GERMINATION BEHAVIOUR OF *ECHIUM LYCOPSIS*

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E. lycopsis is seasonally prominent in several areas in southern Australia. The following features refer to samples of seed (nutlets) collected over a period of 15 years at morphological maturity in locations near Adelaide, South Australia and in the Riverina district, New South Wales. They were held in the laboratory in closed but not sealed containers and examined at intervals.

Germination of fully after-ripened seed was found to be maximal, both in amount and rate, over the relatively high range of 25-30°C, and all subsequent tests were done at 25°C.

During the first 3 months after collection the germination is nil or extremely low. It then rises steadily for up to 2 years, thereafter declining till low values are reached again in 4-6 years (Fig. 1(a)). The maximum germination of intact seeds does not often exceed 75-80%, but seeds, in whose coats a small hole has been chipped remote from the radicle, usually germinate 5-15% more than the corresponding intact seeds. If the coats are completely removed, the embryos germinate virtually completely, even immediately after collection (Fig. 1(b)).

The similarity of water uptake by intact dormant and non-dormant seeds and chipped seeds (20-25% of air dry weight at onset of germination) indicates that impermeability of coats to water is not a cause of delayed germination. From the germinations of intact and chipped seeds and embryos, in a range of mixtures of oxygen, nitrogen, and carbon dioxide, it can also be inferred that restriction of gas diffusion by the coats is not a cause. The effects of mechanical constriction, however, may be important.

Although there are germination inhibitors present in the aerial parts generally (Ballard and Grant Lipp, 1959), aqueous and ethanolic extracts of both dormant and non-dormant seeds or seed coats had little effect on the germination of *Echium* embryos. Moreover, neither leaching with water (up to 8 days) nor applying active carbon increased germination of dormant seeds. There is thus little to suggest control of germination by seed inhibitors.

Among other treatments which did not increase the germination of dormant seeds were cold stratification, irradiation with red light (far red inhibits), and application of auxin or kinetin. Apart from coat removal, the only treatments which markedly increased the germination of very dormant seeds were massive doses of gibberellic acid and thiourea (Fig. 1(b)).

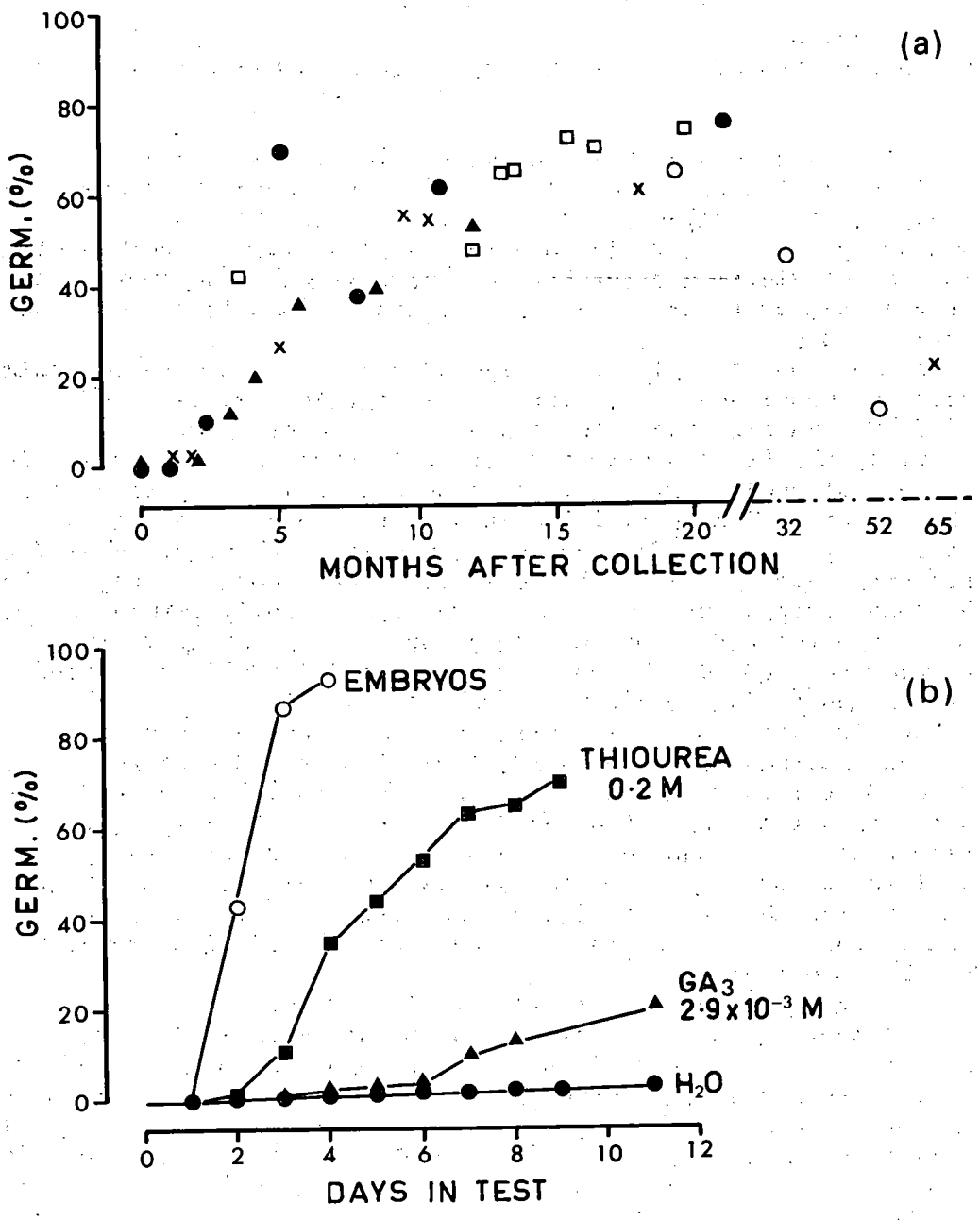

Fig.1 (a) A composite picture of the progress out of dormancy. (A different symbol is used for each collection shown.)

(b) Effective dormancy-breaking treatments. (Five weeks after collection.)

It is not always sound to apply laboratory germination findings to the field. However, a possible interpretation of the pattern of *Echium* seedling emergence is in terms of a field dormancy. The laboratory findings make it unlikely that seed coat impermeability, either to gases or water, would be involved in any such delayed germination. Nothing should be inferred about any possible conservation of seed in the soil, nor are the inhibitor findings decisive in their present form. Thus the question of what factors in nature initiate the cell expansion necessary to overcome the seemingly important coat restriction must remain open.

FLOWERING RESPONSES OF *ECHIUM LYCOPSIS* TO PHOTOPERIOD AND VERNALIZATION

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The development of *E. lycopsis* (Paterson's curse or Salvation Jane) - seedling establishment in late autumn, the formation and growth of rosettes during winter with stem elongation occurring in early spring, followed by flowering on the elongated stems - is characteristic of a pattern frequently shown by plants whose flowering is mainly controlled by long days (LD) but may also be affected by (low) temperature.

These features were therefore investigated on *Echium* plants grown from seed collected near Adelaide, South Australia, and in the Riverina district, New South Wales. The main findings are summarized in the Table.

Flowering is obviously promoted and hastened by long photoperiods and favoured by lower temperatures. At the higher temperatures *Echium* is virtually a qualitative LD plant, with a critical daylength in the vicinity of 12 hours. At the shorter photoperiods some stem elongation occurred, but this did not lead to flower production, both the terminal and lateral meristems producing curious 'perched' rosettes. At lower temperatures the flowering response is quantitative. Although response is possible