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DORMANCY AND HARDSEEDEDNESS IN ABRUS PRECATORIUS LINN

A. Hameed Khan and Masarrat Riaz

Division of Biochemistry, P.C.S.I.R. Laboratories, Karachi 32

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Three lots of *hard seeds* of *Abrus precatorius* Linn were collected in September and December, 1965, and March, 1966, and allowed to germinate on wet blotters in open petridishes at room temperature. The softening of seeds in the 3 lots showed a similar pattern over a period of 2½ years. In 1966, softening started in June and continued upto October; in 1967 large number of seeds softened in May while a total of only 7 seeds softened in 1968. This variation in softening of seeds has been attributed to changes in atmospheric temperature. Effect of sulphuric acid and temperature on the softening of *hard seed* fraction of *Abrus precatorius* has also been studied.

Introduction

Hard-coatedness is caused usually by impermeability of the seed coat or some of its layers, to water or to gases, though both mechanical and chemical inhibition of germination may also be factors in dormancy. Many species of plants have been reported to produce both impermeable seeds and seeds whose coats are readily permeable to water at one or more points. The family Leguminoseae, to which *Abrus precatorius* belongs, has been reported by Ewart[1] and Ress[2] to produce impermeable seeds more than other plants. Certain important nonleguminous plants which produce impermeable seeds are hollyhock (*Althea rosea* L.) belonging to the Malvaceae, morning glory (*Ipomea purpurea* (L) Lam) of the *Convolvulaceae* and canna (*Canna indica* L) of the *Cannaceae*. Certain members of other families such as *Gramineae*, *Geraniaceae*, *Chenopodiaceae* and *Solanaceae* also produce such seeds. Although the *hard seed* fraction varies from 2% to more than 90% in some species it is considered to provide survival insurance to the species under adverse sowing conditions. According to Barton[3] very few investigations have been undertaken to study this important seed fraction.

This paper is a report on experiments in which the effect of seasonal changes on the germination of the *hard seeds* of *Abrus precatorius* has been studied over a period of more than 2½ years. Influence of factors, such as temperature, acid treatment etc., [4–6] which are considered to be helpful in breaking the dormancy of seeds, has also been studied.

Material and Methods

Seeds of the scarlet variety of *Abrus precatorius* were procured from the local market; washed with water to remove adhering dust and allowed to germinate on wet blotters in open petridishes at room temperature. Seeds which remained unsoaked after 21 days were called the *hard seeds*. Three lots of *hard seeds* were collected in September and December, 1965 and March, 1966, in the manner described above.

The temperature effect was studied by placing on wet blotters 25 *hard seeds* in an incubator maintained at 32°–35°C and another 25 seeds at room temperature (22°–25°C), for a period of more than 3 months.

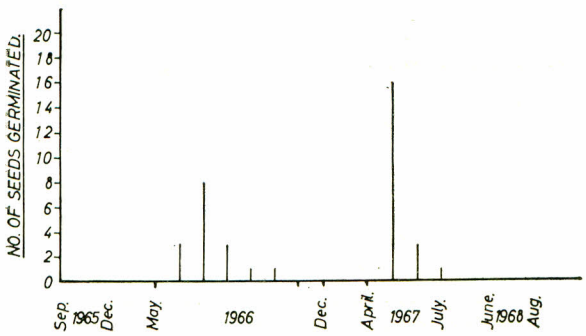
In order to determine the possible effect of the seed coat in restricting germination, seeds were treated with sulphuric acid.* Two batches of *hard seeds* were soaked in concentrated sulphuric acid for 5 and 30 minutes, and four batches with 75% sulphuric acid for 2, 5, 15 and 30 minutes, and then washed thoroughly in water for 1 hour. The seeds afterwards were transferred to petri dishes, having wet blotters and their germination studied at room temperature.

Results and Discussion

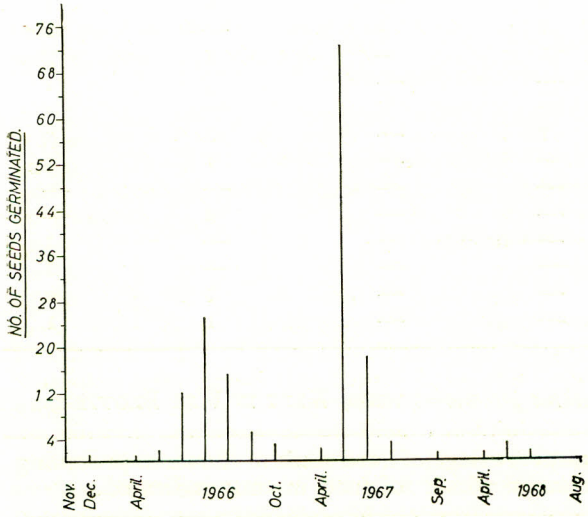
The germination graphs of the 3 lots of *hard seeds* collected in September, 1965 (lot 'A'), December, 1965 (lot 'B') and March, 1966 (lot 'C'), are shown in Figure 1. It is evident that May, June and July are the most favourable months for the germination of these seeds, although some of the seeds may soften** even in October. The pattern of germination graphs in all the 3 lots is also similar but the rate of germination is quite different in 1966, 67 and 68. All factors remaining constant, this difference in germination rates, during 2½ years of the present investigation, can probably be attributed to the temperature changes of the surroundings. A reference to the temperature charts of the Meteoro-

* The seeds were also treated with alcohol, cold and hot glycerine but no improvement in germination was noted.

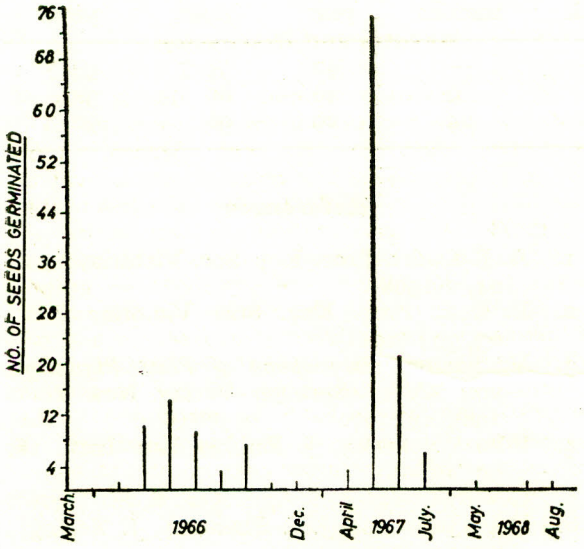
** During this study the words *softening* and *germination* are used as synonymous, since it was observed that 98% of the *hard seeds* which softened during the present investigation, germinated into seedlings.



Lot-A Germination started in September 1965.



Lot-B Germination started in December 1965.



Lot-C Germination started in March 1966.

Fig. 1.—Germination of hard seeds of A. precatorius during 1966—1968.

logy Department indicates that the summer of 1968 (May, June and July) had been comparatively cooler and this has resulted in poor germination in this year. The month of May, being the hottest month in Karachi, must be responsible for a high rate of germination in 1967. But since the seeds were placed in a refrigerated room during May, 1966, the atmospheric temperature, although as high as in 1967, had very little effect on the softening of seeds.

When similar conditions were simulated in the laboratory (Table 1), it was observed that 33% seeds softened within a month at 35°C and by the end of $3\frac{1}{2}$ months the percentage germination went upto 56%. On the other hand only 4% hard seeds softened within this period. It seems that the *hard seeds* of *Abrus precatorius* need a higher temperature for germination than the soft seeds, and this might be responsible to trigger on some physiological process which causes the softening of the seed coat. *Abrus precatorius* grows in drought ridden areas of Sind, and this character of impermeable seeds permits this plant to be distributed in time instead of space and that may be an important factor in the continuance of the species.

Sulphuric acid treatment makes the hard seeds soften at the laboratory temperatures (22°–25°C). Thirty minutes treatment with concentrated sulphuric acid, caused 100% softening within 24 hours, while 75% acid in the same period produced 80% permeability in a month. Similarly, 5 minutes treatment with concentrated sulphuric acid and 15 minutes treatment with 75% acid caused the softening of 60% seeds within a month (Table 2).

TABLE 1.—EFFECT OF TEMPERATURE ON THE GERMINATION OF *hard seeds* OF *Abrus precatorius*.

Experiment started on 15th January, 1968.

Date of soaking	32°–35°C	22°–25°C
	25 seeds	25 seeds
24-1-68	3	—
5-2-68	2	—
6-2-68	1	—
7-2-68	2	—
29-2-68	1	—
4-3-68	1	—
8-4-68	1	—
22-4-68	—	1
24-4-68	1	—
2-5-68	1	—
8-5-68	1	—

TABLE 2.—EFFECT OF SULPHURIC ACID TREATMENT ON THE GERMINATION OF *hard seeds* OF *Abrus precatorius* AT ROOM TEMPERATURE.

No. of seeds taken for each experiment =25
Treatment given on =24.7.1968.

Date	Conc. H_2SO_4		75 per cent H_2SO_4				
	5 min	30 min	2 min	5 min	10 min	15 min	30 min
24-7-68	—	—	—	—	—	—	—
25-7-68	5	25	—	—	—	1	4
28-7-68	—	—	—	—	—	2	1
29-7-68	1	—	—	1	—	2	1
30-7-68	1	—	1	1	3	—	2
1-8-68	2	—	—	1	—	1	2
5-8-68	—	—	1	—	—	3	1
6-8-68	1	—	—	—	1	—	1
8-8-68	1	—	—	1	—	1	3
13-8-68	2	—	1	—	—	1	1
14-8-68	1	—	—	—	—	—	—
20-8-68	—	—	—	—	—	2	—
24-8-68	—	—	—	—	—	—	1
25-8-68	1	—	—	—	—	—	1
26-8-68	—	—	—	—	—	1	2
27-8-68	—	—	—	—	—	1	1

TABLE 3.—RATE OF SOFTENING OF *hard seeds* OF *Abrus precatorius* WHEN KEPT IN WET BLOTTERS.

Lot number with dates	Number of seeds	Average percentage of hard seeds as shown in preceding column which softened in time indicated.				
		1 month	6 months	1 year	2 years	$2\frac{1}{2}$ years
Lot A: 1965	38	—	—	42	94·7	94·7
Lot B: 1965	182	1	9	40	89	92
Lot C: 1966	172	2	24	29	90	92

The rate of softening of the 3 lots of hard seeds of *Abrus precatorius* is shown in Table 3. It is evident that within a given seed lot there was a wide variability in the degree of softening of the individual seeds. It is therefore, impossible to estimate even approximately, in advance, the proportion of the impermeable seeds in any given lot which will germinate under ordinary germination conditions in any given length of time. Similar observations have also been made on the *hard seeds* of *Robinia pseudo-acacia* L by Kondo[7] and on alfalfa (*Medicago sativa* L) by Dexter.[8]

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References

1. A. J. Ewart, Proc. Roy. Soc. Victoria, n.s.v., **21,** 2(1908).
2. B. Ress, Proc. Roy. Soc. Victoria, n.s.v., **23,** 393 (1911).
3. V. Barton, *Encyclopedia of Plant Physiology*, vol. XV/2 (Springer–Verlag, New York, 1965), p. 727.
4. P.R. Wycherley, J. Rubber Res. Inst., **16,** 99 (1960).
5. G.T. Harrington, J. Agri. Res., **6,** 761 (1916).
6. D.V. Juby and J.H. Pheasant, J. Ecology, **21,** 442 (1933).
7. M. Kondo, Ber. O'hara Inst. Indw. Forsch., **4,** 289 (1929).
8. S.T. Dexter, Agron J., **47,** 357 (1955).