INVOLVEMENT OF pH IN GAMETANGIAL FORMATION IN THE MOSS *BRYUM ARGENTEUM* HEDW.

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Growth and development of plants is affected by pH of the nutrient medium. Among bryophytes, growth of male and female clones of *Sphaerocarpos donnellii* is accompanied with definite changes in pH of the medium[1]. Maximal antheridial and archegonial production in *Riccia crystallina* is exhibited in cultures maintained at pH 4·5 and 6·5, respectively[2]. In contrast to these observations no relation between pH of the nutrient medium and sporophyte production has been observed in *Riccia duplex*[3]. Keeping this in view, it was thought worthwhile to observe the role of pH in gametangial formation of the moss *Bryum argenteum*. The observations are reported in this communication.

Material and Methods

The details regarding establishment of male and female clones, and cultural conditions are the same as described earlier[4]. The cultures were raised in liquid, basal medium from 10-day-old, bud-free protonema. In general, the initial pH of the medium was adjusted to 5·5 (before autoclaving) with 0·1 N HCl/NaOH, using pH meter. In various cultures as well as control, the pH of the medium was recorded for 43 days at a 5-day interval, starting from 8 days after inoculation.

Results

Buds appeared on the protonema in 12-13 days after subculturing. Sex induction on the gametophores was observed in 23 days after subculturing. It is clear from Fig. 1 that in both the male and the female clones the pH of the nutrient medium steadily increased as growth advanced. During transition from vegetative phase to reproductive phase, there was an increase in pH of the medium from 6·15 and 6·25 (on the 18th day) to 6·66 and 6·81 (on the 23rd day) in male and female clones, respectively. Once the sexual phase was initiated, further increase in pH was slow. In the female clone pH increased up to 38th day of growth, and in the male clone till the 43rd day, but slowly. In the control no change in pH was recorded.

Keeping in view the results obtained from this experiment, fresh cultures of male and female clones were raised on medium set at different pH values, *viz.*, 4·5, 5·5, 6·2 and 7·0. Table I indicates that growth and sex induction response in both male and female

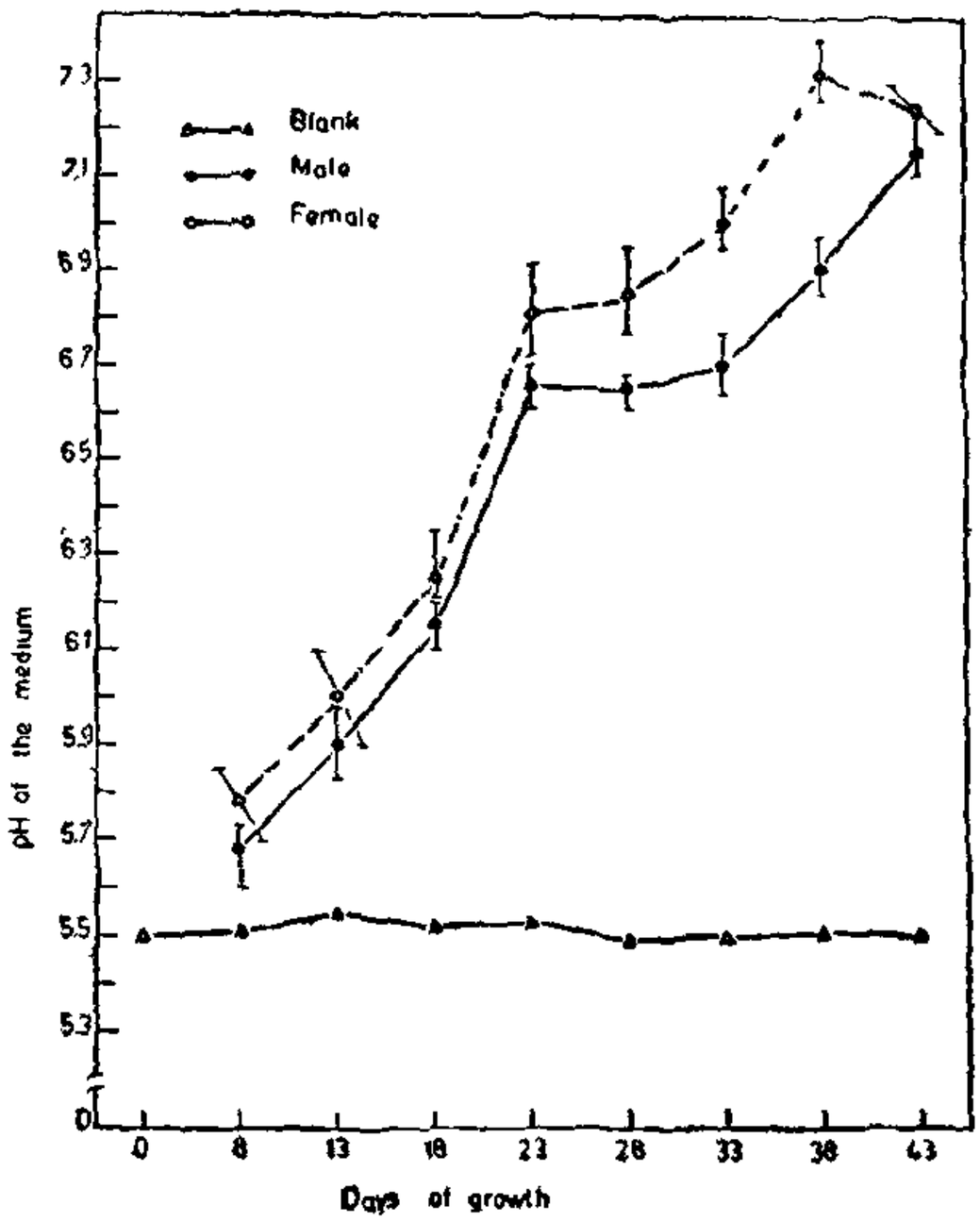

Fig. 1. Changes in pH of the liquid basal medium accompanying growth and development of male and female clones. Each datum represents mean along with maximum and minimum values obtained from five replicates.

clones were not significantly affected by pH in the range of 5·5 to 7·0. At pH 4·5, however, both vegetative growth and sex induction response were slightly inhibited.

Moreover, exogenously modified pH did not affect the time of initiation of gametangia, which appeared in 23 days in both clones, in all the treatments.

Discussion

In male and female clones of the moss *B. argenteum*, pH of the nutrient medium gradually increased with the advancement of growth and development. In contrast, in *Sphaerocarpos donnellii*[1] the nutrient medium of the male cultures, maintained at varying pH values (5·3, 6·0 and 7·4), rapidly dropped in pH to 4·1, and in female clones, it increased from pH 5·3 to 6·0, over a 20-day growth period, while decreasing as in male clones at pH 6 and 7·4. In *Riccia crystallina*[2] grown on acidic media the number of antheridia was higher, but as the pH was increased archegonial production was promoted.

From the above observations it can be concluded that a critical pH attained by the nutrient medium during growth and sex induction in *B. argenteum* has

TABLE I

Effect of exogenously modified pH values on growth and sex induction in male and female clones of Bryum argenteum. *Mean values and standard error are from 12 replicates of 40-day-old cultures*

pH of the medium	Number of gametophores per culture		% of gametophores per culture showing sex induction	
	Male	Female	Male	Female
4·5	48±2	53±2	41±2	38±2
5·5	63±5	73±3	52±2	43±2
6·2	64±5	74±3	53±3	45±3
7·0	58±2	67±3	48±2	40±2

nothing to do with the onset of reproductive phase. It is probably due to increase or decrease in uptake of particular ions by the plant or because of exudation of certain active principles by the plant into the medium. Thus, change in pH of the medium appears to be one of the effects of these morphogenic changes rather than its cause.

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ELECTRORETINOGRAM STUDIES ON HAWKMOTH AND COCKROACH COMPOUND EYE

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ELECTROPHYSIOLOGICAL studies on two nocturnal insects, *Herse convolvuli* (a hawkworm moth found commonly in Southern India) and *Periplaneta americana*, were carried out. As against the common belief[1] that slow eyes of night active insects do not show an 'off' response, we detected a regular and marked 'off' response in both of the above insects. The amplitude of 'o_n' response for the moth as a function of relative intensities and pulse duration was determined. The 'off' response was not large enough for low intensities to permit a quantitative description. Adaptation experiments were also performed for the moth eye.

The specimens used in this experiment were wild type, of either sex. The experimental animals were intact but legs, thorax, and head were rigidly immobilised with bee's wax and colophony and fixed to a stage.

Fine platinum wires (0·01 μ) served as electrodes. The recording electrode was placed in a small hole, made in the cornea, by an insect needle. The reference electrode was inserted close to the eye. Both electrodes were connected to the differential inptus of a Tektronix 5110, 5A21N oscilloscope and the results were photographed.

The insects were placed in a metallic chamber which served both as a Faraday cage and a dark chamber.

For stimulation, a 150 W, tungsten lamp was used. Calibrated neutral density filters were used to vary light intensity. The infra-red radiations were excluded by using a heat filter. The light path was interrupted by a photographic shutter. An optical guide was used to direct the collimated light beam to the experimental eye. Relative light intensity, incident on the insect eye was determined with the help of an optometer. The maximum intensity (Log 1 = 0) corresponded to 220 foot candles.

Light pulses of duration 1/125 to 1 seconds were used[2] to elicit ERG responses over the intensity range of 3 log units. An interval of one or two minutes between successive light flashes allowed the eye to recover its sensitivity fully.

The amplitude of 'on' component of ERG served as a good indicator of the sensitivity of the moth eye to the intensity and duration of light stimulus.

Adaptation experiments involved light adaptations of the moth eye and subsequent recovery of its sensitivity in darkness. The recovery was followed by administering test flashes to the light fatigued eye and comparing the response with that of the normal eye.

RESULTS

Electroretinogram Waveforms

ERGs recorded from dark adapted eyes of *Periplaneta americana* and *Herse convolvuli* are presented