

## Gasteromycetes from China collected by Dr. Harry SMITH 1921—1923, 1924—1925 and 1934

F. E. ECKBLAD

Institute of Biology, Div. Botany, P. O. B. 1045 Blindern, N-0316 Oslo 3,  
Norway

&

H. J. ELLINGSEN

Sanatoriev. 15, N-3000 Drammen, Norway

**Summary.** — Twenty-five species are recorded from the provinces of Nei Mongol, Xizang, Yunnan, Sichuan, and Shanxi. Twelve are new to China, viz. *Lycoperdon mammiforme* PERS., *L. molle* PERS., *L. niveum* KREISEL, *Bovista aestivalis* (BON.) DEMOULIN, *B. limosa* ROSTRUP, *B. paludosa* LÉV., *B. bovistoides* (COOKE & MASSEE) AHMAD, *Disciseda candida* (SCHWEIN.) LLOYD, *D. bovista* (KLOTZSCH) HENN., *Chamonixia caespitosa* ROLL., *Leucophleps spinispora* FOGEL, and *Hysterangium strobilus* ZELLER & DODGE.

### Introduction

The late Dr. Harry SMITH (Karl August Harald SMITH) of Uppsala, collected mostly higher plants during his three travels to China. He also collected some Gasteromycetes, and the present paper is based on the 58 collections of these fungi which he brought back. In the years 1921—1923 SMITH collected in the province of Chili, earlier named Chahar (now a part of Nei Mongol), and in the provinces Yunnan and Sichuan including the westernmost town of China, Tachien-lu. In 1924—1925 he collected in the province of Shanxi, and in 1934 in Sichuan and Xizang. The 58 collections represent 25 species presented below. One collection of *Bovista*, one of an immature *Geastrum*, and one destroyed *Lycoperdon* have remained unnamed.

### Previous studies \*)

The main works on the Gasteromycetes of China are those of S. C. TENG (1932, 1933, 1935, 1936, 1939, 1940, 1947, 1964) terminating with his "Higher fungi of China" (in Chinese). Here 108 species of Gasteromycetes are described with notes on their ecology and choro-

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\*) The monograph: LIU, Bo 1984. The Gasteromycetes of China.-Beih. Nova Hedwigia 76, 235 pp., appeared too late to take its results into consideration in the present paper.

logy within China (TENG, 1964). Other works of importance are those of CHOW (1935 a, b, c; 1936) with records of *Phallus*, *Lloydia*, and the new genus *Calvatiella*. LOHWAG (1937) recorded 15 species based on the collections of the HANDEL-MAZZETTI expedition to South-West China during the years 1914—1918. TAI & HUNG (1948) treated the Nidulariales of Yunnan, and KREISEL (1967) included some Chinese material in his monograph of *Bovista*.

Recent authors are LIU (1976, 1979, 1980), LIU & BAU (1980 a; 1980 b) and LIU, LI & DU (1975, 1978, 1980).

### Acknowledgements

The Chinese collections belong to the Institute of Systematic Botany, University of Uppsala, and were placed at the disposal of the senior author by the late Dr. HARRY SMITH himself. The senior author is especially indebted to the Institute for its long patience.

Dr. V. DEMOULIN, Liège, is thanked for his confirmation of some of our identifications and for his determination of some difficult species of *Lycoperdon*.

We are grateful to Professor LIU Bo, Shanxi University, Taiyuan, and Professor ZHENG RU-YONG, Academia Sinica, Beijing, for the loan of specimens of Chinese Gasteromycetes, and for valuable information.

Specimens from (O) have been studied for comparison.

Furthermore, our thanks go to Dr. R. MÖBERG, Uppsala, for information on the journeys of H. SMITH, to Mr. H. BÖCKMAN, Oslo, for translation of some Chinese texts, to Dr. K. HØILAND and Mrs. E. BRAATEN for technical help with the scanning micrographs which were taken at the EM Laboratory for Bioscience at the University of Oslo.

### List of species

#### LYCOPERDACEAE

##### 1. *Lycoperdon perlatum* PERS.

Specimens seen: Sichuan, reg. bor., Dongrergo. In margine silva, alt. 3900 m, 8 August 1922. — Sichuan, reg. bor.-occid, Drogochi. In silva Abietina, alt. 3300 m, 27 September 1922. — Sichuan, reg. bor.-occid, inter Merge et Sankar-voû-mâ. In silva primaeva, alt. 3700 m, 2 September 1922. — Sichuan, reg., bor.-occid, inter Karlöng et Merge. In silva primaeva Abietina, alt. 3200—3400 m, 28 August 1922. — Sichuan, reg. bor., Dongrergo. In silva primaeva Abietina, alt. 3800 m, 8 August 1922. — Nei Mongol, Hsiao-wu-tai-shan district. In silva mixta subalpina, alt. 2100 m, 19 September 1921.

*Lycoperdon perlatum* is characterized by the caespitose growth, the reticulate appearance of the endoperidium, a capillitium of the *Lycoperdon*-type with pits, and the relatively small, verrucose, and apedicellate spores. The above specimens agree closely with the description of the species given by DEMOULIN (1971).

This very common species is reported a number of times (TENG 1933, 1935, 1939, 1940, 1964; LING, 1932; LOHWAG, 1937; LIU, 1976; LIU & BAU, 1980 b). It is known from almost all provinces of China, so far lacking only in some smaller provinces: Ningxia, Shaanxi, Lianoning, Shadong, Henan, and Hubei.

## 2. *Lycoperdon mammiforme* PERS.

**Specimens seen:** Sichuan, bor.-occid, Karlung. Sub *Picea* in silva primaeva, alt. 3400 m, 27 August 1922.

*Lycoperdon mammiforme* is characterized by the exoperidium falling off in patches and the coarsely verrucose almost aculeate spores up to 6.5 µm in diam. The capillitium is close to that of both *Lycoperdon molle* and *L. perlatum*. False septa, however, occur more frequently in the Chinese material of *L. mammiforme* than in the two other species, which is in agreement with DEMOULIN (1971) who wrote that it has false septa. All other characters agree closely with the description given by KREISEL (1962), although he stated that it lacks false septa.

We have not found this species reported from China before.

## 3. *Lycoperdon molle* PERS. — Fig. 1 A, 2 B

**Specimens seen:** Sichuan, bor.-occid, Sankar-voû-mâ. Sub *Picea* in silva primaeva, alt. 4000 m. 8 September 1922. — Sichuan, reg. bor.-occid, Sankar-voû-mâ. In prato herboso fruticoso, alt. 4000 m, 6 September 1922. — Nei Mongol, Hsiao-wu-tai-shan district, Yang-kia-p'ing, Pei-k'o. In prato aprico fruticoso, alt. 1200 m, 19 August 1922. — Sichuan, reg. bor., Dongrergo. In prato alpino, alt. 4500 m, 9 August 1922. — Sichuan, reg. bor.-occid, Sankar-voû-mâ. In silva primaeva Abietina, alt. 4000 m, 5 September 1922. — Xizang, Kanting (Tachienlu) district, Taposhan. In prato alpino, alt. 4600 m, 22 August 1934.

*L. molle* is characterized by the exoperidium of spines, warts, and clayish particles, and the purplish gleba in mature specimens. Further by the capillitium with pits, the verrucose spores, and the fallen pedicels. *L. molle* is close to *L. umbrinum*, the latter, however, has no clayish layer in the exoperidium, the spores are only punctate to faintly verrucose, and the gleba is never purplish.

Apparently this species has not been recorded from China before, but it may well have been misidentified as the very similar *L. umbrinum* which has been reported a number of times.

## 4. *Lycoperdon niveum* KREISEL — Fig. 1 B

**Specimens seen:** Sichuan, reg.-occid, inter Ch'o-so-djo- et Rumichango. In prato alpino, alt. 4000 m, 24 October 1922.

*Lycoperdon niveum* is close to *L. umbrinum*. They differ, however, in the character of the spines. The former has a white exoperidium

that remains white even on old specimens, the latter species has spines becoming dark brown at maturity (DEMOULIN, 1971; KREISEL, 1969). *L. ericaeum* (syn.: *L. muscorum*) is another closely related species. It differs from *L. niveum* mainly by having a clayish layer mixed with the spines, see KREISEL (l. c.) and DEMOULIN (1979).

*Lycoperdon niveum* appears to be new to China, but may have been confused with other species.

In contrast to *L. umbrinum* which often is associated with coniferous forests, *L. niveum* is an arctic-alpine or montane species, previously reported from Nepal (KREISEL, 1969) Spitsbergen and Iceland (DEMOULIN, 1971).

#### 5. *Lycoperdon atropurpureum* VITT. — Fig. 1 C

Specimens seen: Sichuan, bor.-occid, Karlong. In silva primaeva Abietina, alt. 3400 m, 27 August 1922.

*Lycoperdon atropurpureum* is close to *L. molle*. They have a very similar exo- and endoperidium consisting of fragile spines mixed with a clayish layer. Microscopically, however, they differ. The former has spores with a more distinct ornamentation (compare Fig. 1 A and 1 C). In the Chinese material pits and false septa are much more frequent than in *L. molle*, and the lumen is slightly wider. Furthermore, the purplish gleba of *L. molle* distinguishes the two species. For further discussion on the *Lycoperdon molle*-group, see DEMOULIN (1971).

*L. atropurpureum* was previously reported from Qinghai, Sichuan, Ningxia, Nei Mongol, Shaanxi, Shanxi and Jiangsu. (TENG 1936, 1939, 1964; LIU, 1976).

#### 6. *Bovista pusilla* (BATSCH ex) PERS. — Fig. 1 E

Specimens seen: Nei Mongol, Chou-k'o-tien district. In colle aprico, alt. 150 m, 3 August 1921.

*Bovista pusilla* is characterized by a capillitium of the *Lycoperdon*-type with numerous pits, the apedicellate spores, the hyphal-vesiculose exostratum, the lack of a subgleba, the relatively small size, and the habitat on sandy and open places. *B. aestivalis* is a closely related species. It differs, however, in several characters. The Chinese collection agrees closely with the description of KREISEL (1967), and with Norwegian material of the species.

*Bovista pusilla* has been reported from several provinces. See TENG (1964), LIU (1976), and LIU & BAU (1980 b).

#### 7. *Bovista aestivalis* (BON.) DEMOULIN. — Figs. 1 D, 2 E

Specimens seen: Shanxi, Chieh-hsinh district, Mien-chan-ye. In prato alpino, alt. 2300 m, 20 June 1924. — Xizang, Taofu (Dawo),



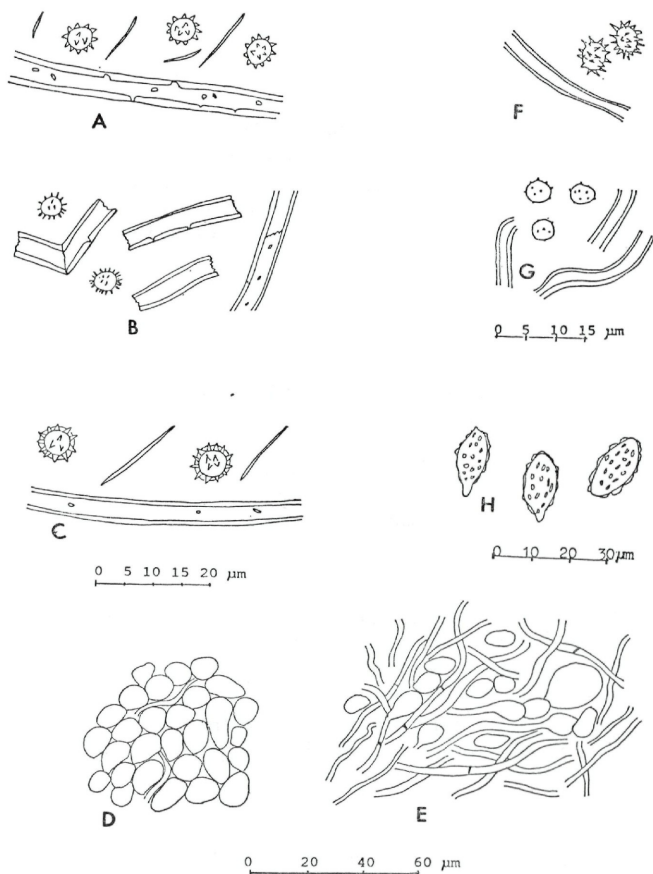


Fig. 1. — A: *Lycoperdon molle*: frequently pitted capillitium, and verrucose spores with fallen pedicels; material from Sichuan. — B: *Lycoperdon niveum*: fragile and pitted capillitium, slightly verrucose spores; Sichuan, alt. 4000 m. — C: *Lycoperdon atropurpureum*: slightly pitted capillitium and strongly verrucose spores; Sichuan. — D: *Bovista aestivalis*: exostratum with vesiculose cells; Xizang. — E: *Bovista pusilla*: exostratum with hyphae and vesiculose cells; Nei Mongol. — F: *Disciseda bovista*: spores and capillitium; Sichuan. — G: *Disciseda candida*: spores and capillitium; Sichuan. — H: *Hysterangium strobilus*: spores; Sichuan.

Hait-ze-shan district. In silva sparsa quercina, alt. 3700 m, 2 September 1934.

*Bovista aestivalis* is characterized by the vesiculose exostratum, the heteromorphic capillitium, which is dichotomously, subseptally, and amphiseptally branched with numerous pits. It differs from *B. pusilla* in the presence of a subgleba, and the vesiculose exostratum. See DEMOULIN (1969) and KREISEL (1967) as *B. pusilliformis* (KREISEL) KREISEL.

Apparently this species has not been reported from China before, but it may have been misidentified as *B. pusilla* which has been reported a number of times (TENG, 1964; LIU 1976; LIU & BAU, 1980 b).

#### 8. *Bovista limosa* ROSTRUP

*Specimens seen:* Sichuan, bor.-occid. Drogochi, in ripa graminosa rivali, alt. 3300 m, 1 October 1922. — Sichuan occid., Ta-hsiangling district. In declivio calcareo, alt. 1500 m, 20 November 1922. — Sichuan, reg. occid., inter Ch'o-so-djo et Rumichango. In prato alpino, alt. 4000 m, 24 October 1922. — Sichuan, reg. bor., Tampa. In duriprato, alt. 3000 m, 4 October 1922.

*Bovista limosa* is characterized by a capillitium of the intermediate type without pits, the small, tube-like mouth of the endoperidium, the pedicellate spores, and the small carpophore. Macroscopically, *B. limosa* agrees closely with *B. echinella* PAT. The latter is, as discovered by KREISEL (1967), characterized by capillitium walls with pits, the lack of septa, and a different exostratum. It appears to be endemic to Ecuador. The Chinese material agrees very well with KREISEL's (1967) description of *B. limosa* and with Norwegian material.

In its present circumscription, excluding the type of *B. echinella*, *B. limosa* is a typical holarctic species.

Previously *B. limosa* was not reported from China, but TENG's (1964) record of *B. aspera* LÉV. from Hebei is based on a misidentified specimen of *B. limosa*.

#### 9. *Bovista paludosa* LÉV.

*Specimens seen:* Sichuan, reg. bor., Tshipula. In prato alpino, alt. 4300 m, 5 August 1922. — Sichuan, reg. bor.-occid. Sankar-voû-mâ. In cariceto humido, alt. 4000 m 7 September 1922. — Sichuan, reg. bor., Hung-chen-kuan. In cariceto subhumido, alt. 3300 m, 19 August 1922.

*Bovista paludosa* is morphologically and ecologically a very well characterized species. The large homogenous subgleba, the capillitium of the *Bovista*-type without pits, the somewhat narrow lumen, and the habitat in bogs distinguish it from other species of the genus.

New to China. It appears to be a typical holarctic species.

10. *Bovista bovistoides* (COOKE & MASSEE) AHMAD

**Specimens seen:** Sichuan, reg. bor.-occid, Drogochi. In ripa sabulosa fluminis, alt. 3000 m, 30 September 1922. — Sichuan, reg. bor.-occid, Merge. In prato alpino, alt. 3800 m, 31 August 1922. — Sichuan, reg. bor.-occid., Merge. In prato graminoso ad fluminem, alt. 3200 m, 1 September 1922. — Sichuan, reg. bor.-occid., Drogochi. In silva sparsa juvenili Abietina, alt. 3400 m, 27 September 1922. — Sichuan, reg. bor.-occid, inter Somo et Drogochi. In ripa graminosa fluminis, alt. 3000 m, 24 September 1922. — Sichuan, reg. bor.-occid, Sankar-voû-mâ. In prato herboso fruticoso, alt. 4000 m, 6 September 1922.

*Bovista bovistoides* is characterized by a capillitium of the *Bovista*-type without pits and true septa, the clayish exoperidium, and the hyphal-vesiculose exostratum. *B. fulva* MASSEE is a closely related species, which differs, however, in having a thinner stem on the capillitium, and almost smooth spores. The Chinese material agrees closely with the specimens from Western Pakistan (O), reported by ECKBLAD (1957).

New to China. The species is a typical alpine species of the Central-Asian mountains from Chitral to Nepal and now China.

11. *Bovista plumbea* PERS.

**Specimens seen:** Sichuan, reg. bor., Chun-che. In prato graminoso, alt. 3200 m, 25 August 1922. — Sichuan, reg. bor., Sungpan. In prato alpino, alt. 3600 m, 15 August 1922. — Shanxi, Cieh-hoinh district, Mien-han-ye. In prato graminoso alpino, alt. 2300 m, 20 June 1924.

The well known species is widely distributed in the Northern Hemisphere (KREISEL, 1967) and also in Eastern Asia as demonstrated i. a. by the above collections. It was reported from the southeastern coast of Siberia by VASILJEVA & SOSSIN (1959). In China it is reported from the provinces Xinjiang, Qianghai, Gansu, Nei Mongol, Sichuan, Shaanxi and Hebei. (TENG 1947, 1964; KREISEL, 1967; LIU, 1976).

12. *Calvatia utriformis* (BULL.) JAAP

**Specimen seen:** Xizang, Taofu (Dawo) district, Taining (Ngota). In duriprato, alt. 3700 m, 10 September 1934.

*Calvatia utriformis* is characterized by the thin, flocculose exoperidium, the distinct and chambered subgleba, the capillitium with sinuous pits, and the smooth, apedicellate spores, 3.5—5.0  $\mu$ m. *C. fragilis* is a related species, but differs in having homogeneous subgleba and verrucose spores, see KREISEL (1969).

Previously reported from China by TENG (1964) and LIU (1976) as *Calvatia caelata* (BULL.) MORG.

13. *Vascellum pratense* (PERS. emend. QUÉLET) KREISEL

**Specimens seen:** Sichuan, reg. bor.-occid., Drogochi. In ripa sabulosa fluminis, alt. 3000 m, 30 September 1922. — Nei Mongol, Hsiao-wu-tai-shan district, Yang-kia-p'ing. In prato herboso fruticoso, alt. 1000 m, 19 September 1921. — Nei Mongol, Chou-k'o-tien district. In colle aprico, alt. 1500 m, 19 September 1921.

*Vascellum pratense* is characterized by the diaphragm, the almost smooth spores, and the richly present para-capillitium with pits and septa. For a further discussion of the genus *Vascellum*, see PONCE de LEON (1970).

Previously reported from China by TENG (1935, 1939, 1964) and LIU & BAI (1980 b). In addition to the provinces of Sichuan and Nei Mongol it is also known from Xinjiang, Fujian, and Hainan.

14. *Disciseda candida* (SCHWEIN.) LLOYD. — Fig. 1 G

**Specimens seen:** Sichuan, reg. bor., Drogochi. In ripa sabulosa fluminis, alt. 3000 m, 30 September 1922. — Sichuan, reg. bor., Mao-chou. In muro graminoso oppidi, alt. 1850 m, 30 June 1922. Further SMITH wrote: "On the Chinese wall among grass, *Iris* and *Lepidium sinense*" (translated from Swedish).

*Disciseda candida* is characterized by the small, depressed-globose carpophore and the almost smooth spores, 4.0–5.5  $\mu\text{m}$ , with a short rest of a pedicel. On the Chinese material the endoperidium is smoke grey to light umber, rigid, thick, and smooth, opening by a small fimbriate mouth. The capillitium is hyaline to light straw yellow, usually not branched, breaking up into segments at the septa. Pits in the capillitium-wall occasionally seen.

*D. calva* was regarded by MORAVEC (1954, 1958) as a closely related species, primarily based on the presence or absence of a spongy layer in the peridium. KERS (1975) maintains that in general there is no such layer, and that the American *D. candida* is identical with the European *D. calva*. The Chinese specimens show no such layer.

*D. candida* has previously not been reported from China.

15. *Disciseda bovista* (KLOTZSCH) HENN. — Fig. 1 F

**Specimens seen:** Sichuan, reg. bor., Mao-chu. In muro graminoso oppidi, alt 1850 m, 30 June 1922.

*Disciseda bovista* is close to *D. candida*. They have the same ecology, a very similar carpophore and capillitium, the spores, however, differ greatly. The former has much larger spores up to 9.5  $\mu\text{m}$ , and they are strongly verrucose. As it is often the case, cp. KREISEL (1962) and KERS (1975), the two species were found growing together. H. SMITH

found them on the Chinese wall. *D. bovista* has not been previously reported from China. TENG (1964) has records of *D. cervina* from Xinjiang, Hebei, and Qinghai. We have examined the specimens from Xinjiang. The spores are strongly verrucose, globose, 6—9  $\mu$ m. According to MORAVEC (1954) *D. cervina* has smaller and almost smooth spores. Further investigation will reveal whether this Chinese material matches *D. bovista*.

#### GEASTRACEAE

##### 16. *Geastrum floriforme* VITT.

*Specimens seen*: Sichuan, reg. bor., Mao-chou. In muro graminoso oppidi, alt. 1850 m, 30 June 1922. — Xizang, Taofu (Dawo) district. In duriprato, alt. 3000 m, 16 September 1934.

*Geastrum floriforme* is characterized by the splitting of the exoperidium into a number of narrow rays, the different colours of the dorsal and ventral side, the sessile endoperidium, and the verrucose, apedicellate spores.

Previously *G. floriforme* has been reported from China by TENG (1964) and LIU (1976). It is now known from the provinces of Xinjiang, Nei Mongol, Liaoning, Hebei, Qinghai, Sichuan, and Xizang.

##### 17. *Geastrum quadrifidum* PERS.

*Specimens seen*: Sichuan, bor. occid, Matung. Sub *Picea* in silva primaeva, alt. 4000 m, 12 September 1922.

Previously reported from China by TENG (1964) and LIU (1976). It is now known from the provinces of Ningxia, Shanxi, Sichuan, and Qinghai.

##### 18. *Geastrum rufescens* PERS.

*Specimens seen*: Xizang, Tanpa (Romichango) district, Maoniü Ndromé. Secus viam ad Tapaoshan. In margine silva Abietina, alt. 3400 m, 4 October 1934.

*Geastrum rufescens* is characterized by the subglobose and sessile endoperidium without a peristome, the relatively large size, and the small spores. *Geastrum triplex* is a closely related species. It differs, however, in having a definite peristome. *Geastrum komarovii* Soss. and *G. sovieticum* Soss are said to be related (SOSSIN, 1973).

*G. rufescens* has repeatedly been reported from China, e. g. LOHWAG (1937), TENG (1932, 1964). It is now known from the following provinces: Xinjiang, Gansu, Hebei, Jiangsu, Hunan, Yunnan, Sichuan, Qinghai, and Xizang.



SCLERODERMATACEAE

19. *Scleroderma verrucosum* PERS.

*Specimens seen:* Nei Mongol, Hsiao-wu-tai-shan district, Yang-kia-p'ing. Ad viam, alt. 850 m, 20 August 1921. — Nei Mongol, Chou-k'o-tien district. In colle aprico, alt. 1500, 3 August 1921.

*Scleroderma verrucosum* is characterized by the thin, brittle peridium with small verrucae, and the globose spores with distinct ornamentation of spines only. There are no clamp connections. A closely related species is *S. lycoperdoides* SCHW. For further details, see GUZMAN (1970).

*S. verrucosum* has been reported from China by TENG (1935, 1939, 1964), and LIU (1976). So far it is not known from Xizang, Xinjiang, Qinghai, Ningxia, Jilin, Liaoning, Shandong, Hunan, and Guizhou.

NIDULARIACEAE

20. *Nidula emodensis* (BERK.) LLOYD. — Fig. 2 F

*Specimens seen:* Xizang, inter Tainang (Ngata) and Taofu Dawo), Sunglingku. In margine silvae, alt. 3400 m, 14 September 1934.

*Nidula emodensis* is characterized by the tomentose, cup-shaped, and somewhat inclined peridium. Spores hyaline, narrowly ellipsoidal to ovoid,  $7.0\text{--}8.0 \times 4.0\text{--}5.5 \mu\text{m}$ , smooth with a rounded apex and an acuminate base. Its closest relative, *N. niveo-tomentosa* differs in the following characters: The peridium has almost vertical sides, the tomentose layer is white and not as felty as in *N. emodensis*, and the peridial wall is thinner.

*N. emodensis* was reported for the first time from China by TAI & HUNG (1948) from the province of Yunnan.

21. *Cyathus hookeri* BERK.

*Specimens seen:* Sichuan, reg. bor., Sungpan district. Ad viam subfruticosam, alt. 3200 m, 30 September 1922. — Nei Mongol, Hsiao-wu-tai-shan district, Yang-kia-p'ing. In horto sub *Juglans*, alt. 1000 m, 21 August 1921.

*C. hookeri* is characterized by the tomentose, campanulate and not plicate peridium, the size of the peridioles, 1.8—2.4 mm in diam., the fragile tunica, and the almost black cortex. Spores hyaline to light straw yellow, ellipsoidal to ovoid,  $8.1\text{--}11.6 \times 5.8\text{--}8.7 \mu\text{m}$ , smooth, mixed with slender, hyaline hyphae. A closely related species (*Cyathus microsporus*) has smaller spores,  $5\text{--}6 \times 4 \mu\text{m}$  (BRODIE, 1975). *C. hookeri* was reported for the first time from China by TAI & HUNG (1948) from the province of Yunnan.

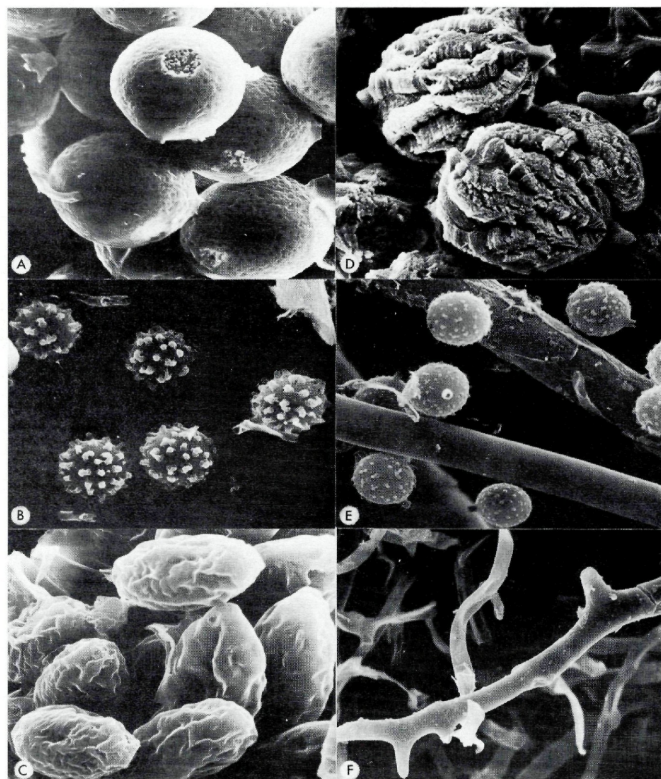


Fig. 2. — A: *Leucophlebs spinispora*; spores, x 2300; Sichuan. — B: *Lycoperdon molle*; spores, x 2300; Sichuan. — C: *Hysterangium strobilus*; spores, x 2300; Sichuan. — D: *Chamonixia caespitosa*; spores, x 1800; Sichuan. — E: *Bovista aestivalis*; spores and capillitium, x 2500; Xizang. — F: *Nidula emodensis*; hyphae from the wall of the peridiole, x 1100; Xizang.



# PHALLACEAE

## 22. *Phallus rubicundus* (Bosc) Fr.

Specimens seen: Xizang, Tampa (Romichango) district, Maoniü (Ndromé). In silva Abietina, sub *Abies*, alt. 2900 m, 3 Oct. 1934.

*Phallus rubicundus* is characterized by the finely rugulose pileus, and the scarlet or orange colour of this and the receptacle. See CUNNINGHAM (1944) and DRING (1964) for a further discussion.

*P. rubicundus* has been reported from several Chinese provinces: LOHWAG (1937), TENG (1964), LIU (1976), CHOW (1935 b).

# HYMENOGASTRACEAE

## 23. *Chamonixia caespitosa* ROLL. — Fig. 2 D

Specimens seen: Sichuan, reg. bor.-occid., Matang. Sub *Picea* sp., subterranea, alt. 3500 m, 12 September 1922.

*C. caespitosa* is characterized by its hypogeous habitat, the distinct peridium, the striking colour change, and the longitudinally ribbed spores. On the Chinese material they are  $10-14 \times 18-23 \mu\text{m}$  with hyaline pedicels  $1.0-3.0 \mu\text{m}$  long. H. SMITH noted that the specimens became intensively blue when bruished, which points directly to *C. caespitosa*.

New to China. *C. caespitosa* seems to be a species of the boreal and the alpine-montane coniferous forests in Europe, perhaps preferably under *Picea* (LANGE & HAWKER, 1951; CAPELLANO, 1967; KOTLABA, 1971; GROSS, 1974). DODGE & ZELLER (1934) also reported it from California. According to SOSSIN (1973) it occurs in the Western part of the USSR.

# MELANOASTRACEAE

## 24. *Leucophleps spinispora* FOGEL. — Fig. 2 A

Specimens seen: Sichuan, reg. bor.-occid., Drogochi. In silva Abietina, alt. 3300—3400 m, 27 September 1922.

This small hypogeous species has a chambered gleba and a thin and fragile peridium. Columella, stipe or sterile base not seen on the Chinese material. The tramal plates are white and vary greatly in thickness from  $50-120 \mu\text{m}$ . The spores are globose,  $8-11 \mu\text{m}$  including a  $2-3 \mu\text{m}$  thick and gelatinous sheath. For a closer description see FOGEL (1979). *L. spinispora* has previously not been reported from China. The species is so far recorded from the Pacific Coast of western North America to the Rocky Mountains (FOGEL, l. c.).

# HYSTERANGIACEAE

## 25. *Hysterangium strobilus* ZELLER & DODGE. — Fig. 2 C

Specimens seen: Sichuan, reg. bor.-occid., Matang. Sub *Picea* sp., subterranea, alt. 3500 m, 12 September 1922.

Carpophore light umber, globose, 0.8—1.3 cm, irregular. Gleba yellowish to ochraceous, chambered. Columella or sterile base not seen. Peridium obviously two-layered, outer layer light brown composed of slender, loosely woven hyphae, inner layer almost hyaline, pseudo-parenchymatous. The thickness varies greatly, inner layer 50—140  $\mu$ m, outer layer 25—170  $\mu$ m. Spores brown, ellipsoidal,  $13\text{--}24 \times 6\text{--}12 \mu\text{m}$ , with thick, slightly wrinkled exospore.

The size of the carpophore, the colour of the gleba, and the two-layered peridium is very similar to the description given by ZELLER & DODGE (1929). The spores of the Chinese material, however, seem to be somewhat larger. In ZELLER & DODGE (l. c.) the size is given as  $12\text{--}16.5 \times 5\text{--}6.3 \mu\text{m}$ .

The specimens were found together with *Chamonixia caespitosa* under *Picea* sp. *Hysterangium strobilus* has previously not been reported from China.

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Autor(en)/Author(s): Eckblad F. E., Ellingsen H. J.

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