

A P P E N D I X

Publication connected with the present  
investigation

1. Dewan, B. B. and A. K. Kar 1974. Fungi of Eastern Himalayas (India). Nova Hedwigia, XXV, 225-227.
2. Kar, A. K. and B. B. Dewan 1975. Some Discomycetes of Eastern Himalayas. Indian Phytopathology, XXVIII, No. 2, 296-297.
3. \_\_\_\_\_ and \_\_\_\_\_ 1975. Fungi of Eastern Himalayas - II. Indian Phytopathology, XXVIII, No. 3. 400-401.
4. \_\_\_\_\_ and \_\_\_\_\_ 1975. Discomycetes of Eastern Himalayas - II. Indian Phytopathology. XXVIII, No. 4. 512-514.
5. \_\_\_\_\_ and \_\_\_\_\_ 1979. Rust Fungi of Eastern Himalayas (India). Nova Hedwigia, 77-83.

# FUNGI OF EASTERN HIMALAYAS (INDIA)

by

B. B. Dewan and A. K. Kar

Department of Botany, Darjeeling Govt. College, Darjeeling, India

## Summary

Two not yet recorded fungi have been collected and described from Eastern Himalayas (India). They are:

1. *Coleosporium bletiae* Diet.
2. *Trichoglossum farlowii* (Cooke) Durand.

This paper deals with two new fungi collected from different parts of Eastern Himalayas (India) at an altitudinal range of 7,000 to 7,500 ft. They are described and illustrated below.

### 1. *Coleosporium bletiae* Diet.

The fungus infects different species of ground orchids (*Habenaria densa* Wall; *Herminium augustifolium* Benth; *Satyrium nepalense* Don Prode; *Anthogonium gracile* Lindl. Lesions are confined to the leafsheath, leafblade and stem but principally on the under surface of the leafblade (Fig. 1 A). They appear in the form of very small typically orange coloured oval to lenticular pustules, slightly erumpent with age, scattered irregularly on the under surface of the leafblade. The *pustules* are solitary and distinct during early infection but with severity of infection they coalesce forming circular patches (1.5 mm to 2 mm) around a central light yellowish zone. Leaf margins often curl with the virulence of infection. Older lesions are blackish-brown with ruptured epidermis (Fig. 1 B) clinging to the pustules in the form of white flakes.

The *teleutospores* are laterally united and form one-celled thick subcuticular crusts (Fig. 1 C). Mature teleutospores give rise to basidiospores (Fig. 1 D).

Specimens examined:



Fig. 1. A-D. *Coleosporium bletiae*. A. Portion of infected leaf,  $\times 1$ ; B. Section of a lesion showing ruptured epidermis,  $\times 200$ ; C. Section through a teleutosorus showing laterally united one-celled teleutospores  $\times 900$ ; D. Mature teleutospores producing basidiospores,  $\times 900$ ; E-H. *Trichoglossum farlowii*. E. Asci with ascospores,  $\times 500$ ; F. Setae and paraphyses,  $\times 400$ ; G. Ascophores,  $\times 1-1/2$ ; H. Seven-septate ascospore,  $\times 1400$ .

Host: *Habenaria densa* Wall.

Locality: Birch Hill, Darjeeling (India), July 18, 1972, Alt. 7,500 ft. leg. B.B. Dewan, DGC 1 (IMI 172606).

Host: *Herminium augustifolium* Benth.

Locality: Birch Hill, Darjeeling (India), July 18, 1972, Alt. 7,500 ft. leg. B.B. Dewan, DGC 2 (IMI 172607).

Host: *Satyrium nepalense* Don Prode.

Locality: Birch Hill, Darjeeling (India), July 25, 1972, Alt. 7000 ft. leg. B.B. Dewan, DGC 3 (IMI 172608).

Host: *Anthogonium gracile* Lindl.

Locality: Birch Hill, Darjeeling (India), August 10, 1972, Alt. 7,500 ft. leg. B.B. Dewan, DGC 4 (IMI 172609).

This is the first report of *C. bletiae* on ground orchids from India.

## 2. *Trichoglossum farlowii* (Cooke) Durand.

*Ascophores* solitary, or clustered, two or three together, 2.5 cm to 5.5 cm high (Fig. 1 G). Ascigerous portion lanceolate, not sharply distinguished from the stem, brownish-black, 1.2-2.2 cm long, often flexuous, rarely somewhat compressed.

The *asci* are many, clavate, sessile, 8-spored,  $112-152 \mu \times 14-18 \mu$  (Fig. 1 E).

The *ascospores* are crowded, clavate-cylindric, multiseriate in the ascus, brownish,  $90-97 \mu \times 3.6$  to  $7.2 \mu$  1-(5)-7 septate (Fig. 1 H).

The *paraphyses* cylindric, curved to circinate at the somewhat thickened tips (Fig. 1 F).

The *setae* are acicular, somewhat narrowed, dark-brown (Fig. 1 F).

Specimen studied:

Habitat: On soil in moist shady palce.

Locality: Birch Hill, Darjeeling (India), August 12, 1972, Alt. 7000 ft. leg. B.B. Dewan, DGC 5.

Thanks are due to the Director, Commonwealth Mycological Institute, Kew, England and to Dr. Mulder of the same institution for their help in identifying the fungi.

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SOME DISCOMYCETES OF EASTERN HIMALAYAS

A. K. KAR AND B. B. DEWAN

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## Some Discomycetes of Eastern Himalayas

A. K. KAR AND B. B. DEWAN

Department of Botany, Darjeeling Govt. College, Darjeeling

This paper deals with four Discomycetes collected from different parts of Eastern Himalayas. Structural details of the specimens were studied from freehand sections of both fresh and preserved (4 per cent formalin) materials stained with lactophenol cotton blue. Specimens are preserved in Darjeeling Govt. College Botanical Herbarium, Darjeeling (DGC).

### 1. *Geoglossum sphaguophilum* Ehrenb. ex Wallr. Sglv. Myc. Ber. 30. 1818.

Ascocarp solitary, rarely clustered, gregarious, 3.5—5.5 cm high ascigerous portion black, about one third the total length of the ascocarp, compressed 1—1.5 cm long, 2—3 mm thick, slightly acute, not sharply delimited from the stem; stem brownish-black, slender, 1.6 to 4 cm long; asci stout, clavate-lanceolate, narrowly-rounded apex, pore blue in iodine, measuring  $161\text{--}181.5\ \mu \times 16.5\ \mu$ , 8-spored; ascospores fascicled, brown, slightly curved, 4—7-septate,  $59\text{--}66\ \mu \times 3\ \mu$ , paraphyses numerous, slightly longer than asci, septate, tip thickened, cells swollen giving moniliform appearance.

*Habitat* : On soil.

*Locality* : Birch hill (altitude 7000 ft) (Darjeeling).

Specimens examined : July 20, 1973; DGC 41, DGC 41a.

### 2. *Geoglossum fallax* Durand, Ann. Myc. 6 : 428. 1908.

Ascocarp solitary, 2—7 cm high, umber brown; ascigerous portion one fifth to one half the total length of the ascocarp, lanceolate—obtuse; stem elongated and slender, slightly thickened upward; asci clavate-cylindric with narrowed apex,  $148.5\text{--}165\ \mu \times 13.2\text{--}16.5\ \mu$ , 8-spored; ascospores multiseriate in the ascus, straight, 11-septate,  $96\text{--}102\ \mu \times 7\ \mu$ ; paraphyses entirely hyaline, septate, apex ellipsoid to globose.

*Habitat* : On loamy soil along slopes.

*Locality* : Darjeeling (altitude 6, 800 ft).

Specimens examined : July 23, 1973, DGC 49; July 27, 1973, DGC 49a.

### 3. *Neottiella vivida* (Nylander) Dennis Ed. 1 : 28.

Ascocarp 6—10 mm in diameter, sessile, disc deep pink, flat with undulating margin, outer surface downy; hymenium blue-green in iodine, asci  $214\text{--}247\ \mu \times 10\text{--}13.2\ \mu$ ; ascospores uniseriate, elliptic-cylindric,  $13.2\text{--}16.5\ \mu \times 7\ \mu$ , containing one large oil drop, wall with warts; paraphyses aseptate, projecting above the asci, tip upto  $7\ \mu$  thick.

*Habitat* : On sandy soil along with mosses and grasses.

*Locality* : Victoria falls (altitude 6,000 ft) Darjeeling.

Specimen examined : July 22, 1973, DGC 45a.

4. *Aleuria aurantia* (Fries) Fuckel, Symb. Myc. 325. 1869.

Ascocarp gregarious, short stipitate (laterally), at first cup-shaped becoming flattened with maturity, sometimes splitting along the margin, diameter 1.5 to 4 cm; hymenium bright orange, flesh thin, fragile, turning green in iodine; asci  $132\text{--}181\mu \times 13\mu$ ; ascospores elliptical, ornamented with a coarse reticulum,  $13.2 \times 10\mu$ , containing two oil drops; paraphyses clavate, projecting above the asci, apical portion swollen, deeply pigmented with orange granules,  $6.6\mu$  thick.

*Habitat* : On bare sandy soil.

*Locality* : Mongpoo (altitude 3,500 ft).

Specimen examined : July 8, 1973, DGC 42.

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FUNGI OF EASTERN HIMALAYA—II

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## Fungi of Eastern Himalaya—II

A. K. KAR\* AND B. B. DEWAN

Department of Botany, Darjeeling Govt. College, Darjeeling.

During a survey of Fungi of Eastern Himalaya, the authors recorded two discomycetous fungi. They are: *Peziza domiciliana* Cooke and *Peziza echinospora* Karst.

1. *Peziza domiciliana* Cooke, Gardener's chronicle 41: 793 (1877)

*Apothecia* gregarious, usually short-stipitate, at first cupulate, soon becoming revolute with age leaving a depression in the centre, at first rounded, soon becoming irregular and often decidedly angular in outline, externally white, margin entire or occasionally splitting, reaching a diameter of 10 cm; *hymenium* at first concave, becoming plane or convex distinctly umbilicate, at first white becoming dingy buff, thick, irregular, *asci* cylindrical to subcylindric reaching a length of 214—244  $\mu$  and a diameter of 10—13  $\mu$ , *ascus* tip blued in Melzer's reagent; *ascospores* ellipsoid hyaline, 1-seriate, without oil globules, smooth-walled, 7X 13 $\mu$ ; *paraphyses* slender, filiform, septate, slightly enlarged above.

Habitat : On plaster with mosses about 6" from the soil.

Locality : Birch Hill (altitude 6,800 ft) Darjeeling.

Specimen examined : November 7, 1973; DGC 60.

2. *Peziza echinospora* Karst, Myc. Fenn. I, P. 54 (1871)



Fig. 1. Apothecia. A. *Peziza domiciliana* XI. B. *Peziza echinospora* XI

*Apothecia* gregarious, occasionally caespitose, usually rather large, upto 8 cm diameter; disc concave, undulate, smooth, brown to dark brown; receptacle cup-shaped, sometimes becoming contorted to almost *Otidea*-like by mutual pressure, broadly sessile, margin often crenate, outer surface paler than disc, often whitish, scurfy to furfuraceous; the outermost surface layer of the excipular tissue composed of interwoven, septate, short-celled hyphae; the lower pseudoparenchymatous layer thick, of large subglobose or polygonal cells, separated from the upper pseudoparenchymatous tissue by a layer of compact *textura intricata* or *textura epidermoidea*; the upper pseudoparenchymatous layer thick, of large subangular or polygonal, thin-walled subhymenium of compact angular or lobed and sinuate cells 8—15 $\mu$  diameter; *hymenium* about 280  $\mu$  thick, *asci* cylindrical slightly narrower below, apex blued in Melzer's reagent, 8-spored, upto 231  $\mu$  long by 13  $\mu$  diameter; *ascospores* uniseriate, hyaline, without oil guttules, ellipsoidal to oblong-ellipsoidal, finely warted, 7X 17  $\mu$ ; *paraphyses* slender, septate, apex subclavate, slightly curved tip swollen reaching a diameter 6.6  $\mu$ .

Habitat : on burnt soil

Locality : Birch Hill (Darjeeling) (altitude 6, 800 ft)

Specimens examined : March 12, 1974, DGC 61; April 8, 1974, DGC 61A

\*Present address : Botany Dept., Presidency College, Calcutta-73 (W. B.)

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DISCOMYCETES OF EASTERN HIMALAYAS—II

A. K. KAR AND B. B. DEWAN

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## DISCOMYCETES OF EASTERN HIMALAYAS—II

A. K. KAR<sup>1</sup> AND B. B. DEWAN

**ABSTRACT :** Four Discomycetous fungi, namely *Peziza petersii*, *P. cerea*, *Tricharia cretea* and *T. gilva* have been collected and described from Eastern Himalayas at an altitude of 7,000 to 7,500 ft.

1. *Peziza petersii* Berkeley and Curtis in Grevillèa 3 : 150 (1875) *Apothecia* scattered to gregarious, upto 7.5 cm., disc regular to (Fig. 1A) contorted, pale brown to pale reddish brown, margin undulate, outer surface much paler than the inner, somewhat scurfy; *asci* cylindrical, slightly narrower towards the base, apex turned blue in Melzer's reagent, 8-spored,  $247 \times 10 \mu$ ; *ascospores* uniseriate,  $13.2 \times 7 \mu$ , ellipsoid to oblong ellipsoid, hyaline, with two large oil globules, covered with minute warts (Fig. 1B); *paraphyses* slender, septate, unbranched, apex distinctly enlarged to about  $7 \mu$ , slightly curved, containing brown granules.

*Note :* Seaver (1928) designated *P. petersii* as the synonym of *P. pustulata* (Hedw.) Pers. But modern authors have accepted to treat *Peziza pustulata* as a synonym of *Pustularia catinus*.

*Habitat :* On soil.

*Locality :* Ghoom (Darjeeling), April 19, 1974, Alt. 7,500 ft. leg. B. B. Dewan, DGC 71 and DGC 71a.

2. *Peziza cerea* Sowerby ex Merat, *Nouvella Flore Paris* 1 : 25 (1821) *Apothecia* short stipitate when young, disc cup-shaped, becoming expanded (Figs. 2A and B) upto 5 cm diam., hymenium yellowish brown, outer surface white, minutely downy to almost scurfy; *asci* subcylindrical,  $182-198 \mu \times 10-13 \mu$ , narrower towards the base, apex blued in Melzer's reagent; *ascospores* uniseriate, hyaline, elliptical, smooth walled, without oil globules,  $10-13 \mu \times 7-10 \mu$ ; *paraphyses* straight, septate, apex enlarged upto  $6.6 \mu$ .

*Habitat :* On moist soil mixed with coal dust and on waste paper.

*Locality :* Birch Hill (Darjeeling), June 9, 1974, Alt. 7,000 ft. leg. B. B. Dewan, DGC 74 and DGC 74a.

3. *Tricharia cretea* (Cooke) Boudier, *Hist. Class. Discom. d'Europe* : 58 (1907) *Apothecia* gregarious or more often densely crowded, reaching a diameter (Fig. 3A) of 1.3 cm., margin dentate, externally clothed with pale brown hairs, hymenium concave, reddish brown, outer surface covered with stiff reddish brown septate hairs (Fig. 3C) with swollen base tapering above into a bristle like apex,  $274 \mu$  long (Fig. 3B); *asci* cylindrical, tapering below,  $178 \times 10 \mu$ ; *ascospores* 1-seriate, ellipsoid, hyaline, without oil globule,  $17 \times 10 \mu$ ; *paraphyses* enlarged above, upto  $6.6 \mu$ .

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<sup>1</sup>Present address : Department of Botany, Presidency College, Calcutta-73.

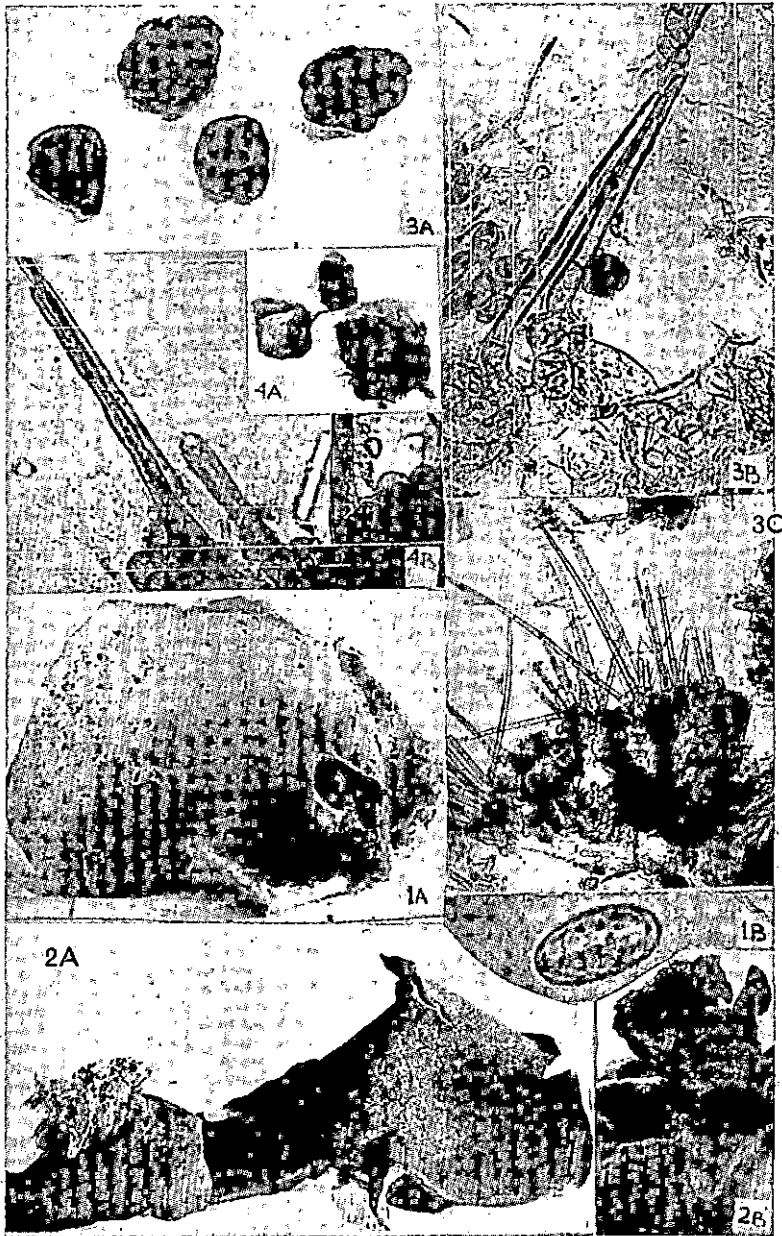


Fig. 1-4. 1A. *Peziza petersii* Apothecium  $\times 2$ ; 1B. *Peziza petersii* Ascospore  $\times 4000$ ; 2A. *Peziza cerea* Apothecia  $\times 2$ , 2B. *Peziza cerea* Apothecium on waste paper  $\times 2$ ; 3A. *Tricharia cretea* Apothecia  $\times 2$ ; 3B. *Tricharia cretea* Hairs  $\times 1276$ ; 3C. *Tricharia cretea* Sectional view of Apothecium showing bunch of Hairs  $\times 250$ ; 4A. *Tricharia gilva* Apothecia  $\times 2$ ; 4B. *Tricharia gilva* Hairs  $\times 1140$ .

Habitat : On plaster of walls.

Locality : Goody Road (Darjeeling), May 24, 1974, Alt. 7,000 ft. leg. B. B. Dewan, DGC 72 and DGC 72a.

4. *Tricharia gilva* Boudier, Icones mycologicae, Livraison 2 (1904) *Apothecia* sessile, disc flat, pale fawn, reaching 7 mm in diameter (Fig. 4A), margin dentate, outer surface covered with septate stiff reddish brown hairs with bulbous base, tapering to a rounded apex (Fig. 4B), upto  $200\mu$ ; *asci* no change in iodine,  $231 \times 13\mu$ ; *ascospores* elliptical, smooth-walled,  $17 \times 10\mu$ ; *paraphyses* slender,  $3.3\mu$  thick.

Habitat : On ground with mosses.

Locality:- Birch Hill (Darjeeling), April 24, 1974, Alt. 7,000 ft. leg. B. B. Dewan, DGC 70 and DGC 70a.

Department of Botany  
Darjeeling Govt. College  
Darjeeling.

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## RUST FUNGI OF EASTERN HIMALAYAS (INDIA)

by

A.K. Kar

Department of Botany, Presidency College, Calcutta (India)

and

B.B. Dewan

Department of Botany, Darjeeling Govt. College, Darjeeling (India)

### Summary

Seventeen rust fungi recorded for the first time from Eastern Himalayas (India) at an altitudinal range of 350 to 7,500 ft. have been described. They are: *Chaconia butleri* (Syd.) Mains; *Coleosporium campanulae* (Pers.) Lev.; *C. myriactidis* Syd.; *C. plectranthi* Barclay; *Phragmidium octoloculare* Barclay; *Puccinia arundinariae* Schw.; *P. caricis* (Schum.) Rebert; *P. colletiana* Barclay; *P. fagopyri* Barclay; *P. menthae* Pers.; *P. punctata* Link; *P. romagnoliana* Maire et Sacc.; *P. roscoae* Barclay; *P. urticae* Barclay; *Uromyces appendiculatus* (Pers.) Unger; *U. fabae* (Pers.) de Bary; *U. trifolii* (Hedw. f) Lev.

During a survey of fungi of Eastern Himalayas (India) seventeen rust fungi have been collected for the first time at an altitudinal range of 350 to 7,500 ft.. The specimens have been preserved dry after taking field notes. They have been worked out following standard techniques. The rust fungi are described below.

#### 1. *Chaconia butleri* (Syd.) Mains

*Symptoms:* lesions distributed on the under surface of leaf blade, orange coloured, irregularly scattered; *pustules* solitary, distinct, erumpent, powdery.

*Causal organism: uredospores echinulate, diameter 23.1  $\mu$  to 26.4  $\mu$ ; telia, pycnia and aecia not found.*

*Host: on leaves of Jasminum pubescens Willd.*

*Specimen studied: DGC 63; Sukna, altitude 359 ft.; April 9, 1975.*

## 2. *Coleosporium campanulae* (Pers.) Lev.

*Symptoms: lesions* characterized by orange coloured pustules distributed on the under surface of the leaves; *pustules* solitary distinct, erumpent, with severity of infection coalesce forming patches.

*Causal organism: uredospores ovoid, one-celled in chains, with spiny wall, 16.5  $\mu$  to 19.8  $\mu$  in diameter; teleutospores laterally united forming crust; 39.6  $\mu$  to 52.8  $\mu$   $\times$  16.5  $\mu$ ; internal promycelium in mature spores; pycnia and aecia not found.*

*Host: on leaves of Campanula colorata Wallich.*

*Specimen studied: DGC 123; Darjeeling; altitude 6,800 ft.; Sept. 15, 1976.*

## 3. *Coleosporium myriactidis* Syd.

*Symptoms: lesions* confined to the leaf sheath, principally on the under surface of the leaf blade, appear in the form of small typically orange coloured pustules, erumpent with age, scattered irregularly; *pustules* solitary, but with severity of infection they coalesce forming circular patches.

*Causal organism: uredospores ovoid, one-celled in chains with spiny wall, hyaline, 18  $\mu$  to 22  $\mu$  in diameter; teleutospores laterally united to form sub-circular crusts with internal promycelium 66  $\mu$  to 82  $\mu$   $\times$  16.5  $\mu$  to 20  $\mu$ ; pycnial and aecial stages not found.*

*Host: on leaves of Myriactis nepalensis Less.*

*Specimen studied: DGC 121, Sonada (Darjeeling); altitude 6,600 ft.; Sept. 10, 1976.*

## 4. *Coleosporium plectranthi* Barclay

*Symptoms: lesions* distributed irregularly on the lower surface of leaves; *pustules* solitary, distinct, scattered irregularly, orange coloured, powdery appearance.

*Causal organism:* uredospores one-celled in chains, outer spiny, 15.5  $\mu$  to 26.4  $\mu$  in diameter, hyaline; *teleutospores* crowded laterally within the subepidermal layer forming a crust, promycelium internal, one-celled, hyaline, 85.8  $\mu$  - 99  $\mu$   $\times$  9.9  $\mu$  - 13.2  $\mu$ ; *pycnial* and *aecial* stages not found.

*Host:* on leaves of *Plectranthus* sp.

*Specimen studied:* DGC 85; Darjeeling; altitude 6,800 ft.; SEpt. 25, 1974.

## 5. *Phragmidium octoloculare* Barclay

*Symptoms:* lesions distributed irregularly throughout the lower surface of leaf; *pustules* dark coloured, irregular in outline, 3-5 mm diameter, erumpent.

*Causal organism:* *teleutospores* many-celled, stalked, chocolate coloured, pedicel hyaline and enlarged towards the base; 92.4  $\mu$  - 115  $\mu$   $\times$  23  $\mu$  - 26.4  $\mu$ ; *uredia*, *pycnia* and *aecia* not found.

*Host:* on leaves of *Rubus rosaefolius* Smith.

*Specimen studied:* DGC 60; Jalapahar (Darjeeling); altitude 7,000 ft.; June 7, 1974.

## 6. *Puccinia arundinariae* Schw.

*Symptoms:* lesions distributed throughout both the surfaces of the leaves; *pustules* light brown, irregular, linear shaped, numerous, erumpent.

*Causal organism:* *teleutospores* produced on flat sori, pedicellate, two-celled mostly ellipsoidal or oblong-ellipsoid, wall 3.3  $\mu$  thick, 6.6  $\mu$  apically, pedicels colourless, 36  $\mu$  - 49.5  $\mu$   $\times$  20  $\mu$  - 23  $\mu$ ; Uredial, aecial and pycnial stages not found.

*Host:* on leaves of *Arundinaria intermedia* Muro.

*Specimen studied:* DGC 84; Darjeeling; altitude 6,800 ft.; March 12, 1975.

## 7. *Puccinia caricis* (Schum.) Rebert

*Symptoms:* lesions dark-brown, rounded, distributed irregularly on the lower surface of the leaf; *pustules* solitary, distinct erumpent, 0.5 mm in diameter.

*Causal organism: teleutospores* two-celled, thick-walled pedicel short and hyaline spores smooth, brown,  $49.5 \mu - 56 \mu \times 13.2 \mu - 16.5 \mu$ , constricted in the middle, apical cell prolonged; *uredia pycnia* and *aecia* not found.

*Host:* on leaves of *Carex cruciata* Wall.

*Specimen studied:* DGC 64; Darjeeling; altitu 6,800 ft., April 7, 1975.

#### 8. *Puccinia collettiana* Barclay

*Symptoms: lesions* distributed on the under surface of the leaf; *pustules* solitary, distinct, circular, red, 3-4 mm in diameter.

*Causal organism: aeciospores* in chains within the cup, surrounded by a light coloured peridium, smooth walled, hexagonal when in chain but spherical when free,  $16.5 \mu$  to  $23 \mu$  in diameter; *telial*, *uredial* and *pycnial* stages not found.

*Host: Rubia cordifolia* Linn.

*Specimen studied:* DGC 81; Darjeeling; altitude 6,800 ft., July 25, 1975.

#### 9. *Puccinia fagopyri* Barclay

*Symptoms: lesions* distributed irregularly on the under surface of the leaves; *pustules* minute, circular, brown, erumpent.

*Causal organism: teleutospores* dark-brown, smooth, two-celled, top cell blunt,  $26.4 \mu - 36.3 \mu \times 13 \mu - 16.5 \mu$ ; uredospores oval, brown with a thick echinulose wall, diameter  $16.5 \mu - 23 \mu$ ; *aecial* and *pycnial* stages not found.

*Host:* On leaves of *Fagopyrum dibotrys* (D. Don) Hara.

*Specimen studied:* DGC 76; Darjeeling; altitude 6,800 ft.; June 12, 1975.

#### 10. *Puccinia menthae* Pers.

*Symptoms: lesions* distributed irregularly on the under surface of the leaves; *pustules* minute, brown, circular, 0.5 to 1 mm in diameter, erumpent.

*Causal organism: uredospores* one-celled, spiny outer wall, elliptical, hyaline, 13.2 to  $19.8 \mu$  in diameter; *teleutospores* chocolate coloured,

two-celled, smooth walled oblong to ovate, attached to persistent stalk, both ends of the spores rounded with constriction at the septum,  $23.1 \mu - 26.4 \mu \times 19.8 \mu$ ; *pycnial* and *aecial* stages not found.

*Host*: on leaves of *Calamintha umbrosa* Benth.

*Specimen studied*: DGC 86; Mongpoo; altitude 6,000 ft.; June 15, 1975.

### 11. *Puccinia punctata* Link

*Symptoms*: lesions distributed on the under surface of the leaves, host tissue turning yellowish, lesions elevated and yellowish.

*Causal organism*: *aeciospores* orange-yellow surrounded by a light coloured peridium, borne in chains within the cup, spores when free spherical but while still in the cup are hexagonal,  $13.2 \mu$  to  $16.5 \mu$  in diameter; *uredial*, *telial*, *pycnial* and *aecial* stages not found.

*Host*: on leaves of *Galium* sp.

*Specimen studied*: DGC 80; Darjeeling; altitude 6,800 ft.; June 10, 1975.

### 12. *Puccinia romagnoliana* Maire & Sacc.

*Symptoms*: characteristic development of yellow to orange coloured pustules on the under surface of the leaf; *pustules* round.

*Causal organism*: *uredospores* single-celled, stalked, echinulate,  $16 \mu$  to  $19 \mu$  in diameter; *telial*, *uredial*, and *pycnial* stages not found.

*Host*: on leaves of *Cyperus rotundus* Linn.

*Specimen studied*: DGC 98; Ging (Darjeeling); altitude 6000 ft.; June 12, 1975.

### 13. *Puccinia roscoepae* Barclay

*Symptoms*: lesions confined to the under surface mainly along the margin of the leaf blade, older lesions blackish-brown with ruptured epidermis; *pustules* solitary, distinct, orange coloured lenticular to irregular, slightly erumpent with age, scattered irregularly on the under surface of the leaf blade.

*Causal organism*: *teleutospores* yellowish-orange, two-celled thick-walled, slightly constricted at the septum, pedicellate,  $20 \mu$  to  $40 \mu \times 10 \mu$  to  $13.2 \mu$ ; *uredial*, *pycnial* and *aecial* stages not found.

*Hosts: Cautleia lutea* Royle; *Globba hookeri* Clarke; *Hedychium acuminatum* Roscoe.

*Specimens studied:* DGC 32, 33, 34; Birch hill (Darjeeling); altitude 7,500 ft.; Sept. 15, 20, 26, 1974.

#### 14. *Puccinia urticae* Barclay

*Symptoms: lesions* appear on the lower surface of the leaves, slightly elevated, yellowish.

*Causal organism: aecium* colourless 313  $\mu$  - 363  $\mu$  in diameter, aecial cup partly within the leaf tissue and partly projecting above it; peridium light coloured; *aeciospores* borne in chains within the cup, angular, 16.5 - 23  $\mu$  in diameter, colourless, smooth walled; *telial, uredial, and pycnial* stages not found.

*Host:* on leaves of *Urtica parviflora* Roxb.

*Specimen studied:* DGC 61; Darjeeling; altitude 6,800 ft.; Jan. 12, 1975.

#### 15. *Uromyces appendiculatus* (Pers.) Unger

*Symptoms: lesions* appear on the under surface of leaf; pustules compact, black, 3-4 mm in diameter, circular.

*Causal organism: teleutospores* one-celled, subglobose, at the apex which has a hemispherical hyaline papilla, smooth-walled, chestnut brown, stalk about equal to the spore length, 26.4  $\mu$  - 29.7  $\mu$   $\times$  19.8  $\mu$  - 23.1  $\mu$ ; *uredial, pycnial, and aecial* stages not found.

*Host:* on leaves of *Phaseolus vulgaris* Linn.

*Specimen studied:* DGC 82; Darjeeling; altitude 6,800 ft.; June 25, 1975.

#### 16. *Uromyces fabae* (Pers.) de Bary

*Symptoms: lesions* elevated, light yellow, borne on or under surface of leaves; *pustules* light-yellow, rounded.

*Causal organism: aeciospores* surrounded by light coloured short cup-shaped peridium, spores in chains within the cup, hexagonal, smooth-walled, 13  $\mu$  to 16.5  $\mu$  in diameter; *telia, uredia* and *pycnia* not found.

*Host:* on leaves of *Pisum sativum* Linn.

*Specimen studied:* DGC 83; Darjeeling; altitude 6,800 ft.; Jan. 12, 1975.

17. *Uromyces trifolii* (Hedw. f) Lev.

*Symptoms:* lesions distributed irregularly on both surfaces of leaves; pustules solitary, 1-2 mm in diameter, dark-brown.

*Causal organism:* teleospores brown, one-celled, smooth and thick walled, stalked, spores bear apical hyaline papilla, after detachment of spores stalks remain in the sorus, stalks almost equal to the spore length, 16.6  $\mu$  to 23.1  $\mu$  in diameter, *uredia*, *pycnia*, *aecia* not found.

*Host:* on leaves of *Trifolium repens* L.

*Specimens studied:* DGC 75; Darjeeling, altitude 6,800 ft.; June 12, 1975.

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