Ind. J. mycol. Res., 2 (1&2), 80-82, 1956.

FORMATION OF SPOROPHORES OF *GANODERMA LUCIDUM* (LEYSS.) KARST. AND *GANODERMA APPLANATUM* (PERS.) PAT. IN CULTURE

Production of typical sporophores of wood-rotting fungi in culture still remains a great problem, as no single and standard method has yet been devised that can be applied in all cases. This difficulty was also experienced by the writers for obtaining sporophores of both *Ganoderma lucidum* and *Ganoderma applanatum* which are found so commonly in Bengal. There are, however, some records that attempts were made to obtain typical sporophores of *Ganoderma* in culture. Long and Harsch (1918) claimed to have produced typical pilei of *G. lucidum* on agar medium. Bose (1929) succeeded in getting 'porous area' of *G. lucidum* on *malt-agar*. Badcock (1943), by following his own method, was able to produce typical pileus of *Ganoderma resinaceous* (=*G. lucidum*). Venkatarayan (1936), following White (1919), used *Areca* stems as the medium and obtained some 'hemispherical lumps' of *G. lucidum* which shed normal basidiospores.

At first trials were made with various agar media such as 2.5% *malt-agar potato-dextrose-agar* and *Czapeck's synthetic-agar* but none of the fungi produced typical fruit-bodies in any of them, even under different conditions of light, temperature and humidity of the laboratory. Occasionally, however, loose porous area containing typical spores of *G. lucidum* were obtained on 2.5% *malt-agar* and *potato-dextrose-agar*. Badcock's (1941) saw-dust medium and the various devices described by him for obtaining an atmosphere of relatively high humidity favourable for the development of sporophores, were then tried, without any success.

All attempts to produce typical sporophores of *G. lucidum* and *G. applanatum* on agar and Badcock's media being a failure, an experiment was started to find out whether the secondary mycelia of the two fungi could be induced to fructify on wood-blocks of their selective host. In Bengal, common host of *G. lucidum* is *Casuarina equisetifolia* and that of *G. applanatum* is *Mangifera indica*. Sapwood of the host-species was selected for the purpose and the experimental procedure employed for each was as follows : sterile and thoroughly water-soaked sapwood-blocks (5 × 3 × 2 c.m.) were introduced into sterilized Kolle flasks and placed over 7-days-old secondary mycelium of the fungus on 2.5% *malt-agar* slants already made available for the purpose. In each flask five such wood-blocks were introduced and they were arranged side by side over the surface of the growing mycelium. These were then kept in complete darkness and under ordinary temperature (30°–33°C.) of the laboratory.

Within ten days the wood-blocks (*Casuarina equisetifolia*) were vigorously attacked on all sides by a luxuriant growth of the mycelium of *G. lucidum* and in about a month they became completely covered by a thick and tough mat. After two months, a few mycelial 'knots' were developed here and there on the surface of the mat. Some of these 'knots' rapidly increased in size, and on the 68th day, looked like small 'knobs'. These knobs, when first formed, were round and perfectly white in colour. In next 3 or 4 days, they became slightly elongated (Pl. I, fig. A), showed a tendency of curving towards the neck of the flask (Pl. I, fig. B) and the upper part of the fruit-body became dull brown in colour. Within a couple of days, a porous area developed at the tip of each knob and this area became surrounded by a sterile rim-like white margin (Pl. I, fig. C). Within the flask, these knob-like fruit-bodies did not grow further. At this stage, the entire solid mat containing the wood-blocks and the fruit-bodies were taken out of the flask carefully and was placed on a moist cotton pad in a Petri-dish. The Petri-dish was then kept under a tap which was adjusted in such a way that only the knobs could get a constant supply of water in the form of small drops. As a result, the knobs soon increased in size, their apical positions expanded horizontally and became flattened, forming typical pilei within a month. In this way, other typical fructifications, each with a distinctly laccate upper surface and a lower fertile hymenial surface, were obtained (Pl. I, fig. D). The average dimension of the fruit-bodies was $5 \times 2 \times 1$ cm.

In case of *G. applanatum*, all the wood-blocks (*Mangifera indica*) became covered by thin, white, mycelial growth within a week. This aerial mycelium soon began to condense, and within a fortnight one or more white and slightly flattened structures appeared at the edge of the wood-blocks in some of the flasks (Pl. I, fig. E). The apical portion of such a rudimentary fruit-body soon began to expand laterally towards the neck of the flask forming a bracket-shaped pileus with characteristic upper surface (Pl. I, fig. F). In some cases, it formed an irregular growth before expansion (Pl. I, fig. F), but in no case typical hymenial surface could develop. This was due to the fact that during the growth of the fruit-body, its lower surface became adpressed to the inner wall of the neck of the flask in such a way as to check the formation of pore-tubes. To obviate this difficulty, some of the blocks containing the knobs were carefully taken out of the flask and placed on moist cotton in Petri-dishes. To ensure regular supply of water to the rudimentary sporophores, moist cotton pads were placed over the wood-blocks and in contact with the developing sporophores. On the 15th day after exposure, the knobs became dull brown in colour and were found to increase in length. Their whitish apices began to flatten and formed small bracket-shaped pilei. Minute shallow pores appeared on the lower side of these flattened portions and within a couple of days these became prominent. Gradually, the entire fruit-body began to increase in size. Its apical portion became flat and somewhat curved, its porous area became entirely localized to its lower surface, and finally a bracket-shaped fruit body was formed (Pl. I, figs. G, H). The average dimension of the fruit bodies was $3.5 \times 2 \times 1$ cm.

Spore-deposits were taken from these sporophores of both the fungi on 2.5% *malt-agar*. Spores were discharged profusely and they were all found to be secondary in origin because sections through the hymenial surface showed total absence of basidia within the pore-tubes and these were found to be borne directly by the hyaline, thin-walled hyphae that projected into the pore-cavities.

From the aforesaid account, it become apparent that for the production of a typical fruit-body of *Ganoderma*, the following conditions should be satisfied, viz., (*i*) sufficient supply of food and moisture, (*ii*) proper aeration, (*iii*) suitable temperature and (*iv*) probably, proper light. In the absence of proper supply of any of these factors the fungus does not produce normal sporophores under cultural conditions. These experiments further reveal another important fact that, in an attempt to fructify a wood-rotting fungus, the relationship existing between the fungus and its host wood and also the environmental conditions under which the fungus grows in Nature should be given due consideration, as pointed out by Banerjee and Sinha (1955).

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November 17, 1957.

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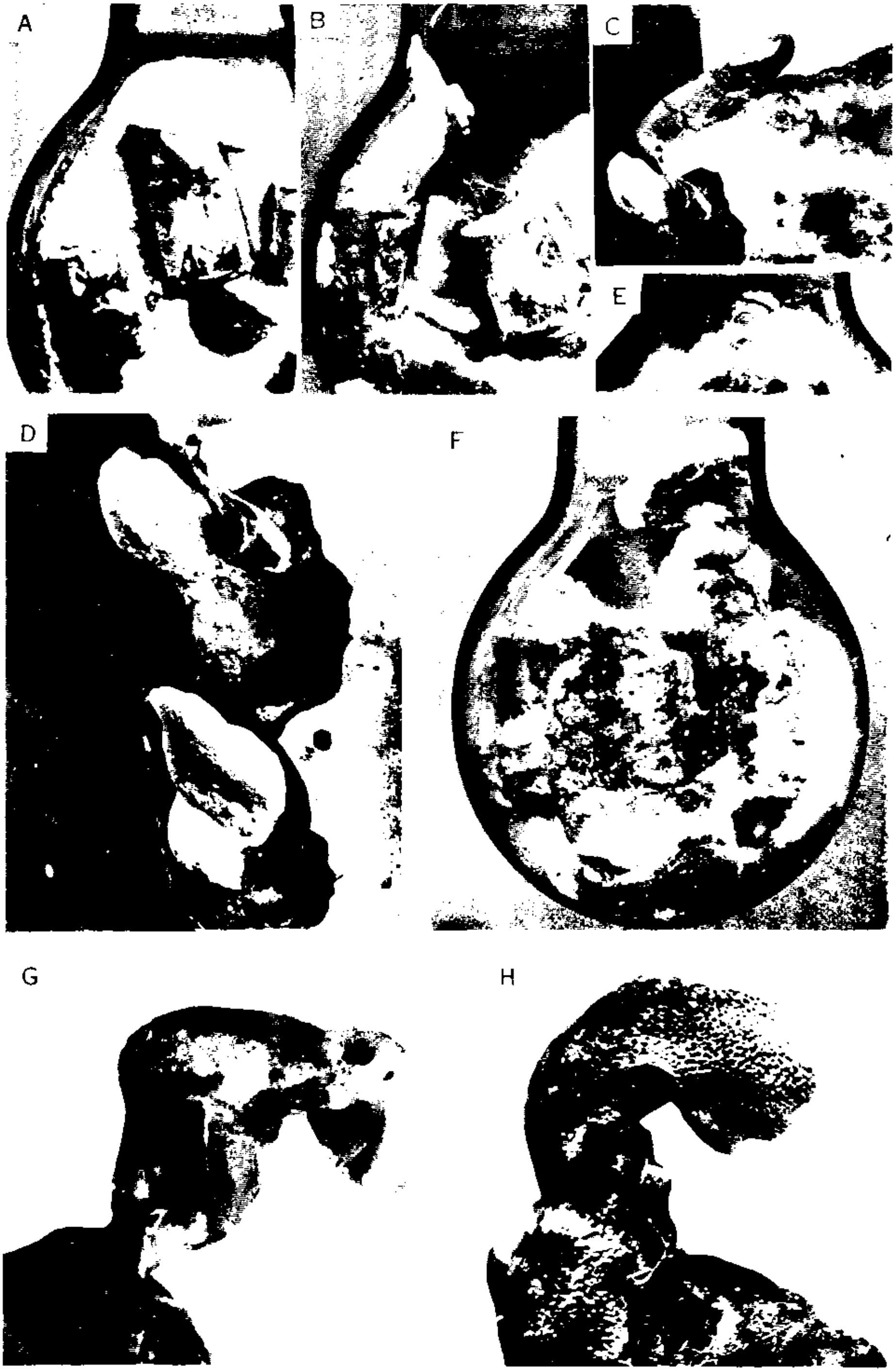

Fruit-body formation in *Ganoderma*

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