

Dictyostelids in Pakistan III. *Dictyostelium aureocephalum* Hagiwara and *D. macrocephalum* Hagiwara, Yeh et Chien

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Abstract *Dictyostelium aureocephalum* and *D. macrocephalum* were obtained from Pakistan. Their descriptions, localities and noteworthy morphological features were presented with illustrations of *D. aureocephalum*.

Key words: cellular slime mold, dictyostelid, *Dictyostelium aureocephalum*, *Dictyostelium macrocephalum*, Pakistan.

Dictyostelium aureocephalum Hagiwara was originally found in the alpine region of Nepal (Hagiwara, 1991a) and was assumed to be endemic to the subalpine and alpine regions of the Great Himalayas (Hagiwara, 1992b). On the other hand, *D. macrocephalum* Hagiwara, Yeh et Chien was discovered in the lowlands of Taiwan (Hagiwara et al., 1985) and was suggested to be a common species of the subtropical and tropical regions in and around Asia (Hagiwara, 1991b). Additionally, this species was reported from the tropical forest of Peru (Landolt and Stephenson, 1991).

Dictyostelium aureocephalum and *D. macrocephalum* have been already reported from Pakistan (Hagiwara, 1992a). In this report, however, they were only enumerated and discussed in their ecological aspects. So their descriptions, localities and noteworthy morphological features are presented here. Procedures of isolation, cultivation and observation are the same as those reported previously (Hagiwara, 1989, 1992a). Twenty spores per isolate are 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 aureocephalum Hagiwara, Bull. Natn. Sci. Mus., Tokyo, Ser. B, 17: 103 (1991).

When cultured at 20°C on non-nutrient agar with *Escherichia coli*, sorocarps often prostrate; sorophores 0.56–2.92 (–3.46) mm in length, with hook-like structures at the points of contact with the agar if prostrate, with typically capitate to somewhat clavate tips, 6–19 µm in diam. at a level 100 µm above the bottom, 3–16 µm in diam. at a level 50 µm below the top; basal disk 14–45 µm in diam.; sori yellow to yellowish white, 50–150 (–180) µm in diam.; spores oblong, usually 1.5–2.1 times longer

than broad, mostly $5.5\text{--}7.7 \times 3.3\text{--}4.1$ (MD $6.0\text{--}7.0 \times 3.6\text{--}3.8$) μm , without polar granules.

Isolates examined: *Hagiwara* PNS-59, 3,450 m alt., Rupal to Lato Bo, Mt. Nanga Parbat, Jammu & Kashmir, 13 Sept. 1990; *Hagiwara* PNS-81, 3,750 m alt., Chilian to Mazeno Pass, Mt. Nanga Parbat, Jammu & Kashmir, 15 Sept. 1990; *Hagiwara* PFM-143 and 144, 3,200 m alt., Lowari Pass, Dir, Malakand, NWFP, 22 Sept. 1992.

Other isolates: *Hagiwara* PFH-26, 2,800 m alt., Batakundi, Mansehra, Hazara, NWFP, 26 Aug. 1990; *Hagiwara* PFH-44, 3,120 m alt., Saiful Muluk, Mansehra, Hazara, NWFP, 27 Aug. 1990; *Hagiwara* PNS-66 and 69, ca. 3,600 m alt., Chilian to Mazeno Pass, Mt. Nanga Parbat, Jammu & Kashmir, 15 Sept. 1990.

World distribution: Asia; Nepal, Pakistan.

Dictyostelium aureocephalum is characterized by its yellow sori (Hagiwara, 1991a). This feature was somewhat unstable in cultures of the non-nutrient agar medium, namely, the yellowish tint tended to become paler. Such a tendency is shown in *D. firmibasis* Hagiwara (Hagiwara, 1989; Cavender and Kawabe, 1989).

Sorophore tips of *Dictyostelium aureocephalum* ranged from typically capitate to clavate forms (Fig. 1). The clavate form, however, seems to be a longitudinally lengthened shape of the capitate form, because its base becomes suddenly thicker than its just under part of the sorophore.

A hook-like structure made by a prostrate sorocarp is conspicuously characteristic of *Dictyostelium aureocephalum* (Fig. 2A). The hook supports a standing portion of the sorocarp as like as a supporter, which is made in some dictyostelids such as *D.*

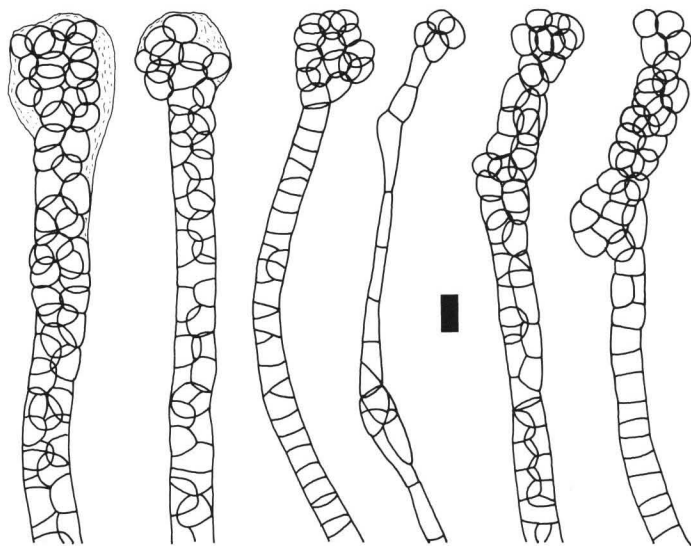


Fig. 1. Sorophore tips of *Dictyostelium aureocephalum*. Scale = 10 μm .

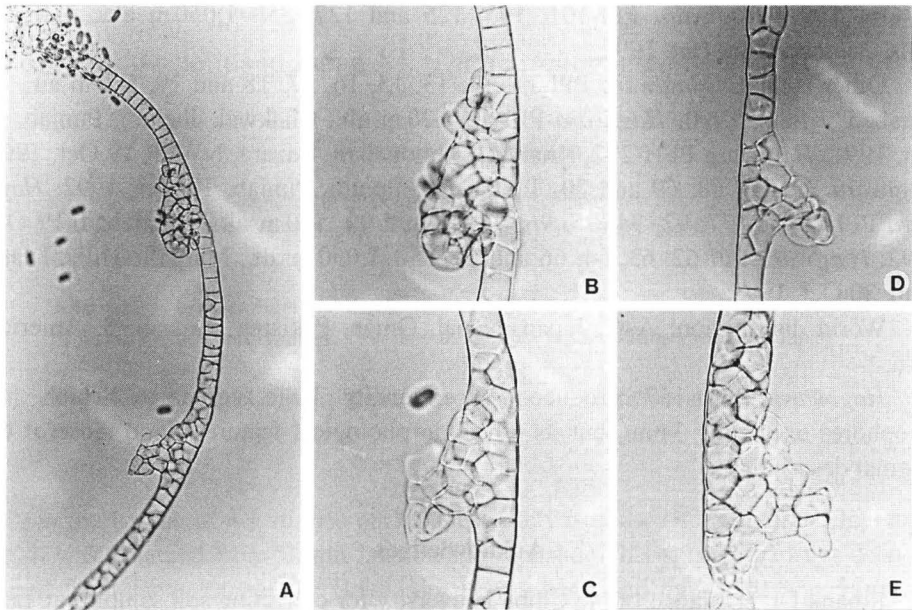


Fig. 2. *Dictyostelium aureocephalum*. A. Upper part of a prostrate sorocarp showing two hook-like structures. $\times 240$. B, C. Details of the hooks of Fig. 2A. $\times 480$. D, E. Other hooks. $\times 480$.

mucoroides Brefeld and *D. purpureum* Olive (Hagiwara, 1989). However, the hook differs from the supporter not only in the shape but also in the structure consisting of normal-sized cells (Figs. 2B–2E).

Dictyostelium macrocephalum Hagiwara, Yeh et Chien, Bull. Natn. Sci. Mus., Tokyo, Ser. B, 11: 104–105 (1985).

When cultured at 20°C on non-nutrient agar with *Escherichia coli*, sorocarps usually unbranched but sometimes branched irregularly or in a monochasium-like manner near the base; sorophores 0.38–2.15 (–3.36) mm in length, 9–28 (–46) μm in diam. at a level 100 μm above the bottom, 3.5–12 (–18) μm in diam. at a level 50 μm below the top; basal disk 17–76 μm in diam.; sori white, 40–280 (–340) μm in diam.; spores oblong, usually 1.5–2.0 times longer than broad, mostly 6.5–9.3 $\times$ 3.9–5.2 (MD 7.2–8.5 $\times$ 4.1–4.8) μm , without polar granules.

Isolates examined: *Hagiwara* PPI-8, 570 m alt., Wah, Rawalpindi, Punjab, 7 Sept. 1990; *Hagiwara* PPI-14 and 20, 550 m alt., Islamabad, 7 Sept. 1990; *Hagiwara* PPI-41 and 44, 620 m alt., Chakwal, Jhelum, Punjab, 23 Oct. 1991; *Hagiwara* PFM-157 and 158, 1,910 m alt., Kalash, Chitral, Malakand, NWFP, 24 Sept. 1992; *Hagiwara* PPK-4, 7 and 9, 350 m alt., Peshawar, NWFP, 28 Sept. 1992; *Hagiwara* PFH-293, Khanpur, Abbottabad, Hazara, NWFP, 19 Oct. 1992; PPI-67, Taxila, Rawalpindi, Punjab, 19 Oct. 1992; *Hagiwara* PPI-72, 88, 93 and 100, 500–650 m alt., Islamabad,

19 Oct. 1992; *Hagiwara* PPI-101, 107, 125 and 127, 550–1,050 m alt., Margalle Hills, Islamabad, 20 Oct. 1992.

Other isolates: *Hagiwara* PPI-11, 12, 13, 15, 16, 17, 18 and 19, 550 m alt., Islamabad, 7 Sept. 1990; *Hagiwara* PPI-42, 620 m alt., Chakwal, Jhelum, Punjab, 23 Oct. 1991; *Hagiwara* PFH-292, Khanpur, Abbottabad, Hazara, NWFP, 19 Oct. 1992; *Hagiwara* PPI-66, 68, 69 and 70, Taxila, Rawalpindi, Punjab, 19 Oct. 1992; *Hagiwara* PPI-74, 75, 77, 92, 94, 95, 96, 97, 98 and 99, 500 m alt., Islamabad, 19 Oct. 1992; *Hagiwara* PPI-62, 63, 64, 66 and 69, 550–1,050 m alt., Margalle Hills, Islamabad, 20 Oct. 1992.

World distribution: Asia; Japan, Nepal, Oman, Pakistan, Taiwan. S. America; Peru.

Hagiwara PFM-157 produced exceptionally large sorocarps which had sorophores exceeding 3 mm, but its other morphological features fitted those of the original description.

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