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Short Communication

EFFECT OF ELECTROMAGNETICALLY PULSED NUTRIENT MEDIUM ON GERMINATION AND TUBE GROWTH OF THE *IMPATIENS BALSAMINA* L. POLLEN*

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The effect of magenetic flux on the plants have been investigated by Pitman (1963), Pitman and Ormrod (1970). Alexander and Ganeshan (1990) and Alexander and Rajasekharan (1990), using the male gametophyte (pollen) of papaya, obtained increased germination and tube length over control. The authors, during their investigations on bio-electromagnetism, found that pulsed nutrient medium promotes germination and tube length in unpulsed balsam (*Impatiens balsamina* L.) pollen during *in vitro* growth and the finding is reported here.

The source of electromagentic field was double Helmoltz coil (radius 15 cm; 200 turns of 21 gauge enameled copper wire in each coil). The power supply consisted of a 2A step down transformer (0,3,6,12,15,18,21,24V) and a 5A bridge rectifier. The DC supply was regulated at 1.5A (20 ± 1 Oersted) with a 2A DC meter. The circuit was completed in a clockwise direction. The coil was positioned and aligned along the Earth's magnetic north. The platform of the coil was aluminium (24 × 14 × 0.1 cm). The centre of the coil was marked on the Aluminium plate to place the medium (place of uniform force).

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The medium consisted of 5 per cent sucrose (Merck analytical grade) supplemented with 100 ppm (0.8306×10^{-3} $MgSO_4$); 30 ppm (0.2967×10^{-3} N) KNO_3 and 30 ppm (1.4556×10^{-3} N) boric acid. Three ml of the medium in a 5 ml glass vial each was placed on the platform of Helmoltz coils for treatment, and as control. Balsam pollen collected on a sunny day (R. H. 80 ± 2 per cent) at 10.30 A.M. was used as experimental material. Aliquote (0.1 ml) of control, and treatment medium (zero hr) was drawn to prepare hanging drop mounts according to standard procedures (Ganeshan, 1985), before the power supply was switched on. The power supply was switched on immediately after zero hr., and aliquotes were drawn at intervals of 5,10,15,30,60 and 90 minutes from the control and treated medium to prepare hanging drop mounts. The control and treated mounts were incubated for 20 minutes 25 ± 1° C; R.H. 100 per cent and stained with Alexander's stain (Alexander, 1980). There were three replicates for each of the time intervals and controls. The observations on pollen germination were recorded from 10 randomly selected microscopic fields following the procedure reported by Ganeshan (1985). The tube length was measured from 10 randomly selected germinated pollen grains. The data were analysed using analysis of variance and treatments were compared using L S D ($p = 0.05$).

The results obtained with respect to per cent germination and tube length (in m) of the control and treated medium are given in Table 1. All treatments other than pulsing the medium for 15 minutes (ignoring the Earth's magnetic field) were statistically non-significant. However, treatment of the medium for 15 minutes (20 x 1 Oersted) produced 23 per cent ($p = 0.05$) higher germination over that of control and 178.7 per cent ($p = 0.1$) increase in tube length over the control. Photomicrographs of control and pollen germinated in the medium exposed to 20 ± 1 Oersted for 15 minutes in hanging drop mounts are given in Fig. 1 and 2. These data showed that exposing the nutrient medium (containing macro and micro elements) for 15 minutes to a magnetic flux (20 ± 1 Oersted) significantly promoted germination and tube growth of balsam pollen.

Table 1 : **Germination percentage and tube length of Balsam (*Impatiens balsamina* L.) pollen *in vitro* in the control and treated nutrient media.**
(Values in parenthesis show percent change over control)

Treatment of nutrient medium (in minutes)*	Germination (per cent)		Tube length (in μ)	
0	49.53 ab	—	113.62 a	—
5	53.92 bc	(8.7)	100.33 a	(–11.7)
10	50.67 ab	(2.3)	85.67 a	(–0.6)
15	61.11 d	(23.4)	316.67 b	(+178.7)
30	56.54 bcd	(14.2)	96.00 a	(–15.5)
60	51.82 bcd	(4.6)	87.67 a	(–22.3)
90	41.17 a	(–16.9)	82.00 a	(–27.8)

The treatment preceded by the same alphabet are not significantly different.

* At 20 minutes exposure significant decrease in germination and tube length were observed from those of 15 minutes exposure, hence deviated from regulated time interval of 5 minutes to 30,60 and 90 minutes exposures to assess the spectrum of action of prolonged exposures of pulsing.

Seed pulsed in static magnetic field produced increased germination and yield (Pitman, 1963; Pitman and Ormrod, 1970). Permanent magnets and electromagnets produce static magnetic field. Alexander and Rajasekharan (1990) observed many windows which promote germination and tube length of papaya pollen over control. Out of these windows only one is the 'Response Window' which gave maximum germination and tube length. The biological systems were energised in the magnetic field by earlier investigators. However in this study the pollen nutrient medium was pulsed. The energisation showed many windows which

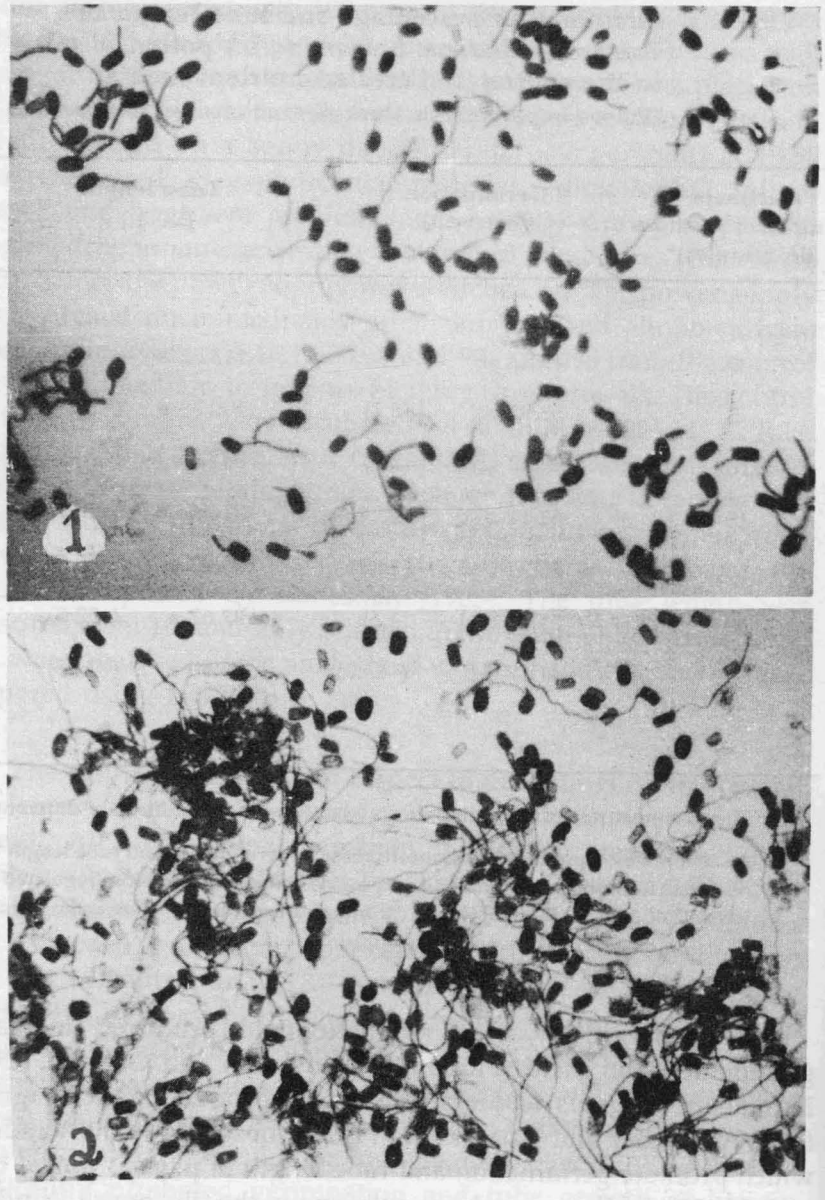

Fig. 1. Photomicrograph showing germination and tube length of balsam (*Impatiens balsamina* L.) pollen cultured in control nutrient medium.

Fig. 2. Photomicrograph showing germination and tube length of balsam (*Impatiens balsamina* L.) pollen cultured in nutrient medium pulsed for 15 minutes.

boosted the germination of balsam pollen. Out of these windows pulsing for 15 minutes produced maximum germination (23.38 per cent increase over control). In the case of tube length different pattern has been observed. Exposure of nutrient medium to 15 minutes produced 178.7 per cent increase of tube length over control. However, exposure to all other time intervals produced lower values than control. This indicate that in the time interval taken there is only one response window for tube length.

The response in the increase in germination and tube length by energising nutrient medium in static magnetic field is paramagnetic. All paramagnetic materials are expected to behave alike under all strength of magnetic field. The explanation for this observed unique phenomenon with no parallel in literature led investigations in magnetobiology using NMR/ESR studies of the nutrient medium before and after exposure in the magnetic field. Hence the present study be treated as a preliminary report.

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