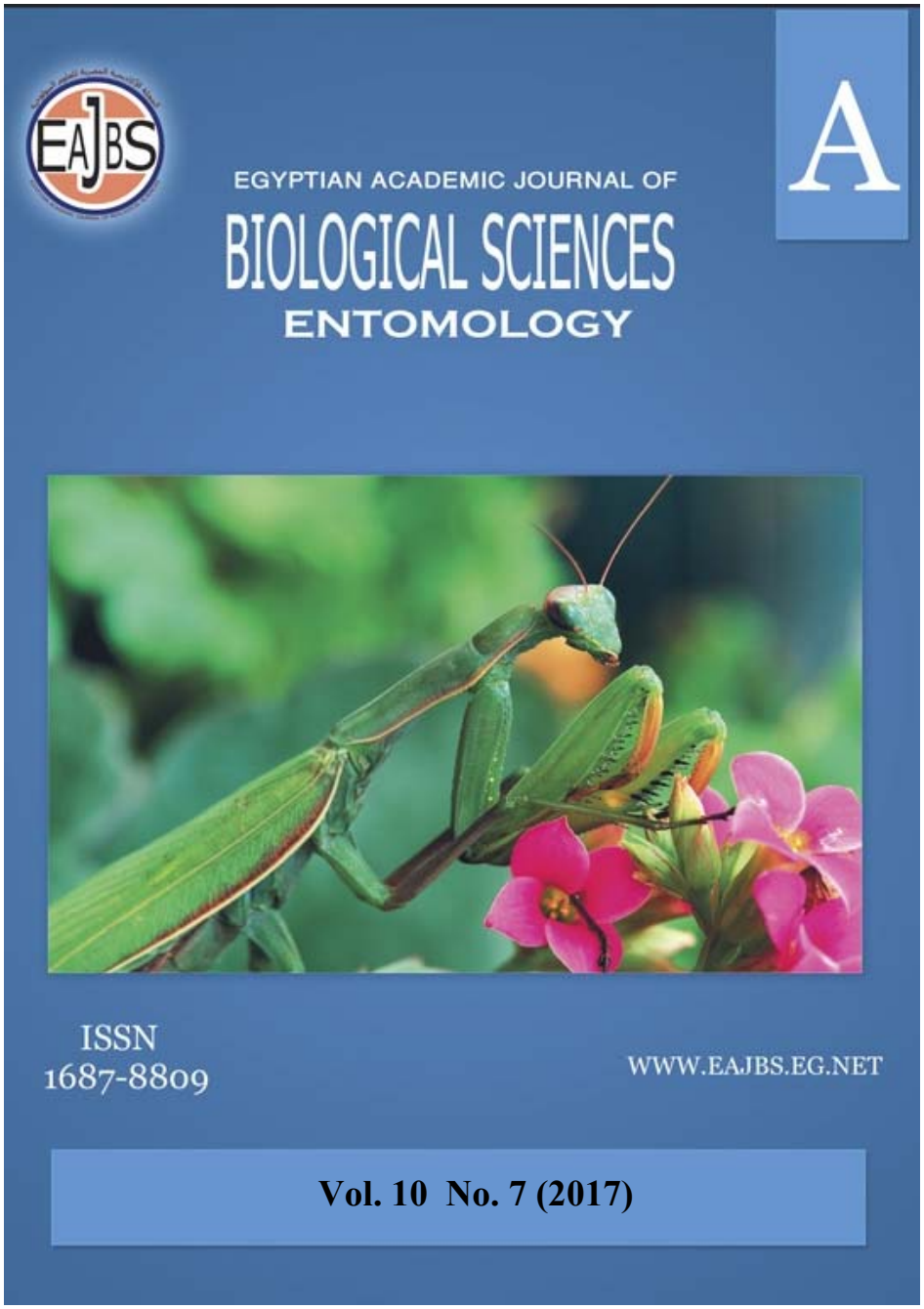

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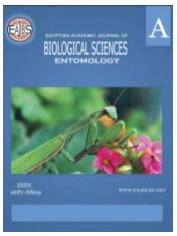

First Record of *Aenasius arizonensis* (Hymenoptera: Encyrtidae) as A solitary, Endoparasitoid of Cotton Mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) Infesting Different Host Plants at Giza Region in Egypt

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ABSTRACT

The primary parasitoid; *Aenasius arizonensis* (Girault)(= *Aenasius bambawalei* Hayat) is a solitary, endoparasitoid of *Phenacoccus solenopsis* emerged from its adult stage. It was recorded for the first time on the two host plants *Lantana camara* (Verbenaceae) and *Hibiscus rosa – sinensis* (Malvaceae) with respective means of 9.8 and 5.1 individuals / branch during June 2016 at Giza region. After one month, (July), *A. arizonensis* was reported on five host plants; *Solanum nigrum* (Solanaceae), *L. camara* (Verbenaceae), *Bidens bipimata* (Compositae), *Withania somnifera* (Solanaceae) and *H. rosa-sinensis* (Malvaceae). Its mean numbers on the five surveyed host plants ranged from 9.0 to 13.6 individuals / branch. The number of *A. arizonensis* females varied with different host plants. The highest percents (65.45% & 63.33%) were reported on the two host plants; *B. bipimata* and *H. rosa-sinensis*, while the least percent of females (42.39%) associated with the host plant *W. somnifera* during July. The corresponding figures were 47.79% & 47.46% on the two host plants; *S. nigrum* and *L. camara*. Most of *A. arizonensis* females (85%) emerged from mummies of mealybug gravid females while most of *A. arizonensis* males (87.5%) were emerged from mummies of mealybug adult females Three hyperparasitoids; *Chartocerus subaeneus* (Forster) (Signiphoridae), *Prochiloneurus aegyptiacus* (Mercet) (Encyrtidae) and *Pachyneuron* sp. were recorded associated with this primary parasitoid. The common hyperparasitois, *C. subaeneus* reduced the population of *A. arizonensis*, with a percent of 18 %. Its mean number ranged from 8.9 to 21.7 individuals / branch; the highest count was located on *L. camara* and the lowest on *H. rosa-sinensis*.

INTRODUCTION

Mealybugs (Hemiptera: Pseudococcidae) are important plant pests worldwide and about 5000 species of mealybugs have been recorded from 246 families of plants throughout the world (Arve *et al*., 2012). The mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) has a wide geographical distribution its origin in Central America, followed

by reports of the Caribbean and Ecuador, Argentina, Brazil, Pakistan and it was described as cotton mealybug due to its large scale occurrence on cotton across many fields (Arve *et al*., 2012).

In Egypt, this pest spreads rapidly on different host plants to the extent that Abd-Razzik *et al*., (2015) recorded it on 29 host plant species belonging to 16 plant families including field crops (3), vegetables (3), ornamentals (7), weeds (13) and fruits (3). Sahar *et al.*, (2016) added new 15 host plant species belonging to 8 plant families including vegetables (2), ornamentals (6), weeds (6) and wild plant (1).

About 28 species of natural enemies including 12 predators and 16 multiple parasitoids of *P. solenopsis* have been reported throughout its range, but only the encyrtid species *Aenasius bambawalei* Hayat has been instrumental in controlling *P. solenopsis* natural population in a range 30 – 60% (Fand and Suroshe, 2015).

Fallahzadeh *et al*., (2014) mentioned that *Aenasius arizonensis* (Girault) (Hymenoptera: Encyrtidae) belong to Anagyrini within Tetracneminae and was originally described from the USA as *Chalcaspis arizonensis* (Girault, 1915) and later transferred to *Aenasius* (Noyes and Woolley, 1994). Hayat, 2009 in India described *Aenasius bambawalei* Hayat and compared it to *A. longiscapus* Compere, although this species falls closer to *A. arizonensis* and by compare *A. arizonensis* from the Smithsonian Institution National Museum of Natural History collection to original description of *A. bambawalei* they found that they are identical so, they conclude that *A. bambawalei* must be treated as a junior synonym of *A. arizonensis*.

This parasitoid is distributed in USA, India, Pakistan, China and Iran (Girault, 1915; Hayat, 2009; Bodlah *et al*., 2010; Chen Hua- Yan, *et al*., 2010 and Fallahzadeh *et al*., 2014). In Egypt, until the end of 2015, the common encyrtid parasitoid of *P. solanspis* was *Acerophagus gutierreziae* Timberlake (Hymenoptera: Encyrtidae) (Attia and Awadallah, 2016). The aim of this work is to shed light on the new parasitoid and its hyperparasitoids associated with *P. solenopsis* infested different host plant at Giza region in Egypt.

MATERIALS AND METHODS

Collection:

In June 2016, it was noticed that parasitoids emerged from mummies of the pseudococcid, *Phenacoccus solenopsis* located on the two ornamental host plants *Lantana camara* and *Hibiscus rosa-sinensis*. Accordingly, a survey was carried out during this month by samples of its branches 30 cm. long (ten replicates) infested with this pseudococcid. On the following month (July, 2016), other host plants infested with the same pest were added to be surveyed for the associated bio agents, with the same previous technique. These host plants were the three herbs *Solanum nigrum*, *Bidens bipimata* and *Withania somnifera*.

During study, it was noticed also that the rate of the female parasitoid *A. arizonensis* emerged from the adult mummies of the mealybug varied from that emerged from gravid mummies. To ensure the presence of this phenomenon, 50 mummies of adult mealybugs and other 50 mummies of gravid mealybugs were isolated individually in glass tubes until emergence of associated bio- agents.

Statistical analysis:

One way A NOVA was performed to analyze obtained data.

Identification:

An unknown host plant of weed was identified as *Bidens bipimata* (Compositae) by Prof. Dr. Ahmed Sadek Kholousy at Weed Research Laboratory, Agric. Res. Center, Giza, Egypt. The new encyrtid parasitoid was identified by Dr. John Noyes (Natural History Museum) as *Aenasius arizonensis* (Hymenoptera: Encyrtidae).

RESULTS AND DISCUSSION

Aenasius *arizonensis* **associated with *Phenacoccus solenopsis* on different host plants during June and July 2016:**

The primary parasitoid, *A. arizonensis* is a solitary, endoparasitoid of *P. solenopsis* emerged from its adult stage. It was recorded for the first time on the two ornamental host plants *L. camara* and *H. rosa – sinensis*, with respective means of 9.8 and 5.1 individuals / branch during June 2016 at Giza region. Recorded means show significant differences between the population of *A. arizonensis* on the two previous host plants (LSD.05% was 1.14) (Table, 1).

During July 2016, *A. arizonensis* was reported on five host plants; *Solanum nigrum* (Solanaceae), *L. camara* (Verbenaceae), *Bidens bipimata* (Compositae), *Withania somnifera* (Solanaceae) and *H. rosa-sinensis* (Malvaceae) with mean numbers ranged from 9.0 to 13.6 individuals / branch.

The greatest count was reported for the insect hosts located on the host plant, *S. nigrum*, while the lowest one was for *H. rosa-sinensis*. Significant differences existed between the population of *A. arizonensis* on *S. nigrum* (13.6 individuals / branch) and both on *L. camara* (11.9 individuals / branch) and *B. bipimata* (11.0 individuals / branch) and both on *W. somnifera* (9.2 individuals / branch) and *H. rosa-sinensis* (9.0 individuals / branch) when the value of LSD.05 was 1.282 (Table,1). In this concern, Arif *et al*. (2012a) mentioned that, plant species play pivotal role in population dynamics of insect pest species and their associated entomophagous insects when found that, maximum population density of mummies (per 6 inch-twig) was (28.6) on shoeflower, followed by cotton (16.6), tomato (10.1), okra (10.9), sunflower (6.8), silvery (6.4) and lastly brinjal (4.8).

Table (1): Mean numbers and statistical analysis of *Aenasius arizonensis* associated with *Phenacoccus solenopsis* on different host plants during June and July 2016 at Giza region.

Month	Host plant	Mean number of *A. arizonensis* ± SE	F- value	LSD.05
June	*Lantana camara*	9.8 ± 0.24 a	65.023**	1.14
	Hibiscus rosa - sinensis	5.1 ± 0.46 b		
July	*Solanum nigrum*	13.6 ± 0.43 a	18.307**	1.282
	Lantana camara	11.9 ± 0.55 b		
	Bidens bipimata	11.0 ± 0.30 b		
	Withania somnifera	9.2 ± 0.55 c		
	Hibiscus rosa - sinensis	9.0 ± 0.26 c		

The number of *A. arizonensis* females varied also with different host plants. During June the higher percent of females (63.95%) was reported on *H. rosa-sinensis* and the lower percent (49.09%) on *L. camara*; showing significant difference between their percents (LSD.05% was 4.841) (Table, 2).

During July, the highest percents (65.45% & 63.33%) were reported for the two host plants; *B. bipimata* and *H. rosa- sinensis*,. while the lowest percent of females (42.39%) associated with the host plant *W. somnifera*. Intermediate values of 47.79% & 47.46% were reported for the two host plants; *S. nigrum* and *L. camara* (Table, 2). Arif *et al*., (2012b) mentioned that, on ornamental plants, parasitism by *A. bambawalei* was high (75.3%) during summer months of May – September. In (2012 a), Arif *et al* found that, population density of the adult female parasitoid, *A. bambawalei* showed significant differences on different host plant species. The highest population density of female parasitoid was captured from shoeflower (35.2 parasitoid females / sweep), followed by slivery (26.9 parasitoid females / sweep) and lastly on cotton (21.6 parasitoid females / sweep). Population density captured from sunflower, brinjal, tomato and okra ranged from 13.1 to 16.4 parasitoid females / sweep.

Table (2): Percet of *Aenasius arizonensis* females on different host plants during June and July 2016 at Giza region

Month	Host plant	Percent means ± SE of *A. arizonensis* females	F- value	LSD .05
June	*Hibiscus rosa-sinensis*	63.95 ± 2.06 a	41.612**	4.841
	Lantana camara	49.09 ± 1.03 b		
July	*Bidens bipimata*	65.45 ± 1.31 a	68.659**	3.549
	Hibiscus rosa-sinensis	63.33 ± 0.94 a		
	Solanum nigrum	47.79 ± 1.04 b		
	Lantana camara	47.46 ± 1.37 b		
	Withania somnifera	42.39 ± 1.49 c		

Investigating the emerged *Aenasius* parasitoid and its associated hyperparasitoids from 50 mummies of mealybug adult females and other 50 mummies of mealybug gravid females, we recorded 80 emerged adult of *A. arizonensis*, 18 individuals of the common hyperparasitoid *C. subaeneus* and one individual of each of the two hyperparasitoids; *Pachyneuron* sp. and *P. aegyptiacus* (Fig.1). Most of *A. arizonensis* females emerged from mummies of mealybug gravid females (85%) while most of *A. arizonensis* males emerged from mummies of mealybug adult females (87.5%) (Fig.2). In this concern, Zain ul Abdin *et al*. (2013) found that, more female parasitoids emerged from the host 3rd instar and adult stage of the mealybug, whereas the host 2nd instar produced a significant higher proportion of males.

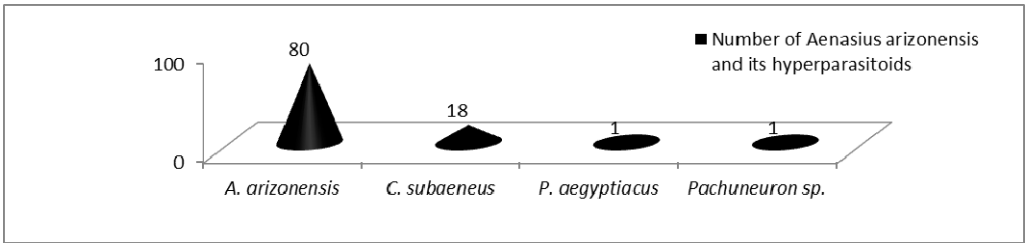

Fig. (1): Number of emerged parasitoids; *Aenasius arizonensis* and associated hyperparasitoid from100 mummies of *Phenacoccus solenopsis* adult and gravid females.

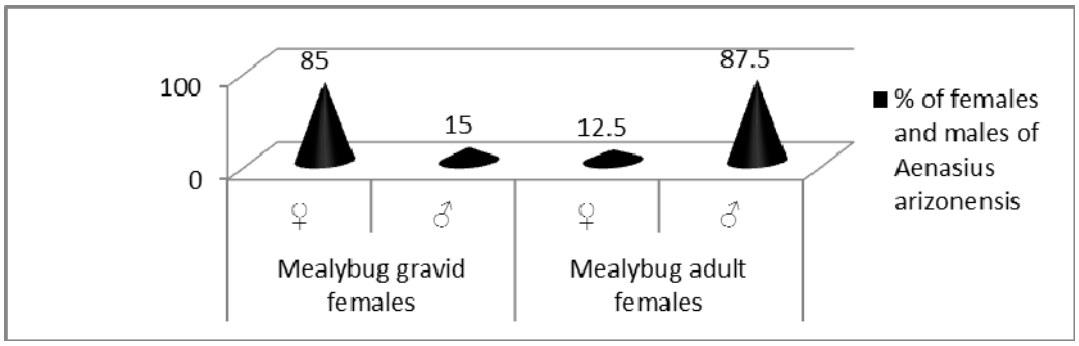

Fig. (2): Percent of females and males of *Aenasius arizonensis* emerging from *Phenacoccus solanespis* adult and gravid female's mummies (80 mummies).

Hyperparasitoids associated with the primary parasitoid *A. arizonensis*:

Three hyperparasitoids were secured during the present investigation associated with the primary parasitoid *A. arizonensis*.

The hyperparasitoid, *Chartocerus subaeneus:*

It is a common gregarious hyperparasitoid. It reduced the population of *A. arizonensis* with a percent of 18 % (Fig. 1). A mean number of 3.95 ± 0.22 individuals emerged from each of a mummy mealybug adult female and 9.05 ± 0.60 individuals emerged from each of a mummy mealybug gravid female (Fig.3). A significant difference existed between counts (10.8 and 8.9 individuals / branch) of the hyperparasitoid, *C. subaeneus* on the two host plants; *L. camara* and *H. rosa-sinensis* (LSD .05% was 0.843).

No hyperparasitoids emerged from the primary parasitoids located on the host plant; *B. bipimata*. On the other four host plants, the mean numbers of *C. subaeneus* ranged from 10.5 to 21.7 individuals / branch; the greatest count was recorded for *L. camara* and the lowest for *H. rosa-sinensis*. A significant difference existed between counts of the emerged hyperparasitoid on the four different host plants (LSD.05 was 1.430) during July 2016 (Table, 3).

The hyperparasitoid, *Pachyneuron* sp.:

No significant differences existed between counts (0.6, 0.5 individual / branch) of *Pachyneuron* sp. on the two host plants; *L. camara* and *H. rosa-sinensis* during June 2016 (Table, 3).For this hyperparasitoid, mean numbers of 0.3, 0.4 and 0.7 individuals /branch emerged from the primary parasitoid located on the three host plants; *W. somnifera*, *L. camara* and *H. rosa-sinensis* respectively, while on the other two host plants; *B. bipimata* and *S. nigrum*, no individuals were reported (Table,3).

The hyperparasitoid, *Prochiloneurus aegyptiacus*:

This hyperparasitoid was recorded only on the two host plants; *H. rosa-sinensis* and *L. camara,* during June and July with respective mean numbers of 0.4, 0.4 and 0.3, 0.4 individuals / branch and with no significant difference (LSD.05 was 0.485 and 0.285) (Table,3).

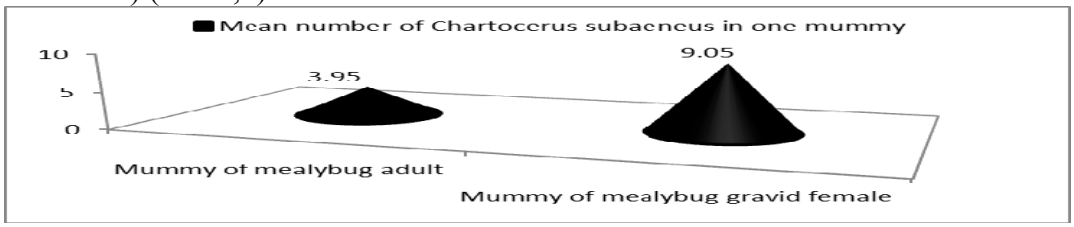

Fig. (3): Mean numbers of the common hyperparasitoid, *Chartocerus subaeneus* emerging from one mummy of adult and gravid females of *Phenacoccus solenopsis* .

Table (3): Mean numbers and statistical analysis of three hyperparasitoids emerged from the primary parasitoid; *Aenasius arizonensis* associated with *Phenacoccus solenopsis* on different host plants during June and July 2016 at Giza region.

Hyperparasitoid	Month	Host plant	Mean ± SE	F- value	LSD.05
Chartocerus subaeneus	June	*Lantana camara*	10.8 ± 0.29 a	22.407**	0.843
		Hibiscus rosa - sinensis	8.9 ± 0.28 b		
	July	*Lantana camara*	21.7 ± 0.63 a	259.298**	1.430
		Solanum nigrum	16.6 ±0.54 b		
		Withania somnifera	12.4 ± 0.65 c		
		Hibiscus rosa - sinensis	10.5 ± 0.37 d		
		Bidens bipimata	0.0 ± 0.00 e		
Pachyneuron sp.	June	*Hibiscus rosa - sinensis*	0.6 ± 0.27 a	0.070	0.795
		Lantana camara	0.5 ± 0.27 a		
	July	*Hibiscus rosa - sinensis*	0.7 ± 0.15 a	5.932**	0.345
		Lantana camara	0.4 ± 0.16 ab		
		Withania somnifera	0.3 ±0.15 bc		
		Bidens bipimata	0.0 ± 0.00 c		
		Solanum nigrum	0.0 ± 0.00 c		
Prochiloneurus aegyptiacus	June	*Lantana camara*	0.4 ± 0.16 a	0.000	0.485
		Hibiscus rosa - sinensis	0.4 ± 0.16 a		
	July	*Lantana camara*	0.4 ± 0.16 ab	3.800*	0.285
		Hibiscus rosa - sinensis	0.3 ± 0.15 ab		
		Withania somnifera	0.0 ± 0.00 b		
		Solanum nigrum	0.0 ± 0.00 b		
		Bidens bipimata	0.0 ± 0.00 b		

Concerning the reviewed hyperparasitoids of *A. bambawale*i associated with *P. solenopsis*; Poorani *et al*., 2009 recorded four hyperparasitoids; *Prochiloneurus pulchellus* Silvestri, *P. albifuniculus* (Hayat) and *P. aegyptiacus* (Mercet) (Hymenoptera: Encyrtidae) and *Promuscidea unfasciativentris* Girault (Hymenoptera: Aphelinidae). Arif *et al*., 2012a mentioned that, the hyperparasitoid, *Promuscidea unfasciativentris* Girault (Hymenoptera: Aphelinidae) was recorded from the mummies of *A. bambawalei* with highest incidence of 26.7% in October, Attia and Awadallah, 2016 recorded the four hyperparasitoids; *C. subaeneus*, *Marietta* sp., and *P. aegyptiacus* from the two primary parasitoids; *Aceropfagus gutierreziae* Timberlake (Hymenoptera: Encyrtidae) and *Chartocerus dactylopii* Ashmead (Hymenoptera: Signiphoridae).

REFERENCES

Abdel- Razzik, K. I., Angel R. Attia and Abdel Aziz M. 2015. Newly host plants of cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera : Pseudococcidae in Egypt. Egypt Acad. Biolog. Sci., 8(3):31-33.

Arif, M.I., Rafiq M., Wazir S., Mehmood N. and Ghffar A. 2012a. Studies on cotton mealybug, *Phenacoccus solenopsis* (Pseudococcidae: Homoptera) and its natural enemies in Punjab, Pakistan. Int. J. Agric. Biol., 14: 557-562.

Arif, M.J., Gogi M.D., Arshad M., Ashraf A., Suhail A., Zain-ul-Abdin, Wakil W. and Nawaz A. 2012b. Host-plants mediated population dynamic of cotton mealybug,Phenacoccus solenopsis Tinsley (Hemiptera: Pseudococcidae) and its parasitoids, *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae). Pak. Entomol., 34(2): 179-184.

Arve S, Patel K. G. and Chavan S. 2012. *Phenacoccus solenopsis*: The white menace to global agriculture: Population dynamics, Biology and Chemical control of mealybug, *Phenacoccus solenopsis* Tinnsley on *Hibiscus rosa – sinensis*. LAP LAMBERT Academic puplishing, pp. 156.

Attia, A. R. and Awadallah, K. T. 2016. Predators, Parasitoids and Hyperparasitoids associated with the cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) infesting different host plants at Giza region. Egypt. Acad. J. Biolog. Sci. 9(4): 97-103.

Bodlah I., Ahmad M., Nasir F. and Naeem M. 2010. Record of *Aenasius bambawalei* Hayat, 2009 (Hymenoptera: Encyrtidae), a parasitoid of *Phenacoccus solenopsis* (Sternorrhyncha: Pseudococcidae) from Punjab, Pakistan. Pakistan J. Zool. 42(5): 533-536.

Chen Hua- Yan, Cao Run-Xin and Xu Zai-Fu. 2010. First record on *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae) a parasitoid of the mealybug, *Phenacoccus solenopsis* tinsley (Hemiptera: Pseudococcidae) from China. J. of Environmental Entomology, 32(2): 280-282.

Fallahzadeh, M., Japoshvili G., Abdimaleki R. and Saghaei N. 2014. New records of Tetracneminae (Hymenoptera, Chalcidoidea, Encyrtidae) From Iran. Turkish Journal of Zoology, 38: 515-518.

Fand, B. and Suroshe, S.S. 2015. The invasive mealybug *Phenacoccus solenopsis* Tinsley, a threat to tropical and subtropical agricultural and horticultural production systems – a review.Crop protection, 69: 34-43.

Girault, A.A. 1915. New chalcidoid hymenoptera. Ann. Entomol. Soc. Am. 8: 279-284.

Hayat, M. 2009. Description of a new species of *Aenasius* Walker (Hymenoptera: Encyrtidae), parasitoid of the mealybug, *Phenacoccus solenopsis* Tinsley (Homoptera: Pseudococcidae) in India. Biosystematica, 3 (1): 21-26.

Noyes JS. and Woolley JB. 1994. North American encyrtid fauna (Hymenoptera: Encyrtidae): Taxonomic changes and new taxa. J. Nat. Hist. 28: 1327 – 1401.

Poorani J., Rajeshwari S.K. and Gupta A. 2009. Notes on diagnosis and biology of *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae), a parasitoid of the invasive mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Sternorrhyncha: Pseudococcidae). J. Biol. Control, 23(4): 463–466.

Sahar M. Beshr, Suzan A. Badr, Anas A. Ahmad and Mohamed G.H. 2016. New record of host plants of invasive mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) in Alexandria and Behaira governorates. J. Entomol., 13(4): 155-160.

Zain ul Abdin, Hussain, F. Khan M. A., Abbas S.K., Manzoor A. and Shina H. 2013. Reproductive fitness of mealybug parasitoid, *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae). World Appl. Sci. J., 26(9):1198-1203.

ARABIC SUMMARY

تسجيل الطفيل الانفرادى داخلى التطفل *Aenasius arizonensis* لأول مرة فى مصر على عوائل نباتية مختلفة مصابة ببق القطن الدقيقى فى منطقة الجيزة.

أنجيل رشدى عطية[1] و كمال توفيق عوض اللة [2] وجون نويز[3]

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2- معمل المكافحة الحيوية، كلية الزراعة، جامعة القاهرة، جيزة ، مصر.

3- قسم علوم الحياة بمتحف التاريخ الطبيعى بلندن

تم تسجيل الطفيل الأنفرادى داخلى التطفل *Aenasius arizonensis* لأول مرة فى مصر على بق القطن الدقيقى *Phenacoccus solenopsis* فى شهر يونية 2016 المتواجد على العائلين النباتين *Lantana camara* & *Hibiscus rosa-sinensis* بمتوسط 9.8 & 5.1 فرد/ فرع. وسجل فى الشهر التالى على خمسة عوائل نباتية (*Solanum nigrum*, *L. camara*, *Bidens bipimata*, *Withania somnifera* and *H. rosa-sinensis*) حيث تراوح تعداد الطفيل من 9 الى 13.6 فرد/فرع.

اتضح من النتائج اختلاف فى نسبة اناث الطفيل الاولى باختلاف العائل النباتى حيث سجل اعلى تعداد للاناث 63.33 & 65.45% على العائلين النباتيين *B. bipimata* and *H. rosa- sinensis* بينما تراوحت النسبة بين 47.79 & 47.45 % على العائلين النباتيين *S. nigrum & L. camara* وسجل اقل تعداد لنسبة الاناث ب 42.39% على العائل النباتى *W. somnifera* .

اظهرت النتائج أن معظم اناث الطفيل الاولى(85%) تخرج من مومياء البق الدقيقى فى مرحلة الاناث الحاملة للبيض (gravid females) بينما معظم الذكور(87.5%) يخرج من مومياء البق الدقيقى فى مرحلة بداية الحشرة الكاملة .

صاحب الطفيل الاولى ثلاث انواع من الطفيليات الثانوية (*Chartocerus subaeneus*, *Prochiloneurus aegyptiacus* and *Pachyneuron* sp. ويعتبر الطفيل الثانوى *C. subaeneus* هو الطفيل الاكثر تعدادا بمتوسط يتراوح بين 8.9 & 21.7 فرد /فرع وسجل اعلى تعداد له على *L. camara* واقل تعداد على *H. rosa-sinensis* كما اظهرت النتائج ان الطفيل الثانوى الاكثر تواجدا يخفض تعداد الطفيل الاولى بنسبة 18%.