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Ecological and Preliminary Control Studies of the Citrus Brown Mite *Eutetranychus orientalis* (Klein) (Tetranychidae: Acarina) on Two Citrus Varieties

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ABSTRACT

The population trend of the citrus brown mite *Eutetranychus orientalis* (Klein) was studied on two citrus varieties; Prior Lisbon Lemon and Washington Navel orange trees in the farm of the College of Agriculture. The symptoms of infestation on both leaves and fruits were discussed.

Mite population reached its peak during September and October. The highest amount of leaf drop occurred also in the fall as a result of infestation.

The application of wettable sulphur, and metasystox 'i', singly or in combination had lowered the number of the mite and the amount of leaf drop as compared to the check. However, both pesticides were responsible for the destruction of the natural enemies which allowed the phytophagous mite to increase freely. The wettable sulphur as a nutrient for citrus, had probably encouraged the phytophagous mite to increase. The lowest number of this tetranychid mite occurred when metasystox 'i' was applied alone. However, this organophosphorous compound had not effectively controlled the citrus brown mite.

INTRODUCTION

In Tripoli, many citrus varieties suffer from Autumn leaf drop. This disorder had been reported by Nour-Eldin and Fudl-Allah (9) and Fudl-Allah (5). The exact causal agent had not been identified. Recently many citrus leaves from different localities were examined. Many individuals of a phytophagous mite were found on the upper surface of these leaves. High numbers of this mite had been found on the leaves late in the summer and in the fall when defoliation of the trees and distortion of the fruits occur. This indicated that this phytophagous mite might be the causal agent for this disorder.

The phytophagous mite had been identified as the citrus brown mite *Eutetranychus orientalis* (Klein) by Dr. E. W. Baker from the United States Department of Agriculture. This tetranychid mite is reported here for the first time since it had not been stated by both Damiano (4) and Zavattari (14) in their lists of Libyan fauna.

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The present study demonstrates the seasonal population trend of this mite on two citrus varieties. Additionally, the effectiveness of some pesticides against this pest is investigated.

MATERIALS AND METHODS

The present study was conducted on six years old Prior Lisbon Lemon trees in an orchard located at the experimental farm of Alfateh University in Tripoli, where the spider mite *Eutetranychus orientalis* (Klein) was regularly noticed. Because of the obvious leaf drop occurrence in this orchard for the past years, a pesticide program was initiated in October 1976 for the mite control.

The control experiment included the following four treatments. A check (T_1); 80% wettabe sulphur at the rate of 6 kilograms per 1,000 liters of water as (T_2); metasystox 'i' 25% emulsifiable concentrate at the rate of 1.25 liter per 1,000 liters of water as (T_3); and the fourth treatment (T_4) received both pesticides of T_2 and T_3 with the same rates which were sprayed separately on two following days. The pesticides were applied every 3–4 weeks during the period of October–December 1976 and January 1977 at which time populations of the phytophagous mite and the leaf drop were high. All trees were thoroughly sprayed with a motor sprayer equipped with a spraying gun.

To detect the susceptibility of another citrus variety to this mite species, samples from a Washington Navel orange orchard of the same age and locality were also examined which represented (T_5).

The replicates of each treatment were a group of four trees. From each tree a sample of 10 leaves were picked up randomly and examined by the use of a 25× binocular, weekly or biweekly according to the infestation. Active immature and adult stages were counted.

Lemon and orange fruits were examined to detect the presence of the mite, but no counts were taken.

The trees of the two orchards had normal agricultural practices and balanced fertilization schedule.

RESULTS AND DISCUSSION

In case of the two citrus varieties examined, different stages of the citrus brown mite *Eutetranychus orientalis* (Klein) were usually found on the upper surface of the leaf, especially along the mid-rib. However, during heavy infestation, when the mid-ribs became crowded, few colonies of the mite were found on the edges and the under-surface of the leaf. In winter, all the stages were occasionally noticed on the undersurface of the leaf, probably as a mean of protection from low temperature.

The feeding of this tetranychid mite resulted in discolouration and yellowing of the mid-rib as well as other leaf areas. Later on, the attacked leaves dropped as a result of the continuous feeding of the mite which caused the depletion of chlorophyl and nutrients contents from its tissues.

During heavy infestation different stages of the mite were found feeding on lemon and orange fruits causing their discolouration and distortion. The infested areas of lemon fruits, became dark brown, cracked and infected with unknown microorganisms.

The above mentioned symptoms were usually obvious during the fall, the main season of infestation of both citrus varieties. It had been noticed that more symptoms occurred on the sunny side of the trees probably due to the availability of more soluble carbohydrates for the active stages of the phytophagous mite. Rodrigues (11) and Fudl-

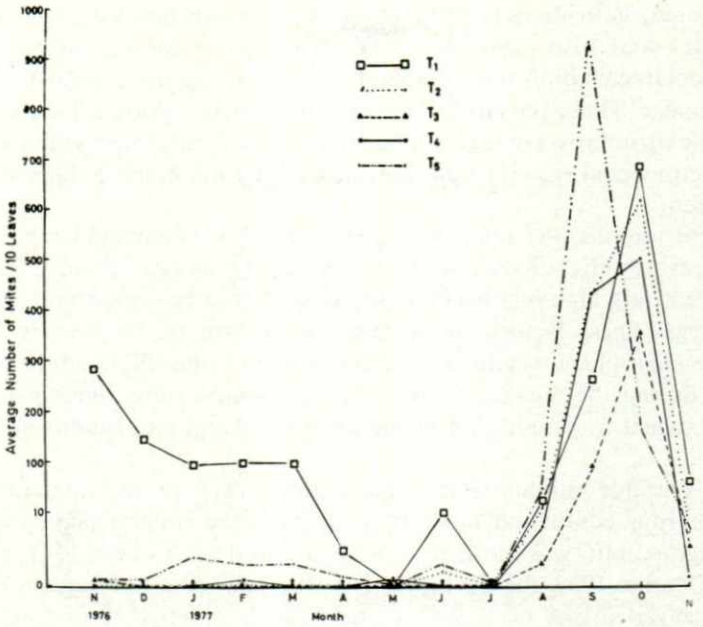

Fig. 1. Population trends of the citrus brown mite *Eutetranychus orientalis* (Klein) on untreated and treated citrus trees, during the indicated months. T_1, untreated Lisbon Lemon trees; T_2, Lisbon Lemon trees treated with sulphur; T_3, Lisbon Lemon trees treated with metasystox 'i'; T_4, Lisbon Lemon trees treated with sulphur and metasystox 'i'; T_5, untreated Washington Navel Orange trees.

*Only one count was reported in November, 1977.

Allah (5) stated also that the symptoms were heavier on the east-facing parts than on the west-facing parts of citrus trees.

The population trends of the phytophagous mite *E. orientalis* (Klein) on untreated and treated lemon trees, and untreated orange trees are shown in Figure 1.

The phytophagous mite populations on the untreated Prior Lisbon Lemon orchard (T_1), had increased gradually during August, September, and October 1977. The moderate temperature which occurred in the last two months encouraged the development and reproduction of the phytophagous mite. There were occasional rain showers, which increased the relative humidity. It is known that comparatively high relative humidity is very important for hatching of tetranychid eggs (7).

The highest populations occurred during October 1977 reaching an average of 684 mites per 10 leaves. During September 1977 the average of the mite population was as low as 256 individuals per 10 leaves. It had been noticed that during this time, there were some predatory mites; eggs and larvae of green lace wings; nymphs and adults of unknown hempteran predatory species; and coccinellid larvae on the leaves of the untreated trees. Consumed dead individuals of the phytophagous mite were noticed which indicated the action of these predators.

In November 1976 the average number was only 280 mites per 10 leaves. This number decreased gradually during the following months of December, January, February and March. This was correlated with the decrease in temperature (Fig. 1).

In April, May and June of 1977, very low number of the active stages of this tetranychid mite was observed. Many eggs were noticed along the mid-rib. During

these months many individuals of predatory mites have been noticed on the leaves. These predatory mites were also identified by Dr. Baker as: *Pronematus saxtoni* Baker, *P. unibiquitus* (McGregor) both from family Tydeidae; *Mediolata cyprius* Gonzales from family Stigmaeidae. Those predatory mites are also newly reported. They are known as predators of the citrus brown mite (1, 10, 12). Members of family Stigmaeidae are known as predators of tetranychid eggs (8). Few individuals, eggs and molting skins of phytoseiids were also present.

During these months, the relative humidity was low, sometimes ranging between 15% and 30%, which might have lowered the percentage of egg hatching. As mentioned before, comparatively high relative humidity is known to be important for hatching of tetranychid eggs. These factors, biotic and abiotic, can be responsible for the low number of the phytophagous mite during this period of time. None of the active stages were noticed during the month of July. The high temperature which sometimes had reached 47°C, acted as a mortality factor for both the phytophagous and predatory mites.

When the wettable sulphur was applied alone (T_2), or in a mixture with the organophosphorous compound metasystox "i" (T_4); the general population trend of the phytophagous mite was close to that of the untreated check (T_1), as shown in Figure 1. In October 1977, the phytophagous mite reached an average of 613 and 494 mites per 10 leaves in case of T_2 and T_4 respectively, whereas during September the average number of mites for both treatments was almost equal. Its average per 10 leaves was 427 mites for T_2 and 425 mites for T_4. These averages are higher than that of the check in the same month which averaged 256 mites per 10 leaves.

Two reasons may explain the increase of the phytophagous mite for treatments T_2 and T_4. On one hand, the pesticides used in both cases were responsible for the destruction of the mite natural enemies. The disappearance of these natural enemies had allowed the phytophagous mite to increase freely reaching these high averages. The same findings had been stated by Dabrowski (3), who stated that application of the wettable sulphur caused a marked increase in the population of the phytophagous mite *Panonychus ulmi* (Koch) on apple trees in Poland because of the destruction of the predatory mites.

On the other hand, it had been concluded by many authors that the tetranychid mites populations are usually correlated with the nutritional level of the host plant (8, 9). The sulphur as a fungicide and an important nutritive element (13), being supplied continuously to the trees of these treatments allowed them to be in a better nutritional condition, and subsequently encouraged the phytophagous mite to increase.

While the wettable sulphur had caused an increase of the citrus brown mite in this study, Coudin and Galves (2) stated that powdered sulphur had provided means of control for the phytophagous mite *Eutetranychus monodi* Audré on citrus in Mauritania.

The lowest population of the phytophagous mite had occured in T_3, where the organophosphorous compound metasystox 'i' was applied alone (Fig. 1). This pesticide was partially able to control the citrus brown mite. The average population of the phytophagous mite was 346 mites per 10 leaves in October. This is lower than those averages of T_1, T_2 and T_4. However, it is relatively high and shows that it is wise not to recommend this pesticide for the control of this pest. The observed dead hemipteran predatory bugs and the disappearance of the predatory mites in this treatment might be also a reason for the high average of the citrus brown mite. These findings agree with those of Dabrowski (3), who stated that metasystox 'i' was responsible for the

destruction of the predatory mites, but the phytophagous mite *Panonychus ulmi* (Koch) did not increase as in case of some other pesticides.

The application of the pesticides in case of treatments T_2, T_3 and T_4 during the infestation season of the year 1976 was responsible for the low number of the phytophagous mite during the months of November till June. The average number of mites during these months ranged between 0.0 and 0.2, mites per 10 leaves as compared to the check which ranged between 0.0–28.0 (Fig. 1). During that period few active stages were noticed on the treated trees, while many eggs were found on the mid-rib of their leaves. The action of the pesticides; the remaining few predatory mites, the low temperature, and the occasional low relative humidity had lowered the number of the phytophagous mite in the period from November to June. The high temperature of July had greatly reduced the populations of these treatments equally with that of the check (T_1). In August, there was a gradual increase in the number of the phytophagous mite for those treatments that received pesticides. This increase was proportionally correlated with the action of the pesticides as explained before.

In case of the Washington Navel orange, which received no pesticides (T_5), the average number of the citrus brown mite was low in November 1976 until July 1977, ranging from 0–4 mites per 10 leaves (Fig. 1). The same biotic and abiotic factors which affected the population for T_1, probably were the limiting factors that caused the low population of T_5. A sudden increase during September occured with an average of 929 mites per 10 leaves. For unknown reasons, this number dropped to 161 mites per 10 leaves in October of the same year.

The Washington Navel orange trees showed the least amount of damage as compared to the Lemon treatments. While a low amount of leaf drop was noticed in case of the former variety, many branches of the untreated lemon trees, the check (T_1), had been highly defoliated. The lemon trees that received the pesticides, T_2, T_3 and T_4 had showed variable amount of defoliation but less than that of the check.

In the first week of November 1977, because the temperature was low, the phytophagous mite decreased in number in all of the treatments, averaging only 0–53 mites per 10 leaves (Fig. 1).

Although a detailed ecological information had been provided in this report, more studies are needed for planning a successful integrated control program on different citrus varieties to prevent the serious damage caused by the citrus brown mite. Maintainance and encouragement of the natural enemies have to be considered.

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دراسات بيئية ومقاومة لحلم الموالح البني ايوتترانيكس اريوتتالس (كلاين) على صنفين من الموالح

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المستخلص

تمت دراسة تعداد حلم الموالح البني ايوتترانيكس اريوتتالس (كلاين) على صنفين من الموالح : ليمون بربر لزين وبرتقال واشنجطن أبو سره في مزرعة كلية الزراعه . نوقشت أعراض الإصابه بهذا الحلم على كل من الأوراق والثمار .

بلغ تعداد الحلم أعلاه خلال شهرى سبتمبر وأكتوبر . وقد بلغت نسبة تساقط الأوراق أعلاها أيضا في فصل الخريف نتيجة للإصابه بهذا الحلم .

وقد نتج عن تطبيق مبيدات الكبريت القابل للبلل والميتا سيستركس كل على حده أو مختلطين التقليل من أعداد الحلم وتساقط الأوراق على الأشجار المعاملة بالمقارنة بتلك الأشجار الغير معاملة . ومع ذلك فقد تسبب عن تطبيق هذه المبيدات قتل الأعداء الحيوية على الأشجار المعاملة مما يساعد الحلم على التزايد بحرية نتيجة لغياب هذه الأعداء . شجع الكبريت القابل للبلل والذى يعتبر كعنصر غذائي للموالح تزايد أعداد الحلم . وقد كان أقل تعداد لهذا الحلم على الموالح عندما تم تطبيق المبيد ميتاسيستركس على حده — ولو أن هذا المبيد العضوى لم يقاوم حلم الموالح البني بالكفاءة المفروضة .