a much-branched conidiophore that bears three immature two-celled spores.

Figs. 5-8. *Helicoceras Nymphaearum* (Rand) Linder.

In these figures may be seen the various types of conidiophores, from the simple to the much-branched. The unequal sizes of the cells of the conidia are clearly brought out, as are also the deep constrictions at the septa.

Figs. 9-16. *Helicoceras Celtidis* (Biv.-Bernh.) Linder.

The fulvous form of the species is shown in figs. 9-12. The branched conidiophores shown by fig. 9 are also found in the typical material. In fig. 16, the exospore has ruptured, exposing the lighter-colored endospore.

Figs. 17-20. *Helicoceras Plantaginis* (Corda) Linder.

The simple type of conidiophore may be seen in fig. 17, and a more loosely branched conidiophore in fig. 20. A branched conidium is also depicted in fig. 20. Such branching of conidia is of relatively rare occurrence.