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Contribution to the Knowledge of the Ladybird beetles (Coleoptera, Coccinellidae), Predators of Mealybugs (Hemiptera, Pseudococcidae) in Hormozgan Province, Southern Iran

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A b s t r a c t : The Coccinellid predators (Coleoptera, Coccinellidae) associated with mealybug species (Hemiptera, Pseudococcidae) in Hormozgan province, south of Iran was studied during years 2009-2010. A total of 8 species representing 5 genera belonging to 3 subfamilies were collected and identified. *Nephus (Sidis) hieckei riyadhensis* FÜRSCH 1979 is new record for the fauna of Iran. Locality and date of collection, host(s) and distribution data for each species are provided.

K e y w o r d s : Coleoptera, Coccinellidae, Predators, Pseudococcidae, Hormozgan, Iran.

Introduction

The Coccinellidae comprise one of the largest and most abundant families of Cucujoidea with over 6.000 nominal species known throughout the world (CANEPARI 2011). Most Coccinellidae are entomophagous, predators of a wide range of hosts from hemipteran pests such as aphids, mealybugs and scale insects, as well as thrips (Thysanoptera) and mites (Acarina) in all parts of the world (RAIMUNDO et al. 2006, 2008). They represent the largest group of predators of mealybugs (Hemiptera, Pseudococcidae) (MAJERUS 1994). Several species of coccinellid beetles have been used or are used today for suppression of various mealybug crop pests (BARTLETT 1978, BEN-DOV 1994, BEN-DOV et al. 2012). Recently, some faunistic studies on Iranian Coccinellids fauna have been generally focused on predators associated with mealybugs (ASADEH & MOSSADEGH 1991, MOSSADEGH & KOCHEILI 1993, NOVIN 2000, LOTFALIZADEH & AHMADI 2000, FALLAHZADEH & HESAMI 2004, FALLAHZADEH et al. 2006, 2010, 2011). Here, we provide some additional information on the distribution of Coccinellid predators associated with mealybug in Hormozgan province southern Iran, add one subspecies to the published records, and provide some new host records.

Materials and Methods

Surveys for predators of mealybug (Hemiptera, Pseudococcidae) were conducted on cultivated and non-cultivated plants in different area of Hormozgan province, Iran, from

2009 to 2010. During each sample, predators were collected using an aspirator, when observed, or by shaking plant to dislodge and collect predators in a funnel below. In the laboratory, immature stages of the predators were reared, on mealybugs, to the adult stage for better identification (using keys by YAZDANI 1990, RAIMUNDO & VAN HARTEN 2000, RAIMUNDO et al. 2006, 2008). Voucher specimens were deposited in the Entomology Department of the Agriculture Faculty, Islamic Azad University, Jahrom Branch, Iran.

Results and Discussion

A total of 8 Coccinellid species representing 5 genera belonging to 3 subfamilies were collected. The list of species and their distributional data are given below.

Subfamily Scymninae Mulsant 1846

Tribe Scymnini Mulsant 1846

Genus *Scymnus* Kugelann 1794

Scymnus (Scymnus) nubilus Mulsant 1850

Material: 2 ♀♀, 3 ♂♂, Rodan, 15.09.2009, ex *Nipaeococcus viridis* (Newstead) on *Citrus* (Rutaceae); 13 ♀♀, 1 ♂, Minab 18.02.2010, ex *N. viridis* on *Citrus*; 3 ♀♀, 4 ♂♂, Minab, 18.02.2010, ex *Maconellicoccus hirsutus* (Green) on *Abutilon fruticosum* Guill & Perr. (Malvaceae); 8 ♀♀, 4 ♂♂, Rodan, 9.10.2010, ex *N. viridis* on *Citrus*; 14 ♀♀, 10 ♂♂, Bandar-e-Abbas, 14.10.2010, ex *M. hirsutus* on *Ricinus communis* L. (Euphorbiaceae); 6 ♀♀, 1 ♂, Bandar-e-Abbas, 14.10.2010, ex *M. hirsutus* on *Helianthus annuus* L. (Asteraceae); 4 ♂♂, Bandar-e-Abbas, 14.10.2010, ex *M. hirsutus* on *Ficus religiosa* L. (Moraceae).

Remarks: It has been recorded as a predator of the mealybug *Maconellicoccus hirsutus* (Green) (Kumar & Chakraborty 1997).

Distribution: Southern Europe, Atlantic islands eastwards to Japan and Micronesia, Africa (Canepari 2001), Iran, Yemen and UAE (Yazdani 1990, Raimundo & Van Harten 2000, Raimundo et al. 2006, 2008).

Scymnus (Pullus) syriacus (Marseul 1868)

Material: 7 ♂♂, Bandar-e-Abbas, 23.04.2009, ex *Planococcus ficus* (Nasonov) on *Ficus* sp. (Moraceae); 13 ♀♀, 1 ♂, Bandar-e-Abbas, 30.5.2009, ex *Phenacoccus solenopsis* (Tinsley) on *Abutilon fruticosum* Guill & Perr. (Malvaceae); 3 ♀♀, 2 ♂♂, 4.12.2009, ex *P. solenopsis* on *Acacia nilotica* (L.) Willd. ex Delile (Mimosaceae); 6 ♀♀, 11 ♂♂, Minab, 18.02.2010, ex *P. solenopsis* on *Hibiscus rosa-sinensis* L. (Malvaceae); 8 ♀♀, 5 ♂♂, Rodkhaneh, 15.06.2010, ex *P. solenopsis* on *Gossypium* L. (Malvaceae).

Remarks: It has been recorded as a predator of the mealybug *Nipaeococcus viridis* (Newstead) (Sharaf & Meyerdirk 1987), *Ferrisia virgata* (Cockerell) (Mangoud 2008).

Distribution: Eastern Mediterranean region especially Jordan, Lebanon, Turkey, Iran, Libya, Yemen and Egypt (Yazdani 1990, Raimundo & Van Harten 2000, Raimundo et al. 2006).

Genus *Nephus* MULSANT 1846***Nephus (Sidis) hieckei riyadhensis* FÜRSCH 1979**

Material: 13 ♀♀, 6 ♂♂, Bandar-e-Abbas, 30.11.2009, ex *P. solenopsis* on *Sesamum orientale* L. (Pedaliaceae); 20 ♀♀, 4 ♂♂, Bandar-e-Abbas, 14.06.2010, ex *P. solenopsis* on *Lantana camara* L. (Verbenaceae); 5 ♀♀, 2 ♂♂, Minab, 18.09.2010, ex *P. solenopsis* on *Hibiscus rosa-sinensis* L. (Malvaceae); 7 ♀♀, Rodan, 19.04.2010, ex *P. solenopsis* on *Solanum nigrum* L. (Solanaceae).

Remarks: The nominal species has been recorded as a predator of the mealybug *Planococcus citri* (RISSO) (FÜRSCH 1979).

Distribution: The nominal species has been recorded from Portugal, Spain, Greece, Turkey, Palestine, Lebanon and Iraq. The subspecies was only known from Egypt, Syria, Yemen, Saudi Arabia and UAE (FÜRSCH 1979, RAIMUNDO & VAN HARTEN 2000, RAIMUNDO et al. 2006, 2008).

***Nephus (Geminosipho) fenestratus* (SAHLBERG 1913)**

Material: 6 ♀♀, 10 ♂♂, Rodan, 15.09.2009, ex *N. viridis* on *Citrus* (Rutaceae); 9 ♀♀, 1 ♂, Minab 18.02.2010, ex *N. viridis* on *Citrus*; 1 ♀, 3 ♂♂, Rodan, 3.09.2010, ex *N. viridis* on *Citrus*; 4 ♀♀, 2 ♂♂, Minab 12.06.2010, ex *N. viridis* on *Citrus*; 5 ♀♀, 1 ♂, Rodan, 16.07.2010, ex *N. viridis* on *Citrus*; 4 ♀♀, 2 ♂♂, Rodan, 12.10.2010, ex *N. viridis* on *Citrus*.

Remarks: It has been recorded as a predator of the mealybug *Nipaecoccus viridis* (NEWSTEAD) (ASADEH & MOSSADEGH 1991, MOSSADEGH & KOCHIL 1993, NOVIN 2000, HESAMI & FALLAHZADEH 2004), *Macronellus hirsutus* (GREEN) (FALLAHZADEH & HESAMI 2004).

Distribution: Egypt, Syria, Iran, Saudi Arabia (FÜRSCH 1979), Yemen and UAE (RAIMUNDO & VAN HARTEN 2000; RAIMUNDO et al. 2006, 2008).

***Nephus (Bipunctatus) includens* (KIRSCH 1870)**

Material: 4 ♂♂, Rodan, 15.09.2009, ex *N. viridis* on *Citrus* (Rutaceae); 19 ♀♀, 3 ♂♂, Minab 18.02.2010, ex *N. viridis* on *Citrus*; 17 ♀♀, 16 ♂♂, Rodan, 3.09.2010, ex *N. viridis* on *Citrus*; 12 ♀♀, 4 ♂♂, Minab 12.06.2010, ex *N. viridis* on *Citrus*; 1 ♀, 2 ♂♂, Rodan, 16.07.2010, ex *N. viridis* on *Citrus*; 54 ♀♀, 3 ♂♂, Rodan, 14.10.2010, ex *N. viridis* on *Citrus*; 6 ♀♀, Rodan, 17.12.2010, ex *N. viridis* on *Citrus*; 1 ♂, Rodan, 20.12.2010, ex *N. viridis* on *Citrus*.

Remarks: It has been recorded as a predator of the mealybug *Nipaecoccus viridis* (Newstead) (ASADEH & MOSSADEGH 1991, MOSSADEGH & KOCHIL 1993, NOVIN 2000), *Planococcus citri* (RISSO) (ARGYRIOU et al. 1976, KONTODIMAS et al. 2005).

Distribution: West Africa (Gambia, Guinea-Bissau, Cape Verde, Canary Islands); Mediterranean Europe, Africa and Near East (Portugal, Greece, Sicily, Turkey, Egypt, Israel, Syria, Ethiopia, Saudi Arabia, Iran, Yemen and UAE (FÜRSCH 1979, 1986, RAIMUNDO 1992, 1994, RAIMUNDO & VAN HARTEN 2000, RAIMUNDO et al. 2006, 2008).

Tribe Hyperaspidiini MULSANT 1846**Genus Hyperaspis DEJEAN 1833*****Hyperaspis polita* WEISE 1885**

Material: 4♀♀, 1♂, Minab, 30.04.2009, ex *M. hirsutus* on *Abutilon fruticosum* GUILL & PERR. (Malvaceae); 6♀♀, 1♂, Rodan, 15.09.2009, ex *N. viridis* on *Citrus*; 8♀♀, Bandar-e-Abbas, 30.11.2009, ex *P. solenopsis* on *Sesamum orientale* L. (Pedaliaceae); 1♂, Bandar-e-Abbas, 30.05.2009, ex *N. viridis* on *Ziziphus mauritiana* Lam. (Rhamnaceae); 2♀♀, 6♂♂, Rodan, 3.09.2010, ex *N. viridis* on *Citrus*; 3♂♂, Bandar-e-Abbas, 30.11.2009, ex *P. solenopsis* on *Sesamum orientale* L. (Pedaliaceae); 2♂♂, Bandar-e-Abbas, 14.06.2010, ex *P. solenopsis* on *Lantana camara* L. (Verbenaceae); 4♀♀, 1♂, Minab, 18.09.2010, ex *P. solenopsis* on *Hibiscus rosa-sinensis* L. (Malvaceae).

Remarks: It has been recorded as a predator of the mealybug *Nipaecoccus viridis* (NEWSTEAD) (ASADEH & MOSSADEGH 1991, MOSSADEGH & KOCHEILI 1993, NOVIN 2000, HESAMI & FALLAHZADEH 2004), *Planococcus vovae* (NASONOV) (LOTFALIZADEH & AHMADI 2000), *Maconellicoccus hirsutus* (GREEN) (FALLAHZADEH & HESAMI 2004), *Planococcus ficus* (SIGNORET) (FALLAHZADEH et al. 2011).

Distribution: Lebanon and the coastal areas of the Eastern Mediterranean region, Turkey, Iran to Pakistan and dry regions in South Western Asia (YAZDANI 1990, RAIMUNDO & VAN HARTEN 2000, RAIMUNDO et al. 2006).

Subfamily Chilocorinae MULSANT 1846**Genus Exochomus REDTENBACHER 1843*****Exochomus melanocephalus* (ZOUBKOFF 1833)**

Material: 2♀♀, 6♂♂, Bandar-e-Abbas, 30.05.2009, ex *N. viridis* on *Ziziphus mauritiana* LAM. (Rhamnaceae); 20♀♀, 1♂, Bandar-e-Abbas, 21.06.2009, ex *N. viridis* on *Z. mauritiana*; 4♀♀, 2♂♂, Bandar-e-Abbas, 7.08.2010, ex *N. viridis* on *Z. mauritiana*.

Remarks: It has been recorded as a predator of the mealybug *Ferrisia virgata* (COCKERELL) (LE PELLEY 1968).

Distribution: South Russia, Transcaucasia, Iran (MADER 1955, YAGHMAEI & KHARAZI PAKDEL 1995).

Subfamily Coccinellinae LATREILLE 1807**Genus Menochilus TIMBERLAKE 1943*****Menochilus sexmaculatus* (FABRICIUS 1781)**

Material: 2♀♀, Minab, 30.04.2009, ex *M. hirsutus* on *Abutilon fruticosum* GUILL & PERR. (Malvaceae); 1♀, 7♂♂, Bandar-e-Abbas, 30.11.2009, ex *P. solenopsis* on *Sesamum orientale* L. (Pedaliaceae); 1♀, Bandar-e-Abbas, 14.06.2010, ex *P. solenopsis* on *Lantana camara* L. (Verbenaceae); 5♂♂, Minab, 18.09.2010, ex *P. solenopsis* on *Hibiscus rosa-sinensis* L. (Malvaceae); 5♀♀, 9♂♂, Rodan, 19.04.2010, ex *P. solenopsis* on *Solanum nigrum* L. (Solanaceae); 4♂♂, Bandar-e-Abbas, 14.10.2010, ex *M. hirsutus* on *Ricinus communis* L. (Euphorbiaceae).

Remarks: It has been recorded as a predator of the mealybug *Phenacoccus*

solenopsis (TINSLEY) (ZHOU et al. 2012).

Distribution: Japan, China, Formosa, India, Philippines, Ceylon, Malaysia, New Guinea, Micronesia, Indonesia, Timor and UAE (RAIMUNDO et al. 2008).

Members of the family Coccinellidae are questionably one of the most useful groups in biological control, whereas several species of them are used in biological control programs of scale insect species (MAJERUS 1994), particularly on the mealybugs (BEN-DOV et al. 2012). In our survey, each species was directly observed feeding on eggs, nymphs, and adults of mentioned mealybug species. The *Nephus (Sidis) hieckei riyadhensis* FÜRSCH 1979 is new record for Iran. More work is needed to document the effectiveness of the native lady beetles, found throughout the world's regions, as mealybug predators.

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Zusammenfassung

Die räuberischen Coccinelliden (Coleoptera, Coccinellidae), assoziiert mit Schmierläusen (Hemiptera, Pseudococcidae), wurden in der südiranischen Provinz Hormozgan im Zeitraum 2009-2010 studiert. 8 Arten aus 5 Gattungen und 3 Unterfamilien konnten nachgewiesen und dokumentiert werden, *Nephus (Sidis) hieckei riyadhensis* FÜRSCH 1979 stellte sich als Erstnachweis für den Iran heraus.

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