

# Anatomical and physiological studies on vegetative propagation of some vicious fruit trees

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The present study was conducted at the horticultural experiment station at Barrage, Kaliobia governorate during two successive seasons 1982/1983 and 1983/1984. It involved two separate experiments; I- Rooting of peach and pear hardwood cuttings, II- Budding of "Bircher" apple variety on some rootstocks. Experiment I: Rooting of peach and pear hardwood cuttings: Two cultivars of peach: "Litchu" and "Meet-Ghamr", as well as, two varieties of pear "Le-conte" and "Bartlett" were used. The cuttings were prepared from the median part of 1-year-old wood every 15 days interval starting from mid-November till mid-December for peach and from mid-December up to mid-January for pear. In the first season, the cuttings were dipped in growth regulator solutions for 10 seconds of either IBA or NAA at the rates of 1000, 2000, 3000 and 4000 ppm as well as combinations of both IBA and NAA at each concentration. In the second season, the above treatments were exactly repeated except the 4000 ppm level was omitted and replaced by a treatment with 500 ppm IBA combined with 500 ppm NAA. Moreover, other cuttings were dipped in tap water for 10 seconds as a control. The treated cuttings were stored in moist mixture of sand and peat moss (1:1) for a period of thirty days for peach and fifty days for pear then planted in the nursery. In early December, number of survived cuttings at different preparing dates was counted then gently removed and washed with tap water for vegetative measurements. Meanwhile, fresh stem samples from the middle portion of 1-year-old shoots in each date of cutting preparation were taken for the determination of total indoles and total phenols. In the same time, other samples were dried and ground for the estimation of total carbohydrates and total nitrogen. Moreover, other cuttings from each cultivar of both peach and pear were prepared on December, 1st. and January, 1st., respectively. These cuttings were divided into two groups. The first group was treated with 2000 ppm IBA while the second one was left untreated as a control. These cuttings were stored in a media of sand and peat moss (1:1) for thirty days for peach and fifty days for pear then samples were taken 10 days interval starting from the initiation of storage till its termination for the determination of total indoles and total phenols. Furthermore, anatomical studies were carried out on rooting of cuttings. Stem cuttings of each cultivar of both species; peach and pear were prepared in early December and early January, respectively. These cuttings were divided into two groups. The first one were treated with 2000 ppm IBA while the other were left untreated as a control. In both groups, the cuttings were stored in a media of sand and peat moss (1:1) till adventitious roots appeared then samples of cuttings were taken every seven days interval from the second week of storage up to the emergence of adventitious roots on cuttings for anatomical studies. The obtained results revealed that: 1- Peach cuttings responded to either IBA or NAA treatments with highest success when cuttings treated with 2000 ppm level. Nevertheless, these cuttings varied in their response to the date of preparation and was more successful when prepared on early December. Generally, IBA treatments had highest effect in rooting of peach cuttings than the corresponding ones of NAA. 2- IBA+NAA combination treatments stimulated rooting of cuttings mainly 2000 ppm + 2000 ppm level. Cuttings prepared on early December were heavier in their rooting as compared with the other preparing dates. 3- "Litche" peach cultivar cuttings surpassed "Meet-Ghamr" peach in their response and rooting. 4- "Le-conte" pear cuttings responded to either IBA or NAA treatments mainly 2000 ppm concentration with highest effect when prepared on early January. However, NAA treatments were

less in their effect as compared to the corresponding ones of IBA. Similarly, these cuttings were markedly successful when treated with IBA+NAA combination at the rate of 2000 + 2000 ppm on early January. 5-Unfortunately, "Bartlett" cuttings had failed completely to respond to growth regulator treatment used in all preparing dates. 6-Cutting total nitrogen content and carbohydrate to nitrogen ratio were statistically similar in the three preparing dates in both peach cultivars. However, carbohydrate content increased significantly up to early December then decreased slightly till mid-December. 7-Total nitrogen content of cuttings of both pear cultivars in the three dates of preparation did not change significantly in both seasons while total carbohydrates, generally, increased significantly from December, 15th. to January, 1st in both cultivars. In addition, C/N ratio mostly increased in cuttings of both cultivars from mid-December to early January. 8-Total indoles increased in peach cuttings of both varieties from mid-November to mid-December whereas the reverse was true when total phenols were concerned in case of "Litchu" variety. The contrary was observed in total phenols content of "Meet-Ghamr" cuttings. Indoles to phenols ratio increased in "Litchu" peach cuttings from mid-November to mid-December. Such marked increase was not noticed in "Meet-Ghamr" cuttings. 9-Total indoles as well as total indoles to phenols ratio increased markedly and total phenols decreased during the period from mid-December to mid-January in "Le-conte" pear variety. In addition, total indoles, total phenols and total indoles to phenols ratio increased in "Bartlett" cuttings up to early January then decreased slightly afterwards. 10-During storage period, total indoles increased greatly while total phenols decreased in the 2000 ppm IBA treated peach cuttings as compared to untreated ones. On the other hand, the ratio of indoles to phenols increased markedly in both treated and untreated cuttings during storage. However, at the termination of storage, such ratio was higher in "Litchu" peach treated cuttings in respect of untreated ones. The contrary was true for "Meet-Ghamr" cuttings. 11-Total indoles and indoles to phenols ratio increased whereas total phenols decreased during storage in both treated and untreated cuttings of both pear cultivars. 12-Anatomical studies showed that roots of both pear and peach cuttings were initiated from the cambium zone. However, "Bartlett" pear cuttings failed to root due to the presence of scleroid cells which prevent root emergence. 13-From the results, it is easy to conclude that "Litchu" peach cuttings are easier in rooting than "Meet-Ghamr" peach. On the other hand, "Le-conte" pear cuttings are easier in rooting than "Bartlett" pear which failed completely in this regard.

**Experiment II Budding of "Bircher" apple variety on some root-stocks:** One-year-old plants of various rootstocks; Quince A, B, C and Balady apple were planted in February 1983 and 1984 in the nursery. Two hundred plants of each root-stock were planted. In June, only one hundred out of the two hundred plants were shield budded with "Bircher" apple buds while the rest were left to grow on their own roots. After forty days, "the Take" on each root-stock were counted then Take percentage was calculated. In December, forty plants similar in their vigour from either budded or unbudded plants were selected for growth measurements, physiological studies, chemical determinations and anatomical studies. The results showed that: Both Balady apple and quince A rootstocks gave the highest values of "Take" percent and "Brittleness moment" of the bud union of "Bircher" apple while quince C was the least in this respect. Thus, Balady apple seems to be the most compatible rootstock followed by quince A. 2-The most vigorous rootstock was quince A followed by Balady apple while quince C was the lowest root-stock in shoot length and leaf number. The best growth concerning top dry weight was of Balady apple rootstock followed by quince A while the least one was of quince C. 3-Number of leaf stomata was highest in quince A and lowest in Balady apple while the highest transpiration rate was in Balady apple rootstock and quince C was the least in this respect. 4-Number of leaf stomata of budded "Bircher" apple was the highest when grown on quince C while the lowest was on Balady apple rootstock. Transpiration rate was the highest when Balady apple was used while the reverse was true when quince C was concerned. The most invigorating rootstock namely Balady apple had resulted in the lowest stomata number and highest transpiration rate in "Bircher" apple while the most dwarfing rootstock namely quince C had the lowest transpiration rate. 5-The most dwarfing rootstock namely quince C had been characterized by lower carbohydrates content in the stem while the most invigorating rootstocks namely quince A and Balady apple had the highest content of stem carbohydrates. 6-Total carbohydrates in scion stem was the highest on quince A and the lowest on quince C whereas in the

bud union zone total carbohydrates were highest on Balady apple and the lowest on quince B. On the other hand, total carbohydrates in the stock region was the highest in Balady apple and the lowest in quince C. 7- Concerning June leaf nutrients content of various rootstocks used, data indicated that Balady apple had the highest amounts of K, Ca, Mg, Fe and Zn nutrients and the lowest amounts of P. Quince A had leaves with highest amounts of N and Mn and lowest amounts of Zn. On the other, hand the lowest levels of N, K, Ca, Mg, Fe and Mn were existed in leaves of quince C. This rootstock contained in the same time the highest amount of leaf P. 8- As for different nutrients content in leaves of different rootstocks in December, the obtained results showed that Balady apple rootstock had leaves with highest levels of N, K, Ca, Mg, Fe and Mn and the lowest amount of P. Leaves of quince A were richest in N and Zn and poorest in P. Quince C had leaves with lowest amounts of all studied nutrients except P. 9- Leaf nutrients content of "Bircher" apple budded on different rootstocks indicated that Balady apple rootstock, among the other used rootstocks, stimulated N, Ca, Mg, Fe and Zn contents and decreased P and K simultaneously. Quince A increased leaf P, K and Mn and decreased Ca remarkably. Moreover, quince B decreased Zn content more than the other rootstocks. The dwarfing quince C rootstock, induced the lowest contents of N, Mg, Fe and Mn in "Bircher" apple leaves. 10- As for stem nutrients content of unbudded rootstocks, the obtained data indicated that the highest amounts of K, Ca, Fe, Mn and Zn and the lowest levels of N and P existed in stem of Balady apple. Stem of quince A had the highest amount of P and the lowest contents of N and Zn. Quince C was inferior in stem K, Ca, Fe and Zn. Quince C was inferior in stem K, Ca, Fe and Mn contents whereas it was superior in stem N. 11- Concerning budded plants, stem of "Bircher" apple contained the highest amounts of K, Ca, Fe, Mn and Zn and the lowest contents of N and P when grown on Balady apple rootstock. Moreover, quince A decreased stem scion N and Zn contents visually and increased P nutrient sharply. Stem at the bud union zone contained the highest amounts of P, Ca, Fe, Mn and Zn contents when "Bircher" apple budded on Balady apple rootstock. In addition, quince A was the highest stock in N and K contents in this respect. Bud union of quince B was only rich in N content. Quince C rootstock had failed to provide bud union with satisfactory amounts of all studied nutrients except Mg since bud union on this rootstock had the lowest amounts of these nutrients. Beside, the rootstock stem of budded plants (below bud union) had the highest amounts of P, K, Mg, Fe, Mn and Zn and the lowest content of Ca when Balady apple rootstock was used. Quince A, among the other rootstocks, had the highest level of N. Furthermore, stock stem of quince B was higher in Ca and lower in P content. The lowest values of N, K, Mg, Fe, Mn and Zn were noticed in the stock stem of quince C. 12- Anatomical studies disclosed that samples taken 21 days after budding gave best results compared with those taken at earlier dates after budding. Perfect budding union between "Bircher" scion and Balady apple rootstock had occurred after 140 days from budding. Meanwhile, in other rootstocks used in this study (quince A, B and C) such perfect union was not completed because the cells of the flanks disintegrated or the cambium tissue stopped partially during this period and was replaced by air pockets in the union zone. Accordingly, Balady apple rootstock could be considered as the most compatible rootstock for budding "Bircher" apple variety while the reverse was true in case of quince rootstocks used in the present study. Meanwhile, quince A rootstock was more promising as compared with the other quince rootstocks.