Chapter 3

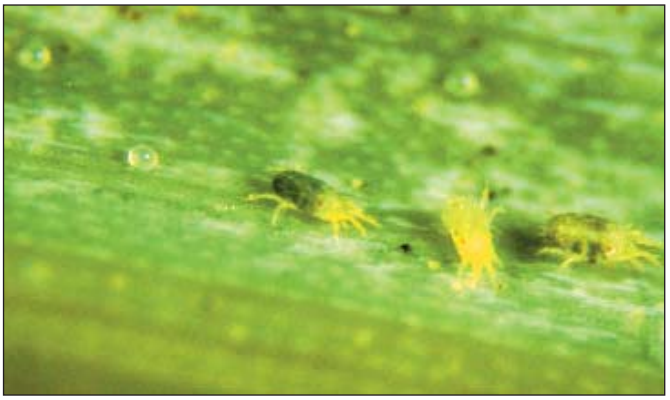
Mite Pests of Date Palm

3 Mite Pests of Date Palm

3.1. Order: Acari

3.1.1. Dust Mite (Old World Date Mite)

***Oligonychus afrasiaticus* (McGregor)**
(Acari: Tetranychidae)



Distribution

About 200 species of Genus *Oligonychus* have been described, including many polyphagous pests of high agricultural and forestry importance. The dust mite, *Oligonychus afrasiaticus*, is one of the most serious pests which attacking date palm. This mite is also called old world date mite and is known as Ghoubar (Arabic: dust) in the Sultanate of Oman and Iraq. The name originated from the fact that this mite covers the infested fruits with web, which retaining dust particles. Thus, the dates and the infested parts appear as if covered by a dust layer. The dust mite is called Bou Faroua (Arabic: with Fur) in Algeria, Ghoubash in Libya and Taka in Mauritania.

The dust mite, *O. afrasiaticus*, is present in all date palm growing areas and is spread and causing severe damage to date palm especially in neglected groves. It is widespread in all the Arabian Gulf Countries: Oman, Bahrain, Kuwait, Saudi Arabia, Qatar, and Iraq. In addition, it spreads in Iran, Yemen, North African countries, e.g. Morocco, Algeria, Tunisia and Libya, as well as it is also recorded in Sudan, Mauritania, Niger, Mali and the United States of America.

Economic Importance

The dust mite, *O. afrasiaticus*, is considered one of the most serious pests infesting date palms, especially those palms

growing in arid areas. It was found that the rate of infestation by the dust mites increases with shortages in irrigation and the lack of care. In some countries, the damage and loss of the crop may reach 80% or more particularly in dry and hot seasons. The different stages of the dust mite (larvae, nymphs and adult mites) feed by injuring the surface of the fruit and sucking the plant sap oozing out of this incision or scratch. Each mite has to scratch the pericarp of the fruit repeatedly to get enough sap.

Generally, the infestation starts from the conical side of the fruit then extends to the other side. That is why the signs of infestation are prominent near the conical side of the fruit, the perianth. The infested fruits are darker in colour, inclined to be reddish especially near the perianth, with the pericarp having a large number of injuries and hard scratches.

It is observed that dust mites prefer feeding on the fruits in their early ripening stages, in Hababouk stage until Khalal stage, and do not prefer to attack dates in Rutab and Tamar stages. As a result the affected fruits do not grow or ripe, many cracks appear on their surfaces changing large areas of their tissue to cork-like structures with hard surface eventually reducing its market value.

In addition the different stages of the dust mite feed on the newly developed date leaflets after the development of the fruits from Khalal to fully ripe Rutab and then to Tamar. The dust mite spins a silk thread like a spider web around the fruits and vegetation parts of the date palm. The web encircles the infested parts of fruits, spikelet and bunches trapping dust and sand particles. As a result the infested fruit bunches appear as if dusted, which gave the mite its name, i.e. dust mite. The presence of this web around the fruit bunches is the key sign of infestation by the dust mite pest, as shown in Fig. 3.1.

In Oman, the dust mite *O. afrasiaticus* migrates from date palm fruits to crown and inner parts of the tree in late August to feed on the new leaflets for about two months or more. Later they move to the area confined between the base of the fronds and the palm fibres, where they remain in small numbers during the winter months until the new crop of the next year. It is also observed that this mite is exclusive to date palm and never infests other plants grown in between date palms, while it is attacks maize, rye grass and other grasses in other countries. In addition, it is found that the infestation of dust mite starts from May and remains all summer season. It is also possible to observe the high infestation in the late varieties, like Al-Jabri, which is severely affected in August, and in Hilali, Khasab and Khalas varieties, which are severely attacked in September.

General Description

The adult mite is white or off-white in colour. The female is 0.3 mm long with rounded end abdomen, while the male is slightly smaller than the female as it is 0.2 mm long with a pointed end abdomen. The egg is spherical, its diameter is 0.12 mm and watery in colour once lay then turns light waxy after one day, that is just before hatching. The larva is green in colour and is 0.15 mm long. It is oval shaped and is characterized by the presence of three pairs of legs. The larva then moults into the nymph stage, which is light yellow or orange in colour and is 0.15-0.20 mm long. It is characterized by having four pairs of legs and has red coloured eyes.


Fig. 3.1. Date fruits cover with web, which retaining dust particles.

Life Cycle

Gharib (1976) in Iran, Hussein (1969) in Iraq and Coudin and Galvez (1976) in Mauritania studied life cycle of the dust mite, *O. afrasiaticus*, extensively. They reported that this species has from 10-12 generations per year in Iran, while in Iraq it has only six overlapping generations per year as illustrated in Table 3.1. It was also found that each female deposits 6-23 eggs with an average of 13 eggs during its lifespan.

The female lays its eggs on the fruits, stalks and the silky web spun around the fruits. The eggs hatch after 2-3 days and light green oval-shaped larvae emerge having three pairs of legs. The larvae start feeding by sucking the plant sap from the fruits and other tissues for about 2-3 days, then rest for 12-24 hours. After the rest period the larva moults to the protonymph (the first nymph stage), which is yellow or green in colour, having four pairs of legs and being bigger than the larva. At this stage, it is easy to distinguish between male and female. The protonymph continues to feed for a day or two then once more rests for 12-24 hours before it moults into deutonymph (the second nymph stage), which is bigger than the protonymph. In turn, the nymph feeds for one or two days and rests once more for 12-24 hours after which it moults and the adult stage emerges to either male or female. It is worth mentioning here that the adult stage of dust mites population are both males and females if they develop from fertilised eggs, while males only develop from unfertilized eggs.

El-Haidari *et al*. (1982) found that the life cycle of *O. afrasiaticus* is shorter under laboratory conditions where it lasted 7, 8, 11 days only under constant temperatures of 25, 30, 35°C, respectively and relative humidity of 55%. They also noticed no development in dust mites under 15-40°C. Hussain (1969) observed that the dust mites had six overlapping generations each year in Iraq in the period between July-September. In addition it was found that the duration of each generation of *O. afrasiaticus* ranged from 15 to 31 days with an average of 24.17 days. Data in Table 3.1 illustrates the duration of the different stage of these six generations, which reported by Hussain (1969).

Susceptibility of Different varieties to Dust Mite Infestation

Some earlier studies clarify that date palm varieties differ in their degree of susceptibility or rather resistance to the dust mite infestation. In Iraq, Hussain (1985) as well as El- Haidari and Al-Hafidh (1986) stated that date palm varieties can be classified according to their susceptibility and resistance to date palm infestation into 3 groups as follows:

1. Susceptible varieties: Khadrawy, Lilawi, Dayri, Hallawy, Breem and Hebhab.
2. Moderately resistant varieties: Zahdi.
3. Relatively resistant: Sayer.

Osman and Abdel Redha (1979) also reported that Barhee variety is the most susceptible variety to dust mite infestation. Hussain (1985) arranged some of the date palm varieties in the Arabian Gulf region according to the severity of infestation and grouped them in similar categories as mentioned above. It was also found that the infestation is rather more severe in dry areas and on palms planted beside dusty roads.

Table 3.1. The duration of the different stages of *O. afrasiaticus*, in the six overlapping generations.

Generation	Egg deposite	Duration of different stages (in days)			Period of generation (in days)
		Incubation period	Duration of Nymphs and larva	Duration of adult	
1st	1st week of July	5	7	16	28
2nd	3rd week of July	4	4	14	22
3rd	4th week of July	3	5	15	23
4th	2nd week of Aug.	4	5	17	26
5th	3rd week of Aug.	3	4	8	15
6th	1st week of Sep.	4	6	21	31
General average		3.83	15.17	5.17	24.17

In Oman, a team of researchers conducted a study on the degrees of resistance of 11 varieties of the Omani date palm varieties to infestation by dust mite, *O. afrasiaticus*. They found that these varieties differ in their degrees of susceptibility and showed that the Damoos variety had a high degree of resistance, while both Hilali and Jabri varieties were very susceptible to dust mite infestation (Anonymous, 1992b). Based on the results of this study it was possible to group these varieties according to their susceptibility to dust mite infestation into five groups as shown in Table 3.2.

Table 3.2. Susceptibility of Omani varieties of date palm to infestation of dust mite, *O. afrasiaticus*.

Group	Date palm variety	Susceptibility to dust mite infestation	
		% of infestation between bunches	Level of infestation
1st Group	Damoos	Nil	----
2nd Group	Fardh	64.5	Low
3rd Group	Umm A'ssila - Madlouki - Zebed Abu Naringa	95 - 100	Low or moderate
4th Group	Khinaizi - Khalas - Barni	100	Moderate or high
5th Group	Hilali - Jabri	100	High

Control Measures

1. Cultural control

- Great care must be exerted to remove the grass and weeds present between the date palms and to remove the fallen fruits to prevent them from becoming a source of infestation in the next year as the infestation rate increases among the neglected date palm trees.
- Planting the date palms at suitable spacing to permit enough ventilation and allow the penetration of sun light in order to keep the relative humidity between the palms as low as possible. A relatively high humidity of 80-85% is considered ideal for the spread of the infestation.
- Regular irrigation especially in arid and very hot seasons because the dry weather and long periods of drought are suitable conditions for outbreak of dust mite.

Generally, an outbreak of mites can be contributed to:

Drought: with very dry and hot weather and irregular watering.

Dust: due to wind or traffic.

Intensive use of pesticides: they all lead to terminating many of the natural enemies of the dust mite.

2. Chemical Control

Before applying any chemical control programme against dust mite, it is very important to give utmost care in inspecting the date palms before fruit set to spot the presence of any form of dust mite. If any found, immediate chemical control should start with one of the recommended Acaricides. In addition, after fruit set they should carefully inspected on short intervals for any sign of infestation and any infested palm should be chemically treated with the suitable Acaricides at 10-15 day intervals.

In Oman it was found that the first appearance of dust mite, *O. afrasiaticus*, infestation is recorded during the months of May-June, thus chemical control should be applied during this critical period. The infested palms can be sprayed with Sulphur (Kumulus DF®) at the rate of 350-400 g per 100 litres of water. Also dusting date bunches early in May with sulphur at the rate of about 100-150 g per palm is effective and reduce the damage of dust mite.

3. Biological Control

Biological control of spider mites has centred on two groups of biological control agents, the predatory mites in the family Phytoseiidae, and various species of Stethorini (McMurtry *et al*., 1970; Helle and Sabelis, 1985; McMurtry and Croft, 1997). The Stethorini are unique among the family Coccinellidae in specializing on mites (principally Tetranychidae) as prey. Within the Stethorini, adults and larvae of *Stethorus* and *Parastethorus* spp. are specialists on spider mites (Tetranychidae) and the closely related Tenuipalpidae, which are known as false spider mites or flat mites.

Within the Stethorini, adults and larvae of *Stethorus gilvifrons* (Mulsant) are considered the most important predators of dust mites, Fig. 3.2. A single larva can devour around 16 mites per day, while the adult can consume around 75-100 mites per day, thus eliminating the number of mites in cases of severe infestation.

In Iran, Afshari *et al*. (2007) studied the geographical distribution and biology of *Stethorus gilvifrons*. They mentioned that under laboratory conditions at 26 ± 1 and 36 ± 1°C mean duration time took 14.6 ± 0.48 and 10.57 ± 0.19 days to develop from egg to adult, respectively. At 26°C, the longevity and feeding rates of *S. gilvifrons* female reared on sugarcane mite *Oligonychus sacchari* were (59.8 ± 5.9 days) and (71.5 ± 7.55 adult mites per day), respectively, that were significantly higher than longevity of males (51.2 ± 6.7 days) and feeding rates with (52.2 ± 5.52 adult mites per day).

In Algeria, Idder and Pintureau (2008) studied the effectiveness of the ladybug *Stethorus punctillum (Weise)* as a predator of date palm dust mite *O. afrasiaticus* (McGregor) in the date palms of the region of Ouargla in Algeria. They mentioned that *S. punctillum* plays an important role in controlling the dust mite, *O. afrasiaticus*.

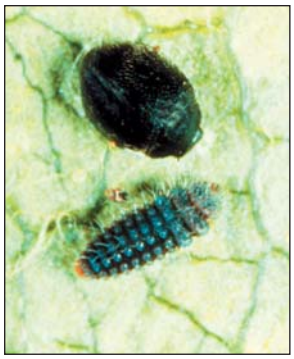
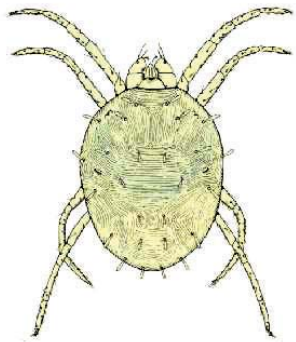


Fig. 3.2. *Stethorus gilvifrons.*

3.1.2. Oriental Red Mite

***Eutetranychus orientalis* Klein**
(Acari: Tetranychidae)



Distribution

Oriental red mite, *Eutetranychus orientalis*, is also known as Citrus Brown mite or oriental spider mite. List of hosts of *E. orientalis* include citrus, date palm, figs, nuts, grapes, quinces, castor, peaches, pears, quinces, sunflowers, sweet potatoes, watermelons, okra and many other plants. Oriental red mite is recorded in many countries as it is present in Afghanistan, Pakistan, Iran, Iraq, Jordan, Kuwait, Palestine, United Arab Emirates, Yemen, Egypt, Libya and Sudan. It was first recorded in the Sultanate of Oman in 1977 by El-Haidari and Al-Tigani.

Economic Importance

The different stages (larvae, nymphs and adults) of the oriental red mite feed on the fruits and green leaves of the date palm by sucking the sap from the under surface of the leaf. The colour of the attacked leaves turns pale yellow with grey patches on the upper surface. The damages of this pest are most obvious in the beginning of the autumn season.

General Description

The adult of *E. orientalis* is approximately 0.5 mm long with colouring ranges from pale brown through brownish-green to dark green with darker spots within the body. The adult females are oval, flattened and larger than the males and their legs are about as long as the body and yellow-brown, while the adult males are elongate and triangular with long legs (leg I about 1.5 x body length). Generally, the egg looks like a kitchen pot. Its cover has a papilla in the centre. The cover swells at hatching. The eggs are pale and become slightly blackish or reddish according to the embryonic growth. Average size of the larva of *E. orientalis* is 0.19 x 0.12 mm. The protonymph is pale-brown to light-green, with legs shorter than the body, average size 0.24 x 0.14 µm. The deutonymph is pale-brown to light-green, average size 0.30 x 0.22 mm, Jepson *et al*. (1975) and Smith-Meyer (1987).

Life Cycle

The females of *E. orientalis* lay their eggs on green leaves and fruits. Each female can lay around eight eggs per day. Jepson *et al*. (1975) reported that in the Middle East, *E. orientalis* females lay about eight eggs per day. In addition, in heavy infestations and during the winter, eggs are laid on both leaf surfaces. The development threshold is 11°C and the thermal constant (when development becomes slower) 26°C. The pre-oviposition period is 1-2 days at 23°C and 4-8 days at 15°C.

It was observed that the female of *E. orientalis* live for 12 days in the summer, 14-18 days in spring and autumn seasons, while they live for 21 days in the winter. Eggs are sensitive to low humidity. It was found that relatively low humidity together with low temperatures cause the high rate of mortality among the eggs, larvae and nymphs of E. orientalis. The optimum conditions for eggs development are 21°C and 59-70% RH, but they will develop at 18-30°C and 35-72% RH.

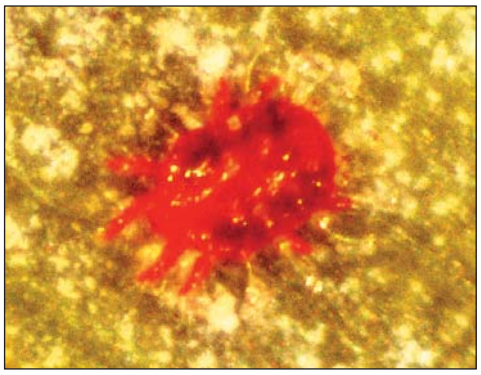
Control Measures

In Oman, the economic damages caused by the oriental red mite, *E. orientalis*, to date palm are not severe enough to warrant activating pest control programmes at present. However, in some places where the infestation is worth fighting, the same pest control measures against dust mites, which are mentioned earlier, can be used.

3.1.3. Red Date Palm Mite

***Raoiella indica* Hirst**

(Acari: Tenuipalpidae)



Distribution

The red date palm mite or scarlet date palm mite, *Raoiella indica* Hirst, is also called coconut red mite, leaflet false spider mite, frond crimson mite or scarlet mite. The common name coconut mite also gives to a species of eriophyid mite, *Aceria guerreronis* Keifer.

It is distributed in many countries in the world and has been recorded in India, Philippines, Mauritius, Reunion, Malaysia, Mauritania, Egypt, Sudan, Iraq, Bahrain, United Arab Emirates and the Sultanate of Oman. The red date palm mite, *R. indica*, is an important pest of coconut, date palms and other palm species, as well as a pest of bananas, beans, and durian in different parts of the world. Welbourn (2006) and Etienne and Fletchman (2006) mentioned that the host plants of *R. indica* is mostly palms followed by plants within the Musaceae and Zingiberaceae.

Economic Importance

The red palm mite, *Raoiella indica*, attacks the date palm leaflets. The larvae, nymphs and adult mites feed on the green leaves, preferring the upper-side of leaflets, by sucking their sap causing spots, which are lighter in colour or even yellow. In severe infestations, they may cause dryness of the infected rachis or fronds. Generally, the infested palm fronds are showing chlorosis and necrosis of the pinnae, which appears to be more pronounced on

basal fronds. The date fruits are also attacked in the green stages only: Kimri and Khalal stages but not in the Rutab and Tamar stages. Although, all stages of the scarlet date palm mite (eggs, larvae, protonymphs and deutonymphs) can be observed during all seasons, the populations of this mite pest increase during spring and autumn seasons.

Kane and Ochoa (2006) observed that in coconuts, the populations of *Raoiella indica* were on the underside of the leaflets, with a higher number on the lower leaves. Mites are located in groups ranging in number from 20 to 300 individuals (eggs, larvae, protonymphs and deutonymphs). There are no data regarding within-plant distribution in other host plants. It is worth mentioning that the scarlet date palm mite does not cause serious economic damages to date palms in Oman.

General Description

The different stages of *Raoiella indica* are scarlet or red in colour. Males and females of *R. indica* were described by Sayed (1942). He mentioned that the adult female of scarlet palm mites is red, typically with dark patches on the body, and about 0.32 mm long. Males are smaller than females and triangular in form. Dorsal setae are present on both sexes.

The body of the red palm mite does not have a striae. The first pair of dorsocentral hysterosomal setae is longer than the others; the fourth pair of dorsosublateral setae is shorter than the first pair. All dorsal body setae are slightly club-like and serrate. The different stages of this mite are scarlet or red in colour. The adult mite is tiny in size as the male is 0.3 mm in length and the female 0.25 mm. There are no visible striae on the body of the adult mite. However, the dorsal spines are slightly swollen and pointed.

Welbourne (2006) stated that the larvae of scarlet palm mites are reddish and sluggish and the minute eggs are oblong, smooth, glistening surface and red and attached to the abaxial leaf surface by a slender stalk in patches of 100-300 eggs and 0.1 mm long, Figs. 3.3 and 3.4.

Life Cycle

Jepson *et al*. (1975) mentioned that the pre-oviposition period of the scarlet date palm mite, *R. indica*, is 3 days in the summer seasons, while it was 7 days during the winter. Each female lay an average of two eggs per day over an average oviposition period of 27 days for about 54 eggs per female. The incubation period for the eggs is around 5 days while the immature stages (the larvae, the protonymphs and deutonymphs) take 17 days in average. Moutia (1958) mentioned that the development of the different stages of *R. indica* is relatively slow in the winter season, hence, the generation period is longer and may last 33 days. In addition, Zaher *et al*. (1969) and Gerson *et al*. (1983) mentioned that the time for development of each stage is egg, 6.1-6.5 days; larva, 5.7-9.5 days; protonymph,

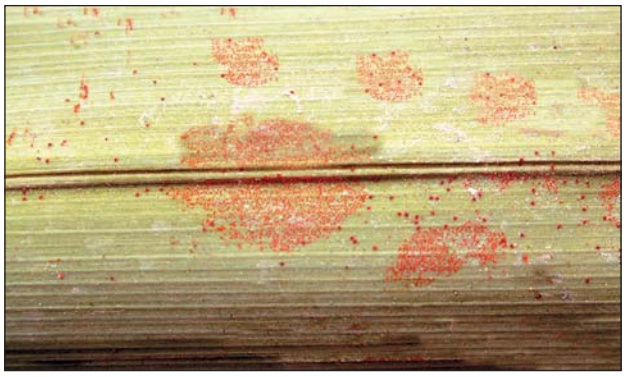


Fig. 3.3. Different stages of scarlet date palm mite, *R. indica*, appear as red spots on leaflet.

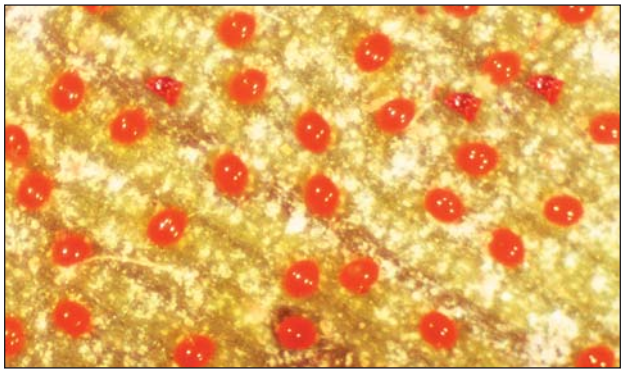


Fig. 3.4. Microscopic photo, showing the eggs and nymphs of scarlet date palm mite, *R. indica.*

5.4-6.5 days; and deutonymph 4.1-10.5 days. Developmental ranges are influenced by temperature, RH and host plant. Thus, the time required to complete the life cycle is 22-33 days. In Oman, it was found that the eggs of the scarlet date palm mite, *R. indica*, start to hatch in the last week of April and the immature stages (larvae and nymphs) start to appear in huge numbers from early May of each year.

Control Measures

1. Chemical Control

In Oman the economic damages caused by the scarlet date palm mite, Raoiella indica, to date palm are not severe enough to warrant activating pest control programmes at present. However, chemical control programmes are used in situations with a high density of the mite when it is affecting date palm in the UAE, Gassouma (2005). In India, the application of Neem oil sprays mixed with Sulfur after a thorough cleaning of the coconut crown showed good results. The extract is sprayed from above, 5 to 6 times per year, and is possible with a sprayer-head attached to a long pole. The application of Neem resulted in a yield increase of 25%.

2. Biological Control

Moutia (1958) observed that in Mauritius the principal predator of *R. indica* in coconut plantations was *Typhlodromus caudatus* Chant (*Amblyseius caudatus* Berlese). Daniel (1981) mentioned that the phytoseiid mite, *Amblyseius channabasavanni* Gupta & Daniel and the Coccinellid beetle, *Stethorus keralicus* Kapur were considered to be the most important predatory species preying on *R. indica*. He added that the females of *A. channabasavanni* were effectively consumed eggs and females of *R. indica*.

In India, Gupta (2001) cites *Amblyseius longispinosus* Evans (Acari: Phytoseiidae) and *Stethorus parcempunctatus* and *Jauravia* sp. (Coleoptera: Coccinellidae) as important natural enemies in the area of Karnanka, while in the area of Kerala the prevalent predators are *A. channabasavannai* and *Stethorus tetranychi* Kapur. Other natural enemies reported preying on *Raoiella indica* in the Caribbean are *Amblyseius largoensis* (Muma) (Acari: Phytoseiidae), *Armascirus taurus* (Kraemer) (Cunaxidae) and *Telsimia ephippiger* Chapin (Coleoptera: Coccinellidae).

3.1.4. False Spider Mite

Tenuipalpus eriophyoides Baker
(Acari: Tenuipalpidae)

Distribution

Baker (1948) described *Tenuipalpus eriophyoides* (*Colopalpus eriophyoides*) on date palm from Iraq. *T. eriophyoides* is known as the False Spider Mite. It is spread in many countries around the world. It was found in Iraq, Bahrain, Kuwait, Saudi Arabia, Oman and many other date palm growing countries.

Economic Importance

The false spider mite, *T. eriophyoides*, causes no obvious economic damages to date palms. It was reported that the rate of infestation with this mite could reach up to 30% on the green palm leaflets, while it is only 1% on the fruits causing no serious economic implications. Hence, there is no need to set a pest control programme against the false spider mite on date palm at present.

General Description

The different stages of the false spider mite, *T. eriophyoides*, are red in colour. The eggs are red in colour, elongated in shape and 0.14 mm long. The female is oval in shape while the male is elongated and resembles the scorpion. The length of body, including rostrum, is 0.4-0.5 mm.

Baker and Tuttle (1972) described the false spider mite, *Tenuipalpus eriophyoides* in details. The general body shape of the female of *T. eriophyoides* is that of a *Brevipalpus* but somewhat narrower. The palpus has three segments, with a single seta on the penultimate segment and two on the distal segment; the stylophore is elongate, narrow; there is a pair of ventral setae on the rostrum. The rostral shield is strongly split and does not cover the rostrum. The three pairs of propodosomal setae are short and narrowly lanceolate, the first pair being the shortest; the dorsomedial area of the propodosoma is without striae. Except for the long, whiplike caudal setae, the hysterosomal setae are similar to those of the propodosoma; the striae are few and longitudinal marginaly except for the area posterior to the second pair of dorsocentral setae; hysterosomal pores are present. The venter is distinctive in that the propodosoma is divided transversely by apodemes between coxae I and between coxae II; posterior to the coxae II apodeme the ventral striae are longitudinal on the propodosoma and hysterosoma. There is a single pair of anterior medioventral setae and four pairs of posterior medioventral setae. The genitoventral plate is entire and possesses the usual number of setae; the striae of the plate are transverse; there appear to be two pairs of anal setae.

The male is very distinctive in having an exaggerated elongate body, especially the opisthosoma. The stylophore is shorter and more rounded than that of the female; the rostral shield is deeply cleft and covers the rostrum. The dorsal body setae are similar to those of the female; the striae are few, weak, and covered with lobes, and are longitudinal as figured. Hysterosomal pores apparently are lacking. The ventral striae are, in general, longitudinal as in the female; there appear to be lateral platelets posteriorly and just anterior to the genital stylets, which are quite enlarged. There are four pairs of posterior medioventral setae.

Life Cycle

Hussain (1967) gave general notes on the biology and damage of *Tenuipalpus eriophyoides*. The adult female mite deposits its eggs on the green palm leaves. In Iraq, Hussain (1985) mentioned that the false spider mite has three overlapping generations each year. It was observed that the false spider mite, *T. eriophyoides*, spends the winter season in hibernation in the form of eggs and adults stages during the first generation. The duration of the three successive generations, 1st, 2nd and 3rd takes about seven months, six weeks and seven weeks, respectively.

3.1.5. Scarlet Date Palm Mite

***Brevipalpus phoenicis* (Geijskes)**
(Acari: Tenuipalpidae)

Distribution

The scarlet date palm mite, *Brevipalpus phoenicis*, is a species of false spider mites. It has different common names as false spider mite, red crevice mite, passion vine mite, scarlet mite, red false mite or flat mite. The first report of a host plant of *B. phoenicis* was *Phoenix* sp. a greenhouse palm by Geijskes (1939).

The scarlet date palm mite, *B. phoenicis*, is polyphagous with an extensive host range, as it infests many fruit trees as well as the date palms. Jepson *et al*. (1975) listed citrus, tea shrubs, coffee, peach, papaya, loquat, coconut palm, apple, pear, guava, olive, fig, walnut, date palm and grape as principal hosts of *B. phoenicis*. He also reported that this mite has a cosmopolitan distribution both in the continental and insular areas and is distributed in the following locations: The Netherlands, Spain, Portugal, Sicily, Italy, Kenya, Tanganyika, Ethiopia, Mauritius, India, Malaysia, Taiwan, Syria, USA (Hawaii, California, Texas, District of Columbia, Florida), Cuba, Trinidad, Argentina, Brazil, Venezuela, Japan (Okinawa), Philippines and Australia. The scarlet date palm mite, *B. phoenicis*, is also widespread and attacking date palm, as it is recorded in Oman, Egypt, Yemen, India, Tanzania and the USA.

Economic Importance

The scarlet date palm mite, *B. phoenicis*, infesting date palm and its different stages feeds on the leaflets by puncturing the leaf epidermis with their chelicerae. The sap that oozes out of the wounded leaf cells is mixed with saliva and imbibed into the digestive tract of the mite. The necrotic spots are visible as a brownish, shaded area on the affected leaflets and the affected area can be seen filled with red coloured eggs and white empty exuviae.

General Description

The colour of the different stages of *B. phoenicis* ranges between orange red to dark red. Haramoto (1969) mentioned that eggs of this mite are elliptical and slightly broadened at one end. When first laid they are light orange, soft and very sticky. The eggs have a stipe, a tail-like projection that extends from the slightly pointed end that came out of the female mite last. A day before hatching, the eggs become opaque white and the red eyes of the larvae are visible within. Larvae have six legs and bright orange-red when newly emerged and average about 0.14 mm long by 0.09 mm wide. When fully-grown they are opaque orange and 0.17 mm long by 0.11 mm wide. The protonymph is larger than the larva, about 0.23 mm long

by 0.14 mm wide, and has eight legs. The outer shell is transparent, light green, orange, black and yellow patches may be seen within the body. The deutonymph is similar in appearance to the protonymph except for having an extra pair of legs, two additional setae (hairs) and being slightly larger, averaging 0.29 mm long by 0.16 mm wide.

The adult female is very small, approximately 0.3 mm long by 0.16 mm wide. The body is elliptical, flat and light to dark green or reddish orange. There are four legs extending forward and four legs extending behind. The adult male is flat, reddish and more wedge shaped than the female.

Life Cycle

Eggs are deposited in cracks, crevices and other protected areas on the plant surface. Although each egg is laid singly, they often occur clustered together because females will use an egg-laying site several times. These clusters of bright reddish orange eggs are more easily seen with the naked eye than any other life stage of the mite.

Zaher *et al*. (1971) mentioned that the number of eggs laid by each female varies with temperature if the relative humidity is held constant. The oviposition process itself takes 12 to 30 minutes. Haramoto (1968) observed that duration of *B. phoenicis* from egg hatch to adult required a minimum of 10.6 days at 30°C and a maximum of 27.3 days at 20°C under laboratory conditions. He also found that the optimum development duration of 19.8 days occurred at 25°C with 70% humidity. On average, adults lived for a maximum of 47 days at 20°C and a minimum of 7.5 days at 30°C with a relative humidity of 85 to 90%. At 25°C, each female laid 1-4 eggs per day for 9 to 35 days.

Although, the scarlet date palm mite, *B. phoenicis*, generally follow the classic pattern of fertilization and subsequent production of male and female progeny, but may also reproduce by parthenogenesis. The unfertilized eggs hatch to give females only. The general mode of reproduction of *B. phoenicis* is thelytokous parthenogenesis (female offspring), and it has a haploid genome. This led Haramoto (1969) to assume that the genetic composition of the mite within an area is fairly uniform. In general, the males in the population of *B. phoenicis* are very few and almost rarely found as the percentage of male is 1 to 1.5% of the population. Whenever possible, the male mites fertilise the one-day aged females and the fertilization lasts for 15-24 minutes. Like other mite species, *B. phoenicis* thrives in the dry weather and long periods of drought, which cause outbreaks in its population and the non-rainy weather increases the population of this mite.

Control Measures

1. Chemical Control

Because this mite reproduces parthenogenetically, as do most other false spider mites, they do not have the genetic variability of most mite species that reproduce sexually. Therefore, resistance to pesticides is less likely to be selected for within a population and is less of a problem. Although, *B. phoenicis* is resistant to certain organophosphates, it is susceptible to most Acaricides. However, resistance may develop if selection pressure is high due to frequent pesticide applications. Hill (1983) recommended that chemical sprays should be applied to affected plants at 2-3 week intervals if the infestation is severe. Any of the registered Acaricides are usually effective. Sulfur has been a widely used pesticide against this pest over a long period in almost all crops affected. Sulfur should not be used in localities where relative humidity is abnormally low. Reisi *et al*. (2003) observed that abamectin and emamectin can be used to control larvae, nymphs and adults of *Brevipalpus phoenicis*. However, abamectin was found to be slightly and moderately noxious to predacious mites, while emamectin was shown to be innocuous and slightly noxious to phytoseiids.

2. Biological Control

Several natural enemies of the scarlet date palm mite, *B. phoenicis*, are known to attack and devour on all stages of this mite. Haramoto (1969) reported four predators of *B. phoenicis* in Hawaii: three predatory mites: *Phytoseiulus*

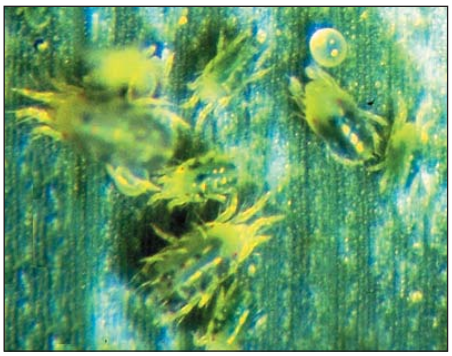
macropilis (Banks), *Amblyseius largoensis* (Muma), *Mexecheles hawaiiensis* (Baker); and the Coccinellid beetle, *Sticholotis punctata* Crotch.

The predatory mites, *P. macropilis* and *A. largoensis* feed on the eggs of *B. phoenicis*, but are not suspected to live and reproduce exclusively on them. The larvae, nymphs and adults of *M. hawaiiensis* attack all active stages of *B. phoenicis* and may survive solely on them. Accounting for 87%, *M. hawaiiensis* is the most abundant predator of this pest in Hawaii. Haramoto (1969) found that the Coccinellid beetle, *Sticholotis punctata* Crotch, which was introduced from China and Japan to control scales, could noticeably control the scarlet date palm mite, *B. phoenicis* and feeds on all stages. It is also noticed that the previous predators generally do not provide economic control because their predatory activity becomes apparent when the prey population density is very high and severe plant damage has already occurred. Therefore, other agents must be introduced for economic control.

3.1.6. New World Date Palm Mite

***Oligonychus pratensis* (Banks)**

(Acari: Tetranychidae)



Distribution

The new world date palm mite, *Oligonychus pratensis*, is also called banks grass mite, banks grass, yellow date palm mite or spider mite. The entomologist Nathan Banks first described it in 1914 in the USA. He recorded this mite on the date palm trees and named it *Tetranychus simplex*. However, in 1955 Pritchard and Baker named it *Oligonychus pratensis* (Banks). This spider mite attacks palm, grasses, sugar cane, beans, sweet potato, cassava, cotton, turf grasses, tomato, cucurbits, onions, garlic, leek, pigeon pea, white corn and yellow maize. The New world date palm mite is widespread in many countries as it was recorded in Morocco, Algeria, Tunisia, Libya, Egypt, Sudan, Mexico, and USA.

Economic Importance

Banks grass mite, *Oligonychus pratensis*, causes great economic damages to the date palm in California state in USA and in some northern African countries. The new world date mite, *O. pratensis*, multiplies rapidly on the unripe dates during the Kimri and Khalal stages and the infestation includes all the inflorescences. The attacked dates are considered of inferior quality and are sold very cheap. It was found that the different stages of this mite (larvae, nymph, and adult forms) attack both the fruits and green leaves all-over the year. It was observed that their numbers decrease during the cold seasons while the infection is most severe in summer. Hussain (1985) was also found that the infestations are scattered on the fruits

and green leaflets and that the damages appear irregularly, asymmetrically and without any particular pattern.

The different stages of *O. pratensis* feed on the sap that oozes out of the wounded leaf cells by making a large number of injuries on the surface of the green leaflets. The larvae, nymphs and adult mites suck the bleeding sap from these incisions. Because of the necrosis of some plant tissues, the colour of these injured site turns white tinted with light black. In the more severe infestations, the attacked site turns pale yellow. In addition, different stages of *O. pratensis* feed on the dates in the kimri and khalal stages and the colour of the affected dates turn to reddish black with noticeable silky threads around the infested fruits. The pericarp of the injured dates become rough and tough and contains many cracks. The fruits do not ripe well and become of inferior quality thus, their market value decreases.

General Description

The adult females of Banks grass mites, *O. pratensis*, are very small, approximately 0.29 mm in length and oval. Its colour is pale yellow or light orange with dark spots on the sides of the body. The male is more like a triangle in shape and coloured as the female but it is smaller, 0.25 mm in length. There are 26 bristles on the back of both the male and female adult mites. They have four pairs of legs and a row of dark spots, brown to reddish brown, on either side of the abdomen extending from near the head to the end of the abdomen. The number and position of the spots are one feature in distinguishing Banks grass mites and two-spotted spider mites.

The egg is spherical in shape and its diameter is 0.13 mm. Its colour is pearly white once laid, then before hatching, it becomes clear as glass and the red spots of the eyes of the larva can be seen through the eggshell.

After hatching, the larva comes out having three pairs of legs and measure 0.15 mm in length. At first, the colour of the larva is the same as the adult female, i.e. pale yellow, but may change later into light green or bright green according to the type of food. The nymph is characterised by its four pairs of legs and its colour is light green or bright green and measures 0.25 mm in length.

Life Cycle

The adult females of *O. pratensis* start depositing their eggs on fruits inflorescence in the Kimri stage during the month of June. The eggs hatch after 2-4 days, the larvae emerge and attacking dates to feed. Shortly after, the larvae moult to the nymphal stage. This mite rapidly multiplies during the months of July and August, while the fruits are in the Kimri and Khalal stages. However, when the fruits enter the Rutab stage, this mite leaves the fruits and stops multiplying on them. Thus, the numbers present on the dates decrease markedly and the mites migrate to the stalk bases, fibrous areas and the white plant tissues present in the crown of the date palm. It is noticed that the larvae, nymphs and adult mites of *O. pratensis* do not escape from the sunrays. However, they escape the high temperature as they hide all the day in the shaded areas of the date inflorescence.

O. pratensis continues to multiply all the year whether on the dates of different varieties, which ripen late or on unfertilized fruits, or green leaves or even grass. It was found that this mite prefers to multiply on Bermuda grass growing in the palm farms in California State in the USA that is why it is called grass mite. It was also reported in California State that *O. pratensis* has a number of generations, which may reach up to 15 generations per year. Each generation takes 8-25 days according to the prevailing temperature.

Susceptibility of Date Palm varieties to Attack

It was found in Iraq that there is a difference in the degree of resistance of date palm varieties to *O. pratensis* infestations. Hussain (1985) mentioned that Khadrawy and Deglet Nour varieties were susceptible whereas, Sayer and Medjool varieties were resistant to the infestation of this mite.

Control Measures

1. Chemical Control

As with the dust mites, sulfur is used to control the yellow date palm mite, *O. pratensis*, by dusting the bunches, once infestation appears. The infested palms can also be sprayed with Sulphur (Kumulus DF®) at the rate of 350-400 g per 100 litres of water. At times, Sulphur use is warranted on date palm, particularly during hot and dry weather. Cultural practices that encourage plant health, such as the avoidance of plant water stress, will reduce the likelihood of Banks grass mite problems.

2. Biological Control

Predatory mites, thrips, and minute pirate bugs often keep Banks grass mites, *O. pratensis*, under control. Have been recorded many natural enemies on Banks grass mite, below is a description of some of the most important of these natural enemies.

Scolothrips sexmaculatus (Pergande) (Thysanoptera: Thripidae)

Six-spotted thrips, *S. sexmaculatus*, spreads in many countries. It is preys on different spider mites including Banks grass mite, *Oligonychus pratensis*. Thrips are tiny, 2-3 mm in length, cigar shaped, slender and has wings long and narrow with long fringes on the margins of their wings. Thrips undergo incomplete metamorphosis, have multiple generations per year, and can be phytophagous or predaceous.

Six-spotted thrips adults can be distinguished from other species by the six black spots on the wings (three on each wing), which cover of the mostly pale-yellow adult, Fig. 3.5. Nymphs are translucent white to yellow and difficult to discern from other thrips species. Adults and larvae are entirely predaceous, feeding most commonly on mites such as *Panonychus ulmi* Koch (the European red spider mite), *Phytonemus pallidus* (Banks) (cyclamen mite) and *Tetranychus* spp.

Six-spotted thrips can rapidly reduce high mite populations, but often don't become numerous until after mites have become abundant and damaging. The adult female of *S. sexmaculatus* lays eggs in the leaves and on hatching the larvae feed on spider mite eggs at an average of 10 eggs per day, while the adults feed on spider mite eggs at the rate of about 60 eggs per day. The lifespan of the adults of *S. sexmaculatus* extends to more than 30 days.

Fig. 3.5. Six-spotted thrips, *Scolothrips sexmaculatus.*

Neoseiulus fallacis Garman (Acari: Phytoseiidae)

One of the main predators recorded on Banks grass mite, *Oligonychus pratensis*, in cornfields, the predatory mite *Neoseiulus fallacis* Garman. The predatory mite *N. fallacis* can feed on Spider mites and in particular *Tetranychus urticae* and *Panonychus ulmi* (Koch). It is found that the female of *N. fallacis* puts its eggs in the centre of a colony of Banks grass mite. On hatching, the larvae of *N. fallacis* feed on the eggs of Banks grass mite, *O. pratensis*, at an average of four eggs per day per larva, while the adult of the predatory mite feeding on Banks grass mite at rate of 15 mites per day.

Stethorus punctum (Leconte) (Coleoptera: Coccinellidae)

The spider mite destroyer, *Stethorus punctum* (Leconte), is known as one of the most important predators of spider mites. It has been found that this Coccinellid beetles could eat about 40 individuals (mites or eggs) per day of Banks grass mite, *O. pratensis*. It is a small beetle about 2 mm long. Female predatory beetle, *S. punctum*, lays its eggs in active colonies of *O. pratensis*, where the eggs hatch after five days and the larvae begin to feed directly on the mites or eggs of Banks grass mite, *O. pratensis*. It is noticed that the female of *S. punctum* could live for a long time, may reach more than one year, where the female lays 750 eggs throughout its lifespan.

Fig. 3.6. Adult of *Stethorus punctum.*

Orius spp. (Hemiptera: Anthocoridae)

In addition to the above, it is found that the flowering bugs, *Orius* spp. could feed on the Banks grass mite, *O. pratensis*. This kind of bugs is small and called "minute pirate bugs". This predatory bug could eat about 30 or more individuals of *O. pratensis* per day. However, as is well known the predatory bug *Orius* spp. is non-specialized predator and feed on eggs of many different insects, it also preys on aphids, thrips, and different species of spider mites, so it may be desirable to sometimes non-existent, because they could feed on the eggs or larvae of other predators.

Neozygites adjarica (Entomophthorales: Neozygitaceae)

Dick *et al*. (1992) described the morphology and biology of the pathogenic fungi, *Neozygites adjarica*, as one of the natural enemies of different spider mites. They observed that *N. adjarica* could decimate natural populations of Banks grass mite, *Oligonychus pratensis*, and two-spotted spider mite, *Tetranychus urticae*, on cornfield and grain sorghum in the western Great Plains of the United States. This is the first description of this pathogen in *O. pratensis*.

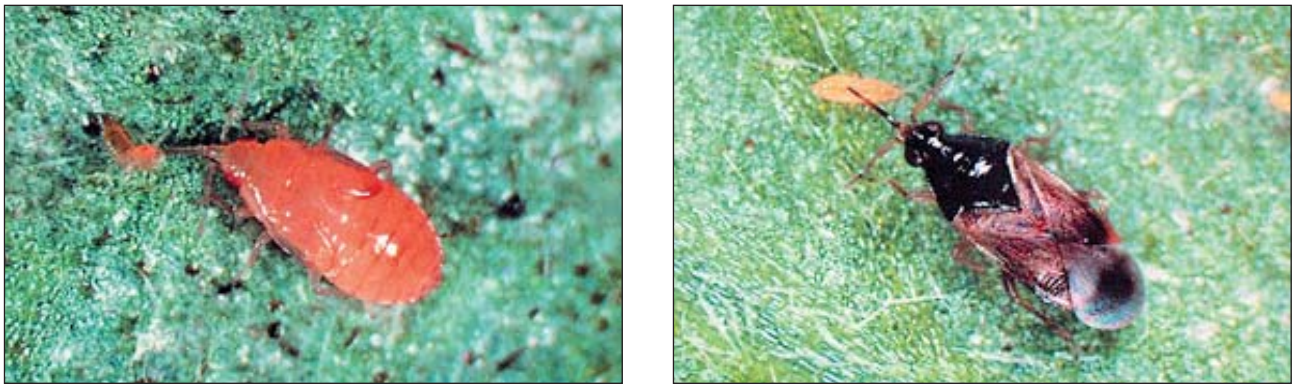


Fig. 3.7. Minute pirate bugs, *Orius pratensis*.