mination of *Triticum* spp., *B. campestris* var. Sarson and *P. typhoides* was comparatively less retarded (2–20%) as compared to *R. sativus* Linn (40–62%).

The effect of *A. mexicana* on the shoot and root length of the four crop plants was measured on the seventh day. The data for percentage retardation or enhancement of shoot length are given in table 2 and the root length in table 3.

The shoot lengths of *Triticum* spp., *B. campestris*, *R. sativus*, *P. typhoides* continuously decreased with the increase in concentration of *A. mexicana* powder from 50 mg 100 ml distilled water to 200 mg/100 ml distilled water. The highest shoot length retardation was observed in *Triticum* spp. at 200 mg amount of *A. mexicana* powder.

It is clear from table 3 that there is a decreasing trend in the root lengths of *Triticum* spp., *B. campestris* var. Sarson and *P. typhoides* root. Interestingly there is no further reduction in the root length of *P. typhoides* beyond 100 mg level.

In the case of *R. sativus* there is an increase in the root length at 50 mg amount of *A. mexicana* powder in comparison to control treatment. This indicates that at this level allelochemics present in the *A. mexicana* powder have a stimulating effect on *R. sativus* roots. The length of roots *R. sativus* was normal at 100 mg in comparison to control and only at 200 mg there was retarding effect (13.3%).

The greatest (94.2%) retardation in the root length was observed at 100 mg amount of *A. mexicana* with *P. typhoides*.

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ELECTRICAL CONDUCTIVITY AS A MEASURE OF SEED VIABILITY IN SAL (*SHOREA ROBUSTA* GAERTN F.)

V. K. YADAV, P. K. KHARE and G. P. MISHRA
Department of Botany, Dr Harisingh Gour Vishwavidyalaya, Sagar 470 003, India.

An association between the readiness with which solutes leach out from seeds and their germinability in the field was first reported in *Pisum sativum* L[1]. This has led to a series of advisory recommendations by the Official Seed Testing Station, Cambridge, UK[2]. Electrical conductivity test was routinely used for testing the viability of field beans *Vicia faba*[3].

Studies on seed testing are mostly confined to field crops and vegetables. Such studies are scanty for forest trees particularly of the tropical region. Sal (*Shorea robusta* Gaertn f) is one of the most important timber trees confined to the tropical moist forests of India. Seeds of this species do not retain their viability for long even at a low temperature and moisture. Such seeds have been classified as recalcitrant[4]. For afforestation programmes, a quick and economic method for predicting germination of the seeds of forest tree species is desirable but this information is lacking. The present work was therefore undertaken to establish a relationship between seed germination and electrical conductivity in Sal.

Fresh Sal seeds were collected from a natural tropical moist deciduous forest of Amarkantak, Madhya Pradesh, during the second week of June 1985 and brought to laboratory in polythene bags. The seeds (200) from each lot were soaked in water for 24 hr and kept for germination in moistened filter papers in seed germinator[5] at 25 ± 2°C. Radicle emergence was recorded as an index of seed germination. Electrical conductivity was tested[6] taking two replicates of 50 seeds for each lot. Seeds were placed in a glass beaker of 80 ± 5 mm base diameter. Beakers were covered after adding distilled water (250 cm^{-3}) to reduce evaporation and contamination by dust. All beakers were kept at 20°C for 24 hr. Soaked water was poured through a course sieve to remove seeds and was then poured back into the first beaker. Electrical conductivity was measured using a dip cell conductivity meter (Systronics, DDR, type 304). The reading of control beaker is subtracted and the electrical conductivity is expressed as $\mu s\ cm^{-1} g^{-1}$.

Table 1 *Germination classes and electrical conductivity in different lots of Sal seeds*

Seed lot No.	Germination (%)	Mean electrical conductivity ($\mu s\ cm^{-1}g^{-1}$)
1	1–10	28.37
2	10–20	25.37
3	20–30	24.72
4	30–40	23.66
5	40–50	22.79
6	50–60	22.54
7	60–70	21.94
8	70–80	21.34
9	80–90	20.43
10	90–100	19.44

Germination classes were made (1–100%) from different seed lots and mean values of electrical conductivity were calculated for each class (table 1). Results indicate a gradual increase in electrolyte leakage as the germination decreases. Statistical analysis showed significant negative relationship ($r = -0.97$ $P < 0.001$) between seed germination and electrical conductivity (figure 1).

In the present investigation the range of electrical conductivity in viable Sal seeds seems to be narrow (19.44 to 28.37 $\mu s\ cm^{-1}g^{-1}$) whereas the Official Seed Testing Station for England and Wales suggested a wide range for many crop seeds (24 or less to 44 $\mu s\ cm^{-1}g^{-1}$)[6].

Damage of cellular membrane is the first deteriorative factor in seeds and this is indicated by an

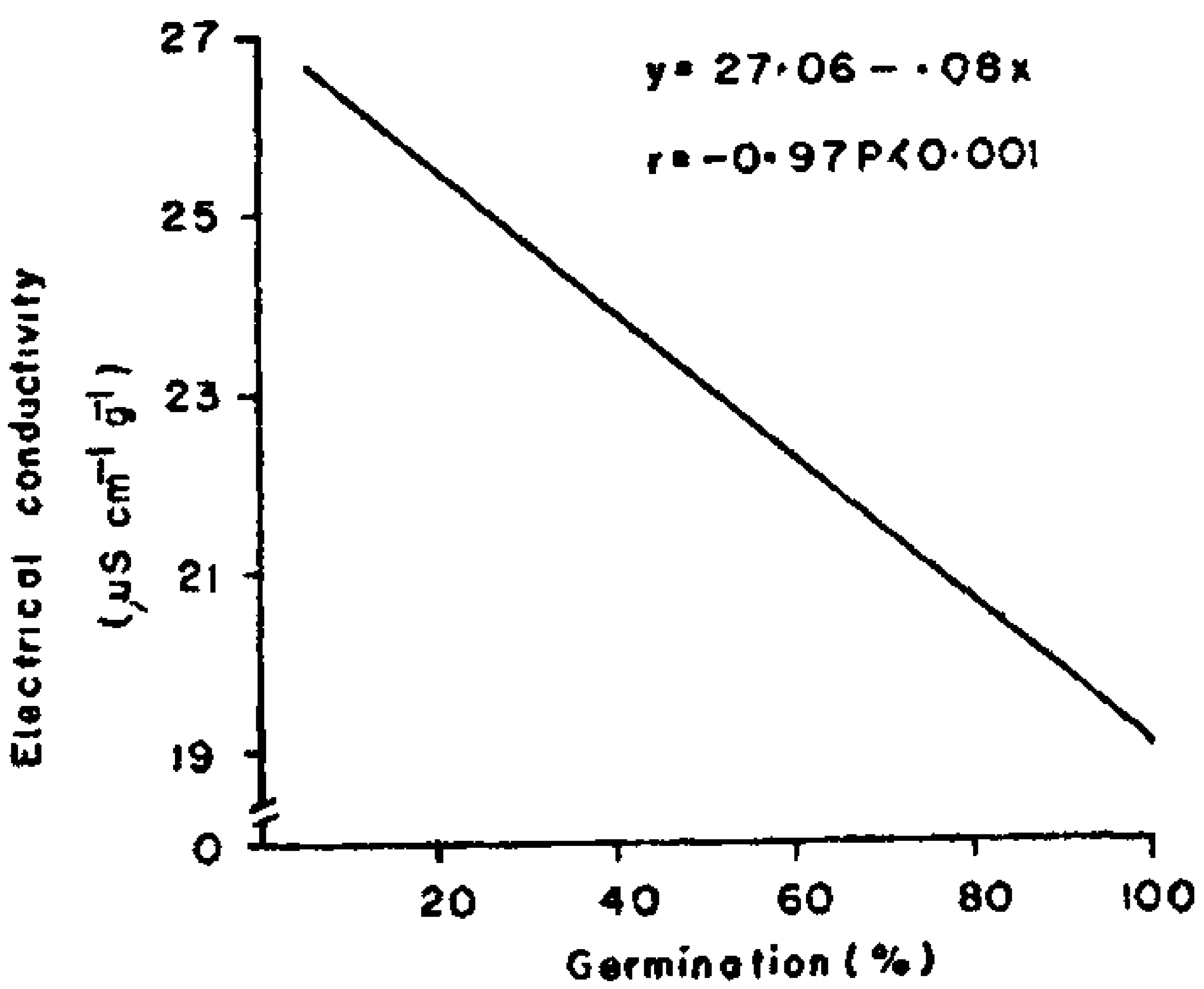

Figure 1. Regression line indicating the relationship of electrical conductance and germination in Sal seeds.

increase in electrolyte leakage[7]. In stored Sal seeds, membrane disruption increases with aging and the moisture content below 25% is a critical factor governing the viability of seeds[8]. However 20% moisture limit as a critical point for membrane integrity was reported in seeds when fast out flux of solutes takes place[9,10]

On the basis of various studies made so far, membrane integrity in Sal seeds and solute leakage appears to be linked with their germination. The present study shows that germination of Sal seeds can be safely predicted on the basis of electrical conductivity.

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ADDITION OF TWO SPECIES OF THE GENUS *BULBOCHAETE* AGARDH (OEDOGONIALES, CHLOROPHYTA) TO INDIAN ALGAL FLORA

H. M. SHUKLA, R. K. TIWARI, U. C. PANDEY* and G. L. TIWARI

Department of Botany, University of Allahabad, Allahabad 211 002, India.
* *P. G. Department of Botany, Bareilly College, Bareilly 243 005, India.*

THE genus, *Bulbochaete* Agardh is known to have 109 species[1,2] and of these 45 species are known from India[1-3]. So far only five species[4-6] have been