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EFFECT OF IBA AND NAA, PLANTING DATE AND TYPE OF CUTTING ON ROOTING POTENTIAL OF TWO *Ficus species*

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ABSTRACT

The present work was conducted at the Experimental Station, Faculty of Agriculture, Cairo Univ. during the two successive seasons; 1998/99 and 1999/2000 on four fixed dates representing the four seasons of the year. Semi-hard and terminal cuttings of *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* were treated by IBA or NAA with five different concentrations; 0,1000,2000,3000 and 4000 ppm. Data were collected on the following characters: rootintg and surrvival percentage, average number and length of adventitious roots per cutting, root fresh and dry weight and root index. The study revealed the following, In both species, IBA treatments caused a pronounced increase in rooting potantial compared with NAA. The highest rooting percentages were achieved with 3000 ppm concentration of both IBA and NAA. Planting cuttings of *Ficus retusa* var. *hawaii* in January (winter) produced the highest rooting percentages, followed by those planted in April (spring), while cuttings planted in July (summer) and October (autumn) showed the lowest rooting percentage.Planting cuttings of *Ficus benjamina* var. *exotica* in April (spring) produced the highest rooting percentage followed by those planted in July (summer), while cuttings planted in January (winter) and October (autumn) showed the lowest rooting percentage. *Ficus retusa* var. *hawaii* semi-hard cuttings produced the highest rooting potential as compared with terminal cuttings. On the contrary, *Ficus benjamina* var. *exotica* terminal cuttings produced the highest rooting percentages as compared to semi-hard cuttings. The normal mortality percentage ranged between 5-7%. The lowest mortality percentages were found at winter planting date and spring planting date for *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica*, respectively.

The highest number of roots per cutting was achieved with 3000 ppm IBA and NAA in both species. Although, all IBA treatments produced a pronounced increase in advantitious root length. In both species NAA assigned concentrations did not cause any significant increase in average length of adventitious roots. The average fresh and dry weight of roots developed on cuttings of both *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* treated with IBA was higher than that treated with NAA. Planting cuttings in winter produced the highest root index in *Ficus retusa* var. *hawaii*. While, the lowest root index was achieved at summer planting date. Planting cuttings in spring produced the highest root index in *Ficus benjamina var. exotica*. While, the lowest root index was obtained at autumn and winter planting dates.

The anatomical study shows that cuttings treated with 3000 ppm IBA activates the cambil initials forming a wider cambial zone which develop a small callus of parenchyma cells which activates the formation of adventatious root premordia.

INTRODUCTION

The genus "*Ficus"* belongs to family *Moraceae;* woody plants, trees, erect shrubs and climbers in great variety in tropical and sub- tropical countries, nearly *2000* species (Bailey, 1969). Two *Ficus* species were

involved in this study, *Ficus benjamina L*. “Exotica “ Java, fig” is native to India and Malaya especially graceful, with slender, arching branches. It is of the most popular evergreen outdoor or indoor plant as well as street trees. It is also used for its medical properties and minor industrial uses. The plants reach 30 ft. height and broadly spreading, shining densely leathery, poparlike leaves of 5 inch long. The plants are grown in the free frost, temperate and sub-tropical regions, wind protected locations in sun or shade. Moreover, the plants are probably the best fig plant for heat tolerance and are used as small trees in entry way or patio, good as espalier or screen.

The other species is known in Egypt as *Ficus hawaii*. Some confusion was found on its identification, where it may be *Ficus retusa*, L. “Indian Laurel” having large evergreen, glabrous leaves broad- ovate to rhomboid- elliptic, aciculate, narrowed at base, 2-4 inch long, petiole 0.5 inch or less long, native to India (Bailey,1961). The Port Jackson fig *Ficus rubiginosa* which is some times known as *Ficus australis* var. *variegata*, has leaves with beautiful cream colored variegation. *Ficus* plants commonly propagated by semi-hard cuttings of which rooting response is greatly affected by the time of taking cuttings. IBA and NAA are widely used growth regulators in the ornamental plant industry to improve plant quality (Deotale *et al*, 1995). Root promoting substances improve the root initiation and enhance rooting ability on cuttings. Rooting ability is relating to, type and concentration of auxin, season of propagation, type of cuttings and the environmental conditions.

The response of *Ficus* plants to growth regulators treatments was studied by Sadiq *et al*., (1991), Still and Zanon (1991), Ferguson *et al*.,(1985) and Kofler *et al*.,(1986). Rooting potentially is commonly affected by planting date Salem (1980) and Souidan *et al*.,(1986). Type of cutting is one of the major factors affecting rooting ability (Pool and Conover,1984), Haggag (1987), El- Malt (1989), El-sayed (1989), Balakrishna and Bhattacharjee (1992) and El-Torky and El-Sennawy (1995).

Response of two *Ficus* species, *Ficus retusa* var. *hawaii* and *Ficus benjamina* L. var.*exotica* to the treatments of IBA and NAA with their different concentrations as well as types of cutting (terminal and semi-hard cutting), in addition to four planting dates (spring, autumn, winter and summer) on rooting potential, vegetative and anatomical characteristics.

MATERIALS AND METHODS

The present work was carried out in two successive seasons; 1998/99 and 1999/2000 in four fixed dates; 10 Th July, 10 th October , 10 th January and 10 th April at the Agriculture Experimental Station, Faculty of Agric.; Cairo Univ. Plant materials were secured from mother stock plant at Orman garden, Giza, Ministry of Agriculture. Where, a uniform cuttings of the two *Ficus* species namely; *Ficus retusa* var. *Hawaii* and *Ficus benjamina* var. *exotica* were used. The cuttings were terminal (10cm long and bearing 3-5 leaves) and semi-hard cuttings (15cm long and bearing 5-7 leaves). Four planting dates summer (July), autumn (October), Winter (January) and Spring

(March), were chosen for studying the effect of planting date on rooting characteristics and histological features of the two *Ficus* species. The growth substances were; IBA {3-indole Butyric Acid 98% and NAA (1-Naphtalene Acetic Acid), at the rate of 0, 1000, 2000, 3000 and 4000 ppm. Cuttings base were dipped for 10 seconds in growth substance solution, and immediately planted individually in plastic pots 6 cm diameter, in filled with planting media containing a mixture of peat-moss and sand (2:1 by volume). The planted cuttings were kept in the greenhouse under plastic tunnels for 30 days, then the tunnels were removed and the plants were kept under green house conditions. The experiment layout was Complete Randomized Block Design (CRBD) with four replicates. Each replicate contained 25 pots for each treatment. (4 reps X 25 plants X 2 growth substance X 5 concentrations X 2 cutting types). Data were recorded on individual plants after 90 days from planting. The following traits were studied: - Rooting percentage, survival percentage, average number of adventitious roots per cutting, average length of adventitious roots, average root fresh and dry weights and root index (weight / length).

The anatomical study was carried out on specimens taken after 15, 30 and 45 days from planting. Specimens of *Ficus retusa* var. *hawaii*, (1cm) long were taken from the cuttings base. These specimens were taken from the untreated and treated cuttings by 3000 ppm IBA that achieved maximum morphological variations from the control. Specimens were killed and fixed for at least 48 hr. in F.A.A(10 ml formalin, 5 ml glacial acetic acid and 85 ml ethyl alcohol 70%). The selected materials were washed in 50 % ethyl alcohol, dehydrated in a normal butyl alcohol series, mbedded in paraffin wax (m.p56 c). Sections, 25 µ thick, were cut using a rotary microtme and stained with crystal violet / erythrosine, cleared in xylene and mounted in Canada balsam (Willey, 1971).

RESULTS

Rooting characters

1-Rooting percentage

Data pertaining rooting percentage in 2 types of cuttings as affected by two growth regulators, IBA and NAA treatments, with four different concentrations. Results revealed are presented in Table 1, planting date caused significant effects on rooting percentages. On the contrary, no significant effects were found due to seasons. IBA treatments retained a pronounced effect on rooting percentage as compared with NAA treatments. As the average rooting percentages of *Ficus retusa* var. *hawaii* were 57.9% and 43.0% for IBA and NAA, respectively. However, the same trend was obtained with *Ficus benjamina* var. *exotica*, as the corresponding average of rooting percentages were 62.3% and 50.9% for IBA and NAA treatments, respectively. It is realized that, comparing with the control, IBA treatments with 3000 ppm produced the highest rooting percentages 83.1% and 84.7% for *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica*, respectively.

Table 1

Regarding the effect of planting date, data proved that in *Ficus retusa* var. hawaii planting cuttings in winter produced the highest rooting percentages. While, cuttings planted in summer showed the lowest rooting percentages. Consequently, the average rooting percentages in *Ficus retusa* var.*hawaii* were 58.45 % and 39.25% for winter and summer planting dates, respectively. It is also evident that, planting cuttings of *Ficus benjamina* var. *exotica* in spring produced the highest rooting percentage followed by those planted in summer, while cuttings planted in winter and autumn showed the lowest rooting percentages. The corresponding values for Ficus *benjamina* were 65.15% and 47.25% in spring and winter planting date respectively.

Concerning the effect of cutting type, data presented in Table (1) illustrate that, *Ficus retusa* var*. hawaii* semi-hard cuttings produced noticeable rooting percentage as compared with terminal cuttings. Regardless growth regulator treatments, the average rooting percentages of semi-hard cuttings was about 24.4% higher than that obtained from terminal cuttings. Conversely, *Ficus benjamina* var. exotica terminal cuttings produced distinguished rooting percentage as compared with semi-hard cuttings. The average rooting percentages were 64.7% and 48.6% for terminal and semi-hard cuttings. It is obvious from the above mentioned results that using growth regulators either IBA or NAA with their different concentrations caused a significant increase in rooting percentage. IBA treatments proved to be more effective for developing roots on cuttings compared with NAA treatments.

2- Survival percentage

The percentage of plants survived up to end of rooting experiment (90 days) compared with their respective percentages of rooted cuttings are presented in Table (2). It is clear that the normal percentage of mortality ranged between 5% to 7%. Analysis of variance of the two successive seasons 1998 and 1999 revealed that both IBA and NAA at their different concentrations as well as seasons did not show significant differences on the mean of survival percentages. On the other hand, type of cuttings as well as planting date show significant differences on the mean of such trait.

Regarding type of cuttings, data presented in Table (2) revealed that plants of *Ficus retusa* var. *hawaii* propagated by semi-hard cuttings showed high survival percentage as compared with those propagated by terminal cuttings, being 49.3% and 39.4% for semi hard and terminal cuttings, respectively. Conversely, plants of *Ficus benjamina* var. *exotica* propagated by terminal cuttings showed higher survival percentage as compared with those resulted from semi-hard cuttings. The corresponding survival percentages were 41.9% and 59.9% in the same order.

With respect to the effects of planting date, it is evident from Table (2) that, in both species, the highest mortality percentages were found at summer planting season. This percentage was 63.9% and 58.52% for *Ficus retusa* var. *hawaii* and *Ficus benjamina* var.*exotica*, respectively. Nevertheless, the lowest mortality percentages were found at winter and spring planting dates for *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica*, respectively, where the average survival percentages were 52.6%

Table 2

and 59.0% for the two species in the same order at winter and spring planting dates, respectively.

3-Average number of roots per cutting

Data presented in Table (3) disclose that, both *Ficus* species, IBA treatments caused pronounced effects on average number of roots compared with NAA treatments. Though, the average number of roots developed on *Ficus retusa* var. *hawaii* cuttings was 8 and 5.8 for IBA and NAA respectively. However, the same trend was obtained with *Ficus benjamina* var. *exotica.* The corresponding averages for such trait were 9.8 and 7.9 for IBA and NAA treatments, respectively. Data given in Table (3) show that, IBA treatments at 3000 ppm produced the highest number of roots per cutting12.2 and 14.9 for *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* respectively. Unlike, 1000 ppm treatments of both IBA (4.6 and 5.9) and NAA (3.4 and 8.1) produced the lowest number of roots per cutting.

Regarding, the effect of sowing date, data shows certain effects on average number of roots, (Table 3). Although, *Ficus retusa* var. hawaii cuttings which were planted in winter produced the highest number of roots per cutting, while those planted at summer were the lowest ones, being 8.1 and 5.5 roots/ cutting for winter and summer, respectively. On the contrary, *Ficus benjamina* var. *exotica* cuttings planted in spring produced the highest average number of roots while those planted at autumn showed the lowest number of roots per cutting being 10.2 and 6.9 roots in spring and autumn planting seasons, respectively.

Concerning the type of cutting effects, data presented in Table (3) illustrate that, *Ficus retusa* var. *hawaii* semi-hard cuttings produced higher number of roots per cutting as compared with terminal cuttings. Regardless to growth regulators treatments, the average rooting percentages of semi-hard cuttings was nearly 25% higher than that obtained from terminal cuttings. Conversely, *Ficus benjamina* var. *exotica,* terminal cuttings produced distinguished rooting percentage as compared with semi-hard cuttings being 9.9 and 7.9 roots for terminal and semi-hard cuttings, respectively.

4- Average length of adventitious roots

Values pertaining the average length of adventitious roots developed on cuttings of *Ficus retusa* var. hawaii and *Ficus benjamina* var. exotica treated by IBA and NAA, as well as planting date and cutting type, are shown in (table, 4). It is evident that IBA treatments produced pronounced significant effects on adventitious root length, while no significant effects were detected due to NAA treatments. All assigned concentrations of IBA caused an increase in the average root length compared with NAA, as the average adventitious root length formed on *Ficus retusa* var*. hawaii* cuttings were 11.64 cm and 8.1 cm for IBA and NAA, respectively. Though, same trend was obtained with *Ficus benjamina* var. exotica, as the corresponding averages for such trait were 14.98 cm and 11.16 cm IBA and NAA treatments, respectively.

Table 3

Table 4

Table (4) discloses that IBA treatments at 3000 ppm produced the longest adventitious roots, 16.1 and 21.6 cm for *Ficus retusa* var.hawaii and *Ficus benjamina* var. exotica respectively. Data in table 4 shows that planting date has remarkable variable effects on the length of adventitious roots. *Ficus retusa* var. hawaii cuttings that were planted in winter produced the longest roots. However, cuttings planted at summer gave the shortest. *Ficus benjamina* var. exotica cuttings planted in spring produced the longest adventitious roots, while those planted at autumn gave the shortest adventitious roots. Subsequently, average lengths of adventitious roots of *Ficus retusa* var. *hawaii* were 11.68 cm and 7.78 cm for winter and summer planting dates, respectively. While, the parallel values for *Ficus bnjamina* var. *exotica* were 14.88 cm and 10.10 cm in spring and autumn planting dates, respectively.

Concerning the type of cutting effects, data presented in Table (4) pointed out that *Ficus retusa* var. *hawaii* plants propagated from semi-hard cuttings produced, the longest adventitious roots compared with those from terminal cuttings, giving average length of adventitious roots of 10.7 cm and 8.7 cm for semi-hard and terminal cuttings, respectively. Conversely, *Ficus benjamina* var.*exotica* terminal cuttings produced long adventitious roots as compared with semi-hard cuttings, being 14.1 cm and 11.50 cm for terminal and semi-hard cuttings, respectively.

5- Root fresh weight (g)

Data concerning the fresh weight of roots developed on cuttings of *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* treated with IBA and NAA at different concentrations and planted in four different seasons are shown in Table (5). Both IBA and NAA significantly enhanced root fresh weight. However, IBA treatments showed the highest root weight as compared with NAA treatments. In *Ficus retusa* var. *hawaii* the average root fresh weights were, 5.2 g and 3.5 g for IBA and NAA, respectively. Same trend was obtained with *Ficus benjamina* var. exotica as the root fresh weights were 6.5 g and 4.4 g in the same order. It is evident from Table (5) that, relative with the control, 3000 ppm IBA or NAA gave the highest root fresh weight in both species as compared with other concentrations, being 8.0 and 4.9 g in *Ficus retusa* var *hawaii* for IBA and NAA, respectively. While in *Ficus benjamina* var. exotica since the corresponding values were 9.7 g and 5.5 g for 3000 ppm IBA and NAA treatments, respectively.

With respect to type of cutting effects, data presented in Table (5) indicate that *Ficus retusa* var. hawaii plants propagated by semi-hard cuttings produced high root fresh weight as compared with those propagated by terminal cuttings giving 5.0 and 3.7 for semi-hard and terminal cuttings, respect regardless of growth regulators effect. In *Ficus benjamina* var. *exotica*, plants propagated by terminal cuttings produced high root fresh weight as compared with semi-hard cuttings being 6.2 g and 4.7 g for terminal and semi-hard cuttings, respectively.

Table 5

Planting season affecting root fresh weight is shown in Table (5). It is evident that planting season has a remarkable effect on root fresh weight of both species under the current investigation. Since planting cuttings in winter produced the highest root fresh weight in *Ficus retusa* var. hawaii. However, *Ficus benjamina* var. exotica showed high root fresh weight at spring planting date. Consequently, the average shoot fresh weight in *Ficus retusa* var. hawaii and *Ficus benjamina* var. exotica were 5.7 g and 6.2 g for winter and spring planting date in the same order. On the other hand, *Ficus retusa* var. hawaii cuttings planted in summer resulted in the lowest root fresh weight, while *Ficus benjamina* var. exotica cuttings planted in autumn showed the lowest root fresh weight.

6- Average root dry weight

The average mean values of dry weight of adventitious roots of both *Ficus retusa* var. hawaii and *Ficus benjamina* var. exotica treated with different concentrations of IBA and NAA, as well as planting date and type of cutting effects in two seasons are presented in Table (6).

Analysis of variance showed that all variants with IBA and NAA, except seasons in both treatments significantly affected the mean values of root dry weight, of both *Ficus retusa* var*. hawaii* and *Ficus benjamina* var. *exotica*.

Data reveal that average root dry weight of *Ficus retusa* var. *hawaii* treated with IBA was significantly higher than those treated with NAA. In both species, 3000 ppm IBA treatments confirmed significant increase in average root dry weight (3.39 and 3.52 g) over the mean values of the control and other examined treatments. The lowest concentration of IBA (1000 ppm) produced the lowest mean values of root dry weight. NAA treatments showed the same trend with low magnitude where, relative to the control, no significant differences were achieved between the control and 1000, 4000ppm NAA treatments.

The outcomes concerning the effect of cutting type, as shown in Table (6) reveal that plants of *Ficus retusa* var. hawaii propagated with semi-hard cuttings produced highly significant root dry weight 1.97 g as compared with those propagated by terminal cuttings 1.69g. On the other hand *Ficus benjamina* var. *exotica* plants propagated by terminal cuttings showed high averages of adventitious roots dry weight (2.13) as compared with those propagated by semi-hard cuttings (1.72).

7- Root index (weight/length)

Root index (Table 7) was used as a criterion to measure growth parameters on number of adventitious roots developed on cuttings of both *Ficus* species. Combined analysis of variance pertaining root index in both species as affected by IBA and NAA treatments, planting date and cutting type produced significant differences. While, no significant effects were found due to seasons.

Data presented in Table (6) disclose that, IBA treatments, in both *Ficus* species, retained pronounced effects on average number of roots as compared with NAA treatments, giving average root index in *Ficus retusa* var.

Table 6

Table 7

hawaii cuttings of 0.428 and 0.422 for IBA and NAA respectively. While in *Ficus benjamina* var. *exotica*, averages were 0.431 and 0.374 for IBA and NAA treatments, respectively. Treatment with 3000 ppm IBA gave the highest root index; 0.490 and 0.455 for *Ficus retusa* var*. hawaii* and *Ficus benjamina* var. *exotica,* respectively. While, 3000 ppm NAA gave root index of 0.473 and 0.410 for two species, respectively. Treatment with 1000 ppm of IBA or NAA gave the lowest root index, being 0.395 and 0.393 in *Ficus retusa* var*. hawaii* and 0.390 and 0.350 in *Ficus benjamina* var. *exotica.*

With respect to, the planting season, data show variable effects on root index. Although, *Ficus retusa* var. *hawaii* cuttings, planted in winter produced the highest root index value 0.510. While, Cuttings planted in summer showed the lowest one 0.405. Contrary, *Ficus benjamina* var. *exotica* cuttings planted in spring produced the highest root index value 0.405 while those planted in autumn showed the lowest root index value.

Regarding type of cutting effects, *Ficus retusa* var. *hawaii* propagated by semi-hard cuttings showed higher root index 0.443 as compared with those propagated by terminal cuttings 0.414. Regardless growth regulator treatments. Conversely, *Ficus benjamina* var.*exotica* terminal cuttings produced distinguished rooting index 0.410 as compared with semi-hard cuttings 0.390.

Anatomical studies

Untreated cuttings of *Ficus retusa* var *hawaii* and those treated with 3000 ppm IBA as shown in transverse sections through the basal end cuttings are presented in Fig.1(a,b and c). Serial tissues are clearly arranged as follows; periderm, cortex, phloem, xylem and pith. Moreover, it can be noticed that the cortex consists of parenchymatous cells varied in size with comparatively wide intercellular spaces. However, the secondary phloem and secondary xylem are separated by the cambium Fig.(1,a). Strips of cambial cells which were arranged in a complete ring of 3 to 5 layers were defined in untreated cuttings, while it was 6 to 8 layers in 3000 ppm treated cuttings Fig. (1,a&2,a).

It is obvious that, control cuttings showed rooting potentiality since, cells of cambial zone were divided and gave rise to different layers from which the root initials were formed, Fig.(1,b). During the development of an initial, it pushes the phloem to outside direction, Fig.(1,b). Root primordia penetrates the phloem and the cortex zone Fig.(1,c). The adventitious root primordium consequently shows more developing characteristic, its vascular system develops and contacts with the main xylem vessels. Root primordium gradually penetrates the cortex and the epidermis during this developmental stage, then appears on the cutting surface, Fig (1,c). However, an abundant amount of parenchyma cells were developed for callus formation of adventitious roots emergence.

Table (8): Measurements (µ) and counts of histological features in transvere section through rooted cutting of *Ficus retusa* var. hawaii untreated and treated with 3000 ppm IBA

Characters	Untreated	Treated 3000ppm
Thickness of periderm (µ)	76.8	89.4
Thickness of cortex (µ)	254.5	198.3
Thickness of phloem (µ)	136.7	162.2
Thickness of cambial zone (µ)	83.3	122.8
Averge diameter of vessels	37.8	48.6
Number of layers of cambial	3 - 5	6 - 8
Thickness of Xylem (µ)	658.8	744.1
Pith diameter (µ)	1150.3	1210.3

Measurements (µ) and counts of transvere section through rooted cutting of *Ficus retusa* var. *hawaii* treated with 3000 ppm IBA are shown in Table (8) and Fig.2 (a,b &c). It is obvious that, periderm tissue developed on treated cuttings was more thickned by 16.4% than the untreated cuttings. However, cortex tissues appears to be less thick compring with the cortex of untreted cuttings. Moreover, the cambial zone of the treated cuttings was comparatively wider 6-8 layers as compared with the untreated cuttings. However, the average thickness of cambial zone were 83.3 µ and 122.8 µ for untreated and treated cuttings, respectively. In the min time, the average thicknesses of cortex were 254.5 µ and 198.3 µ for the untreated and treated cuttings, respectively. It is implies that IBA treatments increased thickness of secondary xylem by 11.4% and secondry phloem by 19.1%. The increase occurred in number and diameter of xylem vessels was associated with an increase in cambium activities. The increase in thickness of cambial zone was associated with an increase in amounts of small callus parenchymatous cells. This may develop and activate the vascular system connection with the main xylem vessels.

DISCUSSION

Rooting promoter substances IBA and NAA are frequently used for propagating many ornamental plants. Findings, which are presented in this study, indicate that IBA has deep effects on rooting capacity comparing with NAA. As adventitious roots usually develop on stem cuttings of certain plants and IBA usually considered an internal growth substances. While, NAA belongs to external growth materials that do not exist naturally inside the plant. Therefore, cuttings are more responsive to IBA treatments compared to NAA treatments. It is also evident that 3000 ppm IBA seemed to be the most favorable concentration for propagating the two *Ficus* species under investigation. Bhattacharjee and Balakrishna (1983) observed that rooting was significantly greater in all treated cuttings compared with the untreated one. It is proved that root fresh and dry weights of the treated cuttings were higher than that of untreated cuttings. This may be due to the increase occurred in both number and length of adventitious roots developed on

treated cutting. These findings are in accordance with those presented by

Fig 1

Fig 2

Pool and Conover (1984), Davies (1986), Filmer and Leiser (1985), Hagag (1987), El- Malt (1989) and El-sayed (1989).

Propagated *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* plants are commonly propagating by cuttings. Findings presented in this study indicate that semi-hard cuttings are perfectly used for propagated plants of *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* plants are popularly propagated by using terminal cuttings. Propagation of three commercial *Jasminum spp* by 5- node apical or semi- hard wood cuttings. *Jasminum grandiflorum* and *Jasminum sambac* rooted best with a percentage of 98 and 94% respectively, when propagated by apical cuttings while, *jasminum auriculatum* rooted 70% when it was propagated by semi-hard wood cuttings (Jayapal *et.al.,* 1980**)**. These foregoing results support those mentioned by Zakaria (1970), Abou- Dahab *et al*., (1975), El-Gamassy *et al*. (1970) and Salem (1980).

Season of propagation, usually considered the restrictive factor for stem cutting propagation. The ability of cuttings to root was greatly affected by cutting preparation date (Davies *et al*, 1986). Though, *Ficus retusa* var. hawaii gave high rooting percentages in winter. While, *Ficus benjamina* var. exotica gave the highest rooting percentage in spring planting date. The seasonal variation on rooting ability of cuttings of many plants was previously reported by several workers among them Moustafa (1973), Gad (1980), Holloway (1985), Lamont (1985) and Still and Zanon (1991).

Anatomical studies supported rooting ability results. As rooting ability is mainly associated by growth regulator treatments. For this reason 3000 ppm IBA treatment decreased cortex thickness and increased combial activities as well as number cell divisions and amounts of callus tissue. The increse in cambil ctivities may suggest the reson for high rooting ability. Bakr *et al.,* (1977) attributed the variance in rooting of cuttings to the lignified wall of sclerenchyma tissues which are physiological or mechanical barriers to adventitious root formation.

The following protocol could be recommended for propagating *Ficus retusa* var. *hawaii* and *Ficus benjamina* var. *exotica* plants by stem cuttings as shown in the tabulation.

Best type of cutting	Semi –hard	Terminal
Best Planting date	Winter (January)	Spring (April)
Best rooting promoter	IBA	IBA
Best concentration	3000 ppm	3000 ppm

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تأثير الاندول بيوتيرك اسيد والنفثالين أستيك اسد وتاريخ الزراعة ونوع العقلة على قدرة التجذير لنوعين من جنس الفيكس .

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أجرى هذا البحث بغرض تقدير مدى استجابة نوعين من جنس الفيكس للمعاملة بنوعين مختلفين من منظمات النمو (اندول استيك اسد ونفثالين استيك اسد) بخمس جرعات مختلفة (٠ ،١٠٠٠ ،٣٠٠٠، ٢٠٠٠ ،٤٠٠٠جزء فى المليون) مع دراسة تأثير نوع العقلة وميعاد الزراعة على قدرة التجذير والصفات المورفولوجية والصفات التشريحية للجذور الناتجة. وقد تم دراسة الصفات الآتية:- النسبة المئوية للتجذير ،نسبة النباتات الحية، متوسط عدد و طول الجذور الجانبية / عقلة ، الجذر القياسي (الوزن/الطول) و الوزن الطازج والجاف للجذور. وكانت أهم النتائج المتحصل عليها:-

1- سببت معاملات الاندول استيك اسد في كل من النوعين تأثيرات منشطة على نسبة التجذير بالمقارنة بمعاملات النفثالين استيك اسد. وكانت اكبر نسبة تجذير متحصل عليها من المعاملة ٣٠٠٠ جزء فى المليون فى كل من الاندول بيوتريك اسد والنفثالين استيك اسد٠

٢- أعطت العقل المنزرعة فى الشتاء للنوع فيكس هاواى والمنزرعة فى الربيع للنوع فيكس بنجامينا أعلى نسبة تجذير بينما فى الصيف والخريف فى النوع الأول وفى الشتاء والخريف فى النوع الثانى تعطى أقل نسبة تجذير٠

٣- تعطى العقل النصف خشبية فى النوع فيكس هاواى أعلى نسبة تجذير بالمقارنة بالعقل الطرفية وعلى العكس فى الفيكس بنجامينا٠

٤- وجد أن اقل نسبة موت كانت للنباتات الناتجة من العقل المنزرعة فى الشتاء للفيكس هاواى و في الربيع للفيكس بنجامينا٠

٥- أظهرت معاملات الاندول بيوتريك اسد أعلى متوسط لكل من عدد و طول والوزن الجاف و الرطب و معامل الجذر (الوزن/الطول) للجذور الجانبية بالمقارنة بمعاملات النفثالين استيك اسد٠ وأعطت الجرعة ٣٠٠٠جزء فى المليون أعلى متوسط بينما الجرعة ١٠٠٠جزء في المليون أقل متوسط٠

٦- فسرت الدراسة التشريحية قدرة العقل على التجذير مع المعاملة ٣٠٠٠ جزء في المليون أندول بيوتيرك أسد للنوع فيكس هاواى بحدوث نقص في سمك القشرة مع الزيادة في عدد طبقات الكامبيوم مصحوبا بزيادة في نشاط الخلايا المنقسمة مما أدى آلي تكوين خلايا صغيرة الحجم كبداءة للجذور العرضية. وبزيادة انقسام الخلايا البارنشيمية في الاتجاه العمودي للمحور أدى ذلك لحدوث الاتصال الوعائي.

وخلاصة البحث انه يمكن اتباع التوصية آلاتية لضمان أعلى نسبة نباتات متحصل عليها في نبات الفيكس هاواى وهي استخدام عقل نصف الخشبية خلال الشتاء (يناير) مع معاملاتها بالمعاملة ٣٠٠٠جزء في المليون بالا ندول بيوتريك اسد بينما للنوع فيكس بنجامينا فانه ينجح باستخدام العقل الطرفية خلال الربيع (أبريل) مع استخدام المعاملة ٣٠٠٠ جزء في المليون بالا ندول بيوتريك اسد٠