extrusion of mucilage. All these stages of cell division were completed within a period 20–22 hr, and the various stages of division are shown in figures 1–4.

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INDUCED MUTATIONS FOR SEED PROTEIN IMPROVEMENT IN *HORDEUM VULGARE* L.

Y. R. BHARGAVA AND A. S. KHALATKAR
Post-graduate Department of Botany, Nagpur University, Nagpur 440 010, India.

AN assemblage of short-awned mutants was induced by ethyl methane sulfonate (EMS) in diploid, Himalayan hull-less barley. These mutants were classified into triple, double and single short-awn types. Their awn lengths being 1.5, 2.7 and 4.2 cm, respectively in comparison with 12 cm of the control. Seeds of these short-awn types were analysed quantitatively for protein by macro-Kjeldahl on Kjeltec System II and for DBC (mg dye bound per gram of sample) by Udy Protein Analyser. All the three categories of short-awned mutations exhibited significantly higher protein levels and were around 20% richer in protein content (table 1).

Negative correlationship between protein content, grain weight and yield is already well documented. Bansal *et al.*[1] have however reported successful positive alterations in the relationship between grain weight and protein content. The degree of adversity in our studies varied in all the three types. In the single short-awn, the weight was less than that of the control; however, the protein content was higher. While, in the double short-awn, the weight was a little on the lower side and the protein content was higher than that of the single short-awn as well as of the control. Whereas in the triple short-awn, the weight as well as the protein cotent was almost similar to that of the double short-awn mutants. Hence, it is apparent that the shortening of the awns had adversely affected the weight of the seeds, perhaps through reduced photosynthetic area[2,3].

Although the reduced weight of the seed was the reflection of the mutation in the gene controlling the awn length, this alteration also affected the protein synthesising potentials of the genotype in almost all the cases. In all the three mutants, the yield per plant remained almost the same and if the quantity of protein per gram of seeds per spike is taken into consideration, the higher protein synthetic potentials of the double and triple short-awn mutations were apparent. Thus, this report for the first time demonstrates the positive alterations in the adverse relationship between the grain weight and protein quantity in the double and triple short-awn mutants through induced mutations.

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TABLE 1

Changes in the association between protein quantity and grain weight in control and advanced induced mutant progenies.

Sample	Protein(%)		DBC (mg dye bound per gm of sample)		1000 grain weight (g)	
	Range	Mean	Range	Mean	Range	Mean
Control	16.9–17.0	16.9	41.4–41.7	41.5	3.7–3.9	3.8
Single short-awn	18.6–20.8	19.7	43.5–44.6	44.5	2.6–2.7	2.6
Double short-awn	20.3–20.8	20.5	46.3–46.3	46.3	2.2–2.4	2.3
Triple short-awn	19.8–20.3	20.0	46.0–46.2	46.1	2.3–2.3	2.3

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BASIDIOCARP PRODUCTION BY *TERMITOMYCES MICROCARPUS* (BERK. AND BR.) HEIM IN CULTURE

A. B. De
Department of Botany, Burdwan Raj College, Burdwan, 713 104, India

Termitomyces microcarpus (Berk. & Br.) Heim is an edible mushroom of India[1]. In the present paper the formation of typical basidiocarp of *T. microcarpus* in culture is described.

The sporophores of *T. microcarpus* were found to grow on soil in Government Reserved Forest, Burdwan, West Bengal, India. Spore deposit was taken from one of these sporophores at the central position on a sterile agar plate. A colony of dikaryotic mycelia was developed from this spore deposit. Within 7 days the colony became 5 cm in diameter. Inocula of uniform size (5 mm in diameter) were obtained by punching out agar discs from advancing zone of this colony. One inoculum was lifted aseptically in each slant containing 10 ml of 2.5% malt agar medium. These slants were exposed to 0, 6, 12, 18 and 24 hr of light (intensity 1,000 lux) every day and then incubated in complete darkness. Incubation temperature was 28 ± 2° C.

Complete darkness inhibited stipe formation. Similar observation was made by some previous workers[2-5]. The slants exposed to 6, 12 and 18 hr of light showed initiation of primordia of basidiocarp within 35–40 days of inoculation but continuous light inhibited basidiocarp initiation. Alternating light and dark periods were required for basidiocarp initiation[3,4]. Further development of the primordia was stopped in the slants exposed to 6 and 12 hr of light but stipe elongation and pileus formation was noticed in slants exposed to 18 hr of light. Manachere[6] also observed that fruit-body development in *Coprinus congregatus* Bull. ex Fr. was only possible if cultures were subjected to suitable light and dark periods.

Initially the stipes were at right angle to the wall of the culture tubes which soon turned towards the mouth of the tubes and grew vertically. The stipes elongated rapidly and reached a length of 2–3 cm within 24–30 hr when their further growth was stopped and their apical ends became knob-like. Within the next 48–72 hr each knob-like apex transformed into a fully-developed pileus (figure 1) producing gills underside. The pileus produced in artificial medium measured 1–1.5 cm in diameter, stipe 2–3 cm long and 0.2–0.5 cm in diameter. Cultural sporophore had shorter stipe and slightly smaller pileus than the corresponding structures of natural sporophores but all the anatomical structures including hyphal elements, basidia, basidiospores and cystidioles produced in natural sporophores were also produced in cultural sporophore.

The present investigation shows that unlike some previous reports[4,7,8] CO_2 accumulated within the closed culture tubes due to respiration of *T. microcarpus*, did not prevent stipe elongation and pileus formation. Instead, light was a limiting factor

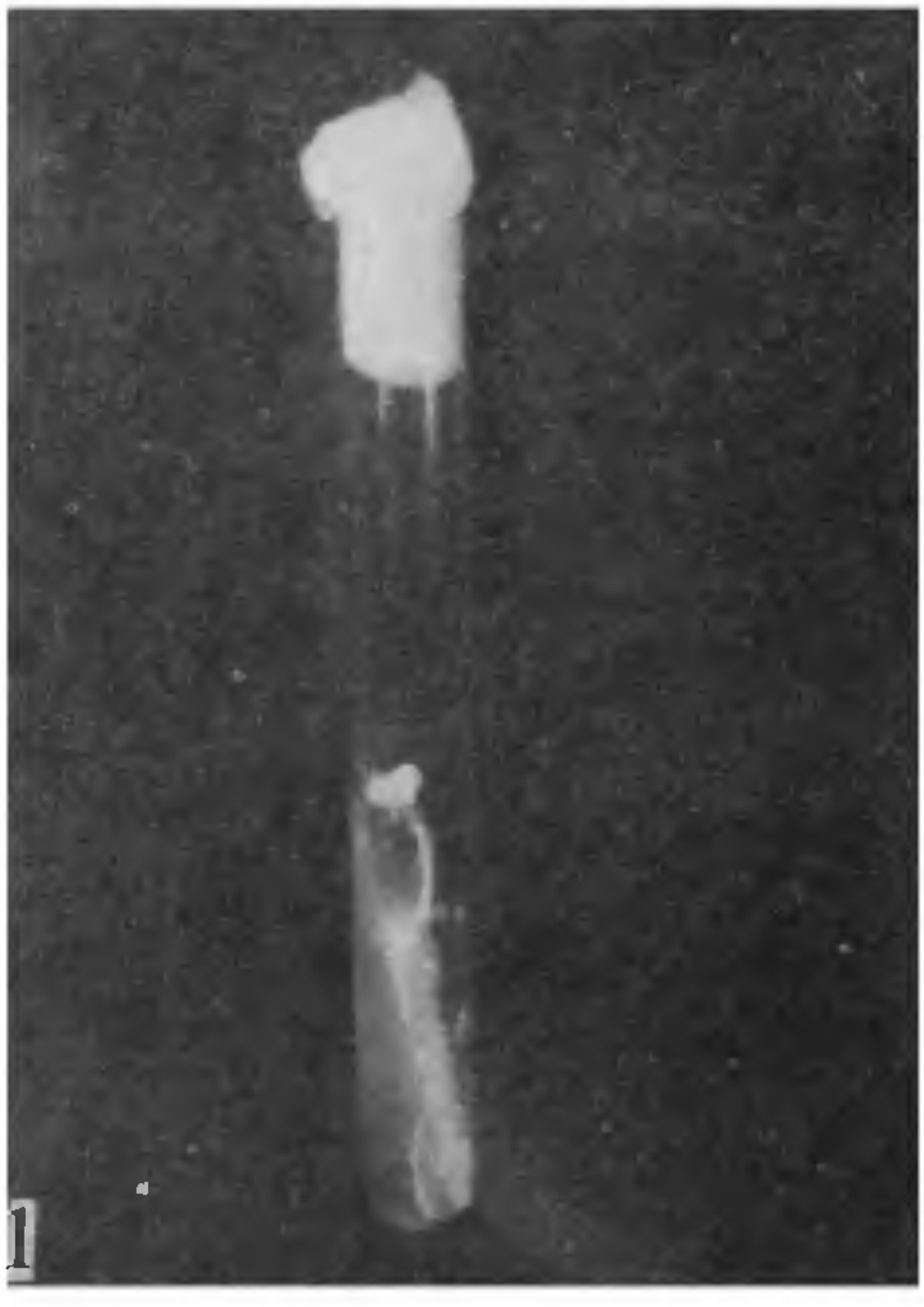

Figure 1. Typical basidiocarp of *Termitomyces microcarpus* (Berk and Br.) Heim. formed in culture tube (× ½).