Bull. Natn. Sci. Mus., Tokyo, Ser. B, **30**(1), pp. 15–19, March 22, 2004

Dictyostelids in Japan. XIII. *Dictyostelium clavatum* Hagiwara

Hiromitsu Hagiwara

Department of Botany, National Science Museum,
Amakubo 4–1–1, Tsukuba, 305–0005 Japan
E-mail: h-hagiwa@kahaku.go.jp

Abstract *Dictyostelium clavatum* Hagiwara, which was originally described from Nepal in 1992, was obtained from forest soil samples collected in Hokkaido and Honshu. This is the first report of this species in Japan. Results of examinations for the formation of sexual structures suggest that *D. clavatum* is a homothallic species.

Key words : cellular slime mold, dictyostelid, *Dictyostelium clavatum*, Japan, macrocyst.

In the course of this study on Japanese dictyostelid cellular slime molds, *Dictyostelium clavatum* Hagiwara, originally described from Nepal (Hagiwara, 1992), was obtained from Hokkaido and Honshu, Japan. Descriptions and observations of this species are presented below.

Procedures of isolation, cultivation and observation are the same as those reported previously (Hagiwara, 1989). Twenty spores per strain were used for calculating the mean spore diameter. Range of mean spore diameters of the isolates examined is indicated by MD in the following description.

Dictyostelium clavatum Hagiwara Figs. 1–3

When cultured at 20°C on non-nutrient agar with *Escherichia coli*, sorocarps usually solitary, sometimes accompanying several to many small satellite sorocarps, usually unbranched, sometimes sparsely and irregularly branched, phototropic, often prostrate; sorophores colorless, (0.4–)1.3–4.9 mm in length, sometimes exceeding 5 mm if prostrate, gradually tapering from bases to tips, often with basal disks, sometimes with supporters if prostrate; sorophore bases clavate, (7.5–)12–40 μm in diam at the thickest portion; sorophore tips clavate, (6.5–)10–36 μm in diam at the thickest portion, (3.5–)6–22 μm in diam at the thinnest portion; basal disks consisting of supporting cells, 30–115(–364) μm in diam; sori white, globose, 20–320 μm in diam; spores hyaline, ellipsoid, usually 1.7–2.1 times longer than broad, smooth, mostly 5.3–6.7×2.8–3.5 (MD 5.8–6.3×3.0–3.2) μm, without polar granules; pseudoplasmodia with radiate streams, sometimes migrating without sorophore formation for a short distance, usually producing single sorogens.

Habitat: In humus and fermentation layers of soils.

Strains examined: Ha20, from evergreen coniferous forest, 960 m alt., Mt. Hayachine-san, Iwate Pref., 7 Aug. 1979; MH10, MH38, MH43 & MH47, from deciduous broad-leaved forest, 1500–2100 m alt., Mt. Hakusan, Ishikawa Pref., 3 Sept. 1985; MB52, from mixed forest of deciduous broad-leaved trees and evergreen coniferous trees, 1820 m alt., Mt. Betsuzan, Ishikawa Pref., 5 Sept. 1985; 91HO10, from evergreen coniferous forest, 280 m alt., Shumarinai, Uryu-cho, Hokkaido Pref., 29 July 1991; 91HO13, evergreen coniferous forest, 10 m alt., Sarobetsu marshland, near Toyotomi-cho, Hokkaido Pref., 30 July 1991; 91HO35, from deciduous broad-leaved forest, 190 m alt., Mt. Arashi-yama, Asahikawa, Hokkaido Pref., 31 July 1991.

World distribution: Asia; Japan, Nepal.

Dictyostelium clavatum is characterized by medial sorophores which do not exceed 5 mm

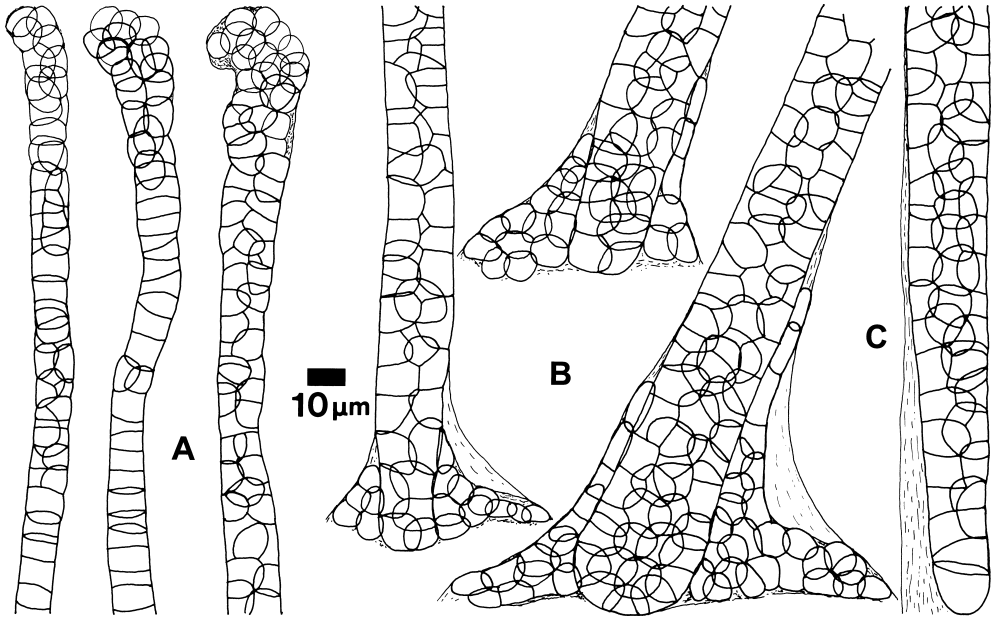


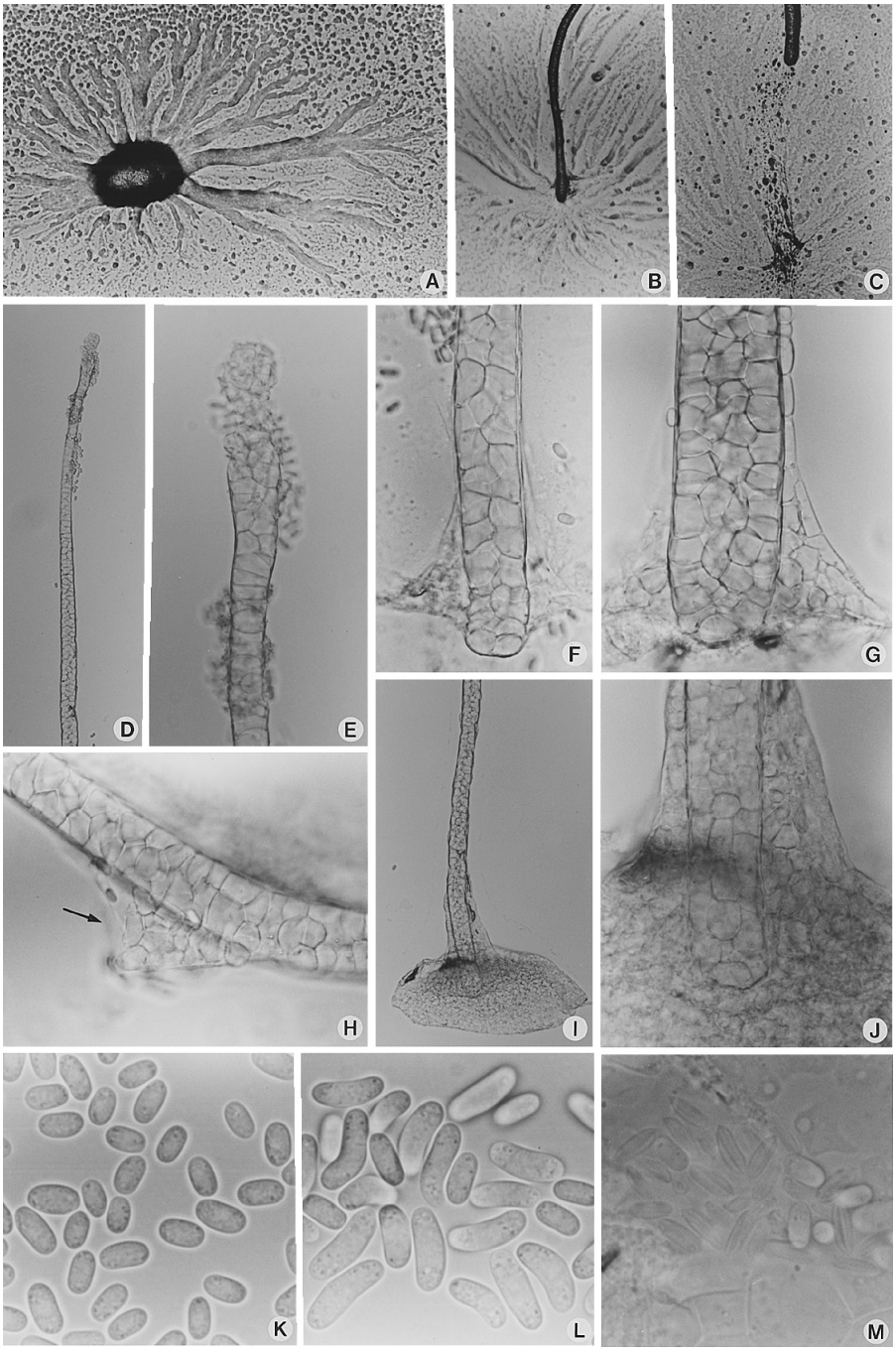
Fig. 1. *Dictyostelium clavatum*. A. Sorophore tips. B. Sorophore bases with supporting cells. C. Sorophore base of a prostrate sorocarp.

except for prostrate sorophores, clavate sorophore tips and small spores (Hagiwara, 1992). Sorophore bases are also clavate and often surrounded by supporting cells. If prostrate, sorocarps usually have acuminate sorophore bases (Fig. 1C), sometimes accompanied by supporters (Fig. 2H). This species sometimes, not often, produces migrating pseudoplasmodia without sorophore formation (Fig. 2C). Spores are ellipsoid, but abnormal spores are lengthened and reniform or sigmoid (Fig. 2L). Spore walls longitudinally split during germination (Fig. 2M).

Although strain MB52 was identified with *D. clavatum*, measurements of the morphological dimensions of MB52 were excluded from the above description because it is an abnormal strain judging from uneven and rugged outer surfaces of the sorophores and broader spores. This strain sometimes forms large basal disks (Figs. 2I & 2J).

All the strains examined except for MH10, MH43 and 91HO10 produced macrocysts, or sexual structures, in an underwater culture incubated at 25°C in the dark. The type strain of *D. clavatum*, *Hagiwara* KPA-15, also produced macrocysts under the same conditions (Fig. 4). These facts suggest *D. clavatum* is a homothallic species. Strains 91HO35 and MB52 often produced unusual macrocysts. In 91HO35, thick

Fig. 2. *Dictyostelium clavatum*. A. Pseudoplasmodium. ×28. B. Growth habit of forming a solitary sorocarp. ×28. C. Growth habit of migrating. A pseudoplasmodium formed a sorocarp after migrating for a short distance from the aggregation center of myxamoebae. ×28. D. Upper portion of a sorophore. ×115. E. Higher magnification of the sorophore tip in Fig. D. ×460. F, G. Sorophore bases with supporting cells. ×460. H. Supporter (arrow). ×460. I. Basal portion of a sorocarp with a large basal disk. ×115. J. Higher magnifications of the sorophore base in Fig. I. ×460. K. Spores. ×1150. L. Abnormal spores mixed with a few normal spores. ×1150. M. Empty spore cases where germination occurred by longitudinal rupture of spore walls. ×1150. Figs. A–C, strain MH43; Figs. D, E & M, strain 91HO35; Figs. F & K, strain Ha20; Figs. G & H, strain MH47; Figs. I & J, strain MB52; Fig. L, strain MH10.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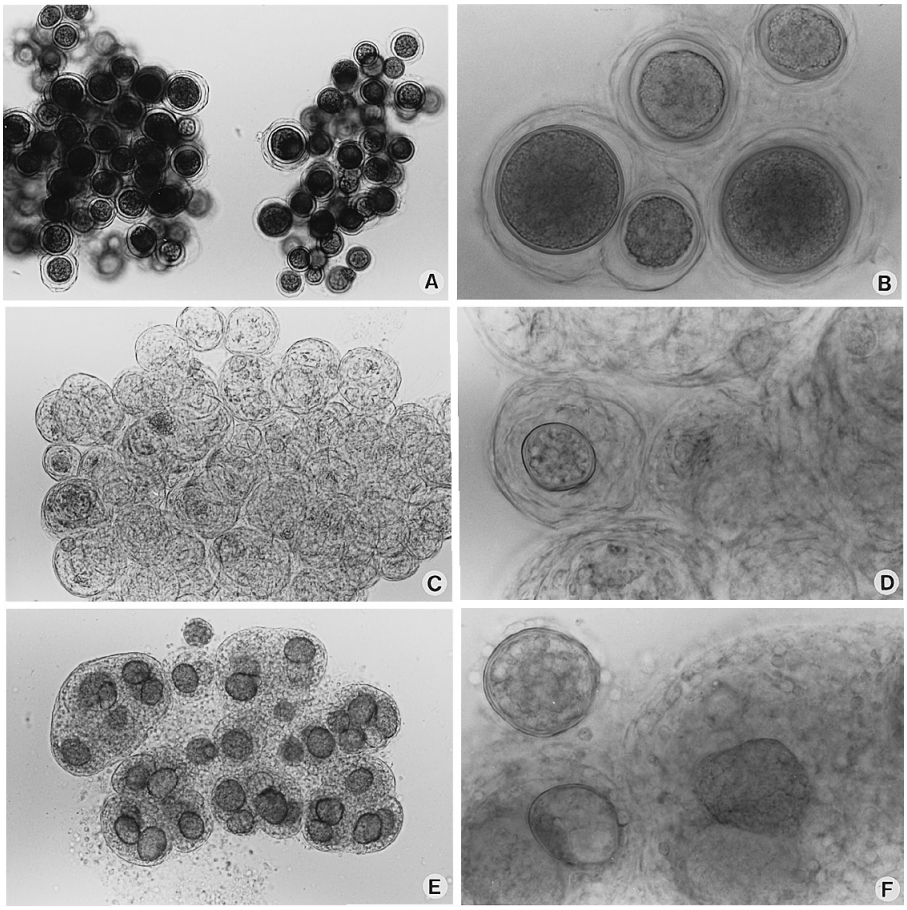

Fig. 3. *Dictyostelium clavatum*. A, B. Macrocysts from strain MH38. C, D. Unusual macrocysts from strain 91HO35. E, F. Unusual macrocysts from strain MB52. Figs. A, C & E, ×115; Figs. B, D & F, ×460.

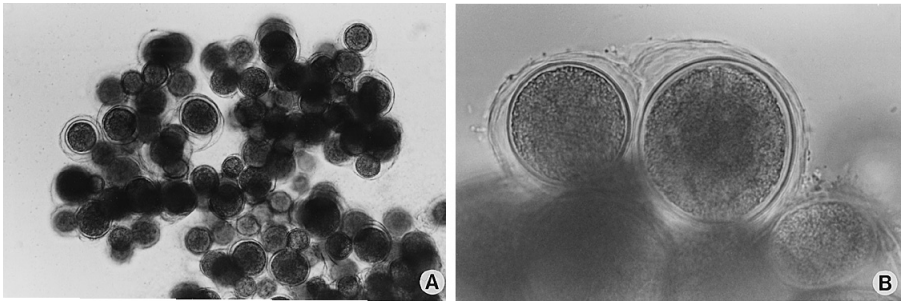

Fig. 4. *Dictyostelium clavatum*. A, B. Macrocysts from the type strain, *Hagiwara* KPA-15. Fig. A, ×115; Fig. B, ×460.

membranes enveloped single macrocysts or amorphous structures which may be sterile macrocysts (Figs. 3C & 3D). On the other hand, in MB52, membranes enveloped a large number of spores surrounding single or plural macrocysts (Figs. 3E & 3F). Such unusual macrocysts have

not been previously reported in any dictyostelids.

Dictyostelium clavatum is most similar to *D. mucoroides* Brefeld amended by Hagiwara (1984), which is not *D. mucoroides* amended by Raper (1984) but *D. sphaerocephalum* (Oud.) Sacc. & March. amended by Raper (1984), in clavate sorophore tips, clavate sorophore bases surrounded by supporting cells, prostrate sorocarps having supporters, migrating pseudoplasmodia without sorophore formation, and sorocarps sometimes accompanying many small satellite sorocarps. But *D. clavatum* has no sorophore collars which characterize *D. mucoroides sensu* Hagiwara. Macrocyst formation is not known in *D. mucoroides sensu* Hagiwara. Several strains deposited in our laboratory were examined for macrocyst formation in underwater cultures incubated at 25°C in the dark, but they produced no macrocysts (Data unpublished). Therefore, *D. mucoroides sensu* Hagiwara is probably not a homothallic species.

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