

## NEW RECORDS OF NIDULARIACEAE FROM THE WEST INDIES

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(With Plate 18)

Five species of *Cyathus* are added to a previously published list of the Nidulariaceae of the West Indies. *Cyathus gayanus* Tul. was known heretofore mainly from Chile. *C. montagnei* Tul. was known only from Brazil. Three other species were recently described as new: *C. bulleri* Brodie is a pale plicate species from Guadeloupe and Jamaica; *C. julietae* Brodie is a large pale yellowish species at present known from Jamaica only; *C. setosus* Brodie, widely distributed in the West Indies, is a large dark plant with prominent setae. All five species have been grown in pure culture.

A revised key to the West Indian Nidulariaceae is included.

A list of the Nidulariaceae or bird's nest fungi, known to grow in the West Indies, was compiled some years ago by myself and Dr R. W. G. Dennis (Brodie & Dennis, 1954). Since that time, I have examined many collections sent to me by mycologists working in the West Indies and, recently, I had the opportunity of collecting there intensively. As a result, five species of *Cyathus* can now be added to the earlier list: of these, one was known heretofore mainly from Chile; another species was known only from Brazil; three others are recently described species (Brodie, 1967 *a-c*).

A few brief notes are given herewith as an addendum to the list published earlier. For the species recently described by myself, the notes do not include all details given in the official descriptions and are intended merely to emphasize salient points.

### KEY TO SPECIES OF THE NIDULARIACEAE OF THE WEST INDIES\*

1. Peridioles not attached by a funiculus to inner wall of peridium (cup); peridioles small, numerous, gelatinous when moist *NIDULA* (*Nidula niveo-tomentosa*)
1. Peridioles attached by funiculus to inner wall of peridium; peridioles usually about 2 mm wide, 10-20 in number, not gelatinous when moist; peridium composed of three distinct layers *CYATHUS*
2. Cups distinctly plicate or fluted inside and outside; outer fluting often hidden by hairy surface
3. Spores very small, elliptical, between 5 and 8 $\mu$ , peridioles with single-layered cortex
4. Cups grey brown to darker; peridioles elliptical; spores elliptical, 5-6  $\times$  7-8 $\mu$   
*Cyathus berkeleyanus*
4. Cups pale grey to linen colour; peridioles not elliptical; spores mostly globose, variable, 5-8.5 $\mu$  *C. bulleri*

\* For a description of terms used in this key and description of species not dealt with in the present paper, see Brodie & Dennis (1954).

3. Spores  $10\mu$  long or more; peridioles with two-layered cortex
5. Plication or fluting fine, the grooves about 0.5 mm apart; spores at least  $30\mu$  in length
6. Cups tall, narrow, 15 mm high  $\times$  5–6 mm broad; peridioles 3 mm wide  
*C. gayanus*
6. Cups broadly conical; peridioles less than 3 mm
7. Cups moderately large, more than 3 mm wide; peridioles about 2 mm wide
8. Spores large,  $30\text{--}50\mu$   
*C. poeppigii*
8. Spores smaller,  $12 \times 20\mu$   
*C. montagnei*
7. Cups small, 2.5–3 mm; spores  $16 \times 44\mu$   
*C. costatus*
5. Plication or fluting coarse, the grooves 0.75–1 mm apart; spores  $10\text{--}12 \times 16\text{--}22\mu$   
*C. limbatus*
2. Cups smooth inside and outside or, if plicate inside, only faintly and irregularly
9. Cortex of peridiole composed of only one layer as seen in section
10. Cups dark brown, evenly woolly, spores  $4 \times 5\text{--}6\mu$   
*C. microsporus*
10. Cups straw-coloured to pale fawn
11. Cups small, thin-textured, crucible-shaped, with long rigid hairs; peridioles circular in outline, smooth  
*C. pallidus*
11. Cups larger, at least 6–8 mm wide
12. Cups covered outside by tomentum the hairs of which cohere in distinct tufts or nodules  
*C. intermedius*
12. Cups, on outside, bearing long retrorse hairs, straw-coloured to pale yellowish; peridioles elliptical  
*C. julietae*
9. Cortex of peridiole composed of two layers as seen in section
13. Peridioles covered with thin, silvery tunica
14. Cups with coarse spreading hairs on outside, spores elliptical,  $12\text{--}14 \times 16\text{--}22\mu$   
*C. triplex*
14. Cups covered with fine even tomentum, dark brown
15. Spores  $12\text{--}16 \times 24\text{--}32\mu$ , elliptical  
*C. earlei*
15. Spores  $7\text{--}9\mu$  globose  
*C. canna*
13. Peridioles shiny black, without tunica
16. Cups large, wide, dark brown; mouth beset with long conspicuous setae; spores  $10\text{--}14 \times 17\text{--}24\mu$   
*C. setosus*
16. Cups smaller, narrower, coprophilous, hairy but lacking distinct setae; spores subglobose  $30\text{--}40\mu$   
*C. stercoreus*
16. Cups 3 mm diam.; spores small,  $8\text{--}16\mu$ , elliptical  
*C. fimicola*

The following descriptions and collection numbers refer to specimens in the Fungus Herbarium of H. J. Brodie, University of Alberta, Edmonton, Canada, where type specimens of the recently described *Cyathus bulleri*, *C. julietae* and *C. setosus* are also located.

(1) *CYATHUS GAYANUS* Tul., *Annls Sci. nat.* III, 1, 76–77, 1844 (Pl. 18, fig. 1)

For many years, this fungus was known only from Chile. I have already drawn attention (Brodie, 1955) to the presence of *C. gayanus* in Central America and its range can now be extended to include Jamaica.

The species is readily recognized by its unusually tall slender peridia which are plicate and dark brown, by its large peridioles and by its subglobose spores ( $20\text{--}32\mu$ ).

*Collections seen.* JAMAICA: Mandeville, H. J. Brodie, no. 6612, 1966, on old coconut fibre; Deanbeigh, H. J. B., no. 6623, 1966, on old wood chips.

- (2) *CYATHUS MONTAGNEI* Tul., *Annls Sci. nat.* III, 1, 70–71, 1844 (Pl. 18, fig. 2)

This species, described by Tulasne (1844) from Brazil, is apparently abundant in the West Indies and in Central America. At the edge of the Dolé River near Trois Rivières, Guadeloupe, I found a rotting jute sack on which over 150 specimens of this fungus were growing.

*C. montagnei* has rather short, *wide-flaring* plicate peridia which are brown and hirsute. (Tulasne described the colour as ferrugineous. Actually, fresh specimens are darker but tend to fade, as do many species in the tropics.) On the inside, the cups are silvery or *lead-coloured*. Peridioles are black, shiny and plump. The elliptical spores measure  $12\ \mu \times 10\ \mu$ .

*Collections seen.* TRINIDAD: Port of Spain, C. J. Alexopoulos, no. 6624a, 1966. JAMAICA: Kingston, H. J. Brodie, no. 6632, 1966, on old wood, banana plantation; Woodside, H. J. B., no. 6633, under banana and *Xanthosoma*; Kingston, H. J. B., no. 6638, 1966, on bamboo pots, nursery; Kingston, Castleton Gardens, H. J. B., no. 6650, on old bamboo chips. GUADELOUPE: Trois Rivières, H. J. B., no. 66104, 1966, on old sack beside stream. COSTA RICA: Punta Arenas, C. B. Heiser, no. 1227, 1953.

- (3) *CYATHUS BULLERI* Brodie, *Bull. Torrey bot. Club* 94, 68–71, 1967 (Pl. 18, fig. 3)

Because of its *pale straw colour* and long external hairs, this recently described species may, in the past, have been confused with *C. pallidus* Berk. & Curt. *C. bulleri*, however, is *strongly plicate* (Pl. 18, fig. 3, right) externally and internally (it belongs in the section *Eucyathus*), whereas *C. pallidus* is smooth or, at least, not regularly plicate. In young specimens of *C. bulleri*, abundant hairs may obscure the external plication (Pl. 18, fig. 3, left). Specimens of what might appear to be a large form of *C. pallidus* should, therefore, be examined closely. An additional difference is marked but may not always be discerned if specimens are old: *C. bulleri* has an epiphragm beset with vertical tufts of red-brown hyphae; the epiphragm of *C. pallidus* is snow-white and unadorned.

*C. bulleri* is the only *very pale* strongly plicate species known to occur in the tropics. It is apparently a common fungus in the West Indies. Spores are spherical to subglobose and measure  $5\text{--}8.5\ \mu$ . *C. bulleri* appears to be most closely related to *C. berkeleyanus* (Tul.) Lloyd, as both species have plicate cups, long external hairs, a single-layered cortex, and small spores. *C. berkeleyanus* (the type of which I examined at Kew), however, is brown, whereas *C. bulleri* is pale grey or linen colour. Moreover, in *C. berkeleyanus*, the peridioles are mostly elliptical, the epiphragm lacks the tufts of brown hairs present in *C. bulleri* and the spores (of *C. berkeleyanus*) are mostly oval.

*Collections seen.* GUADELOUPE: Trois Rivières, H. J. Brodie, no. 6680a (Type), 1966, on old wood, mouth of stream; Trois Rivières, H. J. B., no. 6695a, on old log in stream; Trois Rivières, H. J. B., no. 6697a, 1966, on wood near stream; Trois Rivières, H. J. B., no. 6697b, 1966, on wood in stream. JAMAICA: Woodsville, H. J. B., 1966, on wood chips; Hatfield P. O., 1956, D. Powell, on rotted wood.

(4) *CYATHUS JULIETAE* Brodie, *Svensk bot. Tidskr.* **61**, 93–96, 1967 (Pl. 18, fig. 4)

In Jamaica there occurs a large and distinctive *Cyathus* belonging to the *pallidus* group which I have named *C. julietae*. Peridia are almost twice as large as those of *C. pallidus* and have a pale but distinct *lemon-yellow* tint. The inside of the peridia (Pl. 18, fig. 4, centre) is *smoother* than in any other species of this group. An additional diagnostic character is the pale yellow colour of the epiphragm. This species is known only from Jamaica but it should be looked for elsewhere in the Caribbean area. Spores measure  $5\text{--}7 \times 5\text{--}9 \mu$ .

*Collections seen.* JAMAICA: Hardwar Gap, H. J. Brodie, no. 6641 (Type), 1966, on old wood among mosses; Hardwar Gap, Mrs C. J. Alexopoulos, no. 6641a, 1966; Hardwar Gap, H. J. B., no. 6641b, 1966 on log; St Andrew Parish, G. R. Proctor, 1959, on log in shaded gully.

(5) *CYATHUS SETOSUS* Brodie, *Can. J. Bot.* **45**, 1–3, 1967 (Pl. 18, figs. 5, 6)

One of the largest, darkest-coloured and most distinctive species of *Cyathus* of the West Indies is *C. setosus* so named because of the long *stiff persistent setae* with which the lip of the peridium is beset. These setae can be seen with the unaided eye and are very conspicuous under the hand lens (Pl. 18, fig. 6). The wide conical form, silvery interior and large plump peridioles are additional diagnostic features. The elliptical thick-walled spores measure  $10\text{--}14 \times 17\text{--}24 \mu$ .

The fungus is common and widespread in the West Indies and is unlikely to be confused with any other species of *Cyathus*.

*Collections seen.* JAMAICA: Woodsville, H. J. Brodie, nos. 6619, 6619a (Type), 66621, 66622b, 1966, on old wood under *Xanthosoma*, wet ravine; Kingston, C. J. Alexopoulos, no. 6643, 1966, on twigs; Castleton Gardens, H. J. B., no. 6649, on bamboo nursery pots; Spring Gardens, H. J. B., no. 6655, on loose bark of Mahoe; Port Antonio, H. J. B., nos. 6658, 6664a, 6665, 6652a, 6666, 1966; Ferry, D. Powell, 1956; Kingston, T. H. Farr, no. 5622, 1956. ST LUCIA: Castries, H. J. B., no. 6678, 1966. GUADELOUPE: St Claude, H. J. B., no. 66101. TRINIDAD: St Augustine, R. F. Barnes, 1966.

Thus, at present, we know of the occurrence of eighteen species of the Nidulariaceae in the West Indies.\* It is worthy of note that among ninety collections made recently by myself in the Caribbean islands, thirteen species were represented and three of these were previously undescribed. There seems little doubt that the Caribbean area is richer in numbers of species of these fungi than any other part of the world which has been equally thoroughly searched by mycologists.

In the list and notes by Brodie & Dennis (1954) it was recorded that certain members of the Nidulariaceae seem not to exist in the West Indies. A further word on this matter is appropriate. The genus *Nidularia* is known from Brazil; *Nidula* is known from Australia, Chile, and Japan; *Crucibulum* (a monotypic genus) occurs in Australia; *Cyathus olla* (or forms

\* *Sphaerobolus stellatus* Tode ex Pers. is also found in the West Indies (e.g. in Jamaica), but is not included because it is not recognized by some mycologists as belonging to the family Nidulariaceae.

of it) is found in South Africa, Australia, Peru and Chile. Many of the countries mentioned are wholly or partly within the tropics. Most of the genera and species above however, are not known to occur in the West Indies. The single exception seems to be *Nidula niveo-tomentosa* (Henn.) Lloyd, as reported previously from Jamaica by Brodie and Dennis.

Knowing these facts, I made a special effort, during 8 weeks of collecting in the Caribbean, to look for the 'missing' fungi in all probable sites. I was unable to find a single specimen of any of the missing species and genera; they appear not to occur in the Caribbean regions.

Three other species included in the list by Brodie & Dennis (1954) are *C. earlei* Lloyd, *C. canna* Lloyd and *C. fimicola* Lloyd.

*C. earlei* was previously known from Cuba, Puerto Rico and Hawaii. I did not find this species at all in my 1966 collecting, but have reported its occurrence in Mexico (Brodie, 1962).

*C. canna* Lloyd, known previously only from Barbados and Mauritius, is another species which I failed to locate in the West Indies. I have, however, several collections of this fungus sent to me from Costa Rica by Dr C. B. Heiser and suspect it is of wide distribution.

Regarding *C. fimicola* Lloyd non Berk., nothing new can be added. As noted by Brodie & Dennis (1954), the name was not validly published. It appears to be a good species and, for the time being, I have retained it in the West Indian list.

Finally, it should be recorded that all five species of those named above as new records for the West Indies have been obtained in pure culture in my laboratory. To date the only one which has fruited readily in culture is *Cyathus bulleri*.

It is a pleasure to express my gratitude to the National Research Council of Canada for support of a long-term project and to the University of Alberta for granting leave which enabled me to travel in the West Indies and South America. The assistance of the staff of the Institute of Jamaica is also gratefully recognized.

## REFERENCES

- BRODIE, H. J. (1955). *Cyathus gayanus* from Costa Rica. *Mycologia* **47** (2), 266-268.  
 BRODIE, H. J. (1962). Culture and taxonomy of *Cyathus earlei*. *Can. J. Bot.* **40**, 1483-1485.  
 BRODIE, H. J. (1967a). *Cyathus setosus*, a new member of the Nidulariaceae from Jamaica. *Can. J. Bot.* **5**, 1-3.  
 BRODIE, H. J. (1967b). *Cyathus bulleri*, a hitherto undescribed fungus of the Nidulariaceae from the West Indies. *Bull. Torrey bot. Club* **94**, 68-71.  
 BRODIE, H. J. (1967c). A new species of *Cyathus* in the *pallidus* group. *Svensk bot. Tidskr.* **61**, 93-96.  
 BRODIE, H. J. & DENNIS, R. W. G. (1954). The Nidulariaceae of the West Indies. *Trans. Br. mycol. Soc.* **37**, (2), 151-160.  
 TULASNE, L. R. & TULASNE, C. (1844). Recherches sur l'organisation et le mode de fructification des champignons de la tribu des Nidulariées, suivies d'un essai monographique. *Annls Sci. nat.* III, **1**, 41-107.

## EXPLANATION OF PLATE 18

(Collection numbers refer to specimens in Herbarium of H. J. Brodie, University of Alberta, Canada.)

- Fig. 1. *Cyathus gayanus*. No. 6612 (Jamaica). Dark, cylindrical, plicate peridium.  $\times 2$ .  
Fig. 2. *C. montagnei*. No. 66104 (Guadeloupe). Dark, wide, plicate peridium.  $\times 2$ .  
Fig. 3. *C. bulleri*. No. 6680a, *type* (Guadeloupe). Pale, wide, plicate peridia; also peridioles.  $\times 2$ .  
Fig. 4. *C. julietae*. No. 6641, *type* (Jamaica). Pale, smooth peridia with long hairs.  $\times 2$ .  
Fig. 5. *C. setosus*. No. 6619a, *type* (Jamaica). Dark, wide peridia with conspicuous setae.  $\times 2$ .  
Fig. 6. *C. setosus*. No. 6619a, *type* (Jamaica). Setae around mouth of peridium. Immature specimen.  $\times 3.5$ .

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