

FIRST RECORD OF *AENASIUS ARIZONENSIS* (GIRAULT, 1915)
(HYMENOPTERA, ENCYRTIDAE), A PARASITOID OF
PHENACOCCLUS SOLENOPSIS TINSLEY, 1898 (HEMIPTERA,
PSEUDOCOCCIDAE) IN IRAQ

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ABSTRACT

This article reports the first record of *Aenasius arizonensis* (Girault, 1915) (Hymenoptera, Encyrtidae) parasitizing the recently introduced species of cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera, Psedococcidae) infesting *Lantana camara* L. (Verbenaceae) as well as other ornamental plants in Baghdad province, Iraq. A short morphological description is also presented.

Key words: *Aenasius*, Baghdad, Encyrtidae, Iraq, *Phenacoccus*.

INTRODUCTION

The cotton mealybug, *Phenacoccus solenopsis* (Girault) (Hemiptera, Psedococcidae), is an important pest of cotton and ornamental plants; this species is a polyphagous and has been reported to be feeding on at least 219 host plant species that belong to 53 plant families (Ben-Dov *et al.*, 2017). Some of these hosts are considered economically important plants, such as cotton and horticulture crops in both indoor and outdoor productions (Culik and Gullan, 2005; Hodgson *et al.*, 2008; Afzal *et al.*, 2009; Wang *et al.*, 2009; Yi-Yong *et al.*, 2011); infestation by this mealybug causes huge yield loss; reducing the cotton yield by up to 40-50 % as was reported from some infested fields in India (Jhala *et al.*, 2008). So far, this mealybug had been reported from 37 countries in various biogeographical zones such as South East Asia, North Africa and the Mediterranean (Ben-Dov *et al.*, 2017).

Phenacoccus solenopsis was found for the first time in Iraq in 2014, in Baghdad province (Abdul-Rassoul *et al.*, 2015) on eleven host plant species that belong to nine families.

Several species of Hymenoptera have been found associated with cotton mealybug, *Phenacoccus solenopsis* namely: *Acerophagus coccois* Smith, 1880, *Aenasius bambawalei* Hayat 2009, *Anagyrus aligarhensis* Agarwal & Alam, 1959, *Anagyrus diversicornis* (Howard, 1894), *Anagyrus kamali* Moursi 1948 and *Leptomastix epona* (Walker, 1844) (Encyrtidae); *Promuscidia unfasciiventris* Girault, 1917 (Pteromalidae) in different parts of the world (Ben-Dov *et al.*, 2017).

Ram *et al.*, (2009) indicated that the parasitoid *Aenasius arizonensis* (= *A. bambawalei*) was very active against the mealybug, *P. solenopsis* in India and they observed that the

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parasitization on cotton and other host plants was 37.6% and 47.2% during 2008 and 2009 respectively.

This study is conducted to determine the parasitoids of the invasive mealybug, *Phenacoccus solenopsis* in Iraq; also this investigation reports the first record of *A. arizonensis* as a parasitoid of the mealybug *P. solenopsis* in Iraq.

MATERIALS AND METHODS

Plant part samples of Common Purslane, *Portulaca oleracea* L. (Portulacaceae), Moss-rose purslane, *Portulaca grandiflora* Hook. (Portulacaceae), Lantana, *Lantana camara* L. (Verbenaceae), Pilea, *Pilea serpyllacea* (Kunth) Wedd (Urticaceae), Alternanthera, *Alternanthera amoena* (Lem.) Voss (Amaranthaceae), and Aster, *Aster tripolium* L. (Asteraceae) bearing mealybug mummies of *Phenacoccus solenopsis* were collected from private gardens in two locations in Baghdad province that included: Al-Ghadir and Al-Karrada Al-Sharqiya during 2014 and 2015.

Each sample was placed in a plastic bag and brought to the laboratory for examination and kept in glass jars provided with a gauze cover for proper ventilation for the emergence of parasitoids; these jars were kept under observation to record emergence of the adult parasitoids at room temperature (range 25-35°C), and relative humidity of 35±5%, by using the Hygrothermograph. The emerged parasitoids were mounted on small card, and identified by the author according to available literature given by Girault (1915); Noyes, (1980); Noyes and Ren (1995); Hayat (2009); Poorani *et al.* (2009) and was determined as *Aenasius arizonensis* (Girault, 1915) (= *Aenasius bambawalei* Hayat, 2009). Photographs were made using the camera of Samsung galaxy A5, and using a binocular dissecting microscope (WILD M5, Switzerland) to magnify the morphological features.

RESULTS AND DISCUSSION

A natural parasitoid *Aenasius arizonensis* of the mealybug, *Phenacoccus solenopsis* appeared in Baghdad during 2014 and 2015 on different host plants such as Common Purslane, *Portulaca oleracea* L. (Portulacaceae), Moss-rose purslane, *Portulaca grandiflora* Hook. (Portulacaceae), Lantana, *Lantana camara* L. (Verbenaceae), Pilea, *Pilea serpyllacea* (Kunth) Wedd (Urticaceae), Alternanthera, *Alternanthera amoena* (Lem.) Voss (Amaranthaceae), and Aster, *Aster tripolium* L. (Asteraceae).

This parasitoid was first described and named by Girault from U.S.A- Arizona in 1915, as *Chalacspis arizonensis* (Girault, 1915); Noyes and Woodlley in 1994 transferred this parasitoid to the genus *Aenasius* Walker, 1846. Hayat (2009) described *A. bambawalei* from India, and later Fallahzadeh *et al.* (2014) synonymized it with *A. arizonensis*; this parasitoid is known as a solitary nymphal endoparasitoid of cotton mealybug, *Phenacoccus solenopsis*, which induces up to more than 80 percent parasitization in India (Ram *et al.*, 2009).

Diagnosis: *Aenasius arizonensis* is easily recognized from the other species of *Aenasius* by the following characters: Antenna with scape cylindrical, about six times as long as wide; fore wing with a hyaline streak adjacent to the postmarginal and stigmal veins; costal cell with one line of setae dorsally. The following is a short morphological description given here based on the Iraqi specimens for the simple identification; moreover the female of *A. arizonensis* is easily separated from the male by having different shape of antenna.

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Female (Pl.1): Length: 1.08-1.62 mm. Body short and broad, shiny black with metallic reflections. Legs are metallic green except the tarsi and tips of the middle tibiae which are reddish like the scape. Antennae are reddish except the bulb of scape and the pedicel, which are metallic dark green; club sometimes blackish.

Head wider than thorax, with thimble-like punctures; anterior part of vertex wide, at narrowest point about half as wide as head; malar space longer than length of eye; occipital margin sharp; mandibles bidentate. Antennae (Pl.2) club-shaped, Scape cylindrical, are about six times as long as wide, upper margin of scape markedly bowed downward before middle; flagellum clavate; pedicel somewhat longer than wide; funicle with six segments and transverse, subequal in width, broadening towards clava, sixth largest. Clava large, obliquely truncate, longer than funicle segment together and usually much wider than funicle. Tegulae large; Mesoscutum very short, only half as long as scutellum, with a sculpture very similar to that of head. Scutellum slightly wider than long; axillae separated by a rather long median suture. Fore wings (Pl.3) of normal length, exceeding apex of gaster; fore wings basally infusate, distal half and costal cell hyaline, with a hyaline streak adjacent to the postmarginal and stigmal veins. Marginal vein very short; postmarginal vein as long as stigmal; costal cell with one line of setae dorsally; Hind wings hyaline. Hypopygium reaching apex of gaster.

Male (Pl.4): Length: 0.27- 1.27mm; differs from the female in its generally smaller size, more uniformly black with less metallic in color, in antennal structure, and wings venation. Funicle with two segments much wider than long. Clava one-segmented, long, curved banana-shaped. Fore wings hyaline, venation as in female.

Materials examined: Baghdad province, Al-Ghadir, 1♀ 15.VIII.2014 ex. *Phenacoccus solenopsis* on *Portulaca oleracea* (Portulacaceae), 2♀♀, 1♂ 2.IX.2014 on *Iresine herbstii* (Amaranthaceae), 3♀♀, 1♂ 7, 16.XII.2014, 2♀♀, 1♂ 1.V.2915 on *Lantana camara* (Verbenaceae) 1♀ 8.V.2015, 4♀♀, 4♂♂ 1.VI.2015, 1♂ 14.VI.2015 on *Pilea serpyllacea* (Urticaceae), 2♀♀, 6♂♂ 1.VI.2015 on *Iresine herbstii* (Amaranthaceae), 26♀♀, 47♂♂ 14, 25, 26.VI. 2015 on *Lantana camara* (Verbenaceae); Al-Ghadir 2♀♀, 6♂♂ 11.VIII.2015 on *Lantana camara* (Verbenaceae), 2♂♂ 24.VIII.2015 on *Aster tripolium* (Asteraceae). Karrada Al-Sharqiya 2♀♀, 3♂♂ 26.VI.2015 on *Lantana camara* (Verbenaceae); 2♀♀, 1♂ 1, 24, 27.VII.2015 on *Lantana camara* (Verbenaceae), 5♀♀, 2♂♂ 21, 23.VII.2015 on *Portulaca oleracea* (Portulacaceae), 4♀♀, 4♂♂ 26.VII, 2015 on *Portulaca gradiflora* (Portulacaceae); 1♀, 1♂ 11.VIII.2015 on *Lantana camara* (Verbenaceae) and on *Aster tripolium* (Asteraceae).

Distribution: The parasitoid *Aenasius arizonensis* is widely distributed in India, Pakistan, China, U.S.A. (Noyes, 2017) and newly reported from Iran Fallahzadeh *et al.* (2014) where it is common on *Phenacoccus solenopsis* and *Pseudococcus longispinus* (Noyes, 2017).

Biology: In addition to the taxonomic characters, some observations were made on the biology of the parasitoid, the laboratory rearing of the field collected mummies on different host plants showed that maximum mummies were collected from *Lantana camara* (Verbenaceae) followed by *Iresine herbstii* (Amaranthaceae), and *Portulaca oleracea* (Portulacaceae). It attacks the third instar nymphs of the host and kills the host before reaching maturity and this met with Ashfaq *et al.* (2010). The parasitoid took 10-12 days to complete its development in the host and caused transformation of parasitized mealybug into reddish-brown mummies which could be easily identified on the plants and can easily be distinguished from the healthy colony. It turns the mealybug into barrel-shaped mummy (Pl.5) with dark brown in color. This result is in agreement with Jhalal *et al.* (2008), Ram *et al.* (2009) and Prasad *et al.* (2011).

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This mealybug and its parasitoid were observed for the first time in Iraq simultaneously, so it is possible that this parasitoid is transferred with the mealybug into the newly invaded countries as was also noticed by Muniappan, 2010; Solangi and Mahmood, 2011.

Comments: Our specimens of *Aenasius arizonensis* quite agree with the description which were given by Girault (1915) in describing his new species of *Chalacspis arizonensis* (= *Aenasius arizonensis*), and fit with the characters which were given by Hayat (2009) and Poorani *et al.* (2009) by having a hyaline streak adjacent to the postmarginal and stigmal veins in the fore wing. However, our specimens disagree with other authors who used some characters such as the color of the antennal segments. This character is probably unreliable according to Noyes and Ren (1995). Therefore, in this study, reliable characters were used to define this species.



Plate (1): The female of *A. arizonensis*.



Plate (2): Antenna in the female of *A. arizonensis*.

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Plate (3): Fore wing in the female of *A. arizonensis*.



Plate (4): The male of *A. arizonensis*.



Plate (5): The mealybug *Phenacoccus solenopsis* and their mummy.

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LITERATURE CITED

- Abdul-Rassoul, M. S., Al-Mallo, I. M. and Hermiz, F. B. 2015. First record of *Solenopsis* mealybug, *Phenacoccus solenopsis* Tinsley, 1898 (Hemiptera, Pseudococcidae) from Iraq. *Journal of Biodiversity and Environmental Sciences*, 7(2): 216-222.
- Afzal, M., Rehman, S. U. and Siddiqui, M. T. 2009. Appearance and management of a new devastating pest of cotton *Phenacoccus solenopsis* Tinsley, in Pakistan. Beltwide cotton conference, San Antonio, Texas, pp 5-8.
- Ashfaq, M., Shah, G. S., Noor, A. R., Ansari, S. P. and Mansoor, S. 2010. Report of a parasitic wasp (Hymenoptera: Encyrtidae) parasitizing cotton mealybug (Hemiptera: Pseudococcidae) in Pakistan and use of PCR for estimating parasitisation levels. *Biocontrol Science and Technology*, 20(6): 625-630. DOI 10.1080/09583151003693535.
- Ben-Dov, Y., Miller, D. R. and Gibson, A. P. 2017. *Scale Net*. Available at: <http://www.scale.info/catalogue/Phenococcus%20solenopsis/> (Accessed June 2017).
- Culik, M. P. and Gullan, P. J. 2005. A new pest of tomato and other records of mealybugs (Hemiptera: Pseudococcidae) from Espírito Santo, Brazil. *Zootaxa*, 964: 1-8.
- Fallahzadeh, M., Japoshvili, G., Abdmaleki, R. and Saghaei, N. 2014. New records of Tetracneminae (Hymenoptera, Chalcidoidea, Encyrtidae) from Iran. *Turkish Journal of Zoology*, 38: 515-518.
- Girault, A. A. 1915. New chalcidoid Hymenoptera. *Annals Entomological Society of America*, 8: 279-284.
- Hayat, M. 2009. Description of a new species of *Aenasius* Walker (Hymenoptera: Encyrtidae), parasitoid of mealybug, *Phenacoccus solenopsis* Tinsley (Homoptera: Pseudococcidae). *Biosystematica*, 3: 21-25.
- Hodgson, C. J., Abbas, G., Arif, M. J., Saeed, S. and Karar, H. 2008. *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), a new invasive mealybug damaging cotton in Pakistan and India with a discussion on seasonal morphological variation. *Zootaxa*, 1913: 1-35.
- Jhala, R. C., Bharpoda, T. M. and Patel, M. G. 2008. *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae), the mealybug species recorded first time on cotton and its alternate host plants in Gujarat, India. *Uttar Pradesh Journal of Zoology*, 28 (3): 403-406.
- Muniappan, R. 2010. Three alien invasive mealybugs are on the March in Asia. IAPPS Newsletter. No. X October 2010.
- Noyes, J. S. 1980. A review of the genera of Neotropical Encyrtidae (Hymenoptera, Chalcidoidea). *Bulletin of the British Museum of natural History (Entomology)*, 41 (3): 107-253.

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- Noyes, J. S. 2017. Universal Chalcidoidea Database. World Wide Web electronic publication. Available at: <http://www.nhm.ac.uk/chalcidoids> (Accessed 6th May, 2017).
- Noyes, J. S. and Ren, H. 1995. Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea): the genus *Aenasius* Walker, parasitoids of mealybugs (Homoptera: Pseudococcidae). *Bulletin of natural History Museum, London (Entomology)*, 64 (2): 117-163.
- Noyes, J. S. and Woolley, J. B. 1994. North American encyrtid fauna (Hymenoptera: Encyrtidae): taxonomic changes and new taxa. *Journal of Natural History*, 28 (6): 1327-1401.
- Poorani, J., Rajeshwari, S. K. and Gupta, A. 2009. Notes on diagnosis and biology of *Aenasius bambawalei* Hayat (Encyrtidae:Hymenoptera) a parasitoid of the invasive mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera:Sternorrhyncha: Pseudococcidae). *Journal of Biological Control*, 23(4): 463-466.
- Prasad, Y., Prabhakar, M., Sreedevi, G. and Thirupathi, M. 2011. Spatio-temporal dynamics of the parasitoid, *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae) on mealybug, *Phenacoccus solenopsis* Tinsley in cotton based cropping systems and associated weed flora. *Journal of Biological Control*, 25(3): 198–202.
- Ram, P., Saini, R. K. and Vijaya. 2009. Preliminary studies on field parasitisation and biology of *solenopsis* mealybug parasitoid *Aenasius bambawalei* Hayat, (Encyrtidae:Hymenoptera). *Journal of Cotton Research and Development*, 23: 313–315.
- Solangi, G. S. and Mahmood, R. 2011. Biology, host specificity and population trends of *Aenasius bambawalei* Hayat and its role controlling mealybug *Phenacoccus solenopsis* Tinsley at Tandojam Sind 5th Meeting Asian Cotton Research and Development Network held on February 23-25 Lahore, pp 1-7. Available at: https://www.icac.org/tis/regional_networks/asian_network/meeting_5/documents/papers/PapSolangiGS-et_al.pdf
- Wang, Y. P., Wu, S. A. and Zhang, R. Z. 2009. Pest risk analysis of a new invasive pest, *Phenacoccus solenopsis* to China. *Chinese Bulletin Entomology*, 46: 101-106.
- Yi-Yong, Z., Fung, H. and Yao-Bin, L. 2011. Bionomics of mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton. *Acta Entomologica Sinica* , 54(2): 246-252.

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تسجيل اول للطفيلي

Aenasius arizonensis (Girault, 1915) (Hymenoptera, Encyrtidae)

على البق الدقيقي للقطن

Phenacoccus solenopsis Tinsly, 1898 (Hemiptera, Pseudococcidae)

في محافظة بغداد، العراق

محمد صالح عبد الرسول

مركز بحوث و متحف التاريخ الطبيعي / جامعة بغداد

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الخلاصة

تتضمن هذه الدراسة اول تسجيل للطفيلي *Aenasius arizonensis* (Girault, 1915) (Hymenoptera, Encyrtidae) على النوع الدخيل البق الدقيقي للقطن والتي تصيب نبات الزينة *Lantana camara* L. (Verbeneceae) اضافة الى نباتات زينة اخرى في محافظة بغداد، العراق. قدمت الدراسة وصفا مظهريا مختصرا للطفيلي.