Some new or interesting Physoderma Species from India — IV*).

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With Plate VIII—IX.

Physoderma digitariae-marginatae Thirum. & Pavgi. Sp. nov.

Inciting definite and conspicuous reddish-brown, fusoid to ovate spots, 1 to 2 mm × 0,5 mm, often coalescent, covering most of the laminar surface. Rhizomycelium intracellular and tenuous. Resting sporangia distributed in the mesophyll between and around the vascular tissue, 1 to 3 in each cell, yellowish brown, globoid, oval to hemispherical, smooth, thick-walled and measuring 17,2 to 32,9 μ × 15,7 to 25,2 μ with a mean of 24,1 × 19,2 μ. Germination not observed.

In living leaves of *Digitaria marginata* Link at Pimpri, Poona; 18th July, 1954. Leg. M. J. Thirumalachar, No. 1225 (Type).

Maculae conspicuae bene limitatae rufo-brunneae, fusoideae usque ovales, 1—2 × 0,5 mm saepe confluentes, fere totam folii superficiem occupantes; rhizomycelium intracellulare, tenue; sporangia perdurantia in mesophyllo inter et circa fasciculos vasorum, 1—3 in quaque cellula evoluta, flavido-brunnea, globularia, ovoidea vel hemisphaerica, glabra, crasse tunicata, 17,2—32,9 × 15,7—25,2 μ, plerumque 24,1 × 19,2 μ; germinatio ignota.

The species differs from *Physoderma digitaricola* and *Physoderma digitariae-longiflorae* in that the symptoms are produced on the leaves only, which are conspicuous reddish-brown, fusoid spots. In *Physoderma digitaricola* they are inconspicuous, minute reddish brown, oblong spots both on the leaves and leaf-sheaths, which in fresh condition are visibly surrounded by a yellow halo. In the latter two species, the infection appears to be systemic and only the submerged leaves or leaf-sheaths are infected. The resting sporangia in the present species are yellow, lying free in the host cells without any colored embedding matrix.

Physoderma digitariae-longiflorae Thirum. & Pavgi Sp. nov.

Inciting streaks mostly on the leaves, reddish-brown, 2 to 2,5 mm long, indefinite, usually coalescent forming large spots not raised over the surface. Rhizomycelium intracellular and tenuous. Resting sporangia distributed in the mesophyll, 1 to 2 in each cell, embedded

*) Part III in Sydowia 10: 112—117, 1956.

in a matrix which is yellow at first but dark brown on maturing; sporangia pale yellow, globiod, to ovate, thin walled, smooth and measuring 17,2 to 24,3 $\mu \times 14,3$ to 22,8 μ with a mean of $20,7 \times 17,6$ μ. Germination not observed.

In living leaves of *Digitaria longiflora* Pers. at Pimpri, Poona; 8th September, 1954. Leg. M. J. Thirumalachar. No. 1226 (Type).

Striae rufo-brunneae, 2—2,5 mm longae, indistincte limitatae, plerumque in maculas magnas non incrassatas confluentes; rhizomycelium intracellulare, tenue; sporangia perdurantia in mesophyllo 1—2 in quaque cellula evoluta matrici primum flavae, postea fusco-brunneae immersa, flavidula, globosa, ellipsoidea vel ovoidea, tenuiter tunicata, glabra, $17,2—24,3 \times 14,3—22,8$ μ; media $20,7 \times 17,6$ μ; germinatio ignota; .

The resting sporangia are embedded in a matrix, which is at first yellow later turning brown showing avidity to stains. On scraping an infected leaf, entire host cells containing the sporangia are dislodged in this species a character usually not shown by the other two species referred to which are parasitic on the host genus *Digitaria*.

Physoderma paspalidi Thirum. & Pavgi, Sydowia *10*: 115—116, 1956.

In living leaves of *Paspalidum punctatum* A. Camus, Banaras, Uttar Pradesh, 21-8-1954, leg. M. S. Pavgi No. 1227.

This is a new host record, the type of *P. paspalidi* being described on *Paspalidum geminatum*. The disease symptoms are slightly different. The diseased portions representing the sorus in later stages frey and drop out producing a shot-hole effect. In early stages the symptoms resemble those of *Piricularia oryzae* Cav.

Physoderma nelumbii Mishra & Thirum. Sydowia *7*: 83, 1953.

In living leaves of *Nymphaea stellata* Willd., Poona. leg, M. J. Thirumalachar, 20-11-1956.

The type of *P. nelumbii* was collected on *Nelumbium speciosum* from Bihar. The present collection was made in horticultural garden where different varieties of lotus were being grown in ponds. The spotting due to *P. nelumbii* was so severe as to disfigure and cause premature drying of the leaves. The resting sporangia were germinated in the laboratory. The development of the swarm spores after throwing off the operculum is similar to those described for other species of *Physoderma*. The development of thin-walled ephemeral sporangia and other details were not followed.

Field studies on *Physoderma bothriochloae* Thirum. & Pavgi.

Physoderma bothriochloae was described on *Bothriochloa pertusa* (L) A. Camus from collections made in Poona. The deep purple spots embedding the resting sporangia are characteristic. The disease is systemic and culmicolous, and when rooted stolons are surface sterili-

sed and planted, the new leaves formed show the purple streaks characteristic of the disease. The resting sporangia germinate readily and develop the swarm spores released to the outside by the operculate dehiscence. The spread of the disease by transplating of the culms bearing the disease was the chief factor, since *Bothriochloa pertusa* is a valuable forage grass in non-irrigated lands and remains green during summer months.

The systemic infection brings about severe dwarfing of the internodes and deformity of the shoots. The resting sporangia are heterosporous. The matrix shows great avidity to staining reactions and turns opaque reddish brown on maturity of the sorus. Consequently the mesophyll cells surrounding the vascular bundles become dead and brown.

Physoderma kyllingiae Pavgi & Thirum. Sp. nov.

Inciting development of minute, inconspicuous, pale brownish, raised streaks, closely running and coalescent to form stripes upto 2 to 3 cm. over the upper leaf surface, turning blackish grey at maturity. Rhizomycelium tenuous and intracellular. Resting sporangia chiefly in the epidermis, 3 to 8 in each cell, light-brown, subspherical to oval, occasionally hemispherical, thick-walled, smooth having 3 to 5 hyaline, minute peg-like appendages and measuring 22,9 to 31,5 $\mu \times$ 17,2 to 30 μ with a mean of $27 \times 21{,}9$ μ. Germination not observed.

In living leaves of *Kyllingia brevifolia* Rottb. at Hingne, Poona on 15 June, 1954. Leg. M. S. Pavgi. No. 1229 (Type).

Striae epiphyllae, inconspicuae, pallide brunneolae, incrassatae dense dispositae saepe confluentes et tunc 2—3 cm longae, in maturitate atro-griseae; rhizomycelium tenue, intracellulare; sporangia perdurantia plerumque epidermalia, 3—8 in quaque cellula evoluta, pallide rubro-brunnea, subglobosa, ovalia, interdum etiam hemisphaerica, crasse tunicata, glabra, appendicibus 3—5 hyalinis, minutis praedita, 22,9—31,5 $\times$ 17,2—30 μ, plerumque $27 \times 21{,}9$ μ. Germinatio ignota.

Physoderma brachiariae-eruciformis Thirum. & Pavgi. Sp. nov.

Inciting formation of minute, definite, olive-brown to blackish, fusoid streaks close to each other, 1 to 2 mm long, covering the entire leaf blade. Rhizomycelium tenuous and intracellular. Resting sporangia distributed mostly in the epidermis and mesophyll surrounding the vascular strands; infected cells slightly hypertrophied. Sporangia 1 to 2 in each cell, golden brown, mostly hemispherical to oval, thick walled, smooth and measuring 18,6 to $30 \times 12{,}9$ to 22,9 μ with a mean of $23{,}9 \times 18{,}2$ μ Germanition not observed.

In living leaves of *Brachiaria eruciformis* Griceb. at Pimpri, Poona on 20 July, 1954. Leg. M. J. Thirumalachar. No. 1230 (Type).

Striae dispersae, minutae bene limitatae, olivaceo-brunneae vel nigrescentes, fusoideae plerumque dense dispositae 1—2 mm longae; rhizomycelium intracellulare, tenue; sporangia perdurantia plerumque intraepidermalia sed non raro etiam in mesophyllo evolutae et fasciculos vasorum circumdantia, cellulas matricis subhypertrophice mutantia; sporangia 1—2 in quaque cellula, aureo-brunnea, plerumque hemisphaerica usque ovalia, crasse tunicata, glabra, 18,6—30 × 12,9—22,9 μ, plerumque 23,9 × 18,2 μ; germinatio ignota.

Physoderma sparrovii Thirum. & Pavgi. Sp. nov.

Inciting formation of dark-brown to black, very minute, little raised, elongate specks all over the leaf surface, mostly on the lower leaves. Rhizomycelium tenuous and intracellular. Resting sporangia mainly distributed in the mesophyll, occasionally in the epidermis, golden to pale yellow-brown, subspherical to oval, thin-walled, smooth and measuring 15,7 to 25,7 μ × 12,9 to 22,9 μ with a mean of 20,9 × 17,1 μ. Germination not observed.

In living leaves of *Setaria pallidifusca* Stapf at Pimpri, Poona; 1 August, 1954. Leg. M. J. Thirumalachar. No. 1231. (Type).

Maculae plerumque hypophyllae per totam folii superficiem dispersae plus minusve, elongatae, fusco-brunneae vel atrae, subincrassatae; rhizomycelium tenue, intracellulare; sporangia perdurantia plerumque in mesophyllo, interdum etiam in epidermide evoluta, aurea vel pallide flavo-brunnea, subglobosa ovalia vel irregularia, crasse tunicata, glabra, 15,7—25,7 × 12,9—22,9 μ, plerumque 20,9 × 17,1 μ; germinatio ignota;

The species is named in honour of Dr. F. K. Sparrow, University of Michigan, Ann. Arbor, U. S. A.

Physoderma eragrostidis. Thirum. & Pavgi. Sp. nov.

Inciting formation of fine, very minute, olive brown, slightly raised streaks on the lower leaves covering the whole surface, upto 1 mm long. Rhizomycelium tenuous and intracellular. Resting sporangia distributed in the mesophyll between the vascular tissues, sometimes in the epidermis, 1 to 2 in each cell, light golden-yellow, globose to ovate, thin walled, smooth and measuring 17,2 to 28,6 μ × 11,5 to 24,3 with a mean of 22,2 × 14,7 μ, Germination not observed.

In living leaves of *Eragrostis* sp. at Pimpri, Poona; on 25 July, 1954. Leg. M. J. Thirumalachar. No. 1232 (Type).

Striae hypophyllae, per totam folii superficiem dispersae, tenues, olivaceo-brunneae, subincrassatae, usque 1 mm tantum longae; rhizomycelium tenue, intracellulare; sporangia perdurantia intra fasciculos vasorum raro etiam in epidermide plerumque 1—2 in quaque cellula evoluta, pallide aureo-flavida, globosa, subglobosa, ovalia vel ovoidea, tenuiter tunicata, glabra, 17,2—28,6 μ × 11,5—24,3 μ, plerumque 22,2 × 14,7 μ; germinatio ignota.

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

Explanation of Plates.

Plate VIII.

Fig. 1. Disease symptoms of *Physoderma digitariae-longiflorae*. ×Nat. size. — Fig. 2. T. S. leaf through sorus showing the resting sporangia. ×250. — Fig. 3. T. S. leaf through sorus on *Digitaria marginata*. ×250. — Fig. 4. Diseased symptoms of *Physoderma digitariae-marginatae*. ×Nat. size. — Fig. 5. Infected leaf of *Paspalidum punctatum*. ×Nat. sitze. — Fig. 6. T. S. leaf through sorus of *Physoderma paspalidi*. ×250.

Plate IX.

Fig. 7. Showing diesease symptoms of *Physoderma sparrovii*. × Nat. size. — Fig. 8. Sorus of *P. sparrovii*. × 250. — Fig. 9. T. S. leaf of *Brachiaria eruciforme*. ×Nat. size. — Fig. 10. Sorus of *Physoderma brachiariae-eruciformis*. ×250. — Fig. 11. Habitat of *Physoderma eragrostidis*. × Nat. size. — Fig. 12. Showing resting sporangia of *P. eragrostidis*. ×250.