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GYMNOMYCES MONOSPORUS SP. NOV.

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The genus *Gymnomyces* is differentiated from others in the astrogastraceous Gasteromycetes by having amyloid spore ornamentation and sphaerocysts in the mediostratum of the tramal plates but lacking both latex and a stipe columella. Seven species have hitherto been found in North America (Singer & Smith 1960). In western Oregon we recently collected a strikingly distinct, new species.

Colors of sporocarps were determined by use of Ridgway (1912), but color names are given as the ISCC-NBS near synonyms (Kelly & Judd 1955). Anatomical features were described from sections mounted in 5% KOH, Melzer's reagent, and cotton blue-lactic acid. Collections are deposited in the Mycological Herbarium of Oregon State University (OSC).

GYMNOMYCES MONOSPORUS Stewart & Trappe sp. nov. Figs. 1-2.

Fructificationes vivae 9-25 x 9-35 mm, subglobosae vel irregulares. Peridium persistens, levis, album, dein roseum vel roseo-brunneum. Gleba lutea, columella nulla. Sporae 15-21 x 12-18 μ m, subglobosae vel ellipsoideae, spinis 1.5-3(-5) x 0.5-1 μ m. Basidia monospora, 30-35 x 11-16 μ m. Cystidia 35-47 x 7-12 μ m. Holotypus: Oregon, Benton County, Trappe 3979 (OSC).

Sporocarps 9-25 x 9-35 mm fresh, 7-19 x 7-29 mm as

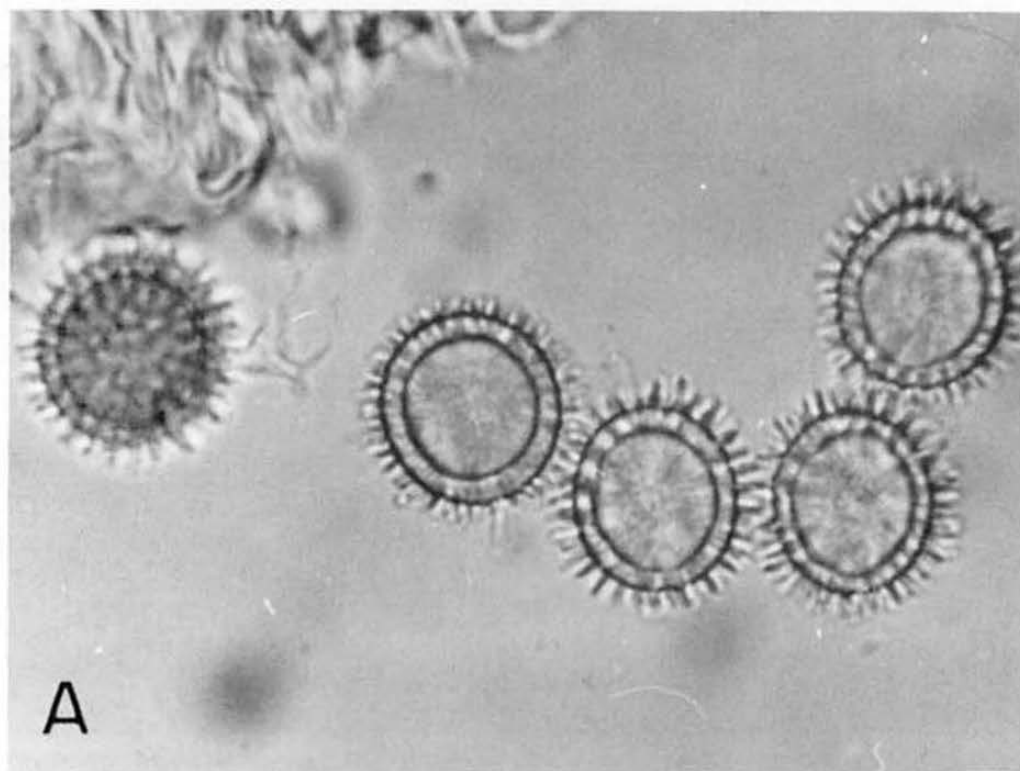
dried, subglobose to irregular, depressed at the base. *Peridium* thin, persistent, felty-smooth to alveolate (depressed over glebal chambers), white, staining pink to grayish red where bruised, drying light brown, not reacting to 5% KOH, 5% FeSO₄, ethanol, or Melzer's reagent. Gleba pale yellow in youth, becoming light orange yellow and, at maturity, dingy orange yellow, drying light yellowish brown; chambers 0.2-0.5 mm diam, rotund; columella lacking, but one to several narrow, sterile veins radiating from sporocarp base. Odor fragrant.

Spores 15-21 x 12-18 μm excluding ornamentation, subglobose to broadly ellipsoid. Walls 1.5-2(-3) μm thick, pale yellow in KOH, dull yellow in Melzer's reagent (walls nonamyloid), cyanophilous in cotton blue-lactic acid. Ornamentation of hyaline rods and spines 1.5-3(-4) x 0.5-1 μm, occasionally with light to heavy amyloid deposits near the base as dots or collars (the amount of amyloid deposits varying markedly from spore to spore), strongly cyanophilous in cotton blue-lactic acid; sterigmal appendage 3-4 x 2-3 μm, inconspicuous, often with a basal amyloid collar.

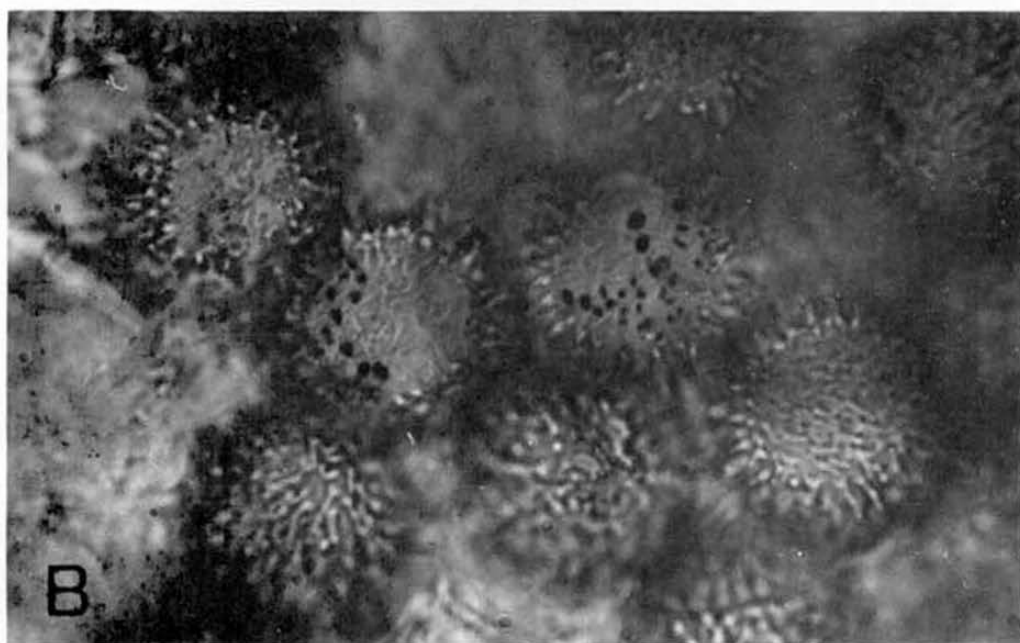
Basidia 30-35 x 11-16 μm, thin-walled, broadly clavate, with a single, prominent sterigma, mostly with granular content in KOH. *Cystidia* 35-47 x 7-12 μm, obtuse-ventricose, thin-walled, with granular content in KOH, scattered, extending 12-25 μm beyond other hymenial elements. *Brachybasidioles* 25-35 x 14-19 μm, thin-walled, the contents clear in KOH. *Subhymenium* of 1-3 tiers of sphaerocyst-like cells mostly 9-25 x 6-15 μm. *Tramal mediostratum* of subparallel hyphae 2-5 μm diam with scattered single to clustered sphaerocysts. *Peridium* 150-300 μm thick, of interwoven, hyaline hyphae 2-3(-4) μm diam, sphaerocysts scattered in tissue adjacent to gleba; no clamp connections found.

HOLATYPE: Oregon, Benton County, T. 13 S., R. 6 W., NW $\frac{1}{4}$ of SW $\frac{1}{4}$ Sec. 31, hypogeous in old roadbed in woods of 20-30 year-old *Pseudotsuga menziesii* (Mirb.) Franco; 23 July 1974, Trappe 3979 (OSC). **PARATYPE:** Same location as holotype; 23 July 1974, Stewart 2004 (OSC).

Gymnomyces monosporus is the only species of the genus with exclusively one-spored basidia. In addition, it has larger spores than any other species currently assigned to the genus. One other large-spored species, *G. roseo-maculatus* Singer & Smith, is reported to stain pink where bruised. The two species can be readily separated by these



A



B

Fig. 1. *Gymnomyces monosporus* spores, x 1,000 in Melzer's reagent: (A) Optical cross-section; (B) Surface view showing amyloid deposits.

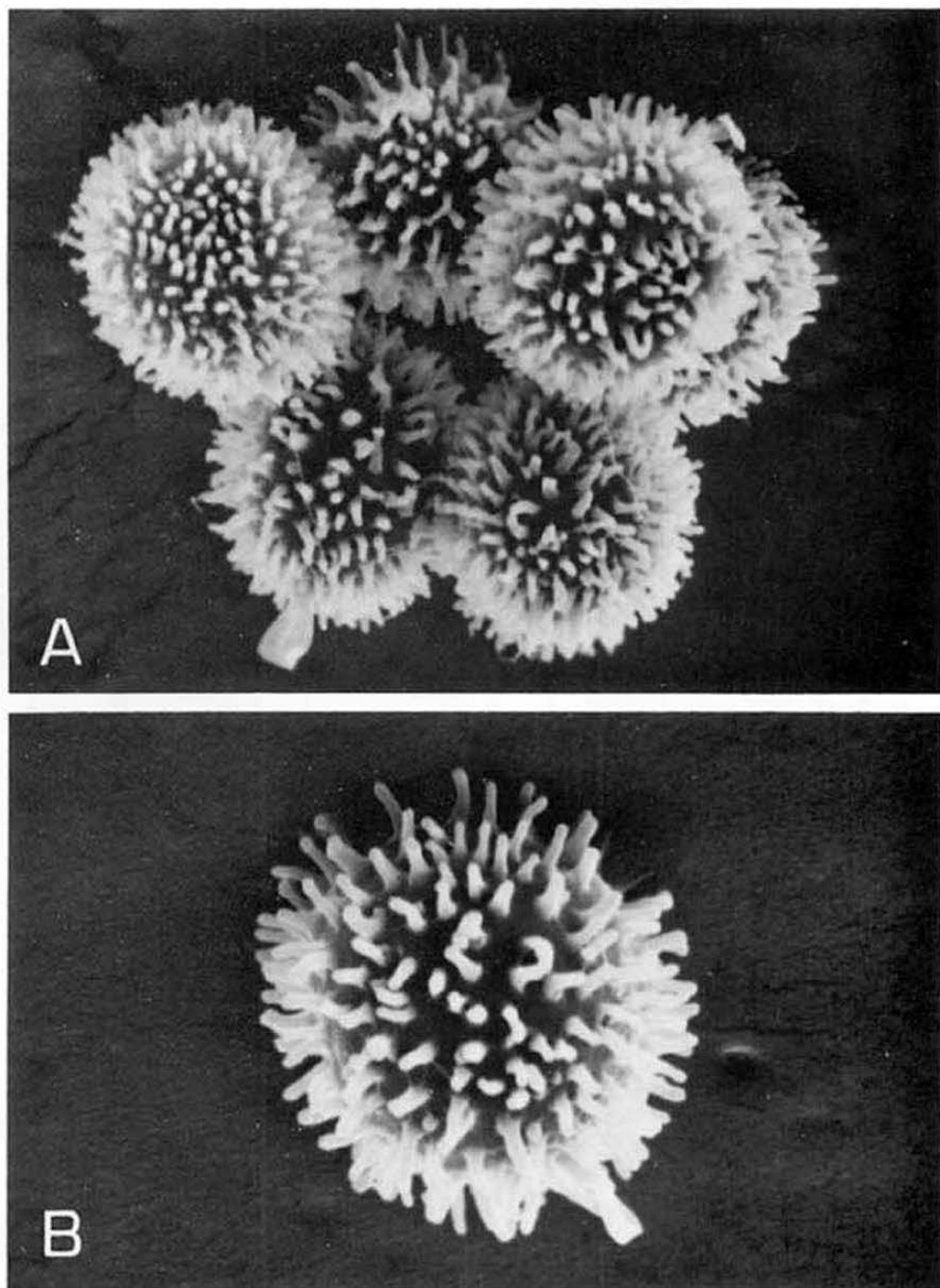


Fig. 2. *Gymnomycetes monosporus* spores, scan electron micrographs: (A) Spore group, x 2,000; (B) Single spore, x 3,000.

characters, as described earlier in this paper and by Singer & Smith (1960), respectively:

	<i>G. monosporus</i>	<i>G. roseomaculatus</i>
Spores per basidium	1	2
Spore size	15-21 x 12-18 μm	14-17 x 12-16 μm
Spore ornamentation	1.5-3(-4) x 0.5-1 μm	1-1.5 x 0.6-1 μm
Spore wall thickness	amyloid deposits at base of some 1.5-2(-3) μm	strongly amyloid thin

This study was supported in part by National Science Foundation Grant GB27378.

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GENICULIFERA RIFAI NOM. NOV.

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SUMMARY

Since Genicularia Rifai & R.C. Cooke 1966 represents a later homonym of the algal generic names Genicularia de Bary 1858 and Genicularia Rouss. ex Desv. 1808, the new name Geniculifera Rifai is proposed to replace it. Key to the species accepted in this genus is presented and seven new combinations are made.

Dr. Barbara L. Newton of the Michigan State University kindly drew my attention to the fact that Genicularia Rifai & R.C. Cooke 1966 is a later homonym of the algal generic name Genicularia de Bary 1858, which currently is used in phycological literatures. In studying this matter it turns out that there is another algal genus Genicularia Rouss. ex Desv. 1808 which de Toni (1905) reduced to the synonymy of Audouinella Bory 1823. Whether or not Genicularia de Bary will have to be conserved should be decided by students of algae, but it is obvious that Genicularia cannot be used for certain species of nematode trapping Hyphomycetes. Consequently the new generic name Geniculifera Rifai is proposed here to accommodate those species which Rifai & Cooke (1966), Rifai (1968), Barron (1968) and Barnett & Hunter (1972) classified in Genicularia.

In contrast with the much adopted practice of recognizing genera of Hyphomycetes based solely on the number of spore septation, Rifai (1968) widened the generic limits of Genicularia to cover not only the species with two-celled conidia but also those with many septate conidia. Geniculifera is intended to encompass this emended generic concept, a description of which is presented below.

GENICULIFERA Rifai, nom. nov.

Genicularia Rifai & R.C. Cooke in Trans. Brit. mycol. Soc. 49 : 153. 1966, emend. Rifai in Reinwardtia 7 : 366. 1968; Barron, Gen. Hyphom. Soil : 169. 1968; non Genicularia de Bary, Unters. Fam. Conjug. (Zygnem. & Desmid.) : 26. 1858; nec Genicularia Rouss. ex Desv., Journ. Bot. 1 : 143. 1808.

In pure culture colonies grow quite rapidly, effused, pale

pink to whitish. Mycelium composed of septate, hyaline, smooth walled, branched hyphae which mostly form thin and sparse mat over the surface of the media, with scanty aerial growth. Conidiophores arise from creeping or submerged hyphae, hyaline, smooth walled, septate, erect or ascending, at first straight, becoming geniculate or flexuous, elongating—sometimes considerably—by repeated subapical renewal of growth. Conidiogenous cells terminal, integrated, generally polyblastic, sympodial and geniculate, with broad, terete or hardly conical denticles of various length. Conidia solitary, acrogenous on young conidiophores, later acropleurogenous, short obpyriform, obpyriform to obovoid-turbinate or broadly fusoid ellipsoidal, 1—many-septate, the basal cell usually obconical and truncate, hyaline when viewed singly but appearing pale pinkish white in mass, smooth walled.

Habitat and distribution: mostly capturing and parasitizing nematodes by means of various kinds of traps in soil or debris, cosmopolitan.

Type species: Trichothecium cystosporium Duddington.

KEY TO RECOGNIZED SPECIES OF GENICULIFERA

- 1a. Conidia typically 1-septate 2
 b. Conidia typically 1-many-septate 4
 2a. Conidia sparsely formed on each conidiophore, narrowly obpyriform, 24—40x12—19 μ m G. paucispora
 b. Conidia profusely formed on each conidiophore, obpyriform 3
 3a. Conidia 24—32.5x12.5—20 μ m; trapping apparatus consists of adhesive three-dimensional system of organ G. cystosporia
 b. Conidia 24—35x18—25 μ m; trapping apparatus consists of adhesive, simple lateral branch G. perpasta
 4a. Conidia 1—3 (mostly 2)-septate 5
 b. Conidia 1—4 (mostly 3)-septate 6
 5a. Conidia broadly obclavate, often unequal sided to slightly curved, 25—40x7.5—19 μ m G. clavispora
 b. Conidia obpyriform, 32.5—50x14—22.5 μ m G. bogoriensis
 6a. Conidia fusoid, 46—71x21—29 μ m G. psychrophila
 b. Conidia obovoid turbinate, 37—55x21—35 μ m ... G. eudermata

Geniculifera paucispora (R.C. Cooke)

Rifai, comb. nov.

Genicularia paucispora R.C. Cooke apud Rifai & R.C. Cooke in Trans. Brit. mycol. Soc. 49: 157. 1966 (basionym).

Geniculifera cystosporia (Duddington)

Rifai, comb. nov.

Trichothecium cystosporium Duddington in Trans. Brit. mycol. Soc. 34: 600. 1951 (basionym). — Arthrobotrys cystosporia

(Duddington) Mektieva in Dokl. Akad. Nauk azerb.SSR.20(6): 70. 1964 (ut Arthrobotrys cystosporium). — Genicularia cystosporia (Duddington) Rifai & R.C. Cooke in Trans. Brit. mycol. Soc. 49: 154. 1966.

Geniculifera perpasta (R.C. Cooke) Rifai, comb. nov.

Genicularia perpasta R.C. Cooke apud Rifai & R.C. Cooke in Trans. Brit. mycol. Soc. 49: 156. 1966 (basionym).

Geniculifera clavispora (R.C. Cooke) Rifai, comb. nov.

Dactylaria clavispora R.C. Cooke in Trans. Brit. mycol. Soc. 47: 307. 1964 (basionym). — Genicularia clavispora (R.C. Cooke) Rifai in Reinwardtia 7: 367. 1968.

Geniculifera bogoriensis (Rifai) Rifai, comb. nov.

Monacrosporium cystosporum R.C. Cooke & Dickinson in Trans. Brit. mycol. Soc. 48: 623. 1965 (basionym). — Genicularia bogoriensis Rifai in Reinwardtia 7: 367. 1968; non Genicularia cystosporia (Duddington) Rifai & R.C. Cooke, nec Geniculifera cystosporia (Duddington) Rifai.

Geniculifera psychrophila (Drechs.) Rifai, comb. nov.

Dactylaria psychrophila Drechs. in Mycologia 36: 161. 1944 (basionym). — Monacrosporium psychrophilum (Drechs.) R.C. Cooke & Dickinson in Trans. Brit. mycol. Soc. 48: 622. 1965 — Genicularia psychrophila (Drechs.) Rifai in Reinwardtia 7: 367. 1968.

Geniculifera eudermata (Drechs.) Rifai, comb. nov.

Dactylaria eudermata Drechs. in Mycologia 42: 40. 1950 (basionym). — Monacrosporium eudermatum (Drechs.) Subram. in J. Indian bot. Soc. 42: 293. 1963. — Genicularia eudermata (Drechs.) Rifai in Reinwardtia 7: 367. 1968.

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NEW XANTHOPARMELIA (LICHENES: PARMELIACEAE)
RECORDS FROM NEW MEXICO

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Summary

Xanthoparmelia ajoensis and *X. wyomingica* are reported for the first time from New Mexico, and new localities for *X. psoromifera* are listed. The new combinations *Xanthoparmelia ajoensis* (Nash) Egan, *Xanthoparmelia tucsonensis* (Nash) Egan, and *Xanthoparmelia huachucensis* (Nash) Egan are made.

The southwestern United States has a great diversity of *Xanthoparmelia* species. Egan (1972) and Nash (1974a) report a total of 16 taxa for New Mexico. This paper reports two additional *Xanthoparmelia* species for New Mexico and lists new localities for *X. psoromifera* (Kurok.) Hale. All specimens cited are deposited in my private herbarium at Texas A&M University and many duplicates have been distributed. Nomenclature follows recent changes proposed by Hale (1974).

1. *XANTHOPARMELIA AJOENSIS* (Nash) Egan, comb. nov. Basionym: *Parmelia ajoensis* Nash, Bryologist 77: 234. 1974.

While studying recent collections of *Xanthoparmelia* from New Mexico, I found specimens of *X. ajoensis* from the Manzano Mountains southeast of Albuquerque. Nash (1974b) reported only two localities for this species, one from Arizona (holotype) and one from the state of Sonora in Mexico (paratype). The collection listed below represents the third reported locality and greatly extends the known range of this species.

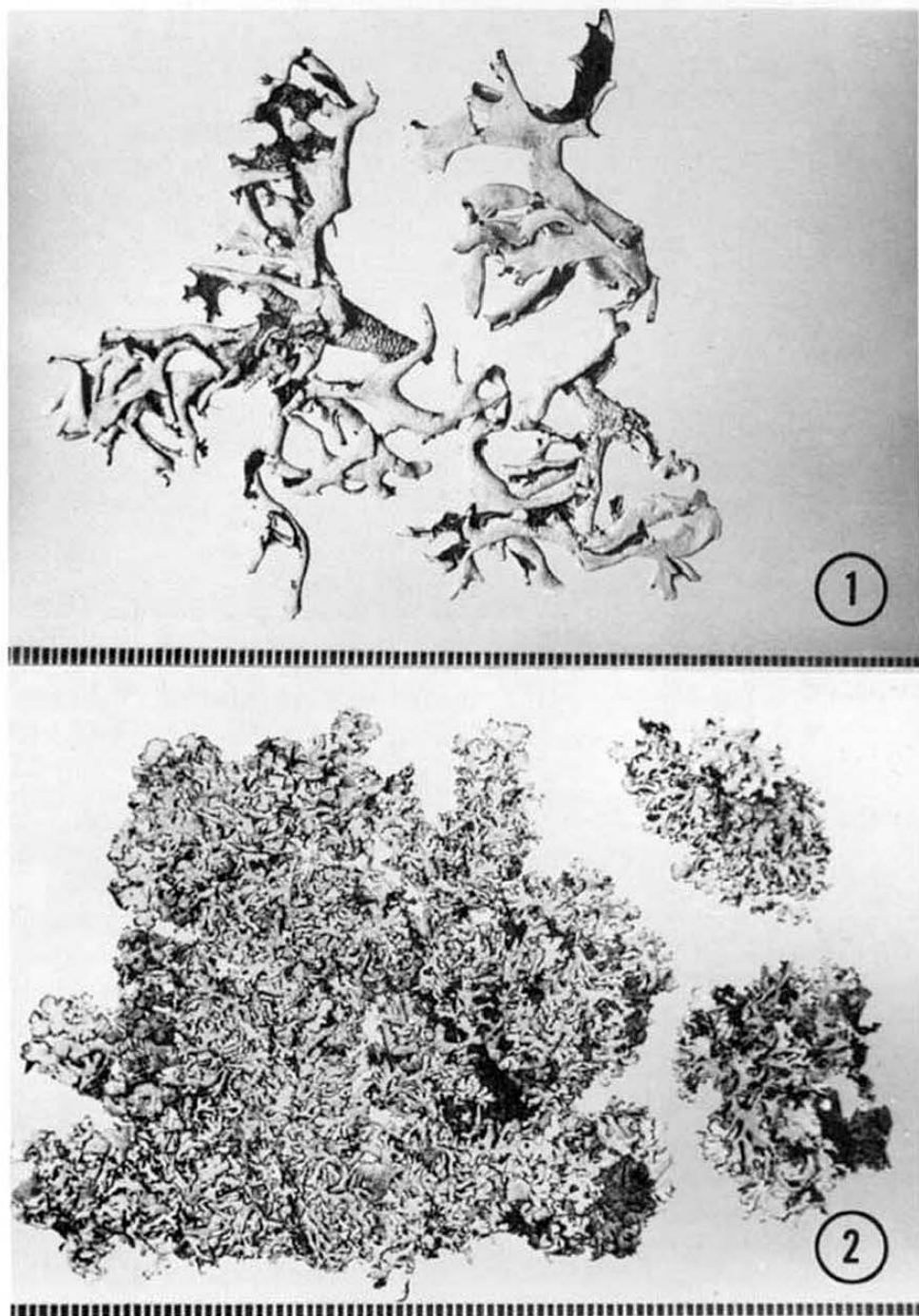
X. ajoensis (Fig. 3) is characterized by the presence of isidia, a pale to brown lower cortex and the occurrence of diffractaic acid in the medulla. Diffractaic acid in the New Mexico material was detected by thin-layer chromatography following the methods outlined in Culberson (1972). TLC plates show the presence of two unknown compounds accompanying the usnic and diffractaic acids. A strong CK+ orange medullary reaction as described by Dey (1974) from *Parmelia diffractaica* is easily seen in the specimens of *Xanthoparmelia ajoensis* from New Mexico.

Diffractaic acid is known from only one other *Xanthoparmelia* species, *Xanthoparmelia tucsonensis* (Nash) Egan, comb. nov. (Basionym: *Parmelia tucsonensis* Nash, Bryologist 77: 234. 1974) This species lacks the isidia characteristic of *X. ajoensis* and is known from only the type locality near Tucson, Arizona.

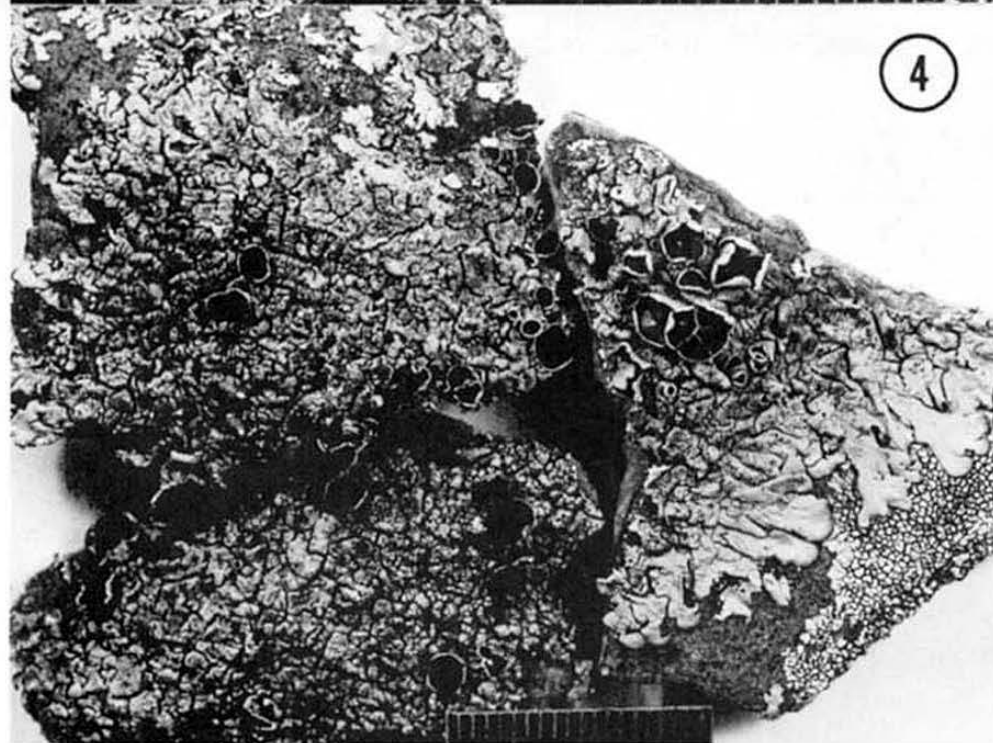
Specimen seen. New Mexico. TORRANCE COUNTY: vicinity of Fourth of July Campground, Cibola National Forest, Manzano Mountains, 2 miles northwest of Tijuque, elev. 7,400 ft., on microcrystalline limestone, August 1970, Egan EL-6823.

2. *XANTHOPARMELIA WYOMINGICA* (Gyeln.) Hale, Phytologia 28: 490. 1974. *Parmelia digitulata* var. *wyomingica* Gyeln., Ann. Mycol. 36: 277. 1938.

X. wyomingica has a growth form and chemistry similar to *X. chlorochroa* (Tuck.) Hale but seems to represent a high elevation counterpart in the Rocky Mountains. It is most abundant on soil and rocks above timberline and is the most frequently collected *Xanthoparmelia* in the alpine zone of New Mexico and Colorado. *X. chlorochroa* and *X. wyomingica* are seldom sympatric since *X. chlorochroa* normally occurs at lower altitudes on bare soil on the grasslands of the Great Plains. However, I have discovered populations of both species on soil in a high mountain valley near Dillon, Colorado. Figs. 1 and 2 show representative specimens of *X. wyomingica* and *X. chlorochroa* from New Mexico. *X. wyomingica* is generally characterized by very narrow lobes which are discrete when collected on soil or alpine vegetation but are often matted when collected on rocks. The species lacks isidia and the lower surface ranges from tan to dark brown. Usnic and salazinic acids are always present.



Figures 1-2. *Xanthoparmelia* from New Mexico: 1, *X. wyomingica* (Gyeln.) Hale; 2, *X. chlorochroa* (Tuck.) Hale. Scale is in mm.



Figures 3-4. *Xanthoparmelia* from New Mexico: 3, *X. ajoensis* (Nash) Egan; 4, *X. psoromifera* (Kurok.) Hale. Scale is in mm.

The salazinic acid producing, non-isidiate *Xanthoparmelia* taxa represent a highly variable group in the southwestern United States, and many of the species intergrade. Much more work must be done before all taxa are satisfactorily characterized.

Specimens seen. New Mexico. SANTA FE COUNTY: Lake Peak, 11 miles northeast of Sante Fe, alpine tundra, elev. 12,300 ft., *Egan* EL-1325A, EL-1609, EL-2527; the same, *Mitchell* (HERB. EGAN); TAOS COUNTY: La Cal Basin, 1.5 miles north of Wheeler Peak, alpine tundra, elev. 12,400 ft., *Egan* EL-1202, EL-2347, EL-2388; the same, *Mitchell* (HERB. EGAN).

3. *XANTHOPARMELIA PSOROMIFERA* (Kurok.) Hale, *Phytologia* 28: 488. 1974. *Parmelia psoromifera* Kurok., *Bull. Nat. Sci. Mus. Tokyo* 10: 374. 1967.

Hale (1967) reported a single collection of *X. psoromifera* (Fig. 4) from the United States from a locality north of Espanola, New Mexico. Since that report I have made several other collections of *X. psoromifera* in the state. Thin-layer chromatography of all specimens shows the presence of usnic, psoromic, and conpsoromic acids. The lower surface of *X. psoromifera* is tan to brown, and the species lacks isidia of the chemically similar *X. kurokawae* (Hale) Hale. *Xanthoparmelia huachuensis* (Nash) Egan, comb. nov. (Basionym: *Parmelia huachuensis* Nash, *Bryologist* 76: 214. 1973) is chemically and morphologically similar but has a black lower cortex. All species grow on rocks.

Specimens seen. New Mexico. LINCOLN COUNTY: 2 miles east of Capitan, elev. 6,400 ft., on quartzite, *Egan & Shushan* EL-2436, EL-2437; RIO ARRIBA COUNTY: south of San Antonio Mountain about 12 miles north of Tres Piedras; elev. 8,700 ft., on basalt, *Egan* EL-6826; TAOS COUNTY: about 7 miles southeast of Tres Piedras, elev. 7,400 ft., on basalt, *Egan* EL-6829.

Acknowledgements

I thank Dr. Thomas Nash, III for his verification of *Xanthoparmelia ajoensis*, Dr. Mason E. Hale, Jr. for his comments on the manuscript, and Mr. Andrew Raiford for identification of the rock types.

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THE MYXOMYCETES OF COSTA RICA¹

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SUMMARY

This is the first comprehensive paper on the Myxomycetes of Costa Rica encompassing a total of 91 species collected in that country between 1963 and 1967 by the second author and including a few specimens collected by others at approximately the same period of time. No new species are described but a few of those included have been rarely collected before anywhere. Thus, the specimen of Badhamia cinerascens Martin, is the second world collection of that species, and that of Lamproderma muscorum (Lev.) Hagelst. is one of the most typical of the species ever found. Other interesting finds include: Ceratiomyxa morchella Welden, Tubifera bombardata (Berk & Br.) Martin, Comatricha subcaespitosa Peck, the second collection of this species from the tropics, Physarum citrinum Schum. and Physarum dictyosporum Martin, the first collection of

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this species outside the United States.

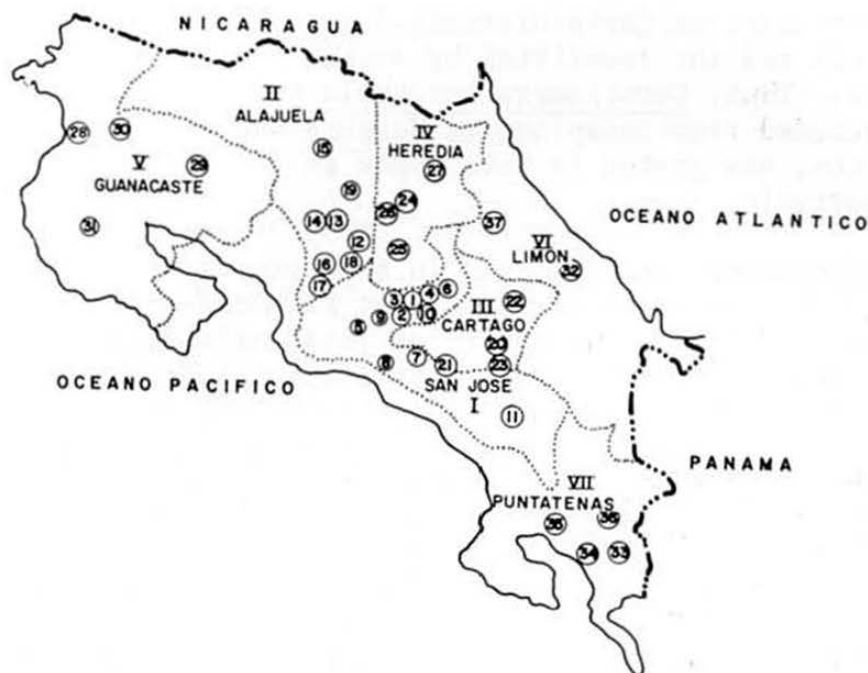
The genus Diachea is transferred to the Didymiaceae, following Farr's (1974) suggestion, supported by Blackwell's (1973, 1974) work.

INTRODUCTION

Relatively little is known about the Myxomycetes of Costa Rica. Although a few specimens have been collected in that country from time to time, most mycologists had largely neglected these organisms until Martin and Welden undertook an expedition to Panama and Costa Rica in the summer of 1952 and Welden (1954) published a list of Myxomycetes from these two countries in which he also included specimens which had been collected in Costa Rica by C. W. Dodge. Welden's paper lists 15 species from Costa Rica.

In 1963 a systematic study of the Myxomycetes of Costa Rica was begun by us, the second author being largely responsible for the collection of the specimens and the first largely responsible for their identification. Some specimens collected by Dr. George Carroll in 1962, by Dr. Bernard Lowy in 1964 and by Dr. E. F. Morris in 1966 are also included. A few of the specimens recorded were developed in moist chamber culture on tree bark, dead herbaceous stems, or other debris collected in Costa Rica by Dr. G. C. Carroll in 1964 and subsequently cultured at the University of Texas. The second author has continued collection, identification and moist chamber culture work and a second report will eventually be published elsewhere.

It will be noted that certain common species in such genera as Licea, Calomyxa, and Echinostelium, are absent from our list. These genera consist mainly of species with minute sporophores which are usually not detected in the field. Inasmuch as extensive moist chamber culture work was not undertaken in connection with this project such species were not observed. The classification adopted here is that of Alexopoulos (1973). Names of species are according to Martin and Alexopoulos (1969) and are arranged in alphabetical order under each genus. In the list of species reported below the collection locations are recorded with reference to the map (Figure 1) in which



I. SAN JOSE

1. San Pedro, Sabanilla, Cinco Esquinas, San Ramon de Tres Rios
2. Los Juncales
3. Electriona
4. Rio Claro
5. Villa Colon
6. San Isidro de Coronado
7. Santa Maria de Dota
8. San Marcos de Tarrazu
9. Santa Ana
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37. Guapiles

VII. PUNTARENAS

33. Coto 47

34. Golfito

35. Palmar Sur

36. San Vito de Java

Figure 1. Map of Costa Rica showing provinces (Roman numerals) and localities (Arabic numerals) where specimens were collected.

the provinces of Costa Rica are designated by Roman numerals and the localities by Arabic numerals in parenthesis. Thus, Ceratiomyxa morchella Welden, for example, is recorded from Sarapiquí of Heredia and from Siquirres of Limon, designated in this paper as IV (27) and VI (32) respectively.

Specimens are deposited in the myxomycete collection of the University of Costa Rica at San José under UCR numbers and in the University of Texas Myxomycete Collection (TEX) under UTMC numbers. Of a total of 91 species in this collection, 12 are listed by Welden from Costa Rica. Three of Welden's species, Badhamia decipiens (now Physarum decipiens), Diderma chondrioderma, and Comatricha aequalis are not included in our collection but are listed in this paper for the sake of completeness. This brings the total number of species now reported in the literature from Costa Rica to 94. In the list of species that follows, those preceded by an asterisk (*) have been reported from Costa Rica by Welden (1954). All others are new records for that country². No attempt was made to search the world herbaria for Costa Rican myxomycete specimens. It is probable that a number of additional species could be recorded if that were to be done.

LIST OF SPECIES

Subclass CERATIOMYXOMYCETIDAE Martin
In Ainsworth, Dict. Fungi, ed 5, 497. 1961.

Order C E R A T I O M Y X A L E S Martin, N. Am. Flora
1 (1):5. 1949.

Family CERATIOMYXACEAE Schroet., in Engler & Prantl,
Nat. Pfl. 1 (1):15. 1889.

²Most of the Costa Rica records in Martin and Alexopoulos (1969) refer to specimens in this collection.

Ceratiomyxa Schroet. in Engler & Prantl, Nat. Pfl. 1 (1): 16. 1889.

*1. Ceratiomyxa fruticulosa (Mull.) Macbr., N. Am. Slime-Moulds 18. 1899.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widespread and abundant. I (1), UCR-60 (TEX 418), 24 VI 1963; (7), UCR-127 (TEX 422), 9 VIII 1963; (8), UCR-259 (TEX 423), 5 XI 1964; (11), UCR-236 (TEX 424), 16 X 1964. III (21), UCR-66 (TEX 419), 28 VI 1963. IV (25), UCR-91 (TEX - specimen lost), 17 VII 1963. V (28), UCR-90 (TEX 420), UCR-95 (TEX 421), 19 VII 1963. VI, Welden, p. 96. All on dead wood.

COMMENTS: All specimens are typical of the species in the morphology of their fructifications and all but UCR-259 are of the arborescent type. In UCR-259 the fructification is sessile, the branches are very short, and the whole structure approaches the well-known porioides type. UCR-60, 90, and 259 are yellowish; all others are white. UCR-158 is an extensive group of robust, well-developed sporophores. The over-all range of spore dimensions is 6.5-7.5 μm . Many of the spores are oval to subglobose. In UCR-259 the spores are in the upper part of the over-all size range given above.

2. Ceratiomyxa morchella Welden Mycologia 46:94, 1954.

KNOWN WORLD DISTRIBUTION: Panama, Honduras (TEX), Surinam, Venezuela, Puerto Rico, Florida (TEX).

COSTA RICA: IV (27), UCR-153 (TEX 426), 24 XI 1963. VI (32) UCR-225 (TEX 427), 2 X 1964. Both on dead wood.

Most of the fructifications in UCR-153 are typically morchelloid. The spores are 6-7.5 x 7.5-10.5 μm . UCR-225, however, consists of one stipitate, morchelloid fructification, 3 sessile, circular somewhat flattened fruiting bodies, and one larger body 4.5 x 1 mm at its widest point which closely resembles the porioides form of C. fruticulosa. Furthermore, in spite of the fact that the range in spore size does not differ appreciably from what is expected, the majority of spores are in the upper limits of the range. It will be recalled that this was also the

case with C. fruticulosa UCR-259 which approached the porioides form.

Specimens like UCR-225 cast some doubt on the validity of C. morchella as a good species, but until many more collections are available for extensive comparative studies, it is thought best to recognize the species.

Contrary to C. fruticulosa, C. morchella and C. sphaerosperma have been found only in wet, hot lowlands (100-300 m).

*3. Ceratiomyxa sphaerosperma Boedjin, Misc. Zool. Sumatrana 24:1, 1927.

KNOWN WORLD DISTRIBUTION: Sumatra, Krakatoa, Panama Canal Zone, Dominica, Jamaica, Brazil, ?Spain.

COSTA RICA: IV (27), UCR-319 (TEX 1451), 10 VI 1966. On dead wood. VI, Castilla, C. W. Dodge 9238, 23 VII 1936.

The fructifications are typical of the species. The spores are spherical or subspherical, 6-7 μ m diam.

Subclass MYXOGASTROMYCETIDAE Martin

In Ainsworth, Dict. Fungi, ed. 5. 497. 1961. Emend Ross, Mycologia 65:483. 1973.

Order L I C E A L E S Jahn, in Engler & Prantl, Nat. Pfl., ed. 2, 2:319. 1928.

Family RETICULARIACEAE Rost, Versuch 6. 1873 (as Tribus).

Tubifera J. F. Gmelin, Syst. Nat. 2:1472. 1791.

1. Tubifera bombardata (Berk. et Br.) Martin, Brittonia 13: 210. 1961.

KNOWN WORLD DISTRIBUTION: Ceylon, Malaya, Sumatra, Philippines (TEX 1682), Puerto Rico, Jamaica, Brazil.

COSTA RICA: I (1), UCR-126 (TEX 431), 7 VIII 1963. II (22) UCR-193 (TEX 438), leg.: B. Lowy, 25 VI 1964; (21) UCR-257 (TEX 437), 6 XI 1964. All on dead wood.

The sporangia of UCR-193 are typical and the pseudo-capillitial bristles bear the spine-like protuberances; the spores measure 6-6.5 μm and their surfaces are definitely reticulate. UCR-126 and 257 represent an interesting variant. We place them here chiefly because of their long stipes on which the sporangia are borne. The fructifications, up to 5 mm tall, consist of from 7 to 20 sporangia, all on long stalks which are firmly united 2/3 to 3/4 of their length, but are separate at the top. The sporangia are ovate-cylindrical, with membranous peridia which are evanescent at the top. No pseudocapillitium is evident in any of the sporangia examined. Even those in which the peridium is still intact contain no bristles or other material except spores. Martin (1961) in reducing Alwisia to a synonym of Tubifera, noted that a Jamaican specimen at IF and IA lacks bristles. The spores of UCR-257 are definitely reticulate over most of the surface exhibiting a broken reticulation over about 1/4 of the wall. They measure 6.5-7 μm in UCR-126 and 6-6.75 μm in UCR-257. Dr. Martin, who kindly examined UCR-257, concurred with our determination.

2. Tubifera ferruginosa (Batsch) J. F. Gmel, Syst. Man. 2:1472. 1791.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (6), UCR-85 (TEX 429), 9 VII 1963. On dead wood. UCR-109 (TEX 436), 3 VIII 1963. III (21), UCR-63 (TEX 2256), 28 VI 1963. On mossy wood.

All three of these collections might represent sessile phases of T. microsperma except for the size of the spores. Each fructification consists of numerous, crowded, cylindrical sporangia tapering down to a stalk-like base. The fructification as a whole, however, unlike those in UCR-40, 43, and 78 (see next species below) in no case rests on a stalk-like hypothallus. The spores are strongly reticulate over at least one half and up to the entire surface and measure 6-6.5 μm being remarkably uniform in size. Such

specimens are intermediate between T. ferruginosa and T. microsperma and throw doubt on the validity of the characters separating the two species.

3. Tubifera microsperma (Berk. & Curtis) Martin, Mycologia 39:461. 1947.

KNOWN WORLD DISTRIBUTION: North and South America, West Indies, Hawaii, Tropical Asia, Japan.

COSTA RICA: I (1), UCR-40 (TEX 430), 4 VI 1963, on dead wood; (5) UCR-78 (TEX 433), 3 VII 1963, on mossy dead wood. II (12), UCR-43 (TEX 434), 1 VI 1963, on dead wood.

If we are to recognize this species, these three collections fit perfectly in that all the fructifications have a conspicuous stalk-like hypothallus and the spores measure 5-6 μm diam.

Dictydiaethalium Rost., Versuch 5, 1873.

1. Dictydiaethalium plumbeum (Schum.) Rost., in Lister, Mycet. 157. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-59 (TEX 440), 23 VI 1963. IV (25), UCR-92 (TEX 432), 15 VII 1963. V (29), UCR-100 (TEX 439), 19 VII 1963. VII (35), UCR-308 (TEX 1450), 10 XI 1965. UCR-92 on bark; all others on dead wood.

All four collections are typical of the species, but UCR-59 is imperfectly matured. The pseudoaethalia of UCR-92 are dark chocolate-brown whereas in UCR-100 and 308 the color is more yellow-brown. The pseudocapillitial threads are 4-4.5 μm thick. The spores measure 9.5-10.5 μm diam. They are bright yellow in mass, pale yellow by transmitted light, with conspicuously thick, minutely roughened walls.

Lycogala Adans., Fam. Pl. 2:7. 1763.

1. Lycogala epidendrum (L.) Fries, Syst. Myc. 3:80. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: Widespread and abundant. I (1), UCR-97 (TEX 443), 29 VII 1963; UCR-230 (TEX 445), 3 X 1964; (5), UCR-69 (TEX 441), UCR-70 (TEX 442), 3 VII 1963. III (20), UCR-8 (TEX 2255), 20 V 1963; (22), UCR-222 (TEX 444) 1 X 1964. VII (35); San Vito de Java, E. F. Morris #957 (TEX 1991), 13 III 1966. UCR-70 on bark; all others on dead wood.

COMMENTS: All 7 collections of this ubiquitous species are typical, with no more than expected variation in aethalial size, color, and markings. The spores in Nos. 8 and 230 measure 6-7.5 μm whereas those of the other specimens are smaller; 5.5-6.5 μm .

2. Lycogala exiguum Morgan, Jour. Cinc. Soc. Nat. Hist. 15:134. 1893.

KNOWN WORLD DISTRIBUTION: Cosmopolitan, especially in the tropics.

COSTA RICA: VII (35), UCR-311 (TEX-1444), 19 XI 1965.

COMMENTS: This species is usually easily identified by its dark, almost black aethalia and especially by the tessellate pustules on the peridium. The spores of the present specimen are somewhat on the large side, measuring 5.5-6.0+ μm . They are, however, warted rather than reticulate as in L. epidendrum. UCR-97 (see previous species) is close to L. exiguum because of its dark aethalia, its tessellate pustules and its non-reticulate spores. The latter, however, measure over 6 μm in diameter and on that basis we leave it in L. epidendrum. Such intermediate forms tend to confuse the issue and one is unable to draw a clear cut line between the two species.

Family CRIBRARIACEAE Rost. Versuch. 5. 1873.

Cribraria Pers., Neues Mag. Bot. 1:91. 1794.

The genus Cribraria is in great need of thorough revision. None of the existing keys is satisfactory and the characters of so many of the described species overlap that correct identification has become extremely difficult.

Unfortunately, no Cribraria has been grown in laboratory culture and it is impossible, therefore, to study the stability and consequently the validity of the characters used in separating species. In spite of this well-nigh chaotic situation, new species and even varieties continue to be described! The following identifications represent our best judgment, but in view of the above must be considered tentative.

1. Cribraria intricata Schrad., Nov. Grn. Pl. 7. 1797.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: I (9), UCR-136 (TEX 2263), 20 IX 1963. II (15), UCR-201 (TEX 849), 24 IX 1964. IV (24), UCR-156 (TEX 2259), UCR-157 (TEX 843), 24 XI 1963; (27), UCR-322 (TEX 2262), 10 VI 1966. All on dead wood.

COMMENTS: Most specimens fit the description given by Martin & Alexopoulos (1969) as well as any Cribraria specimens fit any published description. The sporangia vary from .5 to .75 μ m in diameter and the stalks from 1.5 to 2.5 mm in height. The cup is represented by a thin, membranous, small disc. The nodes are expanded with several free ends. UCR-156 approaches C. splendens because of the strong ribs, but the stalks are longer and the sporangia smaller than is generally true for that species.

2. Cribraria languescens Rex, Proc. Acad. Phila. 43:394. 1891.

KNOWN WORLD DISTRIBUTION: North America, West Indies, Europe, Asia, Africa.

COSTA RICA: I (2), UCR-110 (TEX 838), 3 VII 1963; (1) UCR-196 (TEX 2264), 11 IX 1964; (10) UCR-148 (TEX 840), 4 X 1963. IV (26), UCR-103 (TEX 837), 29 VII 1963. IV (25), UCR-266 (TEX 847), 17 IX 1965. VII (35), UCR-309 (TEX 789), 19 XI 1965. All on dead wood.

COMMENTS: There is considerable variation in these specimens. The diameter of the sporangia varies from .3 to .56 mm, and the stalks are much shorter in UCR-110, 148, and, to a lesser extent, in UCR-266, than usually described for this species. The color of the sporangia also deviates in many instances from the typical. Those of UCR-266,

for example, are very dark. Until we have a better understanding of this genus, all these specimens must be placed in C. languescens.

3. Cribraria microcarpa Schrad., Nov. Gen. Pl. 8. 1797.

KNOWN WORLD DISTRIBUTION: Europe, N. America, West Indies, Colombia, Brazil.

COSTA RICA: I (4), UCR-56 (TEX 841), 21 V 1963. II (14), UCR-131 (TEX 851), 17 VIII 1963. Both on dead wood.

COMMENTS: UCR-56 is a rather typical specimen. UCR-131, on the other hand, exhibits great variation in sporangial diameter and in sporangium:stalk relationship. At first glance the specimen appears to be a mixture of two species, but we believe it is all C. microcarpa.

4. Cribraria minutissima Schw., Trans. Am. Phil. Soc. II, 4:260. 1832.

KNOWN WORLD DISTRIBUTION: U.S.A., West Indies, Uruguay, Brazil, Europe, Hawaii, Asia.

COSTA RICA: V (31), UCR-91 (TEX 852), 18 VI 1964. On dead wood.

COMMENTS: Whether this specimen is indeed C. minutissima or whether it represents an undescribed species is difficult to determine because of the very small number of sporangia at hand, none of which is intact. The overall height of the sporangia does not exceed .37 mm high and the sporangium about .13-.14 μm diam. The cup is represented by a minute membranous disc. The peridial net consists of even threads connected by small, flat, scarcely expanded nodes, and forming mostly pentagonal regular meshes. There are no free ends. The spores measure 6 μm .

5. Cribraria splendens (Schrad.) Pers., Syn. Fung. 191. 1801.

KNOWN WORLD DISTRIBUTION: Europe, N. America, West Indies, Brazil, Asia.

COSTA RICA: I (2), UCR-111 (TEX 790), 3 VII 1963; (7), UCR-122 (TEX 848), 9 VIII 1963; (8) UCR-258 (TEX 2261),

5 XI 1964. IV (24), UCR-155 (TEX 853), 24 XI 1963. All on dead wood.

COMMENTS: All these are probably C. splendens, but in UCR-111 the sporangia are smaller than usual and the nodes are somewhat thickened. UCR-155 is the specimen most typical of the species.

6. Cribraria tenella Schrad., Nov. Gen. Pl. 6. 1797.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-207 (TEX 844), 28 X 1964, UCR-247 (TEX 845), 26 X 1964, UCR-99 (TEX 791), 27 VII 1963; UCR-46b (TEX 2265), 8 VI 1963. III (22), UCR-221 (TEX 846), 1 X 1964. II (14), UCR-132 (TEX 850) 17 VIII 1963. All on dead wood.

COMMENTS: Of the six, UCR-99 is probably the most typical but all deviate in some character from the description. UCR-207 approaches C. languescens. In UCR-132 there are a number of free ends in the peridial net.

7. Cribraria violacea Rex, Proc. Acad. Sci. Phila, 43:393. 1891.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-1145, 16 IV 1971, on dead wood. Locality unknown, TEX-842, summer 1964, leg. G. C. Carroll, on bark. Both developed in moist chamber.

COMMENTS: The color and the minuteness of the sporophores make this species unmistakable.

Dictydium Schrad., Nov. Gen. Pl., 11. 1797.

*1. Dictydium cancellatum (Batsch) Macbride

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and abundant. I (1), UCR-68 (TEX 824), 2 VII 1963; UCR-48 (TEX 825), 8 VI 1963; (6), UCR-86 (TEX 826), 9 VII 1963. III, (20), Welden, p. 96, UCR-19 (TEX 822), 20 V 1963. II (12), UCR-33 (TEX 823), 1 VI 1963. IV (24), UCR-152 (TEX 827), 24 XI 1963. All on dead wood.

COMMENTS: All specimens are typical and remarkably uniform with only very minor variations. In UCR-33 the sporangia are a trifle smaller and the spores somewhat larger than in the other specimens.

Order E C H I N O S T E L I A L E S Martin, Mycologia 52:127. 1960.

Family CLASTODERMATACEAE Alexopoulos & Brooks, Mycologia 63:926. 1971.

Clastoderma Blytt, Bot. Zeit. 38:343. 1880.

1. Clastoderma debaryanum Blytt, Bot. Zeit. 38:343. 1880.

KNOWN WORLD DISTRIBUTION: Probably cosmopolitan, abundant in the tropics.

COSTA RICA: I (1), UCR-195 (TEX 2254), 11 IX 1964, on bark covered with lava dust. Locality not recorded, UCR-105 (TEX 2173), July 1963, developed in moist chamber on bark from unidentified tree, collected July 1963 and cultured in Austin, Texas. Sporangia formed on filter paper in August 1964 and September 1965.

COMMENTS: Our specimens represent an interesting but not very rare variation from the typical in that the prominent, oval, amber-like swelling which usually divides the two portions of the stipe, is absent from all our sporangia.

Order T R I C H I A L E S Macbride, N. Am. Slime-Moulds, ed. 2. 237. 1922.

Family TRICHIACEAE Rost., Versuch 14. 1873 (as tribus).

Perichaena Fries, Symb. Gast. 11. 1817.

1. Perichaena chrysosperma (Currey) Lister

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: II (13), UCR-104 (TEX 830), 30 VII 1963.

COMMENTS: This specimen consists of several typical sporangia and plasmodiocarps on bark. Most plasmodiocarps are doughnut-shaped.

2. Perichaena depressa Lib., Pl. Crypt. 378. 1837.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Locality unknown, G. C. Carroll #3, (TEX 1452), summer 1964. On plant debris in moist chamber.

COMMENTS: This is a typical specimen.

Arcyria Wiggers, Prim. Fl. Holsat. 109. 1780.

*1. Arcyria cinerea (Bull.) Pers. Syn. Fung. 184. 1801.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and abundant. I (1) UCR-41 (TEX 807), 4 VI 1963, UCR-113 (TEX 809), 5 VII 1963. II (12), UCR-32 (TEX 810), 1 VI 1963; (14), UCR-129 (TEX 805), UCR-133 (TEX 803), 17 VIII 1963; (15), UCR-197 (TEX 804), 24 IX 1964. V (28), UCR-93 (TEX 808), 19 VII 1963; (31), UCR-192 (TEX 812), 20 VI 1964. VII (34), Welden, p. 96, UCR-303 (TEX 811), UCR-315 (TEX 806), 16 XI 1965. IV (27), TEX 859, G. C. Carroll # CR-2, 11 VI 1962, UCR-326, 10 VI 1966.

COMMENTS: This is an extremely variable species. In color, the sporangia range from ashy gray, almost white, to a decidedly yellowish hue; in shape, from ovate to long cylindrical when mature. The capillitium is usually distinctly spiny. The so-called digitate form was described by Schweinitz in 1832 as a distinct species, A. digitata, but all modern authors agree it is only a variation of A. cinerea particularly common in the tropics. Inasmuch as, in many fruitings, single sporangia are usually mixed with those united on a common stalk, it appears that a single plasmodium may give rise to both forms. It is of interest to note, however, that we have never been able to germinate spores from digitate fruitings whereas we have often obtained cultures by sowing spores from single sporangia on agar. Nevertheless, Mims (personal communication) noted the formation of some digitate fruitings in agar cultures obtained by sowing

spores from single sporangia collected by one of us (C.J.A.) in Hawaii. Thus, we have experimental as well as circumstantial evidence that the two forms (single and digitate) are the same species.

From the specimens at hand, UCR-32, 93, 113, 197, and 303 are cinereous, whereas UCR-41, 129, 133, 192, and 315 show various amounts of a creamy or yellowish color. In all but UCR-315 the sporangia are cylindrical; in UCR-315 they are mostly globose to ovate. They vary in length from .25 mm to 1.5 mm in UCR-315 to as long as 3 mm in UCR-303. These measurements do not include the stalk. UCR-133 and 303 are typically digitate forms with few if any single sporangia present. Most of the other collections are mixed digitate and simplex with only UCR-315 consisting of only single sporangia. This is in accordance with the well known observation that the digitate form is more prevalent in the tropics.

*2. Arcyria denudata (L.) Wettst. Verh. Zool.-Bot. Ges. Wien 35:abh. 535. 1886.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widespread and common. I, Welden, p. 97, (1), UCR-21 (TEX 817), 21 V 1963, UCR-27 (TEX 814), 21 V 1963; (5), UCR-72 (TEX 813), UCR-79 (TEX 815), 3 VII 1963; (6), TEX 858, collected by G. C. Carroll # GC-1 12 VI 1962. II (12), UCR-34 (TEX 816), 1 VI 1963; (14), UCR-130 (TEX 818), 17 VIII 1963. III (20), UCR-7 (TEX 820), 20 V 1963. IV (27), UCR-321 (TEX 1449), 10 VI 1966. V (30), UCR-101 (TEX 821), 19 VII 1963. VI, Welden, p. 97. VII (34), E. F. Morris #970 (TEX 1996), 16 III 1966.

COMMENTS: The color of the sporangia in the various collections varies from bright rose in UCR-79 to a light chocolate brown in UCR-72. UCR-79 approaches Hagelsteins' (1929) variety dispersa of A. insignis. The sporangia are bright rose, somewhat smaller than in typical A. denudata and scattered. Nevertheless, we believe that the specimen is better referred to A. denudata. UCR-72 on mossy wood; UCR-7, 21, 27, 34, and 79 on dead wood; UCR-101, 130 and GC #1 on bark.

3. Arcyria incarnata Pers., Obs. Myc. 1:58, 1796.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-178 (TEX 829), 5 VI 1964. V (31), UCR-184 (TEX 828), 20 VI 1964.

COMMENTS: This is much less common than the previous species. Both specimens are typical. UCR-178 on bark, UCR-184 on dead wood.

4. Arcyria insignis Kalch. & Cooke, in Kalchbr., Grevilia 10:143. 1882.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-25 (TEX 857), 22 V 1963. III (22), UCR-219 (TEX 856), 1 X 1964. Both on dead wood.

COMMENTS: The chief differences between this species and A. denudata are color and size of sporangia and size of sporangial groupings. Except in relatively rare instances the two species may be distinguished easily. Both our specimens are typical of A. insignis. Reference has already been made to UCR-79 which we placed in A. denudata. This represents a form intermediate between the two species.

5. Arcyria leiocarpa (Cooke) Martin & Alexop. The Myxomycetes 131. 1969.

KNOWN WORLD DISTRIBUTION: U.S.A., Panama, Colombia, Scotland, Czechoslovakia.

COSTA RICA: II (Finca los Ensaynos de Buena Vista), summer 1964. In moist chamber culture on debris collected by George Carroll.

COMMENTS: Only three sporangia developed in the culture but were typical of this species. Unfortunately, the specimen was overrun with mold and was discarded. There is, therefore, no voucher available.

6. Arcyria magna Rex, Proc. Acad. Phila. 45:364. 1893.

KNOWN WORLD DISTRIBUTION: N. America, Panama, Brazil, Philippines, Thailand.

COSTA RICA: V (31), UCR-187 (TEX 1440), 18 VI 1964.

COMMENTS: The specimen is not typical of the species chiefly because of the small cluster of the sporangia. The fruiting mass is dingy yellow to olivaceous but the spores are dull rose in mass. The capillitium bears cogs, half-rings and spines. Although its distribution is wide in the Western Hemisphere, A. magna is not commonly found. Dr. Marie L. Farr concurs with our identification.

Hemitrichia Rost., Versuch. 14. 1873.

*1. Hemitrichia calyculata (Speg.) Farr, Mycologia 66:887. 1974.

This species is usually reported as H. stipitata (Masse) Macbr. It is under this name that our specimens are filed.

KNOWN WORLD DISTRIBUTION: Cosmopolitan and common. Abundant in the tropics.

COSTA RICA: I, Welden, p. 97; (1), UCR-53 (TEX 1361), 8 VI 1963, UCR-57 (TEX 1358), 24 VI 1963, UCR-204 (TEX 1363), 28 IX 1964; (5), UCR-75 (TEX 1360), UCR-76 (TEX 1359), 3 VII 1963. II (12), UCR-31 (TEX 1426), 1 VI 1963; (15) UCR-203 (TEX 1429), 24 IX 1964. III, Welden, p. 97; (20), UCR-9 (TEX 1423), UCR-10 (TEX 1424), UCR-17 (TEX 1425), 20 V 1963; (22), UCR-231 (TEX 1430), 1 X 1964, E. F. Morris #901 (TEX 1995), 18 II 1966. IV, Welden, p. 97; (24), UCR-160 (TEX 1362), 24 XI 1963. VI, Welden, p. 97. VII, Welden, p. 97; (34), UCR-314b (TEX 1432), 16 XI 1965. All on decaying wood.

COMMENTS: In its typical expression, H. calyculata exhibits a slender, dark brown, almost black, stalk which may reach a length of 2 mm, as in UCR-231, and which terminates abruptly at the base of a shallow cup with sides at an obtuse angle. The capillitial threads are essentially smooth and the spores are bright yellow, unevenly spinulose, and 7.5-9 μ m diam. However, most of these characters vary considerably even in the same collection and this variation has caused Lister (1894, 1911, 1925) and Hagelstein (1944) to consider this species synonymous with H. clavata which it admittedly resembles. Unpublished electron micrographs, however, bring out some

interesting differences in the capillitia of the two species which appear to be, for the most part, constant. Lister and Hagelstein (loc. cit.) believe H. calyculata to be an environmentally induced variant of H. clavata, developed under conditions of high temperature. It is of interest in this connection that H. calyculata is abundant in the tropics as well as in the temperate zones whereas H. clavata is found only in the temperate zones (Martin & Alexop., 1969).

Until experimental cultural studies are conducted to determine the effect of the environment at the time of sporulation on the taxonomic characters of the Myxomycetes, these questions will not receive a definitive answer. Unfortunately, neither H. calyculata nor H. clavata has been grown in laboratory culture.

In the specimens at hand, the stalks vary from light yellow-brown to almost black and from .45 mm or shorter to 2 mm. They terminate abruptly at the base of a more or less shallow cup in most specimens, but some sporangia in UCR-9, 31, 53, and 203 have short stalks which merge with the bases of the rather deep cups approaching the situation in H. clavata. The capillitium is nearly smooth in most specimens but distinctly roughened in UCR-9, 31, and 203. In spite of these variations, it seems best to include all specimens in H. calyculata.

2. Hemitrichia serpula (Scop.) Rost. in Lister Mycet. 179. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan; abundant in the tropics.

COSTA RICA: III (20), UCR-20 (TEX 1418), 20 V 1963; IV (26), UCR-102 (TEX 1418), 29 VII 1963; El Roble, UCR-108 (TEX 1420), 30 VII 1963. V, near Laguna de Arenal, E. F. Morris #982 (TEX 1998), 22 III 1966. VII (34), UCR-314a (TEX 1431), 16 XI 1965. UCR-20 and 108 on plant debris; UCR-314a and Morris 982 on decaying wood; UCR-102 on bark.

COMMENTS: This easily recognized species is widely distributed and quite constant in its characters. All specimens in our collection are typical except for the diameter of the capillitial threads which tends to be greater than that given in the various monographs, reaching, in most of

our specimens 7.5 μ m. This and other species of Myxomycetes are often parasitized by a fungus (Stilbella sp.) which produces its synnemata on the surface of the fructifications as in our UCR-108.

Metatrachia Ing, Trans. Brit. Mycol. Soc. 47:51. 1964.

1. Metatrachia vesparium (Batsch) Nann.-Brem. K. Ned. Akad. Wet. C. 69:146. 1966.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-227 (TEX 1366), 9 X 1964; (3), UCR-44 (TEX 1364), 8 VI 1963; (9), UCR-268 (TEX 1367), 27 V 1965. II (22), UCR-214 (TEX 1365), 1 X 1964. VII (33), UCR-290 (TEX 1368), 17 XI 1965. All on decaying wood.

COMMENTS: This very common and easily recognized species usually occurs in two forms: 1) as short-stalked or sessile sporangia crowded into large clusters (pseudo-aethalia), as in UCR-44 and 268, and 2) as polycephaloid, long-stalked pseudoaethalia in which the stalks of many sporangia are completely fused as in UCR-214, 227, and 290. One would be tempted to recognize these two forms as distinct varieties were it not for their occurrence side by side in some fruitings and together with a few individual sporangia. UCR-290 is not mature.

Trichia Haller, Hist. Stirp. Helv. 3:114. 1768.

1. Trichia decipiens (Pers.) Macbr., N. Am. Slime Moulds 218. 1899.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I, (Finca La Azucena, Carretera Panamaamericana), UCR-297 (TEX 1407), 19 XI 1965. On decaying wood.

COMMENTS: The single specimen in our collection is typical of the species.

2. Trichia favoginea (Batsch) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Throughout the temperate zone but also known from the tropics.

COSTA RICA: I (8), UCR-254 (TEX 1409), 5 XI 1964, on bark. III (23), UCR-241 (TEX 1408), 17 X 1964, on bark among Bryophytes.

COMMENTS: Although most spores observed exhibit a rather typical complete reticulation, in some spores of both specimens the reticulation is broken or incomplete. It is chiefly on the nature of the reticulation that T. favoginea was formerly separated from T. persimilis until Farr's (1958) study pointed out the great variability of this character and placed T. persimilis and T. affinis in synonymy with T. favoginea. It is possible, of course, that such variation may represent genetic segregation of possible hybrids between two extreme forms, but until experimental evidence to the contrary becomes available, we are accepting Farr's conclusions.

3. Trichia floriformis (Schw.) G. Lister, Jour. Bot. 57: 110. 1919.

KNOWN WORLD DISTRIBUTION: Widely distributed in all continents but Africa from where it has not yet been reported. In the Caribbean area, known only from Puerto Rico and Jamaica.

COSTA RICA: I (7), UCR-119 (TEX 1911), 9 VIII 1963. IV (25) UCR-96 (TEX 1410), 27 VII 1963. Both on bark.

COMMENTS: Trichia floriformis may be recognized by the petaloid dehiscence of the sporangia, the deep red color of the stalks and the capillitium, and the reddish spores. In a general way it resembles T. botrytis to which it is probably most closely related. The latter has not as yet been found in Costa Rica and, indeed, appears to be rare in the tropics. The T. floriformis sporangia of our specimens are black, which is often the case.

4. Trichia scabra Rost., Mon. 258. 1875.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-118 (TEX 1413), 9 VIII 1963. IV (25), UCR-143 (TEX 1414), 9 XI 1963, both on dead wood.

COMMENTS: All spores examined bear a definite reticulation, at least on one hemisphere and often over the entire surface. Some spores appear oval or slightly turbinate and measure 10 x 12.5 μ m.

5. Trichia varia (Pers.) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (11), UCR-234 (TEX 1415), 16 X 1964. IV (25), UCR-167 (TEX 1412), 9 IV 1964, on stroma of ascomycete.

COMMENTS: Both are typical specimens, although some elaters appear to have three rather than two spiral bands. UCR-167 was determined by Dr. Marie L. Farr.

6. Trichia verrucosa Berk., in Hook, f. Tasm. 2:269. 1859.

KNOWN WORLD DISTRIBUTION: Tasmania, New South Wales, Europe, U.S.A., Mexico, Dominica, Jamaica, South America.

COSTA RICA: I (8), UCR-253b (TEX 1417), 5 XI 1964, on bark.

COMMENTS: Although widely distributed this species is not so common as some of the other Trichias. Our collection consists of three clusters of sporangia interspersed among many fine sporangia of Physarum tenerum (UCR-252a). The material is in all ways typical.

Order P H Y S A R A L E S Macbride, N. Am. Slime-Moulds ed. 2. 22. 1922.

Family PHYSARACEAE Rost., Versuch. 9. 1873 (as tribus).

Cienkowskia Rost., Versuch. 9, 1873.

1. Cienkowskia reticulata (Alb. & Schw.) Rost. Mon. 91. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: III (21), UCR-62 (TEX 1447), 28 VI 1963, on dead wood.

COMMENTS: A collection of many sporophores ranging from .5 mm spheres to 6 mm long, straight or sinuous plasmodiocarps. The peridium is covered with a thick incrustation of yellow lime on which tomato-red glossy spots are scattered. The duplex nature of the capillitium is evident but the spiny branches of the tubules are not so numerous as they are usually.

Physarella Peck, Bull. Torrey Bot. Club 9:61. 1882.

1. Physarella oblonga (Berk. & Curtis) Morgan Jour. Cinc. Soc. Nat. Hist. 19:7. 1896.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-28 (TEX 1437), UCR-38 (TEX 1438), 28 V 1963, UCR-50 (TEX 1439), 8 VI 1963. All on dead wood.

COMMENTS: Of our three specimens only UCR-50 is in good condition, the other two having fruited on decaying wood encrusted with lava dust which crumbles and results in the destruction of most sporangia thereon.

Badhamia Berk., Trans. Linn. Soc. 21:153. 1853.

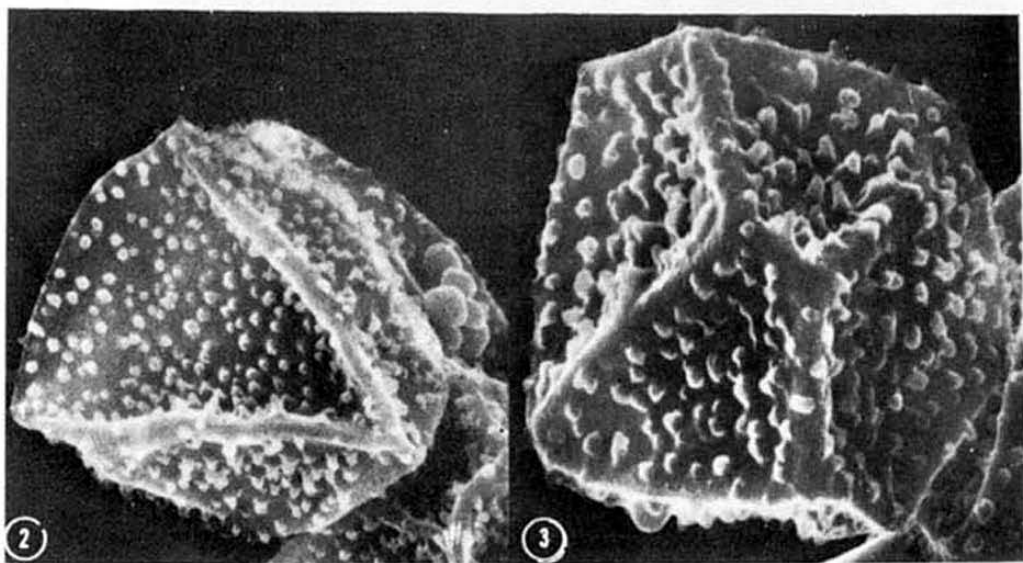
1. Badhamia cinerascens Martin, Jour. Wash. Acad. 22:88. 1932.

KNOWN WORLD DISTRIBUTION: Colombia.

COSTA RICA: III, UCR-13 (TEX 2105), 11 V 1965. On bark. (Authentic specimen).

COMMENTS: This is the second world collection of this species reported in the literature and is the only specimen of a Badhamia from Costa Rica in our collection. Dr. G. W. Martin, who first described this species, concurred with our identification, noting, however, that ". . . the Costa Rican collection is more limy than the type and the spores somewhat smaller, but I can regard neither character as significant . . . Certainly I cannot assign your specimen

to anything but B. cinerascens." Figures 2 and 3 are presented as further evidence in support of our identification.



Figures 2-3. Scanning electron micrographs of the spores of Badhamia cinerascens Martin.

Figure 2. Spore of UCR-13, X 4500

Figure 3. Spore from TYPE in IA, X 5070
(Magnifications approximate).

Fuligo Hall., Hist. Stirp. Helv. 3:110. 1768.

1. Fuligo megaspora Sturgis, Colo. Coll. Publ. Sci. 12:443. 1913.

KNOWN WORLD DISTRIBUTION: U.S.A., Guatemala, Europe, Congo, Pakistan.

COSTA RICA: IV (25), UCR-168 (TEX 1448), 9 IV 1964. On dead wood.

COMMENTS: A typical well-formed aethalium, 3 cm in length. Most spores measure 18 μ m diam.

*2. Fuligo septica (L.) Wiggers, Prim. Fl. Holsat. 112. 1780.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and very common. I (5), UCR-81 (TEX 1435), UCR-82 (TEX 1454), UCR-87 (TEX 1456), 8 VII 1963. II (19), UCR-83 (TEX 1455), 7 VII 1963. III, UCR-80 (TEX 1434), 4 VII 1963; IV, Welden, p. 97. V (31), UCR-182 (TEX 1436), 19 VI 1964, UCR-185 (TEX 1457), 20 VI 1964. VII, Welden, p. 97. (34), UCR-318 (TEX 1458), 16 XI 1965. All on wood or bark.

COMMENTS: In UCR-182 the lime of the cortex is white; in all others it is some shade of yellow. Differences in color of the cortex have been used to distinguish among varieties (Martin & Alexopoulos, 1969; Nannenga-Bremekamp, 1973) but the taxonomic significance of aethial color can be determined only by careful culture work and genetic studies under controlled conditions. F. septica is relatively easy to grow in laboratory culture from spores to the plasmodial stage, but cultures sporulate unpredictably and only after a very long time.

Craterium Trent., in Roth, Catalecta Bot. 1:224. 1797.

1. Craterium leucocephalum (Pers.) Ditmar, in Sturm, Deuts. Fl. Pilze 1:21. 1813.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: I (1), UCR-171 (TEX 1459), 3 VI 1964; (7) UCR-243 (TEX 1461), 6 XI 1964. II (16), UCR-279 (TEX 1462), 7 VI 1965. V (31), UCR-190 (TEX 1460), 18 VI 1964. VII (34), UCR-301 (TEX 1463), 16 IX 1965; (35), UCR-306 (TEX 1464), 19 XI 1965. UCR-171 on bark; UCR-243, 279, 190, on dead leaves; UCR-301 on living leaves; UCR-306 on dead wood.

COMMENTS: Considerable variation is encountered in this species in the shape and color of the sporangia and their method of dehiscence. In UCR-171, 190, and 279 the sporangia are essentially globose; in UCR-243 they are long goblet-shape; and in UCR-306 they are intermediate. In UCR-243 and 279 the brown base of the sporangium is clearly evident; in the others the sporangia are almost entirely white. The operculum is perfectly developed in UCR-243; in all others dehiscence is irregular. Whether the variations noted are genetically or environmentally controlled is not known.

Physarum Pers., Neues Mag. Bot. 1:88. 1794.

1. Physarum bitectum G. Lister, Mycet. ed. 2. 78. 1911.

KNOWN WORLD DISTRIBUTION: Western Europe, U.S.A., Puerto Rico, Colombia, South Africa, Australia, New Zealand.

COSTA RICA: I (10), UCR-287 (TEX 2113), 15 VII 1965, on dead leaf.

COMMENTS: This species is not commonly reported, but as Martin & Alexopoulos (1969) mention, it may be more widespread than is supposed because it often resembles other species such as P. bivalve and may be misdetermined. Our specimen appears to be typical. Dr. Marie L. Farr concurs with our identification.

2. Physarum bivalve Pers., Ann. Bot. Usteri 15:5. 1795.

KNOWN WORLD DISTRIBUTION: Europe, N. America, Chile, South Africa, Angola, Southeast Asia, Japan, Philippines, Samoa.

COSTA RICA: I (7), UCR-121 (TEX 1465), 9 VIII 1963, on dead wood, UCR-251 (TEX 1467), 6 XI 1964, on dead leaves. V (31), UCR-183 (TEX 1466), 20 VI 1964, on dead leaves.

COMMENTS: UCR-251 is the most typical of the three specimens, consisting both of isolated sporangia and variously shaped plasmodiocarps of different lengths. The most interesting of the three specimens, however, is UCR-183 in which all the sporophores are in the form of bright yellow, clam-shaped sporangia.

3. Physarum bogoriense Racib., Hedwigia 37:52. 18F. 1898.

KNOWN WORLD DISTRIBUTION: Known from all continents but particularly abundant in the tropics and subtropics.

COSTA RICA: I (1), UCR-205 (TEX 1471), 28 IX 1964, on herbaceous stem, UCR-98 (TEX 1469), 29 VII 1963, on mossy bark, UCR-147 (TEX 1470), 18 X 1963, on dead leaf. II (17), Orotima, UCR-281 (TEX 1473), 9 VI 1965, on dead leaf. III (22), UCR-220 (TEX 1472), 1 X 1964, on plant debris. IV, UCR-64 (TEX 1468), 24 VI 1963, on leaf base.

COMMENTS: This distinctive species fruits occasionally on bark or wood but usually on dead leaves and plant debris.

The yellowish or brown outer peridium and the stellate dehiscence make it easy to recognize in the field under a hand lens. Only occasionally encountered in cold climates, it is one of the most abundant species in warm regions.

4. Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1:89. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan and very common.

COSTA RICA: I (1), UCR-172 (TEX 2233), 3 VI 1964; (7), UCR-244 (TEX 1475), 6 XI 1964, both on living leaves, San Antonio de Belem, UCR-329 (TEX 1487), 3 VII 1966, on dead wood.

COMMENTS: In UCR-244 the sporangia are well formed but the lime is scanty and the peridium is iridescent; the spores measure 7-9 μ m. In UCR-239 the lime is much more abundant and there are two long, branched plasmodiocarps in addition to the few sporangia. One is tempted to place this specimen in the closely allied P. vernum, but the spores are clearly brownish-violaceous rather than dark purplish-brown; it seems better, therefore, to retain it in P. cinereum in spite of its occurrence on wood. UCR-172 is a scanty collection of but a few sporangia. The spores are not well formed and the determination is therefore tentative.

5. Physarum citrinum Schum., Enum. Pl. Saell. 2:201. 1803.

KNOWN WORLD DISTRIBUTION: Cosmopolitan but not common.

COSTA RICA: I (11), UCR-240 (TEX 1474), 16 X 1964, on wood.

COMMENTS: Our specimen, consisting of over 100 sporangia, is typical in some respects, not so in others. The sporangia are .7-1 mm diam.; the stalks are short and calcareous but tend to be more orange than yellow in color; the columella is minute and conical but the capillitial nodes are elongated. The spores are almost smooth and measure 11-12 μ m, which is somewhat larger than described. New species have been described on smaller differences!

6. Physarum compressum Alb. & Schw., Consp. Fung. 97. 1805.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-30 (TEX 2010), 3 VI 1963, UCR-36 (TEX 1479), 6 VI 1963, UCR-206 (TEX 1484), 28 IX 1964, all on bark; UCR-140 (TEX 1481), 10 VIII 1963, on lizard dung in moist chamber; UCR-169 (TEX 1482), 10 IV 1964, on plant debris; (10), UCR-141 (TEX 1480), 4 X 1963, on dead wood; III (22), E. F. M. #902 (TEX 1994), 18 II 1966, on dead herbaceous stem; III (23), UCR-286 (TEX 1485), 15 VII 1965, on moss.

COMMENTS: This ubiquitous species is a very variable one and several of its forms have been described as new species or have been confused with other Myxomycetes. Typically the sporangia are fan-shaped, as in UCR-286, but plasmodiocarpous fruitings, as in UCR-141 and 200 are not uncommon. Polycephaloid fruitings which resemble *P. nicaraguense* (q. v.) are sometimes produced; UCR-36 is a good example of this variation. Culture studies (Alexopoulos, 1969) have shown that spores taken from various types of fruiting bodies, such as those described above, will yield the typical fan-shaped sporangia when conditions for fruiting are favorable.

*7. Physarum decipiens Curtis, Am. Jour. Sci. II. 6:352. 1848.

KNOWN WORLD DISTRIBUTION: U.S.A., Canada, South America, Western Europe to Greece; Hawaii, Asia, Australia.

COSTA RICA: Heredia (Reported by Welden, 1954 as Badhamia decipiens (Curt.) Berk. No specimen in our collection).

8. Physarum dictyosporum Martin, Brittonia 14:183. 1962.

KNOWN WORLD DISTRIBUTION: U.S.A. (Michigan, Iowa, Kansas, Texas).

COSTA RICA: V (31), UCR-186a (TEX 1486), 20 VI 1964, on dead leaf.

COMMENTS: This is one of the very few species of Physarum with reticulate spores. In our specimen, short plasmodiocarps intermingle with sessile sporangia. The lime in the sporophore is often concentrated in the center forming a rigid pseudocolumella which assumes the shape of the fruiting body. This species, discovered in 1962, has hitherto been known only from four localities in the U.S.A. as noted above.

*9. Physarum didermoides (Pers.) Rost., Mon. 97. 1875.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-1 (TEX 1488), January 1963, UCR-261 (TEX 919), 28 X 1964, UCR-84 (TEX 1492), 9 VII 1963, both on bark; UCR-112 (TEX 1493), 3 VII 1963, on wood covered with moss; UCR-145 (TEX 1517), 18 X 1963, on bark. (4), Rio Claro, UCR-4 (TEX 1489), April 1963, on plant debris. II (19), UCR-165 (TEX 2232), 4 IV 1964, on moss. III, UCR-18 (TEX 1490), 20 V 1963; (22), UCR-213 (TEX 1495), UCR-217 (TEX 1496), UCR-218 (TEX 1497), 1 X 1964, all on bark. VII (34), UCR-300 (TEX 1498), UCR-312 (TEX 1499), 16 XI 1965, on dead leaves.

COMMENTS: All specimens except UCR-145 and 261 are typical of the species. Those two approach P. tessellatum in that the sporangia are somewhat flattened, approximately isodiametric, and crowded together. However, the tessellate crust formed by the contacting sporangia of P. tessellatum is absent in both specimens and we must therefore, consider all as belonging to P. didermoides. It is of interest to note that laboratory cultures of the aberrant forms produced the same type of fructifications. This is another of the relatively few species of Myxomycetes that grow readily in culture from spores.

10. Physarum flavidum (Peck) Peck, Ann. Rep. N. Y. State Mus. 31:55. 1879.

KNOWN WORLD DISTRIBUTION: N. America, Europe, Japan.

COSTA RICA: I (21), UCR-106 (TEX 1501), 26 XII 1963, on mosses and lichens.

COMMENTS: Although it appears to be widely distributed, this is not a common species. Our specimen--the first on record south of the United States in the Western hemisphere--is typical in all respects except the capillitial nodes which are not white-calcareous but translucent and amber-like. It may be that the sporangia are not properly matured, but the uniformity of the spores argues against that hypothesis. Experimental culture work would answer this question, but unfortunately we were unable to obtain cultures from this specimen.

11. Physarum globuliferum (Bull.) Pers. Syn. Fung. 175. 1801.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (2), UCR-11 (TEX 1502), X 1962, on dead wood. V (31), UCR-179 (TEX 1573), 20 X 1964, on plant debris. VII (36), E.F.M. #956 (TEX 1993), 12 III 1966, on bark.

COMMENTS: The first two collections are scanty, consisting of but a dozen fragile sporophores each. The E. F. Morris specimen is somewhat more ample. All appear typical, but the sporophores of UCR-11 lack columellae.

12. Physarum javanicum Racib., Hedwigia 37:53. 1898.

KNOWN WORLD DISTRIBUTION: Java, Africa, Florida, California, Jamaica, Trinidad, Colombia, England.

COSTA RICA: I (1), UCR-194 (TEX 1503), 11 IX 1964, on lava dust on dead wood.

COMMENTS: This is another scanty collection of about a dozen sporophores. The sporangia are not turbinate but vertically compressed and conspicuously umbilicate above. The lava dust is crumbling and the specimen is virtually destroyed.

13. Physarum ?leucopus Lk. Ges. Nat. Freunde Berlin Mag. 3:27. 1809.

KNOWN WORLD DISTRIBUTION: Cosmopolitan but apparently rare in the tropics.

COSTA RICA: II (18), UCR-278 (TEX 2192), 8 VI 1965, on dead leaf.

COMMENTS: Dr. Marie L. Farr confirmed our identifications but reaffirmed our reservations. We quote from her commentary: "Appears to fit except for cylindrical columellae present in some sporangia. Also characteristic whitish color of hypothallus absent; some sporangia have irregular pseudocolumella." Farr also questioned the identity of her own specimen from Dominica (Farr, 1969), but decided that both the Dominica and Costa Rica specimens fit in P. leucopus better than in any other species.

14. Physarum melleum (Berk. & Br.) Masee

KNOWN WORLD DISTRIBUTION: Cosmopolitan; common in the tropics.

COSTA RICA: I (1), UCR-142 (TEX 1504), 11 XI 1963; (7), UCR-242 (TEX 1506), 6 XI 1964. II (16), UCR-273 (TEX 2108), 7 VI 1965; (17), UCR-283 (TEX 1507), 9 VI 1965. V (31), UCR-175 (TEX 2117), 20 VI 1964, UCR-177 (TEX 1505), 20 VI 1964.

COMMENTS: Physarum melleum is a variable species in several of its taxonomically important characters such as color of the sporophore, length of stalk, size of columella and presence of a pseudocolumella. These variations are represented in the specimens at hand. The stalk in UCR-142, 242, and 175 is pure white in most sporangia although it has a tendency to become cream-colored in some sporophores of UCR-175; it is of a light cream color in UCR-177 and more yellow in UCR-273 and 283; it may be described as relatively long in all specimens except UCR-242 in which it is medium to short. The peridium is bright yellow from an abundance of lime in UCR-142, 273 and 283, but gray or white in the other specimens. The whole sporophore is grayish white in UCR-175. The columella is small in most specimens, but conspicuous and yellow in UCR-142 and quite conspicuous and pure white in UCR-175. The capillitium is abundant with angular, white nodes in all specimens but UCR-273 in which it is less abundant and has yellowish nodes. The spores are uniformly light violet-brown and very minutely warted in all specimens. They vary in size from 7.5 to 9 μ m in diameter. In spite of the variation, this species is one of the easiest to recognize in the genus.

15. Physarum murinum A. Lister Mycet. 41. 1894.

KNOWN WORLD DISTRIBUTION: Western Europe, U.S.A.

COSTA RICA: IV (24), UCR-151 (TEX 1969), 21 XI 1963, on decaying wood.

COMMENTS: This appears to be the only report of P. murinum from the tropics. Both Dr. G. W. Martin and Dr. Marie L. Farr, who examined our specimen, agree with our identification in spite of some characters which deviate from the typical.

16. Physarum nicaraguense Macbr. Bull. Nat. Hist. Univ. of Iowa 2:382. 1893.

KNOWN WORLD DISTRIBUTION: Nicaragua, West Indies, Ceylon, India, Japan, Philippines, Caroline Islands.

COSTA RICA: I (2), UCR-14 (TEX 1511), 18 V 1963, UCR-16 (TEX 1512), 18 V 1963; (10), UCR-139 (TEX 1508), 4 X 1963. III (22), UCR-216 (TEX 1441), 1 X 1964. VII (Orotina), UCR-285 (TEX 1442), 9 VI 1965. All on bark.

COMMENTS: Physarum nicaraguense appears to be a strictly tropical species. Its occurrence in Costa Rica was expected in view of the fact that Nicaragua is its type locality. We find it to be a well-defined species, apt to be confused only with some aberrant forms of Physarum compressum (q. v. See also comments in Martin and Alexopoulos, 1969, p. 315).

17. Physarum notabile Macbr. N. Am. Slime-Moulds ed. 2. 80. 1922.

KNOWN WORLD DISTRIBUTION: U.S.A. and Canada, West Indies, Europe, ?New Zealand.

COSTA RICA: I (7), UCR-124 (TEX 2005), 9 VIII 1963. II (19), UCR-164 (TEX 1510), 4 IV 1964. Both on bark.

COMMENTS: UCR-124 does not agree perfectly with the description of this species but cannot be placed elsewhere with more certainty. Dr. Marie L. Farr agrees with this view. UCR-164 is more typical.

18. Physarum nucleatum Rex, Proc. Acad. Phila. 43:389. 1891.

KNOWN WORLD DISTRIBUTION: Throughout the U.S.A. and south to Nicaragua, England, Rumania, South Africa, Hawaii, Japan, the tropics in general.

COSTA RICA: VI (32), UCR-224 (TEX 1575), 2 X 1964, on moss.

COMMENTS: An ample and typical collection. Pseudocolumellae are present but are not prominent.

19. Physarum nutans Pers., Ann. Bot. Usteri 15:6. 1795.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-137 (TEX 1925), 9 VIII 1963, UCR-128 (TEX 2001), 9 VIII 1963; (1), UCR-58 (TEX 2000), 24 VI 1963; (8), UCR-255 (TEX 2003), 5 XI 1964; (23), UCR-202 (TEX 2004), 24 IX 1964, UCR-209 (TEX 918), 26 IX 1964. IV (24), UCR-154 (TEX 2002), 24 XI 1963. UCR-58, 128, 154, and 255 are on bark; UCR-202 is on mossy wood; the others are on dead wood.

COMMENTS: Physarum nutans, a very common species throughout the world, closely resembles P. viride in all characters except color, being gray or white instead of yellow or orange (See Martin & Alexopoulos, 1969). Color differences within the same species have been recorded for Physarella oblonga, Physarum tenerum, Arcyria cinerea and other species of Myxomycetes, and are usually not recognized as separate taxa unless and until experimental evidence indicates the differences hold up under different conditions of culture and are not merely due to changes in the environment. No such evidence has been obtained for the P. nutans/viride complex, chiefly because neither species has been grown in laboratory culture after repeated attempts. All our specimens appear to be typical of P. nutans as this taxon is presently circumscribed.

20. Physarum polycephalum Schw., Schr. Natur. Ges. Leipzig 1:63. 1822.

KNOWN WORLD DISTRIBUTION: Common in the U.S.A., West Indies, Brazil, Uruguay, Angola, France, Rumania, Borneo, Japan.

COSTA RICA: I (1), UCR-26 (TEX 1983), UCR-115 (TEX 1987), UCR-116 (TEX 1980), UCR-117 (TEX 1984), all four collected on 5 VII 1963; (11), UCR-233 (TEX 446), 16 X 1964. III (Cartago), UCR-163 (TEX 1981), 16 X 1964. IV (24), UCR-6 (TEX 1421); (27), UCR-324 (TEX 1422), 10 VI 1966. VII (33), UCR-292 (TEX 1982), 17 XI 1965; (Monte Verde), E.F.M. #858 (TEX 1992), 9 II 1966. Cocos Island, W. A. Weber # M-194 (TEX 1207), Jan-Mch 1964. The habitats of our specimens are as follows: On herbaceous material: UCR-233, 292, 324; on bark: UCR-6 and TEX 1207; on dead wood: UCR-26, 115; on dead leaf: UCR-325; on lichen and moss: E.F.M. #858; on debris in moist chamber: UCR-163,

324; collected as plasmodia and fruited on filter paper: UCR-116, 117.

COMMENTS: Physarum polycephalum exists in two forms and at least two colors in nature. One form is polycephaloid; the other is simple. The latter has been called Physarum obrussum (Berk & Curtis) Rost. and Physarum polycephalum Schw. var. obrussum (Berk. & Curtis) G. Lister. Experimental evidence (Alexopoulos, 1969) supports the view that these are but variants of P. polycephalum Schw. which do not deserve separate designations. In color, P. polycephalum sporangia are either yellow to orange or gray to white. The color and type of fructification in our specimens are as follows: Obrussum type, gray: UCR-6, 117, 324; yellow: TEX 1207; yellowish gray: UCR-116. Polycephaloid type, gray: UCR-292, 325, E.F.M. #858; yellow: UCR-115; yellowish gray: UCR-26. The sporangia of UCR-163 are not well matured and were still black when collected.

21. Physarum pulcherripes Peck, Bull. Buffalo Soc. Nat. Sci. 1:64, July, 1873.

KNOWN WORLD DISTRIBUTION: U.S.A., Panama, Jamaica, Dominica, Trinidad, Ireland, Japan.

COSTA RICA: VII (34), UCR-317 (TEX 2015), 16 IX 1965, on dead wood.

COMMENTS: The identification of this specimen is uncertain. It was first determined by us as Physarum psittacinum Ditmar and Dr. G. W. Martin agreed that it was probably that although both he and we noted it did not fit the description of that species perfectly. Later, Dr. Marie L. Farr redetermined this specimen as P. pulcherripes noting "Columella absent and lime nodes more as in P. psittacinum, but stipes decidedly limy." Thus, the specimen appears to be intermediate between the two species. We are at present filing it under P. pulcherripes.

22. Physarum rigidum (G. Lister) G. Lister, Mycet., ed. 3. 36. 1925.

KNOWN WORLD DISTRIBUTION: Japan, Philippines, Hawaii, U.S.A. (Texas), West Indies, Brazil, Uruguay.

COSTA RICA: I (23), UCR-210 (TEX 2114), 26 XI 1964; (11), UCR-239 (TEX 1220), 16 X 1964.

COMMENTS: Physarum rigidum was first described as a variety of P. viride whose capillitium often consists of rod-like, rigid tubes containing lime granules. Although the capillitium of our specimens lacks these rigid tubes, it does consist of sparingly branched threads arising vertically from the base of the sporangium and bearing long, orange-yellow nodes. In this respect our specimen approaches P. viride (q. v.) but in its limeless peridia it strongly resembles P. flavicomum where we had originally placed it. The capillitium of P. flavicomum is intermediate between those of P. viride and P. rigidum. It is obvious that what might be called the P. viride/rigidum/flavicomum complex requires much experimental study before the relationships can be untangled. We are basing the identification of our specimens on the conclusions reached by Henney & Henney (1968) who attempted unsuccessfully to cross clones derived from UCR-239 with clones of P. flavicomum. Unfortunately, no one has succeeded in growing P. viride in laboratory culture.

23. Physarum stellatum (Masse) Martin, Mycologia 39:461, 1947.

KNOWN WORLD DISTRIBUTION: North and South America, West Indies, Africa, Hawaii, Philippines, Indonesia, Asia.

COSTA RICA: III (22), UCR-223 (TEX 2012), IX 1964. VII (33), UCR-291 (TEX 2011), 17 XI 1965; (35), UCR-305 (TEX 2013), 19 XI 1965. All on wood.

COMMENTS: The pseudocolumella, characteristically present in this species, is conspicuously present in the first two specimens, not so in the third which is in poor condition. All other characters are typical in all three.

*24. Physarum tenerum Rex Proc. Acad. Phila. 42:192. 1890.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-49 (TEX 2008), 8 VI 1963, UCR-54 (TEX 2007), 11 VI 1963, UCR-37 (TEX 2009) 3 VI 1963, UCR-58 (TEX 2107), 24 VI 1963; (8) UCR-253a (TEX 1416), 5 XI 1964. IV (El Roble), UCR-94 (TEX 2006), 30 VII 1963; IV (Heredia), UCR-61 (TEX 2106), 24 VI 1963. All on bark except UCR-94 on a fungus sporophore.

COMMENTS: This is another species of Physarum with two color forms: yellow and gray to white. The colors of our specimens are as follows: Yellow form - UCR-253a, 94, 58, 61; white form - UCR-37, 49.

25. Physarum ?vernum Somm., in Fries, Syst. Myc. 3:146. 1829.

KNOWN WORLD DISTRIBUTION: Western Europe and the British Isles, Rhodesia, Angola, India, Japan, Hawaii, South Australia, New Zealand, Mexico, Cuba.

COSTA RICA: II (16), UCR-177 (TEX 2014), 7 VII 1965, on bark.

COMMENTS: Physarum vernum resembles both P. cinereum and P. sessile, but is usually more plasmodiocarpous than the former and has larger spores than the latter. Our specimen consists of three plasmodiocarps 1.5 to 2 mm long and about 0.4 mm in diameter. The spores measure 8-10 μ m. The sporophores are heavily encrusted with lime. The capillitial nodes are rather large and angular. Obviously the specimen is intermediate between P. vernum and P. cinereum, but we believe it to be closer to the former. Dr. Marie L. Farr concurs.

26. Physarum viride (Bull.) Pers., Ann. Bot. Usteri 15:6. 1795.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-149 (TEX 2110), 18 X 1963, UCR-238 (TEX 2111), 16 X 1963; (7), UCR-123 (TEX 2112), 9 VIII 1963. V (31), UCR-180 (TEX 2109), 20 VI 1964. All on dead wood.

COMMENTS: Except for its similarity in structure to P. nutans (q. v.) this is a well-defined species which may generally be easily recognized by the petaloid dehiscence of the peridium with patches left clinging to the capillitial mass. All our specimens are typical.

Family DIDYMIACEAE Rost., Versuch. 12, 1873.

Diachea Fries, Syst. Orb. Veg. 143. 1825.

Fries first described Diachea in 1825 as a member of his Trichiacei but three years later in his Systema he transferred it to the Stemonitei where it remained until Rostafinski (1874) placed it in the family Spumariaceae of his Calcareae (now order Physarales). (See Martin & Alexopoulos, 1969, p. 176). In this decision Rostafinski was followed by Cooke (1877) and partly by Zopf (1885) who placed Diachea in the Didymiaceae. Massee (1892) continued to regard Diachea as one of the Didymiaceae. All these authors obviously emphasized the presence of lime (a physaraceous character) more than the type of capillitium and peridium which, in Diachea, resemble those of the Stemonitales.

Lister, in all three editions of his monograph The Mycetoza, placed Diachea in the Physaraceae, but mentions (1911, 1925) that "this genus forms a connecting link between the Calcarineae and the Stemonitaceae." Morgan (1894) in the meantime, had transferred it back to the Stemonitaceae emphasizing its resemblance to Lamproderma except for the limy stalk and columella. The European monographers continued to classify this genus in the Physarales, both Schinz (1920) and Krzemieniewska (1960) including it however, in the Physaraceae, following Lister. American monographers, on the other hand (Macbride, 1899, 1922; Macbride & Martin, 1934; Martin, 1949; Martin & Alexopoulos, 1969; Alexopoulos, 1973) followed Morgan, the one exception being Hagelstein (1944) who used Lister's classification throughout, patterned, with few modifications, after Rostafinski.

By 1973, the basis for classification of the Myxomycetes was placing more emphasis on the development of the sporophore (deBary, 1859; Ross, 1957, 1960, 1961, 1973; Alexopoulos, 1969, 1973) rather than on the characters of the mature fructification alone as had been done until recent years. In that year (1973) Blackwell examined the stalk structure of the mature sporophore of Diachea leucopodia with the electron microscope and concluded that the development is "nonstemonitaceous" (subhypothallic) and

that ". . . Diachea (is) misplaced in the Stemonitomycetidae." Shortly thereafter, Farr (1974) on the basis of other features, also suggested that "Diachea seems . . . more naturally and compatibly placed in the Physarales, family Didymiaceae, rather than in the Stemonitaceae." With these conclusions we concur and, therefore, classify Diachea in the Didymiaceae, recognizing, at the same time, that there is merit in considering the erection of a new family for this intermediate genus.

1. Diachea bulbillosa (Berk. & Br.) A. Lister, in Penzig, Myxom. Buit. 45. 1898.

KNOWN WORLD DISTRIBUTION: Southern and Eastern Asia, Eastern Canada, U.S.A., Central America, West Indies, Colombia.

COSTA RICA: V (31), UCR-176 (TEX 1369), 20 VI 1964. VI (37), E. F. Morris # 907 (TEX 1990), 20 II 1966. Both on living leaves.

COMMENTS: A recently described taxon from Dominica, W. I. (D. silvaepluvialis Farr, 1969) differs from this species chiefly in the brown sheathlike covering over the calcareous stipe. All specimens hitherto described as D. bulbillosa should be reexamined for this character. In our specimens all stalks are white and our identifications were checked by Dr. Farr herself.

2. Diachea leucopodia (Bull.) Rost., Mon. 190. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-120 (TEX 1370), 9 VIII 1963, UCR-263 (TEX 1371), 6 XI 1964. IV (27), UCR-320 (TEX 1372), 10 VI 1966. All three on living leaves. VII (38), E. F. Morris # 846 (TEX 1997), 8 II 1966, on dead grass culms.

COMMENTS: All specimens are typical. The species is hard to confuse with any other.

Diderma Pers., Neues Mag. Bot. 1:89. 1794.

*1. Diderma chondrioderma (deBary & Rost.) G. Lister, in Lister, Mycet. ed. 3. 258. 1925.

KNOWN WORLD DISTRIBUTION: Great Britain, Poland, Rumania, U.S.A., Galapagos Islands, Ceylon, Malaya, Japan.

COSTA RICA: V (?), Welden, p. 98.

COMMENTS: We have no specimen from Costa Rica in our collections.

2. Diderma effusum (Schw.) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:155. 1896.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: V (31), UCR-181 (TEX 2194), 19 VI 1964. On leaf.

COMMENTS: This is a typical specimen of a very common and widely distributed species.

3. Diderma hemisphaericum (Bull.) Hornem., Fl. Dan. 33:3. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-173 (TEX 2115), 3 VI 1964. II (16), Carretera panamericana (La Azucena), UCR 298 (TEX 2116), 19 XI 1965. UCR-275b (TEX 1405), 7 VI 1965.

COMMENTS: All three specimens of this easily recognized species are typical.

4. Diderma ?sauteri (Rost.) Macbr., N. Am. Slime-Moulds. 103. 1899.

KNOWN WORLD DISTRIBUTION: Scotland, Austria, Rumania, Eastern North America.

COSTA RICA: I (1), UCR-235 (TEX-specimen misplaced).

COMMENTS: Martin & Alexopoulos (1969) state that this is a very rare species. Our specimen, if indeed it belongs here, is the first one reported from the tropics. It has a calcareous peridium on the basis of which Dr. G. W. Martin disagreed with our identification without, however, assigning our specimen to another known species. Later, Dr. Marie L. Farr expressed the opinion that our

identification was probably correct. We place this specimen tentatively in D. sauteri for lack of a better suggestion. The specimen deposited in the Texas herbarium has been misplaced; the one in the University of Costa Rica herbarium is available.

5. Didyma testaceum (Schrad.) Pers. Syn. Fung. 167. 1801.

KNOWN WORLD DISTRIBUTION: N. America, Jamaica, Dominican Republic, Chile, Europe, Japan, Ceylon, India.

COSTA RICA: VII (34), UCR-304 (TEX 1399), 16 XI 1965.
On leaf fragment.

COMMENTS: The glossy peridium and the large columella are unmistakable characters of this ubiquitous species. Our sporangia are pure white.

Didymium Schrad., Nov. Gen. Pl. 20. 1797.

*1. Didymium clavus (Alb. & Schw.) Rab. Deuts. Krypt. Fl. 1:280. 1844.

KNOWN WORLD DISTRIBUTION: Europe, U.S.A., West Indies, Ceylon.

COSTA RICA: I (1), UCR-74 (TEX 2234), 4 VII 1963, UCR-198 (TEX 2238), 16 IX 1964. III (23), UCR-272 (TEX 2236), 10 VI 1965. VII (34), UCR-313 (TEX 2237), 16 XI 1965. All on dead wood, those of UCR-74 and 198 covered with lava dust.

COMMENTS: The sporangia of UCR-272 are the most typical being decidedly umbilicate above and much depressed. The others tend to be more subglobose, approaching those of D. minus.

2. Didymium crustaceum Fries, Syst. Myc. 3:124. 1829.

KNOWN WORLD DISTRIBUTION: Great Britain, Central Europe, Canada, U.S.A., West Indies, South America, Angola, India.

COSTA RICA: III (23), UCR-199 (TEX 2239), 26 IX 1964, on mossy bark.

COMMENTS: Our specimen consists of two small sporangial

clusters and two single sporangia. All are sessile with very limy peridia.

3. Didymium difforme (Pers.) S. F. Gray, Nat. Arr. Brit. Pl. 1:571. 1821.

KNOWN WORLD DISTRIBUTION: Europe, temperate N. America, W. Indies, S. America, Japan.

COSTA RICA: I (7), UCR-250 (TEX 2240), UCR-252 (TEX 2193), both on 6 XI 1964; (10), UCR-258 (TEX 2241), 15 VII 1965. Caretera Panamericana (La Azucena), UCR-299 (TEX 2242), 19 XI 1965. All on dead leaves.

COMMENTS: This is a widely distributed, probably cosmopolitan species and, therefore, quite variable, sometimes approaching Diderma testaceum in its general appearance (See Martin & Alexopoulos, 1969, p. 384).

4. Didymium iridis (Ditmar) Fr., Syst. Mycol. 3:120. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1) UCR-5 (TEX 2243), January 1963, on dead wood, UCR-332 (TEX 2235), 2 XI 1967, on seeds of Ricinus communis in moist chamber, (La Palma) E. F. Morris # 992 (TEX 1985), 27 II 1966, on dead herbaceous plant; (9), UCR 271 (TEX 2246), 1 VI 1965, on dead leaves. II (16), UCR-280 (TEX 2247), 7 VI 1965, on dead leaf; (19), UCR-166 (TEX 2244), 4 IV 1964, on moss. V (31), UCR-189 (TEX 2245), 18 VI 1964, on dead leaves. VI (37), G. C. Carroll (TEX 414, m. ch. cult. # Co-27), 18 IX 1964, on decaying wood in moist chamber.

COMMENTS: This species closely resembles D. nigripes differing from it chiefly in having a white rather than dark columella, a character that appears to be constant under a variety of environmental conditions. D. iridis is one of the best known of all myxomycete species, having been collected all over the globe. It grows and sporulates easily in laboratory culture on artificial media and its genetics have been intensively studied by Collins and his associates who found both homothallic and heterothallic strains. Its spore development has been recently investigated by Aldrich (1974).

5. Didymium minus (A. Lister) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:145. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-249 (TEX 2188), 6 XI 1964.
Carretera Panamericana, (La Azucena), UCR-295 (TEX 2248),
19 XI 1965. Both on dead leaves.

COMMENTS: UCR-295 is moldy and less typical in its general appearance than UCR-249. The latter is quite typical except for its spores which are somewhat smaller (7-7.5 μm) than described for this species (8-11 μm).

6. Didymium nigripes (Link) Fries, Syst. Myc. 3:119. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (9), UCR-269 (TEX 2189), 1 VI 1965. VII (34), UCR-302 (TEX 2190), 16 XI 1965. Both on dead leaves.

COMMENTS: See comments under D. iridis to which this species appears to be most closely related.

7. Didymium squamulosum (Alb. & Schw.) Fries, Symb. Gast. 19. 1818.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-150 (TEX 2249), 22 X 1963, on living leaves, UCR-226 (TEX 2250), 9 X 1964, on dead leaves; (7), UCR-262 (TEX 2251), 6 XI 1964, on herbaceous stem; (9), UCR-270 (TEX 2252), 1 VI 1965, on dead leaves.
Caretera Panamericana (La Azucena), UCR-296 (TEX 2253),
19 XI 1965, on plant debris.

COMMENTS: All specimens are typical of this unmistakable species. This is one of the relatively few Myxomycetes which can be cultured easily in the laboratory.

Subclass STEMONITOMYCETIDAE Ross, Mycologia 65:483. 1973.

Order S T E M O N I T A L E S Macbride, N. Am. Slime-Moulds, ed. 2. 122. 1922.

Family STEMONITACEAE Rost., Versuch. 6. 1873 (as Tribus).

Stemonitis Roth, Mag. Bot. Rommer & Usteri I (2):25. 1787.

1. Stemonitis axifera (Bull.) Macbr., N. Am. Slime-Moulds 120. 1889.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-22 (TEX 1373), 21 V 1963, UCR-47 (TEX 1375), 8 VI 1963; (8), UCR-265 (TEX 1377), 5 XI 1964. II (12), UCR-35b (TEX 1374), 1 VI 1963. III (21), UCR-65 (TEX 1376), 28 VI 1963; (22), UCR-232 (TEX 1387), 1 X 1964. All on dead wood.

COMMENTS: Stalk length varies greatly in this species. In UCR-22, for example, the stalks are 0.45-1.5 mm high, whereas in UCR-47 they are 3-4 mm. UCR-265 exhibits the membranous expansions in the capillitium, supposedly characteristic of S. flavogenita, and larger surface net meshes than usually found in S. axifera, but the spores place it in the latter species.

2. Stemonitis flavogenita Jahn, Verh. Bot. Ver. Brand. 45:165. 1904.

KNOWN WORLD DISTRIBUTION: U.S.A., West Indies, Panama, Brazil, Europe, Asia, Africa.

COSTA RICA: VII (35), UCR-310 (TEX 1379), 19 XI 1965; (34), E. F. Morris #971 (TEX 1999), 16 III 1966. Both on decaying wood.

COMMENTS: Both specimens agree as closely as can be expected with the description of this variable species.

3. Stemonitis fusca Roth, Mag. Bot. Romer & Usteri I (2): 26. 1787.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-88 (TEX 1381), 7 VII 1963. II (12), UCR-35a (TEX 1380), 1 VI 1963. VI (37), Coll. by G. C. Carroll (TEX 224), 18 IX 1964. III (20), UCR-15 (TEX 388), 20 V 1963; (22), E. F. Morris #897 (TEX 1989), 18 II 1966. VII (34), UCR-316 (TEX 1484), 16 XI 1965. All on dead wood.

COMMENTS: UCR-35a probably represents the variety papillosa. The spores are not reticulate but papillate, the papillae clearly evident only under the oil immersion objective, particularly with phase contrast optics.

4. Stemonitis herbatica Peck, Ann. Rpt. N. Y. State Mus. 26:75. 1874.

KNOWN WORLD DISTRIBUTION: N. America, Jamaica, Brazil, Europe, Africa, Fiji.

COSTA RICA: VI (32), UCR-1481 (No specimen in TEX), 1 VI 1972, on both mossy dead wood and living grass. VII (33), UCR-294 (TEX 1378), 17 XI 1965, on herbaceous stem.

COMMENTS: Both our specimens are typical of the species.

5. Stemonitis splendens Rost. Mon. 195. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-23 (TEX 1385), 21 V 1963, on wood, UCR-52 (TEX 1386), 8 VI 1963, on bark (?).

COMMENTS: In UCR-23 the sporangia are partly agglutinated.

Lamproderma Rost., Versuch. 7. 1873.

1. Lamproderma arcyronema Rost., Mon. 208. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-45 (TEX 1400), UCR-46a (TEX 2191), 8 VI 1963; (7), UCR-248 (TEX 1402), 6 XI 1964; (11), UCR-237 (TEX 1401), 16 X 1964. II (14), UCR-134 (TEX 1396), 17 VIII 1963. VII (34) E. F. Morris #968 (TEX 1988), 16 III 1966. All on dead wood.

COMMENTS: The stalks of UCR-237 are somewhat shorter than usual, constituting about 1/2 to 3/5 of the total height of each sporophore.

2. Lamproderma muscorum (Lev.) Hagelst., Mycologia 27:88. 1935.

KNOWN WORLD DISTRIBUTION: Colombia.

COSTA RICA: II (16), UCR-274 (TEX 1433), 7 VI 1965, on dead leaf. Det. by G. W. Martin.

COMMENTS: Martin & Alexopoulos (1969) say of this particular collection: "A very fine collection . . . from Costa Rica . . . appears to be the closest approach to what Lévillé described that we have seen."

3. Lamproderma scintillans (Berk. & Br.) Morgan.

KNOWN WORLD DISTRIBUTION: Southern Canada, U.S.A., West Indies, Panama, S. America, Galapagos, Great Britain, Germany, Southern and Eastern Asia, Hawaii.

COSTA RICA: I (1), UCR-29 (TEX 1397), 31 V 1963; (9), UCR-135 (TEX 1403), 20 IX 1963. II (16), UCR-275a (TEX 1404), 7 VI 1965; (17), UCR-282 (TEX 1406), 9 VI 1965. All on dead leaves.

COMMENTS: The sporangia of this species are described by Lister (1925) as "steel blue, red or bronze, brilliantly iridescent." This variation in color is sometimes noted in a single sporangial group presumably developed from a single plasmodium, as in our UCR-29 in which both blue and bronze sporangia are found on the same small leaf fragment. In UCR-275a, except for a few blue sporangia on the margin of the leaf, all are bright golden in color. So are those of UCR-282 in which the peridium still persists. In UCR-135 most sporangia are not fully mature. The majority are violet-blue.

One might be tempted to conclude from a study of our specimens that the bronze or golden color is that of the fully and properly matured sporangia and that the violet and blue tints represent earlier stages in sporangial development. This is another case where extended experimental studies in artificial culture would be most helpful. The species has been grown in the laboratory by Alexopoulos (TEX 268, culture) and by Kalyandasundaram (1974), but it is difficult to maintain in culture and no experimental studies have been conducted.

Comatricha Preuss, *Linnaea* 24:140. 1851.

*1. Comatricha aequalis Peck. Ann. Rpt. N. Y. State Mus. 31:42. 1879.

KNOWN WORLD DISTRIBUTION: U.S.A., Costa Rica, Jamaica, Europe.

COSTA RICA: VII (?), Welden, p. 97.

COMMENTS: We have no specimen from Costa Rica in our collections.

2. Comatricha elegans (Racib.) Lister, Guide Brit. Mycet., ed. 3. 31. 1909.

KNOWN WORLD DISTRIBUTION: Europe, U.S.A., West Indies, Brazil, Argentina, S. Asia, Japan.

COSTA RICA: I (1), UCR-39 (TEX 1389), 4 VI 1963. On wood.

COMMENTS: A small collection consisting of about two dozen sporangia. The columella divides at the base of each sporangium into a number of strong branches and the whole configuration of the sporangia is typical for the species. C. lurida is distinguished from C. elegans by its columella which reaches into the sporangium and then divides. Whether this character is constant under various environmental conditions remains to be determined by experimental work when someone succeeds in growing these two species in artificial culture.

3. Comatricha subcaespitosa Peck, Ann. Rpt. N. Y. State Mus. 43:71. 1890.

KNOWN WORLD DISTRIBUTION: Eastern and Central U.S.A. and Canada, California, England, Switzerland, Dominica.

COSTA RICA: V (31), UCR-188 (TEX 1356), 18 VI 1964, on wood. Det. by Dr. G. W. Martin.

COMMENTS: Until Farr (1969) reported it from Dominica, this species was believed to be confined to the temperate regions. Our collection seems to be the second to be reported from the tropics.

4. Comatricha tenerrima (M. A. Curt.) G. Lister, Guide Brit. Mycet., ed. 4. 39. 1919.

KNOWN WORLD DISTRIBUTION: Europe, Quebec, U.S.A., Antigua, Brazil, Jamaica, Japan.

COSTA RICA: IV (El Roble), UCR-105 (TEX 1390), 30 VII 1963, on wood.

COMMENTS: The sporangia have shed most of their spores and are pale brown in color. They appear cylindrical to fusoid but not so much fusoid as in typical C. tenerrima. The capillitium, too, is not exactly typical, lacking the uniformity expected of this species, some of its branches being somewhat heavier than others. The stalks are long, from 2/3 to 3/4 the height of the sporophores. They are dark brown in color and appear fibrous at their origin from the hypothallus. Dr. Marie Farr concurs with our identification.

*5. Comatricha typhoides (Bull.) Rost., in Lister, Mycet. 120. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-42 (TEX 1391), 4 VI 1963, UCR-77 (TEX 1392), 5 VII 1963; (8), UCR-256 (TEX 1395), 5 XI 1964. II (14), UCR-138 (TEX 1394), 17 VIII 1963. VII, Welden, p. 97. All on wood.

COMMENTS: The sporangia of UCR-42 are hard and aberrant for the most part, but the spores are typical. Spore markings of C. typhoides appear to be remarkably constant even when sporangia are developed under adverse conditions as Wollman's (1966) experimental work has amply demonstrated. This makes this species particularly easy to recognize. No other Comatricha has spores resembling those of C. typhoides. The delicate peridium is present on some sporangia in all specimens cited above.

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Badhamia cinerascens, the authors are indebted to Dr. Garry Cole. Mr. Gerald Fay of the University of Texas Cell Research Institute, assisted in the preparation of the illustrations.

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BOOK REVIEW

by

G. L. HENNEBERT

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FUNGI THAT DECAY PONDEROSA PINE, par Robert L. GILBERTSON, x + 197 p., 248 figs., 1974. The University of Arizona Press, Tucson, Arizona, US \$ 9.50.

Le pin ponderosa (*Pinus ponderosa* Laws.) constitue l'espèce la plus largement répandue d'Amérique du Nord, de la Colombie britannique au Mexique. Il y fournit un très grande proportion de la production de bois d'oeuvre. La préservation d'une telle richesse naturelle exige une exacte connaissance des champignons destructeurs qui la menacent.

Des 228 espèces de Basidiomycètes (Tremellales, Aphyllophorales et quelques Agaricales) connus sur le pin ponderosa et qui font l'objet de cet ouvrage, 200 ont été observées en Arizona et au Mexique, tandis que certaines des 28 autres, reconnues ailleurs sur le pin, y ont été retrouvées sur d'autres hôtes. Chaque espèce est décrite avec précision et ses caractères microscopiques dessinés au trait.

Devant la richesse de la mycoflore du pin ponderosa, comprenant par exemple 90 corticiacées et 66 polyporacées, un manuel comme celui-ci contribuera certainement à l'identification plus précise de ces champignons.

INDEX TO FUNGOUS AND LICHEN TAXA

This index includes genera, infrageneric taxa, species, and infraspecific taxa. New taxa are in CAPITALS, and the pages where they are published are in *italics*. Lowe's monograph of *Tyromyces* is separately indexed (pp. 78-82), and these names are not indexed again here except for new taxa and their basionyms. The list of epithets on pp. 155-165 is also not indexed here.

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