Phyuiological studies on malformation in some mango cultivars

Ayman Abdoel-rahman Mahmoud El-kafrawy

This investigation was carried out during three successive years i.e., 1994, 1995 and 1996 on fruitful, budded mango trees of Taymour and Zebda cultivars grown in a private farm located at Kafr El-Soohby village about 20 kms distance from Benha, Qalubia Governorate. The main purpose aimed to throw some light on some factors affecting productivity of such important cultivars through studying their growth habit i.e., growth cycles pertaining their flushing date along the year around and distribution of those sprouted shoots among the tree periphery sides facing the geographical directions (especially North & South) from one hand and their direct reflection on flowering and fruiting aspects or the indirect effect through their influence on the incidence of both vegetative and floral malformation from the other. Moreover, changes in some chemical constituents i.e., leaf mineral composition and shoot terminal bud content of both indoles and phenolic compounds in relation to both tree bearing state and growth cycle were also studied to find out an applicable answer about that question .. is it possible to minimize both malformation and alternate bearing phenomena in mango through application of some mineral nutrition and/or growth regulatorstreatments?Therefore, ten healthy trees from each cultivar were carefully selected in March 1994 as being uniform and representative of both bearing states (on and off-year). In addition, four main branches (limbs) nearly similar in their diameter and equally distributed towards the North and South (2 limbs per each) were carefully selected and tagged on each tree. The differential growth, flowering and fruiting measurementsincluding both vegetative and floral malformation measurements, as well as chemical analysis were carried out as follows :V.1.Vegetative growth measurements :On each tree of both Taymour and Zebda cvs., all newly sprouted shoots (normal or malformed ones) aroze by the four tagged limbs ”main branches were monthly counted starting from April (flushing initiation) until September during both 1994 and 1995 years. Moreover, an average number of the total shoots (both normal and malformed) as well as percentage of malformed ones sprouted during the different months i.e., (April & May); (June, July & August) and (September) for the spring, summer and autumn flushes, respectively were estimated separately per each tagged limb facing either the North or South directions to study the specific effect of both sprouting date and geographical directin, as well as the interaction on the aforesaid two growth measurements.V.2.Flowering measurements :In this regard blooming percentage of sprouted shoots; number of (total & healthy inforescences) and floral malformation expressed either as number or percentage of malformed panicles as well as some panicle characteristics including (inflorescence length, number of both total and perfect flowers per each, sex ratio i.e., perfect flowers : total number of flowers estimated either per the whole inflorescence or its distribution along the panicle axis) all were the various floral measurements investigated in response to the sprouting date (month) of their bearer shoots and the geographical direction (N/S) facing them during the next year of sprouting the labeled shoots i.e., during 1995 and 1996 years.V.3. Measurements of some fruiting aspects :Fruit set percentage and productivity index were the two investigated fruiting measurements in mango trees of both Taymour and Zebda cultivars in response to specific effect of both geographical direction and sprouting date of the inflorescences producer shoots, beside the interaction effect of their combinations according to the following equations :N” of fruitlets (3 weeks after flower opening)a-Fruit set % = x 100N2. of perfect flowersb-Productivity index in response to a

given factor = N2 of induced panicles per each X N' of perfect flowers X fruit set %.V.4. Chemical analysis : V.4.1. Leaf mineral composition :Leaf N,P,K and Zn were determined to study the influence of tree bearing state of both mango cultivars and the growth cycles (Taymour only) on their content.V.4.2. Indoles and phenolic compounds content :Indoles and phenolic compounds content in the November sampled shoot terminal buds of both cultivars were determined in response to tree bearing state and growth cycles.The complete randomized block design with four replications was used. However, data obtained during both seasons were statistically analysed and Duncan's multiple test range was employed.Data obtained during both seasons of study could be summarized as follows :V.1. Vegetative growth measurements :V.1.1. Total number of sprouted shoots :A-Specific effect of sprouting date (growth cycles):Most sprouted shoots were put forth during both spring and summer flushes, while flushing was scarce or completely absent during autumn. Moreover, number of sprouted shoots during summer cycle was significantly higher than the spring cycle with the on-year mango trees (both cvs.), while when trees were in the off-year trend took the other way around especially in 1994 year.B-Specific effect of geographical direction :Data obtained revealed obviously that the total number of sprouted shoots from the southern side of tree periphery in the off-year trees was greater than the northern especially with Taymour cv. However, in the on-year trees the specific effect of direction was not observed.C-Interaction effect :With the on-year trees the southern limbs put forth greater number of shoots during spring flush, while the opposite was true during the summer flush. On the other hand, the southern side of the off-year trees surpassed generally the northern one as both were compared during thesame cycle.V.1.2. Vegetative malformation :Data obtained during both 1994 & 1995 years displayed that Zebda cultivar was so resistant to show any sign of such disorder. However, Taymour cv. was susceptible and its trees were specifically responded to both sprouting date and direction facing their sprouted shoots. Since, theJuly and August sprouted shoots were the most susceptible as exhibited the highest percentage irrespective of the tree bearing state.On the other hand, both geographical directions seemed to be equally the same in this regard.V.2. Flowering measurements :V.2.1. Blooming percentage of sprouted shoots : A-Specific effect of sprouting date :With Taymour mango trees the highest percentage of blooming was always concomitant to the July sprouted shoots. As for Zebda cultivar sprouted shoots during the last month i.e., June 1994 and July 1995 exhibited statistically the highest percentage of blooming next spring of 1995 and 1996 years, respectively.B-Specific effect of geographical direction :Data obtained displayed that the blooming percentage of sprouted shoots in response to geographical direction was not so pronounced toreflect firmer trend.C-Interaction effect :The highest perecentage of blooming was closely related to the June, July and August sprouted shoots from either the northern or sourthern limbs of Taymour trees (especially those of July). However, with Zebda cv. June and July sprouted shoots of both dirrections were the superior during 1995 and 1996 seasons, respectively.V.2.2. Number of total inflorescencesA-Specific effect of shoots sprouting date :It is quite clear that the response of the total number of the induced panicles to the sprouting date took nearly the other way around in comparison with that detected with shoot blooming percentage. Since, the earlier sprouted shoots induced generally the greatest number of inflorescences and continuously decreased by delaying of sprouting date.B-Specific effect of direction :Data revealed that the southern limbs apt to induce higher number of inflorescences than the northern ones, with both mango cultivars.C-Interaction effect :The earliest flush especially of such limbs located on the southern side of mango tree canopy produced the greatest number of panicles thefollowing spring.V.2.3. Floral malformation :1- Number of normal panicles :Data obtained during both seasons declared that the number of normal panicles per each tagged limb was specifically responded to sprouting date, whereas shoots of the earliest flush (April/May) induced significantly the highest number of normal panicles.As for the specific effect of direction, it could be observed generally that the southern limbs exhibited an obvious increase in number of their normal panicles over the northern ones with both cultivars. In addition, specific effects of both investigated factors was clearly reflected on the interaction effect since the earlier sprouted shoots (April/May) ofthe southern limbs exhibited statistically the greatest number of normal panicles.2-Number of malformed panicles :Data obtained during both seasons declared that Zebda trees were too resistant to floral malformation, so that the incidence of such disorder was

completely absent. However, Taymour trees were susceptible to such disorder, whereas the earlier flushes showed the greatest number of malformed panicles, while (May & June) and (July) exhibited the least number during 1995 and 1996 seasons, respectively. On the other hand, specific effect of direction was absent. In addition obtained results regarding the responses to both sprouting date and geographical direction were clearly reflected on the number of malformed panicles, whereas the combination of April or June sprouted shoots showed significantly the highest number during 1995 and 1996 seasons respectively regardless of direction.3-Percentage of floral malformation :Percentage of the malformed panicles followed an opposite trend to that found with the number of malformed panicles regarding the response to sprouting date of inflorescences bearer shoots. Hence the April/May sprouted shoots induced inflorescences with the lowest percentage of malformation. However, the northern side of tree periphery showed significantly higher percentage of floral malformation than the southern one during both seasons. Accordingly, the latest flushes occurred on the northern side of tree canopy showed the highest percentage of floral malformation.V.2.4. Panicle characteristics :Length ”cm.”; number of total and perfect flowers of panicle and sex ratio of either the whole panicle or its portions ”sex distribution” were the 5 studied panicle characteristics. In response to direction and sprouting date of the inflorescences producer shoots.V.2.4.1. Inflorescence length : A-Specific effect of sprouting date :Panicle length of both cultivar was significantly responded to sprouting date of their bearer shoots. However, the delayed sprouted shoots of Taymour cv. especially those of August induced significantly the tallest infloresens, while the reverse was true with Zebda cv., whereas the earlier sprouted shoot (April / May) were the superior.B-Specific effect of geographical direction :Data obtained displayed that both mango cultivars followed a firmer trend which showed that the tallest panicles were always concomitant to the southern side of tree canopy.C-Interaction effect :With Taymour trees the longest panicles were induced by the August sprouted shoots on the southern tree side, while the reverse was true with those of the April / June sprouted shoots facing North. LAs for Zebda trees the tallest inflorescences were induced by April and May sprouted shoots situated toward South.V.2.4.2. Number of total and perfect flowers per panicle :Data obtained during both seasons declared that number of both total and perfect flowers included per a single panicle followed the sametrend regarding their response to the specific and interaction effects of sprouting dates of the inflorescences bearer shoots and geographical direction facing them from one hand. Moreover, such two inflorescence measurements not only were paralleled in their responses when compared each to other, but also they typically followed the same trend of the panicle length as these three panicle characteristic were compared foreach mango cultivar individually.V.2.4.3. Sex ratio of the whole panicle : A- Specific effect of sprouting date :Data obtained during both seasons revealed that both cultivars were not equally responded to sprouting date. With Zebda cultivar the response followed firmer trend could be briefly concluded in superiority of both earlier sprouting dates of each season in this concern. In other words sprouted shoots in (April & May) and (May & June) exhibited significantly the maximum value of sex ratio during 1995 and 1996,respectively.Meanwhile, with Taymour cv. no determined trend could be detected, however the July or June sprouted shoots induced panicles having significantly the highest sex ratio during 1995 and 1996 seasons,respectively.B- Specific effect of geographical direction :Nevertheless, tagged limbs of Zebda mango trees facing the South induced panicles with the highest sex ratio. While, with Taymour cv. differences due to direction was of minor importance.C- Interaction effect :Differences in sex ratio of the whole panicle in response todifferent combinations between sprouting date x geographical direction were so light and could be neglicted in Taymour trees. However, Zebda trees followed firmer trend pointed out that sprouted shoots of May and / or June from the southern side induced panicles with maximum value of sex ratio.V.2.4.4. Sex distribution along panicle’s axis :Sex distribution ”sex ratio among various panicle’s portions alongits axis extension” was investigated regarding the specific and interaction effects of flowers locality ”panicle’s portions” sprouting date and geographical direction.A-Specific effect of flowers locality : In both mango cultivars sex distribution (sex ratio of variouspanicle’s portions) was significantly increased with the upward direction from the lease to apex.B-Effect of sprouting date : Data obtained revealed generally that June and July sproutedshoots induced panicles with the highest sex ratio while the opposite was

found with latest date in Taymour cv. Meanwhile with Zebda cv. the earlier sprouted shoots i.e April 1995 and June 1996 wee the superior, while June 1995 and July 1996 were the inferior.C-Specific effect of geographical direction : Data obtained displayed that the southern side of tree canopyexceeded statistically the northern one in this respect.V.3. Measurements of some fruiting aspects : V.3.1. Fruit set percentage :A- Specific effect of sprouting date :Data obtained during both seasons of study regarding settingpercentage in relation to the specific effect of sprouting date during which panicles bearer shoots were emerged showed clearly that earliest sprouted shoots during every year were the superior. whereas, April and May sprouted shoots showed the highest fruit set percentage during 1995 and 1996 seasons, respectively regardless of cultivar.B- Specific effect of geographical direction :Data obtained revealed that no determined trend could be detected for two cultivars together, however the northern direction showed a relative increase than southern one for Taymour cv. but the reverse was true with Zebda cv. especially in 1996 season.C-Interaction effect :The panicles produced by the earliest sprouted shoots (April 95 &May 96) regardless of geographical direction showed the highest fruit set%.V.3.2. Productivity index :A-Specific effect of sprouting date :Generally, it could be concluded that the highest value ofproductivity index was always in closed relationship with the earliest sprouting date, i.e, April and May of 1995 & 1996 seasons, respectively except Zebda cv in 1996 whereas the June sprouted shoots were the superior in this concern.B-Specific effect of geographical direction : Data obtained during both seasons proved that the southern side oftree canopy apt to have higher potentiality for cropping ”expressed as productivity index ”rather than northern one.C-Interaction effect : The earlier sprouted shoots especially of the southern side of treecanopy showed statistically the higher tendency for cropping i.e, the productivity index. Such trend was generally found with two mango cvs.V.4. Chemical analysis :V.4.1. Leaf mineral composition :Leaf N,P,K and Zn content in response to bearing state (on / off) and growth cycle were determined during both 1994 and 1995 years ”November”. Data obtained displayed clearly that sampled leaves from the off-year trees of both Taymour and Zebda cvs. Were significantly richer in their N, P, K and Zn contents rather than the analogous ones of the on - year trees. On the other hand the effect of growth cycle was not clear, however leaf N% of the spring flush tended to be higher but the opposite trend was found with P, K and Zn contents for Taymour cv.V.4.2. Indoles and phenolic compounds content :Indoles and phenols content of shoot terminal buds in response to bearing state and growth cycle were investigated in two mango cultivars :A- Indoles content :Terminal buds indoles content was greatly varied from one cultivar to another Zebda Cv. was obviously richer than Taymour., Besides, the response to bearing state was of minor importance in Zebda, while inTaymour the off-year samples were markedly richer than on - year ones. In addition, terminal buds collected from spring flush of Taymour trees tended to exceeded significantly those of the summer flush.B- Phenolic compounds :Obtained data during both 1994 and 1995 seasons regarding the phenolic compounds content of terminal buds in Taymour and Zebda mango trees as influenced by tree bearing state and growth cycles revealed the following :1-Taymour samples were richer than Zebda.2-Total phenols were higher during the on - year for both cultivars.3-The free phenol followed the same trend of total phenols with Taymour regarding the response to bearing state, while in Zebda cv. it took the other way around.4-The response to growth cycle was not clear.