

***Anthracoidea songorica* sp. nov. on *Carex songorica* from Iran**

توصیف گونه جدید *Anthracoidea songorica* عامل سیاهک *Carex songorica* از ایران

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Abstract

A new *Anthracoidea* species, *A. songorica*, is described on *Carex songorica* (subgen. *Carex*, sect. *Paludosae*) from Iran.

Keywords: *Cyperaceae*, Golestan National Park, new species, smut fungi, *Ustilaginomycetes*

Introduction

The genus *Anthracoidea* Bref. is a natural group in the *Anthracoideaceae* (Denchev 1997) of the order *Ustilaginales*, parasitising members of *Cyperaceae* in *Carex*, *Carpha*, *Fuirena*, *Kobresia*, *Schoenus*, *Trichophorum* and *Uncinia* (Vánky 2002, Vánky & Salo 2011). Sori are formed around the ovaries as black, globose, agglutinated spore masses with powdery surface, when young covered by a silvery fungal membrane. Spores are formed singly, pigmented (dark-brown), usually ornamented with spines,

چکیده

گونه جدیدی از جنس *Anthracoidea* تحت نام *A. songorica* روی *Carex songorica* از زیرجنس *Carex* بخش *Paludosae* برای نخستین بار از ایران به جهان علم معرفی می‌شود. ضمن ارایه شرح و تصاویر میکروسکوپ نوری و الکترونی از گونه مورد بحث، کلید شناسایی برای گونه‌های *Anthracoidea* روی اعضای *Carex*, subgen. *Carex*, sect. *Paludosae*، *Carex* s. lat. ارایه می‌گردد.

واژه‌های کلیدی: پارک ملی گلستان، گونه جدید، قارچ‌های مولد سیاهک، *Cyperaceae*. *Ustilaginomycetes*

warts or granules, rarely smooth, often with internal swellings or light-refractive areas. Spore germination results in two-celled basidia forming one or more basidiospores on each cell (Kukkonen 1963, 1964). There are ca 100 *Anthracoidea* species known (Vánky 2012), most of them morphologically only slightly different “small species”, adapted to one or several host plant species belonging to the same or closely related sections (see Nannfeldt 1979, Vánky 1979), rarely to not closely related sections. A smut fungus that produces black sori around some ovaries in the inflorescence of *Carex songorica* (*Cyperaceae*, subgen. *Carex*, sect. *Paludosae*), possessing densely, prominently verrucose spores, was collected by the junior author in Iran, Golestan National Park in 1991. The fungus turned out to be a new species and is described here. No smut fungus was reported earlier on *Carex songorica* from Iran (see Ershad 2001, 2009). However, on this sedge, widespread in temperate Asia, four other smut fungi are known: 1. *Anthracoidea subinclusa* (Körn.) Bref., 2. *Farysia thuemenii* (A.A. Fisch. Waldh.) Nannf., 3. *Schizonella melanogramma* (DC.) J. Schröt. and 4. *Urocystis fischeri* Körn. ex G. Winter (see Vánky 2012). All are differing from the new Iranian smut fungus.

Materials and Methods

The specimen studied in this paper was collected on *Carex songorica*, in Iran, Golestan province, Gorgan, Golestan National Park, 22.7.1991, leg. M. Abbasi, HUV 21968, IRAN 11642-F.

Sorus and spore characteristics were studied using dried herbarium specimens. For light microscopy (LM) the spores were suspended in a small droplet of lactophenol, covered with a cover glass, gently heated to boiling point to rehydrate the spores and expel air bubbles from the preparation, and studied at 1000× magnification. For scanning electron microscopy (SEM), spores were placed on double-sided adhesive tape,

mounted on a specimen stub, sputter-coated with gold-palladium, ca 20 nm, and examined in a SEM at 10 kV.

Results

A study of the morphology of the spores of *Anthracoidea* on *Carex songorica* and a comparison of it with *Anthracoidea* species on *Carex*, subgen. *Carex*, sect. *Carex* s. lat. (including sect. *Paludosae*, *Pseudocypereae* and *Vesicariae*), showed that the smut on *Carex songorica* differs from all known *Anthracoidea* species. It is described as:

Anthracoidea songorica Vánky, sp. nov.

Mycobank 563564

Typus in matrice *Carex songorica* Kar. & Kir., Iran, Golestan Prov., Gorgan, Golestan National Park, 37°38'32.5" N, 56°20'59.6" E, alt. 1100 m.s.m., 22 Jul. 1991, leg. M. Abbasi, holotypus HUV 21968, isotypus IRAN 11642-F.

Anthracoidea songorica distincta ab *A. lasiocarpa* B. Lindeb. ex Kukkonen [Ann. Bot. Soc. Zool.-Bot. Fenn. 'Vanamo' 34(3): 85, 1963] sporis atrioribus, crassitunicatis, prominenter magis verrucosis. Sporae in *A. lasiocarpa* 20–30 µm longae, flavidobrunneae, paries 1–2(–2.5) µm crassus, leniter verruculosus, imago obliqua sporae laevis. Idem in *A. songorica* sporae 19–27(–30) µm longae, atro-rubrobrunneae, paries 1–3.5(–5.5) µm crassus, prominenter dense verrucosus, imago sporae sinuata usque ad leniter serrulata.

Sori (Fig. 1) forming black, globose or ovoid, hard bodies in some ovaries in the inflorescence, powdery on the surface, 1.5–2.5 mm in diameter. Spores (Figs 2–4) globoid, broadly ellipsoidal, subpolyhedrally irregular, occasionally elongated, with a subacute or acute tip, 13.5–22.5 × 19–27(–30) µm, dark reddish brown; wall uneven, 1–3.5(–5.5) µm thick, thickest at the angles, no internal swellings, light refracting spots occasionally present, surface densely, prominently verrucose, spore profile wavy to finely serrulate. Spore germination unknown.

On *Cyperaceae*: *Carex* (subgen. *Carex*, sect. *Paludosae*), *C. songorica* Kar. & Kir. Known only from the type locality.

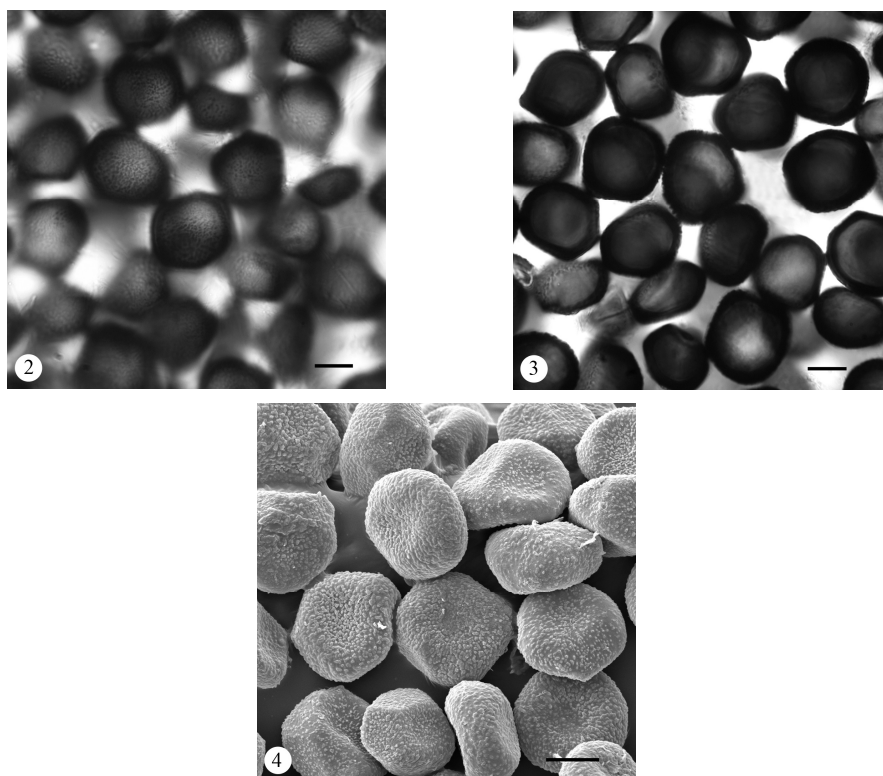
Discussion

On members of *Carex*, subgen. *Carex*, sect. *Carex* s. lat. (including sect. *Paludosae*, *Pseudocypereae* and *Vesicariae*) there are six *Anthracoidea* species known (Vánky 2012: 11). Of these, four species (*A. americana*, *A. inclusa*, *A. intercedens* and *A. subinclusa*) have echinate spores, and two (*A. angulata* and *A. lasiocarpa*) have verrucose spores. A comparison of *Anthracoidea songorica* with the last two species showed that in *A. lasiocarpa* B. Lindeb. ex Kukkonen (type on *Carex lasiocarpa* Ehrh., subgen. *Carex*, sect. *Carex*), the

spores are paler (yellowish to medium dark reddish-brown), the wall is thinner [1–2(–2.5) μm thick], finely punctate-verruculose, the spore profile is smooth. In *A. angulata* (Syd.) Boidol & Poelt (type on *C. hirta* L., subgen. *Carex*, sect. *Carex*), the spores are smaller [16–26(–28) μm long], angular to irregular, the wall is uneven, 1.5–5 μm thick, thickest at the angles, protuberances, light-refractive spots and internal swellings common.



Fig. 1. *Anthracoidea songorica* on *Carex songorica* (type): Sori in some ovaries of an inflorescence. Habit and enlarged two sori, a young, partly still covered by a silvery fungal membrane, showing between the ruptured utricle and a mature, black one. Below a healthy spikelet (Bars = 1 cm for habit and 2 mm for detail drawings).



Figs 2–4. *Anthracoidea songorica* on *Carex songorica* (type): Spores in LM and in SEM, showing the prominently, densely verrucose surface and the unevenly thick spore wall with undulate or finely serrulate spore profile (Bar = 10 μ m).

**Key to the species of *Anthracoidea* on *Carex*, subgen. *Carex*, sect *Carex* s. lat.
(incl. *Paludosae*, *Pseudocypereae* and *Vesicariae*)**

1. Spores verrucose 2
- Spores echinate 4
2. Spores 16–26(–28) μ m long, irregular; wall uneven, 1.5–5 μ m thick, protuberances, light-refractive spots and internal swellings common *A. angulata*
- Spores 20–30 μ m long, more regular; wall thin or thick, protuberances, light-refractive spots and internal swellings absent or uncommon 3
3. Spores dark reddish-brown; wall uneven, 1–3.5(–5.5) μ m thick, coarsely verrucose, spore profile wavy to finely serrulate *A. songorica*
- Spores yellowish or medium dark reddish-brown; wall 1–2(–2.5) μ m thick, finely punctate-verruculose, spore profile smooth *A. lasiocarpa*
4. Spores with 2–4 distinct internal swellings *A. americana*
- Spores without internal swellings 5
5. Spines only rarely exceeding 1.0 μ m in height, rather densely spaced; surface between the warts apparently smooth *A. inclusa*
- Spines higher, less densely spaced; surface between the warts not smooth 6
6. Spines stout, up to 2 μ m high, apically flattened, widely spaced and easily broken; surface between the warts distinctly striate rugulose *A. subinclusa*

- Spines up to 1.5 µm high, more closely spaced, less easily broken; spore surface wrinkled between the spines *A. intercedens*

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