

Notes on some Indian Ustilagineae VII.

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With plate V.

Since the publication of the previous paper (1953), further collections of smuts were made in the States of Bihar and Uttar Pradesh and an account of the studies on these fungi is presented here.

1. *Ustilago caricis-wallichianae* Thirumalachar and Pavgi sp. nov.

Sori formed on ovary wall forming a semi-loose powdery layer, endosperm and embryo remaining intact. Spores in loose dusty mass, deep chocolate-brown, angularly globoid, 18 to 27 μ in diameter with a mean of 21.6 μ . Epispore thick and faintly striated.

Hab. on ovaries of *Carex wallichiana* Presc., Ramgarh, U.P., Aug. 1952, leg. M. J. Thirumalachar.

Sori in ovarii parietibus evoluti, stratum sublaxum pulverulentum praebentes, embryonem et endospermium intactum relinquentes; sporae laxae pulverulentae, obscurae atropurpureae, anguloso-globosae, 18—27 μ , plerumque ca. 21.6 μ diam. metientes; episporio crassiusculo, tenuiter striatulo.

For macroscopic appearance the smut may be mistaken for a species of *Cintractia* (Fig. 1), but the character of the sorus indicates that it belongs to *Ustilago*. There is no columella, false membrane or sterile stands of hyphae (Fig. 2) characteristic of *Cintractia* species. The spores are rather large comparable to those in *Tilletia* (Fig. 3).

2. On *Ustilago sparsa* Underwood.

The grain smut of *Dactylotaenium aegypticum* Richt. (*Eleusine aegyptica*) incited by *Ustilago sparsa* Underwood is of widespread occurrence in the plains of northern India. The infection is scattered and the infected ovaries become bullate, 6 to 8 times the size of the healthy grains, enclosing a dusty mass of spores. Examination of smutted spikelets has revealed that the infection is chiefly restricted to the ovary, other parts of the flower being unaffected.

The chlamydospores were germinated by the method suggested by the writers (1950). The spores germinate readily within 24 to 36 hours at room temperature (24 to 29° C.). The promycelium emerges out, bearing lateral and terminal sporidia, which bud off secondary sporidia in succession.

Sporidia from slide cultures of germinating chlamydospores were transferred aseptically to potato-dextrose-agar. The fungus grew in artificial culture by the formation of matty heaped-up growth, composed of hyphal stands and sporidial mass.

Inoculation experiments were carried out to study the mode of infection. Earlier studies had already indicated that the smut is not seed-borne and systemic, but may be air-borne infecting the spikelets at the stage of anthesis. Inoculations of the spikelets were carried out using both chlamydospores and inoculum from artificial culture of the fungus. Opportunity was availed of to see if the smut would infect the closely related host *Eleusine coracana* Gaertn. which is extensively cultivated in parts of India as millet. On this latter host another grain smut, *Melanopsichium eleusines* (Kulkarni) Mundkur and Thirumal. occurs which is already known to be air-borne (1947) infecting the spikelets. Inoculations with both chlamydospores and inoculum from artificial cultures were carried out by the partial vacuum method suggested by Moore (1936). Four varieties of *Eleusine coracana* grown commercially and *Dactylotaenium aegypticum* grown in pots were inoculated with chlamydospores and artificial culture of *U. sparsa*. The inoculated plants were covered with paper bags to prevent external air-borne infection.

Table 1.

Inoculum	Date	No. of plants	<i>Eleusine coracana</i>				<i>Dacty. aegypt.</i>
			R 0009	RO 324	AKP ₂	AKP ₆	
Blank	18. 9. 51	Inoculated	10	10	10	10	10
		Infected	0	0	0	0	0
Spore suspension	18. 9. 51	Inoculated	10	10	10	10	10
		Infected	0	0	0	0	7
Blank	19. 9. 51	Inoculated	10	10	10	10	10
		Infected	0	0	0	0	0
Culture suspension	19. 9. 51	Inoculated	10	10	10	10	10
		Infected	0	0	0	0	9

Results have indicated that *U. sparsa* does not infect *Eleusine coracana*, but is restricted chiefly to *Dactylotaenium*. Inoculations with sporidia have given higher percentage of infection than chlamydospores.

3. *Sphacelotheca eleocharidis* Thirumalachar and Pavgi sp. nov.

Sori in the ovaries, infecting all ovaries in the inflorescence, appearing as greyish-pink globoid bodies, 3 to 4 \approx 2 to 3 mm., covered by a false membrane, enclosing a semi-agglutinated black spore mass. Spores ovate-globoid, reddish-brown 9 to 13 μ in diameter with a mean of 11.4 μ . Epispore thick and verrucose. Cells of false

membrane pale cinnamon-brown, thick walled, spherical, 7.5 to 12 μ in diameter. Columella short and stumpy.

Hab. in ovaries of *Eleocharis* sp. Netarhat, Bihar, 2. 9. 1952, leg. M. J. Thirumalachar.

Sori fere omnia inflorescentiae ovaria inficientes, griseo-roseoli, subglobosi, 3—4 \Rightarrow 2—3 mm, membrana falsa obtecti, sporarum massa subagglutinata repleti; sporae ovoideo-globosae, rubro-brunneae, 9—13 μ , plerumque 11.4 μ diam. metientes; episporio crassiusculo; membranae falsa cellulae pallide cinnamomeae, crassiuscule tunicatae, globosae, 7.5—12 μ diam.; columella breviuscula et obtusa.

This interesting species of *Sphacelotheca* on *Eleocharis* sp. was collected in marshy places on the hills at Netarhat. The infected plants can be distinguished only with great difficulty on account of inconspicuous nature of the smutted ovaries (Figs. 4 and 5).

Sphacelotheca caricis-petitianae Zundel on *Carex petitiana* in Belgian Congo and *S. cypericola* Pavgi and Mundkur on *Cyperus difformis* in India have been reported on members of Cyperaceae, and these are different from the smut under study.

4. ***Sphacelotheca consimilis*** Thirumalachar and Pavgi sp. nov.

Sori in inflorescence, completely destroying it and part of axis, covered by a very evanescent false membrane in young sorus and enveloped in leaf sheath; false membrane completely disappearing at maturity exposing the black dusty mass of spores; cells of sterile membrane ovate-globoid, thin-walled, 5 to 12 μ in diameter. Columella long and simple. Spores chestnut red, ovate to spherical, 3.5 to 6 μ in diameter with a mean of 5.0 μ . Epispore smooth and thick.

Hab. in inflorescence of *Saccharum munja* Roxb. Patna, Bihar 23. 12. 1952; leg. M. J. Thirumalachar.

Sori inflorescentiam totam destruentes, membrana falsa, tenuissima mox evanescente obvoluti, vagina folii obtecti, in maturitate omnino denudati, pulverulenti, nigri; membranae cellulae ovoideo-globosae, tenuiter tunicatae, 5—12 μ diam.; columella longiuscula, simplex; sporae castaneo-rubrae, ovoideae vel globosae, 3.5—6 μ , plerumque ca. 5 μ diam.; episporio levi, crassiusculo.

This interesting smut on *Saccharum munja* was collected in a field near Marutganj, Patna city. The smutted inflorescence was concealed within the leaf sheath without producing the long whip-like structures. Detailed examination of the smut has indicated that the smut may be identical with *Ustilago consimilis* Syd. reported in India on *Saccharum fuscum* Roxb. and *S. spontaneum* L. The false membrane (Figs. 6 and 7) is so evanescent, that unless fresh specimens are examined in the field they may be completely overlooked altogether. We, however, defer making *Ustilago consimilis* Syd. as a synonym of *Sphacelotheca consimilis* since the false membrane

could not be noticed in the exsiccati type material, which should be expected on account of evanescent nature of false membrane.

5. *Melanotaenium brachiariae* Viegas var. **arthraxonis**

Thirumal. and Pavgi var nov.

Inciting formation of ovate to linear black spots on leaves, non-erumpent, surrounded by a paler reddish zone, 5 to 10 mm. long and 3 to 8 mm. broad. Spores embedded in mesophyll, aggregated in groups, dark olive-brown, irregularly globoid to angular due to mutual compression, thick-walled, smooth, 7.5 to 13.5 μ in diameter with a mean of 10.8 μ .

Hab. on leaves of *Arthraxon* sp., Parasnath, Bihar, 14. 12. 1952, leg. H. C. Govindu.

Maculae ovatae vel lineares, 5—10 mm. longae, 3—8 mm. latae, pallide rubro-marginatae; sporae in mesophyllo evolutae, plus minusve aggregatae, obscure olivaceae, irregulariter globosae vel e mutua pressione angulosae, 7.5—13.5 μ , plerumque ca. 10.8 μ diam. metientes; episporio crassiusculo, levi.

The fungus incites the formation of tar-like spots on the leaves (Fig. 8) and resembles *Melanotaenium brachiariae* Viegas in the mode of arrangement of spores within the mesophyll and is, therefore, presented as a new variety. The coloured wall indicates that it is a species of *Melanotaenium* (Figs. 9 and 10). The spores have not been germinated.

6. *Tilletia biharica* Thirumalachar and Pavgi sp. nov.

Sori in ovaries, infection scattered, only few ovaries in the inflorescence becoming infected, 3 to 5 mm. long, 2 to 2.5 mm broad, protruding beyond glumes, rupturing apically releasing the spores. Mature spores subglobose to spherical, dark olive-brown to opaque, 16.5 to 22.7 μ in diameter with a mean of 19.9 μ . Epispore covered with short echinulations and possessing a hyaline envelope and short peg-like appendage. Sterile cells abundant, intermixed with spores, subglobose, smooth, thick-walled, 16 to 27 μ in diameter.

Hab. in ovaries of *Panicum* sp. Parasnath, Bihar, 14. 12. 1952, leg. H. C. Govindu.

Sori nonnulla tantum ovaria inflorescentiae inficientes, 3—5 \Rightarrow 2—2.5 mm, plus minusve e glumis prominuli, in apice dehiscentes; sporae plus minusve globosae, obscure olivaceae, fere opacae, 16.5—27.7 μ , plerumque 19.9 μ diam. metientes; episporium minute echinulatum, tegumento hyalino, in appendicem plane conicam protracto praeditum.

As already pointed out in the previous paper (1953), the *Tilletia* species on the genus *Panicum* are numerous, but each of them is quite distinct as regards morphological characters. In India itself,

Tilletia narayanaraoana, *T. verrucosa*, *T. narasimhanii*, *T. banarasae* and *T. tumefaciens* etc. have previously been reported on *Panicum* sp. The species under study differs from the above as well as those recorded from other countries (Figs. 11 to 14).

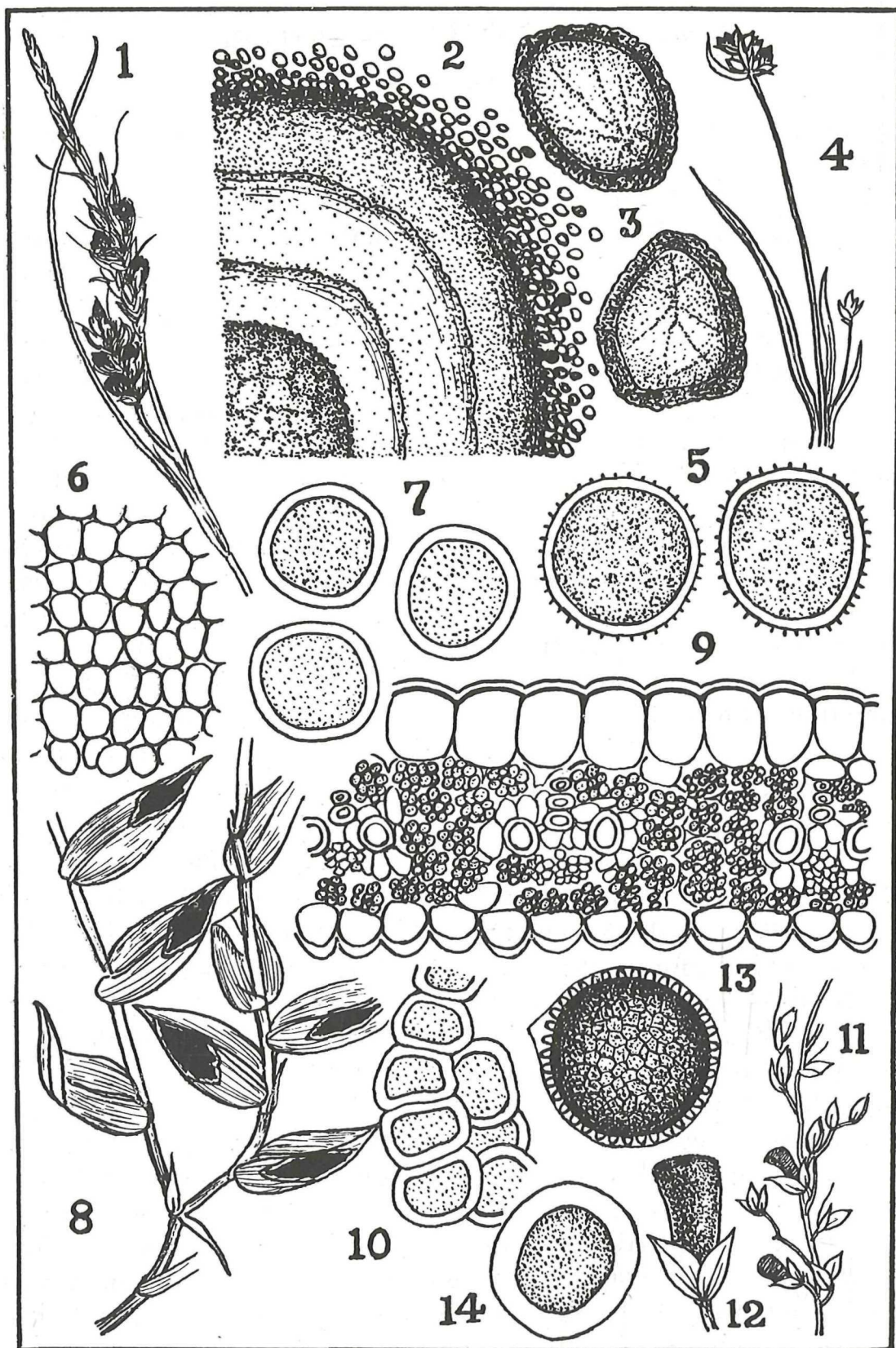
In conclusion the authors wish to acknowledge their indebtedness to Dr. Fr. Petrak, for kindly translating the descriptions of new species into Latin.

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Explanation of Plate.

Figs. 1—3: *Ustilago caricis-wallichianae*: 1. Smutted inflorescence of *Carex wallichiana*. Nat. size. 2. Semidiagrammatic T. S. of sorus. 3. Chlamydospores. $\times 1000$. — Figs 4—5: *Sphacelotheca eleocharidis*: 4. Smutted inflorescence of *Eleocharis* sp. Nat. size. 5. Chlamydospores. $\times 1500$. — Figs. 6—7: *Sphacelotheca consimilis*: 6. Portion of pseudomembrane. $\times 500$. 7. Chlamydospores. $\times 3000$. — Figs 8—10: *Melanotaenium brachiariae* var. *arthraxonis*: 8. Portion of infected culm of *Arthraxon* sp. 9. T. S. of leaf through sorus. $\times 40$. 10. Chlamydospores. $\times 1000$. — Figs. 11—14: *Tilletia biharica*: 11. Portion of infected inflorescence of *Panicum* sp. 12. Sorus enlarged. $\times 4$. 13. Chlamydospore. $\times 1000$. 14. Sterile cell. $\times 1000$.



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