

***Anthracoidea vankyi* (Ustilaginomycetes) in Poland,
with a review of its host spectrum and world distribution**

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Piątek M.: *Anthracoidea vankyi* (Ustilaginomycetes) in Poland, with a review of its host spectrum and world distribution. Acta Mycol. 40 (1): 95-101, 2005.

Anthracoidea vankyi Nannf. on *Carex muricata* L. is confirmed in Poland. The 1919 collection by Käthe Hoffmann from Góry Wałbrzyskie Mts in the Sudets is the only in the country. The fungus is described, and the symptoms of infection plus morphology and ultrastructure of spores are fully illustrated. The host spectrum and global distribution of *Anthracoidea vankyi* are reviewed. It is shown that the fungus parasitizes representatives of *Carex* sect. *Phaestoglochin*, and with some doubts, *Carex* sect. *Vulpinae*. It is known from Europe and Asia, but is very likely that it also occurs in North America.

Key words: *Anthracoidea*, *Carex*, sect. *Phaestoglochin*, sect. *Vulpinae*, smut fungi, taxonomy, Poland, Europe, Asia

INTRODUCTION

The genus *Anthracoidea* Bref. is taxonomically the most entangled genus of smut fungi in Poland. Since the time when the monograph of Polish smut fungi by Kochman and Majewski (1973) has appeared the concept of the genus has been changed markedly. The main result was splitting *Anthracoidea caricis* (Pers.) Bref., a collective species, into small but homogeneous taxa based on host taxonomy and morphology of spores (e.g., Boidol and Poelt 1963; Nannfeldt 1977, 1979; Vánky 1979, 1983; Braun 1982). Recent molecular data largely supported the traditional circumscription of species of *Anthracoidea* (Hendrichs et al. 2005).

In the monograph of Polish smuts, Kochman and Majewski (1973) enumerated four collections of *Anthracoidea* on different *Carex* spp., which they cannot re-examine because of absence of voucher specimens or which they cannot ascribe to any of existing species. One of these latter specimens was *Anthracoidea* on *Carex contigua* Hoppe s.l. (det. T. Majewski) collected by Käthe Hoffmann in Gałazki near Sokołowsko in the Góry Wałbrzyskie Mts Kochman and Majewski (1973) briefly described this specimen as having strongly angular spores, 18–26 × 14–20 µm, with wall delicately and densely verruculose. They stated that thanks

to strongly angular spores it resembles *Anthracoidea caricis* on *Carex pilulifera* L. but differs from this species by weakly verruculose spores. In final remark they concluded that this collection may belong to distinct species because of distantly related hosts: *Carex contigua* belongs to *Carex* subgen. *Vignea* sect. *Phaestoglochis*, whereas *Carex pilulifera* to *Carex* subgen. *Carex* sect. *Acrocystis*.

Nevertheless, Kochman and Majewski (1973) did not decide to describe a new species. It was made by Nannfeldt (1977) during his studies on *Anthracoidea* infecting *Carex* subgen. *Vignea*. He described *Anthracoidea vankyi* Nannf. based on infected specimen of "*Carex pairae*" from Romania. The host plant in the type specimen is actually *Carex divulsa* subsp. *leersii* (Kneuck.) W. Koch (Vánky 1994). In the protologue, Nannfeldt (1977) discussed also other European collections belonging most probably to his new species and among others concluded that "the *muricata* smut recorded from (...) Poland (Walbrzych; Kochman, Majewski (1973), pp. 115-116), according to description and illustrations, exactly matches *A. vankyi*". However, Nannfeldt (1977) did not examine voucher specimen and did not check the host identification.

During the course of ongoing revisionary work on cypericolous smut fungi for the projected monograph "Smut fungi on Cyperaceae and Juncaceae in Poland" I re-examined above mentioned collection together with repeated identification of host plant. The host plant was identified as *Carex muricata* L. s. str. (rev. Z. Szelağ) and the infected smut is indeed *Anthracoidea vankyi* as follows.

DESCRIPTION OF SPECIES

Anthracoidea vankyi Nannf., Bot. Not. 130: 372. 1977 (Figs 1-11)

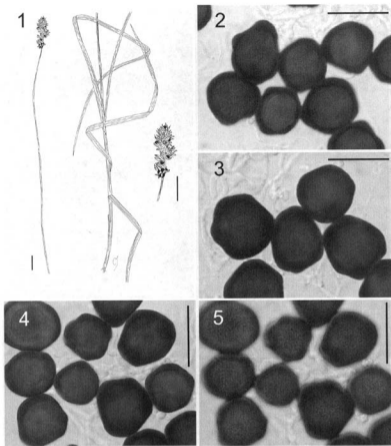
Sori in ovaries, scattered in the inflorescence, as subglobose to ovoid, black, hard bodies around the nutlets, up to 2 mm in diameter, partly hidden by the glumes. Spores medium-sized, dark reddish-brown, subangular to irregular, in side view 12-14 μm thick, in plane view 14-20 \times 16-23 μm , without internal swellings, but often with light-refractive spots, wall very uneven, 1.5-3.0 μm thick, surface distinctly verruculose and the spore profile is finely wavy to serrulate, in SEM spores are with moderately densely situated, irregular, rounded warts, up to 0.7 μm high. Germination unknown.

Specimen examined: On *Carex muricata* L.: Poland. Sudetes. Góry Wałbrzyskie Mts. Gałazki near Sokolowsko ("Wahlenburger Gebirge, Büttnergrund bei Görbersdorf"), 16 Aug. 1919, leg. K. Hoffmann (WRS� s.n.).

Additional specimens examined: On *Carex divulsa* Stokes: France. Ht. Alpes, Tallard à la Garonne, bois, June 1905, leg. F. Brachet (WA 2014, host determination taken from herbarium label, not checked by me); on *Carex muricata* L.: Switzerland. Canton du Valais, vicinity of Ried (Lötschental), 27 July 1913, leg. E. Mayor (BPI 171032).

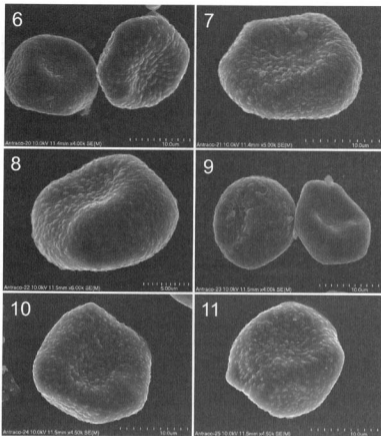
DISCUSSION

Nannfeldt (1977) described *Anthracoidea vankyi* based on collection made by Kálmán Vánky in Öcsém Mt. in Transsilvania (Romania). In this work he also



Figs. 1-5. Fig. 1. *Anthracoidea vankyi* Nannf. on *Carex muricata* L. (WRSL s.n.). Bars = 1 cm. Figs 2-5. *Anthracoidea vankyi* Nannf.: spores in LM (WRSL s.n.). Bars = 20 μ m.

illustrated the species by LM micrographs. Almost the same description was later included by Nannfeldt (1979) in his synopsis of Nordic *Anthracoidea* species. Zambettakis (1978) provided the first SEM micrographs of *Anthracoidea vankyi* – his figure 17: 1 & 2, as *Anthracoidea caricis* on *Carex muricata*. The smut has been subsequently redescribed at length by Vánky (1985, 1994), who also provided good LM and SEM micrographs of spores made from type specimen preserved in H.U.V. These works does not exhaust the list of publications where the species has been redescribed and illustrated after the original description but are surely the most notable.



Figs 6-11. *Anthracoidea vankyi* Nannf.: spores in SEM (WRSL s.n.).

Anthracoidea vankyi belongs to group of *Anthracoidea* species which have extremely irregular spores with unevenly thickened and distinctly verruculose spore wall. This group is formed inter alia by such species as *Anthracoidea caricis* (Pers.) Bref., *A. caricis-albae* (Syd.) Kukkonen, *A. irregularis* (Liro) Boidol & Poelt, *A. humilis* Vánky, *A. michelii* Vánky, *A. pseudirregularis* U. Braun, *A. rupestris* Kukkonen, *A. vankyi* and others. As it has been shown by molecular studies they form core-group of *Anthracoidea* and should be treated as section *Anthracoidea* (Hendrichs et al. 2005).

In Europe *Anthracoidea vankyi* infects species of the *Carex muricata* group (*Carex* sect. *Phaestoglochin*). Within this collective species it was reported on *Carex divulsa* Stokes subsp. *divulsa*, *C. divulsa* subsp. *leersii* (Kneuck.) W. Koch, *C. muricata* L. sub-

sp. muricata, *C. muricata* subsp. *lamprocarpa* Čelak., *C. spicata* Huds. (Vánky 1994). The host plants occur in all Europe but the range of *Anthracoida vankyi* is rather limited with scattered localities. Nannfeldt (1977, 1979) examined collections from Alps (France, Switzerland, Italy) and Romania, but on the basis of host plants concluded that it is also known from Germany, Spain, Netherlands and Poland. The reports from Germany are confirmed by Scholz and Scholz (1988), from Spain by Pando and Hernandez (2002), and from Poland in this paper. In addition to these countries, Vánky (1985) reported *Anthracoida vankyi* from one locality in Slovakia, Karatygin and Azbukina (1989) from European part of Russia and Ukraine, and Holm and Ryman (2003) from one locality in Sweden. The latter finding is the only in Fennoscandia. Although the host plants are not mountain taxa the most of localities of the smut are in mountainous areas. This may suggest that it requires more humid and cold climate or microclimate for its growing.

In this place it should be mentioned that from Switzerland *Anthracoida vankyi* has been also reported on *Carex echinata* Murray that belongs to *Carex* sect. *Stellulatae* (Scholz and Scholz (1988) but in my opinion this record is based on misidentification either the host plant or the smut fungus.

In addition to Europe, *Anthracoida vankyi* has been recorded from Asia. Karatygin and Azbukina (1989) reported it on *Carex contigua* (= *C. spicata*) from Armenia and on *Carex polyphylla* Kar. & Kir. from Armenia, Kazakhstan and Uzbekistan. The more problematic is the occurrence of this species in China. Guo (1994) during her studies on *Anthracoida* and allied genera reported this smut from this country on *Carex otrubae* Podpera. However, this sedge belongs to *Carex* sect. *Vulpinae* while all other records of *A. vankyi* are from sect. *Phaestoglochin*. Section *Vulpinae* has been known to be parasitized by *Anthracoida fischeri* (P. Karst.) Kukkonen, which was found for instance on *Carex vulpina* L. (e.g., Vánky 1994). The molecular studies (Hendrichs et al. 2004) have shown that this latter sedge is very close to, if not conspecific, with *Carex otrubae*. In spite of this, the Chinese collection is clearly distinct from *Anthracoida fischeri*. Such characters as echinulate spores and uniform wall with 1-5 internal swellings and absence of light-refractive spots, characteristic for this latter species, are not mentioned or illustrated by Guo (1994). Instead, the description and micrographs of this collection match very well with those of *Anthracoida vankyi*. The sections *Phaestoglochin* and *Vulpinae* are closely related what was recently confirmed by molecular data (Hendrichs et al. 2004). All of this indicates that, although with some doubts, the Chinese collection may be indeed attributed to *A. vankyi*.

Although *Anthracoida vankyi* has not been reported from North America, its occurrence on this continent is possible. This supposition comes from the fact that Zundel (1953) reported "*Cintractia caricis*" on *Carex muricata* from Vermont in the U.S.A. and Quebec in Canada, and on *Carex occidentalis* L. H. Bailey from Wyoming in the U.S.A. These sedges belong to sect. *Phaestoglochin* and is highly probable that the smut is *Anthracoida vankyi*. However, this assumption must be supported by examination of relevant voucher specimens.

In summary, *Anthracoida vankyi* occurs on several sedges belonging to *Carex* sect. *Phaestoglochin* and, with some doubts, sect. *Vulpinae* and is known from Europe (including Poland) and Asia, where it is rare species. Its occurrence in North America is probable but must be supported by revision of herbarium specimens.

Acknowledgements. I am grateful to Curators of WA and WRSL for hospitality during my personal visits, to Curator of BPI for loan of smut fungi specimens, to Dr. Jolanta Cabała for her drawings, to Dr. Zbigniew Szlag for checking the identification of *Carex muricata*, and to Anna Latkiewicz for assistance with the Scanning Electron Microscope. SEM micrographs were taken in the Laboratory of Field Emission, Scanning Electron Microscopy and Microanalysis at the Institute of Geological Sciences of the Jagiellonian University, Kraków. This study was supported by the State Committee for Scientific Research in Poland (KBN) for years 2005–2007, a grant no. 2 P04G 019 28. Part of this study was made during realization of scholarship of Foundation for Polish Science.

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Anthracoidea vankyi (Ustilaginomycetes) w Polsce oraz przegląd jego żywicieli i światowego rozmieszczenia

Streszczenie

Anthracoidea vankyi Nannf. jest gatunkiem, którego występowanie w Polsce nie było ostatecznie potwierdzone. Po przeanalizowaniu kolekcji zebranej przez Käthe Hoffmann w 1919 w Górach Wałbrzyskich w Sudetach, a przechowywanej w WRSL, stwierdzono, że należy ona do *Anthracoidea vankyi*. Rośliną żywicielską jest *Carex muricata* L. Zbiór ten w monografii Kochmana i Majewskiego (1973) oznaczony był jako *Anthracoidea* sp. na *Carex contigua* Hoppe s.l. Na tej podstawie Nannfeldt (1977) uznał, że należy on do opisanej przez niego *Anthracoidea vankyi*. Nie badał on jednak okazów zielnikowych. Niniejsze badania w pełni potwierdzają sugestię tego autora. Okaz z Sudetów jest szczegółowo opisany, a symptomy infekcji oraz morfologia i ultrastruktura zarodników są zilustrowane. Dodatkowo, w pracy dokonano przeglądu żywicieli oraz rozmieszczenia *Anthracoidea vankyi* na świecie. Przyjęto, że grzyb poraża przedstawicieli *Carex* sect. *Phaestoglochin* oraz, z pewnymi wątpliwościami, *Carex* sect. *Vulpinae*. Znany jest z Europy oraz Azji, a jego występowanie w Ameryce Północnej jest prawdopodobne.