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LEVEL OF ABSCISIC ACID AND GIBBERELLIC ACID LIKE COMPOUND IN GERMINATED AND NON-GERMINATED COTTON SEEDS

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Abstract

ABA and GA like compounds were studied in germinated and non-germinated cotton seeds (*Gossypium arboreum* cv.M–100). High levels of ABA were found in seed coat and cotyledons of germinated and non-germinated seeds. No significant difference was observed in GA like substances. It seems that accumulation of ABA like compounds inhibit germination and the germination process is controlled by the balance between ABA and GA like compounds within the seeds.

Introduction

The process of germination and seed dormancy is controlled by many physiological and biochemical factors. Growth hormones both promotors and inhibitors play an important role in dormancy of seeds and the germination (Frankland, 1961; Thomas & Wareing, 1965; King, 1976; Milborrow, 1974; Black, 1983). ABA has been reported to block the process of germination (Marteen & Varner, 1966; Sondheimer, *et al,* 1968; Milborrow, 1974). Thomas & Wareing (1965), Khan (1968), Robertson (1977) and Black (1983) reported that GA induced germination is blocked by ABA. It would suggest that dormancy and growth are associated with a balance between ABA and GA not only within the whole seed but also in different parts of seed.

In the present investigation the levels of ABA and GA in seed coat and cotyledons of the germinated and non-germinated cotton seeds has been examined and discussed.

Materials and Methods

Seeds of cotton (*Gossypium arboreum* cv.M–100) of approximately equal weight and size were germinated in 9 cm Petri dishes lined with double layers of Whatman No. 1

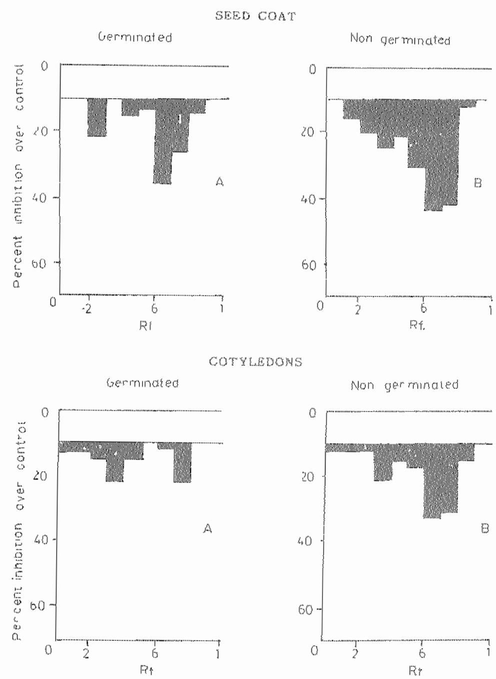

Fig. 1. Histogram showing endogenous ABA-like compounds extracted from seed coat and cotyledons of germinated and non-germinated cotton seeds.

filter paper moistened with distilled water. Germination was carried out in dark at $35^{o}C \pm 1^{o}C$. Emergence of radicle upto 6 days was taken as the criterion of germination. Seeds which did not show any sign of germination upto 6 days were regarded as non germinated.

Five g fresh weight of seed coat and cotyledons from germinated and non-germinated seeds were used for extraction of ABA and GA like compound as described by Badar, *et al*, (1970). Acidic ether fraction containing ABA like compound and acidic butanol fraction containing GA like compound were streaked on 2.5 x 30 cm strips of Whatman No. 3 chromatographic paper previously washed with chromatographic solvent and developed (descending type) in isopropanol: ammonia: water (10:1:1 V/V). Chromatograms of extracted compounds and markers (ABA and GA) were run upto 24 cm, air dried, and cut into 10 strips of equal size each corresponding to Rf value. Samples were run in duplicate together with unspotted control. Bioassay of ABA like compound was carried out by wheat coleoptile test (Nitsch & Nitsch, 1957) and germination of lettuce seeds (Black, 1974). Lettuce hypocotyl elongation test was used for the bioassay of Gibberellic acid (Frankland & Wareing, 1960).

Results

The cotyledons of non-germinated seeds showed greater amount of ABA like compounds with maximum activity between Rf 0.6–0.7 (corresponding to Rf of marker ABA) as compared to germinated seeds (Fig. 1). The amount of ABA like inhibitory compounds was greater in seed coat than in cotyledons. Similar to the cotyledons, seed coat from non-germinated seed, showed more ABA like compound (Fig. 2). Lettuce seed germination test also showed more or less similar results (Table 1). Extracts of seed coat and cotyledons from non-germinated seeds showed respectively 50% and [illegible] germination inhibition whereas the extract of seed coat and cotyledons for germinated seed showed 30% inhibition (Table 1).

Figure 2 shows that the activity of GA like compound resides between Rf 0.3–0.7 with maximum activity at Rf 0.4–0.6. No significant change in the level of GA like compounds was observed in the seed coat and cotyledons (Fig. 2) of germinated and non-germinated seeds.

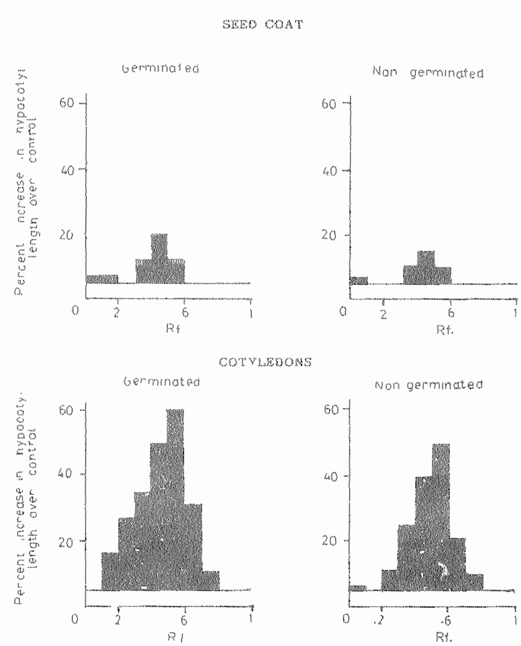

Fig. 2. Histogram showing endogenous Gibberellic acid-like compounds extracted from seed coat and cotyledons of germinated and non-germinated cotton seeds.

Table 1. Effect of ABA like compounds (extracted from germinated and non-germinated cotton seeds) on the germination of lettuce seeds.

Treatment	Cotyledons			Seed coat		
	Total No. of seed	No. of seed germinated	Percent inhibition	Total No. of seed	No. of seed germinated	Percent inhibition
Control	400	400	–	400	400	–
ABA from germinated seeds	400	280 ±1	30	400	280 ±1.2	30
ABA from non-germinated seeds	400	200 ±1.2	50	400	160 ±1	60

Discussion

The results show that both seed coated cotyledon of non-germinated seeds contain high levels of ABA like compounds with comparatively greater amount in the seed coat than the cotyledon. In contrast, no significant difference was observed in GA like compounds in germinated and non-germinated seeds. Failure of GA inducing germination in certain intact seeds may be related to the high levels of ABA like inhibitors in seed coats (Frankland, 1961).

The literature reveals that the role of ABA in dormancy is still debatable. Some investigators (Sondheimer, *et al,* 1968, 1974; Milborrow, 1974, Khan, 1968; Frankland, 1961) suggest that dormancy might be considered to be induced and maintained by endogenous levels of ABA, while others are of the view that correlation between the levels of ABA and its action in dormancy is yet to be established (Black, 1983; Robertson, 1977). Black (1983) further thinks that estimation of total ABA (free or bound) in whole seed may be of little significance. Detailed information is, therefore, required on the levels of ABA in different parts of seeds and its transport before any generalisation could be made on its role in dormancy.

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