Evidences for primary hornblende could, therefore, not be discernible and its genesis is attributed to retrogression that has led to its formation at a temperature and pressure range of 550–625°C and 3–4 kb respectively, being the maximum in the facies transitional to granulites; and the porphyroblastic growth by metamorphic differentiation.

The author expresses his gratefulness to Dr. B. Dash, ex-Reader in Geology, for suggesting the topic and helping at different stages of the work. The guidance and timely suggestions of Sri. A. K. Paul, Lecturer, during field work and in preparing this paper are gratefully acknowledged. Thanks are due to Sri. K. N. Sahu and Sri. K. L. Pandya, Lecturers, for their co-operation during laboratory work. Finally, the author owes his gratefulness to Dr. S. Acharya, Professor and Head of the Department, for providing laboratory facilities.


GROWTH OF BARLEY AND WHEAT ENDOSPERM IN CULTURES

C. B. SEHGAL

Department of Botany, University of Delhi, Delhi-110007, India

Endosperm plays a very significant role in the nutrition and differentiation of embryo. In angiosperms it develops as a result of triple fusion and is mostly triploid. The tissue derived from the culture of endosperm is a homogeneous mass of parenchymatous cells and, therefore, offers a very suitable system for studies on growth and differentiation.

In recent years several attempts have been made to culture immature and mature endosperm, but success has been very limited. So far it has been possible to culture and induce differentiation in the endosperm of some dicotyledonous plants belonging to Euphorbiaceae, Loranthaceae and Santalaceae (see Johri1; Sehgal2).

In 1947, LaRue3 succeeded in establishing cultures of maize endosperm. Since then several workers (Sehgal4; Straus5; Straus and LaRue6; Tamaoki and Ullstrup7) made futile attempts to get differentiation and organogenesis in maize endosperm callus. Norsog8 established continuous cultures from the endosperm of English rye grass. However, he also could not get differentiation from the callus (see also Norsog et al.9). Trione et al.10 failed to grow the endosperm of wheat. The present work was undertaken to study the morphogenetic potentialities of endosperm in two monocotyledonous plants; barley (Hordeum vulgare L.) and wheat (Triticum aestivum L.),

Ovaries of Hordeum and Triticum collected 8 days after pollination were surface-sterilized with chlorine water for 7–10 minutes, followed by rinsing in sterile distilled water. The chalazal part of the endosperm was scooped out and planted under aseptic conditions on modified White's basal medium containing 4% sucrose jelled with 0.8% Difco Bacto-agar (WM). The medium was also supplemented with various concentrations of adenine (Ad -- 20, 40 ppm); autoclaved, coconut milk (CM – 10, 20%); casein hydrolysate (CH – 0.1, 0.25%); indole acetic acid (IAA – 1, 5 ppm); kinetin (Kn – 0.5, 1 ppm); yeast extract (YE – 0.1, 0.25%); zeatin (Ze – 0.5, 1 ppm) and 2, 4-dichlorophenoxy acetic acid (2, 4-D – 1, 5 ppm) either singly or in various combinations. The pH of the medium was adjusted to 5.8 before autoclaving. For each treatment 48 cultures were maintained in diffuse daylight at 25 ± 1°C and 55 ± 5% relative humidity.

In the preliminary experiments endosperms were cultured 4, 6 and 8 days after pollination. The ones excised after 4 and 6 days failed to respond to any of the treatments. Therefore, in subsequent experiments only the endosperms collected from grains 8 days after pollination were inoculated.

In Hordeum the endosperm failed to grow on WM or WM supplemented with various concentrations of the above growth regulators, either singly
or in various combinations excepting CH + IAA. On WM + CH (0.25%) + IAA (1 ppm) the endosperm showed the initiation of callusing 10 days after inoculation (Fig. 1A) in 68% cultures. The growth of callus was slow (Fig. 1B). When this callus was transferred to WM + CM (10%) + 2, 4-D (1 ppm) it grew profusely (Fig. 1C, D) and was yellowish-green in colour. This callus could be easily subcultured on the above medium. Though the callus was cultured continuously for 12 months.

**Fig. 1** A–H. A–D. Hordeum vulgare, E–H. Triticum aestivum. A. 10-day-old culture on WM + CH (0.25%) + IAA (1 ppm), showing initiation of callus, x 4. B. Same, 4-week-old, x 4. C, D. Endosperm raised for 4 weeks on WM + CH (0.25%) + IAA (1 ppm) subsequently transferred on WM + CM (10%) + 2, 4-D (1 ppm) and grown for 1 and 2 weeks, respectively, x 4. E. 1-week-old culture on WM + CM (10%) + Kn (0.5 ppm) + 2, 4-D (1 ppm), x 3. F. Same, 2-week-old; note profuse callusing, x 5. G. Endosperm raised for 1 week on WM + CM (10%) + Kn (0.5 ppm) + 2, 4-D (1 ppm) and subsequently transferred on WM + Ad (20 ppm); note two nodular outgrowths which appeared one week after transfer, x 5. H. Same, 2 weeks after transfer, x 5. (ca, callus; en, endosperm.)
and subjected to different treatments, so far it has not produced any root or shoot.

In Triticum the endosperm failed to grow on WM as well as WM supplemented with Ad (20, 40 ppm); CH (0-1, 0-25%); IAA (1, 5 ppm); Kn (0-5, 1 ppm); YE (0-1, 0-25%); Ze (0-5, 1 ppm) and 2, 4-D (1, 5 ppm) individually or in various combinations. However, an actively growing callus was obtained on the following combinations: (a) WM + CM (10%) + IAA (1 ppm); and (b) WM + CM (10%) + Kn (0-5 ppm) + 2, 4-D (1 ppm). Of these two combinations, the latter proved to be better because on this medium 84% cultures showed callusing as compared to 62% on WM + CM (10%) + IAA (1 ppm). Callus was initiated one week after culture (Fig. 1E). It grew rapidly to form a whitish-yellow friable tissue in another week (Fig. 1F). With the passage of time, proliferation continued but the callus failed to differentiate into plantlets. When the above callus was transferred to WM + Ad (20 ppm) it formed nodular outgrowths in 56% cultures (Fig. 1G). These outgrowths did not differentiate but callused further (Fig. 1H). Trione et al.20 tried as many as 20 different media to culture wheat endosperm, but all their attempts failed.

In the present study I have been able to culture barley and wheat endosperm. However, it has not been possible to get differentiation from the callus. It is concluded that though differentiation from the endosperm of some dicotyledonous plants has been achieved, the production of callus and its differentiation into plantlets from the endosperm of monocotyledonous plants is yet a challenging problem.

I wish to thank Professor H. Y. Mohan Ram for facilities and to Dr. R. N. Chopra for going through the manuscript.


INFORMATION TO CONTRIBUTORS

CURRENT SCIENCE is the Premier Science Fortnightly of India published by the Current Science Association, Bangalore and issued on the 5th and 20th of each month. All material intended for publication in CURRENT SCIENCE and books for review should be addressed to the Editor, CURRENT SCIENCE, Raman Research Institute, Bangalore-560006.

The following types of scientific communications will be considered for publication in CURRENT SCIENCE: (1) Review Articles on topics of major current interest, not exceeding 4,000 words or 12 pages of foolscap; (2) Original Research Papers not exceeding 2,000 words; (3) Letters not exceeding 700 words; (4) Short scientific notes not exceeding 200 words. Articles and papers should include a short abstract at the beginning.

Manuscripts, to be submitted in duplicate, should be typewritten in double space on one side of the paper, carefully revised by the authors and in final form for printing. Illustrations should be minimum in number, drawn in black and white with Indian ink on bristol board, and preferably enlarged to about twice the size they are intended to appear in print which will be mostly in column size.

Business correspondence, remittances, subscriptions, advertisements, reprints, exchange journals, etc., should be addressed to the Manager, CURRENT SCIENCE Association, Raman Research Institute, Bangalore-560006.

Subscription Rates:

Institutions: India Rs. 48.00; Foreign £ 5.00; $ 12.00
Individuals: India Rs. 24.00; Foreign £ 3.50; $ 8.00