
Six new species of *Anthracoidea* (*Ustilaginales*) from China

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Anthracoidea haematostomae on *Carex haematostoma*, *A. pseudofetidae* on *C. pseudofetida*, *A. duriusculae* on *C. duriuscula* subsp. *stenophylloides*, *A. bistaminatae* on *Kobresia myosuroides* subsp. *bistaminata*, *A. royleanae* on *K. royleana* and *A. filamentosae* on *Carex filamentosa* are described as new species. Three new species were discovered in dry specimens kept in Herbarium (PE). Three new species were collected from northwestern China in the summer of 2005. Five keys to the *Anthracoidea* species on sect. *Frigidae* of subgen. *Carex* and sect. *Foetidae* of subgen. *Vignea*, on sections *Elyna* and *Kobresia* of genus *Kobresia*, and on section *Digitatae* of subgenus *Carex* are provided.

Key words: grass, smut fungi, taxonomy, *Ustilaginomycetes*

Introduction

Recently, three new species of the genus *Anthracoidea* were discovered in the Herbarium of the Institute of Botany, Chinese Academy of Sciences (PE) on various *Carex* species. One host plant, *Carex haematostoma* in section *Frigidae* of subgenus *Carex* was collected by Mr Wang Chiwu from Yunnan Province in 1935. The host plant is distributed in Nepal and China (Dai and Liang, 2000). The second host plant, *Carex pseudofetida* in section *Foetidae* of subgenus *Vignea* was collected at 5200 m above sea level from Xizang Autonomous Region in 1976. The host plant is distributed in Afghanistan, China, India, Iran, Mongolia and Russia (Dai and Liang, 2000). The third host plant, *Carex duriuscula* subsp. *stenophylloides* (syn. *C. stenophylloides*) in section *Foetidae* of subgenus *Vignea* (Dai and Liang, 2000) was collected by Kuan Kechien from Xinjiang Uygur Autonomous Region in 1957. The host plant is distributed in China, Mongolia and Russia (Dai and Liang, 2000).

In August 2005, Dr Wang Xuwei and her colleagues participated in a scientific expedition to Qinghai-Tibet plateau. They collected two interesting species of the genus *Anthracoidea* on two *Kobresia* species from Chidu Xian

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in Qinghai Province at 4335 m and 4345 m altitude respectively. One host plant, *Kobresia myosuroides* subsp. *bistaminata* in section *Elyna* is an endemic Chinese subspecies distributed in northwestern China (Zhang, 1999). The second host plant, *K. royleana* in section *Kobresia* is distributed in Afghanistan, China, India, Nepal, Kazakhstan and Tadjikistan (Dai and Liang, 2000).

A species of *Anthracoidea* on *Carex filamentosa* was collected by the author and her colleagues from Gansu Province in June 2005. The host plant, in section *Digitatae* of subgenus *Carex*, is an endemic Chinese species distributed in the Taibai Mountain of Shaanxi Province, southern Gansu Province, eastern Qinghai Province, western and southwestern Sichuan Province and northwestern Yunnan Province (Dai and Liang, 2000).

As noted by Kukkonen (1963, 1964), Nannfeldt (1977, 1979) and Vánky (1979, 2005), the “small species” of *Anthracoidea* are distinct from each other, and are parasitic on the same or closely related host plant sections. To date the genus *Anthracoidea* has ca. 86 known species (Kirk *et al.*, 2001; Guo, 2005; Guo and Wang, 2005; Vánky, 2005), parasitizing the genera *Carex*, *Carpha*, *Fuirena*, *Kobresia*, *Schoenus*, *Scirpus*, *Trichophorum* and *Uncinia* (*Cyperaceae*) (Vánky, 2005). Only the genera *Carex* and *Kobresia* have been reported as host plants of *Anthracoidea* in China.

Materials and methods

The specimens examined are deposited in the Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences (HMAS) and Herbarium Ustilaginales Vánky (HUV). Ustilospores were examined by light microscopy (LM), and mounted in lactophenol and measured after heating to boiling point. For scanning electron microscopy (SEM), dried ustilospores were dusted onto double-sided adhesive tape, fixed on specimen stubs, sputter coated with gold, ca. 20 nm thick, and studied with a FEI Quanta 200 electron microscope.

Results and discussion

Six species of *Anthracoidea* on *Carex* spp. in section *Frigidae* of subgenus *Carex* have been published: 1) *Anthracoidea altera* Nannf. (1979: 12) with ustilospores measuring $16-21 \times 15-18 \mu\text{m}$, wall ca. $1 \mu\text{m}$, type on *Carex misandra* R. Br.; 2) *A. disciformis* (Liro) Zambett. (1978: 58) with ustilospores measuring $16-22 \times 15-19 \mu\text{m}$, wall $1 \mu\text{m}$, type on *C. hirtella* Drej.; 3) *A. misandrae* Kukkonen (1963: 82) with ustilospores measuring $(17-)-18-25(-26) \times (12-)-13-21(-23) \mu\text{m}$, wall $0.7-1.5 \mu\text{m}$ (Vánky, 1994), type on *C.*

misandra R. Br.; 4) *A. nepalensis* Kakish. and Ono (1988: 128) with ustilospores measuring 14-19 × 11-17 μm, wall 1-1.5 μm, type on *C. nakaoana* T. Koyama; 5) *A. sempervirentis* Vánky (1979: 225) with ustilospores measuring (16-)19-24(-27) × 14-22 μm, wall 1.5-2.5(-4) μm, type on *C. sempervirens* Vill.; and 6) *A. stenocarpace* Chleb. (2002: 282) with ustilospores measuring 15-17(-18) × 14-17 μm, wall 1-1.5 μm, type on *C. stenocarpa* Turcz. ex V.I. Krecz. Of these, *A. disciformis* was not validly published, according to Art. 33.2 of the International Code of Botanical Nomenclature. The recently discovered species of *Anthracoidea* on *C. haematostoma* in China differs mainly from *A. nepalensis* by having larger, thicker walled ustilospores. A new species is described:

***Anthracoidea haematostomae* L. Guo, sp. nov.** (Figs. 1, 2)

Etymology: The name refers to the host plant, *Carex haematostoma*.

Sori in ovariis, subglobosi, 1.5-2.5 mm diam. Primum membrana cinerascenti, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae* a fronte globosae, subglobosae vel late ellipsoideae, 19.5-22.5(-24.5) × 15-22 μm, ab acie 10-14 μm latae, hyalinae calyptrae vulgatae, rubrobrunneae; pariete aequaliter incrassato, (2-)2.5-3 μm crasso, tumores interni desunt, regiones lucem repercutientes desunt, superficie verruculoso.

Sori in ovaries, subglobose, 1.5-2 mm in diam., at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilospores* in plane view globose, subglobose or broadly ellipsoidal, 19.5-22.5(-24.5) × 15-22 μm, in side view 10-14 μm wide, hyaline caps common on the flat side, reddish-brown; wall evenly thickened, (2-)2.5-3 μm, no internal swellings, no light reflective areas, surface verruculose.

Key to the *Anthracoidea* species on sect. *Frigidae* of subgen. *Carex*

1. Ustilospores 14-19 μm long 2
1. Ustilospores 16-27 μm long 3
2. Ustilospores 14-19 μm long, surface with sparsely warts *A. nepalensis*
2. Ustilospores 15-17(-18) μm long, surface with dense and low warts *A. stenocarpace*
3. Ustilospores 16-21 × 15-18 μm *A. altera*
3. Ustilospores 16-27 μm long 4
4. Walls 0.7-1.5 μm thick. Ustilospores (17-)18-25(-26) × (12-)13-21(-23) μm. *A. misandrae*
4. Walls thicker 5
5. Ustilospores regular, 19.5-22.5(-24.5) × 15-22 μm, hyaline caps common on the flat side, walls evenly thick, (2-)2.5-3 μm *A. haematostomae*
5. Ustilospores irregular, (16-)19-24(-27) × 14-22 μm, without hyaline caps on the flat side, walls unevenly thick, 1.5-2.5(-4) μm *A. sempervirentis*

Habitat: In living ovaries of *Carex haematostoma*.

Known distribution: Yunnan.

Material examined: CHINA, Yunnan, Deqen, alt. 2700 m, in ovaries of *Carex haematostoma* Nees (*Cyperaceae*, subgen. *Carex*, sect. *Frigidae*), September 1935, C.W. Wang 70101 (HMAS 132709, **holotype designated here**); isotype HUV 20090.

Only three species of *Anthracoidea* on *Carex* spp. in section *Foetidae* of subgenus *Vignea* have been described: 1) *Anthracoidea foetidae* Zogg (1983: 99; Vánky, 1994: 29) with ustilospores measuring (13-)14-20(-21) × (10-)11-18(-20) μm, wall (0.6-)0.8-1(-1.4) μm, type on *Carex foetidae* All.; 2) *A. kari* (Liro) Nannf. (1977: 368; Vánky, 1994: 31) with ustilospores measuring 13-21(-22) × 9-19 μm, wall 1-2 μm, type on *C. brunnescens* (Pers.) Poir.; and 3) *A. variabilis* (S. Ito) Kakish. (1982: 29) with ustilospores measuring 14-24 μm in diam., wall 1.5-2 μm, type on *C. arenicola* Fr. Schm. The recently discovered species of *Anthracoidea* on *Carex pseudofoetida* in China differs from all known *Anthracoidea* species on section *Foetidae* by its smaller ustilospores and surface ornamentation of the ustilospores. The new species of *Anthracoidea* on *Carex duriuscula* subsp. *stenophylloides* has similar sized ustilospores to *A. variabilis*, but differs mainly by having thinner walls of the ustilospores and evenly distributed warts on the ustilospore surface. Two new species are described:

***Anthracoidea pseudofoetidae* L. Guo, sp. nov.**

(Figs. 3, 4)

Etymology: The name refers to the host plant, *Carex pseudofoetida*.

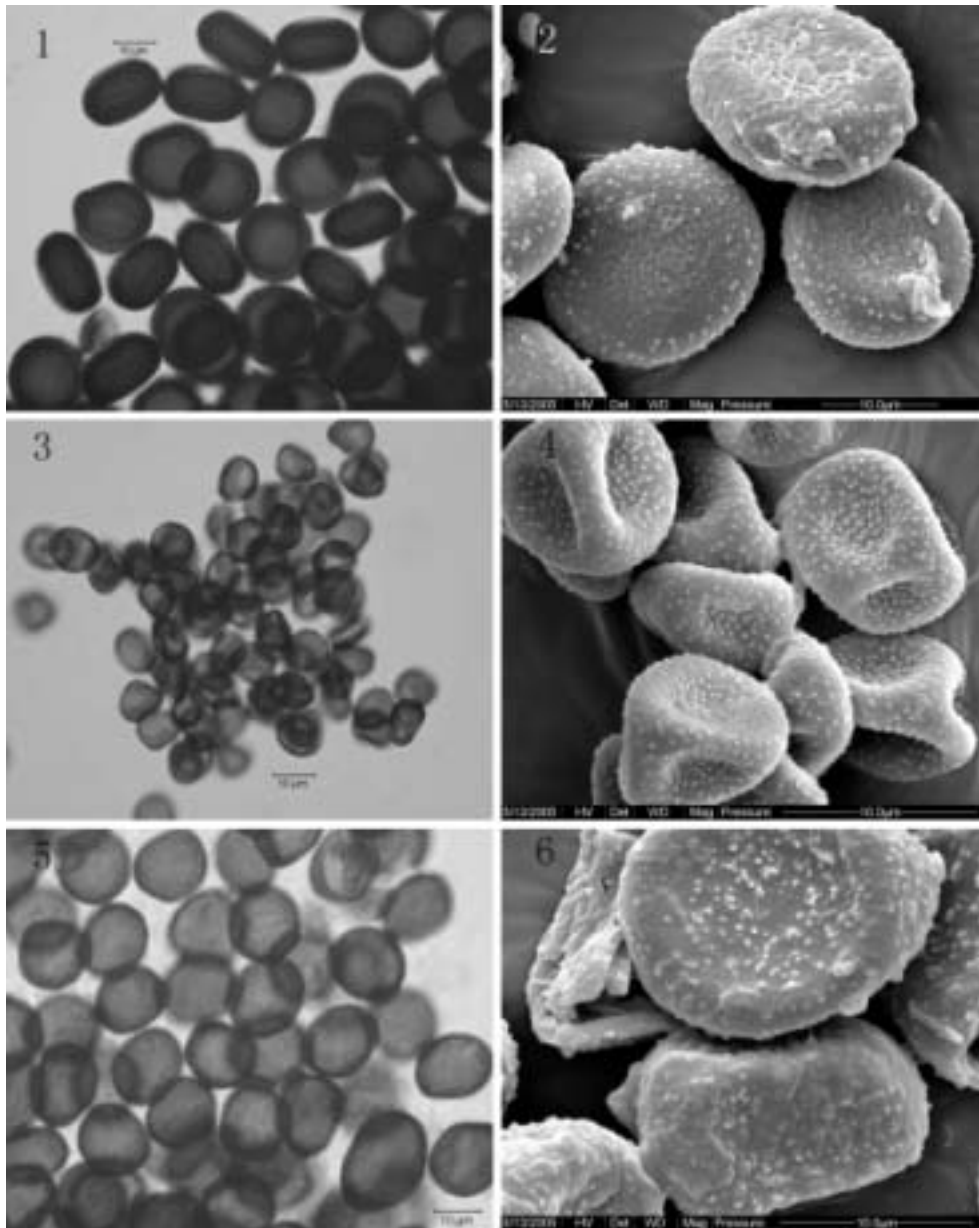
Sori in ovarii, subglobosi, 1.5-2 mm diam. Primum membrana cinerascenti, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae* a fronte ovoideae, subglobosae, late ellipsoideae vel leviter irregulares, 9-12 × 8-11 μm, ab acie 7-8 μm latae, rubrobrunneae; pariete aequaliter incrassato, ca. 1 μm crasso, tumores interni 1-3, regiones lucem reperiunt interdum 1-2, superficie minute echinulato vel verruculoso sub SEM.

Sori in ovaries, subglobose, 1.5-2 mm in diam., at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilosporae* in plane view ovoid, subglobose, broadly ellipsoidal or slightly irregular, 9-12 × 8-11 μm, in side view 7-8 μm wide, reddish-brown; wall evenly thickened, ca. 1 μm, 1-3 internal swellings, occasionally with 1-2 light reflective areas, surface minutely echinulate or verruculose as seen by SEM.

Habitat: In living ovaries of *Carex pseudofoetida*.

Known distribution: Xizang (Tibet).

Material examined: CHINA, Xizang, Gégyai Xian, Alingshan, alt. 5200 m, in ovaries of *Carex pseudofoetida* Kükenth. (*Cyperaceae*, subgen. *Vignea*, sect. *Foetidae*), 15 August 1976, Qinghai-Xizang expedition 13486 (HMAS 130321, **holotype designated here**); isotype HUV 20091.



Figs. 1, 2. Ustilosporia of *Anthracoidea haematostomae* (from holotype, HMAS 132709). **1.** in LM. **2.** in SEM. **Figs. 3, 4.** Ustilosporia of *Anthracoidea pseudofetidae* (from holotype, HMAS 130321). **3.** in LM. **4.** in SEM. **Figs. 5, 6.** Ustilosporia of *Anthracoidea duriusculae* (from holotype, HMAS 130322). **5.** in LM. **6.** in SEM.

***Anthracoidea duriusculae* L. Guo, sp. nov.** (Figs. 5, 6)

Etymology: The name refers to the host plant, *Carex duriuscula* subsp. *stenophylloides*.

Sori in ovarii, subglobosi, 1.5-2.2 mm diam. *Primum membrana* cinerascens, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae a fronte* ovoideae, subglobosae vel ellipsoideae, 14-21(-24) × 13-16.5(-19.5) μm, ab acie 12-13 μm latae, rubrobrunneae; pariete aequaliter incrassato, 0.5-1 μm crasso, tumores interni desunt, regiones lucem repercutescentes desunt, superficie verrucoso.

Sori in ovaries, subglobose, 1.5-2.2 mm in diam., at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilosporae* in plane view ovoid, subglobose or ellipsoidal, 14-21(-24) × 13-16.5(-19.5) μm, in side view 12-13 μm wide, reddish-brown; wall evenly thickened, 0.5-1 μm, no internal swellings, no light reflective areas, surface verrucose, minutely verruculose between the warts as seen by SEM.

Habitat: In living ovaries of *Carex duriuscula* subsp. *stenophylloides*.

Known distribution: Xinjiang.

Material examined: CHINA, Xinjiang, Xiayedi, in ovaries of *Carex duriuscula* C.A. Mey. subsp. *stenophylloides* (V. Krecz.) S.Y. Liang & Y.C. Tang (*Cyperaceae*, subgen. *Vignea*, sect. *Foetidae*), 13 June 1957, K.C. Kuan 885 (HMAS 130322, **holotype designated here**); isotype HUV 20092.

Notes: Karatygin and Azbukina (1989: 39) recorded *Anthracoidea eleocharidis* Kukkonen (1964: 274) on *Carex stenophylloides* V.I. Krecz. (in section *Boernera* of subgenus *Vignea*). *Anthracoidea duriusculae* differs mainly from *A. eleocharidis* by having minutely verruculose surface between the warts.

Key to the *Anthracoidea* species on sect. *Foetidae* of subgen. *Vignea*

1. Ustilosporae 9-12 × 8-11 μm, surface minutely echinulate or verruculose ... *A. pseudofoetidae*
1. Ustilosporae larger 2
2. Ustilosporae 14-24 μm long 3
2. Ustilosporae 13-21 μm long 4
3. Walls 0.5-1 μm thick, warts evenly distributed *A. duriusculae*
3. Walls 1.5-2 μm thick, warts variably distributed *A. variabilis*
4. Ustilosporae distinctly verruculose, no internal swellings *A. foetidae*
4. Ustilosporae finely verruculose, internal swellings present *A. kariii*

Two species of *Anthracoidea* on *Kobresia* spp. in section *Elyna* have been recorded: 1) *Anthracoidea elyanae* (Syd.) Kukkonen (1963: 65) with ustilosporae measuring (14-)16-22(-25) μm in diameter, wall 1-2.5(-3) μm, type on *Kobresia myosuroides* (Vill.) Fiori, Switzerland; and 2) *A. xizangensis* L. Guo (2005) with ustilosporae measuring 17-22.5 × 15-18 μm, wall 1.5-2

μm , type on *K. duthiei* C.B. Clarke, China. The recently collected species of *Anthracoidea* on *K. myosuroides* subsp. *bistaminata* in China is similar to *A. xizangensis*. It differs from *A. xizangensis* by having smaller ustilospores ($15\text{-}20 \times 12.5\text{-}18 \mu\text{m}$) being punctate in face view and verruculose in side view, while *A. xizangensis* has larger ustilospores ($17\text{-}22.5 \times 15\text{-}18 \mu\text{m}$) and is verruculose in flat view. The new species is described as:

***Anthracoidea bistaminatae* L. Guo, sp. nov.** (Figs. 7, 8)

Etymology: The name refers to the host plant, *Kobresia myosuroides* subsp. *bistaminata*.

Sori in ovarii, subglobosi, 1.2-2 mm diam. Primum membrana cinerascenti, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae* a fronte subglobosae, ellipsoideae, ovoideae vel leviter irregulares, $15\text{-}20 \times 12.5\text{-}18 \mu\text{m}$, ab acie $10\text{-}13 \mu\text{m}$ latae, rubrobrunneae; pariete aequaliter incrassato, $1\text{-}1.5(-2) \mu\text{m}$ crasso, tumores interni desunt, regiones lucem repercutes desunt, superficie a fronto visu puncticulosa, a latere verruculosa sub SEM.

Sori in ovaries, subglobose, 1.2-2 mm in diam., at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilospores* in plane view subglobose, ellipsoidal, ovoid or slightly irregular, $15\text{-}20 \times 12.5\text{-}18 \mu\text{m}$, in side view $10\text{-}13 \mu\text{m}$ wide, reddish-brown; wall evenly thickened, $1\text{-}1.5(-2) \mu\text{m}$, no internal swellings, no light reflective areas, surface in face view punctate, in side view verruculose as seen by SEM.

Habitat: In living ovaries of *Kobresia myosuroides* subsp. *bistaminata*.

Known distribution: Qinghai.

Material examined: CHINA, Qinghai, Chindu Xian, alt. 4335 m, in ovaries of *Kobresia myosuroides* (Vill.) Fiori subsp. *bistaminata* (W.Z. Di & M.J. Zhong) S.R. Zhang (*Cyperaceae*, sect. *Elyna*), 7 August 2005, X.W. Wang, Q.P. Zhou, Y.J. Wang & X.L. Li 20 (HMAS 133832, **holotype designated here**); isotype HUV 21143.

Key to the *Anthracoidea* species on sect. *Elyna* of gen. *Kobresia*

1. Ustilospores smooth, walls $1\text{-}2.5(-3) \mu\text{m}$ thick *A. elyinae*
1. Ustilospores verruculose, walls $1\text{-}2 \mu\text{m}$ thick 2
2. Ustilospores $15\text{-}20 \times 12.5\text{-}18 \mu\text{m}$, surface punctate on the flat sides, profile verruculose as seen by SEM, walls $1\text{-}1.5(-2) \mu\text{m}$ thick *A. bistaminatae*
2. Ustilospores $17\text{-}22.5 \times 15\text{-}18 \mu\text{m}$, surface verruculose, walls $1.5\text{-}2 \mu\text{m}$ thick..... *A. xizangensis*

Four species of *Anthracoidea* on *Kobresia* spp. in section *Kobresia* have been described: 1) *A. kobresiae* (Mundk.) Kukkonen (1963: 44) with ustilospores measuring $14\text{-}21 \times 10\text{-}18(-19) \mu\text{m}$, wall $0.7\text{-}2.5 \mu\text{m}$, type on *K. laxa* Boeck., Kashmir; 2) *A. lindebergiae* (Kukkonen) Kukkonen (1963: 68)

with ustilospores measuring (14-)15-20(-22.5) μm in diameter, wall 0.7-2.5 μm , type on *K. simpliciuscula* (Wahlenb.) Mack., Canada; 3) *A. filifoliae* L. Guo (1995-1996: 164) with ustilospores measuring (13-)16.5-22.5 \times 12-19 μm , wall 1-2.5 μm , type on *K. filifolia* (Turcz.) C.B. Clarke, China; and 4) *A. macranthae* L. Guo and S.R. Wang (2005) with ustilospores measuring 15-18(-19.5) \times 13-17.5 μm , wall 0.5-1 μm , type on *K. macrantha* Boeck., China. The recently collected species of *Anthracoidea* on *K. royleana* in China differs from *A. macranthae* by its larger ustilospores [15-21(-23) \times 12.5-18.5 μm] and the surface ornamentation; the ustilospore surface of *A. macranthae* is smooth. It differs mainly from the other *Anthracoidea* species on section *Kobresia* by ustilospores that have thinner walls (1-1.5 μm versus 0.7-2.5 μm). The new species is described as:

***Anthracoidea royleanae* L. Guo, sp. nov.** (Figs. 9, 10)

Etymology: The name refers to the host plant, *Kobresia royleana*.

Sori in ovarii, subglobosi, 1-2 mm diam. Primum membrana cinerascenti, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae* a fronte subglobosae, late ellipsoideae vel ovoideae, 15-21(-23) \times 12.5-18.5 μm , ab acie 10-14 μm latae, rubrobrunneae; pariete aequaliter incrassato, 1-1.5 μm crasso, interdum hyalinae calyptrae, tumores interni desunt, regiones lucem repercutes desunt, superficie a fronto visu puncticulosa vel verruculosa, a latere verruculosa sub SEM.

Sori in ovaries, subglobose, 1-2 mm in diam., at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilospores* in plane view subglobose, broadly ellipsoidal or ovoid, 15-21(-23) \times 12.5-18.5 μm , in side view 10-14 μm wide, reddish-brown; wall evenly thickened, 1-1.5 μm , occasionally with hyaline caps on the flat sides, no internal swellings, no light reflective areas, surface in face view punctate or verruculose, in side view verruculose as seen by SEM.

Habitat: In living ovaries of *Kobresia royleana*.

Known distribution: Qinghai.

Material examined: CHINA, Qinghai, Chindu Xian, Zhenqin Xiang, alt. 4345 m, in ovaries of *Kobresia royleana* (Nees) Boeck. (*Cyperaceae*, sect. *Kobresia*), 6 August 2005, X.W. Wang, Q.P. Zhou, Y.J. Wang & X.L. Li 15 (HMAS 133834, **holotype designated here**); isotype HUV 21144.

Key to the *Anthracoidea* species on sect. *Kobresia* of gen. *Kobresia*

- 1. Ustilospores smooth, walls 0.5-1 μm thick *A. macranthae*
- 1. Ustilospores verruculose, walls 0.7-2.5 μm thick 2
- 2. Walls 1-1.5 μm thick, ustilospore surface punctate to verruculose on the flat sides, profile verruculose as seen by SEM..... *A. royleanae*
- 2. Walls 0.7-2.5 μm thick, ustilospore surface verruculose 3

3. Ustilosporae regular to irregular, with 1-3 internal swellings *A. kobresiae*
 3. Ustilosporae regular to slightly irregular, occasionally with 1(-2) internal swellings or without internal swellings 4
 4. Ustilosporae without internal swellings, surface finely and densely verruculose between warts *A. filifoliae*
 4. Ustilosporae occasionally with 1(-2) internal swellings, surface verruculose... *A. lindebergiae*

Five species of *Anthracoidea* on *Carex* spp. in section *Digitatae* of subgenus *Carex* have been published: 1) *A. rupestris* Kukkonen (1963: 47) with ustilosporae measuring (15-)16-25(-26) × (11-)12-20(-21) μm, wall 1-3.5(-4) μm, type on *Carex rupestris* All., Finland; 2) *A. humilis* Vánky (1983: 321) with ustilosporae measuring (17.5-)19-25.5(-27) × (14.5-)16-21(-22.5) μm, wall (1-)1.5-4(-5) μm, type on *C. humilis* Leyss., Romania; 3) *A. irregularis* (Liro) Boidol and Poelt (1963: 23) with ustilosporae measuring 18-29(-34) × 13-22 μm, wall 1-2.5(-3.5) μm, type on *C. digitata* L., Finland; 4) *A. shaanxiensis* L. Guo (2004: 508) with ustilosporae measuring 17.5-21(-24) × 13-19.5 μm, wall 1-2 μm, type on *C. shaanxiensis* Wang et Tang ex P.C. Li, China; and 5) *A. striata* H.C. Zhang and L. Guo (2004: 308) with ustilosporae measuring 15-30(-37.5) × 14-20 μm, wall 1-3.5 μm, type on *C. pediformis* C.A. Mey, China. The recently collected species of *Anthracoidea* on *C. filamentosa* in China has ustilosporae of the same size as those of *A. shaanxiensis*, but the warts are larger [ca. 0.3-0.8(-1) μm in diameter vs. ca. 0.2-0.4 μm in diameter]. The new species is described as:

***Anthracoidea filamentosae* L. Guo, sp. nov.** (Figs. 11, 12)

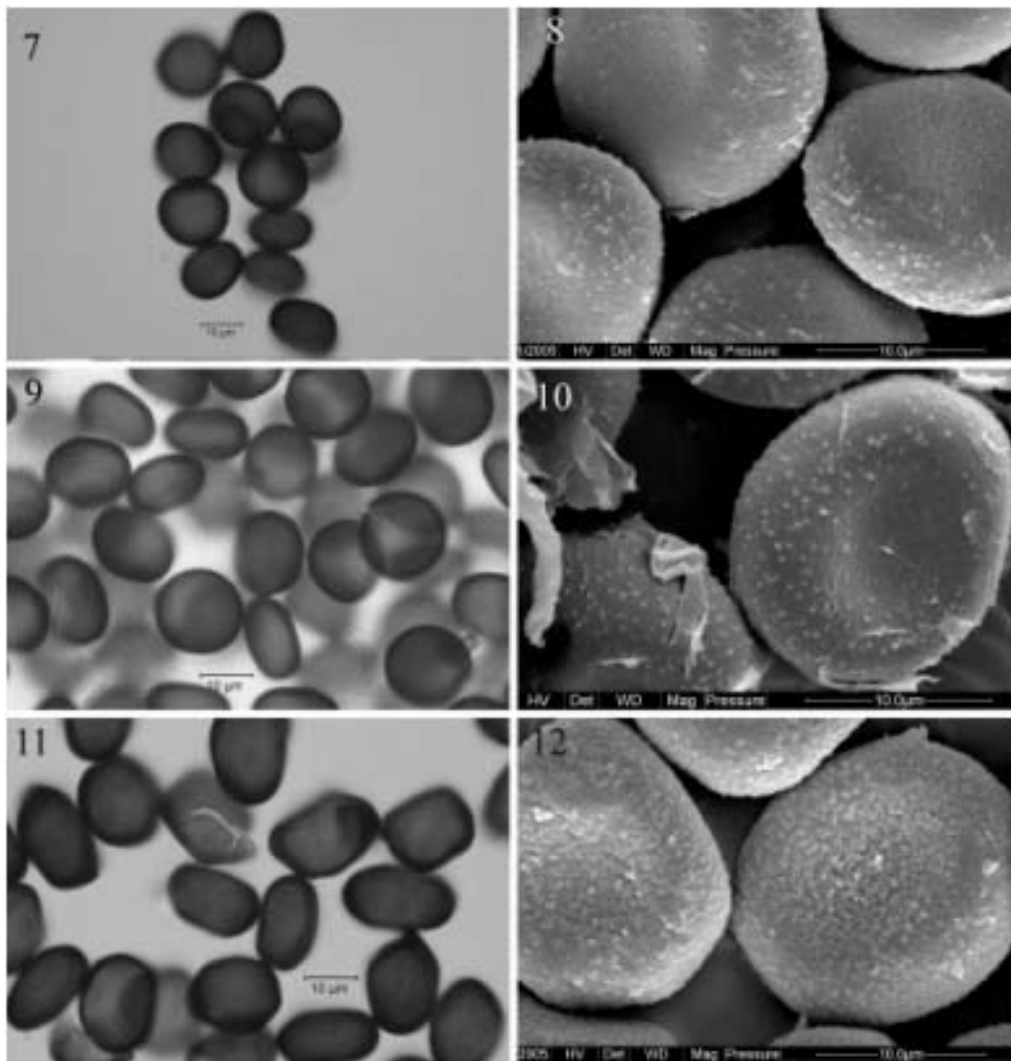
Etymology: The name refers to the host plant, *Carex filamentosa*.

Sori in ovariiis, subglobosi, 2-2.5 mm longi, 1.2-2 mm lati. Primum membrana cinerascenti, fungali cooperti, deinde expositi. *Massa sporarum* nigra, semiagglutinata. *Ustilosporae* a fronte ovoideae, ellipsoideae vel irregulares, 15-22(-24) × 13.5-18.5(-21) μm, ab acie 11-15 μm latae, rubrobrunneae; pariete leviter inaequaliter incrassato, 1.5-2(-2.5) μm crasso, protuberantiis 1-4, interdum regione lucem repercutescentes 1, superficies sub SEM verrucis saepe confluentibus, ca. 0.3-0.8(-1) μm diam.

Sori in ovaries, subglobose, 2-2.5 mm long, 1.2-2 mm wide, at first covered by a greyish fungal membrane, later becoming exposed. *Spore mass* black, semi-agglutinated. *Ustilosporae* in plane view ovoid, ellipsoidal or irregular, 15-22(-24) × 13.5-18.5(-21) μm, in side view 11-15 μm wide, reddish-brown; wall slightly unevenly thickened, 1.5-2(-2.5) μm, protuberances 1-4, occasionally one light reflective area, surface verrucose, the warts often confluent, ca. 0.3-0.8(-1) μm in diameter as seen by SEM.

Habitat: In living ovaries of *Carex filamentosa*.

Known distribution: Gansu.



Figs. 7, 8. Ustilosporium of *Anthracoidea bistaminatae* (from holotype, HMAS 133832). **7.** in LM. **8.** in SEM. **Figs. 9, 10.** Ustilosporium of *Anthracoidea royleanae* (from holotype, HMAS 133834). **9.** in LM. **10.** in SEM. **Figs. 11, 12** Ustilosporium of *Anthracoidea filamentosae* (from holotype, HMAS 133833). **11.** in LM. **12.** in SEM.

Material examined: CHINA, Gansu, Kangde, Lianhua Mountain, in ovaries of *Carex filamentosa* K.T. Fu (*Cyperaceae*, subgen. *Carex*, sect. *Digitatae*), 16 June 2005, L. Guo, N. Liu & Z.Y. Li 3346 (HMAS 133833, **holotype designated here**); isotype HUV 21145.

Key to the *Anthracoidea* species on sect. *Digitatae* of subgen. *Carex*

- | | |
|--|------------------------|
| 1. Ustilosporous 15-22(-24) μm long..... | 2 |
| 1. Ustilosporous 15-30(-37.5) μm long..... | 3 |
| 2. Warts ca. 0.3-0.8(-1) μm in diameter, often confluent..... | <i>A. filamentosae</i> |
| 2. Warts ca. 0.2-0.4 μm in diameter..... | <i>A. shaanxiensis</i> |
| 3. Ustilosporous very irregular, 15-30(-37.5) μm long..... | 4 |
| 3. Ustilosporous moderately irregular, (15-)16-25.5(-27) μm long..... | 5 |
| 4. Ustilosporous 18-29(-34) μm long..... | <i>A. irregularis</i> |
| 4. Ustilosporous 15-30(-37.5) μm long..... | <i>A. striata</i> |
| 5. Walls 1-3.5(-4) μm thick, internal swellings common..... | <i>A. rupestris</i> |
| 5. Walls (1-)1.5-4(-5) μm thick, internal swellings weak..... | <i>A. humilis</i> |

There are now 33 species of the genus *Anthracoidea* recorded for China (Guo, 2000, 2002, 2004, 2005, Guo and Wang, 2005, Guo and Zhang, 2004, Wang and Piepenbring, 2002, Zhang and Guo, 2004), representing about 38% of the world's known species of the genus.

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