

## Studies on lophiostomataceous fungi from Xinjiang, China<sup>1</sup>

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A floristic investigation was conducted on the lophiostomataceous fungi in Xinjiang, China. Ten species and seven varieties of the genus *Lophiostoma*, one variety of *Lophiotrema* and one species of *Navicella* are treated. *Lophiostoma glaciale* var. *tianshanicum*, *L. minusporum*, *L. macrostomum* var. *exappendiculatum*, *L. muriforme*, *L. quadrinucleatum* var. *curvatum*, *Lophiotrema nucula* var. *heterosporum*, and *Navicella xinjiangensis* are proposed as new taxa. Seven species and four varieties of the genus *Lophiostoma* are recorded for the first time from China.

Keywords: Taxonomy, Lophiostomataceae, *Lophiostoma*, *Platystomum*, *Lophiotrema*, *Navicella*.

The Lophiostomataceae (Ascomycetes, Pleosporales) is most readily recognized by black, carbonaceous ascomata that have a vertically flattened or ridge-like apex opening by a preformed slit. Comprehensive taxonomic treatments of the family have been published by Chesters & Bell (1970), Holm & Holm (1988) and Barr (1992). Earlier accounts on the family are found in Ellis & Everh. (1892), Munk (1957) and Dennis (1968).

The traditional concept of the family Lophiostomataceae is artificial, and several genera, including *Navicella*, have been moved to other families of different orders (Eriksson, 1981; Barr, 1990). For practical reasons, however, the family is treated here in its original broad sense and the classifications of Holm & Holm (1988) applied to Swedish species is followed.

Lophiostomataceous fungi are poorly known in China. Only three species, *Lophiostoma compressum* (Pers.: Fr.) Ces. & De Not., *Navicella pileata* (Tode: Fr.) Fabre (as *Lophiostoma excipuliforme* (Fr.) Ces. & De Not.), and *Schizostoma pachythele* (Berk. & Br.) Sacc., have so far been recorded (Eriksson & Yue, 1988). The present study is part

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of a program of monographic studies on the mycobiota of the Xinjiang Region (Province) in far northwest China.

### Materials and methods

Descriptions of each species or variety treated in this paper are based on freshly collected material, or on collections preserved in the Herbarium of Mycology, August 1st Agricultural College, Xinjiang (HMAAC), where all specimens are now deposited. The specimens were collected in the Central Tianshan Mountain (CTM) near Urumqi and in West Tianshan Mountain (WTM) near Hazakhstan, about 1400–2300 m above sea level. In addition, few collections were made in the South Zhongger (Jungger) Basin (SZB), a desert area. The Tianshan Mountain runs across the center of Xinjiang, dividing Xinjiang into the northern and southern parts. The mountain has a temperate semiarid climate, with a maximum annual precipitation of 600 mm and with a spruce dominated vegetation in its west and central parts. The Zhongger Basin in northern Xinjiang has an average elevation of 500 m, with a temperate arid climate and an annual precipitation below 200 mm. The vegetation is sparse in this area with *Haloxylon*, *Calligonum*, *Reaumuria*, and *Tamarix* as the main elements of the vegetation.

Microscopic examination of the specimens was performed on squash mounts and thin median sections. Fresh material was mounted in Shear's mounting fluid (Dhingra & Sinclair, 1985) and Melzer's reagent, while the dry material was first rehydrated by soaking it in 5% KOH. Fifty mature ascospores for each species, or 100 for new taxa were measured, and arithmetic means calculated.

### Descriptive part

Only three genera, *Lophiostoma*, *Lophiotrema* and *Navicella* were collected during this survey. The following modified key to these genera is based on that of Holm & Holm (1988).

#### Key to genera of the Lophiostomataceae of Xinjiang

- 1 Spore septa thickened, lumina lenticular ..... *Navicella*
- 1\* Not so ..... 2
- 2 Spores 1–3-septate, hyaline; ascomatal peridium of "*Lophiotrema*-type\*" ..... *Lophiotrema*
- 2\* Spores 1-pluriseptate or muriform, hyaline to dark brown; ascomatal peridium of "*Lophiostoma*-type\*" ..... *Lophiostoma*

\* Fide Holm & Holm (1988), see text for definition.

**Lophiostoma** Ces. & De Not. (nom. cons.)

The genus *Lophiostoma* was erected by Cesati & De Notaris in 1863 to accommodate several species without typification. Later, Holm (1975) selected *L. macrostomum* as type of the genus. At one time or the other almost all pyrenocarpous ascomycetes that opened by a slit were included in *Lophiostoma* (Holm & Holm, 1988). While there is no uniform definition for the genus, we are following the concept proposed by Holm & Holm (1988):

“Ascomata immersed-erumpent, generally with a distinct, flattened neck, opening by a slit-like ostiole. Peridium often of the “Lophiostoma-type”: peridium not of uniform thickness but broader laterally at base, up to 50 µm, and here composed of several layers parallel, long, prismatic cells. Asci mostly clavate, bitunicate. Pseudoparaphyses branched, with sparse septa. Spores 1-septate, pluriseptate or muriform, hyaline to dark brown, often with terminal appendages, but without mucous sheath. Saprophytic on woody as well as herbaceous plants, including grasses.”

**Key to the species and varieties of *Lophiostoma* in Xinjiang**

- 1 Spores hyaline ..... 2
- 1\* Spores brown ..... 5
  
- 2 Spores 1-septate, at least whilst still within ascus ..... 3
- 2\* Spores with 3–5 septa, narrowly fusiform ..... *L. myriocarpum*
  
- 3 Spores with terminal appendages ..... 4
- 3\* Spores without terminal appendages .....  
       ..... *L. macrostomum* var. *exappendiculatum*
  
- 4 Appendages ca.3–4 µm long, spores 22–32 × 6–7 µm .....  
       ..... *L. macrostomum*
- 4\* Appendages (4)–6–10 µm long, spores 34–44 × 5–7 µm .....  
       ..... *L. glaciale* var. *tianshanicum*
  
- 5 Spores with transverse septa only ..... 6
- 5\* Spores also with longitudinal septa ..... 14
  
- 6 All or most spores with 3 septa ..... 7
- 6\* Most spores with 5 or more septa ..... 9
  
- 7 Spores uniformly 3-septate, subclavate or fusiform .... *L. calligoni*
- 7\* Spores mostly 3(–5)-septate, ellipsoid to broadly fusiform ..... 8

- 8 Spores 18–26 × 7–8 μm, straight, mostly ellipsoid .....  
 ..... *L. quadrinucleatum* var. *triseptatum*
- 8\* Spores 28–34 × 8–10 μm, curved, mostly broadly fusiform.....  
 ..... *L. quadrinucleatum* var. *curvatum*
- 9 Spores appendiculate ..... 10
- 9\* Spores not appendiculate ..... 11
- 10 Spores mostly with 5 septa ..... *L. caulium* var. *c*
- 10\* Spores mostly with 7 septa ..... *L. caulium* var. *d*
- 11 Most spores distinctly caudate ..... *L. caudatum*
- 11\* Not so ..... 12
- 12 On herbaceous plants, spores with up to 9 septa ..... *L. prominens*
- 12\* On woody plants, spores with up to 7 septa ..... 13
- 13 Spores >25 μm mostly with 7 septa ..... *L. macrostomoides*
- 13\* Spores <25 μm mostly with 5 septa ..... *L. caulium* var. *e*
- 14 All spores with numerous oblique longitudinal septa .....  
 ..... *L. muriforme*
- 14\* Most spores with 1–3 longitudinal septa ..... 15
- 15 Spores subclavate, yellow to light brown ..... *L. curtum*
- 15\* Spores ellipsoid or ellipsoid-oblong, brown to deep brown ..... 16
- 16 Spores 12–18 × 5–6 (–8) μm, mostly with 3 transverse septa,  
 ellipsoid..... *L. minosporum*
- 16\* Spores (14–)19.5–28 × 6.3–8 μm, mostly with 5 transverse septa,  
 ellipsoid-oblong ..... *L. compressum*

1. ***Lophiostoma calligoni*** B. Kravtz., Collect. of Pap. on Crypt. of Kazakhst. 9: 40. 1961. – Fig. 46.

Ascomata scattered to confluent, semi-immersed in decorticated branches, subglobose, 0.3–0.6 mm diam., with a compressed neck up to 0.05 mm high; peridium up to 40–60 μm thick. – Asci 8-spored, clavate, with a short basal stalk, 90.5–115.5 × 12–14 μm. – Ascospores biseriata or obliquely uniseriate, subclavate, fusiform, deep yellow brown, uniformly 3-septate, slightly constricted at all septa, more distinctly at the middle septum, 16–24 × 6–8 (mean 20 × 7) μm. – Pseudoparaphyses abundant, simple, up to 180 μm long and 2 μm wide.

**Habitat.** – On branches of *Calligonum leucocladum* (Schrenk) Bge., desert brush, alt. 560 m.

**Material examined.** – Xinjiang: Beishawo (SZB), Changji, on *Calligonum leucocladum*, 1.V. 1991, Z.Y. Zhao & Z.Q. Yuan, HMAAC 731 & 732.

2. ***Lophiostoma caudatum*** Fabre, Ann. Sci. Nat. Bot., ser. 6, 9: 103. 1879. – Fig. 21.

Syn.: *Lophiostoma dacryosporum* Fabre, Sph. Vaucl.: 103. 1878.

**Ascomata** densely scattered, immersed to semi-immersed, globose, 0.35–0.48 mm diam., with a distinct, crested, but not much compressed neck up to 0.25 mm high; peridium of the typical “*Lophiostoma*-type” up to 50  $\mu\text{m}$  thick. – **Asci** 8-spored, clavate, with a short basal stalk, 90–110  $\times$  12  $\mu\text{m}$ . – **Ascospores** biseriate, caudate or subclavate, brown, with 3–5 (mostly 3) transverse septa, basal cell  $\pm$  caudate, lighter, 18–28  $\times$  6–8 (mean 21  $\times$  7)  $\mu\text{m}$ . – **Pseudoparaphyses** simple, 150  $\times$  2  $\mu\text{m}$ .

**Habitat.** – On branches of *Salix tianschanica* Rgl., spruce forest, alt. 2100 m.

**Material examined.** – Xinjiang: Nanshan (CTM), Urumqi, on *Salix tianschanica*, 4. VII. 1990, Z. Q. Yuan, HMAAC 684.

In our collection *L. caudatum* was found associated with *L. compressum* and is recognized by its lower and less strongly compressed neck.

3. ***Lophiostoma caulium*** (Fr.) Ces. & De Not., Comm. Soc. Critt. Ital. 1: 219. 1863

**Ascomata** scattered to densely crowded, immersed to semi-immersed, globose, up to 0.5 (0.6) mm diam., neck compressed, crested, up to 0.25 mm high and 0.2 mm wide. – **Asci** clavate. – **Ascospores** biseriate, narrowly to broadly fusiform, straight or curved, pale brown to deep brown, (3)–5–7-septate, 20–32  $\times$  5–10  $\mu\text{m}$ , most spores with hyaline appendages, 5–12  $\mu\text{m}$ . – **Pseudoparaphyses** abundant, branched, septate.

Three varieties of the species were distinguished in this survey.

*L. caulium* var. *c* L. & K. Holm, Acta Univ. Ups. Symb. Bot. Ups. 18(2): 14. 1988. – Figs. 1, 22.

Ascospores biseriate, broadly fusiform, straight or curved, light brown, 5-septate (occasionally 6), constricted at all the septa, with inflated 3rd cell and pointed ends, large,  $26-32 \times 6-7$  (mean  $28.8 \times 6.2$ )  $\mu\text{m}$ ; appendages hyaline, 6–10  $\mu\text{m}$  long, usually curved towards one side of the spore.

Habitat. – On decorticated branches of *Lonicera* sp., valley brush, alt. 2200 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Lonicera* sp., 25. IV. 1980, Z. Y. Zhao, HMAAC 669.

*L. caulium* var. *d* L. & K. Holm, Symb. Bot. Ups. 18(2): 14. 1988. – Fig. 23.

Ascospores biseriate, broadly fusiform, slightly curved, light brown, with 5–7 transverse septa (mostly 6 or 7), large,  $(28-32-36(-44) \times 6-8$  (mean  $34 \times 7$ )  $\mu\text{m}$ ; appendages hyaline, 6–13  $\mu\text{m}$  long.

Habitat. – On *Lonicera altmanni*, Rgl. et Schmalh., *Lonicera* sp., tableland brush of valley bottom, alt. 1000 m, and brush of spruce forest fringe, alt. 1700 m.

Material examined. – Xinjiang: Huecheng (WTM), Yili, on *Lonicera altmanni*, 21. VIII. 1990. Z. Q. Yuan & Z. Y. Zhao, HMAAC 712; Baiyongguo (CTM), Urumqi, on *Lonicera* sp., 2. VII. 1991. Z. Q. Yuan & Mayla, HMAAC 755.

*L. caulium* var. *e* L. & K. Holm, Symb. Bot. Ups. 18(2): 14. 1988. – Figs. 2, 3, 29–33.

Ascospores biseriate, oblong ellipsoid, obtuse or acute at ends, light brown to brown, with 3–5 (mostly 5) transverse septa,  $18-24 \times 6-7$  (mean  $20.3 \times 6.1$ )  $\mu\text{m}$ .

Habitat. – On dead branches of *Artemisia terra-albae* Krasch., twigs of *Lonicera* sp., dead branches of *Salix capusii* Franch., branch canker of *Salix tianschanica* Rgl., branches of *Salix* sp., wood of *Prunus divaricata* Ldb., brush land and spruce forest at alt. 500–2100 m.

Material examined. – Xinjiang: Beishawo (ZGB), Changji, on *Artemisia terra-albae*, 1.V. 1991, Z. Y. Zhao & Z. Q. Yuan, HMAAC 729; Nanshan (CTM), Urumqi, on *Lonicera* sp., 10. V. 1991, Z. Q. Yuan & al., HMAAC 728; Nanshan (CTM), Urumqi, on *Salix capusii*, 2. VII. 1990, Z. Q. Yuan, HMAAC 682; Nanshan (CTM), Urumqi, on *Salix tianschanica*, 30. VII. 1990, HMAAC 683; Gunlu (WTM), Yili, on *Salix* sp., 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 695;

Huecheng (WTM), Yili, on *Prunus divaricata*, 19. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 696.

4. *Lophiostoma compressum* (Pers.: Fr.) Ces. & De Not., Comm. Soc. critt. Ital. 1: 219. 1863. – Figs. 4–9, 34–45.

Syn.: *Sphaeria compressa* Pers.: Fr., Syst. Myc. 2: 470. 1823; Pers., Syn. Meth. Fung. p. 54. 1801.

*Platystomum compressum* Trev., Bull. Soc. R. Bot. Belg. 16: 16. 1877

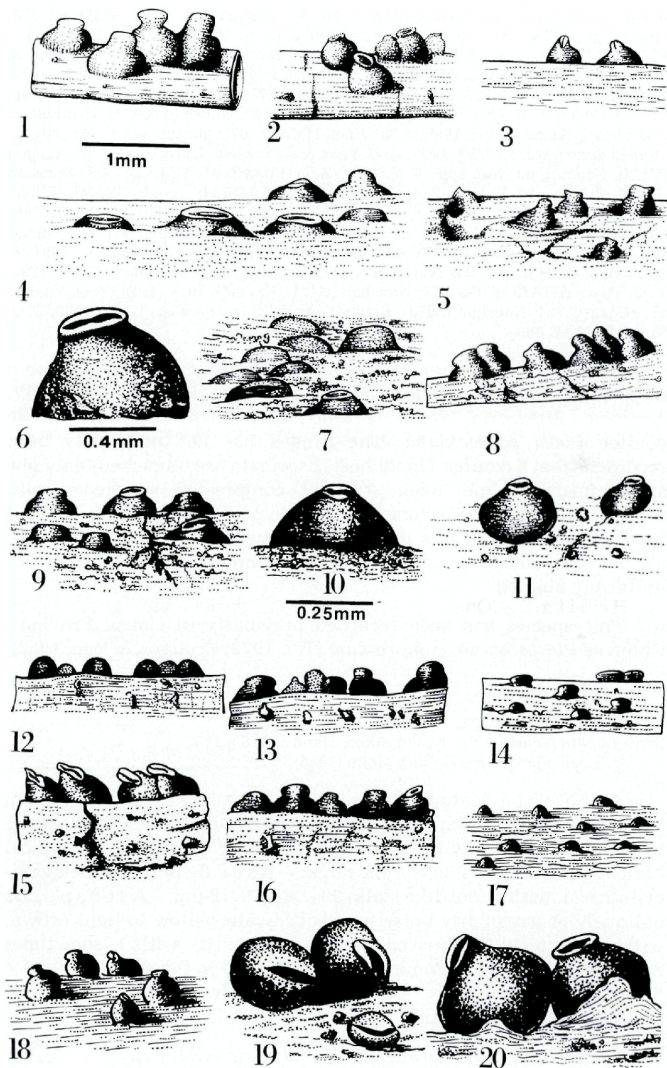
Other synonyms see Holm & Holm (1988).

Ascomata scattered to crowded over a large area, mostly immersed, seldom semi-immersed, black, coarse, 0.2–0.7 mm diam., with a large, strongly compressed, crested neck, up to 0.5 mm high, when immersed in bark only the neck exposed and the necks usually aligned parallel to the long axis of the host. – Ascii 8-spored, clavate to cylindrical with a short basal stalk, 130–140 × 9–14 µm. – Ascospores obliquely or irregularly uniseriate to biseriate, variable in septation and shape, generally oblong-ellipsoid or fusiform with obtuse ends, brown, with 3–7 (mostly 5) transverse septa and 1–2 longitudinal septa, slightly constricted or not at all septa, some spores deeply constricted at the middle septum, (14–)19.5–28 × 6.3–8 (mean 24.5 × 7.4) µm. – Pseudoparaphyses branched, non-septate, tapered at ends, with numerous droplets, 112.5–175.0 × 1.0–1.25 µm.

Habitat. – On deciduous wood and decorticated branches of *Betula tianschanica* Rupr., *Cotoneaster melanocarpus* Lodd., *Lonicera altmanni* Rgl. et Schmalh., *Lonicera caerulea* L., *Lonicera hispida* Pali. ex Roem et Dchwt, dead twigs of *Lonicera* sp., *Myricaria alopecuroides* Schrenk, *Padus racemosa* (Lam.) Gilib., *Picea schrenkiana* Fish et Mey., *Prunus divaricata* Ldb., *Rosa* spp., *Rubus idaeus* L., *Salix* spp., *Salix capusii* Franch., *Salix tianshanica* Rgl., spruce forest and brush land at 1500–2200 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Betula tianschanica*, 1981, Z. Y. Zhao, HMAAC 672; Nanshan (CTM), Urumqi, on *Cotoneaster melanocarpus*, 5. VII. 1990, Z. Q. Yuan, HMAAC 675; Tianchi (CTM), Fukang, on *Lonicera altmanni*, 13. VIII. 1990, Z. Q. Yuan, HMAAC 689; Nanshan

Figs. 1–20. Ascomata. – 1. *Lophiostoma caulium* var. c (HMAAC 669). – 2–3. *L. caulium* var. e (HMAAC 696). – 4–9. *L. compressum* (4, HMAAC 692; 5, HMAAC 674; 6, HMAAC 675; 7–8, HMAAC 676; 9, HMAAC 677). – 10. *L. curtum* (HMAAC 679). – 11. *L. minosporum* (HMAAC 678). – 12–13. *L. macrostomoides* (HMAAC 697). – 14. *L. macrostomum* (HMAAC 702). – 15. *L. myriocarpum* (HMAAC 670). – 16. *L. quadrinucleatum* var. *triseptatum* (HMAAC 698). – 17. *L. quadrinucleatum* var. *curvatum* (HMAAC 686). – 18. *L. macrostomum* var. *exappendiculatum* (HMAAC 701). – 19, 20. *Navicella xinjiangensis* (HMAAC 668). (Scale bar = 1 mm for Figs. 1–5, 7–9, 12–20, 0.4 mm for Figs. 6, 11 and 0.25 mm for Fig. 10).





(CTM), Urumqi, on *Lonicera caerulea*, 30. VI. 1990, Z. Q. Yuan, HMAAC 674; Huashugou (CTM), Urumqi, on *Lonicera hispida*, 9. V. 1991, Z. Q. Yuan & al., HMAAC 725; Nanshan (CTM), Urumqi, on *Lonicera* sp., 10.V. 1991, Z. Q. Yuan & al., HMAAC 727; Gunglu (WTM), Yili, on *Myricaria alopecuroides*, 22. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 704; Gunglu (WTM), Yili, on *Padus racemosa*, 21. VIII. 1990, Z. Y. Zhao & Z. Q. Yuan, HMAAC 692; Nanshan (CTM), Urumqi, on *Picea schrenkiana*, 1. VII. 1990, Z. Q. Yuan, HMAAC 673; Huecheng (WTM), Yili, on *Prunus divaricata*, 19. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 691; Huashugou (CTM), Urumqi, on *Rosa* spp., 9. V. 1991, Z. Q. Yuan & al., HMAAC 723; Nanshan (CTM), Urumqi, 10. V. 1991. Z. Q. Yuan & al., HMAAC 724; Gunglu (WTM), Yili, on *Rubus idaeus*, 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 690; Nanshan (CTM), Urumqi, on *Salix* spp., 1981, Z. Y. Zhao, HMAAC 632; Huashugou (CTM), Urumqi, 9. V. 1991, Z. Q. Yuan & al., HMAAC 722; Nanshan (CTM), Urumqi, 10. V. 1991, Z. Q. Yuan & al., HMAAC 726; Nanshan (CTM), Urumqi, on *Salix capusii*, 2. VII. 1990, Z. Q. Yuan, HMAAC 676 & 677; Nanshan (CTM), Urumqi, 10. V. 1991, Z. Q. Yuan & al., HMAAC 721; Nanshan (CTM), Urumqi, on *Salix tianshanica*, 1. VII. 1990, Z. Q. Yuan, HMAAC 680.

We collected this fungus on species of *Rosa* and *Rubus*, and on a number of trees and shrubs including species of *Betula*, *Cotoneaster*, *Lonicera*, *Myricaria*, *Padus*, *Prunus*, and *Salix* spp., and on the conifer *Picea schrenkiana*. The fungus has not previously been recorded from a conifer. On all hosts ascomata are immersed (only few semi-immersed) and have strongly compressed, crested necks, sometimes elongating to tongue-like. The necks are typically aligned parallel to the long axis of the host; however on *Betula* they are aligned perpendicular to the long axis and on *Rosa* they are not uniformly aligned.

This species has been recorded previously in Gansu Province, China as *Platystomum compressum* (Tai, 1979; Eriksson & Yue, 1988).

5. ***Lophiostoma curtum*** (Fr.) Ces. & De Not., Comm. Soc. Critt. Ital.

1: 219. 1863. – Figs. 10, 24.

Syn.: *Lophium curtum* Fr., K. Vet. Akad. Handl. 1818 p.113.

Other synonyms see Holm & Holm (1988).

**A s c o m a t a** scattered, immersed to semi-immersed, subglobose, 0.2–0.4 mm diam., neck lacking to prominent, cylindrical at base, up to 0.16 mm high with a slot-like ostiole; peridium of typical “*Lophiostoma*-type”, 30–40 µm thick. – **A s c i** 8-spored, subclavate-cylindrical, with a foot-like stalk, 90–130 × 8–12 µm. – **A s c o s p o r e s** obliquely or irregularly uniseriate, subclavate, yellow to light brown, with 3–6 (mostly 3) transverse septa, at maturity with 1, sometimes 2–3 longitudinal septa, some spores constricted in the middle, 14–20 × 6–8 (mean 18.9 × 6.8) µm. – **P s e u d o p a r a p h y s e s** branched, non-septate, up to 185 × 2.0 µm.

**H a b i t a t .** – On branches of *Salix tianschanica* Rgl., spruce forest, alt. 1600 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Salix tianschanica*, 4. VII. 1990, Z. Q. Yuan, HMAAC 679.

6. *Lophiostoma glaciale* Rehm var. *tianshanicum* Z.Q. Yuan, var. nov. – Fig. 51.

Varietas nova affinis *Lophiostomati glaciali* var. *glaciali*, a quo collo inconspicuo, ascosporis majoribus; appendicibus brevioribus, decurrentibus differt. – Ascomata sparsa ad gregaria, erumpentia, globosa, ad 0.5 mm diam., collo inconspicuo, minus valde compresso vel paulo ellipsoideo, ca. 0.1mm alto, apice ostiolo fissurato, conspicuo; peridio typo *Lophiostoma*, ad 60  $\mu$ m crasso. – Asci octospori, clavati, stipitibus valde brevibus, pedatis, 100–120  $\times$  10–14 (–16)  $\mu$ m. – Ascospores biseriatae, fusiformes, hyalinae, uniseptatae, 34–44  $\times$  5–7  $\mu$ m, 2–3 guttulis; appendicibus (4–)6–10  $\mu$ m longis, ex tunica hyalina exorientibus. – Pseudoparaphyses septatae, 140  $\times$  2  $\mu$ m.

Hab. in lignis Rubi idaei L.

Holotypus: Gunlu (WTM), Yili, Xinjiang Provincia, China, 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 703 (HMAAC).

Ascomata scattered to gregarious, erumpent, globose, up to 0.5 mm diam., with inconspicuous, laterally less strongly flattened neck, somewhat ellipsoidal, about 0.1 mm high, with a conspicuous slit-like ostiole at the apex; peridium of typical "*Lophiostoma*-type," up to 60  $\mu$ m thick, with many layers of flattened cells. – Asci 8-spored, clavate, with a very short basal foot-like stalk, 100–120  $\times$  10–14(–16)  $\mu$ m. – Ascospores biseriatae, fusiform, hyaline, 1-septate, 34–44  $\times$  5–7 (mean 40.4  $\times$  6.5)  $\mu$ m, with 2–3 distinct oil droplets, with a hyaline sheath that terminates into an acute appendage (4–)6–10  $\mu$ m long at each end. – Pseudoparaphyses simple, septate, 140  $\times$  2  $\mu$ m.

Habitat. – On stem of *Rubus idaeus* L., valley brush, alt. 1600 m.

Material examined. – Xinjiang: Gunlu (WTM), Yili, on stem of *Rubus idaeus*, 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 703 (Holotype).

The Chinese collection differs from *L. glaciale* var. *glaciale* in having an inconspicuous neck that is less strongly compressed, and in having slightly larger ascospores and shorter appendages that originate from a hyaline sheath surrounding the spores. Holm & Holm (1988) gave ascospore measurements of (25–)30–35  $\times$  5–6  $\mu$ m and length of appendages of (5–)7–12  $\mu$ m for European *L. glaciale* var. *glaciale*. In addition to these morphological differences, var. *glaciale* has previously been found only on species of *Aconitum* in Europe.

7. *Lophiostoma macrostomoides* (De Not.) Ces. & De Not., Comm. Soc. Critt. Ital. 1: 219. 1863. – Figs. 12, 13, 25, 28.

Syn.: *Sphaeria macrostomoides* De Not., Mem. Accad. Sci. Torino, ser. 2, 13: 111. 1854.

*Lophiostoma compressum* ssp. *pseudomacrostromum* Sacc., Michelia 1: 334. 1878.

*Trematosphaeria hypoxyloides* Rehm, Ann. Myc. 5: 540. 1907.

*Thyridaria macrostomoides* (De Not.) Barr, N. Amer. Fl. II, 13: 34. 1990.

Ascomata scattered or gregarious, immersed to semi-immersed, subglobose to globose, coarse, 0.4–0.8 mm diam., with a ± distinctly crested neck 0.02–0.3 (0.4) mm high; peridium of typical “*Lophiostoma*-type”, up to 50 µm thick, consisting of numerous, compressed, oblong cells. – Ascii 8-spored, clavate, 130–170 × 14–18 µm. – Ascospores biseriate, oblong-ellipsoid, with obtuse ends, brown, paler at ends, with 5–7 (mostly 7) transverse septa, seldom with 3 transverse septa, some spores constricted in the middle, 26–42 × 7–10 (mean 31.1 × 8.4) µm, with a length:width ratio of 3.7:1. – Pseudoparaphyses simple, septate, 200 × 2 µm.

Habitat. – On deciduous wood and decorticated branches of *Lonicera altmanni* Rgl. et Schmalh., *Picea schrenkiana* Fish et Mey, *Salix* spp., *Artemisia* sp., spruce forest and brush land at alt. 1500–2300 m.

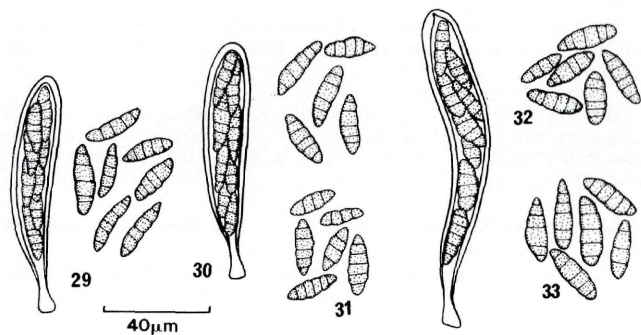
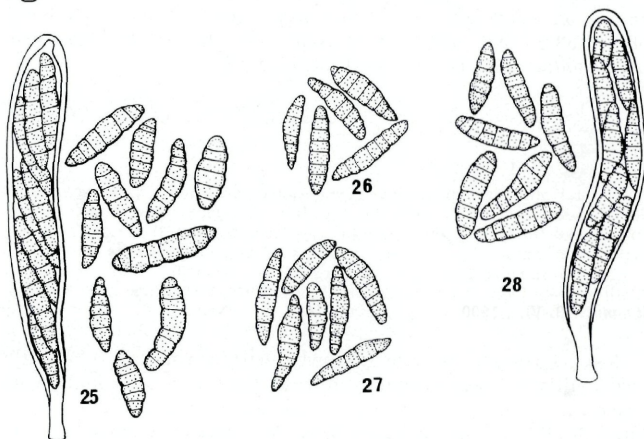
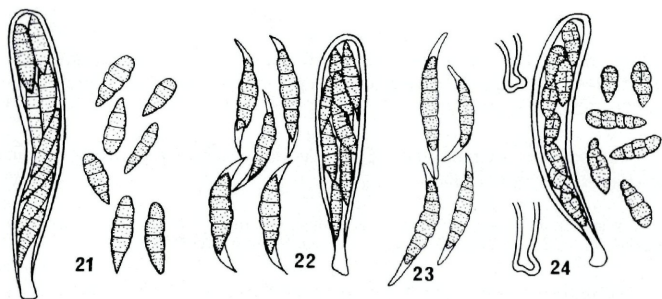
Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Lonicera altmanni*, 13. VIII. 1990, Z. Q. Yuan, HMAAC 693; Nanshan (CTM), Urumqi, on *Picea schrenkiana*, 3. VII. 1990, Z. Q. Yuan, HMAAC 671; Gunlu (WTM), Yili, on *Salix* spp., 21. VIII. 1990, Z. Y. Zhao & Z. Q. Yuan, HMAAC 694; Nanshan (CTM), Urumqi, 3. VII. 1990, Z. Q. Yuan, HMAAC 671; Ganglu (WTM), Yili, on *Artemisia* sp., 22. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 697.

8. *Lophiostoma macrostromum* (Tode: Fr.) Ces. & De Not., Comm. Soc. Critt. Ital. 1: 219. 1863. – Figs. 14, 52.

Syn.: *Sphaeria macrostroma* Tode, F. Meckl. 2: 12. 1791. Other synonyms see Holm & Holm, 1988.

Ascomata scattered, immersed to semi-immersed in the blackened substrate, 0.2–0.4 mm diam., with a highly compressed, crested neck, 0.15 mm high and 0.4 mm wide, fan-shaped, notched, aligned perpendicular to the long axis of the host. – Ascii 8-spored,

Figs. 21–33. Ascii and spores. – 21. *Lophiostoma caudatum* (HMAAC 684). – 22. *L. caulium* var. *c* (HMAAC 669). – 23. *L. caulium* var. *d* (HMAAC 755). – 24. *L. curtum* (HMAAC 679). – 25–28. *L. macrostomoides* (25, HMAAC 671; 26, HMAAC 694; 27, HMAAC 697; 28, HMAAC 693). – 29–33. *L. caulium* var. *e* (29, HMAAC 682; 30, HMAAC 683; 31, HMAAC 729; 32, HMAAC 696; 33, HMAAC 695). (Scale bar = 40 µm for all Figs.).



clavate, 100–120 × 12–13 µm. – Ascospores biseriatae, fusiform, hyaline, 1-septate, lastly turning faintly brown and 3-septate, 22–32 × 6–7 (mean 27.5 × 6.4) µm, with 2–3 distinct oil droplets; appendages short, 3–4 µm long. – Pseudoparaphyses abundant, simple, up to 170 × 2 µm.

**Habitat.** – On stem of *Myricaria alopecuroides* Schrenk, brush of river valley, alt. 1500 m.

**Material examined.** – Xinjiang: Gunlu (WTM), Yili, on *Myricaria alopecuroides*, 22.VIII.1990, Z. Y. Zhao & Z. Q. Yuan, HMAAC 702.

*L. macrostomum*, the type species of the genus *Lophiostoma*, is common on wood and bark of frondose trees and shrubs (Holm & Holm, 1988). We collected it only on the shrub *Myricaria alopecuroides* which is a new host for this fungus.

9. *L. macrostomum* var. *exappendiculatum* Z. Q. Yuan, var. nov. – Figs. 18, 59.

Varietas proxima *Lophiostomati macrostomo* var. *macrostomo*, a quo sporis non appendiculatis, paulo longioribus differt. Ascosporae biseriatae, anguste fusiformes, partim curvae, diu uniseptatae, hyalinae, 2–4 (fere 3) guttulis, postremo triseptatae, brunneae, glabrotunicatae, 30–36 × 5–7 µm; non appendiculatae.

**Hab.** in ramulis *Lonicerae altmanni* Rgl. et Schmalh. Holotypus: Gunlu (WTM), Yili, Xinjiang Provincia China, 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 701 (HMAAC).

Ascospores biseriatae, narrowly fusiform, some spores slightly curved, initially 1-septate and hyaline, with 2–4 (mostly 3) oil droplets in each cell, with 3 transverse septa and brown at maturity, smooth-walled, 30–36 × 5–7 (mean 33.5 × 6) µm; terminal appendage lacking.

**Habitat.** – On branches of *Lonicera altmanni* Rgl. et Schmalh., *Lonicera* sp., spruce forest fringe, alt. 1650 m and valley brush, alt. 1700 m.

**Material examined.** – Xinjiang: Gunlu (WTM), Yili, on *Lonicera altmanni*, 21. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 701 (Holotype); Baiyonggou (CTM), Urumqi, on *Lonicera* sp., 2. VII. 1991, Z. Q. Yuan & Mayla, HMAAC 756.

Morphological characteristics in our collections from *Lonicera* spp. are the same as in *L. macrostomum* var. *macrostomum*, except that there are no appendages at the ends of the spores, and that the spores are slightly longer (30–36 µm) than those in *L. macrostomum* var. *macrostomum* (22–32 µm).

*L. macrostomum* var. *exappendiculatum* is also similar to *L. semiliberum*. However, ascospores in *L. macrostomum* var. *exappendiculatum* have fewer oil droplets (up to 4), and the mature ascospores are smooth rather than minutely verrucose. *Lophiostoma semiliberum* is always found on grass culms (Holm & Holm, 1988), whereas the new variety occurs on a woody plant.

10. *Lophiostoma minosporum* Z. Q. Yuan sp. nov. – Figs. 11, 47, 48.

Similis Lophiostomati compresso, a quo differt ascosporis minoribus, triseptatis. Ascumata sparsa ad dense congesta, innata-erumpentia, globosa, 0.2–0.4 mm diam, collo compresso, cristato, ad 0.15 mm alto. Asci cylindrici, stipitibus brevibus, 90–125 × 8–12 μm. Ascosporeae oblique monostichae, ellipsoideae, brunneae, 3-transverse septatae (raro 4 vel 5), 1–2-longitudinaliter septatae, constrictae ad omnia septa, 12–18 × 5–6(–8) μm. Pseudoparaphyses ramosae, esepatae, ad 180 μm longae et 1.5 μm latae.

Habitat in lignis deciduis Piceae schrenkianae Fish et Mey. Holotypus: Nanshan (CTM), Urumqi, Xinjiang Provincia, China, 5. VII. 1990, Z. Q. Yuan, HMAAC 678 (HMAAC).

Ascumata scattered to densely crowded, covering large areas, immersed-erumpent, globose, small, 0.2–0.4 mm diam., with a compressed crested neck up to 0.15 mm high. – Asci cylindrical, with a short stalk, 90–125 × 8–12 μm. – Ascospores obliquely uniseriate, ellipsoid, brown, with 3 transverse septa (occasionally 4 or 5), and 1–2 longitudinal septa, constricted at all septa, 12–18 × 5–6(–8) (mean 15.2 × 6.6) μm. – Pseudoparaphyses branched, non-septate, up to 180 μm long and 1.5 μm wide.

Habitat. – On wood of *Picea schrenkiana* Fish. et Mey., branches of *Salix tianschanica* Rgl., spruce forest, 1850–2350 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Picea schrenkiana*, 5. VII. 1990, Z. Q. Yuan, HMAAC 678 (Holotype); Nanshan (CTM), Urumqi, on *Salix tianschanica*, 4. VII. 1990, Z. Q. Yuan, HMAAC 681.

*Lophiostoma minosporum* is close to *L. compressum*, but differs in size and septation of the ascospores. Ascospores in *L. compressum* are (14–)19.5–28 × 6.3–8 μm [(16–)20–28 × 7–9 μm fide Holm & Holm, 1988], with primarily 5 transverse septa and variable number of longitudinal septa, while ascospores of the new species are shorter, 12–18 × 5–6(–8) (mean 14.4 × 6.0) μm on *Picea* and 14–18 × 6–8 (mean 16 × 7.2) μm on *Salix*. The ascospores have 3 transverse septa only and 1–2 longitudinal septa and are ellipsoidal, with a length:width ratio of 2.3:1. *L. minosporum* is also close to *L. curtum*, which has yellow to light brown, subclavate ascospores, rather than dark brown, ellipsoid spores.

11. *Lophiostoma myriocarpum* Fckl., F. rhen. no. 1807 (1866); Symb. Myc. 156. 1870. – Figs. 15, 53.

Syn.: *Lophiotrema myriocarpum* Sacc., *Michelia* 1: 338. 1878.

*Lophiotrema vigheffulense* (Pass.) Berl., Ic. Fung. 1: 4. 1890.

*Lophiosphaera vigheffulensis* Pass., Erb. Critt. Ital. ser. 2, no. 1373. 1883.

Ascomata scattered to crowded, semi-immersed, subglobose, 0.3–0.5 mm diam., with a compressed neck up to 0.1 mm high; peridium of “*Lophiostoma*-type,” 50  $\mu$ m thick. – Asci 8-spored, subcylindrical, 100–120  $\times$  10–12  $\mu$ m. – Ascospores biseriate, narrowly fusiform, with acute ends when young, hyaline to slightly greenish yellow, 3–5 (mostly 5) transverse septa, usually constricted in the middle, some spores with the third cell enlarged, 28–36  $\times$  6–7 (mean 30.8  $\times$  6.3)  $\mu$ m, with numerous oil droplets. – Pseudoparaphyses abundant, simple, 135  $\times$  2  $\mu$ m.

Habitat. – On bark of *Salix capusii* Franch., river valley brush, alt. 1750 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Salix capusii*, 2. VII. 1990, Z. Q. Yuan, HMAAC 670.

12. *Lophiostoma quadrinucleatum* Karst. var. *triseptatum* (Peck) Chesters & Bell, Mycol. Pap. 120: 36. 1970. – Figs. 16, 54–56.

Syn.: *Lophiostoma triseptatum* Peck, in Ellis & Everh., N. Am. Pyrenom. 224. 1892.

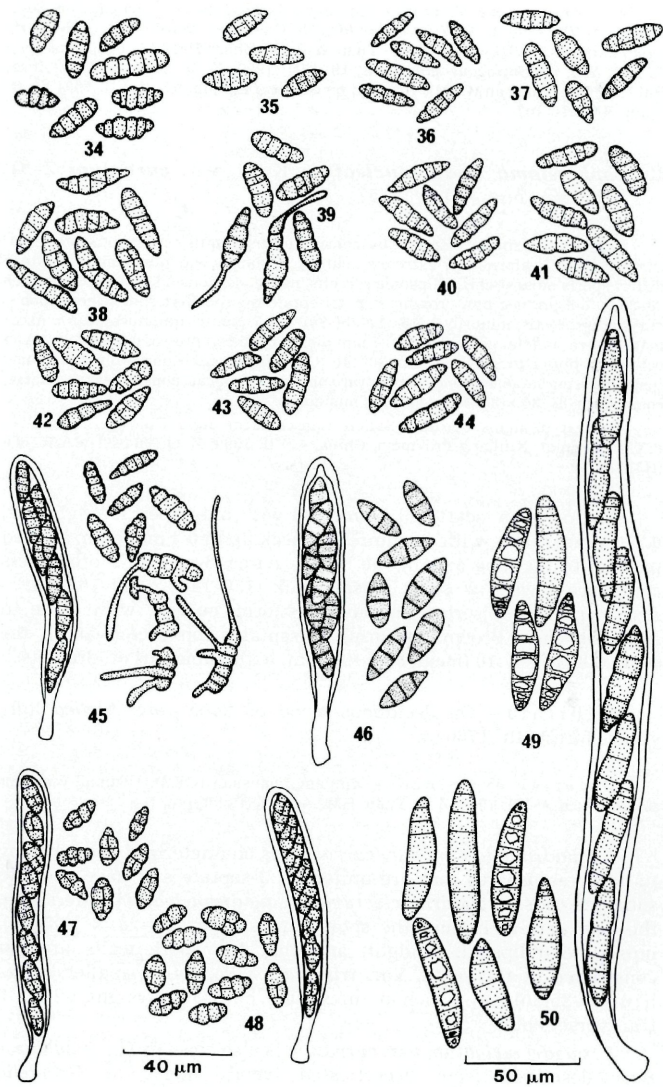
*Thyridaria triseptata* (Peck) Barr, N. Amer. Fl. II, 13: 36. 1990.

Other synonyms see Chesters & Bell (1970).

Ascomata scattered, immersed to semi-immersed, globose, up to 0.5 mm diam., with a compressed crested neck to 0.3 mm high, aligned parallel to the long axis of the host; peridium of “*Lophiostoma*-type”, ca. 40  $\mu$ m thick. – Asci 8-spored, subclavate, 120–130  $\times$  12–14  $\mu$ m. – Ascospores irregularly uniseriate, ellipsoid to subclavate, with obtuse ends, brown, 3-septate, occasionally 4-septate, constricted at most septa, 18–26  $\times$  7–8 (mean 21.6  $\times$  6)  $\mu$ m, with numerous oil droplets. – Pseudoparaphyses simple, 168  $\times$  1.5–2  $\mu$ m.

Habitat. – On dead branches of *Salix capusii* Franch., *Berberis nummularia* Bge., *Crataegus sanguinea* Pall., *Sorbus tianschanica* Rupr., brush land and spruce forest at alt. 1000–1750 m.

Figs. 34–50. Asci and spores. – 34–45. *L. compressum* (34, HMAAC 672; 35, HMAAC 675; 36, HMAAC 692; 37, HMAAC 674; 38, HMAAC 676; 39, HMAAC 680; 40, HMAAC 704; 41, HMAAC 677; 42, HMAAC 689; 43, HMAAC 690; 44, HMAAC 691; 45, HMAAC 632). – 46. *L. calligoni* (HMAAC 731). – 47–48. *L. minosporum* (47, HMAAC 678, type; 48, HMAAC 681). – 49–50. *Navicella xinjiangensis* (49, HMAAC 730; 50, HMAAC 668, type). (Scale bar = 40  $\mu$ m for Figs. 34–48 and 50  $\mu$ m for Figs. 49–50).





**Material examined.** – Xinjiang: Nanshan (CTM), Urumqi, on *Salix capusii*, 5. VII. 1990, Z. Q. Yuan, HMAAC 685; Huecheng (WTM), Yili, on *Berberis nummularia*, 19. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 698; Huecheng (WTM), Yili, on *Crataegus sanguinea*, 19. VIII. 1990, Z. Q. Yuan & Z. Y. Zhao, HMAAC 699; Nanshan (CTM), Urumqi, on *Sorbus tianschanica*, 2. VII. 1991, Z. Q. Yuan, HMAAC 757.

13. *Lophiostoma quadrinucleatum* Karst. var. *curvatum* Z. Q. Yuan, var. nov. – Figs. 17, 57.

Dignoscitur sporis biserialibus constanter triseptatis, constrictis ad septa, curvatis, late fusiformibus, extremis acutulis. Proxima var. quadrinucleato quae differt sporis monostichis, ellipsoideis, rectis, non-constrictis ad septa et minoribus  $20-28 \times 7-8 \mu\text{m}$  nec non proxima var. triseptato quod differt sporis monostichis, ellipsoideis, rectis, minoribus  $(16-17-25(30) \times 5-7 \mu\text{m}$ , tri-quinqueseptatis. Ascomata sparsa, innata, globosa, 0.2–0.4 mm diam.; collo compresso, 0.2 mm alto. Asci octospori, plus minus cylindrici,  $130-140 \times 14-16 \mu\text{m}$ . Ascospores biseriatae, late fusiformes, curvatae, extremis acutis, raro obtusis, brunneae, constanter triseptatae, constrictae,  $28-34 \times 8-10 \mu\text{m}$ , guttulis numerosis.

Habitat in lignis deciduis *Salicis tianschanicae* Rgl.. Holotypus: Nanshan (CTM), Urumqi, Xinjiang Provincia, China, 4. VII. 1990, Z. Q. Yuan, HMAAC 686 (HMAAC).

**Ascospores** scattered, immersed with only apex free, globose, 0.2–0.4 mm diam., with a compressed neck up to 0.2 mm high, aligned parallel to the long axis of the host. – **Asci** 8-spored, more or less cylindrical, with a short basal stalk  $130-140 \times 14-16 \mu\text{m}$ . – **Ascospores** biseriatae, broadly fusiform, curved, with acute to subacute ends, brown, uniformly 3-septate, constricted at all the septa,  $28-34 \times 8-10$  (mean  $32.5 \times 9$ )  $\mu\text{m}$ , with numerous oil droplets.

**Habitat.** – On deciduous wood of *Salix tianschanica* Rgl., spruce forest, alt. 1700 m.

**Material examined.** – Xinjiang: Nanshan (CTM), Urumqi, on *Salix tianschanica*, 4. VII. 1990, Z. Q. Yuan, HMAAC 686 (Holotype).

*L. quadrinucleatum* var. *curvatum* is characterized primarily by its large ascospores that are uniformly 3-septate and have acute to subacute ends. *L. quadrinucleatum* var. *quadrinucleatum* differs from the new variety in that the spores are smaller ( $20-28 \times 7-8 \mu\text{m}$ ), uniseriate, ellipsoid, straight, and that the spore walls are not constricted at the septa. Var. *triseptatum* has also smaller spores [ $(16-17-25(30) \mu\text{m}$ ], which are uniseriate, ellipsoid, straight, with 3–5 transverse septa.

*L. quadrinucleatum* var. *curvatum* is also close to *L. columbiense* Barr described from decorticated woody stems of *Grindelia*

(Compositae) and *Holodiscus* (Rosaceae) (Barr, 1992). However, ascospores of this species are hyaline and become brown in age.

14. *Lophiostoma prominens* Peck, Ann. Rep. New York State Mus. 32: 50. 1879. – Fig. 60.

Syn.: *Lophiostoma turritum* Cooke & Peck in Peck, Ann. Rep. New York State Mus. 26: 86. 1874.

*Navicella turrita* (Cooke & Peck) Kuntze, Rev. Gen. Pl. 3: 500. 1898.

*Thyridaria turrita* (Cooke & Peck) Barr, N. Amer. Fl. II 13: 36. 1990.

Other synonyms see Barr (1990).

Ascomata scattered to crowded, immersed, only neck erumpent, subglobose, 0.2–0.4 mm diam., with a strongly compressed, crested neck up to 0.2 mm high, neck aligned parallel to the long axis of the host. – Asci 8-spored, clavate, with a short basal stalk, 100–110 × 12–14 µm. – Ascospores biseriate, elongated-ellipsoid, subclavate, hyaline when young, light brown, with 4–9 (mostly 5) transverse septa, slightly constricted at all the septa, some spores wider at the third cell, 24–34(–48) × 6–8 (mean 30 × 6.5) µm, length-width ratio 4.6: 1, with numerous oil droplets. – Pseudoparaphyses simple, up to 155 × 2 µm.

Habitat. – On dead twigs of *Artemisia* sp., valley brush, alt. 1700 m.

Material examined. – Xinjiang: Nanshan (CTM), Urumqi, on *Artemisia* sp., 5.VII.1990, Z. Q. Yuan, HMAAC 687.

*L. prominens* has been transferred to *Thyridaria*, a genus in the Platystomataceae, by Barr (1990). *Lophiostoma turritum* Cooke & Peck is an earlier but invalid *nomen nudum* of the species.

15. *Lophiostoma muriforme* Z. Q. Yuan, sp. nov. – Fig. 61.

Ascomata sparsa ad gregaria, innata ad semi-innata, subglobosa, 0.1–0.35 mm diam; collo nullo, apice ostiolo fissurato. Asci octospori, cylindrici, stipitibus brevibus, 140–150 × 14 µm. Ascosporeae monostichae, ellipsoideae ad late fusiformes, brunneae, muriformes, 6–7-transverse septatae (vulgo 7), numerose longitudinaliter septatae, non constrictae ad septa, 22–24 × 8–10 µm. Pseudoparaphyses ramosae, eseptatae.

Habitat in lignis *Salicis tianschanicae* Rgl.. Holotypus: Nanshan (CTM), Urumqi, Xinjiang Provincia, China, 4. VII. 1990, Z. Q. Yuan, HMAAC 688 (HMAAC).

Ascomata scattered to gregarious, immersed to semi-immersed, subglobose, 0.1–0.35 mm diam.; papilla inconspicuous or lacking, with slit-like ostiole at the apex. – Asci 8-spored, cylindrical, with a short stalk, 140–150 × 14 µm. – Ascospores

uniserial, ellipsoid to broadly fusiform, brown, muriform, with up to 7 transverse septa and numerous longitudinal septa, not constricted at septa, 22–24 × 8–10 µm. – Pseudoparaphyses branched, non-septate.

**Habitat.** – On branches of *Salix tianschanica* Rgl., spruce forest, alt. 1700 m.

**Material examined.** – Xinjiang: Nanshan (CTM), Urumqi, on *Salix tianschanica*, 4. VII. 1990, Z. Q. Yuan, HMAAC 688 (Holotype).

This species does not match any of the taxa with muriform ascospores that were included in *Lophidium* or *Platystomum* (Ellis & Everhart, 1892; Berlese, 1894; Chesters & Bell, 1970).

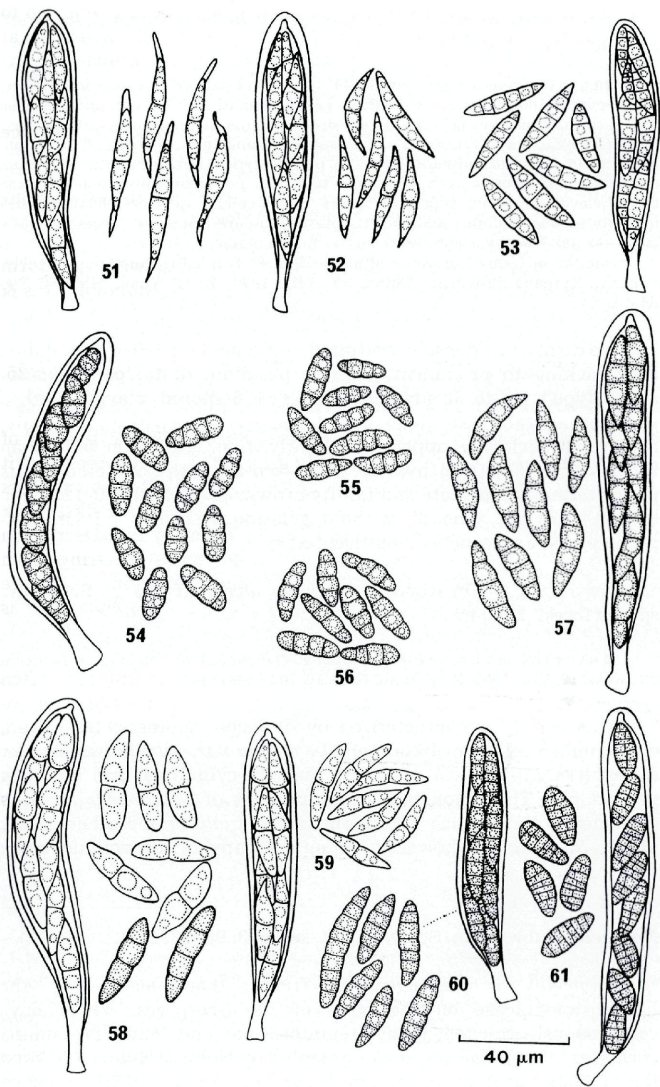
***Lophiotrema*** Sacc. emend. L. & K. Holm. Symb. Bot. Ups. 18 (2): 25. 1988.

This genus was erected by Saccardo in 1878 for species of Lophiostomataceae with hyaline, phragmosporous ascospores, but it has been treated as a synonym of *Lophiostoma* by most recent authors (Chesters & Bell, 1970; Hawksworth & al., 1983; Eriksson & Hawksworth, 1987). Holm & Holm (1988) emended the description and recognized *Lophiotrema* as a separate genus differing from *Lophiostoma* in structure of the peridium and in ascospore morphology. Following Holm & Holm (1988), *Lophiotrema* is described as follows:

**Ascomata** small to medium-sized, + pyriform but neck often reduced, even lacking, sometimes cylindrical. – **Peridium** of “*Lophiotrema*-type”, of approximately even thickness, 20–30 µm, composed of an outer *textura angularis* of uniformly pigmented cells, up to 12 µm wide, and an inner layer of very small hyaline cells with somewhat thickened walls. – **Asci** cylindrical. – **Paraphyses** branched, with sparse septa. – **Ascospores** hyaline, first 1-septate, later 3-septate, with distinct guttules, often with a mucous sheath.

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Figs 51–61. Asci and spores. – 51. *L. glaciale* var. *tianshanicum* (HMAAC 703). – 52. *L. macrostomum* (HMAAC 702). – 53. *L. myriocarpum* (HMAAC 670). – 54–56. *L. quadrinucleatum* var. *triseptatum* (54, HMAAC 685; 55, HMAAC 699; 56, HMAAC 698). – 57. *L. quadrinucleatum* var. *curvatum* (HMAAC 686, type). – 58. *Lophiotrema nucula* var. *heterosporum* (HMAAC 700, type). – 59. *Lophiostoma macrostomum* var. *exappendiculatum* (HMAAC 701, typus). – 60. *Lophiostoma prominens* (HMAAC 687). – 61. *Lophiostoma muriforme* (HMAAC 688). (Scale bar = 40 µm for all Figs.).



1. *Lophiotrema nucula* (Fr.: Fr.) Sacc. var. *heterosporum* Z. Q. Yuan, var. nov. – Fig. 58.

Dignoscitur sporis majoribus [32–44 × (8–)10–12 μm], cellula superiore latiore, sporis maturis non-verruculosis. Affinis *Lophiotremati nuculae* var. *nuculae* quae differt sporis minoribus [18–21(–24) × 5–6(–7)], cellulis sporarum aequalibus, sporis maturis verruculosis. Ascumata dense sparsa, erumpentia, globosa, 0.2–0.6 mm diam; collo nullo ad subnullo, cristato; peridio typo *Lophiotremati*, ad 32 μm crasso. Asci octospori, clavati, 120–150 × 18–22 μm. Ascospores biseriatae, clavatae ad subclavatae; cellula superiore latiore quam cellula inferiore, hyalinae, diu niseptatae, biguttulatae, denique triseptatae, obscure brunneae, laeves, 32–44 × (8–)10–12 μm. Pseudoparaphyses ramosae, multiseptatae.

Habitat in lignis *Lonicerae altmanni* Rgl. et Schmalh. Holotypus: Tianchi, Fukang, Xinjiang Provincia, China, 13. VIII. 1990, Z. Q. Yuan, HMAAC 700 (HMAAC).

Ascumata densely scattered, erumpent, 0.2–0.6 mm diam.; neck lacking to prominent, crested; peridium of typical “*Lophiotrema*-type”, up to 32 μm thick. – Asci 8-spored, clavate, with a short basal stalk, 120–150 × 18–22 μm. – Ascospores biseriatae, clavate to subclavate; upper cells slightly wider (10–12 μm wide) than the basal cell (8–10 μm), hyaline, first 1-septate with 2 or 3 oil droplets per cell, finally 3-septate and faintly brown, 32–44 × (8–)10–12 (mean 38.2 × 10.6) μm, smooth, without gelatinous sheath. – Pseudoparaphyses branched, multiseptate.

Habitat. – On wood of *Lonicera altmanni* Rgl. et Schmalh., spruce forest, 2000 m.

Material examined. – Xinjiang: Tianchi (CTM), Fukang, on *Lonicera altmanni*, 13. VIII. 1990, Z. Q. Yuan, HMAAC 700 (Holotype).

This variety is characterized by its large spores which have a wider upper cell than basal cell. *L. nucula* var. *nucula* has smaller spores [(18–21(–24) × 5–6(–7) μm] that are cylindrical and minutely verruculose. The taxon is also reminiscent of *Massarina lignorum* (Wehmeyer) Barr which occurs on *Lonicera ciliosa* and other woody plants. *M. lignorum*, however, has an elongated or low rounded apex (Barr, 1992).

*Navicella* Fabre. Ann. Sci. Nat. Bot. ser. 6. 9: 96. 1879.

*Navicella* is distinguished from other genera in the Lophiostomataceae on the basis of its ascospores, which have conspicuously thickened (distoseptate) septa and lenticular lumina (Eriksson, 1981). The genus was accepted by Holm & Holm (1988) and Barr (1990), but in different families and orders. Barr (1990) referred

*Navicella* to the Massariaceae (Melanommatales) because of its ascial structure, distoseptate ascospores and melanommataceous hamathecium.

1. *Navicella xinjiangensis* Z. Q. Yuan, sp. nov. – Figs. 19, 20, 49, 50.

Dignoscitur ascis perangustis, longis; ascosporis mediocribus ( $47.5\text{--}62.5 \times 10\text{--}12.5 \mu\text{m}$ ); vulgo septemseptatis. Ascumata sparsa ad dense congesta, interdum aggregata per 50 et connata in lateribus, basi innata ad erumpentia, globosa,  $0.5\text{--}1.5 \text{ mm}$  diam; collo forti, cylindrico et apice cylindrico vel compresso ad ellipsoideo; ostiolo rimoideo vel triangulari. Ascii octospori, cylindrici, stipitibus, brevibus,  $287\text{--}355 \times 14.3\text{--}17.5 \mu\text{m}$ . Ascosporeae oblique monostichae, anguste ellipsoideae vel fusiformes, distosepti 5–7 (vulgo 7); cellulis extremis fere hyalinis et cellulis ceteris brunneis,  $47.5\text{--}62.5 \times 10\text{--}12.5 \mu\text{m}$ . Pseudoparaphyses ramosae, eseptatae,  $320\text{--}450 \times 1.0\text{--}1.2 \mu\text{m}$ .

Habitat in lignis deciduis *Haloxylon ammodendri* (A. Mey) Bunge. Holotypus: Gajiahu (SZB), Wusu, Xinjiang Provincia, China VII. 1983, B. H. Jiang, HMAAC 668 (HMAAC).

Ascumata scattered to densely crowded sometimes in group of up to 50 and laterally confluent, immersed at the base to erumpent, globose,  $0.5\text{--}1.5 \text{ mm}$  diam., with a strong neck which is cylindrical at base, cylindrical or compressed to ellipsoid at the apex, with a elongated slit-like ostiole or triangular opening. – Ascii 8-spored, cylindrical, with a short basal stalk,  $287\text{--}355 \times 14.3\text{--}17.5 \mu\text{m}$ . – Ascospores obliquely uniseriate, narrowly ellipsoid or fusiform, tapered, subacute, with 5–7 (mostly 7) transverse septa, terminal cells almost hyaline, the others deep brown with lenticular lumina,  $47.5\text{--}62.5 \times 10\text{--}12.5$  (mean  $54.2 \times 11.1$ )  $\mu\text{m}$ , with a length:width ratio of 4.9:1. – Pseudoparaphyses branched, non-septate, in gel matrix,  $320\text{--}450 \times 1.0\text{--}1.2 \mu\text{m}$ .

Habitat. – On deciduous wood of *Haloxylon ammodendron* (A. Mey) Bunge, basal stems of *Lonicera hispida* Pali. ex Roem et Dchwt, desert forest, alt. c. 300 m, and spruce forest fringe, 1750 m.

Material examined. – Xinjiang: Gajiahu (SZB), Wusu, on *Haloxylon ammodendron*, VII. 1983, B.H. Jiang, HMAAC 668 (Holotype); Nanshan (CTM), Urumqi, on *Lonicera hispida*, 10.X.1991, Z. Q. Yuan & al, HMAAC 730.

*Navicella xinjiangensis* is characterized by the very long, narrow asci and middle-sized ascospores with typically 7 distosepta. It is close to *N. elegans* Fabre and *N. pileata* (Tode: Fr.) Fabre and the ascospore size is within the range of that of *N. pileata*. It is easily distinguished from *N. pileata* by its much narrower and longer asci [(95–)150–265(–300)  $\times$  (16–)20–30(–40)  $\mu\text{m}$  in *N. pileata*] with a length:width ratio of 20:1, and usually narrower ascospores [(10–)

12–18  $\mu\text{m}$  in *N. pileata*] with 5–7 (mostly 7) distosepta rather than 7–11. Asci in *N. pileata* and in *N. elegans* have a length:width ratio of 10:1.

*N. elegans* has much smaller spores, (22–)25–38  $\times$  7.5–10(–12)  $\mu\text{m}$  with fewer, (3–)5–7 (typically 5) distosepta than *N. xinjiangensis*.

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