

Taxonomic Notes on Asiatic Smuts.—III.

By Lee Ling (Washington, USA.).

With 1 Textfigure.

While studying Asiatic collections of smut fungi, it became apparent that, excluding some cosmopolitan and endemic species, most smuts occurring in this area have much wider distribution in other parts of the old world than previously recorded. According to the distribution of this group of fungi, Asia may be roughly divided into three geographic regions. Southern Asia, including South China, India, Burma, Indo-China, and Malay Peninsula, forms a natural division, from where many species find their way through adjacent Pacific Islands into Australia in one direction and into South Africa in another direction. Western Asia, including Near East and Middle East, forms another region with more species of smuts extending from there to the Mediterranean Region and North Africa than to Southern Asia. The third region, comprising North China, Korea, Japan, and a large part of Asiatic Russia, has many species in common with Central and North Europe.

Consequently, in order to disentangle the confusion long perpetuated in the taxonomy of smuts, it has become necessary to compare the Asiatic collections with species recorded on related hosts from the other areas mentioned above. A part of the results of this study is included, in the present notes, although such general treatment may appear to make the title of this series somewhat inappropriate.

The writer is indebted to Mr. J. A. Stevenson for his help in various ways; to Miss Edith Cash for preparing the latin diagnosis; and to the curators of various herbaria mentioned below for the privilege of examining the material in their institutions¹).

¹) Herbaria where the specimens are located are referred to according to the following abbreviations: BM = British Museum of Natural History; BPI = Mycological Collections, Bureau of Plant Industry, U. S. Department of Agriculture; BR = Jardin Botanique de l'Etat, Brussels; FH = Farlow Herbarium, Harvard University; K = Royal Botanic Gardens, Kew; KR = Uniwersytet Jagiellonski, Krakow; NY = New York Botanical Garden; P = Museum National D'Histoire Naturelle, Paris; PRM = Mycological Herbarium, Union Department of Agriculture, Pretoria; S = Naturhistoriska Riksmuseet, Stockholm; UP = Universitetes Institution för Systematisk Botanik, Uppsala. Wherever the location is not given, the specimen is in the writer's personal collection.

Tilletia pennisetina Syd., Ann. Myc. **27**: 421. 1929.

Syn.: *Neovossia macrospora* Petr., Meddel. Från. Göteb. Bot. Tradg. **17**: 114. 1947.

On *Pennisetum alopecuroides* (L.) Spreng., about 2 miles northwest of Heyo, Korea, Nov. 9, 1930, P. H. Dorsett & W. J. Morse (BPI); Chinkiang, Kiangsu, China, Oct. 1921, K. Kolthoff 35: 2, type of *N. macrospora* (UP).

Ustilago aculeata (Ule), Liro, Ann. Acad. Sci. Fenn. A. **17**: 66. 1924.

On *Brachypodium japonicum* Miq., Nigataken, Japan, July 1909, K. Yoshino.

This fungus was reported by Ito (4) as *Tilletia olida* (Riess) Wint., which possesses coarsely reticulate and much larger spores than *Ustilago aculeata*.

Ustilago crus-galli Tracy & Earle, Bull. Torrey. Bot. Club. **22**: 175. 1895.

On *Echinochloa frumentacea* Link, Pusa, India, Oct. 4, 1907, E. J. Butler 889, sub *Ustilago panici-frumentacei* Bref.

As originally described, *Ustilago panici-frumentacei* Bref., which is probably a synonym of *Ustilago sphaerogena* Burr., infects scattered kernels of a panicle. Butler (1), however, illustrated and described it as causing galls on stems. An examination of the specimen cited here revealed that he had mistaken *Ustilago crus-galli* for Brefeld's species. Although the spores of these two species appear very much alike, the characteristics of infection differentiate them readily. Unless it can be proved that both the ovaries and the stems can be infected by one fungus, the separation of these two species seems justified.

Ustilago nawaschini Rac., Bull. Intern. Acad. Sci. Cracovie 1909: 349.

Sori in the flowers, infecting the ovaries and probably also the anthers, filling them with purplish brown, dusty spore masses. Spores globose to oval, or slightly irregular, $9.5-14 \times 9-12 \mu$; epispore yellow brown, finely pitted, 1μ or less thick; endospore with granular content.

On *Polia* sp., Buitenzorg, Java, Indonesia, 1900, S. Nawaschin, type (FH).

Ustilago spermophora Berk. & Curt. ex de Toni, in Sacc. Syll. Fung. **7**: 466. 1888.

On *Eragrostis japonica* (Thung.) Trin., La Paz, Tarlac prov., Luzon, Philippines, Dec. 12, 1924, M. S. Clements 4881 (BPI).

On the same host, two other species of *Ustilago* have been reported, one as *U. egenula* Syd. & Butl. from Punjab, India (7) and another as *U. eragrostidis-japonicana* Zundel from Vryberg, South Africa (8). Specimens of both have been examined. The latter has light olivaceous and distinctly echinulate spores measuring $6.7-8.7 \times 6-8.7 \mu$, whereas the former matches the type of *U. egenula* well in possessing deep reddish brown and finely echinulate spores, $10.5-13.5 \mu$ in diameter. The collection from Luzon cited here, on the other hand, fits *U. spermophora* better than the two species mentioned above in having light olivaceous brown and finely echinulate spores measuring $9-12 \times 8-10.5 \mu$.

Taking collections on other species of *Eragrostis* into consideration, it appears extremely difficult to divide this variable group of fungi into separate entities. Arbitrarily, the color and size of spores probably serve as better criteria than the degree of echinulation for distinguishing species. In this way, *U. egenula* would be characterized by its large and deep-colored spores, *U. spermophora* by its medium sized and light-colored spores, and *U. eragrostidis-japonicana* by its small and light-colored spores.

Ustilago thwaitesii Berk. in Chipp, Gardens' Bull. Straits Settle. **2**: 276. 1920.

Chipp (2, 3), apparently based upon a specimen in the Herbarium at Singapore, recorded this species as occurring on leaves of *Justicia gendarussa* L. in Malay Peninsula. He evidently mixed this name with *Puccinia thwaitesii* Berk. *Ustilago thwaitesii* is merely a manuscript name, which appeared on the labels of two specimens, one in the Herbarium of C. E. Broome of the British Museum of Natural History without any data and another from Ceylon in the Museum National D'Histoire Naturelle, Paris. Both probably came from same origin and are identical with *Farysia merrillii* (P. Henn.) Syd. on *Carex*.

Sphacelotheca ischaemicola Ling, Sydowia **3**: 126. 1949.

On *Ischaemum timorense* Kunth, Kuching & vicinity, Sarawak, Borneo, Aug. 26, 1929, J. & M. S. Clemens 6565 (NY).

Sphacelotheca lanigeri (Magn.) Maire apud Zundel, Mycologia **22**: 141. 1930.

Syn.: *Ustilago lanigeri* Magn., Verhandl. Zool.-Bot. Ges. Wien **49**: 88. 1899.

Ustilago furcata Pat. & Hariot, Jour. de Bot. **14**: 236. 1900.

Sphacelotheca furcata Pat. & Hariot, Bull. Mus. Nation. Hist. Nat. Paris **15**: 197. 1909.

Sphacelotheca concentrica Zundel, Mycologia **22**: 138. 1930.

Sphacelotheca cymbopogonis Yen, Rev. Myc. n. s. **3**: 7. 1938.

Sphacelotheca consueta Syd., Ann. Myc. **37**: 442. 1939.

Sphacelotheca yenii Zundel, Mycologia **31**: 584. 1939.

Sori in the inflorescences, each involving a pair of racemes, protruding beyond the enveloping spathes, cylindrical, tapering at the apex, 5–16 mm. long, 1.5–3 mm. diam., each enclosed at first by a pale brown, rather thick, false membrane which ruptures later to disclose a semi-agglutinate, dark spore mass surrounding a well-developed columella, usually forked at the tip; sterile cells of the membrane hyaline, thick-walled, subglobose to ellipsoid, often subangular, $8.5\text{--}18.5 \times 7.5\text{--}15\ \mu$. Spores occasionally loosely aggregated into balls at an early stage of development, chiefly medium reddish brown, but immature and pale yellowish ones often also present, globose to oval, or often slightly irregular, $6\text{--}9 \times 5.7\text{--}8\ \mu$; epispore $0.7\text{--}1.0\ \mu$ thick, varying from punctate to finely echinulate under higher magnifications.

On *Andropogon* (*Cymbopogon*) *laniger* Desf., Mount Kuh-tagh-Ali, Kerman, Iran, June 20, 1892, J. Bormüller 4436, type (S); Skourat, Morocco, June 13, 1934, G. Malençon, type of *S. yenii* (BPI). — On *Cymbopogon parkeri* Stapf, Shahkot Hills, Punjab, Pakistan, Dec. 15, 1935, S. Ahmad 60, type of *S. consueta* (S); Margalla, Rawalpindi Dist., Punjab, Pakistan, May 1934, R. R. Stewart 13882 (NY). — On *Cymbopogon plurinodis* Stapf, Pretoria, South Africa, Nov. 1, 1917, A. O. D. Mogg, type of *S. concentrica* (PRM 10708). — On *Cymbopogon schoenanthus* (L.) Spreng., Lahore, Punjab, Pakistan, J. L. Stewart, in Herb. M. Cooke, sub *Ustilago segetum* (K). — On *Cymbopogon* sp., Sompi, region de Tombouctou, French Sudan, Aug. 1899, M. A. Chevalier, type of *U. furcata* (FH, P).

The original description of *Sphacelotheca concentrica* characterizes that species as possessing spores with four concentric zones, which are merely an artifact due to light refraction.

One of the Pakistan collections (R. R. Stewart 13882) cited above was reported by Mundkur (6) as *Sphacelotheca schoenanthi* (Syd. and Butl.) Zundel, which differs from the present species only in having slightly smaller and darker spores.

Sphacelotheca manilensis (Syd.) Ling, Sydowia **4**: 78, 1950.

Syn.: *Sphacelotheca sacciolepidis* Thirum., Lloydia **13**: 173. 1950.

On *Sacciolepis indica* (L.) Chase, Bhadravati, Mysore, India, Aug. 18, 1947, H. C. Govindu, type of *S. sacciolepidis*.

Sphacelotheca themedicola sp. nov. (Fig. 1).

Soris inflorescentiam totam destruentibus, soro quoque racemum singularem involventi, spatha partim obvoluto vel supra protrudenti, anguste ellipsoideo, 3—5 mm longo, 1—1.5 mm lato, primum membrana falsa tenui griseola tecto, ea in maturitate dehiscendi rhachidem persistentem massa fusca pulverulenta sporarum circumdantem detegenti; membranae falsae cellulis sterilibus crasse tunicatis, pallidis, subglobosis vel oblongis. $7.5-17.5 \approx 6-13 \mu$; sporis plerumque globosis subglobosis vel saepe ovoideis, $4.5-6 \mu$ diam., episporio 0.5μ crasso, pallide olivaceo-brunneo, sublevi sed amplificatione maiore subtiliter punctato.

Sori destroying the whole inflorescence, each involving a solitary raceme, partially enveloped by the spathe or protruding beyond it, narrowly ellipsoidal, 3—5 mm. long, 1—1.5 mm. diam., enclosed at first by a thin, grayish false membrane, which flakes away at maturity disclosing a dark, dusty spore mass, surrounding a remnant rachis which is left behind after the dispersing of spores; sterile cells of the false membrane thickwalled, lightly tinted, subglobose to oblong, $7.5-17.5 \approx 6-13 \mu$. Spores chiefly globose or subglobose, often oval, $4.5-6 \mu$ diam.; episore 0.5μ thick, light olivaceous brown, apparently smooth, but faintly punctate under higher magnifications.

On *Themeda gigantea* (Cav.) Hack., Anuling, Zambales province, Luzon, Philippines, Nov.-Dec. 1924, M. Ramos & G. Edano, Herb. Bur. Sci. Phil. 44578, type (BPI).

Cintractia axicola (Berk.) Cornu, Ann. Sci. Nat. Bot. VI. **15**: 279. 1883.

Syn.: *Cintractia fimbristylis-kagiensis* Saw. var. *fukiensis* Y. Ling & Chen, Res. Bull. Inst. Zool. Bot. Fukien Acad. **1**: 17. 1945.

Cintractia pilulifera Y. Ling & Chen, Res. Bull. Inst. Zool. Bot. Fukien Acad. **1**: 17. 1945.

On *Fimbristylis annua* R. & S., Kapit, Upper Rejang River, Sarawak, Borneo, Aug. 2, 1929, J. & M. S. Clements 6297 (NY).

Farysia orientalis Ling, Sydowia **3**: 130. 1949.

On *Carex baccans* Nees, Doi Sutep, 5,000 ft. alt., Siam, Feb. 1928, T. D. Cockerell (K).

Sorosporium andropogonis-aciculati (Petch) Petch, Ann. Roy. Bot. Gard. Peradeniya **5**: 227. 1912.

On *Rhaphis aciculata* (Retz.) Desv., Kapit, Upper Rejang, River, Sarawak, Borneo, Aug. 1929, J. & M. S. Clements 6250 (NY).

Sorosporium barberi (Mundk.) comb. nov.

Syn.: *Ustilago barberi* Mundk., Trans. Brit. Myc. Soc. **32**: 98. 1939.

Sori in the ovaries, frequently infecting only the spikelets of the topmost racemes, ellipsoidal, tapering at both ends, 5—8 mm. long,

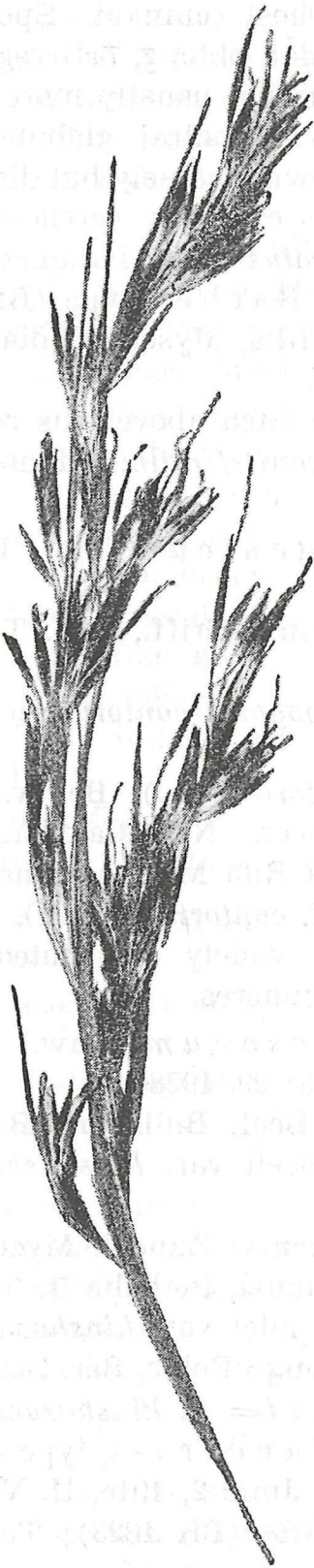


Fig. 1. *Sphacelotheca themedicola*.

around 1 mm. diam., each enclosed by a thick, brown false membrane of prosenchymatous tissue, which later lacerates from the apex disclosing a dark, semi-agglutinate spore mass surrounding 4—7 slender threads of host remnant. Spore-balls evanescent at maturity, opaque, ellipsoidal, oblong, or irregular, $35-75 \approx 30-56 \mu$. Spores globose to ellipsoid, but usually more or less angular, $7.5-13 \approx 6.5-10.5 \mu$, each with a central globule; outer spores reddish brown to deep reddish brown, sparsely but distinctly verrucose; inner spores lighter colored, less evidently verruculate.

On *Cymbopogon coloratus* Stapf, Palamcotta, Tinnevely, Madras, India, May 11, 1901, C. A. Barber, type (BPI). — On *Cymbopogon flexuosus* Wats., Nandi Hills, Mysore, India, March 21, 1942, M. J. Thirumalachar (K).

The second collection cited above was reported by Mundkur (5) as *Ustilago andropogonis-finitimi* Maubl., which is a member of the *Hyphomycetes*.

Sorosporium caledonicum Pat., Bull. Soc. Myc. Fr. **3**: 173. 1887.

Syn.: *Sorosporium contortum* Griff., Bull. Torrey Bot. Club **31**: 83. 1904.

? *Sorosporium heteropogonis-contorti* Baccarini, Ann. Bot. (Italy) **14**: 132. 1917.

On *Heteropogon contortus* (L.) Beauv., Chengtu, Szechwan, China, Nov. 1947, K. R. Lin; New Caledonia, 1868—1870, M. Balansa, type (FH); Santa Rita Mts., Arizona, U.S.A., Sept. 12, 1903, D. Griffiths, type of *S. contortum* (BPI).

This is apparently a widely distributed species, occurring in warm parts of both hemispheres.

Sorosporium formosanum (Saw.) Saw., Dept. Agr. Gov't. Res. Inst. Formosa Rep. 35: 29. 1928.

Syn.: *Sorosporium panici* Beeli, Bull. Jard. Bot. Brux. **8**: 7. 1922.

Sorosporium panici Beeli var. *kinshasaensis* Beeli, Bull. Jard. Bot. Brux. **8**: 8. 1922.

Sorosporium kinshasaensis Zundel, Mycologia **29**: 590. 1937.

Sorosporium beelii Zundel, Bothalia **3**: 307. 1938.

Sorosporium beelii Zundel var. *kinshasaensis* Hendrickx, Publ. Inst. Nat. Etude Agron. Congo Belge, Ser. Sci. **35**: 8. 1948.

On *Panicum repens* L. (= *P. kinshasaensis* Vanderyst), Boma, Belgian Congo, 1913, H. Vanderyst, type of *S. panici* (BR 1315); Kinshasa, Belgian Congo, June 2, 1916, H. Vanderyst 4, type of *S. panici* var. *kinshasaensis* (BR 1323); Tel-Aviv, Israel, May 12, 1937, T. Rays (BPI).

On the specimen sheet labelled *Sorosporium panici* are attached two plants of *Panicum repens* infected by three different fungi. One

of the plants was infected by a member of the *Hyphomycetes* and the other by two smuts, one in the inflorescences and another in the ovaries. The original description of *S. panici* indicates that the smut fungus in the inflorescences was the one Beeli had examined.

Both collections from the Belgian Congo cited above possess spores slightly larger than those in collections of the same species from southern Asia, the Mediterranean region and other parts of Africa, measuring 5.5–8.5 μ in diameter.

Sorosporium nardi (H. & P. Syd.) comb. nov.

Syn.: *Ustilago nardi* H. & P. Syd., Ann. Myc. **4**: 425. 1906.

Sphacelotheca nardi Zundel, Mycologia **22**: 137. 1930.

Sori in the inflorescences, each involving two or probably more racemes, filiform, 4–10 mm. long, completely concealed by the leaf sheathes; spore-mass dark, rather compact, enclosed by a thin, whitish false membrane and surrounding 1 or 2 slender threads of host remnant, which frequently protrude beyond the sorus. Spore-balls firm in the young sori, but becoming evanescent at maturity, subglobose to ellipsoid, or irregular, 37–112 \Rightarrow 22–67 μ . Spores mostly somewhat irregular, often globose to oval, 6–9 \Rightarrow 5.5–8 μ ; outer spores medium to deep reddish brown, distinctly punctate, with episporos about 0.5 μ thick; inner spores chiefly medium brown, almost smooth to punctate.

On *Cymbopogon confertiflorus* (Steud.) Stapf, Vayitri, Wyanaad Hills, Malabar, India, Nov. 2, 1904, E. J. Butler 470, type (S).

Sorosporium pollinae Magn., Verhandl. Zool.-Bot. Ges. Wien. **50**: 433. 1900.

Syn.: *Sorosporium icosiense* Maire, Bull. Soc. Hist. Nat. Afr. Nord. **8**: 145. 1917.

Sori in the ovaries, destroying all the florets in an infected inflorescence but retaining their normal arrangement and positions, cylindrical, often curved, tapering at both ends, 5–9 mm. long, up to 1 mm. diam., each enclosed in a pale yellowish false membrane which later lacerates from the apex to disclose a granular, dark spore mass surrounding one, rarely up to 3, simple columellae. Spore-balls ovoid to oblong, often irregular, semi-opaque, 25–60 \Rightarrow 20–38 μ , rather persistent. Spores globose to ellipsoid, or polyhedral, 9–13.5 \Rightarrow 7–10.5 μ , episporos 0.7–1 μ thick; outer spores deep olivaceous brown, densely verruculose on the free surface; innermost spores light olivaceous, smooth, smaller in size.

On *Andropogon distachyus* L. (= *Pollinia distachya* L.), rochers Ju Te'lemly, Alger, Algeria, in Maire, Champ. Afr. Nord 8116 (BPI); Jaffa (Judea), Israel, May 15, 1897, J. Bornmüller 1015, type (S); Kiuat, Israel, Apr. 20, 1938, T. Rays (BPI).

Sorosporium spermoideum (Berk. & Br.) comb. nov.

Syn.: *Ustilago spermoidea* Berk. & Br., Jour. Linn. Soc. Bot. London **14**: 94. 1875.

Sphacelotheca spermoidea Mundk., Trans. Brit. Myc. Soc. **23**: 96. 1939.

Sori in the inflorescences, each involving 1 pair, or probably more, of racemes, filiform, 4–8 mm. long, about 0.5 mm. diam., usually completely and tightly enclosed by leaf sheaths and reduced leaves; spore-mass dark, granular, covered by a whitish, thin false membrane and intermixed with 1 or 2 slender threads of host tissue, which often protrude beyond the sorus. Spore-balls rather persistent, opaque, subglobose to oblong, often angular, $67-165 \approx 60-127 \mu$. Spores globose to oval, ovoid, or angular, $7.5-11.5 \approx 7-10.5 \mu$, episporium around 0.5μ thick, endospore with a distinct central globule and a wall about 1.5μ thick, which can be detected clearly by crushing the episporium under slight pressure; outer spores deep to dark reddish brown, finely punctate on the free surface under higher magnifications; inner spores light to medium yellowish brown, smooth.

On *Andropogon venustus* Thw., Peradeniya, Ceylon, May 18, 1908, T. Petch (BPI). On *Cymbopogon confertiflorus* (Steud) Stapf, Hakgala, Ceylon, in Syd. Fungi Exot. Exs. 238 (BPI). On *Cymbopogon nardus* (L.) Rendle, Ceylon, Thwaites 589, type (BM).

Tolyposporium evernium Syd. Ann. Myc. **37**: 443. 1939. Syn.: *Tolyposporium paspali* Langdon, Papers Univ. Queensland, Dept. Biol. **2** (9): 4. 1948.

On *Paspalum distichum* L., Wusih, Kiangsu, China, Sept. 2, 1947, S. C. Liu; Akalgarh, Punjab, Pakistan, S. Ahmad 105, type (S).

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