

**(1557) Proposal to conserve the name *Cryptococcus gattii* against *C. honduricus* and *C. bacillisporus* (Basidiomycota, Hymenomycetes, Tremellomycetidae)**

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- (1557) *Cryptococcus gattii* (Vanbreus. & Takashio) Kwon-Chung & Boekhout, in Kwon-Chung & al., *Taxon* 51: 806. 2002. (*C. neoformans* var. *gattii* Vanbreus. & Takashio. *Ann. Soc. Belg. Med. Trop.* 50: 701. 1970), *nom. cons. prop.*  
Holotypus: from spinal fluid of *Homo sapiens* L.; Zaïre ([lyophilized culture] Mycological Department, Institut de Médecine tropicale, Antwerp No. RV 20186).
- (=) *Cryptococcus honduricus* Castell. in *Med. Press Circ.* 136: 440. 1933, *nom. rej. prop.*  
Neotypus: from skin of a patient with blastomycosis, A. Castellani ([lyophilised culture] ATCC 14248; iso-neotypus: [lyophilised] CBS No. 883)
- (=) *Cryptococcus bacillisporus* Kwon-Chung & J. E. Bennett in Kwon-Chung & al., *Int. J. Syst. Bacteriol.* 28: 618. 1978, *nom. rej. prop.*  
Holotypus: ex cerebral spinal fluid, from a patient from the San Fernando Valley, California, U.S.A. in the Veteran's Administration hospital, Los Angeles, isolated by Milton Huppert prior to 1971 ([lyophilised culture] ATCC No. 32608; isotypi [lyophilised] CBS No. 6955; NIH No. 191).

pathology (Kwon-Chung in *Mycologia* 67: 1197–1200. 1976; *Mycologia* 68: 9420946. 1976; in *The Yeasts*, a taxonomic study, 4th ed., pp. 656–662. 1998). In medical mycology, however, the two taxa are usually labelled by their yeast (anamorph) names. They differ serologically: in *C. neoformans* the serotypes A, D and AD, and in *C. bacillisporus* serotypes B and C are recognized. The major natural reservoir of *C. neoformans* is pigeon droppings and soil contaminated with avian guanos. In contrast, *C. bacillisporus* is mainly associated with *Eucalyptus* L'Hér. trees, although the species has also been isolated from tree hollows of *Moquilea* Aubl., *Ficus* L. and *Guettarda* L. species.

Prior to the description of *C. bacillisporus* as a distinct species, a strain of *C. neoformans* that produced elliptical yeast cells in vivo was described as a new variety, *C. neoformans* var. *gattii* Vanbreuseghem & Takashio (*Ann. Soc. Belg. Med. Trop.* 50: 695–702. 1970). Subsequent studies by Kwon-Chung & al. (Antonie van Leeuwenhoek J. Microbiol. Serol. 48: 25–38. 1982) revealed that biochemical, morphological and serological characteristics of the ex-type (CBS 6289) strain of *C. neoformans* var. *gattii*, were the same as serotype B strains of *C. bacillisporus*. Furthermore, the ex-type strain formed basidia upon mating with a *C. neoformans* serotype D, mating type a, reference strain (ATCC 34874). The results of cross matings exhibited a mixture of both the *F. neoformans* and *F. bacillispora* types of basidiospores. Based upon these observations, Kwon-Chung & al. (l.c., 1982) proposed to reduce the two species to two varieties of *C. neoformans*: *C. neoformans* var. *neoformans* (serotype A–D) and *C. neoformans* var. *gattii* (serotype B–C). This taxonomic treatment was supported by the observed value of DNA relatedness of 55.2–63% between *C. neoformans* var. *neoformans* and *C. neoformans* var. *gattii* which is a higher value than commonly observed between different species.

Since the advent of the AIDS epidemic, research on

cryptococcosis and the etiology of the disease has surged and voluminous literature on *C. neoformans* var. *neoformans* and *C. neoformans* var. *gattii* has accumulated. Recently, DNA sequences of various genes (URA5, CNLAC1, CAP59, CAP64, IGS and ITS rRNA, mtLrRNA), isolated from *C. neoformans* var. *gattii* and *C. neoformans* var. *neoformans* were compared and phylogenetic trees were constructed (Fan & al., J. Med. Vet. Mycol. 33: 215–221. 1995; Kwon-Chung & al., Stud. Mycol. 38: 67–79. 1995; Diaz & al., Syst. Appl. Microbiol. 23: 535–545. 2000; Fell & al., Int. J. Syst. Evol. Microbiol. 50: 1351–1371. 2000; Xu & al., Mol. Ecol. 9: 1471–1481. 2000; Petter & al., Microbiology 147: 2029–2036. 2001). Regardless of the genes studied, *C. neoformans* var. *gattii* strains formed a monophyletic cluster that clearly diverge from the cluster of *C. neoformans* var. *neoformans* strains. The separation of the two taxa was also strongly supported by DNA fingerprint approaches, such as amplified fragment length polymorphism (AFLP) (Boekhout & al., Microbiology 147: 891–907. 2001). Most importantly, molecular genetic analysis of progeny resulting from the cross between *C. neoformans* var. *gattii* ex-type strain (CBS 6289) and the *C. neoformans* var. *neoformans* reference strain (ATCC 34874) showed no evidence of genetic recombination between the two varieties (Varma & al., Am. Soc. Microbiol., abstr. F-10, 2002). These results indicate that the two varieties are sufficiently distinct and should be recognized as separate species. There is no problem with naming the holomorphs using the telomorphic names *F. neoformans* and *F. bacillispora*. However, because most references utilize the anamorph yeast names, there exist problems.

Five yeast taxa were described for organisms that match the description of *Cryptococcus neoformans* var. *gattii* and belong to the same phylogenetic cluster (see Boekhout & al., Microbiology 147: 891–907. 2001), but only two bear valid species names, namely *C. bacillisporus* and *Cryptococcus hondurianus* Castellani (Med. Press Circular 136: 440. 1933 [May]), the latter later the same year [Oct] treated as *Torulopsis hominis* var. *honduriana* (Castell.) Castell. & Jacono (J. Trop. Med. Hyg. 36: 297. 1933).

“*Saccharomyces subcutaneus tumefaciens*” Curtis (Ann. Inst. Pasteur, 10: 463. 1896), *nom. invalid.* (Art. 23.6 of the ICBN, Greuter & al., Regnum Veg. 138. 2000) was based on an isolate from a case of cryptococcosis in France. “*Cryptococcus hominis* var. *tumefaciens*” Benham (J. Infect. Dis. 578: 271. 1935) *nom. invalid.* (Art. 36.1) was proposed for the same morphotaxon but without a Latin description. Molecular analyses of what would have been an ex-sytype (CBS 1622) showed it to be identical with *C. neoformans* var. *gattii* (Boekhout & al., Microbiology (Washington) 147: 891–

907. 2001; Kwon-Chung, unpubl. observ.). Similarly, “*Torulopsis neoformans* var. *sheppei*” M. Giord. (Boll. Sez. Ital. Soc. Int. Microbiol. 7: 122. 1935), *nom. invalid.* (represented by the culture CBS 919), and “*C. neoformans* var. *shanghaiensis*” Liao & al. (Chin. Med. J. 96: 287. 1983), *nom. invalid.*, (represented by CBS 7229), both lack required Latin descriptions (Art. 36.1).

*Cryptococcus hondurianus* and the later synonym *C. bacillisporus* have priority over the epithet *gattii* when the latter is raised to the species level, as is done below. However, the name *C. hondurianus* has never been used since it was first proposed, while *C. bacillisporus* has seldom been used. In contrast, the epithet “*gattii*” has been in world-wide use for the past 20 years, more or less in a vernacular sense. Varietal or species rank has little interest to medical mycologists and clinicians while the epithet “*gattii*” is of great importance. Adoption of either *C. hondurianus* or *C. bacillisporus* for strains of serotype B and C would result in confusion since most investigators in the field of immunology, epidemiology, clinical microbiology, molecular biology and, most importantly, clinicians that treat cryptococcosis patients, are only familiar with the epithet “*gattii*” for strains of serotype B or C formerly considered a variety of *C. neoformans*.

To facilitate communication on the identity of this medically important fungus between investigators of many different fields, and on the advice of colleagues in the *Cryptococcus* field, we propose a new, albeit currently superfluous, combination at the species level using the epithet *gattii*, and then propose to conserve it under Art. 14 of the ICBN. Our new name, although superfluous until conserved, is legitimate because it is based on the legitimate name *C. neoformans* var. *gattii* Vanbreus. & Takashio (Art. 52.3).

We note that although de Vroey & Gatti (Mycoses 32(12): 675. 1989) sought to validate the name *Cryptococcus neoformans* var. *gattii* (by designating as type, specimen slide No. H1113, Laboratory for Mycology, Institute of Tropical Medicine, Antwerp) because the name published in 1970 was interpreted to be invalid by the edition of the ICBN applicable in 1989 (Greuter & al., Regnum Veg. 118. 1988), the acceptance of an originally designated lyophilised culture (RV 20186) as type material (Art. 8.4) now makes the 1970 dated name valid.

No holotype was designated for *C. hondurianus*, but one of Castellani’s two original strains is represented by culture No. CBS 883 and No. ATCC 14248, and has been listed as “type” in catalogues. A lyophilised holding at ATCC is hereby designated as a neotype. Additionally, it should be noted that in 1978, No. ATCC 32608 was designated as “type” of *C. bacillisporus*, and that at that time, it was represented by lyophilised ampoules and deep frozen capsules by that number, as is documented at

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the American Type Culture Collection—ATCC (D. Chalkley & S.-C. Jong, pers. comm., 2002).

*Cryptococcus gattii* (Vanbreus. & Takashio) Kwon-Chung & Boekhout, **comb. nov.** (basionym: *C. neoformans* var. *gattii* Vanbreus. & Takashio, Ann. Soc. Belg. Med. Trop. 50: 701. 1970).