surface fauna, and studies have shown that the rate of such dispersal for epigean forms is low (*7*, pp. 534–535).

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References and Notes

1. A. Vandel, *Biospeleology: The Biology of Cavernicolous Animals*, B. E. Freeman, Transl. (Pergamon, Oxford, 1965).
2. T. L. Poulson and W. B. White, *Science* **165**, 971 (1969).
3. T. C. Barr, in *Evolutionary Biology*, Th. Dobzhansky, M. K. Hecht, W. C. Steere, Eds. (Appleton-Century-Crofts, New York, 1968), vol. 2, pp. 35–102; 47; 83.
4. H. Torii, *Jap. J. Zool.* **12**, 555 (1960); *ibid.* **13**, 424 (1962).
5. This is the largest (10,438 km²), youngest, and volcanically most active island in the Hawaiian chain.
6. E. Zimmerman, *Insects of Hawaii* (Univ. of Hawaii, Honolulu, 1948), vol. 1; S. Carlquist, *Hawaii: A Natural History* (Natural History, Garden City, N.Y., 1970), pp. 122–138.
7. For example, see H. L. Carson, D. E. Hardy, H. T. Spieth, W. S. Stone, in *Essays in Evolution and Genetics in Honor of Theodosius Dobzhansky*, M. K. Hecht and W. C. Steere, Eds. (Appleton-Century-Crofts, New York, 1970), pp. 437–543.
8. Only one other cixiid is reported to be cavernicolous, *Typhlobrixia namorokensis* Synave from Madagascar. Vandel considered it a soil form accidental in caves (*1*, p. 183), but morphologically it is intermediate between epigean species and the Hawaiian cave cixiid. In Cixiidae, the adult is the dispersal stage, and most root-feeding cixiids molt to epigean adults. Field observation has shown that the nymphs of the Hawaiian cave cixiid feed on exposed tree roots in the caves and not on those roots within the soil and that the adults disperse entirely within lava tubes and associated cavities.
9. T. Esaki, *Annu. Mag. Nat. Hist. Ser. 10* **4**, 341 (1929).
10. G. A. MacDonald and A. T. Abbott, *Volcanoes in the Sea* (Univ. of Hawaii, Honolulu, 1970), p. 30; H. T. Stearns, *Geology of the State of Hawaii* (Pacific Books, Palo Alto, Calif., 1966), pp. 114–116.
11. This study was supported by NSF grant GB 23075 and is part of an integrated program of studies on island ecosystems, the International Biological Programme, Hawaii Subprogram. I thank F. J. Radovsky for his review and encouragement; G. A. Samuelson for identifying the carabid; and both of them and W. A. Steffan, W. C. Gagné, F. D. Stone, and N. C. Howarth for technical assistance. Contribution No. 1, Island Ecosystems IRP/IBP Hawaii.

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Sexual Stage of Histoplasma capsulatum

Abstract. *Twelve primary subcultures of* Histoplasma capsulatum, *paired in all possible combinations on agar containing yeast extract and Alphacel, produced fertile cleistothecia, resembling those of* Ajellomyces dermatitidis (Blastomyces dermatitidis).

In 1967, Ajello and Cheng (*1*) reported the sexual stage of *Histoplasma capsulatum*, a pathogenic fungus. The claim was refuted by Kwon-Chung in 1968 (*2*) on the basis that the cultures were mixed, and that the cleistothecia they observed were not produced by *H. capsulatum* but by a nonpathogenic Gymnoascaceous fungus. The refutation was subsequently supported by various mycologists (*3*).

Recently, I isolated 12 strains of *H. capsulatum* from soil samples collected under bird roosts in Miller County, Arkansas (*4*), and cultured them in pairs of 144 possible combinations on agar medium containing Alphacel (*5*) and yeast extract. Cleistothecia were found in 70 combinations after 3 weeks at 25°C. The cleistothecia resemble those of *Ajellomyces dermatitidis* (*6*), the etiologic agent of North American blastomycosis, by the formation of tightly coiled hyphae radiating from a common source at the base of the young ascocarp (Fig. 1, A and B). The main difference in the fruiting body of the two fungi can be found, however, in the shape and size of the branches originating from the coils.

In contrast to *A. dermatitidis*, the highly branched short hyphae arising from the coil in *H. capsulatum* are irregularly curved and never constricted at the cross walls (Fig. 1D).

The mature cleistothecia are globose (Fig. 1C) with buffy pigment, ranging in size from 80 to 250 μm in diameter. When a cleistothecium is mounted in a solution of lactophenol and cotton-blue for microscopic examination, intensely stained clusters of asci (Fig. 1E) are visible at the central part of the ascocarp. The pear-shaped asci contain eight smooth, hyaline spherical ascospores that are 1.5 μm in diameter (Fig. 1F). The single ascospore isolates obtained by micromanipulation were found to be heterothallic and produce conidia typical of *H. capsulatum*. The cultures also transform into the yeast phase typical of *H. capsulatum* at 37°C on blood-cysteine glucose agar.

A detailed account of the heterothallism, development of the cleistothecia, and a Latin description is in preparation.

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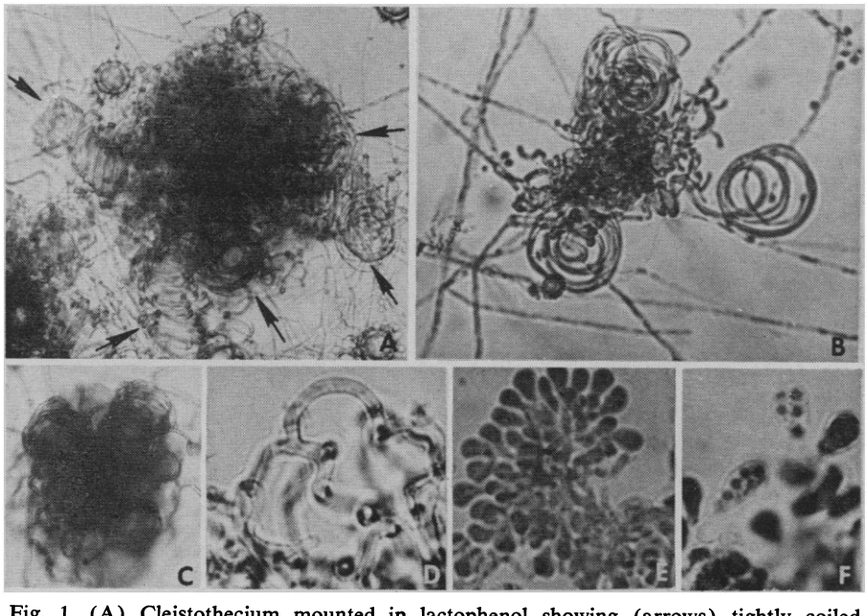

Fig. 1. (A) Cleistothecium mounted in lactophenol showing (arrows) tightly coiled hyphae (×300). (B) Young ascocarp with three coils and ascogenous hyphal mass at the central part (×485). (C) Mature cleistothecium (×300). (D) Irregularly curved hyphae originated from the coils (×1250). (E) Cluster of young asci stained with cotton-blue (×750). (F) Mature asci with ascospores (×1250).

References and Notes

1. L. Ajello and S. Cheng, *Science* **155**, 1696 (1967); *Bacteriol. Proc.* **1967**, M45, 68 (1967); *Mycologia* **59**, 689 (1967).
2. K. J. Kwon-Chung, *Sabouraudia* **6**, 168 (1968).
3. M. D. Berliner, *ibid.*, p. 272; J. W. Brandsberg, R. J. Weeks, W. B. Hill, W. R. Piggott, *Mycopathol. Mycol. Appl.* **38**, 71 (1969); G. F. Orr, *Can. J. Bot.* **48**, 1061 (1970).
4. The soil samples were collected by R. Weeks and L. Vining, Center for Disease Control, Kansas City, Kansas.
5. Hydrolyzed Alphacel was obtained from Nutritional Biochemicals, Cleveland, Ohio.
6. E. S. McDonough and A. L. Lewis, *Science* **156**, 528 (1967); *Mycologia* **60**, 76 (1968).

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