Jawwad Hassan Mirza

Ph.D. Acarologist

All the social standards, scientific morals, research ethics, academic values and administrative experiences, which I learned and gained, are deposition on me. My aim is to transfer these to the next generation. I feel it as my duty to benefit my institution with my hard-working nature and target oriented task execution.

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RESEARCH EXPERIENCE

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

Researcher
Nov. 2014 — till date

- Conducting biological, ecological and behavioral experiments
- Analyzing data, both nominal and genetic
- Surveying different geographical localities for the collection of mites (pests and non-pests)
- Taxonomy and systematics of different mite groups
- Collection of mite pest species from agricultural and wild ecosystem
- Planning different projects, their execution and management
- Rearing of Biological Control Agent, Aphid Lion, *Chrysoperla carnae*
- Rearing and maintaining the culture of mite specialist predator, *Stethorus gilvifrons*
- Maintaining and mass production of pest moth, *Ephestia cautella*
- Writing and reviewing different research

National Institute for Biotechnology and Genetic Engineering
Insect Molecular Lab

Skilled DPL
Sept. 2012 — Oct. 2013

- Project: Barcode of Life-Engaging Developing Nations
- Study the biodiversity of insect fauna around the Pakistan, from ice cold mountains of Gilgit and Chitral to sandy shores of Karachi
- Collection, sampling, identification, preservation and display, tagging and labeling of collected samples
- Surveyed and Sampled 28 districts of Punjab, few areas of Karachi and Sindh, Gilgit, Chitral, Shogran, KPK and Kashmir
- Tissue sampling, DNA extraction, DNA amplification and DNA Barcoding of the insect samples
- Mass rearing of gram pod borer and armyworm in the laboratory
- Handling and maintenance of Insect DNA Barcode Museum.

National Agricultural Research Center
Insect Pest Management Program

Internee
Sept. 2012 — Oct. 2013

- Experiments regarding antibiosis, antixenosis, tolerance and resistance in different arid and irrigated wheat varieties against wheat aphid.
- Experiments to check the effect of different plant extracts made in different solvents against red flour beetle.
- Mass rearing of two biological control agents i.e. *Trichogramma* and *Chrysoperla carnea.*
- Tests to estimate the effect of botanicals against the parasitic activity of *Trichogramma* against *Sitotroga cereallela*.
- Eradication and control of rodent pests from the field of grains and vegetables by using mechanical and chemical options.

TEACHING EXPERIENCE

Muhammad Nawaz Shareef University of Agriculture
Department of Entomology

Lecturer
Jan. 2014 — Nov. 2014

- Lecturer Entomology
- Taught different courses related to basic and applied entomology, including Major Semester students
- Purchase Inspector
- Incharge Computer Lab
- Chairman Disciplinary Committee
- Secretary Cafeteria Committee

PROJECTS

COMPLETED

National Institute for Biotechnology and Genetic Engineering
Insect Molecular Lab

- **Project: Barcode of Life-Engaging Developing Nations**
- **Skilled DPL**
- Study the biodiversity of insect fauna around the Pakistan, from ice cold mountains of Gilgit and Chitral to sandy shores of Karachi
- Collection, sampling, identification, preservation and display, tagging and labeling of collected samples
- Scope of the project included mosquito biodiversity and other insects
- A joint research between NIBGE and Biodiversity Institute of Ontario, University of Guelph, Guelph, ON, Canada

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

- **Project: Beneficial Insects and Mites in agroecosystem of Saudi Arabia**
- **Research Assistant**
- Collection and identification of beneficial mite (predators mostly) species
- Total of 8 regions including Medina Munawwarah, Tabuk, Jizan, Baha, Jouf, AlAh-sa, Dammam and Riyadh, were extensively visited
- All types of agroecosystems including open fields and greenhouse were visited
- Project was funded by Ministry of Agriculture, Saudi Arabia

ONGOING

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

- **Project: Diversity of Spider mite pests (Acari: Tetranychidae) based on morphology and genetic variations in the Kingdom of Saudi Arabia (worth 600,000 SAR)**
- **Research Assistant**
- Collection and identification of spider mite pest species
- Total of 6 regions including Medina Munawwarah, Tabuk, Jizan, Baha, AlAhsa and Riyadh, were extensively visited
- All types of agroecosystems including open fields and greenhouse were visited
- Project is funded by National Plant for Science and Technology (NPST), King Saud Universi-ty

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

- **Project: Establishing mass rearing of the predator, Chrysoperla carnea (Stephens) (Neuroptera: Chrysopidae) in Saudi Arabia and management of some agricultural mite and insect pests by its augmentative releases in the field and greenhouses (worth 600,000 SAR)**
- **Research Assistant**
- Collection and identification of *Chrysoperla carnea* species
- Conducting lab and field experiments on two important mite pest species viz. date palm mite, *Oligonychus afrasiaticus* and citrus mite, *Eutetranychus orientalis*
- Project is funded by National Plant for Science and Technology (NPST), King Saud University

- **Project: Insect and Mite pests in agroecosystem of Saudi Arabia**
- **Research Assistant**
- Collection and identification of pest mite species
- Total of 8 regions including Medina Munawwarah, Tabuk, Jizan, Baha, Jouf, AlAhsa, Dammam and Riyadh, were extensively visited
- All types of agroecosystems including open fields and greenhouse were visited
- Project was funded by Ministry of Agriculture, Saudi Arabia
- Project is funded by Ministry of Agriculture

SUBMITTED

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

- **Project: Rearing technology for indigenous coccinellid predator, *Stethorus gilvifrons* (Mulsant) (Coleoptera: Coccinellidae) and its biology on two mite pests; avocado brown mite, *Oligonychus punicae* (Hirst) and red palm mite, *Raoiella indi-ca* Hirst (worth 350,000 SAR)**
- **Research Assistant**
- Predator mass rearing and biological experiments both in greenhouse and open field
- Project will be funded by Deanship of Scientific Research, King Saud University

PUBLICATIONS

PUBLISHED

Akram, W. **Mirza, J.,** 2011. Studies on predatory efficacy of Daphnia magnusand mesocyclops species on different instars of *Aedes albopictus* larvae: 1.4-052. ***Tropical Medicine & International Health*****,** 16. —————————————————————————————————————**(Q2: JIF=2.62)**

Ashfaq M., Hebert P.D.N., **Mirza J.H.**, Khan A.M., Zafar Y., 2014. Analyzing Mosquito (Diptera: Culicidae) Diversity in Pakistan by DNA Barcoding. ***PLoSONE*** 9(5): e97268. ————————————**(Q2: JIF=3.24)**

Kamran, M., **Mirza, J.H.** and Alatawi, F.J., 2016. The genus *Paraplonobia* Wainstein and *Neopetrobia* Wainstein (Acari, Trombidiformes, Tetranychidae) from Saudi Arabia: new species, new records and key to the world species of *Paraplonobia*. ***ZooKeys*****,** 598: 27-55. ————————————————————**(Q2: JIF=1.54)**

Alatawi, F.J., Kamran, M. and **Mirza, J.H.**, 2018. Mesostigmatic mites (Acari: Mesostigmata) of Saudi Arabia (excluding Phytoseioidea), new records and a key to the known species. ***Zootaxa***, 4388 (3): 373–394. ————————————————————————————————————**(Q3: JIF=1.091)**

Alatawi, F.J., Abidin, S.Z.U., **Mirza, J.H.** and Kamran, M., 2018. Functional response of the predatory mite *Cydnoseius negevi* (Swirski & Amitai) (Acari: Phytoseiidae) to the *Oligonychus afrasiaticus* (Mcgregor) and *Tetranychus urticae* Koch (Acari: Tetranychidae). ***Asian Journal of Agriculture and Biology***, 6(2):265-277.

Mirza, J.H., Kamran, M. and Alatawi, F.J., 2018. Response of the predatory mite *Cydnoseius negevi* (Acari:Phytoseiidae) to webbing of the date palm mite, *Oligonychus afrasiaticus* (Acari: Tetranychidae), on date palm fruits and leaves. ***Experimental and Applied Acarology***, 75:445–455. ————————————————————————————————————**(Q2: JIF=2.13)**

Mirza, J.H., Kamran, M. and Alatawi, F.J., 2018. Webbing life type and behavioral response of the date palm mite, *Oligonychus afrasiaticus*, to webbing residues on leaves and fruits of date palm. ***Experimental and Applied Acarology***, 76(2):197–207. ————————————————————————**(Q2: JIF=2.13)**

Kamran, M., **Mirza, J.H.** and Alatawi, F.J., 2019. New records and re-descriptions of some phytoseiid species (Acari: Mesostigmata) from Saudi Arabia. ***International Journal of Acarology***, 45(5), 307-314. ————————————————————————————————————**(Q3: JIF=1.05)**

Alatawi, F.J., Mushtaq, H.M.S., **Mirza, J.H.** and Kamran, M., 2019. Predation efficiency and preference of lab-reared and field-collected populations of predatory mite *Cydnoseius negevi* (Acari: Phytoseiidae) on two mite pest species *Oligonychus afrasiaticus* and *Tetranychus urticae* (Acari: Tetranychidae). ***International Journal of Pest Management***, 65(4), 363-369. ————————————————**(Q2: JIF=1.907)**

Alatawi, F.J., **Mirza, J.H.**, Alsahwan, K.A. and Kamran, M., 2019. Field population sex ratio of the date palm mite, *Oligonychus afrasiaticus* (McGregor). ***African Entomology***, 27(2), 336-343. ——**(Q3: JIF=1.18)**

Mirza, J.H., Kamran, M., Saleh, A.A. and Alatawi, F.J., 2020. Molecular and phenotypic variations in *Eutetranychus orientalis* (Klein) populations from Saudi Arabia. ***PLoSONE***, 15(5), p.e0233389. ————————————————————————————————————**(Q2: JIF=3.24)**

Mirza, J.H., Kamran, M. and Alatawi, F.J., 2021. Phenology and abundance of date palm mite *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae) in Riyadh, Saudi Arabia. Saudi ***Journal of Biological Sciences***. ————————————————————————————**(Q2: JIF=4.219)**

Mirza, J.H., Kamran, M. and Alatawi, F.J., 2022. New Genus and New Subgenera of Camerobiid mites (Acari: Prostigmata: Camerobiidae) with the key to world species of the genus *Neophyllobius*. ***Insects***, 13(344); 1-34 ————————————————————————————————————**(Q1: JIF=2.769)**

ABSTRACTS

Mirza, J.H., Saleh, A.A, Mushtaq, H.M.S., Kamran, M. and Alatawi, F.J., 2018. Molecular and Morphological characterization of *Eutetranychus* mite populations collected from different hosts and regions of Saudi Arabia *(Published in XV International Congress of Acarology, Antalya, Turkey)*

Kamran, M., **Mirza, J.H.,** Mushtaq, H.M.S. and Alatawi, F.J., 2018. The genus *Oligonychus* Berlese () from Saudi arabia; new records and some morphological and webbing behavioral variations between *Oligonychus ephamnus* and *Oligonychus afrasiaticus. (Published in XV International Congress of Acarology, Antalya, Turkey)*

ACADEMICS

King Saud University
College of Food and Agriculture Sciences
Acarology Research Laboratory

Ph.D.
(Entomology)

Duration: 2015-2021
CGPA: 4.86/5.00
Dept: Plant Protection
Specialization: Taxonomy, Biology, Behavior, Ecology and Genetics of Mites
Dissertation: Webbing life type, phenology and molecular investigation of diapause in the old world date mite, *Oligonychus afrasiaticus* (McGregor)

University of Agriculture, Faisalabad
Department of Entomology

M.Sc. (Hons.)
(Agricultural Entomology)

Duration: 2010-2012
CGPA: 4.00/4.00
Dept: Entomology
Specialization: Biological control and survey of mosquitoes
Thesis: Surveillance and Laboratory evaluation of different aquatic predators against *Aedes albopictus*

University of Sargodha
University College of Agriculture

B.Sc.(Hons.)
(Agricultural Entomology)

Duration: 2006-2010
CGPA: 3.96/4.00
Dept: Entomology
Distinction: 3rd Position (Bronze Medal)

Progressive Public College, Sargodha

Intermediate
(Pre-Medical)

Duration: 2004-2006
Marks: 817/1100
Division: 1st

Progressive Public School, Sargodha

Matric
(Science)

Duration: 2002-2004
Marks: 653/850
Division: 1st

PRESENTATIONS AND PARTICIPATIONS

- **Participated:** Dengue Control Workshop, **Lahore, Pakistan**
- **Participated:** Seminar on New Challenges of Insects on Citrus Plant, **Faisalabad, Pakistan.**
- **Participated:** Symposium on Dengue Fever: Virology and Vector Control, **Faisalabad, Pakistan.**
- **Participated:** Conference on Biotechnology: Prospects in Agriculture, Industry, Health, **Faisalabad, Pakistan.**
- **Participated:** Honey Bee Conference, **Jeddah Saudi Arabia**.

- **Presentation:** The Biodiversity studies of Mosquitoes in different areas of **Pakistan, Faisalabad**
- **Presentation:** Papaya mealybug as an invasive pest in **Pakistan, Faisalabad.**
- **Presentation:** IPDP-Conference 2017, **Arabian Gulf University, Bahrain**
- **Presentation:** XV International Congress of Acarology 2018, **Antalya, Turkey**

ACHIEVEMENTS AND AWARDS

- **2010:** Bronze Medal (3rd position with 3.96/4.00 CGPA) in B.Sc. (Hons.).
- **2011:** First Position in the Intra-Department Presentation Competition held at Department of Entomology, University of Agriculture, Faisalabad
- **2012:** TOEFL-iBT with 91 score

SKILLS

- Excellent communication and presentation skills
- Scientific know-how on designing and executing various biological, ecological, behavioral and molecular experiments
- Good scientific writing, reviewing and publishing experience
- Confident to manage different projects and completing in time
- Well experienced in analyzing the nominal and genetic data statistically using different soft wares like SAS, Sigmaplot, Minitab, Bioedit, MEGA etc.
- Experience in delivering lectures in efficient manner

OPEN ACCESS Freely available online

PLOS ONE

Analyzing Mosquito (Diptera: Culicidae) Diversity in Pakistan by DNA Barcoding

Muhammad Ashfaq[1]*, Paul D. N. Hebert[1], Jawwad H. Mirza[2], Arif M. Khan[2], Yusuf Zafar[3], M. Sajjad Mirza[2]

1 Biodiversity Institute of Ontario, University of Guelph, Guelph, ON, Canada, **2** National Institute for Biotechnology and Genetic Engineering, Jhang Road, Faisalabad, Pakistan, **3** Pakistan Atomic Energy Commission, Islamabad, Pakistan

Abstract

Background: Although they are important disease vectors mosquito biodiversity in Pakistan is poorly known. Recent epidemics of dengue fever have revealed the need for more detailed understanding of the diversity and distributions of mosquito species in this region. DNA barcoding improves the accuracy of mosquito inventories because morphological differences between many species are subtle, leading to misidentifications.

Methodology/Principal Findings: Sequence variation in the barcode region of the mitochondrial COI gene was used to identify mosquito species, reveal genetic diversity, and map the distribution of the dengue-vector species in Pakistan. Analysis of 1684 mosquitoes from 491 sites in Punjab and Khyber Pakhtunkhwa during 2010–2013 revealed 32 species with the assemblage dominated by *Culex quinquefasciatus* (61% of the collection). The genus *Aedes* (*Stegomyia*) comprised 15% of the specimens, and was represented by six taxa with the two dengue vector species, *Ae. albopictus* and *Ae. aegypti*, dominant and broadly distributed. *Anopheles* made up another 6% of the catch with *An. subpictus* dominating. Barcode sequence divergence in conspecific specimens ranged from 0–2.4%, while congeneric species showed from 2.3–17.8% divergence. A global haplotype analysis of disease-vectors showed the presence of multiple haplotypes, although a single haplotype of each dengue-vector species was dominant in most countries. Geographic distribution of *Ae. aegypti* and *Ae. albopictus* showed the later species was dominant and found in both rural and urban environments.

Conclusions: As the first DNA-based analysis of mosquitoes in Pakistan, this study has begun the construction of a barcode reference library for the mosquitoes of this region. Levels of genetic diversity varied among species. Because of its capacity to differentiate species, even those with subtle morphological differences, DNA barcoding aids accurate tracking of vector populations.

Citation: Ashfaq M, Hebert PDN, Mirza JH, Khan AM, Zafar Y, et al. (2014) Analyzing Mosquito (Diptera: Culicidae) Diversity in Pakistan by DNA Barcoding. PLoS ONE 9(5): e97268. doi:10.1371/journal.pone.0097268

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Funding: This research was enabled by grant 106106-001, Engaging Developing Nations in the International Barcode of Life (iBOL) Project, from IDRC. Sequence analysis was enabled by a grant from the Government of Canada through Genome Canada and the Ontario Genomics Institute in support of iBOL. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

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Introduction

Mosquitoes are important vectors of animal diseases [1]. Although Pakistan is one of the hotspots for mosquito-vectored diseases [2,3], mosquito biodiversity in the country is under-explored [4]. However, the recent outbreaks of dengue in Pakistan [5] have generated interest in mosquito distributions in this region [6–8]. Among the 3500 mosquito species recorded worldwide (www.mosquito-taxonomic-inventory.info) 104 have been documented from Pakistan and Bangladesh [4], but their morphological identification remains difficult.

Correct vector identification is very important to design strategies for managing vector-borne diseases [9]. Because detailed taxonomic studies have focused on mosquitoes that are vectors of human disease [10], other species have received little attention [11,12]. Moreover, many closely related species of mosquitoes with differing ecological and host preferences are nearly indistinguishable morphologically [13]. These factors mean that the identification of mosquitoes to a species or sometimes even a genus is often difficult [14–16]. As a consequence, DNA-based approaches to mosquito identification [17–19], genetic diversity [20,21], and molecular phylogeny [22,23] have gained increasing adoption. Although use of nuclear genes is not uncommon [24–27], mitochondrial genes have gained primary adoption for analyzing genetic diversity in mosquitoes [28,29]. DNA barcoding [30] has already seen frequent use for mosquitoes in varied contexts [31–37]. As a result, the overall DNA barcode library now includes records for 894 mosquito species among the 320K animal species which have been analyzed (www.boldsystems.org).

Prior studies have monitored mosquito populations using both morphological [38] and molecular approaches [39]. For example, Reisen et al. (1982) [40] used morphological identifications to assess the diversity of mosquitoes in Pakistan, especially those important in the transmission of viral diseases. Mousson et al. (2005) [41] subsequently used mitochondrial DNA variation to study the phylogeography and relationships of *Aedes aegypti* and *Aedes albopictus*, while Chen et al. (2002) [25] used 28S rDNA and COII to examine the distribution and vector status of *Anopheles*

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RESEARCH ARTICLE

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The genus *Paraplonobia* Wainstein and *Neopetrobia* Wainstein (Acari, Trombidiformes, Tetranychidae) from Saudi Arabia: new species, new records and key to the world species of *Paraplonobia*

Muhammad Kamran[1], Jawwad Hassan Mirza[1], Fahad Jaber Alatawi[1]

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Abstract

The two tetranychid genera *Paraplonobia* Wainstein and *Neopetrobia* Wainstein (Trombidiformes: Tetranychidae) are reported for the first time from Saudi Arabia. Three new species *Paraplonobia* (*Anaplonobia*) *arabica* Mirza & Alatawi, **sp. n.**, *P.* (*A.*) *haloxylonia* Alatawi & Mirza, **sp. n.** and *P.* (*A.*) *tabukensis* Kamran & Alatawi, **sp. n.** are described and illustrated based on adult females, collected from *Prosopis juliflora* (SW.) Dc. (Fabaceae) and *Haloxylon salicornicum* Bunge (Amaranthaceae) from two different regions of Saudi Arabia. *Neopetrobia mcgregori* (Pritchard and Baker) is redescribed and illustrated based on female collected from *Cynodon dactylon* L. (Poaceae).The diagnostic morphological features including leg chaetotaxy of all known species of the subgenus *Anaplonobia* is tabulated. A key to the world species of the genus *Paraplonobia* is also provided.

Keywords

Hystrichonychini, *arabica*, *haloxylonia*, *tabukensis*, *Prosopis*

Asian J Agri & Biol. 2018;6(2):265-277.

AJAB

Original Research Article

Functional response of the predatory mite *Cydnoseius negevi* (Swirski & Amitai) (Acari: Phytoseiidae) to the *Oligonychus afrasiaticus* (Mcgregor) and *Tetranychus urticae* Koch (Acari: Tetranychidae)

Fahad J. Alatawi[1], Syed Zain ul Abidin[1], Jawwad H. Mirza[1], Muhammad Kamran[1]

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Abstract

The study of functional response characteristics of natural enemies is one of the most important approaches to assess their efficiency in regulating the pest population as they are key aspects in the dynamics of predator-prey interactions. In the present study, the functional response type and parameters, and maximum feeding capacity of the predatory mite *Cydnoseius negevi* (Swirski & Amitai) (Acari: Phytoseiidae) deutonymph and adult female were assessed at different densities of movable stages of the date palm mite (DPM) *Oligonychus afrasiaticus* (McGregor) and two-spotted spider mite (TSSM) *Tetranychus urticae* Koch (Acari: Tetranychidae). The experiments were carried out at 30 ± 2°C and relatively low humidity of 35 ± 5 % RH under controlled conditions, for the first time. The logistic regression model was used to determine the type of functional response exhibited by *C. negevi*. Both the stages of predator showed Type II functional response when fed the DPM and TSSM individuals at different stages. Roger's random-predator equation was used to define the handling time (*Th*) and attack rate (*a*) coefficients of type II functional response by fitting the equation into the non-linear least square regression model. The longest *Th* was shown by deutonymph and adult females of *C. negevi* when they fed on the DPM and TSSM females, and TSSM females, respectively. Furthermore, no significant differences were recorded for most of the *a* values of the deutonymph and adult female of *C. negevi* among different stages of DPM and TSSM. The maximum feeding capacity of *C. negevi* adult female was significantly higher for DPM female when compared with that of TSSM. According to previous and current studies, *C. negevi* could be a potential predator at a wide range of humidity.

Keywords: Biological control, Prey, Density, Feeding capacity, Handling time, Attack rate

Introduction

The date palm mite (DPM) *Oligonychus afrasiaticus* (McGregor) and two-spotted spider mite (TSSM) *Tetranychus urticae* Koch (Acari: Tetranychidae) are severe pests of the date palm, *Phoenix dactylifera* and various agricultural crops in Saudi Arabia (SA), respectively (Alatawi, 2011; Alatawi and Kamran, 2018). They severely affect both the quality and quantity of crop production by impairing their

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Article

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Mesostigmatic mites (Acari: Mesostigmata) of Saudi Arabia (excluding Phytoseioidea), new records and a key to the known species

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Abstract

This paper reports on 35 species and 33 genera belonging to 18 families of the order Mesostigmata, collected from different provinces of Saudi Arabia. Among these, eight families, 21 genera and 30 species, mostly collected from date palm agroecosystem, are new to the fauna of Saudi Arabia. Five species reported previously are also recorded in this study. The collection data and distribution of all species recorded in this study as well as those reported previously are given. A comprehensive key to the females of the mesostigmatic mites reported from Saudi Arabia, except the Phytoseioidea, is provided.

Key words: Ameroseiidae, Macrochelidae, Uropodidae, Polyaspididae, species diversity, fauna, identification

Introduction

The Mesostigmata (Acari: Parasitiformes) is highly diverse group of mites including three suborders, namely, Monogynaspida (56 families), Trigynaspida (28 families) and Sejida (six families) (Krantz & Walter, 2009; Hoy, 2011; Dhooria, 2016). Monogynaspids account for more than 90% species of Mesostigmata (Krantz & Walter, 2009; Beaulieu *et al*., 2011; Dhooria, 2016). The mesostigmatic mites are mostly free-living predators inhabiting soil and leaf litter. Some of these mites also have been reported as parasites and phoretic on birds, mammals, reptiles and other arthropods (Krantz & Walter, 2009; Carrillo *et al*., 2015).

The soil Mesostigmata feed mostly on lightly sclerotised arthropods (mites, springtails, other insect eggs and their immatures), nematodes, rarely on fungal hyphae or spores and dead organic matter (Beaulieu & Weeks, 2007; Carrillo *et al*., 2015). Members of the families Rhodacaridae, Macrochelidae, Parasitidae, Uropodidae, Laelapidae, and Ascidae are important biocontrol agents of various soil dwelling pests i.e. insects and nematode pests (Koehler, 1999; Krantz & Walter, 2009; Carrillo *et al*., 2015).

The mesostigmatic mite fauna of Saudi Arabia (SA) has been poorly investigated. Only 31 species (including nine unidentified) and 25 genera from 14 families have been reported previously from the country. Among these, 13 species belong to three families Ascidae, Laelapidae and Macrochelidae (Dabbour & Abdel-Aziz, 1982; Al-Khalifa & Bayoumi, 1983; Alatawi, 2011; Fouly & Rehiayani, 2011; Elmoghazy, 2016). Others belong to the families Rhodacaridae, Ameroseiidae, Ologamasidae and Zerconidae (Dabbour & Abdel-Aziz, 1982; Al-Khalifa & Bayoumi, 1983; Fouly & Rehiayani, 2011; Elmoghazy, 2016), Parasitidae (Dabbour & Abdel-Aziz, 1982; Al-Khalifa & Bayoumi, 1983; Fouly & Rehiayani, 2011; Elmoghazy, 2016), Melicharidae (Al-Khalifa & Bayoumi, 1983), Varroidae, Macronyssidae, Uropodidae, Sejidae (Dabbour & Abdel-Aziz, 1982; Al-Khalifa & Bayoumi, 1983; Fouly & Rehiayani, 2011; Al-Dhafar & Al-Qahtani, 2012) and Trematuridae (Al-Dhafar & Al-Qahtani, 2012; AlSaqabi, 2012) (Table 1). Recently, Alatawi *et al*. (2017) reported 23 phytoseioid species belonging to three families, namely Blattisociidae Garman, Otopheidomenidae Treat, and Phytoseiidae Berlese (Acari: Phytoseioidea). This is the first comprehensive study of mesostigmatic mites of SA.

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Response of the predatory mite *Cydnoseius negevi* (Acari: Phytoseiidae) to webbing of the date palm mite, *Oligonychus afrasiaticus* (Acari: Tetranychidae), on date palm fruits and leaves

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Abstract

The behavioral response of a generalist phytoseiid predator, *Cydnoseius negevi* (Swirskii & Amitai) (Acari: Phytoseiidae) to the complicated webbing of the date palm mite (DPM) *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae) was evaluated for the first time on date palm leaves and fruits, both in the laboratory and on field-collected samples. *Cydnoseius negevi* used its first pair of legs in a swimming-like to-and-fro movement to penetrate the complicated webbing of DPM and demonstrated three attack behaviors, i.e., patrolling (PG), web invasion (WI), and web penetration (WP), against the webbing of DPM on date fruits and leaves. The time spent by the predator on attack behaviors was significantly longer in the laboratory for treatments where either more prey females or immature stages along with females were present. The time spent by *C. negevi* on response behaviors such as searching, grooming, and resting increased with increased number of DPM females and with the addition of immature stages along with DPM females. *Cydnoseius negevi*, even though being a generalist phytoseiid predator, showed its potential towards penetrating the complex dense webs of DPM on date palm fruits and leaves. If released in suitable numbers prior to establishment of DPM colonies, *C. negevi* may prove to be an effective biological control agent.

Keywords Behavioral response · Web penetration · Web invasion · Generalist predator · Patrolling · Grooming

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Webbing life type and behavioral response of the date palm mite, *Oligonychus afrasiaticus*, to webbing residues on leaves and fruits of date palm

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Abstract

The present study examined the webbing life type and behavioral response of date palm mite (DPM) *Oligonychus afrasiaticus* (McGregor) toward its webbing residues, in presence or absence of immature individuals, on leaves and fruits of date palm. DPM exhibited a complicated web life type on both the leaves and fruits of date palm, which is characterized by the following features: complicated irregular web structure; webbing density on the leaves is medium and on the fruits extremely high; eggs are always laid on the threads of web without web cover; fecal pellets are deposited on the substrate surface (both leaf and fruit); quiescent stages are on the silken web threads; and the preferred site for feeding and walking is under the web. Behavioral observation of DPM females revealed that the midrib of leaves and the base of fruits of date palm were the preferred sites for feeding and web construction. The number and development stage of DPM affected the behavioral response of females on date palm leaves but not on the fruits. DPM spent most time feeding under the web on both the leaves and fruits of date palm.

Keywords Webbing density · Complicated web · Irregular web structure · Triangular entry holes

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New records and re-descriptions of some phytoseiid species (Acari: Mesostigmata) from Saudi Arabia

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ABSTRACT

Four phytoseiid species *Neoseiulus sinaiticum* (Amitai and Siwirski 1982), *N. tabularis* Chaudhri, Akbar and Rasool 1979, *Eusieus eitanae* (Swirski and Amitai, 1965) and *Proprioseiopsis badryi* (Yousef and El-Brollosy, 1986) are recorded for the first time from Saudi Arabia. The two new records *N. sinaiticum* and *N. tabularis* are re-described and illustrated based on adult females. Keys to the world species of the *N. paspalivorus* and *N. desertus* species groups are provided.

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Species groups; key; Neoseiulus desertus; N. paspalivorus; Proprioseiopsis badryi

Introduction

The genus *Neoseiulus* Hughes includes approximately 412 nominal species distributed worldwide (Demite et al. 2019). Chant and McMurtry (2003) divided the genus into 10 species groups namely; *rancidus* Chant and McMurtry, *paloratus* Beard, *leucophaeus* Chant and McMurtry, *barkeri* Chant, *letrauformis* Chant and McMurtry, *peruanus* Chant and McMurtry, *desertus* Chant and McMurtry, *paspalivorus* Tseng, *canadensis* Chant and McMurtry, *cucumeris* Athias-Henriot. The *desertus* and *paspalivorus* species groups include 13 and 15 species, respectively, which are distributed worldwide (Chant and McMurtry 2003; Demite et al. 2019).

In this paper, four phytoseiid species namely *N. sinaiticum* (Amitai and Swirski), *N. tabularis* Chaudhri, Akbar and Rasool (both re-described and illustrated based on females), *Eusieus eitanae* (Swirski and Amitai) and *Proprioseiopsis badryi* (Yousef and El-Brollosy) are recorded for the first time from Saudi Arabia. Also, keys to the world species of *desertus* and *paspalivorus* species groups of the genus *Neoseiulus* are provided.

Material and methods

The mite specimens were collected by shaking the plant parts, on a white sheet of paper. Mites found moving on paper were collected with the help of a camel hairbrush and preserved in small vials containing 70% ethanol. Preserved mite specimens were observed under a stereomicroscope (SZX10, Olympus, Tokyo, Japan) and mounted on glass slides in Hoyer's medium. The mounted specimens after drying were examined under phase contrast microscope (DM2500, Leica, Wetzlar, Germany). Different body parts were pictured using an auto montage software system (Syncroscopy, Cambridge, UK), then drawn with Adobe Illustrator (Adobe System Inc., San Jose, CA, USA). All measurements were taken with ocular micrometer attached to the microscope (DM2500, Leica, Wetzlar, Germany) and are given in micrometers (μm). The terminology used in this study follows that of Chant and McMurtry (2007). All collected specimens including type specimens of the new species have been deposited at King Saud University Museum of Arthropods (KSMA, Acarology section), Department of Plant Protection, College of Food and Agriculture Sciences, King Saud University, Riyadh, Saudi Arabia.

Results and discussion

New records and re-descriptions

Genus *Neoseiulus* Hughes

Species group *desertus* Chant and McMurtry

Diagnosis

(Based on Chant and McMurtry 2003)
Setae *J1* present, spermathecae with atrium not deeply forked, ventrianal shield long, mostly almost two times long as maximum width, peritremes at least extending up to the bases of setae *j3*, chelicerae fixed digit with 2–4 teeth, sternal shield with three pairs of setae except *N. sinaiticum* Amitai and Swirski.

Neoseiulus sinaiticum (Amitai and Swirski 1982)

Amblyseius sinaiticum Amitai and Swirski 1982: 63.
Phytodromus sinaiticum – Denmark 1993: 111.

Previous records

Israel (Amitai and Swirski 1982).

Material examined

One female, *Ochradenus baccatus* (Resadaceae), Al-Ula, 26°36.519N, 37°55.593′E, 5 May 2017, coll. E. M. Khan and M. U. Rahman; two females, *Eryngium glomeratum* (Apiaceae), 21°18.590′N, 040°28.554′E, 12 September 2017, coll. M. Kamran and E. M. Khan, one female, *Anabasis setifera* (Chenopodiaceae), Al–Ula, 26°36′29.3″N, 37°54′31.2″ E, elevation 756.6m, 5 May 2017, coll. E. M. Khan and M. Ur Rahman; one female, *Haloxylon salicornicum* (Amaranthaceae), 26°40′35.1″N, 37°53′28.6″E, elevation 800.9m, 7 May 2017, Al–Ula, coll. E. M. Khan and M. Ur Rahman.

Description (n = 5)

Dorsum (Figure 1). Dorsal shield 428–433 long, maximum wide 249–251 near setae *Z4*, oval elongate, strongly sclerotized, reticulate entirely, with 17 pairs of smooth simple setae except *Z4* and *Z5*, which are finely serrated. Setae *r3* and *R1* on the soft cuticle. All setae without tubercles. Measurements of dorsal setae: *j1* 11–12, *j3* 13–19, *j4* 11–14, *j5* 12–17, *j6* 15–20, *J2* 16–20, *J5* 5–7, *z2* 13–16, *z4* 13–18, *z5* 12–15, *Z1* 17–22, *Z4* 27–34, *Z5* 23–31, *s4*

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Predation efficiency and preference of lab-reared and field-collected populations of predatory mite *Cydnoseius negevi* (Acari: Phytoseiidae) on two mite pest species *Oligonychus afrasiaticus* and *Tetranychus urticae* (Acari: Tetranychidae)

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ABSTRACT

The predatory mite *Cydnoseius negevi* (Swirski and Amitai) is mostly found in association with the old world date mite (OWDM), *Oligonychus afrasiaticus* (McGregor) and occasionally with the two spotted spider mite (TSSM), *Tetranychus urticae* Koch. We evaluated the predation efficiency and preference of lab-reared (LR) and field-collected (FC) populations of *C. negevi* on larvae and nymphs (juveniles) of OWDM and TSSM. No significant effect of long-term pollen feeding on predation efficiency or prey-stage preference was observed when comparing LR and FC populations of *C. negevi*. However, significant differences were observed between LR and FC populations of *C. negevi* for prey species preference, the LR population of *C. negevi* significantly preferred OWDM over TSSM. Maximum predation efficiency was observed in prey species preference tests (average 29–31 juveniles of OWDM and TSSM together) as compared to predation efficiency/prey stage preference tests (average 20–24 and 16-22 juveniles of OWDM and TSSM, respectively) within 24 h. The results revealed that *C. negevi* somewhat preferred OWDM than TSSM. The availability of pollen did not affect the predation efficiency of *C. negevi* against both pest species.

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Biological control; choice test; date palm pollen; phytoseiid predator

Introduction

The old world date mite (OWDM), *Oligonychus afrasiaticus* (McGregor) and the two spotted spider mite (TSSM), *Tetranychus urticae* Koch (Acari: Tetranychidae) are major pests of date palm and various agricultural crops, respectively. They severely affect crop production and depreciate their commercial values in national and international markets (Palevsky et al. 2005; Aldosari 2009; Alatawi 2011). *Cydnoseius negevi* (Swirski and Amitai) (Acari: Phytoseiidae) is a commonly occurring predatory mite on different grasses grown in date palm agro-ecosystems of Saudi Arabia, commonly associated with OWDM and occasionally with TSSM (Negm et al. 2012; Alatawi et al. 2017). Previous biological studies showed that *C. negevi* is an effective predator of OWDM (Negm et al. 2014) and TSSM (Abou-Awad et al. 1989; Momen 1997).

As a generalist facultative predator (type III), *C. negevi* (Momen et al. 2009), can feed on a wide range of food types, i.e., thrips, tetranychid and eriophyid mites, and pollen of different plant species (Momen 1997; Momen et al. 2009; Negm et al. 2014; Hussein et al. 2016).

Many generalist phytoseiid predators have successfully reproduced on date palm pollen as an alternative food source, e.g., *Amblyseius swirskii* Athias-Henriot, *Typhlodromus bagdasarjani* Wainstein and Arutunjan (Abou-Elella et al. 2013; Riahi et al. 2016, 2017), *Euseius scutalis* (Athias-Henriot) (Al-Shammery 2011; Fouly et al. 2013; Abou-Elella et al. 2013), *E. finlandicus* (Oudemans) (Abou-Elella et al. 2014), *Proprioseiopsis asetus* (Chant) (Fouly 1997), and *Neoseiulus californicus* (McGregor) (Khanamani et al. 2017a).

However, long-term rearing of the generalist predators on plant pollen could reduce their predation efficiency and make them unsuitable for use in a biological control program (Rasmy and Hussein 1996; Gerson et al. 2003; Bellutti 2011; Hoy 2011; Sørensen et al. 2012; Khanamani et al. 2017b).

The present study aimed to evaluate the predation efficiency and preference of two populations of *C. negevi*, a field-collected (FC) and a lab-reared

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Field population sex ratio of the date palm mite, *Oligonychus afrasiaticus* (McGregor)

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The effect of some abiotic and biotic factors on the population sex ratio of the date palm mite (DPM), *Oligonychus afrasiaticus*, were evaluated on four date palm cultivars in two regions (Riyadh and Qateef) of Saudi Arabia. The week of infestation, fruit stage, and their interactions, as well as the cultivar, significantly affected the DPM sex ratio. The DPM infestation, in the first week, started with a high female proportion (from 0.78 to 1) in both regions of the 'kimri' fruit stage, and remained female-biased till the fifth week of infestation (from 1.5:1 to 4:1) with a growing DPM population density in both regions. The DPM sex ratio declined to equality (1:1) during the sixth week of infestation, the onset of the 'khilal' fruit stage, and further declined to a male-biased sex ratio (4:1) on the Selj, Hamra and Shaishie cultivars, with a declining DPM population density in the last week of infestation. The date fruit stage affected the sex ratio of DPMs negatively in Riyadh and positively in Qateef. The interaction between the week and fruit stage had a significant positive effect on the DPM sex ratio in Riyadh, and a negative effect in Qateef. This study of the DPM sex ratio could be a step in establishing a female-based sampling programme during the early weeks of infestation.

Key words: Riyadh, Qateef, female proportion, biotic and abiotic factor, strand position, bunch direction, date palm cultivar, week of infestation.

INTRODUCTION

The sex ratio is one of the key factors that defines the survival and adaptive ability of a species, and explains the seasonal population dynamics in an environment (Amano & Chant 1977). The spider mites (Acari: Tetranychidae) are haplodiploid organisms, in which the number of females is a function of the population sex ratio, because they are foundresses of new colonies and have the ability to produce haploid males (from unfertilised eggs) and diploid females (from fertilised eggs) (Mitchel 1973; Sabelis *et al*. 2002; Wrensch & Young 1983). The sex ratio of a normally developing spider mite population is always female-biased, with values ranging from 2:1 to 3:1, and can be as extreme as 9:1 (Wrensch & Young 1983).

The shift in the female-biased sex ratio of a developing spider mite population to equality and then to a male-biased sex ratio involves the effects of different biotic and abiotic factors, including the following: population density and food quality (Wrensch & Young 1978), fertilisation status of the female, duration of copulation (Helle & Pijnacker 1985; Potter 1978), age of the female parent (Shih 1979), female remating frequency, distribution of males and females (Markow 2002), temperature, humidity, and photoperiod (Wrensch 1993).

Among these, the temperature and food quality were considered to be the most important factors, as abrupt changes in them can place the spider mite population under stress (Krainacker & Carey 1991; Margolies & Wrensch 1996; Nagelkerke & Sabelis 1996; Roy *et al*. 2003). In a stressed population, the sex ratio is more male-biased, as the young females get ready to migrate, while older females produce an increased number of males to ensure that all young females are inseminated before migration (Roy *et al*. 2003; Wrensch & Young 1983).

There are a number of laboratory studies on the evaluation of factors affecting the sex ratio in mites (Chaaban & Chermiti 2010; Chaaban *et al*. 2011; Macke *et al*. 2012; Macke *et al*. 2014; Noronha 2006; Potter 1978; Roeder 1992; Roy *et al*. 2003; Wrensch & Young 1983; Young *et al*. 1986). However, fewer studies have been conducted on wild populations of mites in the field (Johnson & Proctor 1991; Krainacker & Carey 1991; Michalska & Mańkowski 2006).

The date palm mite (DPM), *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae), is a severely damaging pest mite that targets the fruit bunches of the date palm (Chaaban *et al*. 2011;

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RESEARCH ARTICLE

Molecular and phenotypic variations in *Eutetranychus orientalis* (Klein) populations from Saudi Arabia

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Abstract

The oriental red spider mite, *Eutetranychus orientalis* (Klein) is a major pest of citrus in many countries including Saudi Arabia (SA). The morphological variations among the different populations of *E. orientalis* were reported. In the present study, phenotypic variations based on 40 different morphological characteristics were evaluated in 10 *E. orientalis* populations collected from different hosts and regions of SA. Further, ITS2-rDNA sequences were used to confirm the identity of these phenotypically varying populations. Phenotypic variations in all populations were found in the shape and length of dorsal setae, striation pattern between setae *d1* and *e1*, and leg chaetotaxy. The rDNA sequence analysis of these morphologically varying populations resulted in 10 different ITS2 Saudi haplotypes. The phenotypic and genetic variations were more related to the host plants rather than their geographic distribution. The *E. orientalis* population collected from *Phoenix dactylifera* was phenotypically distinct and genetically divergent. The populations collected from citrus species were also more phenotypically and genetically related to each other than to populations collected from non-citrus host plants. The haplotypes recovered from *Ziziphus* sp., *Morus* sp., and *Azadirecta indica* from different regions were grouped in the same sub-clade. Further, the ITS2 haplotypes of Saudi *E. orientalis* recovered from *Citrus reticulata* from Riyadh and Al Ula were 100% identical to the ITS2 haplotypes recovered from *Citrus* sp. from Israel. It is concluded that phenotypic variations exist among different populations of *E. orientalis* inhabiting different host plants. This species should be identified carefully by considering phenotypic intraspecific variations.

Introduction

The oriental red spider mite, *Eutetranychus orientalis* (Klein), is a major pest of many economical shrubs and fruit trees including *Citrus* sp. and *Prunus* sp. They are widely distributed in many countries of Oriental, Afrotropical, and Palaearctic regions, including Saudi Arabia (SA) and have been found inhabiting more than 200 host plants [1–4]. Different morphological

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Original article

Phenology and abundance of date palm mite *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae) in Riyadh, Saudi Arabia

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ABSTRACT

In the present study, we evaluated the effect of management practices, fruit season, host habitats (young and old fronds, date fruits and grasses), and temperature on the phenology and abundance of the date palm mite (DPM). The study was conducted in two date palm orchards (two plots each): a managed and an unmanaged plot. The phenology of DPM was assessed based on adult cumulative mite days (ACMDs), while mean mite density was used to assess the mite abundance on different host habitats. The ACMDs and mean mite density were significantly different between managed and unmanaged plots on different host habitats in both fruiting and off-seasons. The date fruits had highest ACMDs during fruiting season. While young fronds had significantly higher ACMDs than on old fronds an grasses during both seasons in both plots.. The temperature and season type significantly affected the mean density of DPM eggs and adults. There was a significant effect of host habitats mean density of DPM eggs and immatures. Based on the adult phenology and abundance of DPM, the mite overwinters in young fronds and aerial offshoots of infested date palm trees. These overwintering DPM caused the seasonal date fruit infestation, each year. Additionally, different phytophagous and predatory mites, which co-occur with DPM, and were found on different host habitats affected the phenology and abundance of DPM. Moreover, the change in DPM body color was related to the host habitat that they fed in. Exceptionally, the brown color of females collected during the winter season could be due to physiological changes due to low temperature. In DPM males collected from different host habitats throughout the study, some morphological variations in the width of the knob, height of the hook, and the angle between the knob axis and dorsal margin of the shaft were also recorded. The results of this study suggest that young fronds and grasses are the suitable sites for DPM survival and overwintering. Hence, the management practices, early in the fruit season and/or during off fruit winter months, should be directed towards these habitats. These could provide efficient reduction in seasonal infestation of DPM.

1. Introduction

The development of insects and mites depends on and is mainly modified by cues from the prevailing environmental temperature (Belozerov, 2009; Jarošik et al., 2011; Pedigo and Rice, 2014; Hoy, 2011). The changing population levels of insect and mite species in different habitats, when strongly linked with climate or temperature, becomes a measure of its phenology (Nietschke et al., 2007; Pau et al., 2011; Logan et al., 2006; Hodgson et al., 2010; Walton et al., 2010; Vangansbeke et al., 2015). Phenology is defined as "the timing of periodic life history events", such as diapause, molting, and time of emergence or infestation (Hodgson et al., 2010; Visser, 2008). The factors influencing the phenology of mites include the photoperiod (Visser, 2008), acaricide applications (James, 2000; Kim and Lee, 2003; Woods et al., 2012), the presence of predators (Walton et al., 2010), alternate hosts (James, 2000; Kim and Lee, 2003), and the phenology of the host plant (Herms, 2004; Palevsky et al., 2003, 2004; Samah and Chermiti, 2010; Arnemann et al., 2015; Dar et al., 2015).

The phenology of economically important insect and mite pests is studied to understand the effect of changing climate on their life history traits and to practice integrated management (Nietschke et al., 2007; Richardson et al., 2009). In this regard, numerous

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Article

New Genus and New Subgenera of Camerobiid Mites (Acari: Prostigmata: Camerobiidae) with a Key to World Species of the Genus *Neophyllobius* †

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Simple Summary: The present study erects a new genus, *Monobius* Alatawi and Kamran, where all the leg tarsi in females have one midventral seta. Moreover, the genus *Tillandsobius* Bolland is synonymized with the genus *Tycherobius* Bolland and the genus *Neophyllobius* Berlese is categorized in two new subgeneric divisions. For the first time, a key to all known species of the genus *Neophyllobius* is provided. The ambiguities in the ventral idiosoma setal notation are highlighted and discussed.

Abstract: A new genus, *Monobius* Alatawi and Kamran, is hereby proposed for the two already described species, viz; *M. electrus* (Żmudziński) and *M. meyerae* (Bolland). In addition, the monospecific genus *Tillandsobius* Bolland is synonymized with the genus *Tycherobius* Bolland due to variations in the setae number of tibiae I–IV. Further, the genus *Neophyllobius* Berlese is categorized in two new subgeneric divisions as *Neophyllobius* Berlese and *Monophyllobius* Mirza. The number and position of the midventral setae on tarsi I–IV are considered as strong diagnostic generic and subgeneric diagnostic characters. The present study also includes the key to all known species of the genus *Neophyllobius*. The morphological characters of ten poorly described *Neophyllobius* species were studied in detail through published literature. The ambiguities in the ventral idiosoma setal notation are highlighted and discussed. It is concluded that two intercoxal setae *3a–4a* are always present on small platelets, paired aggenital setae (*ag*) are present anteriorly and paired genital setae (*g*) present posteriorly on genital shield. In addition, five records of new species for Saudi Arabia are reported along with re–descriptions of three species.

Keywords: classification; ventral idiosoma; *Monobius*; *Monophyllobius*; comb. nov

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1. Introduction

The family Camerobiidae Southcott (Acari: Prostigmata) is the second largest family in the superfamily Raphignathoidea. It consists of more than 170 species in seven genera that can be differentiated in two groups based on the position of the solenidion on tarsi I–II. The three genera, viz; *Neophyllobius* Berlese [1], *Tillandsobius* Bolland [2] and *Tycherobius* Bolland [2] have a solenidion present on the basal half of the tarsi I–II, while the four genera, *Acamerobia* Fan and Walter [3], *Camerobia* Southcott [4], *Bisetalobius* du Toit, Theron and Ueckermann [5] and *Decaphyllobius* Bolland [2] have a solenidion present on distal half of tarsi I–II.

The camerobiid mites, also known as stilt–legged mites, are non-potential predators feeding on different phytophagous pest mites and crawlers of scale insects [2]. Although they are widely distributed in both, temperate and tropical zones, their biology is not yet studied [2,3]. In the field, camerobiid mites are present in low numbers as reported for all the described species, globally [2–5]. There are four active developmental stages, viz. larva,

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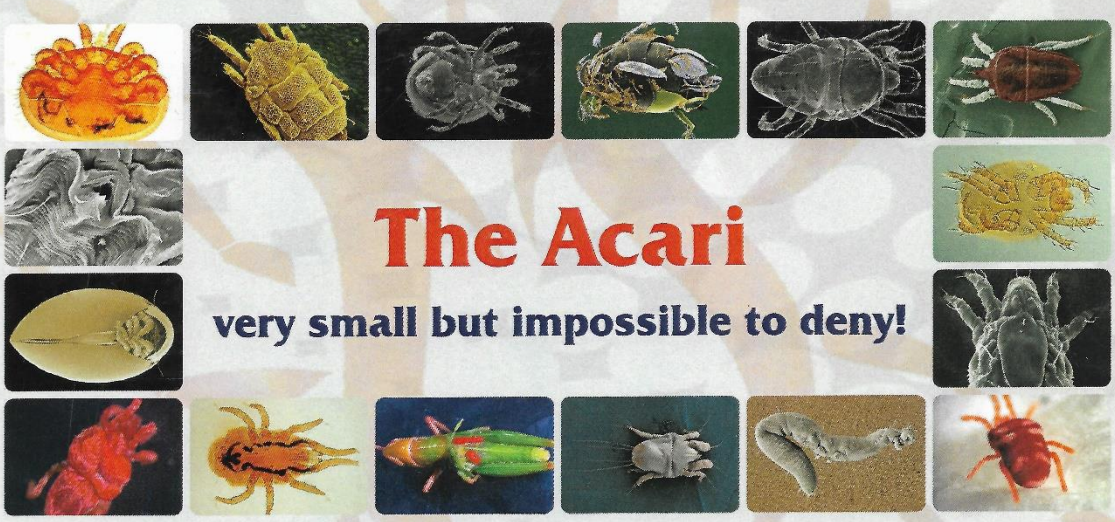

ABSTRACT BOOK

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Morphological and molecular characterization of *Eutetranychus* mite populations collected from different hosts and regions of Saudi Arabia

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Spider mites of the genus *Eutetranychus* (Acari: Trombidiformes: Tetranychidae) are primarily phytophagous, mostly feeding on shrub and tree leaves, and making little webs on the leaves. Among *Eutetranychus* species, the oriental red spider mite, *E. orientalis*, is considered a major pest of citrus in many tropical and subtropical countries. Within the populations of *E. orientalis*, variations in the length and shape of dorsal body setae, pattern of striations between setae *d1* and *e1*, and chaetotaxy on the femora and tibiae, have been reported. Such morphological variations in the *E. orientalis* species complex have resulted in misidentification of its populations. For this reason, molecular methods can help taxonomists precisely identify and/or confirm different mite species. The present study aimed to confirm the identity of *Eutetranychus* mites collected from different plant hosts in different regions of Saudi Arabia. The second internal transcribed spacer (ITS2) region was amplified and sequenced from the morphologically-characterized mite samples. The cleaned and edited DNA sequences were compared with the NCBI-GenBank database for possible matches. DNA sequence analysis confirmed the identity of morphologically-characterized mites belonging to *E. orientalis*. Moreover, three different ITS-2 genotypes of *E. orientalis* were identified, suggesting that the Saudi *E. orientalis* populations may be genetically very diverse. In addition, a new *Eutetranychus* species was morphologically and molecularly identified. On-going studies will be conducted to elucidate the phylogenetic relationships among the Saudi mites and their counterparts worldwide. It is anticipated that the outcomes of the present study will help in resolving some problems associated with cryptic mite species. In addition, the proper identification of pest species can contribute to the development of effective management strategies.

Keywords: ITS2, *orientalis*, genotypes, genetic diversity, phenotypic variations

The genus *Oligonychus* Berlese (Prostigmata: Tetranychidae) from Saudi Arabia; new records and some morphological and webbing behavioral variations between *Oligonychus ephamnus* and *Oligonychus afrasiaticus*

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Two species, *Oligonychus* (*Reckiella*) *ephamnus* Beard and Walter and *O.* (*R.*) *orthius* Rimando, are recorded for the first time from Saudi Arabia from grasses (Poaceae) under the date palm, *Phoenix dactylifera* L., and *Washingtonia* sp. (Arecacae), in association with the date palm mite, *O.* (*R.*) *afrasiaticus* (McGregor). The *Oligonychus* species, especially those belonging to the subgenus *Reckiella* Tuttle and Baker, are very difficult to identify through the morphological characters of adult females and usually are distinguished by the shape of the male aedeagus. Some morphological and webbing structural variations between adult females of *O.* (*R.*) *ephamnus* and *O.* (*R.*) *afrasiaticus,* were observed and studied in the present research work. The females of these two species are morphologically similar, except for differences in comparative length of leg empodia and proximo-ventral hairs, and the characteristics of web structure. All leg empodia are 1.6 to 1.8 times longer than proximo-ventral hairs in *O. afrasiaticus*, compared to all empodia almost equal in length to the proximo-ventral hairs in *O. ephamnus*. Moreover, *O. afrasiaticus* deposited its fecal pellets on the leaf surface of the date palm and *Washingtonia* sp., and the eggs were laid in the middle of an irregular, complicated web structure whereas in *O.* (*R.*) *ephamnus*, both the fecal pellets and eggs were scattered throughout the regular, complicated web structure. Webbing structure behavior may also be used to distinguish other closely related *Oligonychus* species. An illustrated key of males and females of all known *Oligonychus* species from Saudi Arabia is provided.

Keywords: Date palm, mite, fecal pellets, webbing structures, taxonomy