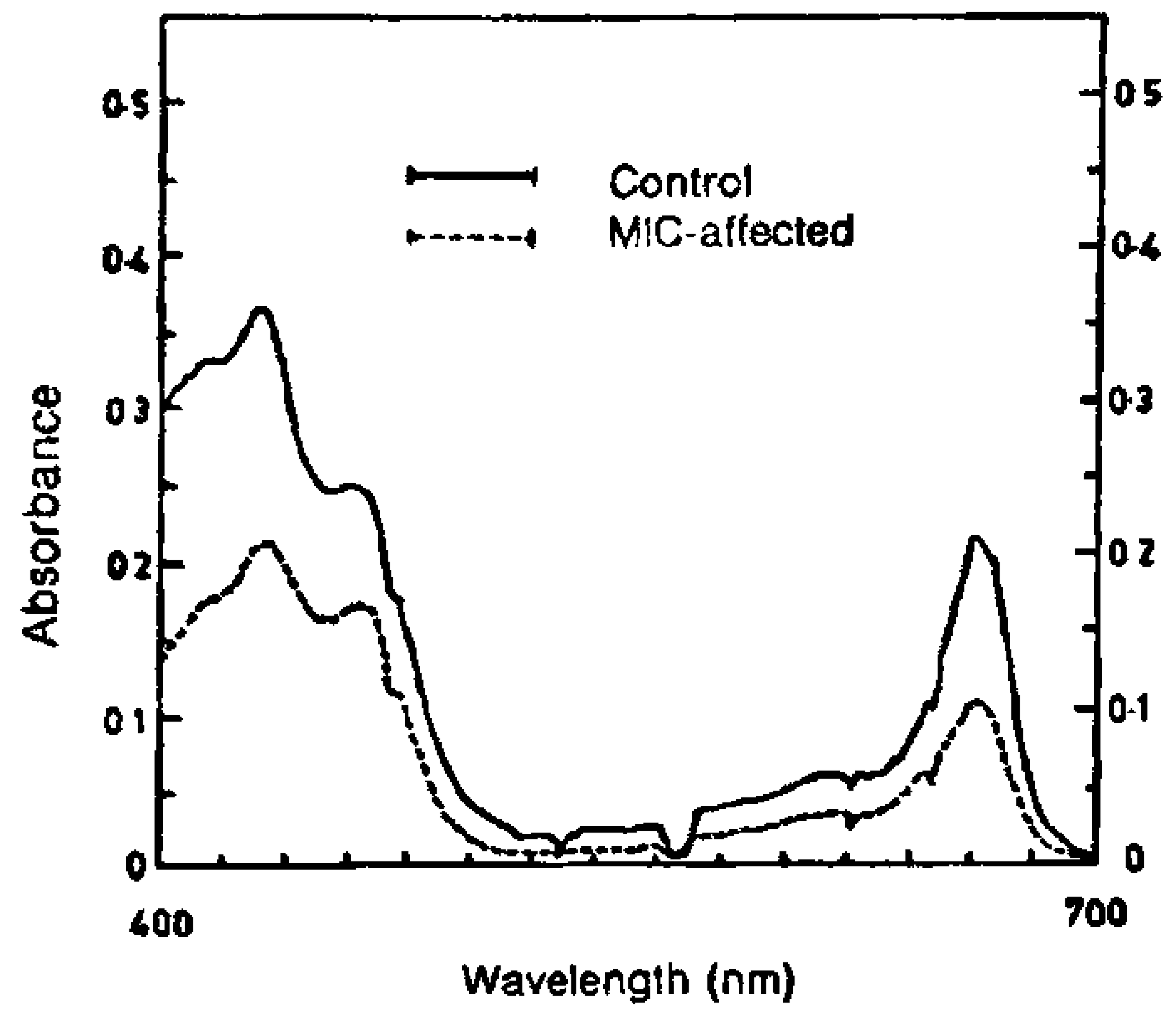

Figure 1. Chlorophyll contents of MIC-affected and control prothalli of *T. augescens*.

biochemical processes through intercalation of base pairs. While the first property leads to mortality, the latter may constitute some interesting departures from the normal form and structure of the organism.

A few fern leaves sagging up due to exposure of MIC leaked from the Union Carbide Factory on 2nd December 1984, were collected from a private garden in Bhopal. The spores from these leaves were tapped out, cultured in the laboratory and maintained at 24±2°C, on nutritive agar gel plates[2]. A couple of plates of the same species growing in the botanical garden of this University served as control. To estimate the chlorophyll content 20 mg of fresh weight of 19-day-old (2-D spatulate) MIC-affected and control prothalli were used. Chlorophyll was extracted in 5 ml 80% acetone, centrifuged and the absorbance recorded using a spectrophotometer (Perkin Elmer Lamba 3) in the visible range.

Most of the control spores of *Thelypteris augescens* germinated within 4 days, showing 90% germinability. But MIC-affected spores showed both delayed germination and lower germinability at 41%. The latter also gave rise to some aberrant gametophytes[1]. The chlorophyll contents were markedly decreased in comparable stages of control prothalli (figure 1) suggesting that MIC had also affected the chlorophyll synthesis. This inhibition could be genic, as MIC leakage occurred during the sporulation period of the material. It can therefore be concluded that MIC at mild doses acts as a powerful mutagen.

One of the authors (IPS) is thankful to CSIR, New Delhi, for financial assistance.

22 July 1988; Revised 13 September 1988

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A NEW REPORT ON ABNORMALLY FAST GERMINATING SEEDS OF *HALOXYLON* SPP.—AN ECOLOGICAL ADAPTATION TO SALINE HABITAT

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HALOXYLON RECURVUM (Moq.) Bunge ex Boiss. and *H. salicornicum* (Moq.) Bunge. are the two characteristic halophytes of the Indian desert; the latter is found even on sandy saline soil. An extremely fast germination in the seeds of these two species, commonly occurring within an hour is being reported for the first time in any Indian plant species. An ecological adaptive role is assigned to such a fast phenomenon of germination, which appears like uncoiling of the young embryo out of the testa immediately after contact with water. An unusually high rate of cell division and cell elongation, soon after imbibition appears to be the cause for such an unusual feature.

A variety of germination mechanisms in the seeds in relation to the characteristic habitat of the Indian desert have been reported[1]. A few reports on the seed germination of saline plants of this area are also on record[2,3], but a rapid germination has not been observed in any species. The establishment of a seedling under uncongenial conditions of salinity (physiological drought) or absence of moisture (physical drought) is possible, only if a seedling grows with a rapid rate to make use of a brief period of water availability, with lesser salt concentration.

Members of the series Curvembryae and family Chenopodiaceae, prominent genera among them, like *Atriplex* and *Haloxylon* are fairly common throughout the world in saline areas. *Haloxylon recurvum* and *H. salicornicum* are two members of this family commonly found in the inland salines of the Indian desert. The latter species is widely distributed even on sandy plains showing high NaCl content, but is not fleshy in nature. The former species which is not widely distributed is quite fleshy. Both these species flower and fruit profusely. During studies on the halophytes of Indian desert, a tremendously fast phenomenon of germination was discovered in these two species. The seeds of *H. recurvum* are larger and darker in colour as compared to *H. salicornicum*. Williams[4] reported that the black seeds of *Halogeton glomeratus* raised on moist filter paper absorb water so rapidly that the seed coat ruptures and the embryo is expelled within an hour.

Table 1 *Effect of time duration of seed germinability of two Haloxylon spp. in April*

Plant species	Time	Initiation of germn. (min)	CV (%)	Period of max. germn. Time	Period of max. germn. Germn. (%)	Total germn. (%) at 4 PM	Ratio of Radicle : Hypocotyl : Cotyledons after 24 h
H. salicornicum	9 AM	60	27	2 PM	26.6	33.3 (35.2)	3.3 : 1.3 : 2.1
(wt. 62.6 mg/100	10 AM	105	24	3 PM	20.0	33.3 (35.2)	3.5 : 1.1 : 2.5
seeds)	11 AM	90	26	3 PM	13.3	26.6 (31.0)	3.1 : 1.3 : 2.5
	12 Noon	180	23	3 PM	26.6	40.0 (39.2)	3.1 : 1.3 : 2.1
	1 PM	75	50	3 PM	13.3	46.6 (43.0)	3.5 : 1.3 : 2.0
	2 PM	60	100	3 PM	26.6	60.0 (50.7)	3.1 : 1.1 : 2.4
	3 PM	45	75	4 PM	33.3	53.3 (46.8)	3.0 : 1.0 : 2.1
C.D. (5%)						N.S.	
H. recurvum	9 AM	120	13	4 PM	6.6	13.3	6.3 : 2.3 : 4.6
(wt. 93 mg/100	10 AM	—	—	—	—	—	6.0 : 2.6 : 5.1
seeds)	11 AM	—	—	—	—	—	5.3 : 2.5 : 5.3
	12 Noon	—	—	—	—	—	4.8 : 3.1 : 5.0
	1 PM	75	50	3 PM	20.0	20.0	5.0 : 2.3 : 4.8
	2 PM	—	—	—	—	—	4.6 : 3.0 : 4.6
	3 PM	—	—	—	—	—	4.6 : 2.5 : 4.6
C.D. (5%)						10.63	

Values in parentheses denote arc sine $\sqrt{\%}$ values; (—) = Nil; CV, coefficient of velocity.

Table 2 *Effect of time duration on seed germinability of two Haloxylon spp. in May*

Plant species	Time	Initiation of germn. (min)	CV (%)	Period of max. germn. Time	Period of max. germn. Germn. (%)	Total germn. (%) at 4 PM	Ratio of Radicle : Hypocotyl : Cotyledons after 24 h
H. salicornicum	8 AM	85	23.8	12 Noon	13.3	33.3 (35.2)	4.5 : 1.2 : 2.8
	9 AM	95	33.3	12 Noon	13.3	26.6 (31.0)	4.6 : 1.5 : 2.5
	10 AM	60	50.0	1 PM	13.3	20.0 (26.5)	2.8 : 1.1 : 2.1
	11 AM	120	50.0	1 PM	13.3	26.6 (31.0)	3.1 : 1.0 : 2.8
	12 Noon	95	36.3	3 PM	20.0	26.6 (31.0)	4.1 : 1.0 : 2.6
	1 PM	75	50.0	3 PM	26.6	33.3 (35.2)	4.3 : 1.1 : 1.8
	2 PM	60	60.0	3 PM	20.0	40.0 (39.2)	3.3 : 1.2 : 2.2
	3 PM	60	50.0	4 PM	26.6	53.3 (46.8)	5.0 : 1.2 : 2.0
C.D. (5%)						N.S.	
H. recurvum	8 AM	80	16.0	2 PM	20.0	40.0 (39.2)	7.8 : 2.8 : 5.4
	9 AM	40	100.0	11 AM	26.6	6.6 (14.8)	5.3 : 4.1 : 4.0
	10 AM	45	75.0	12 Noon	26.6	20.0 (26.5)	5.8 : 4.1 : 6.4
	11 AM	75	50.0	1 PM	13.3	20.0 (26.5)	4.8 : 4.1 : 5.6
	12 Noon	40	66.6	1 PM	13.3	26.6 (31.0)	5.5 : 4.8 : 6.2
	1 PM	80	50.0	3 PM	26.6	33.3 (35.2)	4.1 : 4.5 : 4.6
	2 PM	40	100.0	3 PM	33.3	100.0 (90.0)	5.0 : 4.5 : 5.0
	3 PM	30	100.0	4 PM	66.6	93.3 (75.0)	4 6 : 4 8 : 5.0
	4 PM	25	100.0	5 PM	46.6	100.0 (90.0)	4 8 : 4 8 : 5.1
C.D. (5%)						21.19	

Values in parentheses denote arc sine $\sqrt{\%}$ values; CV, coefficient of velocity.

The time taken for seeds to imbibe water and the embryo to emerge from the seed coat has been studied in the seeds of these two species of *Haloxylon* during April and May 1988 starting from 8.00 A.M. The seeds were collected during December 1987 (*H. salicornicum*) and February-March, 1988 (*H. recurvum*). Seed germination was studied in sterilized petri dishes lined with a single layer of filter paper moistened with distilled water in triplicate. The criterion for seed germination is the protrusion of radicle from the testa. Hourly observations were made from 8 A.M. to 4 P.M. The percentage of water imbibed was estimated at 15 min intervals each up to 3 h. Seedling growth was also measured to estimate seedling vigour. The temperature varied from 30 to 37°C and the relative humidity from 75 to 85. The data statistically analysed after converting into arc sine values[5] are presented in tables 1 and 2.

The following conclusions are drawn:

(i) Water imbibition: The percentage of water imbibition rapidly increased with increase in the duration of hydration and reached a maximum after 105 and 90 min in *H. recurvum* and *H. salicornicum*, respectively (figure 1).

(ii) Seed germination: Germination in *H. recurvum* is initiated within 75–120 min in April and 25–80 min in May; whereas in *H. salicornicum* this period is 40–180 min in April and 60–120 min in May. The initiation is fastest during 3–5 P.M. (tables 1 and 2).

(iii) Seedling vigour: In *H. recurvum* the coefficient of velocity (CV) values were greater in the afternoon (100%) in May than in April (50%). The values for the initiation of germination favour CV values indicating better seedling vigour. In *H. salicornicum* the CV values are higher in the afternoon (100%) in April than in May (60%). Here the values for initiation of germination in April also coincide with CV, indicating better seedling vigour.

(iv) Seedling growth: The seedling growth after 24 h of initiation (tables 1 and 2) shows that seedlings in both species attained their maximum elongation irrespective of setting seed for germination experiment at different hours of the day within 24 h. Variations in the seedling growth due to onset of the experiment in two different months are insignificant (figures 2–4). The fast seed germination in *Haloxylon*

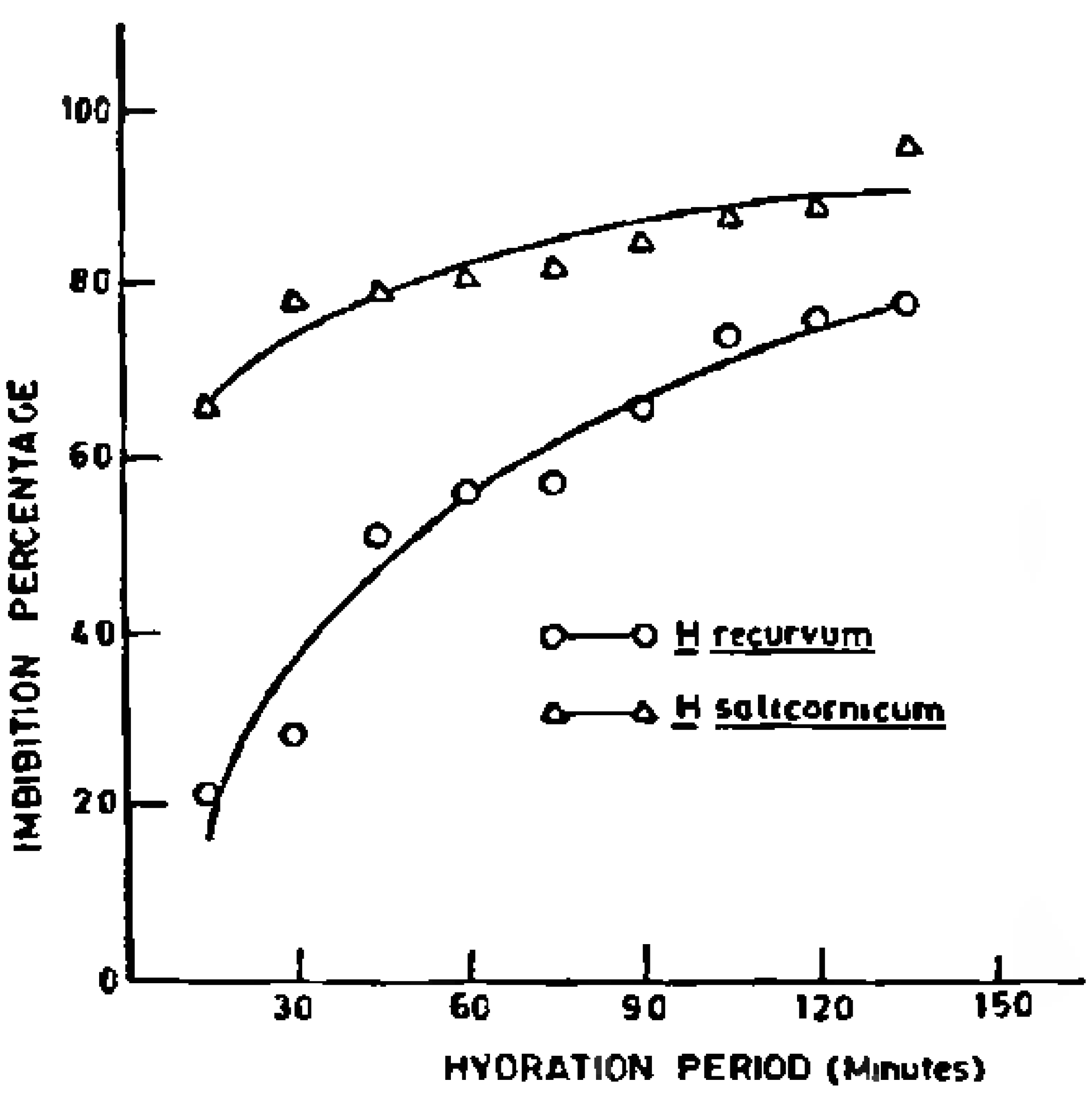
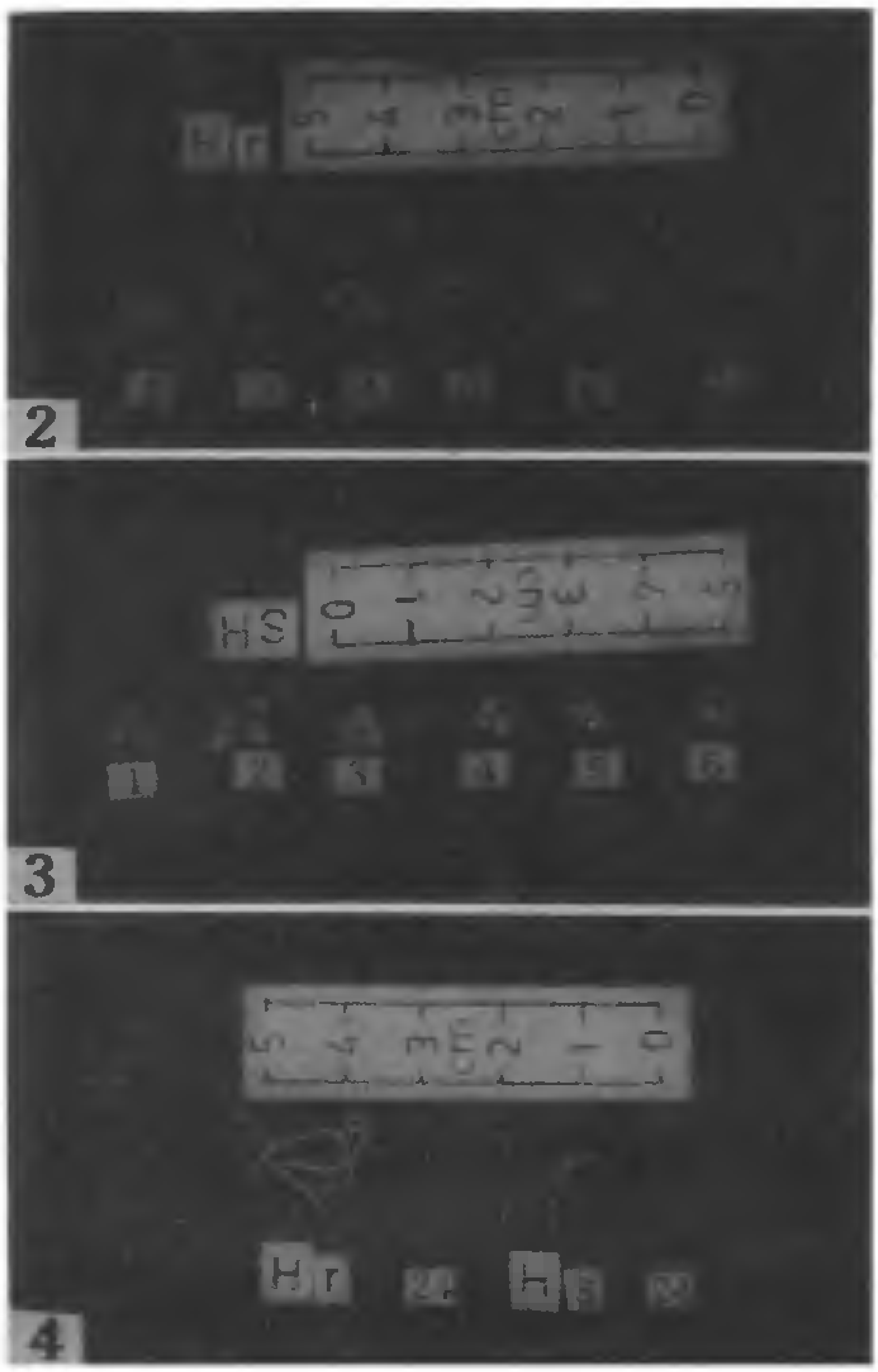


Figure 1. Relation between hydration period and imbibition percentage of *H. recurvum* and *H. salicornicum*.



Figures 2–4. The process of seed germination during 2–24 h in *H. recurvum* (**2**), and during 1–6 h in *H. salicornicum* (**3**), and comparison in seedling growth at the end of 24 h in *H. recurvum* (hr) and *H. salicornicum* (hs) (**4**).

spp. indicates their adaptive strategy as the availability of water with reduced NaCl content in soil during the rainy season is for a short duration. This is because evaporation of moisture under bright sunlight and heat, increases the salt content by a capillary movement. If a seed can take advantage and grow fast, the seedling establishment is ensured and this is what is achieved in these two species.

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SORGHUM PURPUREOSERICEUM (A. RICH) ASCHERS. AND SCHWEIF SUB SP. *DIMIDIATUM* (STAPF) GARBER: OCCURRENCE, MORPHOLOGY AND CYTOLOGY

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Sorghum Moench is a heterogeneous genus and subdivided into sections *Chaetosorghum*, *Heterosorghum*, *Parasorghum*, *Sorghum* and *Stiposorghum*[1]. The section *Parasorghum* contains about 8-10 species of annual and 75 perennial wild grasses[2]. Very little work has been done on the cytomorphology of these wild sorghum types, probably because of the non-availability of viable seed in any germplasm bank in the world. One such species, *Sorghum purpureosericeum*, belonging to the section *Parasorghum*, is reported to have two subspecies: *deccanense* and *dimidiatum*[3].

In a 1979 germplasm collection mission to eastern Sudan, organized by the ICRISAT, four *Parasorghum* panicle samples were collected and their locations are shown in table 1.

These samples were brought to the ICRISAT Centre through the Indian Plant Quarantine Service, and they have been conserved in the ICRISAT gene bank at 4°C and 20% RH. They were grown and studied in the ICRISAT Botanical Garden during the 1981/82 post-rainy season and identified as *Sorghum purpureosericeum* subspecies *dimidiatum* by

Table 1 *Details of parasorghum panicle samples [local name: Anees] collected from different locations*

Collection No.	Province	Exact location	Mean annual rainfall (mm)
PGI 44	Kassala	Komshetta	576
PGI 47	Kassala	Doka	576
PGI 68	Kassala	23 SW Samsum	576
PIA 113	Blue Nile	170 SW Damazin	730

Figure 1. *Sorghum purpureosericeum* subspecies *dimidiatum* showing ligule hairs, bearded sheath nodes, simple panicle branching and long awns.