

**PHYSIOLOGICAL AND HISTOLOGICAL
STUDIES ON MANGO FLOWERING**

By

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T H E S I S

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INTRODUCTION

Mango is the third fruit crop in Egypt. The area under mango orchards increased from 14424 feddans in 1955 to 28767 feddans in 1975. At present, Sharkia, Giza, Ismaelia, Qalubia and Behera Governorates are the main growing areas. The average production of different varieties ranged at the last ten years between 1.4 and 5.8 tons.

"Taimour" mango covers about 40 % of the total acreage of mango at Southern Sector of El-Tahreer Province, however, its production is rather below the average (table, 1). It is believed, that the main factors responsible for the crop failure of "Taimour" mango in this area, are the high susceptibility to flowering malformation (1, 2, 15, 23, 24, 36), and the high tendency towards early blooming during winter (89, 90).

Although flowering malformation has been investigated since 1891 (49), the causal agent of this disorder remains unclear, and there is no definite recommendation to control it. On the other hand, some studies (89, 90), recommended pinching the terminal flowering buds of "Taimour" mango at the break stage to stimulate the development of late bloom flush on the decapitated shoots. However, this method seems to be laborious and not practical.

Table (1): Average production per feddan
of "Taimour" mango cultivar at
Southern Sector of El-Tahreer
Province.

Year	Average yield per feddan
1968	100 kg.
1969	028 kg.
1970	093 kg.
1971	424 kg.
1972	204 kg.
1973	098 kg.
1974	225 kg.
1975	178 kg.

The acreage is about 494 feddans.

According to Horticultural Division,
Southern Sector of El-Tahreer Province.

Thus, attention was focused in the present investigation to achieve two goals. Firstly, investigating some morphological, physiological and histological aspects associated with mango flowering malformation ; and the susceptibility of some mango cultivars to this disorder. Secondly, looking for suitable method to delay the early blooming of "Taimour" mango trees. In this respect, some investigators found that spraying GA_3 (30, 58), or urea (33), delayed the time of blooming in mangoes.

REVIEW OF LITERATURE

Flowering and fruiting in mangoes

Mango inflorescence is a pyramidal terminal panicle varies from few inches to 2-3 feet in length and bears perfect and male flowers (11, 67).

The total number of flowers per panicle was found to vary from few hundred to some thousands according to variety, of those, perfect flowers percentage varied from as low as 0.74 % in one variety to about 78 % in another variety (6, 7, 12, 15, 22, 24, 44, 55, 59, 67, 71, 72, 89).

Concerning fruit set and fruiting, many studies revealed that only a small percentage of the perfect flowers was capable of producing fruits. Under normal field conditions, the percentage of fruit setting ranged between 0.5 % and 23 % according to variety (6, 12, 15, 22, 24, 29, 44, 57, 77, 89).

The various factors leading to poor fruit set and fruiting in mangoes were reported to be: Nitrogen depletion, the high proportion of staminate to perfect

flowers, ineffective pollination due to lack of transferring agents, the limited period of stigmatic receptivity, the maturation of stigma before the anther (protogyny), sterility of pollen grains and wet weather causing pollen loss (12, 44, 67, 71, 74, 78, 80, 81). However, the crop failure of many mango varieties was mainly attributed to the flowering malformation (1, 2, 15, 23, 24, 36, 39, 49, 82), and the early blooming (22, 75, 80, 85, 89, 90).

Mango malformation

The first world record of mango flowering malformation was detected by Maries, 1891 in India as quoted by Prasad et al. (49). In Egypt, Ziaiyadi and Serour (87), detected this disorder in 1930 on the vegetative growth of mango trees. However, Tripathi (84), reported that both vegetative and flowering malformation could be considered as symptoms of the same disorder which he called mango malformation. Lately, Prasad et al. (49), described three distinct types of mango malformation; namely, bunchy top or seedlings, vegetative malformation on young and adult trees, and flowering malformation on the floral parts.

Symptomatology :

The chief symptoms of disorder on mango seedlings were reported to be the production of numerous thick vegetative shoots at the growing points, and the whole seedling get stunted. Numerous buds were usually produced at the axils of malformed leaves which failed to attain normal size. In adult trees, vegetative malformation was characterized by the inhibition of the apical dominance which affected orientation and development of the laterals oranges and resulted in the production of numerous small shoots with short internodes. Such shoots generally bore small leafy structure giving an over crowded appearance (16, 23, 24, 49, 83).

On the other hand, flowering malformation was characterized by compact growth of panicle, reduction in length of peduncle, stimulation of male flowers production and high tendency towards branching (1, 2, 15, 18, 23, 24, 26, 49, 82). Furthermore, Attia (5), reported that it was difficult to distinguish between the affected and non affected panicles at time of inflorescence emergence, but later, the affected panicles could be easily detected.

These affected panicles remained on the tree till they were mechanically removed.

The causal agent(s) of malformation :

Although malformation in mangoes has been investigated since, 1891 (49), there is still no fully agreement between workers about the reasons of disorder, thus a complete understanding of the phenomenon is still lacking.

Many entomologists attributed the disorder to some species of mites (5, 45, 47, 51, 57, 70). However, others confirmed that this disorder was not related to mites injury (24, 36, 49).

Some pathologists suggested that the phenomenon of malformation might be of virus origin (3, 31, 47, 56, 58). Others, believed that virus could not be consider the causal agent (8, 24, 45, 49, 70, 86).

Some Indian and Egyptian pathologists attributed the disorder to some species of fusarium, especially Fusarium moniliforme Shield (1, 23, 82, 83). On the contrary, others believed that the disease could not be attributed to any fungus injury (10, 15, 24, 49, 70).

Many physiologists were of opinions that the nutrients might play a role in this disorder (20, 33, 41, 46, 49, 56, 62). However, others believed that the disorder had no relation with the nutritional deficiency and that the disease was not associated with the cultural practices particularly pruning, manuring, and ringing (35, 66, 70, 84).

Recently, it was reported that both vegetative and flowering malformation were linked in some way with the balance of endogenous hormones within mango tree, (2, 16, 25, 48).

Susceptibility of mango varieties to malformation :

Incidence of flowering malformation was found to be associated with some varieties than others. In Egypt, Goshania and Teimour mangoes were found to be the most susceptible ones, followed by Hindy Be Sinnara, Mabrouka and seedling varieties, while Zebda mango was the most resistant variety (1, 36). In India, Singh and Jawanda (60), revealed that the incidence of disorder was linked with some varieties like Alphonse, Pairi, Bombay green, Zafarani and Samarbehist chosa. Jawanda (26), found that

the percentage of malformed shoots varied from 1 to 96 % in the resistant and susceptible varieties, respectively. later, El-Bana (15), found that young trees of "Taimour" and "Zebda" varieties produced lower percentages of malformed inflorescences than the old ones. Budded trees of "Zebda" variety produced higher percentage of malformed inflorescences than the seedling trees. Jawanda (26) and Ibrahim (24), reported that the severity of disorder was higher in the "Off" years than in the "On" years.

Flowering malformation in relation to vegetative growth :

Under West Pakistan conditions, Khan and Khan (34), found that mango shoots destined to bear normal panicles showed normal growth and ultimate leaf area, compared with shoots destined to bear malformed panicles which showed more initial growth, abnormal leaf structure and numerous buds production.

In Egypt, Hassan (22), found that panicles produced by the mid growth cycle (June) of Hindy "El Sinnara", and "Mabrouka" mangoes, were more susceptible to flowering malformation than those produced by the mid late growth cycle (July - August). El-Bana (15), revealed that shoots

which their apical buds produced malformed inflorescences were shorter and thicker than those produced the healthy inflorescences.

Sex expression in relation to flowering malformation :

A high shift towards maleness was detected in the malformed panicles of many mango varieties. Such panicles converted into compact mass of staminate flowers with almost no fruit set and fruiting in either medium or heavy malformation (2, 34, 39, 49). In Langra mango, Khan and Khan (34), found that the percent of perfect flowers was about 4.5 % in the malformed panicle as contrasted with 45.5 % in the normal ones. In Taimour mango, Abou-Hussein et al. (2), reported that malformation completely prevented the production of perfect flowers and highly stimulated the development of male ones. El-Bara (15), found that malformed inflorescences of Taimour mango produced 2.6 % perfect flowers, as compared to 4.0 % in the normal ones.

Nutritional condition of mango tree
in relation to malformation :

Khan and Khan (35) in India, pointed out that too amount of carbohydrates in shoots bearing the malformed