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Research Article

Survey and Taxonomy of Mites Associated with Fruit Orchards Trees from Sakaka Governorate, Kingdom of Saudi Arabia

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ABSTRACT

Fruits are considered one of the important crops in Kingdom of Saudi Arabia, especially palm and olive crops. Several mite species commonly attack fruit orchards trees around the world, phytophagous mites have causing damage to leaves, buds and fruits. This study deals with mites associated with fruit orchards trees (date palm, olive, grape, pomegranate and citrus trees) from Sakaka governorate, Kingdom of Saudi Arabia. The present study had revealed records of 35 species belonging to 29 genera and 20 families. Of which, twenty two mite species inhabiting different habitats were recorded in Sakaka, KSA for the first time in 2015-2016. Mite species were categorized according to their feeding habits into three categories: nine species belong to phytophagous, sixteen species belong to predaceous mites, while the ten species belong to families of different feeding habits, miscellaneous, of the total amount of collected mite species. The present study also showed that the number of mite species associated with date palm was higher in the soil as compared with aerial parts and other host plants, predaceous mites inhabiting date palm were more predominant as compared with phytophagus and miscellaneous species. On the other hand, the mite species recorded on the aerial parts of citrus, grape, pomegranate and olive were higher respectively as compared with the soil mite species, in which phytophagus mites were more predominant on citrus, olive and pomegranate respectively. In grape, phytophagus and predaceous were equal in the number and higher than miscellaneous species.

Key words: Survey, Taxonomy, Mite, Orchards trees, Sakaka, Saudi Arabia

INTRODUCTION

Members of the family Tetranychidae are plant feeders that cause considerable injury to agricultural crops (Zaher, 1984). Sixty species of Tetranychidae have been recorded on citrus in different regions of the world (Migeon and Dorkeld, 2009 and Vacante, 2010). The two-spotted spider mite, *Tetranychus urticae* Koch, feeds on various species of plants and attacks more than 200 host plants. This mite is a very polyphagous pest with a worldwide distribution. It is a major pest of vegetables, ornamentals, fruit trees, etc. (Skorupska, 2004).

The date palm mite *Oligonychus afrasiaticus* (McGregor) is a serious pest of date palm fruits in Saudi Arabia (Talhouk, 1991). Members of the family Tenuipalpidae infest fruit trees, vegetable crops, wood trees, ornamentals and grasses. Mites are usually found on leaves, twigs, buds, flowers, fruits and tree bark (Zaher, 1984). They are usually considered to be secondary pests, but the ability of some species of the genus *Brevipalpus* to vector plant viruses has necessitated an updated review of this relatively little known family (Gerson, 2008).

Gamasida fauna is extremely rich and a considerable number of this group is an efficient biological control agent for mite and insect pests as well as those living on the shoot system (leaves and buds) and known as aerial predators (Wekesa *et al.*, 2007 And Ukabi *et al.*, 2009)

The Laelapid mites are found in several habitats as free-living predators or associated with vertebrates and invertebrates (Faraji and Halliday, 2009).

The Oribatid mites can be found in most terrestrial microhabitats: in soil, leaf litter, moss, underwood, foliage and in aquatic habitats as well, they can be found mostly in great species richness and abundance in their habitats. As this group plays a significant role in soil processes, it is necessary to know its spatial pattern and the causes of pattern generation, which can be used later for indication (Behan-Pelletier, 1999).

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This study deals with mites associated with fruit orchards trees (date palm, olive, grape, pomegranate and citrus trees) from Sakaka governorate, Kingdom of Saudi Arabia. Mites inhabiting orchards trees (soil, stem or trunk fibers, leaves and fruits) studied during 2015 - 2016.

MATERIALS AND METHODS

Data collection

The samples were taken at different locations in Sakaka governorate, Kingdom of Saudi Arabia, monthly during a period from March, 2015 to February, 2016.

Extraction and preparation of soil mite specimens

The samples were taken from soil under date palm, *Phoenix dactylifera* L., olive, *Olea europea* L., grape, *Vitis vinifera* L., pomegranate, *Punica granatum* L., and citrus, *Citrus* spp. trees orchards. Five soil samples were taken from (0-20 cm depth) by rectangle (6x6x8 inch), one Kg /sample, at each location, then were put singly in tightly closed polyethylene bags. In the laboratory, mites were extracted from soil samples using the Berlese-Tullgren funnel extractor (Lasebikan, 1974). Receiving the extraction (mites and other arthropods) in aquatic medium helped in purification and prohibit escaping mites.

Sampling from fruit trees

The samples were collected from ex-fruit trees from the same ex-locations and times. Random samples of the leaves were picked from different trees that could be reached easily by hand then singly kept in tightly closed paper bags. Twenty leaves, some samples from stem or trunk fibers and fruits were randomly collected for each tree species, and then transferred to the laboratory for examination, using a stereomicroscope. A label including all necessary information concerning habitat, locality and date of collection was stuck on each bag. All stages of the mites were counted and recorded (except their eggs).

All extracted mites were then transferred to solution containing ethanol and acetic acid at 9: 1 ratio, sudden death solution, which quickly killed mites and stretched their bodies (Elmoghazy, 2002). After that, mites were transferred to clearing solution such as Nesbitt's solution or lactic acid for a period depending on mite species and inflexible degree. Mite individuals were picked from clearing solution and singly mounted in Hoyer's medium on glass slides and sample data was recorded on each slide. The slides were placed in an oven at 45˚C for 5 days and then the specimens were examined using a light microscope.

Specimens are deposited in the acarology laboratory of the department of Biology, Faculty of Science, Aljouf University, Sakaka governorate, Kingdom of Saudi Arabia.

Mite identification

All the mounted mites were examined under a compound microscope and identified to species level using appropriate taxonomic references.

Statistical analysis

Data of the average numbers of mite individuals in each family and inhabiting different habitats found at each locality were statistically analyzed by using SPSS program (Statistical Package of Social Science) program, version 16.0.0, 2007. To compare the means of mite populations by One-Wey ANOVA ($P<0.05$).

RESULTS AND DISCUSSION

The present study has revealed records of 35 species belonging to 29 genera and 20 families. Of which, twenty two mite species inhabiting different habitats were recorded in Sakaka governorate, Kingdom of Saudi Arabia for the first time in 2015-2016. The mites were collected from samples of date palm, olive, grape, pomegranate and citrus trees orchards (soil, stem or trunk fibers, leaves and fruits) in Sakaka. These mite species belong to two orders and four suborders (Figs. 1, 2).

Mite species were categorized according to their feeding habits into three categories: nine species belong to phytophagous mites and presented 25.71%, sixteen species belong to predaceous mites and presented 45.71%, while the ten species belong to families of different feeding habits, miscellaneous, and representing 28.57% of the total amount of collected mite species (Fig. 3). It was observed that the predaceous mites had highest number found in this study followed by the miscellaneous then phytophagous species. The average of total numbers of mite species were significantly differed between different sites of survey ($P<0.05$).

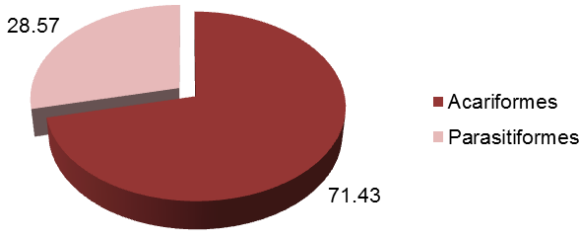

Fig. 1: Percentage of mite species according to taxonomical orders in Sakaka governorate, Kingdon of Saudi Arabia.

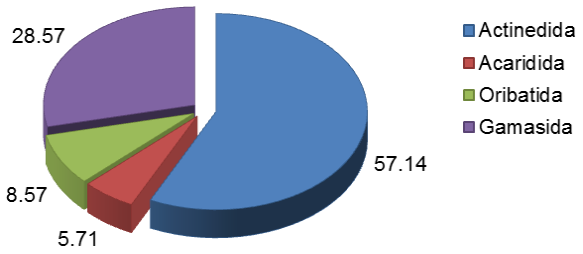

Fig. 2: Percentage of mite species according to taxonomical suborders in Sakaka governorate, Kingdom of Saudi Arabia

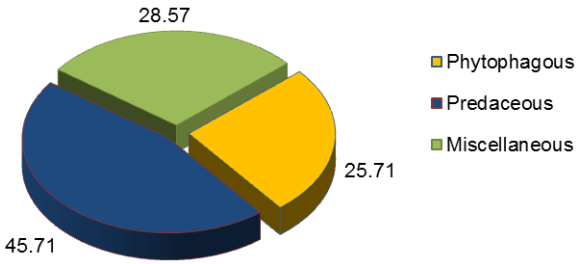

Fig. 3: Percentage of mite species according to feeding habits in Sakaka governorate, Kingdom of Saudi Arabia

Table 1: Taxonomical categories and feeding habits of mite species collected from different locations in Sakaka governorate, Kingdom of Saudi Arabia in 2015-2016

Order: Acariformes			
Suborder	Family	Species	Feeding habits
I- Actinedida	1. Anystidae Oudemans	*Anystis baccarum* (Linnaeus)•	Predaceous
	2. Cunaxidae Thor	*Cunaxa capreolus* (Berlese)•	Predaceous
		Cunaxa sp.	Predaceous
	3. Cheyletidae Leach	*Cheyletus malaccensis* Oudemans•	Predaceous
	4. Eriophyidae Nalepa	*Oxycenus maxwelli* (Keifer)•	Phytophagous
	5. Stigmaeidae Oudemans	*Apostigmaeus navicella* Grandjean	Predaceous
		Stigmaeus sp.•	Predaceous
	6. Tarsonemidae Kramer	*Iponemus* sp.	Miscellaneous
		Steneotarsonemus sp.•	Miscellaneous
	7. Tenuipalpidae Berlese	*Brevipalpus lewisi* (McGregor)•	Phytophagous
		Brevipalpus obovatus Donnadieu	Phytophagous
		Brevipalpus phoenicis (Geijskes)•	Phytophagous
		Tenuipalpus sp.•	Phytophagous
	8. Tetranychidae Donnadieu	*Eutetranychus orientalis* (Klein)•	Phytophagous
		Oligonychus afrasiaticus (McGregor)	Phytophagous
		Oligonychus sp.•	Phytophagous
		Tetranychus urticae Koch	Phytophagous
	9. Tydeidae Kramer	*Brachytydeus* sp.•	Miscellaneous
		Tydeus oregonensis Baker	Miscellaneous
		Tydeus californicus (Banks) •	Miscellaneous
II – Acaridida	1. Acaridae Leach	*Tyrophagus longior* (Gervais)	Miscellaneous
		Tyrophagus putrescentiae Schrank•	Miscellaneous
III- Oribatida	1. Epilohmaniidae Oudemans	*Epilohmannia cylenderica* Berlese	Miscellaneous
	2. Lohmaniidae Berlese	*Lohmannia* sp.	Miscellaneous
	3. Phthiracaridae Perty	*Hoplophthiracarus* sp. •	Miscellaneous
Order: Parasitiformes			
I- Gamasida	1. Asciade Voigts & Oudemans	*Lasioseius* sp.•	Predaceous
	2. Laelapidae Berlese	*Androlaelaps casalis* (Berlese)	Predaceous
	3. Macrochelidae Vitzthum	*Macrocheles muscadomestica* (Scopoli)•	Predaceous
	4. Ologamasidae Ryke	*Gamasiphis* sp.•	Predaceous
	5. Parasitidae Oudemans	*Parasitus* sp.•	Predaceous
	6. Rodacaridae Oudemans	*Rodacarus* sp.	Predaceous
	7. Phytoseiidae Berlese	*Amblyseius mumae* (Shehata & Zaher) •	Predaceous
		Euseius scutalis (Athias-Henriot) •	Predaceous
		Typhlodromips (Amblyseius) swirskii Athias-Henriot	Predaceous
		Metaseiulus (Typhlodromus) pyri (Scheuten) •	Predaceous

● = new record in Sakaka governorate, Kingdom of Saudi Arabia.

The present data showed that the order Acariformes was represented by 3 suborders, Actinedida, Acaridida and Oribatida. Suborder Actinedida were represented by the families Anystidae, Cheyletidae and Eriophyidae (one species); Cunaxidae (two species in one genus); Stigmaeidae and Tarsonemidae (two species in two genera); Tenuipalpidae and Tetranychidae (four species in three genera); Tydeidae (three species in two genera). From these results it can be noticed that mites belonging to families Tenuipalpidae and Tetranychidae were the most abundant species where four species were collected in each family. Suborder Acaridida was represented by only one family, Acaridae (two species in one genus). Suborder Oribatida was represented by only one species in families Epilohmaniidae, Lohmaniidae and Phthiracaridae.

On the other hand, the order Parsitiformes was represented only one suborder Gamasida which was represented by only one species in families Asciade, Laelapidae, Macrochelidae, Ologamasidae, Parasitidae and Rhodacaridae. While family Phytoseiidae (four species in four genera) as shown in table (1).

The Phytoseiid mite which could be considered the most abundant predatory mite species throughout the present study, was frequently observed feeding on all stages of the two spotted spider mite *Tetranychus urticae* Koch infesting plants. Among the areal predatory mites, *Typhlodromips* (*Amblyseius*) *swirsiki* was found associated with citrus brown mite *Eutetranychus orientalis*. *Metaseiulus (Typhlodromus) pyri* was observed feeding on *T. urticae*. *Euseius scutalis* was found with *T. urticae*, citrus brown mite *E. orientalis.*

This was in agreement with Talhouk (1991) who said that date palm mite *Oligonychus afrasiaticus* (McGregor) is a serious pest of date palm fruits in Saudi Arabia. He was recorded thirty one predaceous mites collected from samples of plant shoot and root systems of cultivated plants, debris and organic manure in Al-Qassim region, these mite species belong to three suborders, 16 families and 29 genera. Gamasid mites were the most abundant group of predaceous mites, represented 67.74% of the whole collected species during the study conducted by Fouly and Al-Rehiayani (2011). As regard predaceous mites, Beaulieu *et al*. (2011) recorded that family Phytoseiidae Berlese comprises over 90 genera and more than 2,300 nominal species in the world. Predaceous mites play an important role in suppressing pest population occupying different habitats and used in biological control programs (Amitai, 1992). Elmoghazy and Shawer (2013) also stated that the environment of soil organisms in managed ecosystems can be influenced by land use factors, such as tillage, pesticides and fertilizers application, soil compaction during harvest, and removal of plant biomass.

Table 2: Mite species and host plants regarding to its site on plants recorded in Sakaka governorate, Kingdom of Saudi Arabia.

Mite species	Host plant	Site	Remarks
1. *Anystis baccarum* (Linnaeus)	Pomegranate, *Punica granatum* L.	Leaves	**
	Grape, *Vitis vinifera* L.	Soil	**
2. *Cunaxa capreolus* (Berlese)	Date palm, *Phoenix dactylifera* L.	Soil	**
3. *Cunaxa* sp.	Olive, *Olea europea* L.	Soil	*
4. *Cheyletus malaccensis* Oudemans	Date palm, *Phoenix dactylifera* L.	Soil	*
5. *Oxycenus maxwelli* (Keifer)	Olive, *Olea europea* L.	Leaves	**
6. *Apostigmaeus navicella* Grandjean	Citrus, *Citrus* spp.	Soil	*
7. *Stigmaeus* sp.	Citrus, *Citrus* spp.	Soil	*
8. *Iponemus* sp.	Citrus, *Citrus* spp.	Soil	**
9. *Steneotarsonemus* sp.	Citrus, *Citrus* spp.	Soil	**
10. *Brevipalpus lewisi* (McGregor)	Pomegranate, *Punica granatum* L.	Leaves & fruit	***
11. *Brevipalpus obovatus* Donnadieu	Olive, *Olea europea* L.	Leaves	**
12. *Brevipalpus phoenicis* (Geijskes)	Citrus, *Citrus* spp.	Leaves & fruit	**
13. *Tenuipalpus* sp.	Date palm, *Phoenix dactylifera* L.	Leaves	**
14. *Eutetranychus orientalis* (Klein)	Citrus, *Citrus* spp.	Leaves	**
15. *Oligonychus afrasiaticus* (McGregor)	Date palm, *Phoenix dactylifera* L.	Leaves	***
16. *Oligonychus* sp.	Grape, *Vitis vinifera* L.	Leaves	*
17. *Tetranychus urticae* Koch	Date palm, *Phoenix dactylifera* L.	Leaves & fruit	**
	Citrus, *Citrus* spp.	Leaves	***
	Grape, *Vitis vinifera* L.	Leaves	**
18. *Brachytydeus* sp.	Date palm, *Phoenix dactylifera* L.	Trunk fibers	*
19. *Tydeus oregonensis* Baker	Citrus, *Citrus* spp.	Leaves	**
20. *Tydeus californicus* (Banks)	Grape, *Vitis vinifera* L.	Leaves	**
21. *Tyrophagus longior* (Gervais)	Date palm, *Phoenix dactylifera* L.	Soil	**
22. *Tyrophagus putrescentiae* Schrank	Date palm, *Phoenix dactylifera* L.	Soil	**
23. *Epilohmannia cylenderica* Berlese	Olive, *Olea europea* L.	Soil	**
24. *Lohmannia* sp.	Citrus, *Citrus* spp.	Soil	**
25. *Hoplophthiracarus* sp.	Grape, *Vitis vinifera* L.	Soil	**
26. *Lasioseius* sp.	Date palm, *Phoenix dactylifera* L.	Soil	**
27. *Androlaelaps casalis* (Berlese)	Citrus, *Citrus* spp.	Soil	**
28. *Macrocheles muscadomestica* (Scopoli)	Citrus, *Citrus* spp.	Soil	**
29. *Gamasiphis* sp.	Date palm, *Phoenix dactylifera* L.	Soil	**
30. *Parasitus* sp.	Citrus, *Citrus* spp.	Soil	**
	Pomegranate, *Punica granatum* L.	Soil	**
31. *Rodacarus* sp.	Date palm, *Phoenix dactylifera* L.	Soil	**
32. *Amblyseius mumae* (Shehata & Zaher)	Citrus, *Citrus* spp.	Soil	**
33. *Euseius scutalis* (Athias-Henriot)	Grape, *Vitis vinifera* L.	Leaves	**
34. *Typhlodromips (Amblyseius) swirskii* Athias-Henriot	Citrus, *Citrus* spp.	Leaves	**
	Grape, *Vitis vinifera* L.	Leaves	**
35. *Typhlodromus pyri* Scheuten	Citrus, *Citrus* spp.	Soil	**

*= (<4) mites/ leave or 1 kg. soil; ** = (4-8) mites/ leave or 1 kg. soil; *** = (>8) mites/ leave or 1 kg. soil

Table 3: Number and percentage of mite species associated with host plants regarding to its site on plant recorded in Sakaka governorate, Kingdom of Saudi Arabia

Plant	No. (%) of mite species			
	Soil	Stem or trunk fibers	Leaves	Fruits
Date palm, *Phoenix dactylifera* L.	7 (16.67%)	1 (2.38%)	4 (9.52%)	1 (2.38%)
Olive, *Olea europea* L.	1 (2.38 %)	-	2 (4.76%)	-
Citrus, *Citrus* spp.	6 (14.29 %)	-	6 (14.29%)	2 (4.76%)
Grape, *Vitis vinifera* L.	2 (4.76 %)	-	6 (14.29%)	-
Pomegranate, *Punica granatum* L.	2 (4.76 %)	-	2 (4.76%)	1 (2.38%)

Comparing the types of mite species that have been counted from the date palm, olive, grape, pomegranate and citrus trees orchards (soil, stem or trunk fibers, leaves and fruits), it was observed that these types and numbers varied depending on the host plant (Table 2). The results showed that mites *Brevipalpus lewisi*, *Oligonychus afrasiaticus* and *Tetranychus urticae* were the most abundant species where their population considerably exceeds eight individuals. The rest of the collected mites were found in moderate or few numbers. The mites often were found on the leaves at flush growth then migrate to the fruits when the injury becomes more intense as shown in plate (1).

This is in agreement with Vacante (2010) who conducted a review of the phytophagous mites collected on citrus in the world and observed that the *T. urticae*, and *B. obovatus* had a worldwide distribution. Özsisli and Çobanoğlu (2011) conducted surveys to identify mite (Acari) species from cultivated plants in Kahramanmaras, Turkey. They collected phytophagous and predatory mite species on fruit trees namely grape and pomegranate during 1997–2000. They found that the most abundant predatory mite species from mixed fruit orchards belong to the family Phytoseiidae. Ferragut *et al.* (2013) also stated that many mite species usually attack the citrus grown in all parts of the world. They had reported up to 104 species herbivore damage to leaves, buds and fruit, but only a dozen can be considered major pests which require control measures including red mite East *E. orientalis.*

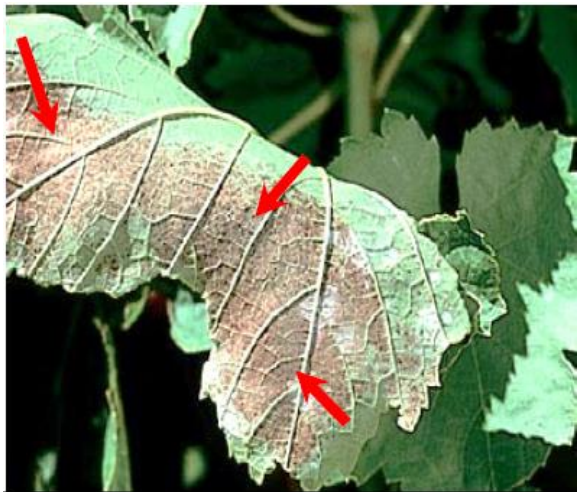

Fig. 4: Symptoms due to *Oligonychus* sp. on grape leave (red arrows).

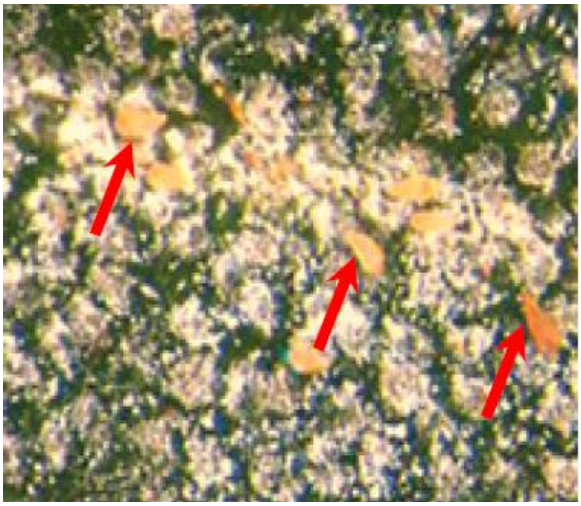

Fig. 7: *Oxycenus maxwelli* on olive leave (red arrows).

Fig. 5: Symptoms due to *Oxycenus maxwelli* on olive leaves (red arrows).

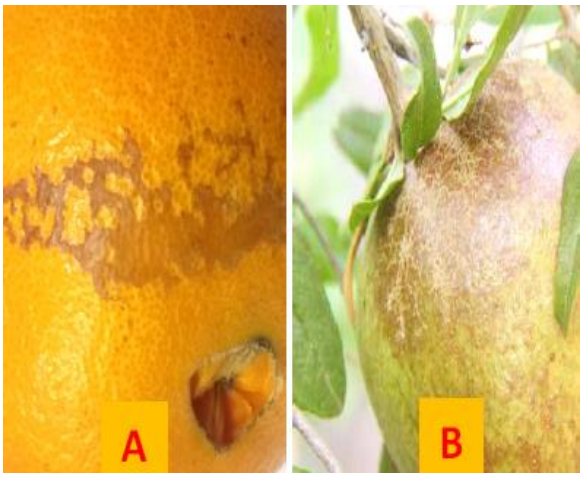

Fig. 8: Symptoms due to *Brevipalpus phoenicis* on citrus fruit (A) and *B. lewisi* on pomegranate fruit (B).

Fig. 6: Symptoms due to *Tetranychus urticae* and its web on citrus leaves.

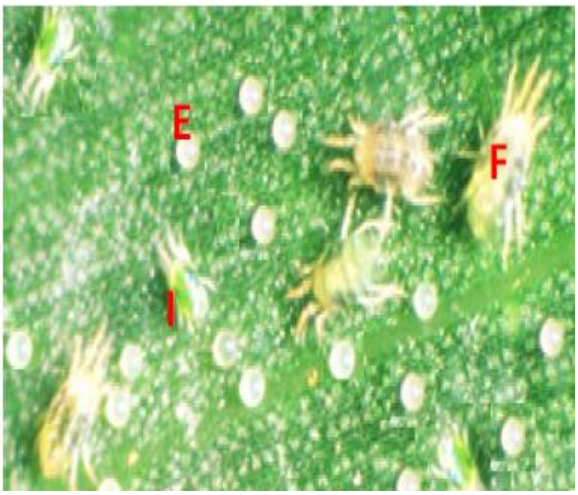

Fig. 9: *Tetranychus urticae* females (F), immature (I), and egg (E) on date palm leave.

Plate 1

In the current study, it was observed that the number of mite species associated with date palm was higher in the soil as compared with aerial parts and other host plants. On the other hand, the mite species recorded on the aerial parts of citrus, grape, pomegranate and olive were higher respectively as compared with the soil mite species as shown in table (3) and fig. (10).

Stratification of recorded mite species associated with different host plants according to feeding habits in the present study revealed that predaceous mites inhabiting

date palm were more predominant as compared with phytophagus and miscellaneous species. On the other hand, other host plants showed different pattern in which phytophagus species were more predominant on citrus, olive and pomegranate respectively as compared with predaceous and miscellaneous mite species. In grape, phytophagus and predaceous were equal in the number and higher than miscellaneous of total number of recorded species (Fig. 11). This was in agreement with Childers (2011) who stated that infrequent surveys of over 50 commercial citrus orchards as well as field experiments were conducted across Florida between 1978 and 2011 and he ascertained that very low numbers of predaceous mites were recovered from fruit and leaf samples in orchards prior to 1994 and most often, no beneficial mites were found.

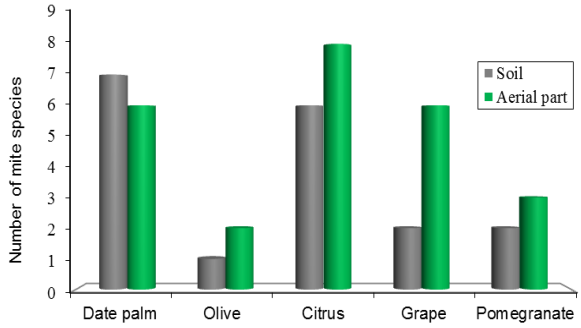

Fig. 10: Number of mite species associated with host plants according to its site on plants recorded in Sakaka governorate, Kingdom of Saudi Arabia

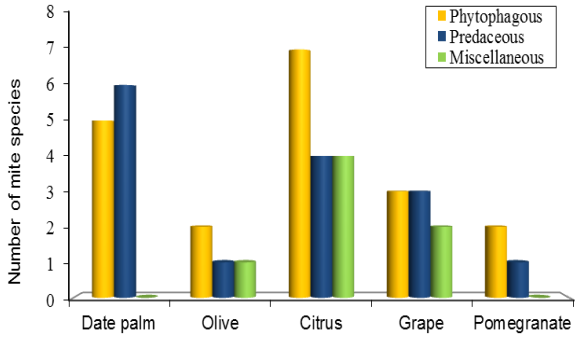

Fig. 11: Number of mite species associated with host plants according to their feeding habits recorded in Sakaka governorate, Kingdon of Saudi Arabia

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REFERENCES

Amitai S, 1992. New records of Phytoseiid mites (Acarina: Phytoseiidae) from Cyprus. Entomolgia Hellenica, 10: 19-20.

Beaulieu F, APG Dowling, H Klompen, GJde Moraes, and DE Walter, 2011. Superorder Parasitiformes Reuter, 1909. In: Zhang ZQ (Ed.), Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness. Zootaxa, 3148: 123-128.

Behan-Pelletier VM, 1999. Oribatid mite biodiversity in agroecosystems: role for bioindication. Agriculture, Ecosystems and Environmentm 74: 411-423.

Childers CC, 2011. Assessment of an integrated pest mite and disease management program on Florida citrus utilizing 224 or 235_C horticultural mineral oils (HMO). In: Moraes GJ, de Proctor HC (eds) Acarology XIII: proceedings of international congress zoo symposia, 6: 139-151.

Elmoghazy MME and SS Shawer, 2013. Relationship between soil diversity and inhabitant mites (Arachnida: Acari). Acarines, 7: 41-45.

Elmoghazy MME, 2002. Ecological and Biological Studies on Some Mites Associated with Plants. MSc Thesis, Fac Agric Al-Azhar Univ, 145 pp.

Faraji F and B Halliday, 2009. Five new species of mites (Acari: Laelapidae) associated with large Australian cockroaches (Blattodea: Blaberidae). Inter J Acarol, 35: 245-264.

Ferragut F, D Navia, and R Ochoa, 2013. New mite invasions in citrus in the early years of the 21st century. Exp Appl Acarol, 59: 145-164.

Fouly AH and SM Al-Rehiayani, 2011. Predaceous mites in Al-Qassim region, Saudi Arabia, with description of two new Laelapid species (Acari: Gamasida: Laelapidae). J Entomol, 8: 139-151.

Gerson U, 2008. The Tenuipalpidae: An under-explored family of plant-feeding mites. System Appl Acarol, 13: 83-101.

Lasebikan BA, 1974. A preliminary communication on microarthropods from a tropical rainforest in Nigeria. Pedobiologia, Jena, 14: 402-411.

Migeon, A. and F Dorkeld, 2009. Spider Mites Web: a comprehensive database for the Tetranychidae [Internet]-Available from: ttp://www1.montpellier. inra.fr/CBGP/spmweb/Sina University Press, Hamadan (In Persian).

Özsisli T and S Çobanoğlu, 2011. Mite (Acari) fauna of some cultivated plants from Kahramanmaras, Turkey. Afric J Biotechnol, 10: 2149-2155.

Skorupska A, 2004. Resistance of apple cultivars to spotted spider mite, *Tetranychus urticae* Koch (Acarina, Tetranychidae) Part II. Infeluence of leafe pubescence of selected apple cultivars on fecundity of two-spotted spider mite. J Plant Protec Res 44: 69-74.

SPSS Inc, 2007. SPSS (statistical package of social science) base 16.0.0 User's guide. SPSS Inc, Chicago, IL.

Talhouk AS, 1991. On the management of the date palm and its arthropod enemies in the Arabian Peninsula. J Appl Entomol, 111: 514-520.

Ukabi S, WG Whitford, and Y Steinberger, 2009. Faunal pedturbation effects on soil microarthropods in the Negev Desert. J Arid Environ, 15: 1-5.

Vacante V, 2010. Review of the phytophagous mites collected on citrus in the world. Acarologia, 50: 221-241.

Wekesa VW, GJ Moraes, M Knapp, and I Delalibera Jr., 2007. Interactions of two natural enemies of *Tetranychus evansi*, the fungal pathogen *Neozygites floridana* (Zygomycetes: Entomophthorales) and the predatory mite, *Phytoseiulus longipes* (Acari: Phytoseiidae). Biological Control, 41: 408-414.

Zaher MA, 1984. Survey and ecological studies on phytophagous, predaceous and soil mites in Egypt. I. Phytophagous mites in Egypt (Nile Valley and Delta). PL. 480 U.S.A. Project No. EG- ARS- 30 Grant No. FG- EG- 139: 228 pp.