RESULTS AND DISCUSSION

I. Effect of some physical and chemical treatments on germination of seeds (Shrubs):

I.1. *Cassia didymobotrya*:

I.1.a. Cold and hot water treatments (H.W.T's):

Cassia didymobotrya L. seeds were either soaked in cold water at room temperature (28°C) or in hot water coincided by raising or lowering temperatures to or below 40, 50 or 60°C. In Table (1) data of season 1981 and 1982 indicate that, soaking seeds in cold water resulted in the best number and percentage of germinated seeds as compared to any other treatment of raising or lowering temperatures. Significant differences are noticed between number of germinated seeds of control and H.W.T's R. which gave the least number of germinated seeds, indicating that *C. didymobotrya* L. seeds are sensitive to high temperature. The cause may be attributed to injurious effects on embryo or due to heat influences on some biochemical pathways of metabolites needed by active embryo.

Accordingly, shortage of some compounds needed by embryo will block germination process. In This concern Hamly (1932) on *Meliotus alba* and Hutton and Porter(1937) on species of Leguminosae found that the permeability of hard seeds by water was increased and germination was enhanced by soaking the seeds in water. Lohmeyer (1951) mentioned

Table (1): Effect of H.W.T.s on seed germination of trees and shrubs.
<u>Cassia didymobotrya</u> L.
First season 1981

Treatment	Means No.of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	40	50	60	40	50	60	40	50	60
Cold water at 28°C	23.0	23.0	23.0	92.0	92.0	92.0	16.7	16.7	16.7
H.W.T.R*	11.0	11.7	10.3	44.0	46.8	41.2	15.3	16.7	15.3
H.W.T.L*	19.7	22.7	18.0	78.8	90.8	72.0	15.3	16.7	14.3
L.S.D. at 0.05	8.11	4.41	5.30	--	--	--	N.S	N.S	N.S
0.01	N.S	7.30	8.76	--	--	--	N.S	N.S	N.S
Second season 1982									
Cold water at 28°C	21.0	21.0	21.0	84.0	84.0	84.0	12.3	12.3	12.3
H.W.T.R.*	14.7	14.3	12.3	58.8	57.2	49.2	11.7	12.3	9.3
H.W.T.L.*	17.7	18.7	15.0	70.8	74.8	60.0	11.0	10.7	9.7
L.S.D. at 0.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S

R. = Raising
L. = Lowering temperatures

that the dormancy of Acacia seed is due to a hard outer covering impereable to water, he suggested that seeds may be boiled for one minute and then removed from boiling water. Taylorson and Hendricks (1972) postulated that the temperature potentiation of germination may be interpreted as a change in membrane pereability or removal of an inhibitor. Alvarez-Racelies and Bagaloyos (1977) indicated that seeds of Leucocenphala sp. treated by soaking in water temperature at 80°C for 1 minute gave best germination as 90%.

Concerning number of days to maximum percentage of germination, no significant differences are noticed in Table (1). The least number of days needed for maximum germination was recorded from seeds treated with H.W.T's L. in both seasons.

I.1.b. Effect of peat moss and sulfuric acid treatments:

In 1981, Table (2) shows that the highest number of germinated seeds resulted from soaking in cold water or inserting seeds in wet peat moss at room temperature with mean average of 23 and 21 germinated seeds respectively. The first value is significant as compared to control or sulfuric acid treatments. For the next season 1982, results revealed that inserting seeds in wet peat

Table (2): Effect of H_2SO_4 and peat moss on seed germination

Cassia didymobotrya L.

First season 1981

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	15.0	60.0	28.0
Seeds Soaking	23.0	92.0	16.7
peat moss	21.0	84.0	11.0
10% for 5 min.	17.0	68.0	15.7
10% for 10 min.	15.3	61.2	16.3
20% for 5 min.	13.3	53.2	17.7
20% for 10 min.	11.3	45.2	20.0
L.S.D. at 0.05	4.48	--	N.S
0.01	6.29	--	N.S

Second season 1982

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	18.3	73.2	21.3
Seeds Soaking	21.0	84.0	12.3
peat moss	24.3	97.2	8.3
10% for 5 min.	20.0	80.0	11.7
10% for 10 min.	17.7	70.8	14.0
20% for 5 min.	13.3	53.2	14.3
20% for 10 min.	9.3	37.2	19.7
L.S.D. at 0.05	7.31	—	N.S
0.01	N.S	—	N.S

moss gave the highest number, percentage as well as the least number of days for maximum percentage of germination as 8.3 days compared to 19.7 days for (H_2SO_4 20% for 10 minutes) and 21.3 days for direct sowing. Thus peat moss application seemed to be the best treatment which may be conttributed to adequate supply of both moisture for imbibition and well gaseous exchange at early stages of germination. The results agree with those of Brown (1940), who emphasized the importance of gaseous exchanges in the regulation of coat imposed dormancy of seeds.

Also the ability of gases to influence the level of endogenous hormones effective on releasing dormancy was shown by the study of Brown and Van staden (1975).

Data in Figure (1) emphasize that GA_3 application at 50, 100, 150 p.p.m. following seed soaking in cold and hot water or sulfuric acid significantly decreased number of germinated seeds of C. didymobotrya L. GA_3 in all cases supressed seed germination, this is probably due to some effects of GA_3 on changing endogenous balance of hormones and enzymes in seeds. Khan (1971) reported that seeds of the same or different species are not expected to give the same response to application of a gibberellin. The varying response of these seeds to exogenous hormones is consistent with hypothesis of primary, preventive and permissive roles of hormones.

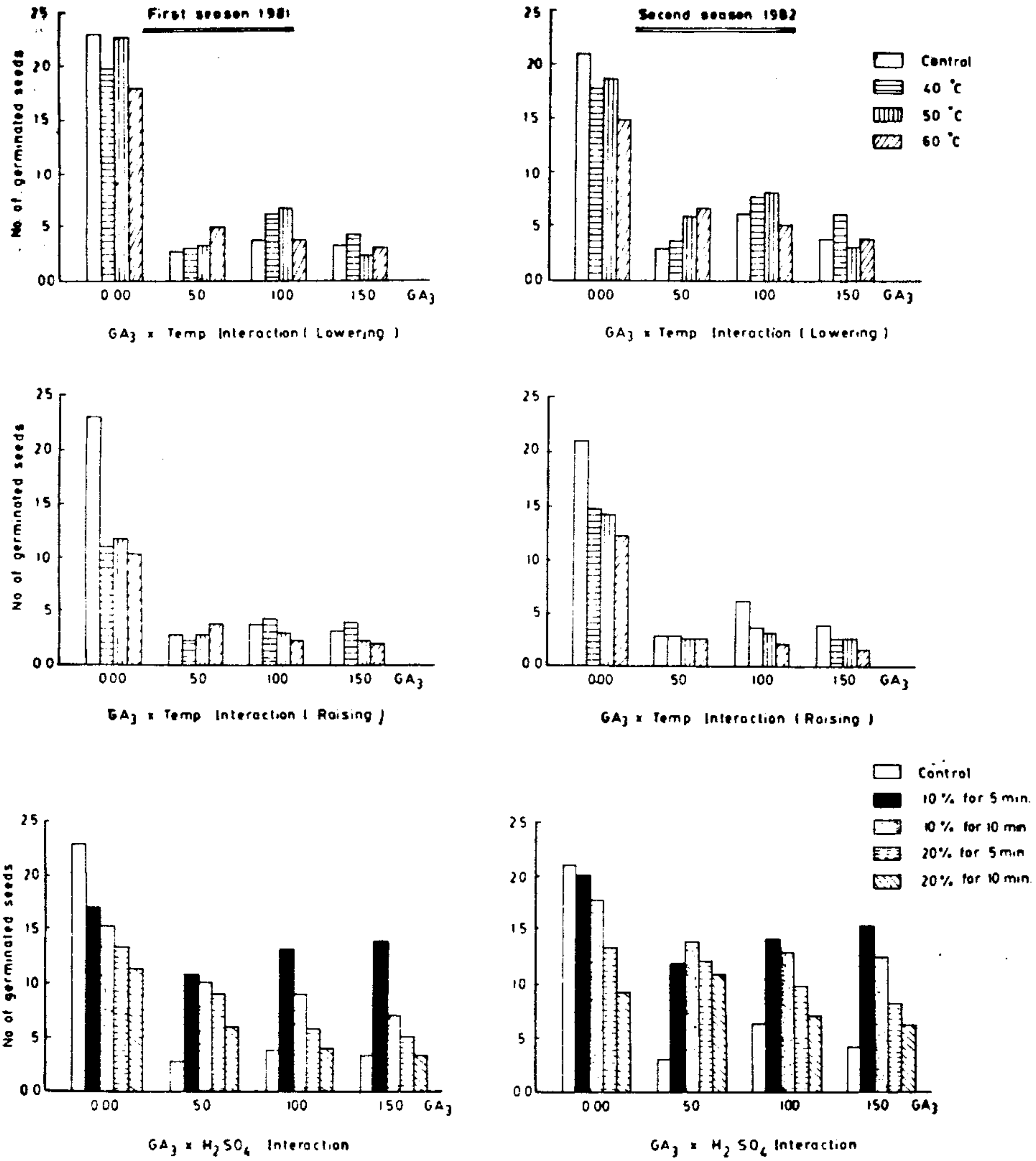

Fig.(1) Effect of GA_3 soaking in water or sulfuric acid treatments on seed germination of <u>Cassia didymobotrya</u>.

I.2. <u>Cassia goluca</u> L.:

I.2.a. <u>Cold and Hot water Treatments (H.W.T's.)</u>:

In both season of 1981 and 1982 Table (3) shows that number of germinated seeds of <u>C. goluca</u>, L., recorded the highest values with cold water treatments. Raising temperature of water decreased both number and percentages of germinated seeds especially with raising temperature to 60°C. In this later case seed germination percentages were 36 and 40 in 1981 and 1982, respectively, compared to 78.8 and 68.0 for control in the two seasons.

In such cases high temperature may cause injury to some embryos and possibly it may influence the activity of enzymes during the early stages of imbibition. Consequently retardation or complete failure of seed germination may happen. The percentages of seed germination due to H.W.T.s. were coincided with longer period to reach survival seeds to their maximal germination. This indicated that H.W.T's probably had thermal stresses on germination. The effect of high temperature on germination especially with H.W.T's was suggested to vary due to differences among the seeds of different genera and species. Mc. Donough (1967) and Heydecker (1969) reported that super-maximal temperatures can modify the responses of seeds to temperature and/or light and/or water

Table (3): Effect of H.W.T.s on seed germination of some trees and shrubs.
Cassia goluca.
First season 1981

Treatment	Means No.of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	40	50	60	40	50	60	40	50	60
Cold water at 28°C	19.7	19.7	19.7	78.8	78.8	78.8	13.0	13.0	13.0
H.W.T.R*	9.0	7.7	9.0	36.0	30.8	36.0	16.7	19.0	17.7
H.W.T.L*	14.3	17.3	12.3	57.2	59.2	49.2	14.3	15.3	13.0
L.S.D. at 0.05	N.S	8.90	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
Second season 1982									
Cold water at 28°C	17.0	17.0	17.0	68.0	68.0	68.0	10.7	10.7	10.7
H.W.T.R.*	11.0	11.7	10.0	44.0	46.8	40.0	14.3	15.7	16.7
H.W.T.L.*	14.7	16.7	13.0	58.8	66.8	52.0	14.3	16.7	11.7
L.S.D. at C.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
C.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S

R. = Raising
L. = Lowering temperatures

stress. Also, other explanation was stated by Porto and Siegel (1960) who mentioned that as temperatures approach the maximum there is a gradual decline in the rate of germination which indicates things, begin to go wrong. Such events are consistent with the concept of high temperature lesion's which can be healed by supplying seeds with what presumably is a depleted factor or substitute for it or a compound that enables the seed to manufacture it.

I.2.b. Effect of peat moss and sulfuric acid treatments:

The results of *Caccia goluca* L. in Table (4) gave the same trend of results as *Cassia didymobotrya* L. In 1981 the highest number of germinated seeds as 19.7 with a percentage of 78.8 was recorded from seeds soaked in cold water, whereas, peat moss treatment produced the highest number and percentage of germination in 1982 Table (4). Compared to sulfuric acid treatments, applications of water, peat moss or direct sowing were much better for increasing both numbers and percentages of germinated seeds. The least numbers of germinated seeds were recorded from seeds treated with sulfuric acid 20% for 10 minutes; only 7.3 seeds were able to germinate. It seems that *C. goluca* L. has non-deep dormancy which can be overcome by some physical treatments. Sulfuric acid may cause injury to such seeds. In this concern

Table (4): Effect of H_2SO_4 and peat moss on seed germination of some trees and shrubs.

Cassia goluca

First season 1981

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	18.0	72.0	18.7
Seeds Soaking	19.7	78.8	13.0
peat moss	19.0	76.0	7.7
10% for 5 min.	15.3	61.2	17.7
10% for 10 min.	15.0	60.0	16.3
20% for 5 min.	12.7	50.8	18.7
20% for 10 min.	11.7	46.8	16.7
L.S.D. at 0.05	N.S	--	6.57
0.01	N.S	--	N.S

Second season 1982

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	14.3	57.2	21.7
Seeds Soaking	17.0	68.0	10.7
peat moss	20.0	80.0	7.0
10% for 5 min.	16.7	66.8	17.0
10% for 10 min.	13.0	52.0	16.7
20% for 5 min.	9.3	37.2	19.3
20% for 10 min.	7.3	29.2	16.7
L.S.D. at 0.05	N.S	--	N.S
0.01	N.S	--	N.S

Nalini and Vimala (1968) on Cassia marginata Roxbl, found that the application of concentrated sulfuric acid for 10 min. damaged the embryo, and resulted in only 5% germination. Generally, peat moss may be the best aplicable treatment for better germination of C. goluca, L.

It is clear from data in Table (4) that peat moss was able to give high number of germinated seeds and the shortest period needed to attain maximum number of germinated seeds. The differense in this respect was statistically significanit in 1981. More oxygen in the meduim of peat moss compared to soil may be an important factor in increasing the activity of embryos. Esashi and Leopold (1968); Katoh and Esashi (1975) reported that germination of upper seeds of Cocklebur is stimulated by the addition oxygen. This was due to the ability of gases to influence the level of endogenous hormones and its effectiveness on releasing dormancy Brown and Van staden (1975). Data in Figure (2) emphasize that GA_3 application at 50, 100, 150 p.p.m. following seed soaking in water or sulfuric acid significantly decreased number of germinated seeds of Cassia goluca L. Control seeds (0.00 concentration of GA_3) gave the highest number of germinated seeds, when GA_3 was applied at 50 p.p.m. at room temperature (28°C) the decrease in germinated seeds was 88.2% in 1981 and 64.7% in 1982. As the concentration of GA_3

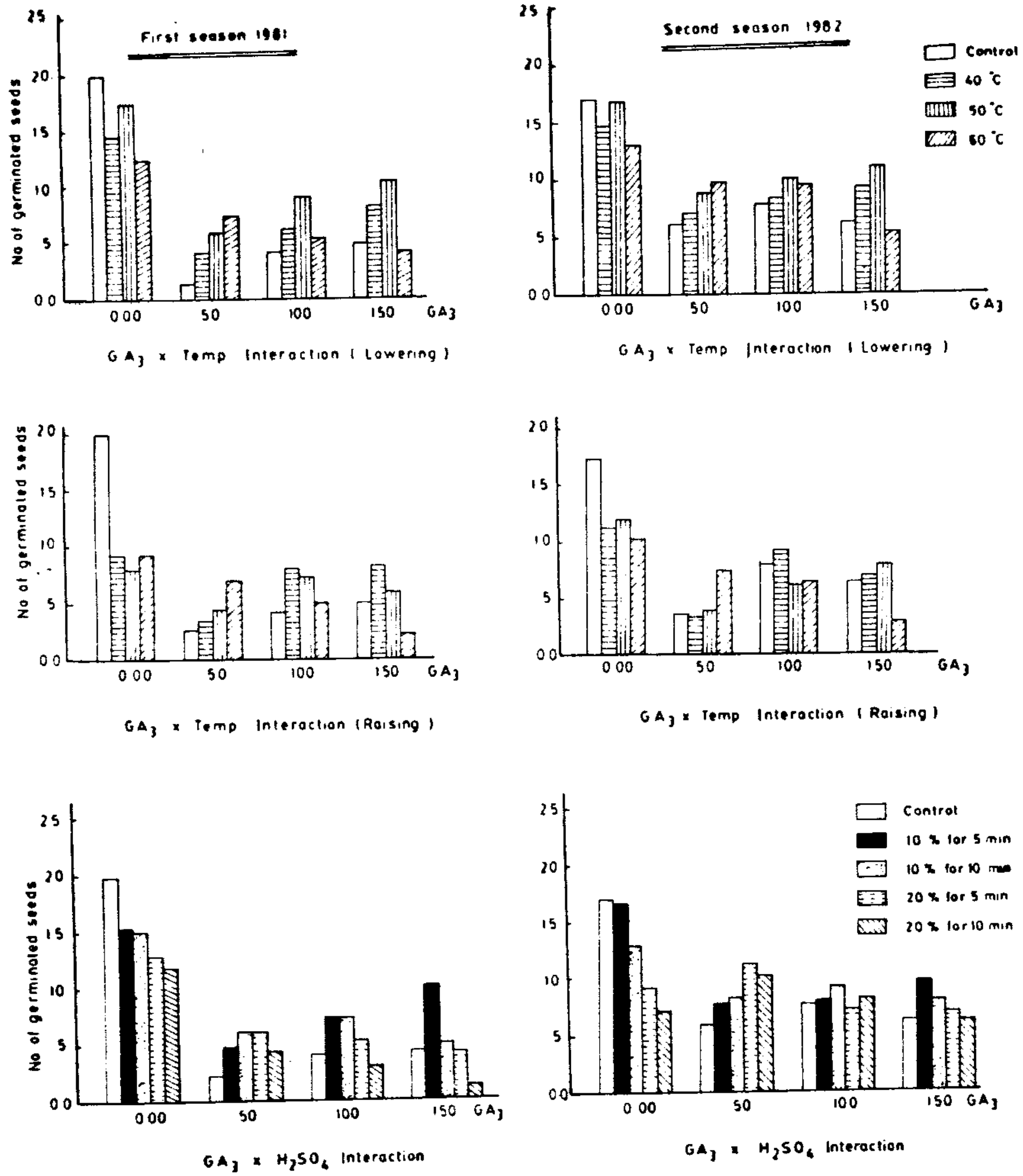

Fig.(2) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of <u>Cassia</u> <u>goluca</u>

increased from 50 to 100 or 150 p.p.m. the numbers of germinated seeds at room temperature as 28°C, 40°C or 50°C increased but these numbers were still lower as compared to their controls. With the high temperature (60°C) the number of germinated seeds decreased with the increased concentration of GA_3. This was true in both seasons, Figure (2).

Hence, it is possible that the used concentrations of GA_3 were under the level needed to push germination. Other probability is that GA_3 applications caused some unbalanced ratio of hormones within the seeds resulting in retardation or inhibition of germination. But as the concentration increased from 50 to 150 p.p.m. there was an influence to GA_3 on increasing germination, although the increases did not reach that of controls. GA_3 was found to have great influence on increasing seed germination as reported by Lang (1965), Stokes (1965). Indeed, GA_3 will stimulate germination in seeds where dormancy or quiscence is imposed by a wide variety of mechanisms for example, incomplete embryo development, mechanically resistant seed coats, Amen (1968) to postulated that GA_3 play an universal role in seed germination. On the other side seeds of various genera or species have not the same response to exogenious factors which influence germination, Campbell and Popenoe (1968), found that the treatment with GA_3 solutions of 3.5, 35, 350, 3500 and 35000 p.p.m. concentrations caused dormant seeds of *Annona diversifolia* to germinate readily.

I.3. Cassia modesta:

I.3.a. Cold and Hot water Treatments (H.W.T.s):

In both seasons of 1981 and 1982 Table (5) shows that number and percentages of germinated seeds of *C. modesta* were comparably lower than *C. didymobotrya* and *C. goluca*. (Tables 1 & 3). The highest percentage of germination resulted from soaking seeds in water then raising its temperature to 60°C. This treatment gave 33% and 70% germinated seeds in 1981 and 1982 respectively, compared to 20% and 47% for control in the two seasons.

Raising temperature of imbibed seed might have some influence on softening seed coats and permiting more absorption of water. Also, seeds might have been stimulated through the effects of the high temperature on enzymes activities.

Seed soaking in water heated to 40, 50, 60°C then cooled to room temperature did not improve the seed germination of *C. modesta*.

In this case soaked seeds received lower quantity of heat as compared with H.W.T's by raising temperature. The results are in agreement with those reported by Primushko (1963) who found a promising effect on germination

Table (5): Effect of H.W.T.s on seed germination of some Trees and shrubs.

Cassia modesta

First season 1981

Treatment	Means No.of * germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	40	50	60	40	50	60	40	50	60
Cold water at 28°C	2.0	2.0	2.0	20.0	20.0	20.0	18.7	18.7	18.7
H.W.T.R*	1.0	2.7	3.3	10.0	27.0	33.0	27.7	20.0	18.3
H.W.T.L*	1.3	1.7	2.7	13.0	17.0	27.0	30.3	26.3	25.0
L.S.D. at 0.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
Second season 1982									
Cold water at 28°C	4.7	4.7	4.7	47.0	47.0	47.0	19.7	19.7	19.7
H.W.T.R.*	4.7	6.3	7.0	47.0	63.0	70.0	18.3	19.7	17.3
H.W.T.L.*	4.3	5.0	6.7	43.0	50.0	67.0	26.7	21.7	24.7
L.S.D. at 0.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S

* Means of 10 seeds.

R. = Raising

L. = Lowering temperatures

was produced by heating the seeds of Honey Locust and White acacia in water at a temperature of 90°C. The permeability of hilum increased and created a favorable condition for seed germination. On this ground, it may be concluded that soaking seeds of *C. modesta* in water followed by heating to reach 60°C may be advised for increaseing the percentage of germination.

L.3.b. Effect of peat moss and sulfuric acid treatments:

The results of germination of *Cassia modesta* in Table (6) indicate that incubating seeds in wet peat moss produced the highest number and percentages of germination. This was the same trend as that previously investigated with *C. didymobotrya* and *C. goluca*. The highest number of germinated seeds valued 7.0 (70%) and 6.7 (67%) for 1981 and 1982, respectively. These values were statistically significant when compared with any other treatment.

Peat moss treatment gave the least number of days required to reach the maximum percentage of germination as 6.7 days in 1981 and 9.7 days 1982 compared with 30.7 and 29.3 days with direct sowing in the same order. Thus peat moss application seemed to be the best treatment, Table (6): Effect of H_2SO_4 and peat moss on seed germination of some trees and shurbs.

Cassia modesta

First season 1981

Treatment	Mean No.of* germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	3.3	33.0	30.7
Seeds Soaking	2.0	20.0	18.7
peat moss	7.0	70.0	6.7
10% for 5 min.	1.7	17.0	32.3
10% for 10 min.	1.3	13.0	28.0
20% for 5 min.	2.0	20.0	31.0
20% for 10 min.	2.0	20.0	28.0
L.S.D. at 0.05	2.70	--	14.30
0.01	3.70	--	N.S

Second season 1982

Treatment	Mean No.of* germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	5.7	57.0	29.3
Seeds Soaking	4.7	47.0	19.7
peat moss	6.7	67.0	9.7
10% for 5 min.	4.0	40.0	29.0
10% for 10 min.	3.0	30.0	26.7
20% for 5 min.	5.7	57.0	21.7
20% for 10 min.	5.3	53.0	24.3
L.S.D. 0.05	N.S	--	11.49
0.01	N.S	--	N.S

* Means of 10 seeds.

this may be conttributed to an adequate supply of both moisture for imbibition and well gaseous exchange at early stages of germination. The results agree with those reported by Brown (1940) who emphasized the impo-rtance of gaseous exhcnages and interaction of gaseous and nongaseous hormones in regulation of coat imposed dormancy of seeds.

Sulfuric acid treatments retarted seed germina-tion as compared with control or direct sowing.

Generally data in Figure (3) emphasize that GA_3 at 50, 100 and 150 p.p.m. had same stimulating effect on seed germination especially with H.W.T.L. followed by GA_3 at 150 ppm. The later treatment gave 73% germination compared to 46.7% for control.

Some investigators as Lang (1965); Stokes (1965) reported that GA_3 will stimulate germination in seeds where dormancy or quiscence is imposed by a wide variety of mechancally resistant seed coats or presence of germi-nation inhibitors and factors relating to the physiologi-cal competence of the embryo axis. Campbell and Popenoe (1968) found that the treatment with GA_3 solutions of 350 p.p.m. concentration gave the greatest increase in germination without causing abnormal development. Similar

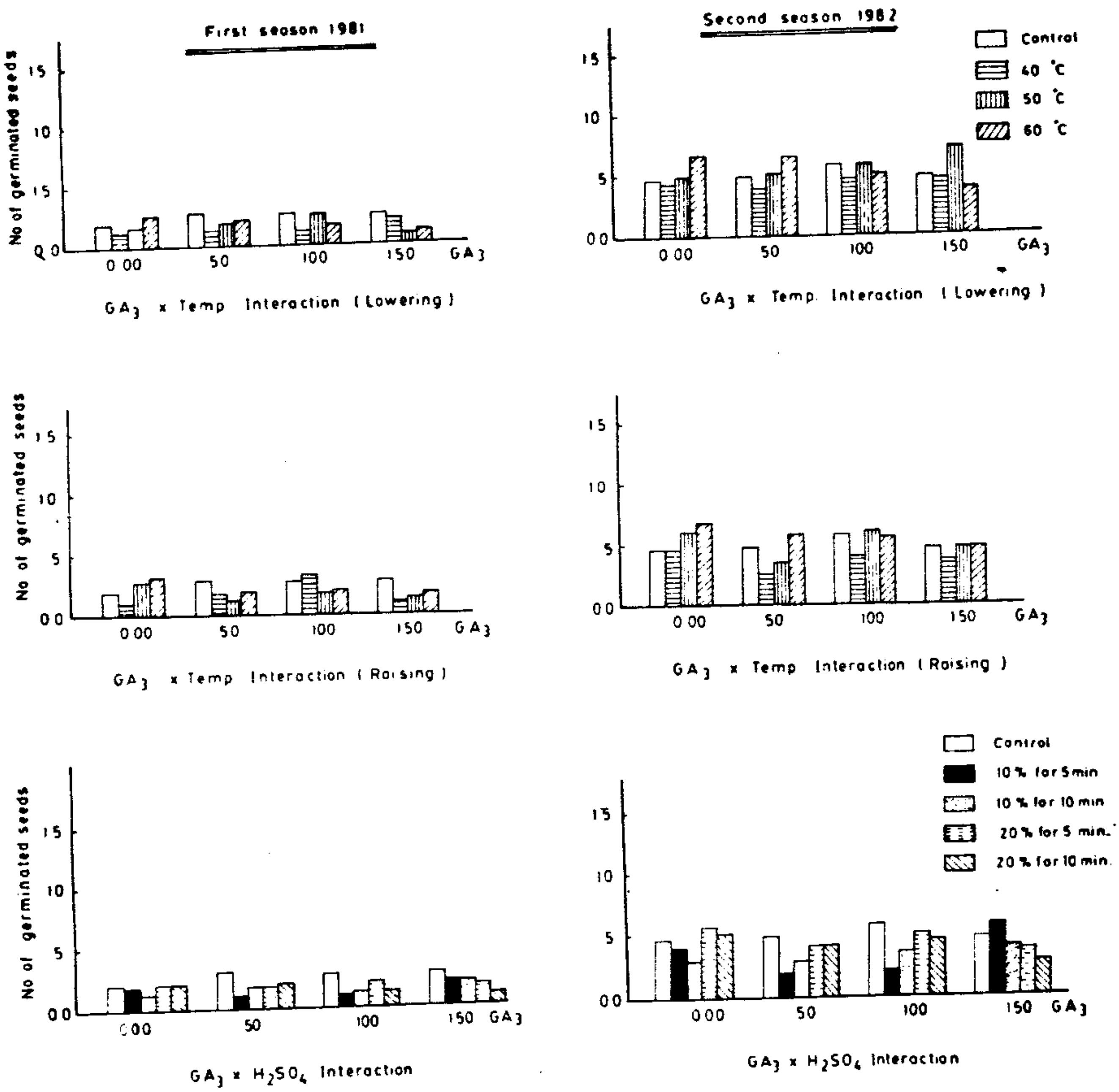

Fig.(3) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of Cassia modesta results are reported by Nagad and Sakai (1979) on seeds of Alexandra palm which were presoaked for 24 or 72 hours and treated with 100 or 1000 p.p.m. GA_3. When GA_3 application followed sulfuric acid treatments it is obvious from data in Figure (3) that it also stimulated seed germination of C. modesta, the best treatment in concern was GA_3 at 150 p.p.m. on seeds treated with 10% H_2SO_4 for 5 minutes.

It this respect, H_2SO_4 may had its effect on seed coat, while GA_3 may influence the endogenous balance of hormones or enzymes.

Jones (1972) showed that catalase, malate synthetase and isocitrotelyase activities were dependent on the presence of the embryo axis or GA_3. Koehler and Varner (1973) found that the multiplicity of the effects of GA in the regulation of enzyme synthesis and secretion in cereal aleurone cells indicates that this hormone has the potenial to regulate germination in numerous ways.

Chemical analysis:

II. Effect of H.W.T.s and GA_3 on the indoles and phenols content of seeds and seedlengs of Cassia didymobotrya:

II.1.a. Indoles:

Data in Table (7) showed a very low concentration of indoles in dry seeds of Cassia didymobotrya as 4.3 mg/100 gms (D.W.t.) compared with seedlings of direct sowing which gave 11.0 mg/100 gms (D.W.t.). The increase in this respect valued 155.8%. Seeds imbibed at room temperature for 24 hours (28°C) gave the same value as 11.0 in their seedlings. When seeds were treated with H.W.T.R., seedlings showed a content of 8.0 mg/100 gms of IAA equaling 318.6% over dry seeds content. The same trend was true with H.W.T.R. at 50°C which showed slight increase in indole content. The content was depleted again with 60°C H.W.T.R. resulting in a value 10.5 which is nearly as that of direct sowing 11.0. With H.W.T.L. (50°C) increase in content is demonstrated in Table (7) as (29.0 mg/100 gm (D.W.t.). This value was higher by 574.4% over dry seed content.

The previous results indicated that the highest percentages were coincided with seeds soaked for 24 hours in water at room temperature followed by seeds treated

Table (7): Effect of H.W.T.s and GA_3 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of *Cassia didymobotrya* (season 1982).

Compounds	Treatments	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m. S. 28°C	S. 40°C	S. 50°C	S. 60°C	S. means	50 p.p.m. 28°C	40°C	50°C	60°C	100 p.p.m. 28°C	40°C	50°C	60°C	150 p.p.m. 28°C	40°C	50°C	60°C
Indoles	H.W.T.R.	4.3	11.0	11.0	18.0	19.0	10.5	14.6	11.0	16.0	13.3	12.5	12.0	11.3	9.7	10.0	7.0	9.0	7.0	5.3
Indoles	H.W.T.L.	4.3	11.0	11.0	14.0	29.0	10.0	16.0	11.0	24.0	23.0	15.0	12.0	24.0	20.0	14.0	7.0	14.0	16.0	20.0
Phenols	H.W.T.R.	27.0	86.0	24.0	47.0	61.0	68.0	50.0	63.0	32.0	74.0	50.0	47.0	27.0	40.0	40.0	77.0	39.0	41.0	69.0
Phenols	H.W.T.L.	27.0	86.0	24.0	49.0	66.0	76.0	53.8	63.0	76.0	44.0	99.0	47.0	42.0	52.0	97.0	77.0	33.0	53.0	99.0

Table (8): Effect of GA_3 X H_2SO_4 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of *Cassia didymobotrya* (season 1982).

Compounds	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m. 0.00	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	mean	50 p.p.m. 0.00	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	100 p.p.m. 0.00	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	150 p.p.m. 0.00	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.
Indoles	4.3	11.0	11.0	8.3	9.0	8.0	8.0	8.9	11.0	9.5	11.5	7.5	9.0	12.0	13.0	12.0	4.0	8.3	7.0	7.5	7.0	6.5	8.5
Phenols	27.0	86.0	24.0	54.0	82.0	68.0	76.0	60.8	63.0	45.0	28.0	37.0	36.0	47.0	24.0	51.0	44.0	59.0	77.0	30.0	45.0	57.0	51.0

with H.W.T.L. at 50°C. Connecting the results of germination with the IAA content it seems that increases of IAA in seedling had no particular relationship with the germination at early stages. Many investigations as Poljakoff-Mayber *et al* (1957) reported that auxins perform many roles in the seedlings, they probably are not invovolved in dormancy control mechanisms. Nikolaeva (1970), reported that large quantities of auxin have been reported in several species of deeply-dormant seeds and *Acer tataricum* auxin levels decline during startification.

When GA_3 at 50 p.p.m. was applied on seeds imbibed at room temperature or treated with hot water, IAA content was unchanged with control seed (28°C) and gave 11.0 mg/100 gms (D.W.T.). The percentage of germinated seeds with this treatment was lower by 600% as compered to non GA_3 treated seeds. (P.N. Figure 1). H.W.T.S. followed with GA_3 (50 p.p.m.) gave higher content of IAA when compared with room temperature treatment. Comparably seeds at the same conditions of H.W.T.s. and non treated with GA_3 were higher in their content of IAA except with 60°C which also gave lower percentage of germination.

Raising the concentration of GA_3 to 100 or 150 p.p.m. considerably decreased the content of IAA particularly with H.W.T.R. as compared to untreated seeds.

With H.W.T.L. the trend was different, the content of IAA increased to a maximum with 60°C treated seeds and GA_3 at 150 p.p.m. The value was double of that in 60°C and non treated with GA_3. Despite of the changing in IAA content-resulting from GA_3 treatments the percentages of germination did not increase due to the hormone application. It can be concluded from the results that IAA content in early stages of germination had a vague action on germination and GA_3 did not actually benifit the germination of the seed of the representative shrub (C. didymobotrya).

II.1.b. Phenols:

Data of phenols in Table (7) indicate that seedling from direct sowing contained more phenols as compared with dry seeds. Seedlings germinated from seeds imbibed for 24 h. in water at room temperature (28°C) gave the least content of phenols as 24 mg/100 gm (D.W.T.). The percentage of germination in this case was 84% (Table 1) which was the highest one as compared with any treatment.

These results confirm that phenols play an inhibiting action on seed germination. Soaking seeds was effective on leaching some of phenols to reach a balance between the other endogenous factors that facilitate seed germination. (Mayer and Poljakoff-Mayber, 1975), reported that coumarin and its derivatives are widely distributed in nature and the inhibitor is rapidly metabolized in germinating seed.

Comparing the other contents of seedlings subjected to any of the experimental treatments it is obvious from data in the same Table (7) that content of phenoles did not give a particular trend and it was always higher than in the prementioned case. Also, GA_3 treatment in most cases did not reduce the content of phenols especially with the H.W.T.s L at 60°C which gave the highest content of phenols with a retardation effect on the growth of seedlings.

II. Effect of H_2SO_4 and GA_3 on the indoles and phenols content of seeds and seedling of *Cassia didymobotrya*:

II.1.c. Indoles:

Table (8) seedling germinated from seeds treated with 10%H_2SO_4 far 5 min. gave IAA content as 8.3 mg/100 gm (D.W.t.) compared with IAA 4.3 for dry seeds. The increase in this respect was 93.2% over dry seeds but it was lower than imbibition at room temperature by about 25%.

The imbibition at room temperature gave 84% (Table 1) germinated seeds compared to 80% (Figure 1) with ($10\%H_2SO_4$ for 5 minutes) and these percentages were the highest as compared with any other treatment of H_2SO_4

All H_2SO_4 treatments decreased the IAA content in seedlings.

When GA_3 treatments followed H_2SO_4 results of IAA content indicated noticable decrease with the 150 p.p.m. GA_3 treatment. It was obvious also that H_2SO_4 treatments generally had a depleting effects on IAA content in seedlings after germination.

II.1.d. <u>Phenols:</u>

As for phenols Table (8) reveals that seed imbibition in water was the best treatment which decreased the phenols contents in seedlings germinated from non GA_3 treated seeds. This was followed by 10% H_2SO_4 which gave low content of phenols. Both treatments were highty effective on increasing germination (Figure 1). It means that high germination was always related with lower content of phenols.

When GA_3 at any concentration (5o, 100 and 150 p.p.m.) followed acid treatments, in these cases the phenols contents decreased. However, such decrease did not reflect on increasing seed germination because the phenols were still higher than that in seeds imbibed in water.

In conclusion chemical analysis gave some particular trend showing that exogenous treatments of seeds by H.W.T's, H_2SO_4 and GA_3 had an influence on the content of seedlings from indoles and phenols . It seems that seeds may act in some different pathways due to the material applied.

Seeds of Cassia didymobotrya, Cassia goluca, Cassia modesta do not need any treatment rather than soaking in cold water or incubation in peat moss for (8.3-11.0) days in order to increase their gemination capacity. This is due to leaching of some inhibitors from seeds and the good aeration in the second one (peat moss treatment).

III. <u>Effect of some physical and chemical treatments on germination of seeds: (Trees)</u>:

III.1. <u>Cassia</u> <u>fistula</u>, L.:

III.1.a. <u>Cold and hot water treatments (H.W.T's)</u>:

As shown in Table (9) when seeds of <u>Caccia fistula</u> were soaked in hot water at 95°C and left till cooling gown to room temperature (28°C) they gave 12.7 germinated seeds, which amounted 50.8%. The difference in this concern were statistically significant.

The second rank which gave 10.3 germinated seeds as (41.2%) was from seeds soaked in hot water at 60°C then cooled to room temperature. Also, the increase was significant at 0.05 level. Soaking seeds in water followed by heating 50°C gave higher number of germinated seeds as compared to control with no significant difference in between. The percentage of germination in this concern was 33.2%.

As for the number of days required to reach the maximum germination, data in the same Table (9) show that the least number of days was 12 days. This was recorded from seeds treated with H.W.T. (R) to 95°C.

Concerning the number of days required to reach

Table (9): Effect of H.W.T.s on seed germination of some trees and shrubs.

Cassia fistula

First season 1981

Treatment	Means No.of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	50	60	95	50	60	95	50	60	95
Cold water at 28°C	3.3	3.3	3.3	13.2	13.2	13.2	30.7	30.7	30.7
H.W.T.R*	8.3	7.0	1.0	33.2	28.0	4.0	21.3	16.7	12.0
H.W.T.L*	6.7	10.3	12.7	26.8	41.2	50.8	28.3	23.7	14.3
L.S.D. at 0.05	N.S	3.28	1.84	--	--	--	N.S	N.S	14.50
0.01	N.S	N.S	3.05	--	--	--	N.S	N.S	N.S
Second season 1982									
Cold water at 28°C	3.7	3.7	3.7	14.8	14.8	14.8	28.7	28.7	28.7
H.W.T.R.*	5.3	5.3	1.0	21.2	21.2	4.0	23.0	18.7	11.7
H.W.T.L.*	4.7	6.0	11.7	18.8	24.0	46.8	24.3	22.0	16.3
L.S.D. at 0.05	N.S	N.S	3.15	--	--	--	N.S	N.S	11.25
0.01	N.S	N.S	5.22	--	--	--	N.S	N.S	N.S

R. = Raising.

L. = Lowering temperatures.

the maximum germination coincided with the highest number of germinated seeds, soaking seeds in hot water at 95°C followed by cooling was the best treatment. In this respect the maximum germination was attained after 14.3 days with highly significant difference as compared to control.

Similar results were obtained in the next season (1982).

The results agree with those reported by Lohmeyer (1951), who mentioned that the dormancy of Acacia sp. seed is due to a hard outer covering impermeable to water; Velkov (1970), revealed that which were treating seeds of Robinia pseudoacacia Forst. treated with bioled water for 5 sec. gave the highest germination.

III.1.b. Effect of peat moss and sulfuric acid treatment:

The average number and percentages of germinated seeds in Table (10) show that the best treatment which gave the highest number as 19.3 and 24.3 for 1981 and 1982 and percentages of germinating seeds as 77.2 and 97.2, was H_2SO_4 application for 30 minutes. The increases over any other treatments were highly significant except the soaking in the acid for 45 minutes.

Data of both seasons showed similar trend. Application of sulfuric acid for 30 minutes on seeds gave the

Table (10): Effect of H_2SO_4 and peat moss on seed germination of some trees and shrubs.

Cassia fistula

First season 1981

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	2.3	9.2	33.3
Seeds Soaking	3.3	13.2	30.7
peat moss	7.0	28.0	26.0
30 - min.	19.3	77.2	16.7
45 - min.	14.0	56.0	16.7
60 - min.	4.0	16.0	9.7
75 - min.	3.0	12.0	9.7
L.S.D. at 0.05	3.83	--	12.22
0.01	5.38	--	17.15
Second season 1982			
Control (direct sowing)	3.0	12.0	13.3
Seeds Soaking	3.7	14.8	28.7
peat moss	4.3	17.2	22.7
30 - min.	24.3	97.2	14.0
45 - min.	23.3	93.2	14.0
60 - min.	6.3	25.2	11.7
75 - min.	2.7	10.8	9.3
L.S.D. at 0.05	3.62	--	9.77
0.01	5.09	--	13.72

highest germination capacity when compared with H.W.T's.

Peat moss treatment although produced higher number and percentages of germinated seeds of Caccia fistula as compared to control it was much lower than sulfuric acid treatment for 30 or 45 minutes.

The role of sulfuric acid in this concern was revealed by some investigations of Nalawadi *et al.* (1975) on *Cassia fistula* L. The obtained results are in the same line of using concentrated sulfuric acid for 5 to 20 minutes either alone or followed by soaking in water for 24 h. They concluded that soaking in acid for 20 minutes resulted in 84% germination and additional soaking in water for 24 h. did not enhance germination. Similar results on other genera were mentioned by Misra (1963) and Shafik (1970 - 1971).

Concerning the role of germenation it is obivously clear from the data in the same table that this treatment gave earlier germination than control or direct seed sowing.

The period needed to fulfil the maximum germination was 50% from days needed for control. The cause of earliness might be due to fastening the rupture of seed coat.

As shown in Figure (4) in both experimental seasons 1981 and 1982, GA_3 following H.W.T. (L) 95°C increased germination especially with 150 p.p.m. In this later case the number of germinated seeds was more than control.

The reason of increasing germination by the successive treatments of hot water then GA_3 might be due to the effect of hot water, in this process the permeability of hilum increased and created a favorable condition for seed germination(Primusko 1963). While GA_3 would encourage germination in seeds as reported by Lang (1965), Stokes (1965), Amen (1968), and Koehler and Varner (1973).

Concerning the effects of GA_3 on the germination of seeds previously treated with sulfuric acid, it is clear from data presented in Figure (4) that 30 minutes seed application in sulfuric acid either followed with GA_3 or not, gave the best results for germination.

Accordingly and from economical and practical point of view soaking seeds in sulfuric acid for 30 minutes would be advised for better germination of <u>Cassia fistula</u>. There is no need for GA_3 applications afterwards.

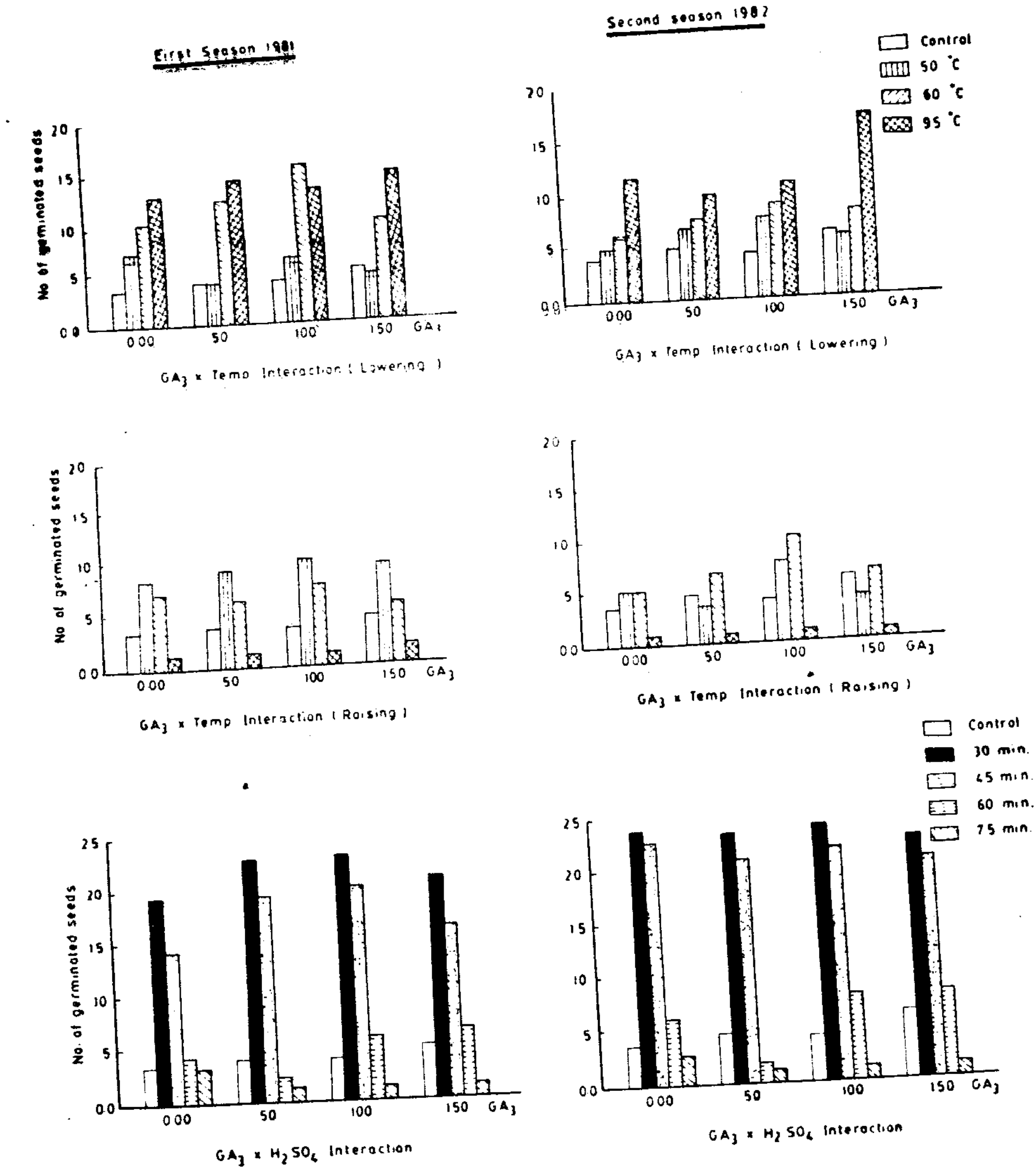

Fig.(4) Effect of GA_3 and soaking in water or sulfuric acid treatment on seed germination of *Cassia fistula*

Chemical analysis:

III.1.c. Effect of H.W.T.s and GA_3 on the indoles and phenols content of seeds and seedlings:

Indoles:

The most important results in Table (11) concerning indoles content in both seeds and seedlings of Cassia fistula as affected by hot water or/and GA_3 reveal that the least content of IAA was found in the dry seeds.

When seeds were sown in soil or soaked in water at (28°C) or subjected to heated water, seedlings resulting from such different treatments showed higher content of indoles, except with water heated to 95°C (L) the content in this case equaled that of the direct seed sowing.

Also, treating the later seeds with GA_3 at 50 p.p.m. did not increase indoles content. The mentioned treatment was a good one which increasied the rate and percentage of germination as 46.8%.

Generally, the content of Indoles in seedlings varied between 7.3 to 20.8 mg/100 gm (D.W.T). The later value was recorded from seedlings previously treated with H.W.T. (L) 95°C followed by GA_3 at 100 p.p.m. the percentage of germination for this treatment was 44%, Figure (4). Such fluctuations in indoles contents when related to the

Table (11): Effect of H.W.T.s and GA_3 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of <u>Cassia fistula</u> (season 1982).

Compounds	Treatments	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.					50 p.p.m.				100 p.p.m.				150 p.p.m.			
				S. 28°C	50°C	60°C	95°C	means	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C
Indoles	H.W.T.R.	5.7	7.3	11.9	13.1	12.4	*	12.5	10.3	8.2	12.0	*	17.7	8.4	15.2	*	12.0	12.8	16.0	*
Indoles	H.W.T.L.	5.7	7.3	11.9	14.2	15.8	7.5	12.4	10.3	13.1	15.4	7.3	17.7	13.5	18.4	20.8	12.0	16.9	19.8	14.3
Phenols	H.W.T.R.	25.4	82.5	97.1	75.2	82.7	*	85.0	91.8	62.7	76.4	*	88.5	51.0	79.7	*	70.0	56.0	70.0	*
Phenols	H.W.T.L.	25.4	82.5	97.1	86.1	77.5	70.3	82.8	91.8	99.0	89.8	70.0	88.5	70.0	77.5	66.0	70.0	65.0	75.3	67.9

* Temp 95°C Raising did not preduce seedling.

Table (12): Effect of GA_3 X H_2SO_4 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of <u>Cassia fistula</u> (season 1982).

Compounds	Dry seeds	Direct sowing	0.00	GA_3 - 0.00 p.p.m.					50 p.p.m.					100 p.p.m.					150 p.p.m.			
				30 min	45 min	60 min	75 min	mean	0.00	30 min	45 min	60 min	75 min	0.00	30 min	45 min	60 min	75 min	0.00	30 min	45 min	60 min	75 min
Indoles	5.7	7.3	11.9	14.3	18.3	11.0	9.7	13.1	10.3	16.1	18.5	8.1	8.3	17.7	20.3	16.9	6.7	7.8	12.0	17.6	15.0	13.0	7.9
Phenols	25.4	82.5	97.1	63.6	66.0	85.0	86.4	79.7	91.8	71.0	67.0	77.8	60.3	88.5	41.3	49.4	68.8	78.8	70.0	52.6	69.0	78.8	67.7

percentages of germination, it is obvious that indoles content did not have a particular trend which shows relationship between its content in seedlings and the maximum germination of <u>Cassia fistula</u> seeds.

<u>Phenols:</u>

As for phenolic compounds content in dry seeds and seedling Table (11), it obvious from the presented data that the least content of phenolic compounds was in dry seeds indicating 25.4 mg/100 gm (D.W.T.). While in seedling resulting from direct sowing or previously imbibed seeds in cold water the content was nearly 3 to 4 times that in the dry seeds. It is worthy to notice that GA_3 when applied on seeds previously imbibed in cold water there was always decrease in phenolic content in seedling as the concentration of GA_3 increased. Such relationship proved that GA_3 promotion might act through its inhibiting of the phenolic compounds action in seed germination. This trend was almost the same with H.W.T.s X GA_3 as shwon in Table (11).

The most promising effect of H.W.T.s X GA_3 on seed germination was reported by Primushko (1963) who found a promising effect on germination by heating the seeds of Honey locust and White acacia in water at a temperature of 90°C and a solution of NaCl. In this process the permeability of hilum increased and created a favarable condition for seed germination. Simmonds and Simpson (1971) concluded that the P P P (pentose phosphate pathway) has a critical role in *Avena fatua* and that GA induces a shift in glucose metabolism resulting in the increased participation of the ppp pathway. They speculated that since some of the key enzymes of this pathway are present in the dry dormant seeds, GA may regulate the activity of these enzymes allosterically.

Generally the best treatment which gave the least content of phenolic compounds was H.W.T.s 95°C (L). This treatment gave 46.8% of germination when GA_3 was applied as 150 p.p.m. and raised the percentage of germination to 68%. In conclusion treating seeds of *C. fistula* with H.W.T.s 95°C (L) followed with GA_3 150 p.p.m. may be advised for increased germination.

III.1.d. Effect of H_2SO_4 and GA_3 on the indoles and phenols content of seeds and seedling.

Indoles:

Comparing content of seedling produced from seeds previously treated with H_2SO_4, it is noticed in Table (12) that inoles content was 14.3 mg/100 gm (D.W.T) in the seedlings resulting from the 30 minutes soaking of seeds in concentrated sulfuric acid. This value was higher than the untreated seeds as well as those treated for 60 or 75 minutes. All later treatments were lower in their germination capacity. Also, when the similar seeds were soaked for 30 or 45 min in H_2SO_4 and treated with GA_3, higher content of auxins was determined indicating the same relationship between facilitating seed germination and the increased auxin content which is logically needed for advanced biochimical processes which proceed after germination.

Phenols:

On the contrary, in most cases the lowest content of phenolic compounds can explain the inhibition of phenols on seeds germination.

The inhibition of phenoles on seed germination was reported by Nutile(1945) and Van Sumere (1960) with several other phenolic compounds gave similar results. The inhibitory effect of these substances had been attributed in part to their restricting influence on the supply of oxgyen into the embryo or generally to cellular oxidation taken into account. These compounds are present mostly in seed coats and they can be leached from seeds during imbibition enabling immediate germination.

Mukheriee *et al* (1966) found that the inhibitors are more prominent in the embryo of *Cassia fistula* seed than in the endosperm, particularly with adged fruits.

III.2. <u>Acacia farnesiana</u>, Willd:

III.2.a. <u>Cold and hot water treatment(H.W.T's)</u>:

Data in Table (13) indicate that the proper treament for increasing the number and percentage of germinating seeds of <u>Acacia farnesiana</u> was the application of H.W.T., L. 95°C. Such treatment gave equal maximum germination as 17.7 seeds in each season compared to only one germinated seed with control. The increase in this respect was highly significant as compared to any other treatment.

The same treatment showed the shortest period for maximum germination as 8.7 and 13.3 days in the first and the second season, respectively. It means that <u>A. farnesiana</u> seeds are similar to <u>C. fistula</u> in their response.

It was interesting to notice that seed soaked in cold water then raising the temperature to 95°C did not injure the viability of seeds, which was observed in <u>Cassia fistula</u>.

Other H.W.T.s have no great influence on increasing germination; the action of hot water could be helpful in increasing the softening of seed coats, consequently permiting water absorption needed for embryo activation.

Table (13): Effect of H.W.T.s on seed germination of some trees and shrubs.

<u>Acacia farnesiana</u>

First season 1981.

Treatment	Means No.of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	50	60	95	50	60	95	50	60	95
Cold water at 28°C	1.0	1.0	1.0	4.0	4.0	4.0	36.7	36.7	36.7
H.W.T.R*	1.0	1.0	5.7	4.0	4.0	22.8	29.7	27.3	13.3
H.W.T.L*	1.0	1.0	17.7	4.0	4.0	70.8	32.0	22.7	8.7
L.S.D. at 0.05	N.S	N.S	5.13	--	--	--	N.S	N.S	10.56
0.01	N.S	N.S	8.49	--	--	--	N.S	N.S	17.48
Second season 1982									
Cold water at 28°C	1.0	1.0	1.0	4.0	4.0	4.0	34.0	34.0	34.0
H.W.T.R.*	2.0	1.3	3.0	8.0	5.2	12.0	31.7	26.7	15.7
H.W.T.L.*	1.0	2.0	17.7	4.0	8.0	70.8	34.0	24.3	13.3
L.S.D. at 0.05	N.S	N.S	3.01	--	--	--	N.S	N.S	15.42
0.01	N.S	N.S	4.99	--	--	--	N.S	N.S	N.S

R. = Raising.

L. = Lowering temperatures.

Simillar conclusions were reported by Cavanagh, and Tran, (1980) on *Acacia longifolia*, who immersed its seeds in boiling water and found that the highest final percentage (over 80%) was obtained with boiling water treatment.

III.2.b. Effect of peat moss and sulfuric acid treatment:

In Table (14) results demonstrate that soaking seeds of *Acacia farnesiana* in sulfuric acid for 75 minutes gave the highest number of germinated seeds as 22.3. The next treatment was soaking in H_2SO_4 for 60 minutes. Both treatments had statistical significance over direct sowing, soaking and peat moss treatment. Soaking seeds for 30 or 45 minutes also gave increases in seed germination but were still lower than the 60 or 75 minutes soaking in H_2SO_4. The percentages of germination showed similar results to the numbers of germinated seeds. The results of both season were of similar trend.

Concerning the period needed to attain the maximum germination it is clear from data in Table (14) that soaking seeds in H_2SO_4 for 45 minutes resulted in the shortest period. However, the maximum germination was lower than for seeds soaked in H_2SO_4 for 60 and 75 minutes. The differences in this respect were insignificant among H_2SO_4 treatments, but were highly significant as

Table (14): Effect of H_2SO_4 and peat moss on seed germination of some trees and shrubs.

<u>Acacia farnesiana</u>

First season 1981

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	1.0	4.0	39.0
Seeds Soaking	1.0	4.0	36.7
peat moss	1.3	5.2	39.0
30 - min.	19.3	77.2	13.3
45 - min.	19.3	77.2	11.0
60 - min.	20.3	81.2	13.3
75 - min.	22.3	89.2	15.7
L.S.D. at 0.05	3.40	--	10.57
0.01	4.77	--	14.84

Second season 1982

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	1.0	4.0	36.3
Seeds Soaking	1.0	4.0	34.0
peat moss	1.0	4.0	34.0
30 - min.	14.7	58.8	13.3
45 - min.	18.3	73.2	9.3
60 - min.	19.7	78.8	15.7
75 - min.	20.7	82.8	15.0
L.S.D. at 0.05	3.98	—	10.27
0.01	5.95	—	14.68

compared with the other treatments. The results of the second were similar to those of the first one.

The most important result which can be advised for best germination is soaking seeds of Acacia farnesiana for 75 minutes in H_2SO_4.

The effect of H_2SO_4 on promoting the germination of hard coat seeds was mentioned by many investigators as (Misra, 1963), on the seeds Ipomoea crassicaulis, Mohnot and Chatterjc (1965) on Parkinsonia aculeata seeds.

Data in Figure (5) indicate that in 1981 there were no influences on increasing seed germination of Acacia farnesiana. due to GA_3 applications after H.W.T.s or after sulfuric acid treatments. No promotion effects are noticed on seed germination due to GA_3 treatments in the second season except in cases of GA_3 applications on seeds previously treated for different periods with H_2SO_4.

The maximum germination was noticed with (H_2SO_4 (30 min) X GA_3 (150 ppm). The interaction was significent in this concern.

The explantion for the increased rate of germination may be due to the effect of H_2SO_4 on softening the

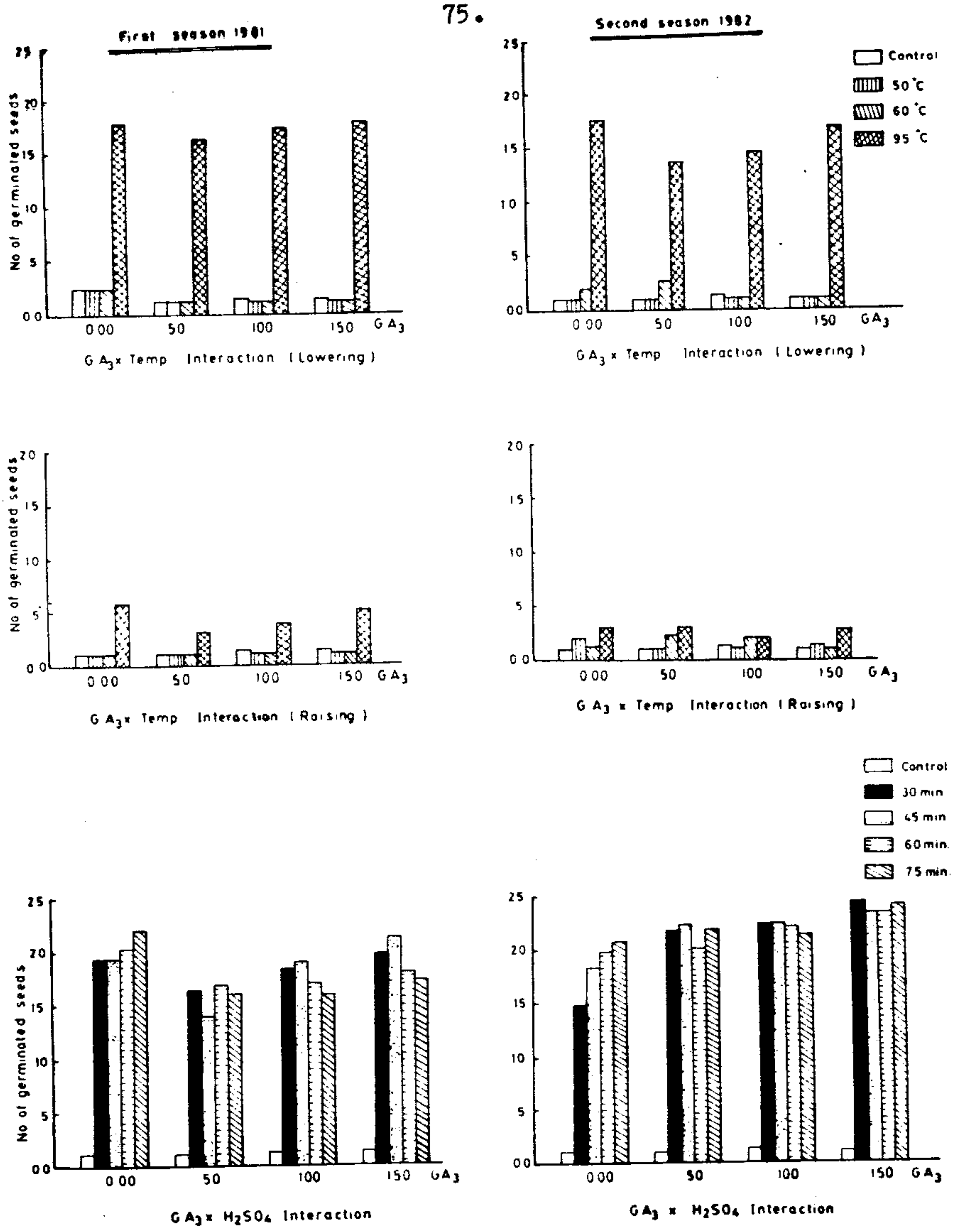

Fig.(5) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of <u>Acacia farnesiana</u>

seed coat and the GA_3 promotion of embryo activity.

Similar conclusions was noted by Misra (1963) indicated that soaking seeds of Ipomoea crassicaulis, Benth in concentrated H_2SO_4 destroyed the scleroid cells of the seed coat and created favorable conditions for water permeability. Simmonds and Simpson (1971) concluded that the ppp (pentose phosphate, pathway) has a critical role in Avena fatua and that GA induces a shift in glucose metabolism resulting in the increased participation of the pp pathway. They speculate that since some of the key enzymes of this pathway are present in the dry dormant seeds, GA may regulate the activity of these enzymes allosterically.

Chemical analysis:

III.2.c. Effect of H.W.T.s and GA_3 on the indoles and phenols content of seeds and seedlings:

Indoles:

Data obtained for indoles content as affected by H.W.T.s and GA_3 levels on seeds and seedlings of Acacia farnesiana during 1982 are represented in Table (15). It appeared that H.W.T's gave seedlings which contained more indoles than that estimated in dry seeds. H.W.T's as 50°C decreased the content in seedling as compared with direct sowing or imbibed seeds water at room temperature. While with H.W.T's at 60°C by raising decreased

Table (15): Effect of H.W.T.s and GA_3 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of Acacia farnesiana (season 1982).

Compounds	Treatment	Dry seeds	Direct sowing	GA_3-0.00 p.p.m.					50 p.p.m.				100 p.p.m.				150 p.p.m.			
				S. 28°C	50°C	60°C	95°C	mean	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C
Indoles	H.W.T.R.	5.0	28.1	28.8	17.9	19.6	35.9	25.6	32.0	21.6	32.5	22.3	29.2	21.9	29.4	33.9	34.1	26.7	30.6	35.9
Indoles	H.W.T.L.	5.0	28.1	28.8	24.8	32.3	32.5	29.6	32.0	27.1	29.4	20.9	29.2	32.9	28.1	23.4	34.1	39.4	44.2	45.9
Phenols	H.W.T.R.	30.6	350.5	351.5	174.8	159.7	299.2	246.3	260.5	220.2	133.5	277.2	261.1	194.7	121.0	238.5	248.4	167.3	119.2	209.6
Phenols	H.W.T.L.	30.6	350.6	351.5	117.6	113.2	107.1	172.4	260.5	261.9	214.2	156.4	261.1	192.2	158.2	68.0	248.4	201.5	126.9	66.7

Table (16): Effect of GA_3 X H_2SO_4 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of Acacia farnesiana (season 1982).

Compounds	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.						50 p.p.m.					100 p.p.m.					150 p.p.m.				
			0.00	30 min	45 min	60 min	75 min	mean	0.00	30 min	45 min	60 min	75 min	0.00	30 min	45 min	60 min	75 min	0.00	30 min	45 min	60 min	75 min
Indoles	5.0	28.1	28.8	37.9	33.3	39.7	28.2	33.6	32.0	30.7	29.4	30.2	24.5	92.2	35.6	34.7	30.6	32.5	43.1	36.7	37.7	24.3	25.9
Phenols	30.6	350.6	351.5	179.8	148.2	144.9	142.5	193.4	260.5	118.0	117.7	121.4	125.3	261.1	110.8	99.9	118.2	126.8	248.4	199.6	89.4	108.1	123.0

the content to 19.6 mg/100 gm (D.W.T.). With the same temperature by lowering, the content increased over the previous mentioned treatments. At temperature of 95°C contrary results were noted where by raising temperature of imbibed seeds to 95°C, seedlings contained higher value of indoles as 35.9 compard to 32.5 with imbibed seeds and lowering temperature from 95°C to room temperature. The later temperature was the best one which produced the highest values of seed germination.

Moreover, when GA_3 at different concentrations was applied on seeds previously treated with or without hot water, indoles content flactuated and showed different trend of results. The only exception was the GA_3 at 150 ppm when applied on seeds of H.W.T's L where indoles content increased in their seedling due to any increase from room temperature to 95°C. The content in the later case was the highest value of indoles as compared to any other treatment. This was coincided with the highest percentage of gemination. The high temperature had its action on seed coat and embryo activation, also GA_3 had its influence on embryo growth as and endogenous hormones as reported by Lohmeyer (1951), Primusko (1963) who found that the high temperature had its action on breaking the seed coat, hence the permeability of hilum increased and created a favorable condition for seed germination. Also Dziewanowska and Lewak, (1975), who implied that GA_3 contributes to the control of IAA level.

However, the content of indoles in seedling did not give any indication of importance for seed germination of Acacia farnesiana.

Phenols:

The different H.W.T's decreased phenols in seedling as compared with direct sowing or imbibing seeds in water at room temperature Table (15). The least value for H.W.T's as 107.1 mg/100 gm (D.W.T.) is noticed with H.W.T.s L (95°C). It is interesting to notice that dry seeds showed the lowest content of phenols but by seed treatments the value gave the peaks in seedlings of direct sowing or those previously imbibed in cold water.

Generally, H.W.T.s and GA_3 treatments gave lower values of phenols content in seedlings than cold water and direct sowing. The most promising effect of treatments on decreasing phenols and increasing seed germination was observed with GA_3 application at 150 ppm on seeds previously treated with H.W.T.L (95°C). The results agree with those reported by Mayer and Poljakoff-mayber, (1975) who found that coumarin and its dervatives are widely distributed in mature and the inhibitor is rapidly metabolized in germinating seed. Lang (1965), Stokes (1965)

Indeed, GA_3 stimulate germination in seeds where dormancy or quiscence is imposed by awide variety of mechanisms.

It seemed that <u>Acacia farnesiana</u> seeds can be treated with H.W.T. at 95°C and cooling to 28°C then treating seeds with GA_3 at 150 ppm before seed sowing.

III.2.d. <u>Effect of H_2SO_4 and GA_3 on the indoles and phenols content of seeds and seedlings</u>:

<u>Indoles</u>:

Concerning the effect of H_2SO_4 treatments followed with or without GA_3, data in Table (16) reveal that seedlings content for indoles increased after as both cold water imbibition and direct sowing.

H_2SO_4 treatments resulted in slight increases of indoles in seedlings as compared to non-treated seeds except with H_2SO_4 dipping for 75 minutes which gave nearly similar content as the direct sowing with great difference in concern of germination capacity. With direct sowing the percentagsof germination was 4% and with 75 minutes of acid treatment the percentage raised to 82.8%. This fact indicates that indoles content had a minor role in seed germination of <u>Acacia farnesiana</u>.

Data of GA_3 following acid treatments indicated no particular trend of indoles content due to GA_3 applications as shown in Table (16).

Phenols:

As for phenols content, it is obvious that H_2SO_4, GA_3 or their combinations had decreased phenols in seedlings especially with the treatments which produced relatively higher percentages of germination i.e. dipping seeds for 30 minutes in H_2SO_4 followed with (150 ppm GA_3) application which gave 97.2%. (seedlings contained in this case 99.6 mg phenols /100 gm (D.W.T) compared to 351.5 mg/100 gm (D.W.T.) in seedlings of control which resulted in 4% germination.

Hence, it can be concluded that phenols in *Acasia farnesiana* have a role in germination capacity.

III.3. Acacia arabica willd:

III.3.a. Cold and hot water treatments (H.W.T.s):

The obtained results in Table (17) for H.W.T.s at 95°C confirm that germination of Acacia arabica seeds can be stimulated by the application of H.W.T.s which reflected on the rupture and softening of the seed coat layers. Seed soaking in H.W.T.L at 95°C resulted in 14.3 germinated seeds (57.2%) compared to 2.0 (8%) for control.

When H.W.t.s were applied at 50°C or 60°C no improvement in seed germination capacity happened. The best treatment which raised the percentages of germination was the same which required the minimum number of days for maximum germination as 17.0 days compared to 22 days for control. This is due to more absorption of water facilitating the activation of embryo and saving time for better germination.

In the second season the trend of results was similar to that of the first season. These results are in agreement with the findings of several investigators as Alvarez-Racelies and Bagaloyos (1977), on Leucocephala sp., Cavanagh, and Tran, (1980), on Acacia longifotia who found that bioled water treatments increased the capacity of seed germination.

Table (17): Effect of H.W.T.s on seed germination of some trees and shrubs.

Acacia arabica

First season 1981

Treatment	Means No. of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
C°	50	60	95	50	60	95	50	60	95
Cold water at 28°C	2.0	2.0	2.0	8.0	8.0	8.0	22.0	22.0	22.0
H.W.T.R*	1.7	4.3	4.0	6.8	17.2	16.0	24.3	19.7	19.3
H.W.T.L*	1.0	2.0	14.3	4.0	8.0	57.2	24.3	21.7	17.0
L.S.D. at 0.05	N.S.	N.S	7.10	--	--	--	N.S.	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
Second season 1982									
Cold water at 28°C	3.0	3.0	3.0	12.0	12.0	12.0	22.3	22.3	22.3
H.W.T.R.*	3.0	5.0	3.3	12.0	20.0	13.2	20.0	19.7	17.3
H.W.T.L.*	1.7	3.0	15.7	6.8	12.0	62.8	21.7	20.0	15.0
L.S.D. at C.05	N.S	N.S	6.28	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	10.40	--	--	--	N.S	N.S	N.S

R. = Raising

L. = Iowering temperatures

III.3.b. Effect of peat moss and sulfuric acid treatments:

Data concerning the effects of H_2SO_4 and peat moss treatments on the germination percentage in the two season are presented in Table (18). The percentages of germination were 62.8% and 73.2% respectively. Statistical analysis proved significance in concern when direct sowing, soaking in cold water or peat moss treatments are compared with sulfuric acid treatments. The H_2SO_4 treatment for 45 minutes gave the highest percentage of germination and least number of days for maximum germination as 12.3 and 8.7 for the first and second seasons respectively. Generally H_2SO_4 can be adviced for better germination of *Acacia arabica*.

This finding is in line with the conclusion of Lebrun (1966) who found that treating seeds of *Robinia pseudoacacia* forst, with concentrated H_2SO_4 for 80 minutes gave 76.85% germinated seeds compared to 16.23% for control.

Figure (6) shows the germination percentage of *Acacia arabica* seeds as affected by soaking in different concentrations of GA_3 following H.W.T.s. GA_3 applications did not give higher percentages of germination

Table (18): Effect of H_2SO_4 and peat moss on seed germination of some trees and shrubs.

<u>Acacia arabica</u>

First season 1981

Treatment	Mean No.of germinated seeds	The percentage of germinated seeds	No.of days to max. germ.
Control (direct sowing)	1.3	5.2	21.7
Seeds Soaking	2.0	8.0	22.0
peat moss	3.7	14.8	21.7
30 - min.	14.3	57.2	14.7
45 - min.	15.7	62.8	12.3
60 - min.	13.0	52.0	17.0
75 - min.	12.7	50.8	16.0
L.S.D. at 0.05	3.28	--	N.S
0.01	4.60	--	N.S
	Second season 1982		
Control (direct sowing)	3.0	12.0	21.3
Seeds Soaking	3.0	12.0	22.3
peat moss	5.3	21.2	19.7
30 - min.	14.0	56.0	8.7
45 - min.	18.3	73.2	8.7
60 - min.	15.3	61.2	13.3
75 - min.	16.0	64.0	13.3
L.S.D. at 0.05	5.24	--	9.88
0.01	7.36	--	N.S

as compared with the 95°C (L) water treatment. Although the applications encouraged the germination with the low temperatures, however the percentages of germination did not exceed that of the 95°C L. treatment in both seasons.

Concerining the effects of GA_3 on the germination of seeds previously treated with sulfuric acid, the average number and percentage of germinated seeds in Figure (6) show that the best treatment which gave the highest number in both seasons was GA_3 at 100 ppm following the H_2SO_4 (45 minutes) treatment.

The action of GA_3 might be due to the activation of embryo and perhabs it gave a kind of balance in the hormanal system within the seed.

Simlar conclusions were reported by Dziewanowska and Lewak (1975), which implies that GA_3 contribute to the control of IAA level, as earlier postulated by Galston and Davies (1969).

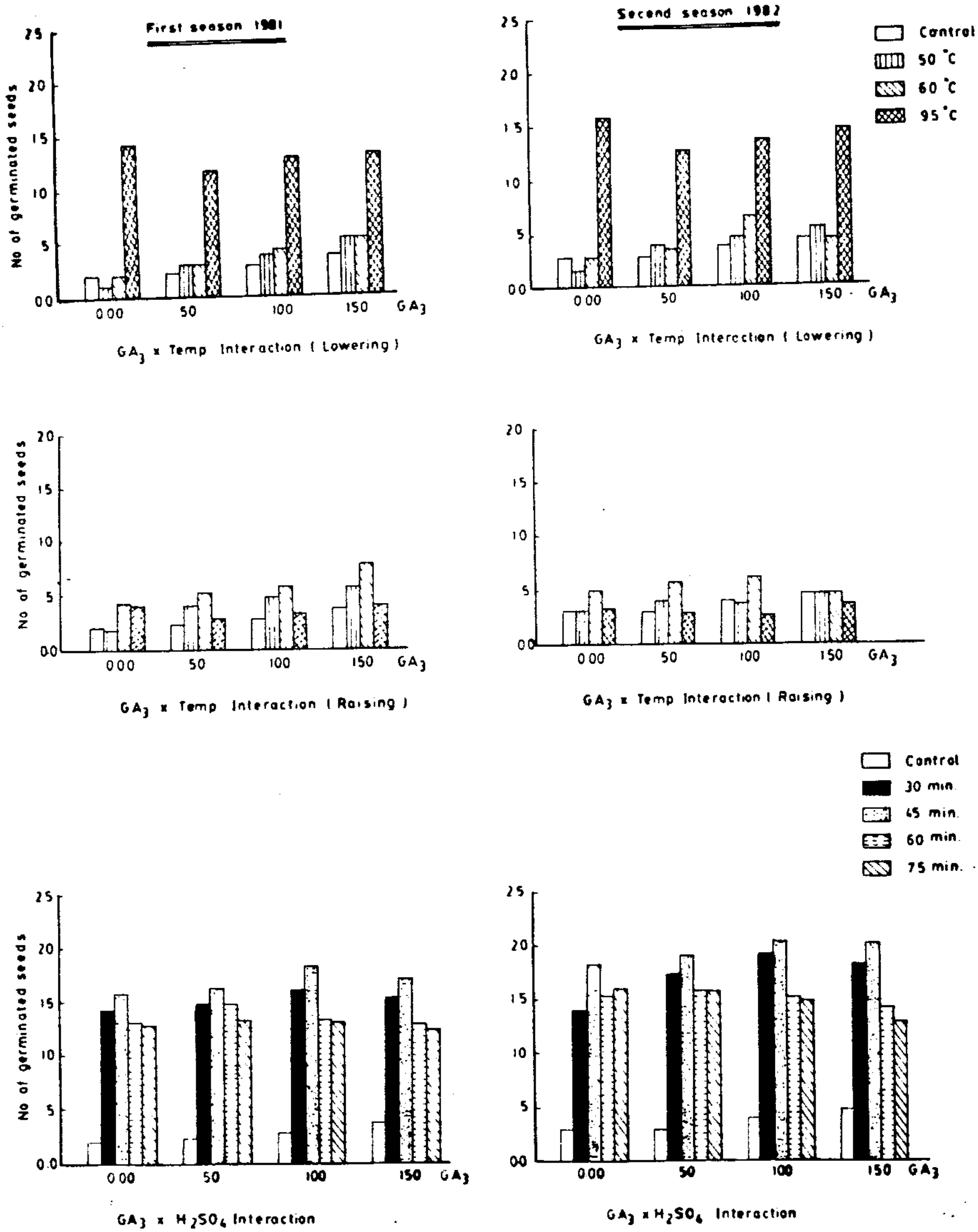

Fig. (6) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of Acacia arabica

Chemical analysis:

III.3.c. Effect of H.W.T.s and GA_3 on the indoles and phenols content of seeds and seedlings:

Indoles:

Data in Table (19) domenstrate that indoles content in seeds was lower in dry seeds as compared to seedlings. Seedlings from both direct sowing or cold water imbibition treatments gave similarly indoles content as that found in seedling resulting from 95°C (L) treatment which produced the highest percentage of germination in 1982 as (62.8%). This conclusion support the opinion that indoles content had little effect on increasing the capacity of germination.

On the other side, raising the temperature of imbibed seeds did not show particular trend in indoles content. Also, GA_3 treatments on seeds treated with cold water (control) showed diminishing effect on indoles content in seedlings.

When GA_3 was applied on seeds treated with hot water, the content of indoles in seedling was raised in some cases as (150 ppm 95°C L treatment), however the percentages of germination did not increase.

Generally, the indoles contents in seedling were

Table (19): Effect of H.W.T.s and GA_3 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of <u>Acacia</u> <u>arabica</u> (season 1982).

Compounds	Treatment	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.					50 p.p.m.				100 p.p.m.				150 p.p.m.			
				28°C	50°C	60°C	95°C	mean	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C	28°C	50°C	60°C	95°C
Indoles	H.W.T.R.	5.8	29.2	31.7	15.8	24.5	27.7	24.9	14.2	20.8	25.6	23.8	17.1	24.4	27.6	22.1	18.4	26.1	27.8	26.1
Indoles	H.W.T.L.	5.8	29.2	31.7	15.9	20.9	32.4	25.2	14.2	16.6	23.0	33.8	17.1	18.8	23.3	32.7	18.4	21.7	25.2	41.6
Phenols	H.W.T.R.	30.6	202.8	229.8	166.3	168.9	267.8	208.3	187.6	168.8	150.0	230.4	183.4	160.5	121.4	187.9	179.6	146.2	108.3	140.9
Phenols	H.W.T.L.	30.6	202.8	299.8	228.1	175.4	169.4	200.7	187.6	166.2	156.4	169.1	183.4	159.4	153.8	126.1	179.6	131.9	140.2	95.6

Table (20): Effect of GA_3 X H_2SO_4 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of <u>Acacia</u> <u>arabica</u> (seaon 1982).

Compounds	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.						50 p.p.m.					100 p.p.m.					150 p.p.m.				
			0.0	30 min.	45 min.	60 min	75 min	Mean	0.0	30 min	45 min	60 min	75 min	0.0	30 min	45 min	60 min	75 min	0.0	30 min	45 min	60 min	75 min
Indoles	5.8	29.2	31.7	27.3	22.2	18.6	18.8	23.7	14.2	25.2	17.1	15.2	9.3	17.1	22.8	21.6	21.6	13.2	18.4	23.7	23.3	17.3	15.4
Phenols	30.6	202.8	229.8	175.6	176.2	159.1	136.7	175.5	187.6	157.2	[illegible]	86.6	124.5	183.7	120.4	106.7	111.4	119.4	179.6	94.7	97.3	105.2	111.9

not indicators to increased capacity of germination. Seeds of Acacia arabica was similar to those of Acacia farnesiana and both did not respond to GA_3 applications.

Phenols:

The phenols content in Acasia arabica was lower in the dry seeds than in controls seedlings. H.W.T.s as shown in Table (19) had some effects on phenols content, a decreasing effects is noticed with 50°C and 60°C (R) as well as with 60°C and 95°C (L). However, the best treatment which gave the highest percentage of germination due to H.W.T.s was the 95°C (L),it was the same treatment which gave noticeably lower phenols than that of controls. This indicates a relationship between the decreased pehnols content and the increased germination.

GA_3 treatment showed decreasing effects on phenols content except in one case. It seemed that GA_3 had a role on phenols through some rearrangement of hormonal activities. The function of GA_3 at its proposed concentrations on the hot water treated seeds seemed to have little importance on forcing Acacia arabica. seeds to full germination.

III.3.d. Effect of H_2SO_4 and GA_3 on the indoles and phenols content of seeds and seedling:

Indoles:

The presented data in Table (20) indicate that sulfuric acid treaments decreased the content of indoles in seedlings as compared with controls (direct sowing or cold water soaking). The treatment which gave the highest rate of germination (H_2SO_4 for 45 minutes) gave a moderate indoles contentas 22.2 mg/100 gm(D.W.T.). This was higher than in seedlings from seeds treated for longer time in sulfuric acid. Hence, indoles content had no main trend in relation with germination of *Acacia arabica*.

GA_3 treatments decreased indoles content in seedling of controls. The highest percentage as (81.2%) of germinated seeds was previously recorded with sulfuric acid treatment for 45 minutes followed with GA_3 (100 ppm). This treatment showed 21.6 mg/100 gm (D.W.T.) in seedlings. The value was similar to some other cases which gave low percentages of germination. Hence, indoles content in seedlings of *Acacia arabica* with does not give an indicating relationship germination.

Phenols:

Sulfuric acid treatments generally decreased the phenols contents in seedling as compared with controls.

This effectiveness was higher with the longer periods of soaking in the acid. The treatment of sulfuric acid which gave the highest rate of germination showed 176.2 mg/100 gm (D.W.T.) of phenols.

GA_3 treatments on control seeds decreased the phenols content. The GA_3 application at 100 ppm or seeds which were previously soaked in sulfuric acid for 45 minutes gave 106.7 mg/100 gm (D.W.T.). This is compareably lower than sulfuric acid treatment for 45 minutes without GA_3 treatment. Hence, GA_3 definitely had a great influence on decreasing phenols content and may have a great role on stimulating seed germination.

But this conclusion is dependant on the previous treatments which facilitate the water absorption. The role of GA_3 in such case might be due to its influence on a kind of balance of hormones.

III.4. Olea europaea, L.

III.4.a. Cold and hot water treatments (H.W.T.s):

It is clear from data in Table (21) that H.W.T.s have some influence on increasing number and percentages of germinated seeds of olives. The H.W.T.s (L) at 60°C was the best one for cv. chemlali, while the H.W.T.s (R) to 40°C was the best one for cv. koderia. This was true in both seasons, however the differences were insignificant.

As for the shortest period needed for maximum germination, seed soaking in cold water was the best treatment with cv. chemlali. But for cv. koderia the H.W.T's 40°C (R) was the best one as compared to the other treatments. The results were identical in both seasons.

III.4.b. Effect of peat moss and sulfuric acid treatments:

Data in Table (20) indicate slight increasing effect for H_2SO_4 treatments (10%) as compared to direct sowing or control, However control gave the least number of days for maximum germination of chemlali seeds in both seasons.

For koderia, the best treatment which gave the maximum number of germinated seeds was H_2SO_4 (10%) for 5 minutes. This was true in both seasons, as compared

Table (21): Effect of H.W.T.s on seed germination of (*Olea europaea*).

First season 1981

Treatment	Cv. chemlali									Cv. koderia								
	Mean No. of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.			Mean No. of germinated seeds			The percentage of germinated seeds			No. of days to max. germ.		
°C	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
Cold water at 18°C	11.3	11.3	11.3	45.2	45.2	45.2	91.3	91.3	91.3	7.0	7.0	7.0	28.0	28.0	28.0	103.0	103.0	103.0
H.W.T.R.*	9.3	9.3	10.3	37.2	37.2	41.2	93.7	101.3	103.0	9.7	8.3	7.3	38.8	33.2	29.2	96.0	105.3	107.7
H.W.T.L.*	12.0	10.0	14.0	48.0	40.0	56.0	93.7	100.7	103.0	5.3	5.0	5.0	21.2	20.0	20.0	98.3	103.0	98.3
L.S.D. at 0.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S

Second season 1982

Treatment	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
Cold water at 18°C	11.0	11.0	11.0	44.0	44.0	44.0	102.0	102.0	102.0	7.7	7.7	7.7	30.8	30.8	30.8	105.3	105.3	105.3
H.W.T.R.	10.3	12.0	10.0	41.2	48.0	40.0	102.0	104.7	107.0	10.0	8.7	7.0	40.0	34.8	28.0	99.0	103.3	111.7
H.W.T.L.	13.7	8.3	17.0	54.8	33.2	68.0	102.3	102.7	104.7	7.7	7.0	6.7	30.8	28.0	26.8	101.0	107.7	103.0
L.S.D. at 0.05	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S
0.01	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S	N.S	N.S	N.S	--	--	--	N.S	N.S	N.S

R : Raising   L = Lowering temperatures

Table (22): Effect of H_2SO_4 and peat moss on seed germination of (*Olea europaea*).

Treatment	Cv. chemlali						Cv. koderia					
	Mean No. of germinated seeds		The percentage of germinated seeds		No. of days to max. germ.		Mean No. of germinated seeds		The percentage of germinated seeds		No. of days to max. germ.	
	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
Control (soil)	13.3	10.7	53.2	42.8	91.3	104.0	6.0	8.0	24.0	32.0	100.7	105.3
Control soaking	11.3	11.0	45.2	44.0	91.3	102.0	7.0	7.7	28.0	30.8	103.0	105.0
peat moss	10.3	8.0	41.2	32.0	118.7	125.0	6.0	3.0	24.0	12.0	110.0	126.3
10% for 5 min.	13.7	10.3	54.8	41.2	100.7	109.7	10.0	12.0	40.0	48.0	105.3	107.7
10% for 10 min.	11.7	11.0	46.8	44.0	100.7	111.7	5.7	10.3	22.8	41.2	103.0	103.3
20% for 5 min.	10.3	8.3	41.2	33.2	105.3	107.0	4.7	7.3	18.8	29.2	105.3	107.7
20% for 10 min.	10.3	6.3	41.2	25.2	100.7	104.7	6.7	7.0	26.8	28.0	110.0	109.7
L.S.D. at 0.05	N.S	N.S	--	--	13.55	N.S.	N.S.	3.07	--	--	N.S.	13.37
0.01	N.S.	N.S.	--	--	N.S.	N.S.	N.S	N.S	--	--	N.S.	N.S.

with any other treatment. The increase was significantly more than the control in the second season.

Peat moss treatment significantly needed the longest periods of days to reach the maximum germination, in the second season. The other treatments needed nearly similar number of days.

In conclusion, both H.W.T's and H_2SO_4 and peat moss have not to be practised for the germination of olive seeds.

III.4.c. <u>Effect of sodium hydroxide and sodium carbonate solutions treatment's:</u>

From results in Table (23) it is obvious that both treaments of sodium hydroxide (10% for 5 minutes) and sodium carbonate (5% for 6 h.) gave significantly the highest number of germinated seeds in both season. The results for cv. chemlali were significant as compared to control, Na OH 10% (hot) for 5 min. and Na OH 10% (hot) for 10 min. in the first season. In the second season the results were highly significant as compared to all other treatments.

Sodium carbonate in both seasons showed similar trend of results indicating that germination number

Table (23): Effect of sodium hydroxide and sodium carbonate on seed germination of (*Olea europaea*).

Treatment	Cv. chemlali						Cv. koderia					
	Mean No. of germinated seeds		The percentage of germinated seeds		No. of days to max. germ.		Mean No. of germinated seeds		The percentage of germinated seeds		No. of days to max. germ.	
	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
Cold water	11.3	11.0	45.0	44.0	91.3	102.0	7.0	7.7	28.0	30.8	103.0	105.3
NaoH. Cold 10% for 5 min.	17.7	22.3	70.8	89.2	98.3	99.4	13.3	10.7	53.2	42.8	103.0	103.3
NaoH. Cold 10% for 10 min.	14.0	15.7	56.0	62.8	100.7	102.0	11.7	9.3	46.8	37.2	105.3	105.7
NaoH. hot. 10% for 5 min.	10.3	15.3	41.2	61.2	103.0	104.7	8.7	8.0	34.8	32.0	107.7	109.7
NaoH. hot. 10% for 10 min.	10.0	14.3	40.0	57.2	105.3	106.7	7.7	7.3	30.8	29.2	112.3	112.0
Na_2CO_3 5% for 6 hour	16.0	16.3	64.0	65.2	89.0	93.0	11.0	9.3	44.0	37.2	91.3	94.7
L.S.D. at 0.05	4.31	3.60	--	--	N.S	N.S	N.S	N.S	--	--	N.S	N.S
0.01	N.S.	5.11	--	--	N.S	N.S	N.S	N.S	--	--	N.S	N.S

and percentage were significantly increased as compared to control.

Similar results although not significant are noticed with koderia seeds as treated with either sodium hydroxide or carbonate.

In this respect, control seed gave the minimum number and percentages of germination in both seasons.

The action of both sodium hydroxide and carbonate on facilitating seed germination of olive is probably due to the structure of seed itself. Olive stone which is known to be very hard, has also an oily layer on the outer surface of the seed coat which prevents absorption of water. In this connection, both mentioned chemicals have reactions with the oil which lead to saponification. When such seeds are washed thereafter the layer of oil is removed. Hence water absorption will be easier.

Similar conclusions were mentioned by Pansiot and Robour (1961) who stated that soaking seeds in 1% soda solution for a certain time, depending on the hardness of the stone, (10-20 minutes for Arbequine variety, and 1-3 hours for thicker stones) can be used to affect seed germination. As for the number of days needed to reach maximum germination, sodium carbonate was the most effective treatment which gave the minimum number of days needed. The results in concern, however were insignificant in both seasons for both varicties under investigation. These results are in harmony with the finding of Dela Rocha (1956-1957), who found that soaking oilve seeds in 5% sodiumcarbonate increased the germination of seeds and gave the most rapid one.

In conclusion, treating seeds with sodium hydroxide 10% for 5 minutes is adivsable for both varieties.

Data in Figure (7) concerning the interactions of GA_3 X H.W.T's generally indicate that GA_3 applications at the different concentrations, either decreased seed germination of cv. chemlali or gave the same number of germination as control in the first seasons.

In the second season GA_3 treatments following H.W.T's L. gave similar results as the first season. While, the concentrations GA_3 50 and 100 ppm with 40, 50 and 60°C H.W.T's R. increased seed germination in a range between 27.5% to 50% as compared to their controls.

Comparing the results of cv. koderia in Figure (8) it is obvious that GA_3 treatments as 150 ppm following

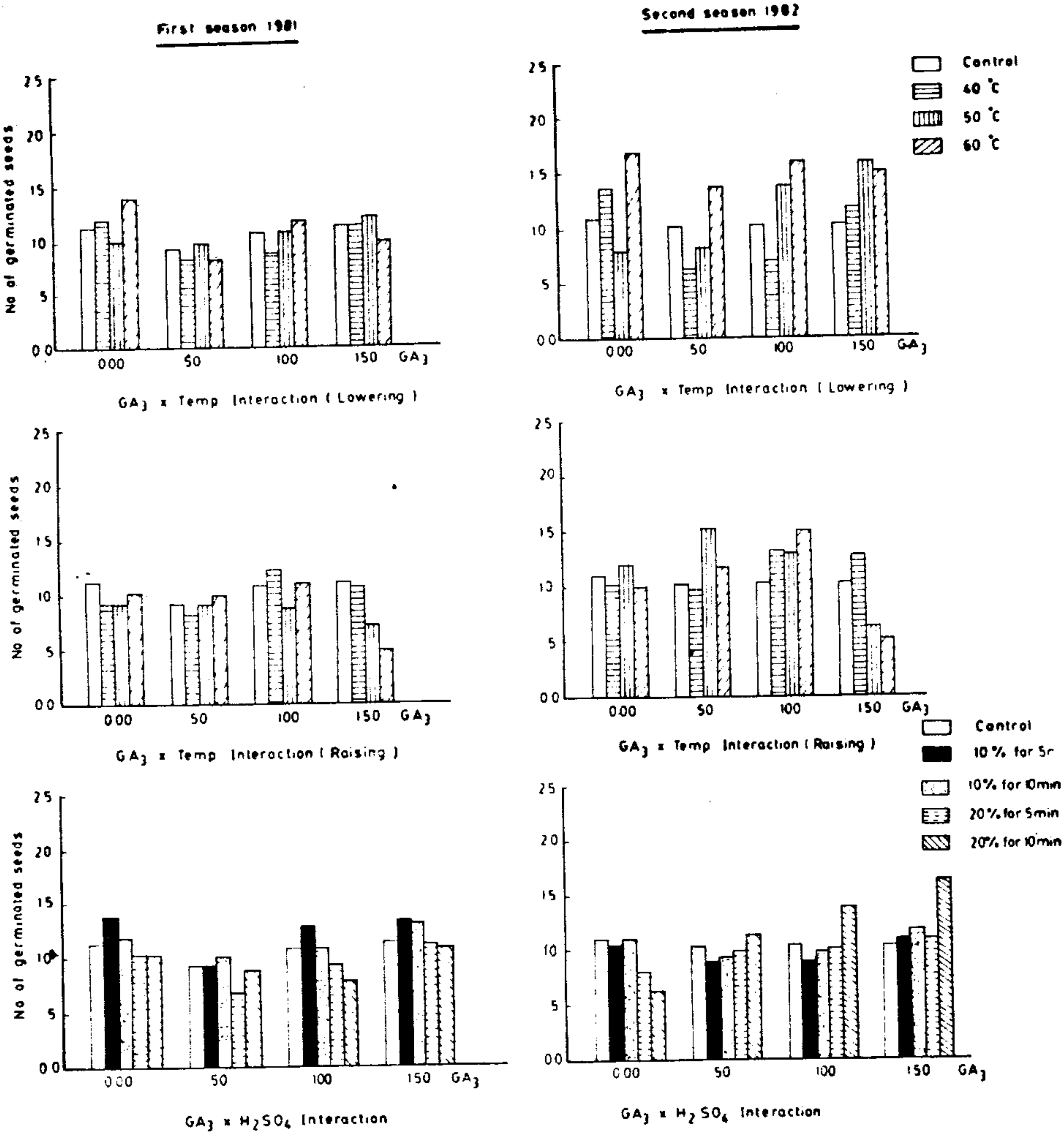

Fig. (7) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of olea europaea cv. Chemlali olive

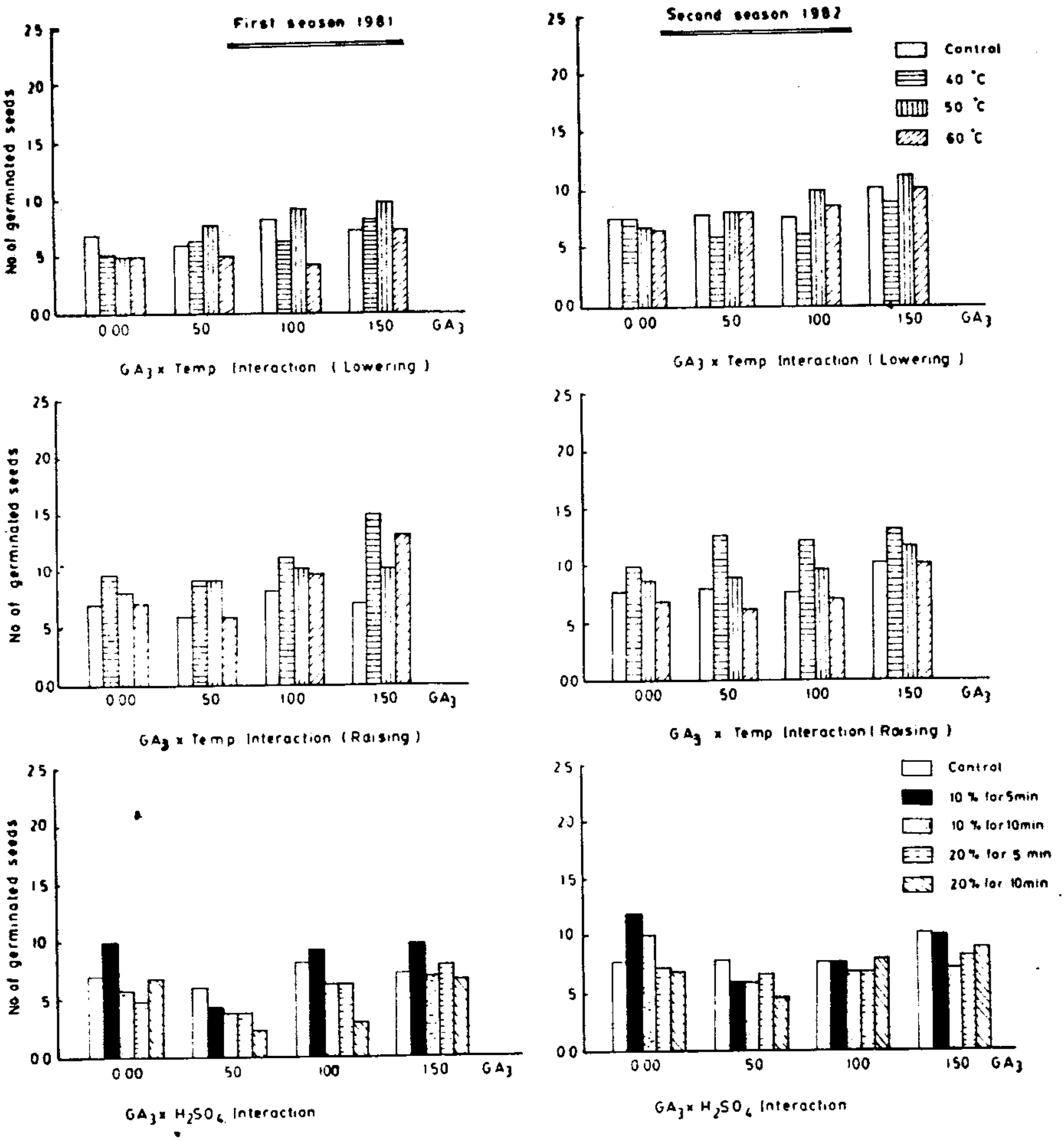

Fig.(8) Effect of GA_3 and soaking in water or sulfuric acid treatments on seed germination of Olea europaea cv. Koderia olive

H.W.T's raised the seed germination as compared to control and the other treatments.

The results of effects of GA_3 on increasing seed germination agree with those reported by Campbell and Popenoe (1968) and Nagad and Sakai (1979).

Data in Figure (7) show that GA_3 applications on cv. chemlali seeds previously treated with sulfuric acid gave different trend of results in the two seasons. The most promising effect was in second season, where GA_3 at 150 ppm following H_2SO_4(20%) for 10 minutes raised the germination by 158.7%.

As for cv. koderia GA_3 had no increasing effects on seed germination Figure (8).

Chemical analysis:

III.4.d. Effect of H.W.T.s and H_2SO_4 and GA_3 on the indoles and phenols content of seeds and seedlings:

Data in Tables (24, 25, 26) reveal that there are no relationship between the contents of indoles and phenols in the seedlings of olive and the experimental treatments involved. The only exception was the effects of GA_3 on the imbibed seeds where concentrations of

Table (24): Effect of H.W.T.s and GA_3 on indoles and phenols content (mg/ 100 g dry weight) of seeds and seedlings of Olea europaea Cv. chemlali (season 1982).

Compounds	Treatment	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.					50 p.p.m.				100 p.p.m.				150 p.p.m.			
				28°C	40°C	50°C	60°C	Mean	28°C	40°C	50°C	60°C	28°C	40°C	50°C	60°C	28°C	40°C	50°C	60°C
Indoles	H.W.T.R.	5.0	24.0	19.0	16.0	16.0	13.0	16.0	22.5	17.3	20.0	20.8	22.1	18.0	21.0	22.6	27.0	19.0	18.8	17.8
Indoles	H.W.T.L.	5.0	24.0	19.0	17.0	17.5	18.0	17.9	22.5	15.0	20.0	25.0	22.1	21.0	25.5	24.4	27.0	22.0	25.0	27.0
Phenols	H.W.T.R.	44.0	206.0	281.2	94.0	112.0	97.0	141.0	427.0	406.1	116.5	163.0	322.1	162.5	141.1	149.0	302.0	122.3	223.8	213.5
Phenols	H.W.T.L.	44.0	206.0	281.2	111.0	84.0	96.0	143.1	427.0	109.0	145.0	163.0	322.1	151.0	124.0	143.8	302.0	141.0	105.0	176.0

Table (25): Effect of GA_3 X H_2SO_4 on indoles and phenols content (mg/100 g dry weight) of seeds and seedlings of Olea europaea Cv. chemlali (season 1982).

Compounds	Dry seeds	Direct sowing	GA_3 - 0.00 p.p.m.						50 p.p.m.					100 p.p.m.					150 p.p.m.				
			28°C	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	mean	28°C	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	28°C	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.	28°C	10% for 5 min.	10% for 10 min.	20% for 5 min.	20% for 10 min.
Indoles	5.0	24.0	19.0	27.7	26.7	20.0	21.0	22.9	22.5	25.1	26.7	27.5	15.2	22.1	26.4	27.9	31.5	26.7	27.0	27.3	31.3	32.9	31.0
Phenols	44.0	206.0	281.2	489.0	499.5	341.9	289.8	400.3	427.0	213.6	338.2	420.1	301.9	322.1	246.7	380.9	259.9	243.4	302.0	298.8	311.4	175.3	248.6

Table (26): Effect of sodium hydroxide and sodium carbonate solutions on indoles and phenoles content (mg/100 g dry weight) of seeds seedlings of <u>Olea europaea</u> cv. <u>chemlali</u> (season 1982).

Treatment / compounds	Dry seeds	Direct Sowing	Sodium hydroxide				Sodium carbonate
			Cold 5% for 5 min.	Cold 10% for 10 min.	hot 5% for 5 min.	hot 10% for 10 min.	5% for 6 hour
Indoles	5.0	24.0	28.5	37.0	28.0	23.5	36.5
phenoles	44.0	206.0	284.0	276.1	303.4	356.2	205.1

phenols raised as compared to control. The effect also had no indication on seed germination.

Hence, it can be concluded that the contents of such compounds (indoles and phenols) in seedlings of olive had no influence on seed germination.

Second Experiment

In 1981 a preliminary study on some different media was undertaken to judge which one is suitable for the propagation of *Ficus elastica* var *decora* cuttings, the unpublished data concluded that coarse sand was the most suitable medium.

Effect of IBA, Kinetin and Kinetin x IBA on the propagation of *Ficus elastica* var. *decora*, Roxb.

I. Effect of IBA:

I.a. Terminal cuttings:

The results in Table (27) showed that the 5500 p.p.m. (Phots 2) of IBA was the most effective concentration which produced 100% rooted cuttings in both seasons.

Besides, the same concentration gave highly significant number of roots/cutting as compared to 4000 p.p.m. or lower concentrations and control (Photo 2 and 3).

Also, the longest roots were carried on the cuttings treated with this concentration Table (27).

I.b. Middle portion cuttings:

In the same Table (27) it is clear that the middle portion cuttings of *Ficus elastica* var. *decora* responded

Table (27): Effect of IBA on the propagation of *Ficus elastica* var, *decora*.
using different types of cuttings.
Season 1982, 1983.

Cuttings	Treatments / Character	1982 IBA (ppm) Control	2000	3000	4000	4500	5000	5500	L.S.D. 0.05	L.S.D. 0.01	1983 IBA (ppm) Control	2000	3000	4000	45000	5000	5500	L.S.D. 0.05	L.S.D. 0.01
Terminal	No. of rooted cuttings	3.3	1.7	2.7	4.0	4.0	4.0	4.0	N.S	N.S	2.7	2.3	2.7	2.7	4.0	3.7	4.0	N.S	N.S
	% of rooted cuttings	82.5	42.5	67.5	100	100	100	100	-	-	67.5	57.5	67.5	67.5	100	92.5	100	-	-
	No. of roots/cutting	12.0	9.0	15.0	17.0	23.3	24.3	26.0	6.96	9.64	11.3	14.3	14.3	13.7	19.0	20.7	23.3	5.86	8.12
	Mean length of roots in cms	13.8	10.0	12.0	12.0	16.3	19.3	21.3	N.S	N.S.	11.2	12.0	13.5	10.8	15.3	17.7	18.7	N.S	N.S
Middle	No. of rooted cuttings	3.7	2.7	2.7	3.0	4.0	4.0	4.0	N.S	N.S.	3.0	2.3	3.0	3.3	3.7	3.3	3.7	N.S	N.S
	% of rooted cuttings	92.5	67.5	67.5	75.0	100	100	100	-	-	75.0	57.5	75.0	82.5	92.5	82.5	92.5	-	-
	No. of roots/cutting	10.7	13.3	15.0	16.3	30.0	30.7	32.3	7.82	10.84	9.0	16.0	15.7	13.7	21.0	23.0	26.0	7.26	10.06
	mean length of roots in cms	16.3	15.0	14.7	21.0	18.0	18.3	22.0	N.S	N.S	13.0	14.7	13.2	19.0	16.0	17.3	21.3	N.S	N.S
Leaf bud	No. of rooted cuttings	1.0	4.0	3.3	2.3	2.3	2.7	2.7	1.14	1.58	1.7	4.0	4.0	2.7	1.7	2.0	2.7	1.20	1.66
	% of rooted cuttings	25.0	100	82.5	57.5	57.5	67.5	67.5	-	-	42.5	100	100	67.5	42.5	50.0	67.5	-	-
	No. of roots/cutting	6.0	17.0	15.3	12.3	14.0	13.0	14.0	5.05	7.00	8.7	18.7	18.3	18.3	17.3	17.0	16.7	5.71	7.91
	mean length of roots in cms	15.7	22.0	18.7	18.0	18.3	17.0	17.7	N.S	N.S	20.0	27.7	20.2	16.7	19.3	19.3	17.0	8.77	N.S

Photo (1)

Photo (2)

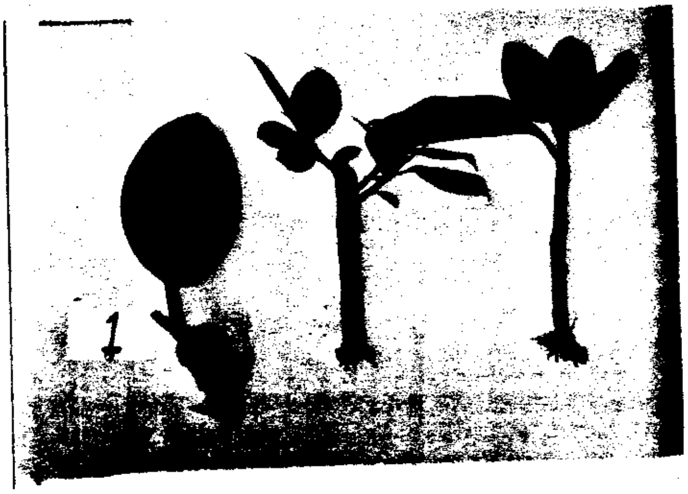

Photo (3)
control

Photo (1) : Effect of IBA 5500 p.p.m (17)

(2) : Effect of IBA lower than 5500 p.p.m (terminal cutting).

(3):Control.

Photo (4)

Photo (5)

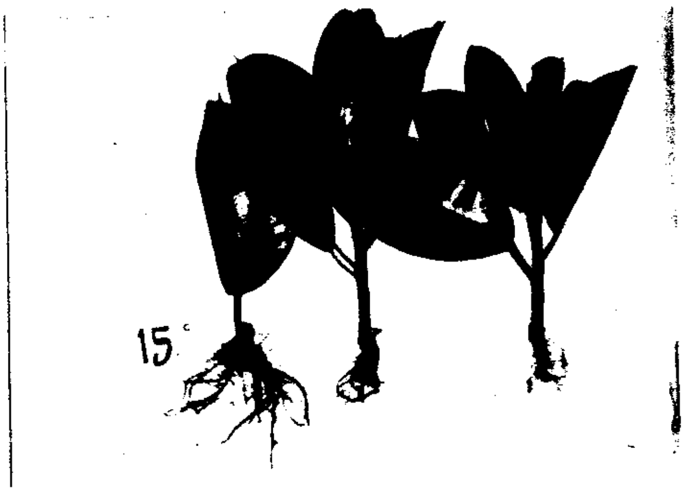

Photo (6)

Photo (4): Effect of IBA 5500 p.p.m (17).
(5): Effect of IBA 2000 p.p.m (15) on leaf bud cuttings.
(6): Effect of IBA 2000 p.p.m on (T, M, and l.b).

in a similar way as terminal cuttings, IBA at 5500 p.p.m. (Photo 4) gave the highest percentages of rooted cuttings, increased both number and length of roots on cuttings.

I.c. Leaf Bud cuttings:

As for leaf bud cuttings, 2000 p.p.m. of IBA (Photo 5) seemed to be the most suitable concentration which produced 100% rooted cuttings in both seasons, in the meantime cuttings carried the highest number and longest roots. The increases in the number of roots was highly significant as compared to control P.N. (Photo 6).

II. Effect of Kinetin:

II.a. Terminal cuttings:

Data of both seasons in Table (28) appeared that dipping the basal part of *Ficus elastica* var. *decora* cuttings in kinetin at 5 p.p.m. for 3 hrs (Photo 7), resulted in 100% successful cuttings in 1982 and 75% in 1983. In both seasons, this treatment was the best one which gave highly significant increases in the number of roots/cutting as well as the longest roots as compared to control.

II.b. Middle portion cuttings:

It is also evident from the same Table (28) that in both seasons more successful cuttings were obtained by

Table (28): Effect of Kinetin on the propagation of *Ficus elastica* var *decora*.
Using different types of cuttings.
Season 1982, 1983.

Cuttings	Character	1982 Kinetin ppm Control	1	5	10	15	L.S.D. 0.05	L.S.D. 0.01	1983 Kinetin ppm Control	1	5	10	15	L.S.D 0.05	L.S.D 0.01
Terminal	No. of rooted cuttings	3.3	2.0	4.0	4.0	4.0	N.S	N.S	2.7	2.3	3.0	3.3	3.7	N.S	N.S
	% of rooted cuttings	82.5	50.0	100	100	100	-	-	67.5	57.5	75.0	82.5	92.5	-	-
	No. of roots/cutting	12.0	8.3	28.0	20.0	16.0	5.73	8.15	11.3	8.7	22.7	16.7	11.7	5.08	7.22
	mean length of roots in cms	13.8	14.0	15.9	12.8	16.7	N.S	N.S	11.2	15.7	14.3	11.7	13.3	N.S	N.S
Middle	No. of rooted cuttings	3.7	2.7	4.0	4.0	4.0	N.S	N.S	3.0	2.7	3.7	2.7	3.0	N.S	N.S
	% of rooted cuttings	92.5	67.0	100	100	100	-	-	75.0	67.5	92.5	67.5	75.0	-	-
	No. of roots/cutting	10.7	11.7	27.0	24.0	16.7	2.39	13.35	9.0	6.2	21.7	16.3	13.0	6.20	8.81
	Mean length of roots in cms	16.3	15.7	17.3	20.8	21.0	N.S	N.S	13.0	10.5	16.5	16.0	19.0	3.78	5.38
Leaf bud	No. of rooted cuttings	1.0	2.7	1.7	2.3	1.7	N.S	N.S	1.7	3.0	1.3	2.0	1.7	N.S	N.S
	% of rooted cuttings	25.0	67.5	42.5	57.5	42.5	-	-	42.5	75.0	32.5	50.0	42.5	-	-
	No. of roots/cutting	6.0	4.0	8.7	7.3	5.7	N.S	N.S	8.7	3.7	6.3	5.7	5.0	N.S	N.S
	mean length of roots in cms	15.7	14.7	12.0	12.8	16.7	N.S	N.S	20.0	20.7	10.7	21.3	21.0	N.S	N.S

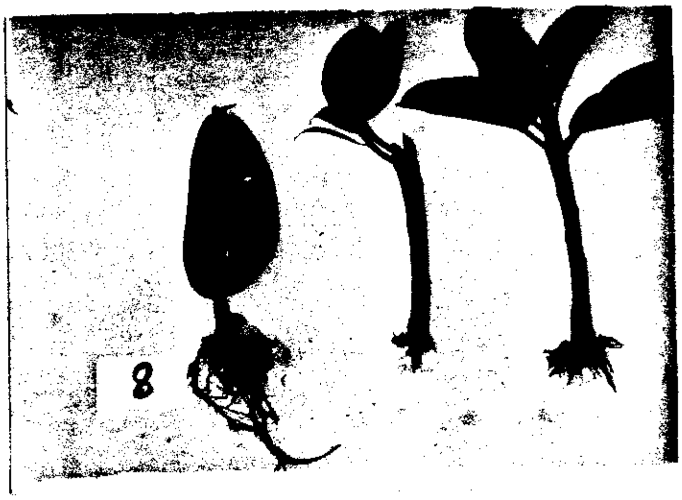

Photo (7)

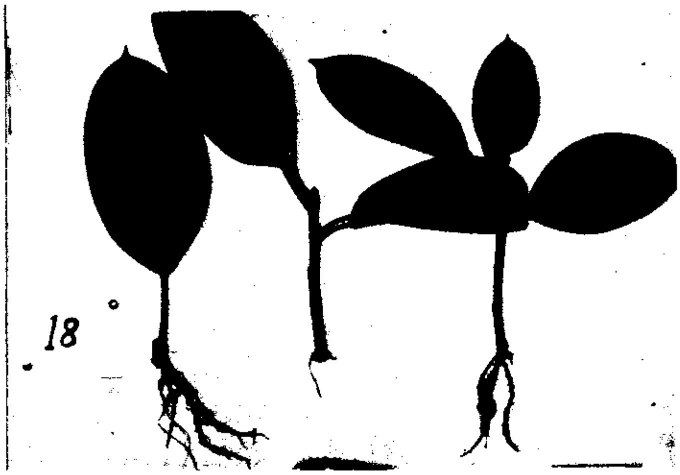

Photo (8)

Photo (9)

Photo (7): Effect of kinetin 5 p.p.m. on (T, M, l.b.)
(8): Effect of kinetin 1 p.m.m. on (T, M, l. b.)
(9): Effect of kinetin 15 p.p.m. on (T, M, l.b.).

application of Kinetin at 5 p.p.m. for 3 hrs (Photo 7). This treatment also gave highly significant increases in the number of roots/cutting as compared to control. Significant increases in the root length Photo (3) due to the application of this treatment is also noticed.

II.c. Leaf bud cuttings:

As shown in Table (28) the least number of rooted cuttings resulted from the untreated leaf bud cutting and the highest record was attained by the application of 1 p.p.m. of Kinetin for 3 hrs. before planting (Photo 8). However, the numbers of initiated roots and length of roots were insignificantly lower than the high concentration (15 p.p.m.) Photo (9).

III. Kinetin x IBA effects:

III.a. Terminal cuttings:

Data in Table (29) indicate that the application of 1 p.p.m. Kinetin followed with 5000 p.p.m. of IBA decreased the number of rooted cuttings as compared to control. While the best treatment which gave the highest number and percentage of rooted cuttings coincided with the most number of roots/cutting and longer roots

Table (29): Effects of (Kinetin x IBA) on the propagation of *Ficus elastica* var, *decora* using different types of cuttings.
Season 1982, 1983.

Cuttings	Character	1982 Kinetin x IBA (ppm)* Control	1	5	10	15	L.S.D 0.05	L.S.D 0.01	1983 Kinetin x IBA (ppm)* Control	1	5	10	15	L.S.D 0.05	L.S.D 0.01
Terminal	No. of rooted cuttings	3.3	1.3	3.7	4.0	4.0	0.89	1.30	2.7	1.3	3.0	3.3	4.0	1.62	N.S
	% of rooted cuttings	82.5	32.5	92.5	100	100	-	-	67.5	32.5	75.0	82.0	100	-	-
	No. of roots/cutting	12.0	9.0	19.0	20.7	24.0	10.17	N.S	11.3	8.0	16.7	17.0	21.3	6.93	N.S
	mean length of roots in cms	13.8	16.0	12.2	19.0	17.7	N.S	N.S	11.2	16.3	12.5	11.7	14.3	N.S	N.S
Middle	No. of rooted cuttings	3.7	3.7	4.0	4.0	4.0	N.S	N.S	3.0	3.0	3.7	4.0	3.7	N.S	N.S
	% of rooted cuttings	92.5	92.5	100	100	100	-	-	75.0	75.0	92.5	100	92.5	-	-
	No. of roots/cutting	10.7	19.0	24.0	32.0	31.0	8.42	12.24	9.0	18.7	21.3	25.3	24.7	8.38	N.S
	mean length of roots in cms	16.3	16.3	20.7	19.3	20.7	N.S	N.S	13.0	14.3	14.7	16.7	16.7	N.S	N.S
Leaf bud	No. of rooted cuttings	1.0	2.0	2.7	3.3	2.0	N.S	N.S	1.7	1.7	2.7	3.0	2.3	N.S	N.S
	% of rooted cuttings	25.0	50.0	67.5	82.5	50.0	-	-	42.5	42.5	67.5	75.0	57.5	-	-
	No. of roots/cutting	6.0	14.7	14.7	14.3	14.0	N.S	N.S	8.7	14.0	14.7	12.3	10.3	N.S	N.S
	mean length of roots in cms	15.7	18.3	18.0	23.0	13.7	4.51	N.S	20.0	18.7	22.7	24.0	16.0	N.S	N.S

* Dipping in kinetin for 1.5 hr. followed by IBA solution at 5000 ppm for 5 seconds.

Photo (10)

Photo (11)

Photo (12)

Photo (10): Effect of kinetin 15 p.p.m. x IBA 5000 p.p.m. on (T, M, and l.b).
(11): Effect of kinetin 10 p.p.m. x IBA 5000 p.p.m. on (T, M, and l.b.).
(12): Effect of kinetin 5 p.p.m. x IBA 5000 p.p.m. on (T, M, and l.b.).

was the combination Kinetin 15 p.p.m. x IBA 5000 p.p.m. (Photo 10). However, the recorded data for IBA alone were better in comparison.

III.b. Middle portion cuttings:

With cuttings from the middle portion the best treatment in both seasons was the Kinetin 10 p.p.m. x IBA 5000 p.p.m. In this case no cutting failed to root, the rooted cuttings significantly carried more number of roots as compared to control. Also, longer roots were noticed for such cuttings Table (29) and Photo (11).

III.c. Leaf bud cuttings:

Data in Table (29) show that the combination Kinetin 10 p.p.m. x IBA 5000 p.p.m. was the best treatment which increased number and percentages of rooted cuttings (Photo 11). Besides, cuttings carried high number and fairly longer roots as compared to control or to 5 p.p.m. x IBA 5000 p.p.m. (Photo 12). Hence, the application of kinetin at 10 or 15 p.p.m. followed by IBA 5000 p.p.m. may be advised for the best rooting of *Ficus elastica* var. *decora* cuttings. The trend of the results was identical in both seasons.

The obtained results agree with those reported by Klahr and Still (1979), who mentioned that rooting response vaired with hormone concentration. Also, Hanson (1978) added that the most successful rooting was observed for semihard wood cuttings treated with 3700 p.p.m. of IBA. Das *et al*. (1978) found that IBA at 1000 p.p.m. produced best rooting (32 roots/cutting on rosa compared with 3.29 roots/cutting in control.

Many evidences pointed out that root differentiation is controlled in part by a balance between the cytokinis and auxins. Large proportions of the latter favored root formation and large proportions of cytokinins favored bud formation. But at low concentrations of cytokinins, a stimulation of root initiation was true (Torrey 1956).

The role of kinetin in this work may be explained by its action on cell division promotion (Patau *et al*. 1957) and Leonard *et al*. (1968), as well as the retardation of leaf sensescence (Richmond and Lang 1957). According to the obtained data high root forming capacity could be attained by a general application of IBA at 5500 p.p.m. for 10 second for terminal and middle portion cuttings and 2000 p.p.m. for leaf bud cuttings or kinetin 5 p.p.m. (3 hrs.) for terminal and middle protion cuttings and 1 p.p.m. for leaf bud cutting. Also a combination of Kinetin 15 p.p.m. (1.5 hrs.) x IBA 5000 p.p.m. (5 seçonds) for terminal cuttings and Kinetin 10 p.p.m. (1.5 hrs.) x IBA 5000 p.p.m. (5 seconds) for either middle portion cuttings or leaf bud cuttings would be applicable.

The prementioned compounds for sure have their influence on reducing inhibitors of rooting thus providing a kind of balance between auxins and cytokinins within the tissue of cuttings.

IV. Chemical analysis:

Effects of growth regulators on some chemical constituents in cuttings and leaves of *Ficus elastica* var. *decora*, Roxb.

IV.a. Nitrogen percentage:

With terminal cuttings all concentrations of the different growth regulators decreased N % as compared to control Table (30). The trend was not the some with middle portion and leaf bud cuttings with no great variation among different treatments except in control of middle portion which gave the least N % as 0.58 %. Thus it can be concluded that growth regulator as IBA and Kinetin have some increasing effect in this case.

Table (30): Effect of growth regulators on some chemical constituents in cuttings and leaves of **Ficus elastica** var. **decora** season 1983

Treatment	Terminal cuttings						Middle portion cuttings				Leaf bud cuttings			
	D. W. B.				Fresh wet		D.W.B.				D. W. B.			
	N %	Total carbo-hydrate %	mg/100 g		Chlorophyll mg/100 g		N %	Total carbo-hydrate %	mg/100 g		N %	Total carbo-hydrate %	mg/100 g	
			Indoles	Phenols	A	B			Indoles	Phenols			Indoles	Phenols
I. IBA														
Control	1.24	16.50	19.05	80.10	88.00	63.00	0.58	16.62	9.83	85.00	0.90	17.18	12.68	42.99
2000 p.p.m.	1.16	20.10	19.94	102.27	96.00	91.00	0.96	26.51	15.40	113.75	0.88	24.60	23.09	142.11
3000 p.p.m.	1.14	20.20	19.44	112.67	92.00	82.00	0.94	16.43	12.38	58.77	0.94	24.56	43.43	286.59
4000 p.p.m.	0.46	28.20	24.21	70.34	88.00	63.00	0.78	16.75	22.02	84.72	0.92	23.33	33.92	117.68
4500 p.p.m.	0.44	23.30	21.90	77.16	107.00	65.00	1.00	20.50	10.78	87.77	0.86	24.62	28.71	90.79
5000 p.p.m.	0.42	16.42	22.90	96.26	102.00	67.00	1.12	22.05	22.19	43.30	0.92	23.28	23.11	82.96
5500 p.p.m.	0.56	17.43	23.45	52.10	101.00	89.00	0.88	20.10	13.95	58.65	1.00	23.85	33.75	165.31
II. Kinetin														
1 p.p.m.	1.12	19.30	15.64	145.83	97.00	69.00	0.96	15.15	11.25	76.31	0.96	22.81	25.37	197.30
5 p.p.m.	0.46	20.65	15.22	75.44	107.00	72.00	0.92	24.68	9.91	43.68	0.96	23.98	10.63	66.69
10 p.p.m.	0.62	13.45	29.89	101.90	120.00	100.00	0.84	14.51	9.59	60.15	1.12	21.56	18.06	231.95
15 p.p.m.	0.44	16.43	25.41	80.36	126.00	77.00	0.82	16.68	20.77	32.50	0.96	25.00	20.31	131.54
III. Kin X IBA														
1 x 5000 p.p.m	1.02	22.50	18.93	122.58	92.00	82.00	0.80	15.11	10.42	40.63	0.88	21.61	11.30	158.97
5 x 5000 p.p.m	0.58	14.18	27.34	119.19	115.00	103.00	0.70	16.18	11.09	63.94	0.88	21.48	6.21	135.00
10 x 5000 p.p.m	0.88	23.97	21.28	102.10	129.00	107.00	0.68	21.27	26.82	82.65	1.02	18.42	5.80	130.00
15 x 5000 p.p.m	0.78	24.53	20.07	102.22	106.00	86.00	0.76	20.15	24.00	76.36	1.04	17.81	14.40	70.15

IV.b. Carbohydrates percentage:

As for carbohydrates the most promising effect is noticed with the 4000 p.p.m. terminal cutting which gave the highest percentage (28.20 %) of whereas the least percentage was from rooted cutting of 10 p.p.m. kinetin (13.45 %) both treatments gave 100 % rooted cuttings. It means that carbohydrates percentage flacutuate tissues (raising or lowering) depending on the activities of tissues. With other portions this statment was also true Table (30).

IV.c. Indoles:

As for indoles in Table (30) there was increasing effects due to growth regulators application in terminal, middle portion and leaf bud cuttings except with kinetin X IBA where decreasing effects are noticed when 1, 5 or 10 p.p.m Kinetin X IBA was applied. The increased indoles are possibly responsible for more activation.

IV.d. Phenols:

Phenols did not show a particular trend due to growth regulators applications on the different cuttings. Table (30).

IV.e. Chlorophyll a and b:

Comparing the effects of growth regulators on the chlorophyll content in Table (30) it is clear that chlorophyll (a and b) was increased with kinetin application. In this connection Osborne and McCalla (1961) showed the ability of cytokinins to supress the loss of chlorophyll. This was true with most of treatments where kinetin was applied with or without IBA. Whereas chlorophyll a and b did not show the same trend with the treatments of IBA. However, IBA also in most cases increased the content as compared to control.

In conclusion growth regulators have great effects on changing biochemical substances within the rooted cuttings of *Ficus elastica* var *decora* and this indicates an- importance for using the suitable growth promotors with a suitable concentration to push rooting of different portions of cuttings.

SUMMARY

Two Experiments in a randomized complete block system with four replicates, were carried out at the Experimental Farm of the Faculty of Agriculture at Moshtohor, Zagazig University, Egypt, during the seasons of 1981, 1982 and 1983 to study seed germination of different genera and species.

Local fresh seeds were subjected to one of the following treatment H.W.T's (40, 50, 60 and 95°C) by raising or lowering temperatures beside control (soaking in water at room temperature for 24 hours, also seeds were soaked in sulfuric acid 10 %, 20% or concentrated for 5, 10, 30, 45, 60 and 75 minutes, then thoroughly washed with water. While with olive seeds were soaked in sodium hydroxide (10 %) cold or warm solution at 55°C for 5 or 10 minutes, or sodium carbonate solution for 6 hours before direct planting. All previous treatments were compared to embeding seeds in wet peat moss, soaking in cold water or direct sowing.

Also combination of the previous treatments and GA_3 at 0.00, 50, 100, 150 p.p.m. for 24 hours before sowing were conducted.

Equal patches of treated seeds were sown in 15 cm pots during the first week of September of each year, while with olive this was in the last week of November. Soil medium consisted of 2 part sand : 1 part loam. All pots were watered up to the adequate soil moisture needed for best germination. The second experiment dealed with propagation by terminal, middle portion and leaf bud cuttings of Ficus elastica var. decora. Roxb. which were subjected to different treatments of growth regulators by dipping the basal parts as follows:

A. Control (distilled water).
B. IBA treatments dipping for 10 seconds at concentrations of 0.00, 2000, 3000 , 4000, 4500, 5000, and 5500 p.p.m.
C. Dipping in kinetin for 3 hours in concentrations at 1, 5, 10 and 15 p.p.m.
D. Dipping in kinetin for 1.5 hours in the previous concentration then followed by dipping in IBA (5000 p.p.m. for 5 seconds).

The treated cuttings were inserted into sand in 20 cm clay pots, each pot contained 4 cuttings in three replicates.

Data for seeds were recorded just after emerging, but for cuttings after 3 months from planting.

The most important results are:

Cassia didymobotrya, L.:

1. C. didymobotrya, seeds are sensitive to high H.W.T's since soaking in cold water resulted in the best number and percentage of germination. The cause may be attributed to injurious effects on embryo or due to heat influence on some biochemical pathways of metabolites needed by active embryo.

2. Incubating seeds in wet peat moss at room temperature for 8 days gave the highest number of germinated seeds due to the adequate supply of both moisture for imbitition and well gaseous exchange at early stages of germination.

3. GA_3 supressed seed germination of C. didymobotrya due to changing endogenous balance of hormones in seeds.

4. Chemical analysis of seeds and seedlings indicated that the highest percentages of indoles were coincided with seeds soaked for 24 hours. No particular relationship was found between IAA content and germination at early stages.

5. GA_3 at 150 p.p.m. changed the content of IAA in seedling of previous H.W.T, L (60°C), although germination percentages did not increase.

6. Cold water and H_2SO_4 10 % treatments decreased phenols and those treatments were effective on increasing germination. High germination percentage was always related with lower content of phenols.

7. Chemical analysis gave some particular trend showing that exogenous treatments of seeds by H.W.T's, H_2SO_4 and GA_3 had influence on the content of seedlings from indoles and phenols.

<u>Cassia goluca, L.</u>:

1. H.W.T's had thermal stresses on germination; seed of C. goluca followed a similar trend as <u>C. didymobotrya</u>.

2. Peat moss application also was the best treatment for better germination.

3. It seemed that <u>C. goluca</u>,L. has non-deep dormancy which can be overcome by some physical treatments as soaking in cold water or inserting in wet peat moss, H_2SO_4 may cause injury to such seeds.

4. GA_3 decreased seed germination as compared to control except at the higher concentration as 150 p.p.m.

<u>Cassia modesta</u>, L:

1. H.W.T.R. to 60°C gave the highest number and percentages of germinating seeds by softening seed coats.

2. Peat moss treatment gave similar trend as C. didymobotrya or C. goluca this was coincided with the shortest period for germination.

3. GA_3 application at 150 p.p.m. following H.W.T's, L. or H_2SO_4 stimulated seed germination as compared to control.

Cassia fistula, L.:

1. For H.W.T's the shortest period to reach maximum highest number of germinated seeds resulted from soaking in H.W.T, at 95°C followed by cooling. All seeds were injured with H.W.T.R. to 95°C.

2. Treating seeds with H_2SO_4 for 30 minutes raised their percentage of germination to 97.2 % compared with 12 % (control) and this was the best experimental treatment including peat moss treatment. (The period needed for maximum germination was statistically shorter as compared with control).

3. GA_3 treatments after H.W.T's or H_2SO_4 had no great influence on raising germination as compared to the application of H_2SO_4 for 30 minutes.

4. Dry seeds contained the least content of indoles as

7.3 mg/100 gm (D.W.T.). Contents of indoles varied in seedlings between 7.3 to 20.8 mg/100 gm (D.W.T), and the higher contents indicated a relationship between facilitating seed germination and the increased auxin content.

5. After germination, seedlings content of phenols was 4 times as much as in dry seeds. Application of high concentration of GA_3 decreased the content of phenolic compounds in seedlings; such relationship proved that GA_3 promotion acts through inhibiting some phenolic compounds within seeds.

<u>Acacia</u> <u>farnesiana</u>, Willd:

1. H.W.T's gave similar trend to <u>C</u>. <u>fistula</u> although H.W.T.R. to 95°C did not completely injure seed viability.
2. The best germination percentage was attained by soaking seeds for 75 minutes in H_2SO_4.
3. The most promising effect of GA_3 promotion to seed germination was noticed after H_2SO_4 treatment for 30 minutes. The interaction of H_2SO_4 30 minutes x GA_3 150 p.p.m. was significant.

4. Chemical analysis proved that indoles had a minor role in seed germination of A. farnesiana; seedlings contained more indoles and phenols than in dry seeds. The contents flactuated in seedlings with no relationship to increased germination except when GA_3 was applied at high concentration as 150 p.p.m. indoles increased.

5. H_2SO_4 and GA_3 or their combinations had decreased phenols in seedlings especially with treatments which produced relatively higher percentages of germination. Hence, phenols showed a role in germination of A. farnesiana.

Acacia arabica, Willd:

1. H.W.T's.L. at 95°C reflected on the rupture and soffening seed coat layers of A. arabica. resulting in 57.2 % compared to 8 % with control.

2. Dipping seeds of A. arabica in concentrated H_2SO_4 for 45 minutes resulted in the highest number of germinated seeds.

3. Incubating seeds of A. arabica in wet peat moss gave comparatively good results.

4. The best treatment of GA_3 which gave the highest

percentage of germination was GA_3 at 100 p.p.m. following H_2SO_4 (45 minutes) treatment.

5. A positive relationship showed that treatments which increased germination were the same which decreased phenols content in seedlings.

6. H_2SO_4 decreased contents of both indoles and phenols in seedlings compared to controls, GA_3 had a definite role on increasing seed germination of *A. arabica* when the application follow a previous treatment which facilitate water absorption.

Olea europaea, L.

1. H.W.T's and H_2SO_4 and peat moss treatments have not to be practised for the germination of Olive seeds.

2. Both treatments of sodium hydroxide (10 %) for 5 minutes and sodium carbonate (5 %) for 6 hours gave significantly the highest number of germinated seeds for both cvs.

3. Sodium carbonate gave the most rapid germination.

4. GA_3 at 150 p.p.m. following H.W.T's raised seed germination which was still lower than sodium hydroxide and carbonate treatments.

5. No relationship was found between indoles and phenols contents in olive seedlings and germination.

Ficus elastica var. *decora*, Roxb:

1. The best results for rooting terminal cuttings were application of IBA at 5500 p.p.m. for 10 seconds or kinetin at 5 p.p.m. for 3 hrs or kinetin 15 p.p.m. for 1.5 hrs x IBA 5000 p.p.m. for 5 seconds.
2. The middle portion cuttings need to be treated with IBA at 5500 p.p.m. for 10 seconds, kinetin at 5 p.p.m. for 3 hrs or kinetin 10 p.p.m. for 1.5 hrs x IBA 5000 p.p.m. for 5 seconds.
3. As for leaf bud cuttings, the successful rooting can be fulfilled by using IBA at 2000 p.p.m. for 10 seconds, kinetin 1 p.p.m. for 3 hrs. or kinetin 10 p.p.m. for 1.5 hrs x IBA 5000 p.p.m. for 5 second.

Chemical analysis:

In conclusion growth regulaters have great effects on changing biochemical substances since kinetin increased chlorophyll content and permitted more photosynthesis.