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Effect of Spraying 'Taimour' Mango Trees with Neem and Lemon Grass Oils on Fruit Set.

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ABSTRACT

This investigation was conducted on 'Taimour' Mango cv. (*Mangifera indica* L.) to improve tree productivity through the application of a protective program against powdery mildew and malformation diseases. The protective program included spraying trees (copper oxychloride 3g/ l), (Sulfur 3g/l), (Neem oil 1%) *Azadirachta indica L.*, (lemon grass 1.5%) *Cymbopogon citrates L.* and water as a control through different stages of inflorescence development. Spraying trees with the mentioned materials led to increase in initial fruit set (IFS) and retained fruits no. /panicle (RF) comparing with those of control. The highest significant value IFS was 3.75 of (Neem and lemon grass oils) compared with control was 1.75 .The (RF) was 0.50 of (Neem or/and lemon grass oils) compared with 0.25 of control. The lowest powdery mildew disease severity index (DSI %) and the malformation percentages were 13.60% of lemon grass and 18.17% of Neem oil compared with the control 82.34 and 45.19% respectively. The results indicated the great efficiency of lemon grass oil in the control of mango powdery mildew, while Neem oil was more efficient against mango malformation.

Keywords: Mango fruit set, Neem oil, Lemon grass, powdery mildew, malformation and alternative spray program.

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INTRODUCTION

Mangos (*Mangifera indica* L.) are universally considered one of the finest fruits and are one of the most important fruit crops in tropical and subtropical areas of the world [1]. Mango is one of the most important fruit tree in Egypt. It produces (786.5 tons) of mangos and exports moderate amounts (6538 tons) according to Union of Producers and Exporters of Horticultural Crops (UPEHC, 2012). Organic production has recently increased the demand for environmentally-friendly control programs to eliminate the risk of fungicide and pesticide resistance so it is important to study the alternatives from natural extractions.

Fruit yield can be drastically reduced or even lost due to powdery mildew caused by *Oidium mangiferae* Berthet. It is a widespread disease of leaves, panicles, blossom clusters, and fruit and has been reported from most of the important mango producing countries in the world [2]. It causes the most serious losses when flowering and growth flushes occur during cool, dry conditions [3, 4] The disease can cause yield reductions up to 70% due to its effect on fruit set and development [5, 6] reported that floral malformation caused by *Fusarium mangiferae* is a serious threat to mango cultivation in various countries. cleared two strains of *Fusarium subglutinans* from malformed 'Keitt' and 'Tommy Atkins' mango panicles caused vegetative and floral malformation [7].

The decreasing efficacy of many of the fungicides used to control plant diseases, as well as risks associated with fungicide residues on the leaves and fruit, have highlighted the need for more effective and safer alternative control measures. [8]found that the fungicides also reduced pollen germination and fertility in mango. Effective management of the disease remains a problem. One of the potential methods of reducing the severity of powdery mildew in an environmentally safe manner is the use of natural compounds. Natural compounds are those products which are not produced by synthesis but which occur in nature in mineral salts, plants and biological agents [9]. Tested the efficacy of three natural substances with fungicidal activity (sulpher, soya lecithin, salicylic acid) on chicory and proved the positive role of sulphur in quality and quantity of yield [10].

The best way to ensure success of a disease-management program is to use integrated disease-control measures [11, 12]. Generally, IPM is regarded as the use of environmentally safe practices to reduce the disease incidence and development or use of multiple control tactics integrated into a single pest control strategy [13, 14].For example, different natural products, i.e., biocontrol agents, plant extracts and natural compounds were used as an IPM program to control powdery mildew of greenhouse crops [12, 15, 16] and grape [17-19] found that neem based products viz., neemark (0.3%), nimbicidin (0.3) and neem seed kernel extract (5%) tested against the powdery mildew of rose were effective in suppressing the disease [20] found that Foliar applications with aqueous emulsions of neem oil have been shown to provide effective control of fungal diseases such as powdery mildew of lilac or hydrangea and bean rust without causing damage to the plants.

Currently, there is interest in the use of neem products in integrated pest management strategies [21]. Neem seed extracts have considerable broad-spectrum activity against a number of agricultural pests and pathogens [22, 23]. Neem oil or water extracts of neem cake control soilborne plant pathogens [24, 25] tested the efficacy of three neem extracts (neem seed kernel extracts, neem oil and neem cake extract), leaf extracts of *Prosophis juliflora* and *Ipomoea carnea* against *E. polygoni* in black gram (*Vigna mungo*) in a pot culture experiment. All treatments significantly controlled the disease, neem seed kernel extract (5%) was most efficient in suppressing the disease with increased yields [26] cleared that neem oil and fish emulsion may be increased the resistance of the treated plants to the pathogen causing bacterial spot [27] evaluated the effect of ethanol extracts of five plants [*Azadirachta indica* L. (neem), *Cymbopogon citrates* L. (lemon grass), *Capsicum frutescent* L. (hot chilly),(*Zingiber officinale* L. (ginger), and *Syzygium aromaticum* L.(clove)] on the *Hypomeces squamosus* (Fallen Leaves, Damage Leaf and Visiting Insect) of mango, were sprayed with 0.5% of each extract at weekly intervals for five weeks, with water treatment as control. The plant extracts from neem and chilly showed remarkable reduction in the number of fallen and damaged leaves. Lemon grass and ginger also recorded low insect count. The aim of this experiment to improve productivity of 'Taimour' mango trees through evaluating some alternative spray protective programs against powdery mildew and malformation diseases depending on natural extracts as (Lemon grass and Neem oil) with different chemicals compatible with organic agriculture at different development stages of florescence.

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MATERIALS AND METHODS

This study was carried out on some adult trees of mango cultivars 'Taimour' in the Experimental Farm of the National Research Center, Nubaria, Behura Governorate, Egypt, the trees planted at 4 x 5 m. in sandy soil, age 7 years old were selected for this study. It were received the same cultural practices that are recommended. The experiment had five treatments as in **Table (1)** each treatment applied on four replicates trees (ten florescence/tree), the tree was sprayed with some compounds by alternative order at the different inflorescence development stages as in shown in Fig (1) these included (A) bud-well to bud break stage ; (B) mouse-ear stage – elongation of basal bracts and emergence of inflorescence; (C) protected stage – elongation of inflorescence still protected by bracts; (D) green-colored – further elongation of inflorescence and opening of secondary rachis, flowers still in bud stages; (E) red-colored – final elongation of inflorescence and reddening of rachis; (F) red-open – individual flowers start opening from base; (G) full-bloom – all individual flowers on inflorescence open;(H) fruit-set stage [28, 29]. Trees were sprayed till run-off with approximately 5 liters of spray solution per tree, the Tween 20 were used for solubilizing the oil in the surfactant /water system.The parameters of Initial Fruit Set/ panicle (IFS), retained fruits no./ panicle (RF), Disease severity index (DSI %) and malformation percentage were calculated.

The (DSI %) was recorded on blossom clusters which were naturally infected with powdery mildew were rated for disease severity on a 0–4 scale where 0 no powdery mildew colonies observed on tissue, 1 = 1–10%, 2 = 11–25%, 3 = 26–50% and 4 = 50% area covered by powdery mildew colonies (Reuveni and Reuveni, 1995). The DSI was calculated based on the following formula (Nur Ain Izzati and Abdullah 2008):

$$\text{Disease severity index (DSI)} = \frac{\Sigma(A \times B)}{\Sigma B \times 4} \times 100 \qquad (1)$$

Where:
A – Disease class (0, 1, 2, 3 or 4)
B – Number of plants showing that disease class per treatment

$$\text{The malformation percentage} = \frac{\text{Total no.malformed inflorescence}}{\text{Total inflorescence / tree}} * 100 \qquad (2)$$

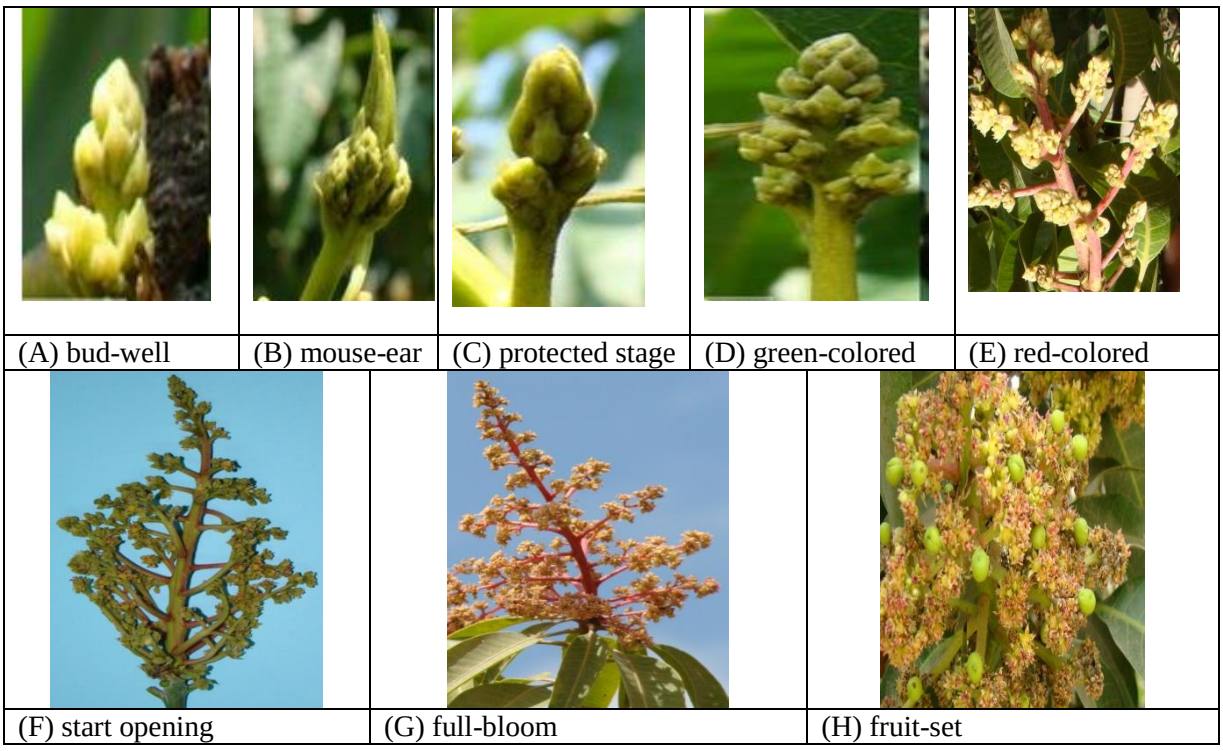

Figure 1: Different inflorescences development stages of 'Taimour' mango

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Table 1: The different spraying programs of some natural compounds at different development stages of Taimour mango inflorescences

Treatments / Stages	T1	T2	T3	T4	Cont.
(A) Bud-well	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Water
(B) Mouse-ear	Neem oil 1%	Neem oil 1%	Lemon grass oil 1.5%		Water
(C) Protected stage	Micro sulfur 3 g/ L	Micro sulfur 3 g/ L	Micro sulfur 3 g/ L	Micro sulfur 3 g/ L	Water
(D) Green-colored	Lemon grass oil 1.5%	Neem oil 1%	Lemon grass oil 1.5%		Water
(E-F) Red colored - start opening	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Water
(G) Full-bloom	Neem oil 1%	Neem oil 1%	Lemon grass oil 1.5%		Water
(H) fruit-set	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Copper oxychloride 3 g/ L	Water

Essential oil

Essential oil of lemon grass was purchased from squeezing and extraction of natural oil unit, National Research Centre, Egypt and neem oil was purchased from Horticulture institute, Agriculture ministry, Giza, Egypt. These essential oil were stored in dark bottles at 4ºC until using.

Experimental Design

A complete randomized design was applied with ten replicates per treatment, each replicate was ten inflorescences.

Data analysis

The mean of the two seasons were subjected to ANOVA and were evaluated by MSTATC program. The differences between means were compared using LSD test at 0.05 levels.

RESULTS AND DISCUSSION

Data as in (Fig. 2) results indicated that using neem oil and lemon grass oil as a foliar spray was highly protective against natural infection by the powdery mildew and malformation diseases in the field conditions. Also had an effect on initial fruit set percentage (IFS %) and retained fruit percentage. The powdery mildew disease severity index (DSI) was 13.60 and 21.11 and 16.72 % of spray with lemon grass oil, Neem oil and the combination of lemon grass oil and neem oil insignificant respectively while DSI of using (Sulfur and Copper oxchloride) and control 68.13 and 82.34% significantly with each other and with natural compounds, also malformation percentages were (18.17, 24.72, 27.06, 27.06 45.19%) of neem oil, (combination of neem oil and lemon grass oil), (Sulfur and Copper oxchloride), lemon grass oil and control significant respectively.

The spray by using lemon grass oil was more effective than spray by neem oil against powdery mildew infection while spray by using neem oil was better than using lemon grass oil against mango malformation; the powdery mildew disease severity index (DSI) was 13.6 % of lemon grass oil while it was 21.11 % of spray Neem oil. The malformation percentage was 18.17 with Neem oil and 30.15 % with lemon grass oil.

The initial fruit set percentage (IFS %) were (3.75, 3.25 and 2.75%) with spray of the combination of (lemon grass oil and Neem oil), lemon grass oil and Neem oil significant respectively while the retained fruit percentage was 0.50 % but it was 0.25% with Sulfur, Copper oxchloride and control.

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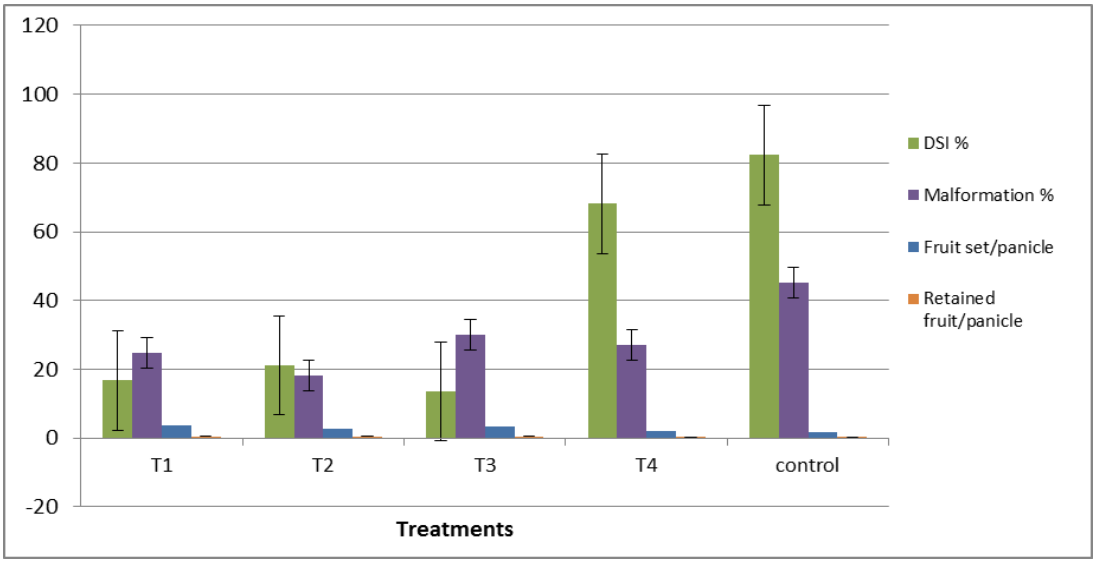

Figure 2: Efficacy of foliar sprays of lemon grass and/or neem oil on powdery mildew, malformation diseases severity, initial fruit set percentage and retained fruit percentage.

Our results agreement with the same results that reported by [30], using neem extracts on cucumber plant reduced the powdery and downy mildews disease severity compared with control [31] tested effect of 21 different plant extracts against powdery mildew of mulberry (*Phyllactinia corylea*) both under in vitro and in vivo conditions and observed that *Azadirachta indica* was the most effective [25] found that neem seed kernel extract (5%) was most efficient in suppressing the disease with increased yields [6] reported that concoction-brewed compost (*Datura stramonium*, *Calotropis gigantean*, *Azadirachta indica* (neem) and cow manure) is effective, inexpensive, easy to prepare and constitutes a sustainable and eco-friendly approach to control floral malformation in mango when it is sprayed at bud break stage and again at fruit stage.

CONCLUSION

The conclusion was the spray with lemon grass oil was more effective than spray by neem oil against powdery mildew infection while spray with neem oil was better than lemon grass oil against mango malformation. The highest significant value IFS was 3.75 of (Neem and lemon grass oils) compared with 1.75 of control. The (RF) was 0.50 of (Neem or/and lemon grass oils) compared with 0.25 of control. The lowest powdery mildew disease severity index (DSI %) and the malformation percentages were 13.60% of lemon grass and 18.17% of Neem oil compared with the control 82.34 and 45.19% respectively. So we can recommend the spray program which combined Neem with lemon grass oil intervals to increase mango yield not only for control the powdery mildew and malformation diseases but also for pests management so it can be used in IPM program of organic agriculture.

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