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Short Communication

Correlative Aspects of Imposition of Dormancy in Caryopses of *Aegilops kotschyi*

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ABSTRACT

Caryopses of *Aegilops kotschyi* Boiss. from different positions within the same spikelet differ greatly in their degree of dormancy. Imposition of this dormancy pattern is a correlative phenomenon within the spikelet, inasmuch as the uppermost developing caryopsis is least dormant and its development is associated with the dormancy status imposed on the lower (one or two) caryopses. Differences in pigmentation of the caryopses follow a corresponding pattern.

Spikelets of *Aegilops kotschyi* Boiss. are normally composed of three florets, of which the terminal one is not fertile. Germinability of the two caryopses which are normally produced differs markedly. The upper one (from the subterminal floret) attains a high capacity for germination shortly after anthesis, while the lower one (from the basal floret) retains a high level of dormancy for a long time (6). The present study was made to investigate the endogenous phenomena involved in the imposition of this differential dormancy within the spikelet.

MATERIALS AND METHODS

Plants of *Aegilops kotschyi* Boiss. were grown from mature caryopses, collected as random samples from the natural habitat, near Be'er Sheva, in May 1971. We found that growth at low temperature or with improved mineral nutrition cause a marked increase in the fertility of the terminal floret in the spikelets.

In one experiment, plants were grown from seed to full maturity (Dec. 1971-May 1972) in the phytotron of the Faculty of Agriculture of the Hebrew University at Rehovot (2) in 16-hr photoperiods (0400-2000), at day/night temperature regimes of 27/22, 22/22, 22/17, and 17/12 C (day = 0800-1600, night = 1600-0800). The drained plant containers were irrigated each morning with half-strength Hoagland nutrient solution (4), and each afternoon with tap water. In all but the 17/12 C temperature regimes, the plants almost exclusively produced the typical spikelets with two caryopses each. At 17/12 C, about one-third of the spikelets contained caryopses in all three florets.

In another experiment, plants were grown from seed to full maturity outdoors, in the natural growing season for this species (Dec. 1971-May 1972) at Bar-Ilan University. A planting medium consisting of sandy loam-vermiculite-peat moss-compost (5:1:1:1) was used. The drained plant containers were irrigated three times each week. One group was irrigated with tap water, the other with half-strength Hoagland nutrient solution. The first group produced typical spikelets with two caryopses each. About one-third of the spikelets produced by the second group contained caryopses in all three florets. The three caryopses thus produced did not differ greatly in mature dry weight. This was true in both experiments, although weight of the phytotron-grown caryopses was almost double that of the ones grown in the open (Table I).

Germinability of the different caryopses was tested at 20 C in darkness (interrupted for counting and removal of germinated seedlings) in 9-cm Petri dishes containing one layer Whatman No. 2 filter paper and 4 ml of distilled H_2O. Preliminary tests showed that dark germination was not affected by brief daily illumination with white light. Germination tests consisted of four replicates with 50 caryopses each.

RESULTS

In both experiments, whenever terminal caryopsis failed to develop, germinability of the uppermost caryopsis (from the subterminal floret) was considerably higher than that of the remaining basal caryopsis (Fig. 1, A and B). In contrast, whenever the terminal caryopsis did develop, its germinability was highest, while that of the subterminal caryopsis was considerably lower, approaching that of the basal caryopsis (Fig. 1, C and D). Whichever caryopsis develops uppermost in a spikelet has the highest germinability, and the remaining (one or two) caryopses developing in the lower floret(s) are domant. In other words, germinability of the caryopsis from the subterminal floret was increased by failure of the terminal floret to produce a caryopsis.

When all three caryopses developed in each spikelet, the uppermost (terminal) one was light colored, and both remaining caryopses (subterminal and basal) were darkly pigmented (Fig. 2), whereas when the terminal caryopsis fails to develop, the subterminal caryopsis, which is now uppermost, is light colored and only the basal one was darkly pigmented (Fig. 2).

DISCUSSION

The results in Figure 1 indicate that the developing uppermost caryopsis is involved in the correlative imposition of dormancy in the remaining caryopses. This is supported by the finding (6) that when the upper two florets are excised from the spikelet, the single caryopsis which develops in the remaining basal floret increases in germinability to the level of the caryopsis of the uppermost (subterminal) floret in the unmutilated controls, which produce two caryopses each.

The different germination capacities of the three caryopses which are produced do not seem to be associated with differ-

Table I. *Mature Dry Weight of A. Kotschyi Caryopses Developing in Different Positions in Same Spikelet when Parents Were Grown at 17/12 C or Outdoors with Enriched Mineral Solution*

Caryopsis type	Dry weight (mg) per caryopsis[1]	
	17°/12°	Outdoors
Terminal	9.50	4.59
Subterminal	10.64	5.40
Basal	8.99	4.47
L.S.D. p <0.05	0.96	0.33

[1] Lyophilized; calculated from 4 replicates of 25 caryopses each.

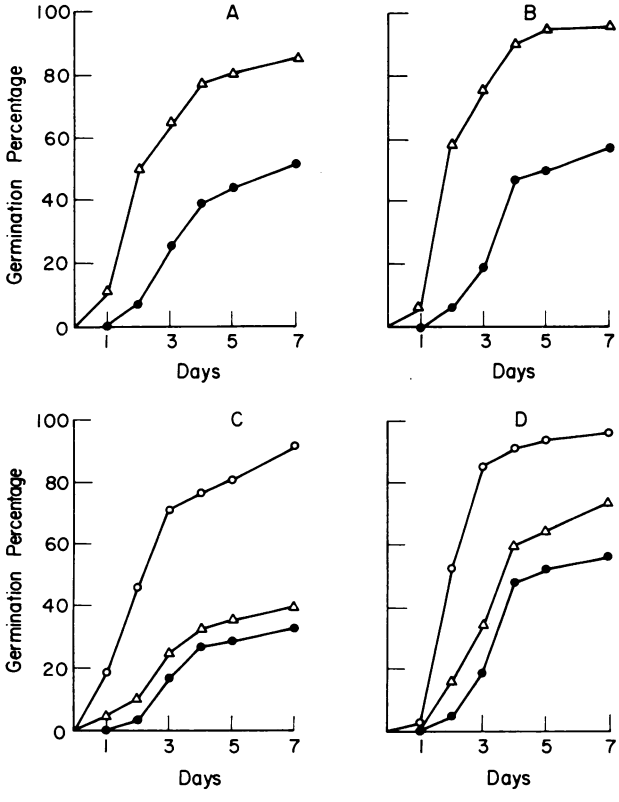

FIG. 1. Time course of germination of caryopses of *A. Kotschyi* developing in different positions in the same spikelet when parents were grown at 17/12 C (left) or outdoors with enriched mineral nutrition (right). Top: spikelets in which the terminal floret failed to produce a caryopsis: bottom: spikelets in which the terminal floret produced a caryopsis. Germination tests were done at 20 C on 4 replicates of 50 caryopses each. Terminal (○), subterminal (△), and basal (●) caryopses. yopses.

ences in weight of the caryopses (Table I). However, the correlative determination of germinability may be an indirect result of competition for essential metabolites or growth regulator, in which the uppermost developing ovary is dominant. Such a mechanism has already been suggested in this species (6) as well as in *Aegilops ovata* (1) and *Avena ludoviciana* (3). On the other hand, a more direct imposition of dormancy by the uppermost

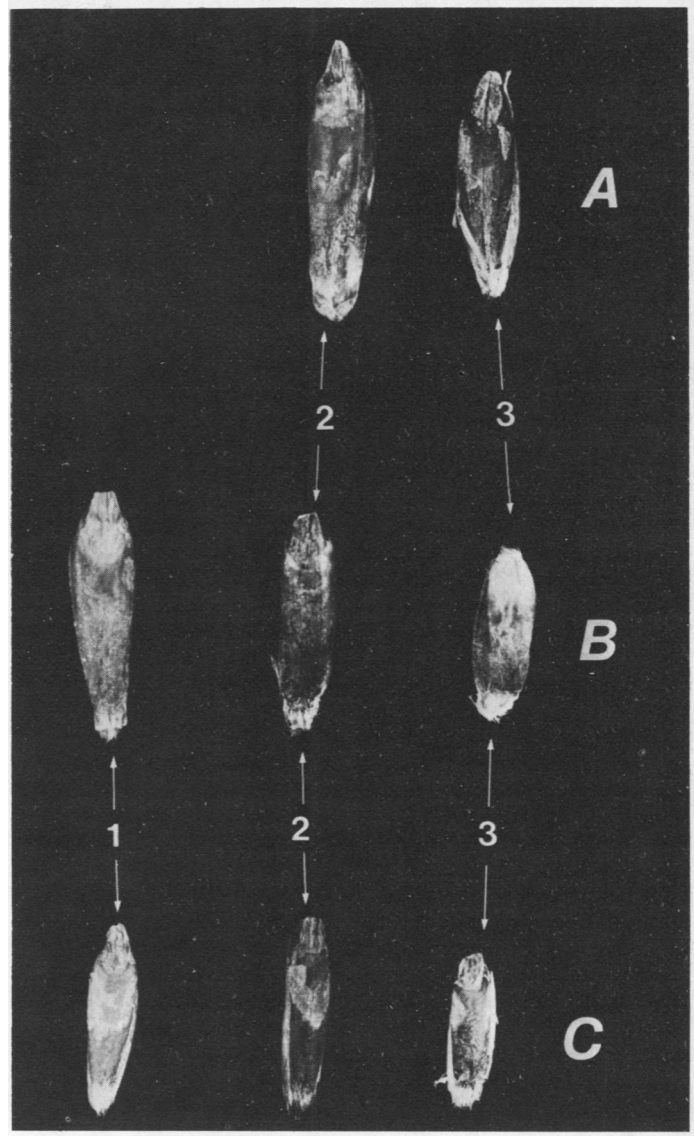

FIG. 2. Differences in pigmentation of caryopses of *A. kotschyi* developing in different positions in the same spikelet, when the terminal floret fails to produce a caryopsis (A), and when it is induced to produce one by growing the parents at 17/12 C (B), or by improving mineral nutrition (C). Terminal (1), subterminal (2), and basal (3) caryopses.

developing ovary on the ovaries below it cannot be ruled out, especially in view of differences in inhibitor content (5).

LITERATURE CITED

1. DATTA, S. C., M. EVENARI, AND Y. GUTTERMAN. 1970. The heteroblasty of *Aegilops ovata* L. Israel J. Bot. 19: 463-483.
2. KOLLER, D., M. OFIR, AND J. KIGEL. 1970. Environmental control of weed physiology. U.S. Dept. Agric., PL 480 Project No. A10-CR-80. (Final report.)
3. MORGAN, S. F. AND A. M. M. BERRIE. 1970. Development of dormancy during seed maturation in *Avena ludoviciana* winter wild oat. Nature 228: 1225.
4. WENT, F. M. 1957. The experimental control of plant growth. Chron. Bot. 17: 79.
5. WURZBURGER, J. 1974. The physiology of induction of seed dormancy and of its release. Ph.D. thesis. Bar-Ilan University, Ramat-Gan, Israel (in Hebrew, English summary).
6. WURZBURGER, J. AND D. KOLLER. 1973. Onset of seed dormancy in *Aegilops kotschyi* Boiss. and its experimental modification. New Phytol. 72: 1057-1061.