

Notes on some Indian Ustilaginae-IX.

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With Plates I—II.

1. *Farysia olivacea* (DC.) Sydow in Ann. Mycol. 17: 41, 1919, Mundkur and Thirumalachar in Ustilaginales of India, Commonwealth Mycol. Inst. pp. 8—9, 1952.

Sori infecting the ovaries, completely destroying them and forming globoid-round bodies containing blackish brown, semi-agglutinated spore mass and elators enclosed by the outer glumes, 2 to 2.5 mm $\times$ 1.5 to 2 mm. Spore masses formed between the sterile elators. Spores globose-subglobose, oval, occasionally irregular in shape, pale cinnamon brown and measuring 5.7 to 8.6 μ in diameter with a mean of 7.12 μ . Epispore thick and ornamented with minute short scaly processes. Elators numerous, deep brown, multicellular, long and simple.

In the ovaries of *Carex condensata* Nees in the Upper Indus Valley, North Western Himalayas; October, 1894. Leg. J. S. Gamble (Figs. 1 to 3).

The material collected in India by Gamble was traced in the Mycological Herbarium Forest Research Institute, Dehra Dun, wherein the entire collection was perhaps deposited by him. A portion of it became available for examination to the authors through the kindness of Dr. K. Bagchee, Mycologist, Dehra Dun. The structure and organization of the sorus precisely conform to the description of *Farysia* by Thirumalachar (2).

2. *Melanopsichium pennsylvanicum* Hirschh. var. *besseyanum* Zundel, Mycologia 35: 183, 1943.

Sori in the stems and pedicels forming dark brown irregular lobes, often coalescent becoming spindle shaped to a length of several inches; each lobe 10 to 15 mm long, 8 to 10 mm broad; sorus internal in lysigenous cavities containing a shiny black firmly agglutinated spore mass, often mixed with the host tissue. Spores light cinnamon brown, subspherical, globose-subglobose to ovoid, often irregular in shape, measuring 9 to 14.5 μ in diameter with a mean of 10 μ . Epispore medium thick and finely but distinctly punctate.

In the stems and pedicels of *Polygonum glabrum* Willd. at Khandala

on 12 August, 1954, Leg. M. J. Thirumalachar, No. 1233 (Figs. 4 to 7). This is the first record of this fungus in India.

3. *Sorosporium heteropogonicola* Mundkur & Thirumalachar in Mycol. paper, Commonwealth Mycol. Inst. No. 40, p. 5, 1951.

In the ovaries of *Cymbopogon caesium* Stapf at Parasnath, Bihar; December, 1952. Leg. H. C. Govindu, No. 1234. (Figs. 8 and 9).

4. *Sorosporium semisagittatum* sp. nov.

Sori ovariicolous, infecting only few spikelets in a panicle, forming elongate greyish-brown fusoid bodies, 4 to 5 mm $\times$ 1.5 to 2 mm in dimensions, half enclosed by the glumes; pinkish false membrane rupturing irregularly at maturity releasing dusty brownish black spore mass and a fine, simple columella. Spore balls irregular, semipermanent and opaque. Spores dark brown, subglobose, mostly polyhedral with depressed surfaces, 9 to 13.5 μ in diameter with a mean of 11.7 μ . Epispore thick and finely verrucose. Inner sterile cells rather few in number, usually in groups of 6 to 12, hyaline to tinged yellowish, globoid, thin-walled, smooth and measuring 6 to 10.5 μ in diameter. The smut resembles to some extent *Sorosporium polycarpum* Syd. which is also ovariicolous, developing semipermanent spore balls on *Ischaemum pectinatum* Trin. in Australia. However, the spores of this are 4—5 to 7 μ in diameter and much smaller than the one under study in which they are 9—13 μ .

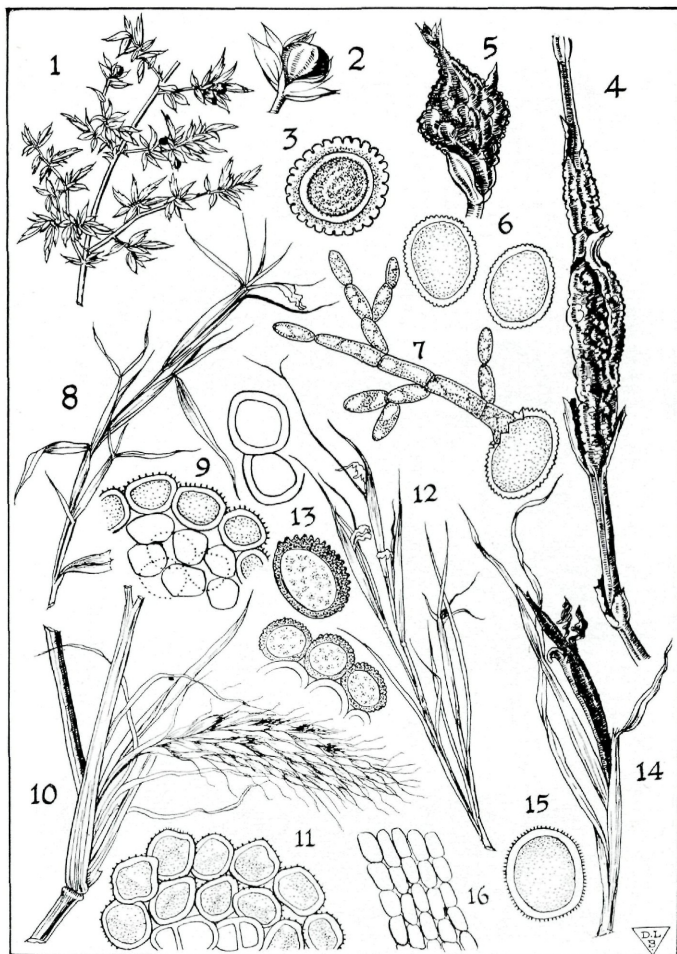
In the ovaries of *Ischaemum semisagittatum* Roxb. at Khandala, Poona; 14 November, 1954. Leg. M. J. Thirumalachar, No. 1235. (Type) (Figs. 10 & 11).

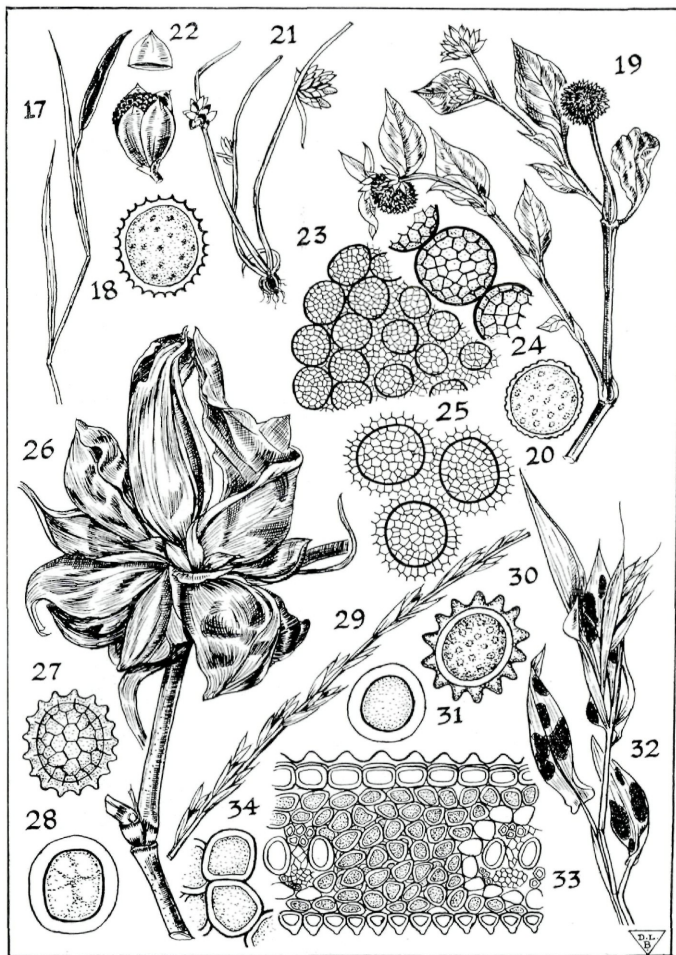
Sori ovariicoli, glumis semitecti, nonnullas paniculi spiculas tantum occupantes, fusoides, griseo-brunnei, 4—5 $\times$ 1.5—2 mm, membrana falsa roseola, in maturitate irregulariter disrupta, massam fusco-nigram, pulverulentam et columellam tenuissimam ostendentes; sporarum glomeruli irregulares, opaci, mox dilabentes; sporae subglobosae, saepe polygoniae, angulosae, in superficie depressae, 9—13.5 μ , plerumque ca. 11.7 μ diam.; episporio crassiusculo et minutissime verruculoso; cellulae interiores plerumque 6—12 glomeratae, hyalinae vel flavescentes, globosae, tenuiter tunicatae, leves, 6—10.5 diam.

5. *Sorosporium turneri* McAlpine in Smuts of Australia, p. 185, 1910.

In the ovaries of *Eragrostiella bifaria* Forsk. at Ganeshkhind, Poona; 10 October 1954. Leg. M. J. Thirumalachar, No. 1236.

This smut has been earlier collected by the authors at Majhgawan, M. P., on *Eragrostis* sp. (1). The present collection forms a new host for the smut species.





6. *Sorosporium lophopogonis* sp. nov.

Sori destroying the panicle completely, forming long, narrow bodies, 1.5 to 4 cm long and upto 1.5 mm broad, partially enclosed by the leaf sheath, covered by a pale yellowish false membrane, which flakes away exposing the brownish black dusty spore mass and a long fine, simple or branched whiplike columella. Spore balls semipermanent, oval to irregularly rectangular, opaque, brown, 60 to $78\ \mu \times 45$ to $75\ \mu$ in dimensions. Spores globose to subglobose, oval, dark cinnamon brown, 9.8 to $13.5\ \mu$ in diameter with a mean of $11.5\ \mu$. Epispore thick and finely echinulate on the free side. Sterile spores of the core not abundant, globose to oval, hyaline to pale yellowish, smooth, thin walled and measuring 9 to $12\ \mu$ in diameter. Sterile cells of the membrane hyaline, mostly rectangular, thin walled and 6 to $13\ \mu$ in diameter.

In the inflorescence of *Lophopogon tridentatus* Hack. at Pimpri, Poona; October, 1954. Leg. M. J. Thirumalachar. No. 1237 (Type). (Figs. 12 and 13).

Sori inflorescentiam omnino destruentes, 1.5—4 cm longi sed usque ad 1.5 mm tantum lati, vagina folii partim inclusi, membrana falsa pallide luteola, in maturitate glebuloze dilabente tecti, tunc sporarum massam fusco-nigram pulverulentam et columellam tenuissimam simplicem vel flagelliformiter ramulosam ostendentes; sporarum globuli mox dilabentes, ovoidei vel irregulariter rectanguli, opaci, brunnei, 60 — 78×45 — $75\ \mu$; sporae globosae, subglobosae vel ovoideae, obscure cinnamomeae, 9.8 — $13.5\ \mu$, plerumque ca. $11.5\ \mu$ diam.; episporio crassiusculo, in superficie libera minutissime echinulato; sporae interiores steriles paucae, globosae vel ovoideae, hyalinae vel flavescentes, leves, tenuiter tunicatae, 9 — $12\ \mu$ diam.; cellulae membranae steriles hyalinae, plerumque rectangulae, tenuiter tunicatae, 6 — $13\ \mu$ diam.

7. *Sphacelotheca chrysopogonis-grylli* sp. nov.

Sori in the inflorescence destroying it completely, long, cylindrical 2 to 3 cm long and 1.5 to 2.5 mm broad, covered at first by a pinkish false membrane which soon ruptures exposing the dark spore mass and a long simple columella. Mature spores reddish brown, globose to subglobose, oval and measuring 10 to $15\ \mu$ in diameter with a mean of $11.5\ \mu$. Epispore thick and minutely echinulate. Sterile cells of the membrane hyaline, irregularly globoid, thick walled smooth and measuring 8.75 to $11.25\ \mu$ in diameter.

In the inflorescence of *Chrysopogon gryllus* Trin. at Trehgaum, Kashmir; 15 June, 1953. Leg. M. S. P a v g i. No. 1238 (Type). Figs. 14 to 16).

Sori inflorescentiam omnino destruentes, elongato-cylindracei, 2—3 cm longi, 1.5—2.5 mm lati, primo membrana falsa, roseola induti, ea mox disrupta massam sporarum obscuram et columellam longam,

simplicem ostendentes; sporae maturae rufo-brunneae, globosae vel subglobosae, interdum ovoideae, 10—15 μ diam., plerumque ca. 11.5 μ ; episporio crassiusculo, minutissime echinulato; cellulae membranae steriles irregulariter globosae, crasse tunicatae, leves, 8.75—11.25 μ diam.

8. *Ustilago rabenhorstiana* Kuhn in Hedwigia 15: 4, 1876.
Syn. *Sphacelotheca digitariae-pedicellaris* Mishra in Mycologia 49: 259, 1957.

In the inflorescence of *Digitaria pedicellaris* Prain at Varanasi, U. P. 16 August, 1953. Leg. M. S. P a v g i. No. 1239. (Figs. 17 and 18).

Young fresh sorus usually remains covered by a grey, non-cellular gelatinous membrane which ruptures in dry weather releasing the spore dust. No columella or as pseudomembranous envelop are discerned in the sorus at any stage of its development.

9. *Ustilago polygoni-alati* sp. nov.

Sori in the ovaries, all flowers in a panicle infected. Ovaries hypertrophied into globoid to conical bodies, 4 to 5 mm $\times$ 1.5 to 2 mm; pinkish brown in color, rupturing irregularly to expose purplish brown powdery spore mass. Mature spores pale yellowish brown, globose to ovoid and measuring 9 to 14.5 μ in diameter with a mean of 11.0 μ . Epispore medium thick and densely punctate. Immature spores abundant, intermixed with mature ones, hyaline to tinged yellowish and crumpled.

In the ovaries of *Polygonum alatum* Ham. at Mundah, Chakrata, U. P. 29 September, 1934. Leg. K. B a g c h e e. No. 1240 (Type). (Figs. 19 and 20).

Sori in ovariis hypertrophice transformati evoluti, flores inflorescentiae omnes occupantes, globosi vel conici, 4—5 $\times$ 1.5—2 mm metientes, roseolo-brunnei, postea irregulariter disrumpentes et massam sporarum purpureo-brunneam pulverulentam ostendentes; sporae maturae pallide flavo-brunneolae, globosae vel ovoideae, 9—14.5 μ , plerumque ca. 11 μ diam.; episporio crassiusculo, dense punctato; sporae immaturae numerosae, cum maturis permixtae, hyalinae vel flavescentes et vietae.

The collection was available to the authors for examination through the kindness of Dr. K. B a g c h e e, Dehra Dun.

10. *Zundelula bulbostylidis* sp. nov.

Sori in the ovaries, infecting 1 to 3 ovaries in the inflorescence, developing into spherical-ovate, bullate, dirty grey bodies, 1.5 to 2 mm in diameter, covered by a thick pseudoperidium, rupturing irregularly to expose dark black 12 to 15 minute, irregularly globoid, opaque and permanent spore balls measuring 150 to 190 $\times$ 125 to 160 μ in dimensions, produced basipetally. Spore balls firm, composed of an outer sheath of one to two layers of sterile cells and an inner core of fertile spores. Sterile

cells dark cinnamon brown, globose to subglobose, ovoid, thick walled with reticulate thickenings and measuring 8.6 to 18.6 μ in diameter with a mean 12.9 μ . Fertil spores cinnamon brown, globose to subglobose, oval and measuring 8.6 to 12.9 μ in diameter with a mean of 10.0 μ . Exospore medium thick, smooth and interconnected with pale yellowish, polygonal thin walled dermata upto 1.0 μ in diameter.

In the ovaries of *Bulbostylis capillaris* Kunth at Varanasi, U. P.; 19 October, 1953. Leg. M. S. P a v g i. No. 1241. (Type). (Figs. 21 to 25).

Sori 1—3 ovaria in quaque inflorescentia invadentes, globoso-ovoidei, bullati, sordide grisei, 1.5—2 mm diam., pseudoperidio crassisculo obtecti, in maturitate irregulariter disrumpentes et 12—15 sporarum glomerulos minutos, atros, irregulariter globosos, perdurantes, 150—190 $\times$ 125—160 μ metientes, basipetaliter ortos ostendentes; sporarum globuli duri e stratis 1—2 cellularum sterilium, sporas interiores fertiles cingentibus compositi; cellulae steriles cinnamomeo-brunneae, globosae, subglobosae vel ovoideae, crasse tunicatae, reticulo-incrassatae, 8.6—18.6 μ , plerumque ca. 12.9 μ diam.; spora fertiles cinnamomeo-brunneae, globosae, subglobosae vel ovoideae, 8.6—12.9 μ plerumque ca. 10 μ diam.; episporio crassiusculo, levi sed pelliculis minutissimus, pallide flavescentibus, polygoniis usque ad 1 μ diam. metientibus praedito.

11. *Melanotaenium ischaemianum* sp. nov.

Inciting dull black, tarlike, oval-elongate, nonerumpent spots on the leaves measuring 0.5 to 1.5 $\times$ 3 to 5 mm. Spores chiefly embedded in the mesophyll surrounding the vascular bundles. Spores aggregated, dark olive brown, globose to subglobose, ovoid and measuring 7.5 to 12 μ in diameter with a mean of 10.4 μ . Episporium medium thick and smooth.

In the leaves *Ischaemum semisagittatum* Roxb. at Khandala, Poona; 14 November, 1954. Leg. M. J. Thirumalachar. No. 1242 (Type). (Figs. 32 to 34).

Maculae foliicolae, piceae, elongato-ovales, 0.5—1.5 cm $\times$ 3—5 mm; spora praecipue in mesophyllo evolutae, vasorum fasciculos cingentes, aggregatae, obscurae brunneae, globosae, subglobosae vel ovoideae, 7.5—12 μ , plerumque ca. 10.4 μ diam.; episporio crassiusculo, levi.

12. *Tilletia bambusae* sp. nov.

Sori ovaricolous, developing into large, hypertrophied, cylindrical to conical, purplish brown bodies, 2 to 5 cm long and 1 to 1.5 cm broad tapering apically, exposed prominently and surrounded by a whorl of enlarged calyx, the sepals of which become tough and leathery, dull brownish in colour. Four to twelve or even more flowers in a panicle infected to form a cluster resembling witch's broom. Soral sacs formed of host and fungal tissue-complex with a tough leathery peridium rupturing irregularly to expose abundant dusty, snuff colored spore mass.

Mature spores pale cinnamon brown, globose to subglobose, oval and measuring 17.9 to 24.3 μ in diameter with a mean of 20.2 μ . Epispore thick and reticulate with 4 to 6 areolations. Sterile cells hyaline to slightly tinged yellowish, irregularly globoid, thick walled, smooth and measuring 14.3 to 20 μ in diameter.

In the ovaries of *Bambusa* sp. at Chakrata, U. P. through Dr. K. B a g c h e e. No. 1243. (Type). (Figs. 26 to 28).

Sori in ovariis hypertrophice transformati evoluti, majusculi, cylindracei vel conici, purpureo-brunnei, 2—5 cm longi, 1—1.5 cm lati, antice parum attenuati, distincte prominuli, verticillo glumarum auctarum cincti; glumis tenacibus coriaceisque obscure brunneis; flores plerumque 4—12 vel complures in inflorescentia quadam infecti, caespitem scoparum instar efficientes; tunica sori e matricis et fungilli textura composita, tenaci-coriacea, irregulariter tandem disrumpens et sporarum massam pulverulentam, obscure brunneo-atram ostendens; sporae maturae pallide cinnamomeae, globosae, subglobosae vel ovoideae, 17.9—24.3 μ , plerumque ca. 20.2 μ diam.; episporio crasso, areolis 4—6 ornato; cellulae steriles hyalinae vel pallidissime flavescentes, irregulariter globosae, crasse tunicatae, leves, 14.3—20 μ diam.

The collection was kindly made available to the authors for examination by Dr. K. B a g c h e e. The packet, however, did not bear the date of collection of the name of the collector.

13. *Tilletia pennisetina* Sydow. in Ann. Mycol. 27: 421—422, 1929.

In ovaries of *Pennisetum orientale* Tich. Mussoorie, U. P. 24 October, 1953. No. 1244; in the ovaries of *Pennisetum flaccidum* Griseb. at Mussoorie, U. P. 26 October, 1953. Leg. M. S. P a v g i. No. 1245.

14. *Tilletia poonensis* sp. nov.

Sori destroying the ovaries, forming minute, ovoid, ridged, greenish black bodies, partially covered by the glumes, 2 mm long, 1 mm broad. Mature spores dusty, blackish brown in mass, globose to subglobose, oval, ovoid, dark cinnamon brown, semiopaque and measuring 15.8 to 31 μ in diameter with a mean of 18.6 μ . Epispore dark brown, thick and ornamented with pale brownish pyramidal processes 2 to 3.5 μ in height. Sterile cells numerous, globoid, hyaline, thick walled, smooth and measuring 15 to 21 μ in diameter.

In the ovaries of *Eragrostiella bifaria* Forsk. at Ganeshkhind, Poona, 10 October, 1954. Leg. M. J. T h i r u m a l a c h a r. No. 1246 (Type). (Figs. 29 to 31).

Sori in ovariis omnino destructis evoluti, minuti, ovoidei, costati, viridi-atrici, partim glumis induti, 2 mm longi, 1 mm lati; sporae maturae pulverulentae, acervatim atro-brunneae, globosae, subglobosae vel ovoideae.

deae, obscure cinnamomeae, subopacae, 15.8—31 μ , plerumque ca. 18.6 μ ; episporio obscure; cellulae steriles numerosae, subglobosae, hyalinae, crasse tunicatae, leves, 15—21 μ diam.

Acknowledgment

We are grateful to Dr. F. Petrak for kindly translating into Latin diagnoses of the new species.

Plate I.

Fig. 1. *Farysia olivacea*. — Habit sketch showing ovariicolous infection of *Carex condensata*. — Fig. 2. Infected ovary enlarged. — Fig. 3. Teliospores. Fig. 4. *Melanopsichium pennsylvanicum* var. *besseyanum*. — Gall formation on the peduncles of *Polygonum glabrum*. — Fig. 5. A gall enlarged. — Fig. 6.

A teliospore. — Fig. 7. Germination stages of the teliospore.

Fig. 8. *Sorosporium heteropogonicola*. — Habit sketch on *Cymbopogon caesium*.

— Fig. 9. Teliospores and sterile cells.

Fig. 10. *Sorosporium semisagittatum*. — Habit sketch in the panicle of *Ischaemum semisagittatum*. — Fig. 11. Teliospores.

Fig. 12. *Sorosporium lophopogonis* infected shoot showing destroyed inflorescence of *Lophopogon tridentatus*. — Fig. 13. Teliospore, sterile cells and their enlargements.

Fig. 14. *Sphacelotheca chrysopogonis-grylli*. Infected inflorescence of *Chrysopogon gryllus*. — Fig. 15. Teliospores. — Fig. 16. Sterile cells of the false membranes.

Plate II.

Fig. 17. *Ustilago rabenhorstiana*. — Habit sketch showing destroyed inflorescence of *Digitaria pedicellaris*. — Fig. 18. Teliospores.

Fig. 19. *Ustilago polygoni-alati*. — Infected inflorescence of *Polygonum alatum*. — Fig. 20. Teliospores.

Fig. 21. *Zundelula bulbostylidis*. — Habit sketch showing destroyed and hypertrophied ovaries. — Fig. 22. Infected ovary enlarged. — Fig. 23. Portion of a typical spore ball. — Fig. 24. Outer sterile cells enlarged. — Fig. 25. Inner fertile cells enlarged.

Fig. 26. *Tilletia bambusae*. — Habit sketch of infected ovaries in the inflorescence of *Bambusa* sp. — Fig. 28. A teliospore. — Fig. 28. A sterile cell.

Fig. 29. *Tilletia poonensis*. — An infected inflorescence of *Eragrostiella bifaria* showing the enlarged ovaries. — Fig. 30. Teliospore. — Fig. 31. Sterile cell.

Fig. 32. *Melanotaenium ischaemianum*. — A shoot of *Ischaemum semisagittatum* showing the infection on the leaves. — Fig. 33. A semidiagrammatic cross section of leaf through the sorus. — Fig. 34. Teliospores.

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