believe that 8-quinolinol sulphate does not possess cytokinin-like activity.

A. RAMESHWAR
PETER L. STEPONKUS

Department of Floriculture
and Ornamental Horticulture,
Cornell University,
Ithaca, New York.

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Development of Dormancy during Seed Maturation in *Avena ludoviciana* Winter Wild Oat

STUDIES on seed dormancy have concentrated on the physiology of dormancy break in mature seeds rather than its development during maturation. Thurston[1] reported that unripe grains of *Avena ludoviciana* did not exhibit substantial dormancy, and Quail and Carter[2] demonstrated the same phenomenon in Australian material of this species. We have confirmed these findings and have concluded that the development of dormancy is influenced both by the parent plant and by events independent of the parent.

The seed of *A. ludoviciana* is a caryopsis surrounded by hard hulls or pales. Normally the spikelet comprises two such seeds and it does not disarticulate at maturity. This feature in contrast to *A. fatua*, the spring wild oat, makes it possible to compare directly seeds from the same spikelet. Such a comparison shows that there is a gradient of dormancy within the spikelet, the larger proximal seed being less dormant than the smaller distal seed[1,2], while a much smaller third seed, occasionally present, is extremely dormant[3].

Table 1. PERCENTAGE GERMINATION OF PROXIMAL CARYOPSES OF *A. ludoviciana* AT DIFFERENT STAGES OF RIPENESS

Class	Colour of Caryopsis	Colour of Pale scar	Percentage viability	Percentage germination of viable caryopses
1	Green Yellow	Green	69	49
2	Green	Green	92	66
3	Yellow	Green	91	34
4	Brown	Green	95	4
5	Brown	Brown	97	0

A. ludoviciana was grown outdoors in a good soil. Spikelets were collected at intervals and scored for ripeness judged on the colour of the caryopis and the pale scar. Five classes of ripeness were recognized, as indicated in Table 1. At harvest, the pales were removed by hand and the caryopses were set to germinate at 10° C in darkness. Twenty caryopses and 1·5 ml. of distilled water were placed in 4·5 cm Petri dishes lined with Whatman seed test paper. There were five replicates per treatment. Germination was scored after 14 days and caryopses which had not germinated by then were pricked with a needle just above the scutellum to break dormancy. Subsequent germination indicated the seeds' viability. Where appropriate a χ^2 comparison was carried out.

Table 1 indicates that, as shown previously[1,2], dormancy develops during seed maturation. Futhermore, this dormancy resides in the caryopsis itself and does not result from maturatiom of the pales, a process which is known to inhibit germination in non-dormant caryopses[3]. Viability is low in very young caryopses but rapidly reaches levels found in mature material. At maturity all caryopses are dormant, even at 10° C, the optimum temperature for germination[2,3].

Because loss of water is an integral part of seed ripening, the development of dormancy was studied in dried immature seed. Seed belonging to classes 2 and 4 was harvested and dried for 6 days at room temperature before germination was assessed as previously described. Drying increased the level of dormancy in such samples (Table 2), indicating that after a certain stage, dormancy can develop in a seed separated from the parent plant.

Table 2. PERCENTAGE GERMINATION OF DRIED AND UNDRIED IMMATURE CARYOPSES OF *A. ludoviciana*

Class	Proximal caryopses Not dried	Proximal caryopses Dried	Proximal χ^2	Distal caryopses Not dried	Distal caryopses Dried	Distal χ^2
2	44	12	23·83*	31	4	23·41*
4	16	6	4·13†	8	1	4·18†

* P 0·01. † P 0·05.

The inception of dormancy usually takes place on the parent plant. Thurston[4] has shown that removal of the proximal ovary decreases dormancy in the distal seed. Natural loss of a seed in a spikelet also decreases dormancy in the survivor, although the phenomenon is more marked when the distal seed is the survivor (Table 3). A plausible explanation for the decline in dormancy is that, during ripening, both seeds act as sinks for a limited supply of some promotive substance. Being larger and perhaps nearer the source, the proximal seed normally receives more promoter than the distal, and thus removal of the proximal has a greater effect on the surviving distal seed than the opposite case.

Table 3. PERCENTAGE GERMINATION OF SEEDS WHICH DEVELOPED ALONE OR WITH NEIGHBOURS

Seed type	Proximal		Distal	
Neighbour	Present	Absent	Present	Absent
Germination	67	81	27	65
χ^2 Presence vs. absence	4·39*		27·56*	

Table 4. PERCENTAGE GERMINATION OF PROXIMAL CARYOPSES FROM PANICLES RIPENED IN VARIOUS SOLUTIONS

Treatment	Concentration 10^{-4} M	Concentration 10^{-3} M	χ^2 Treatment vs. water 10^{-4} M	χ^2 Treatment vs. water 10^{-3} M
Gibberellic acid	43	100	14·24*	110·22*
Coumarin		36		8·52*
PCMB	42	83	13·49*	66·64*
Iodoacetate	12	95	0·00	98·87*
Water	14			

* P 0·01. † P 0·05.

Black and Naylor[5] have already demonstrated that the introduction of a promotive substance, gibberellic acid, to ripening seed of *A. fatua* renders them non-dormant. In a similar experiment, detached panicles of *A. ludoviciana* were ripened in a glasshouse in solutions of gibberellic acid with similar results (Table 4). Furthermore, it has been shown that the metabolic inhibitors sodium *p*-chloromercuribenzoate, sodium iodoacetate and coumarin will sharply reduce the development of dormancy in ripening seeds of this species. The latter result is interesting because whereas gibberellic acid promotes germination in this species, *p*-chloromercuribenzoate and iodoacetate have no effect at the concentrations quoted, and coumarin causes some inhibition[3]. It is not known whether the site of action of these substances during ripening is in the parent plant or in the developing seed.

We propose that dormancy seeds of *A. ludoviciana* depends partly on (*a*) a supply of a promotive substance which is shared among the seeds present and (*b*) a process occurring in the caryopsis during ripening, whether attached to the parent plant or not. Furthermore, it seems that a detailed investigation of the effects of the inhibitors we have mentioned may help to explain the inception of dormancy during seed ripening.

S. F. MORGAN
A. M. M. BERRIE

Department of Botany,
The University,
Glasgow W2.

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