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First Observation and Identification of Some Natural Enemies Collected from Heavily Infested Tomato by *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Jordan

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Abstract: Biweekly field visits starting from January to the end of April 2011 were conducted to tomato fields (open and plastic houses) heavily infested with the tomato borer *Tuta absoluta,* in order to survey natural enemies associated with this pest. Three hemipterans were found: *Orius albidipennis*, *Orius* sp. (Anthocoridae) and *Nesidiocoris tenuis* (Miridae). In addition, the parasitic wasp *Bracon (Habrobracon) concolorans,* (Hymenoptera: Brachonidae) is recorded for the first time from Jordan. Field observations and other available data are presented and discussed.

Key words: Tuta absoluta · Orius albidipennis · Nesidiocoris tenuis · Bracon (Habrobracon) concolorans

INTRODUCTION

Tomato is considered the most important vegetable crop in Jordan Valley (200-400 m below sea level). Its warm temperatures enable the farmers to produce tomato in the winter season which is important for exporting tomato to European countries. In addition tomato is planted in the highland as well as some dessert regions in Jordan [1].

The tomato borer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), is one of the most devastating pests of tomato crops in South America [2]. After its initial detection in eastern Spain in 2006, it rapidly invaded various other European countries and spread throughout the Mediterranean basin [3]. Tomato borer was first detected in Jordan in October 2009 from sex pheromone traps installed in Southern Jordan Valley. Many males were captured and then sent for identification at the University of Jordan Insect Museum. Since that time, this tomato borer spread quickly in all tomato growing areas in Jordan destroying entire open fields and tomato plastic houses.

T. absoluta is controlled by several methods. Cultural practices included muslin barriers using a double-door, avoidance of alternative host plants and removal of infested organs. Searching for resistance tomato cultivars may be promising. Proffit *et al*. (2011) [4] studied the attraction and oviposition of *Tuta absoluta* females in response to tomato leaf volatiles and found differences between three cultivars of *S. lycopersicum*. Pheromone traps were used either for detection or for mass trapping. Preventive treatments as Btk were used integrated with the release or conservation of predatory mirids. Curative treatments with approved insecticides should be applied when dealing with *T. absoluta* outbreak levels (Desneux *et al.* 2010). However, because of the short generation time and the frequent applications of insecticides to manage *T. absoluta,* resistance to several insecticides has been developed. Branco *et al*. (2001) [5] reported significant resistance of *T. absoluta* to acephate and deltamethrin. Resistance to deltamethrin, lamba=cyhalothrin, mevinphos, metamidophos and esphenvalerate was reported in Chile [6]. Resistance to Cartap was reported in Brazil [7]. Resistance to abamectin was additionally reported in Brazil [8]. Liettii *et al*. (2005) [9] confirmed *T. absoluta* resistance to deltamethrin and abamectin as well as to methamidophos in Argentine. Since *T. absoluta* was just recently introduced into Jordan, no reports about insecticide resistance were reported. However, resistance to insecticides is highly expected since farmers in the Jordan Valley tend to use frequent applications due to quick pesticide degradation and fast growing tomatoes because of the warm temperatures of the Jordan Valley.

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Biological control of *Tuta absoluta* usually involves the use of mirid predators or parasitic wasps. Since this pest is an introduced pest into Jordan, there is an important need to search for its natural enemies. This research was established to conduct preliminary survey for the natural enemies of *T. absoluta* in heavily infested tomato fields and to present relevant data from literature about the collected natural enemies and the pest. Such data may help in developing integrated pest management programs to control this serious pest.

MATERIALS AND METHODS

Biweekly field trips were conducted to collect natural enemies associated with *T. absoluta* in heavily infested tomato fields in the different parts of Jordan from January to the end of April 2011.The survey included farms in Central and Southern Jordan Valley (Ghour As Safi, at southern tip of the Dead Sea). The specimens were collected by aspirator or by direct picking from tomato in open fields and plastic houses. Most of the natural enemies, especially the parasites, were collected after the infestation exceeded the economic injury level and no more insecticides were applied. The specimens were kept in small vials containing 75% alcohol and sent to the National History Museum in UK to confirm our preliminary identifications. Voucher specimens were preserved in the University of Jordan Insect Museum.

RESULTS AND DISCUSSION

***Bracon (Habrobracon) concolorans* (Marshall, 1900) (Hymenoptera: Brachonidae):** This species has generally been referred to as *Habrobracon* (or *Bracon*) *nigricans* (Szepligeti) but recently the name *nigricans* has been synonymized under *concoloans.* The subgenus *Habrobracon* is a fairly distinctive assemblage of species that is often treated as a genus separate from *Bracon,* but only on rather spurious grounds. All species of *Bracon* are idiobiont ectoparasitoids. They paralyze the host larva at oviposition and the host does not develop any further while the parasitoid larva feeds from the outside.

Bracon concolorans is known from a wide range of countries from western and southern Europe east to Russian (Primorsky) and China. It was found in Tunisia, Iran and Turkey (Gavin Broad, in lett.). It is recorded from Jordan for the first time. Large numbers of this parasitoid were observed landing on the inner side of plastic houses especially at the end of the season after large numbers of the host have developed on tomato plants.

Desneux *et al*. (2010) [3] mentioned that species of Brachonidae have been reported as natural enemies on *T. absoluta* from the Mediterranean Basin and in South America *B. lucileae, B. lulensis, B. tutus* and *Bracon* sp. were reported to parasitize *T. absoluta*. Other species of Brachonidae was recorded in Italy on *T. absoluta*. Loni *et al*. (2011) [10] reported *Agathis fuscipennis* (Zetterstedt) for the first time in Italy. Fifty-five species of Brachonidae were recorded from Cyprus, among them *Bracon (Habrobracon) concolorans* (*as Habrobracon nigricans*) [10] Fallahzadeh and Saghaei (2010) [12] listed 202 species of Brachonidae from Iran. They listed *Bracon (Habrobracon) concolorans as Bracon (Habrobracon) nigricans.* Beyarslan *et al*. 2005 [13] listed 62 species of Brachonidae from the western Black Sea region in Turkey and reported Bracon *(Habrobracon) nigricans* on *Etiellaz inckenella* TR. (Phycitidae)*, Pexicopia malvella* HB. (Gelechiidae)*, Cnephasia sedana* Conts. (Torticidae) which are all micro Lepidoptera. Beyarslan *et al*. (2010) [14] published a synopsis of *Bracon* species of Turkey. He reported *B. (H.) nigricans* from five phytogeographical provinces in Iran. *Habrobracon concolorans* is listed associated with the beetle *Ernobius nigrinus* Sturm (Coleoptera: Anobiidae) and several micro-Lepidoptera species: *Cnephasia sedana* (Constant), *Cydia strobilella* (L.) (Tortricidae), *Ephestia terebrellum* Zeller, *Etiellaz inckenella* (Treitschke), *Loxostege sticticalis* (L.) (Pyralidae) *Pexicopia malvella* Hubner. (Gelichiidae) (Taxapad.com data base, Yu and van Achterberg, 2010[15]). Therefore, the association of this species with *T. absoluta* in Jordan fits well with its host range.

***Orius albidipennis* (Reuter, 1884) (Hemiptera: Anthocoridae):** This Mediterranean species was used indoors against thrips in Belgium, France, Palestine, Italy, Netherlands and Spain [1]. This species was recorded from Spain, Africa (southwards to Nigeria), Near East, Arabian Peninsula, Iraq, Iran, Central Asia and Pakistan [16]. *Orius albidipennis* and *Orius laevigatus* were collected from maize (*Zea maize* L.) and sorghum (*Sorghum bicolor* L.) fields at Shandaweel Research Station, Sohag Governorate, Egypt during two planting dates and two successive growing seasons in 2004 and 2005 [17]. It is recorded on *Tuta absoluta* in Jordan for the first time.

***Orius* sp (Hemiptera: Anthocoridae):** It was not possible to identify the collected female specimen since the male is needed for positive identification. However, the general

habitus was within the color variation found in *O. pallidicornis* (Reuter) and *O. laevigatus* (Fieber). Both taxa occur in the region (Dr. Luis Hernandez Triana, in lett.). Hamdan & Abu-Awad (2007) [18] studied the effect of host plants on the predatory bug, *O. laevigatus* in Palestine. *Orius albidipennis* and *Orius laevigatus* were collected from maize fields in Egypt [17]. Ghahari *et al.* (2009)[19] reported these two species among 14 species of *Orius* from Iran. EPPO (2002, 2010) [2, 20] included them in the list of biological control agents widely used in the EPPO region. Therefore, the occurrence of any of these two species or both is expected in Jordan. However, more collecting is needed to get positive determination and to find other possible of *Orius* species. Future studies may be directed towards the relationship with *T. absoluta*. *Orius insidiosus* and *Orius* sp. were recorded as predators of *T. absoluta* in Venezuela and Brazil respectively [3].

***Nesidiocoris tenuis* (Reuter, 1895):** Urbaneja *et al*. (2009) [21] studied the prey suitability of *T. absoluta* eggs and larval instars under laboratory conditions to *Macrolophus pygmaeus* (Rambur) and *Nesidiocoris tenuis* Reuter in Spain. They found that both predators preyed actively on *T. absoluta* eggs and all larval stages, although they preferred first-instar larvae. Their results showed that both species could adapt to *T. absoluta*, contributing to their value as biological control agents in tomato crops.

This species was recorded by Katbeh *et al*. (2000) [22] in September from two sites in the highlands of Jordan (Amman and As-Salt) and in April in the Central Jordan Valley.

CONCLUSIONS

In this preliminary work, four species of natural enemies were recorded associated with *Tuta absoluta*. All the found species are known to be natural enemies of the pest. Further sampling is needed in the highlands of Jordan and in the eastern and southern deserts where other natural enemies may be found. Further studies aimed at the relationship between the found species and the tomato borer should be conducted to determine the efficacy of each one in reducing the population of the pest and how such natural enemies may be used in an integrated pest management program of this pest in Jordan.

REFERENCES

1. Department of Statistics, 2007. The Hashemite Kingdome of Jordan, Department of Statistic. Annual agricultural statistics. Amman, Jordan, 2007 http://www.dos.gov.jo/agr/agr_e/
2. EPPO. 2010. List of biological control agents widely used in the EPPO region. http:// archives.eppo.org/ EPPOStandards/ biocontrol_web/bio_list.htm
3. Desneux, N., E. Wajnberg, K.A.G. Wyckhuys, G. Burgio, S. Arpaia, C.A. Narva´ez-Vasquez, J. Gonza´lez-Cabrera, D.Catala´n Ruescas, E. Tabone, J. Frandon, J. Pizzol, C. Poncet, T. Cabello and A. Urbaneja, 2010. Biological invasion of European tomato crops by *Tuta absoluta*: ecology, geographic expansion and prospects for biological control. J. Pest Science, 83: 197-215.
4. Proffit, M., G. Birgersson, M. Bengtsson, R. Reis, P. Witzgall and E. Lima, 2011. Attraction and Oviposition of *Tuta absoluta* Females in Response to Tomato Leaf Volatiles. J. Chemical Ecology, 37(6): 565-574.
5. Branco, C.M., F.H. Franka, M.A. Medeiros and J.G.T. Leal, 2001. Use of insecticides for controlling the South American Tomato Pinworm and the Diamond back Moth: a case study. Horticultura Brasileira, 19(1): 60-63.
6. Salazar, E. and J. Araya, 2001. Tomato moth, *Tuta absoluta* (Meyrick) response to insecticides in Arica, Chile. Agricultura Técnica, 61(4): 429-435.
7. Siqueira, H.A.A., R.N.C. Guedes and M.C. Picanco, 2001b. Insecticide resistance in populations of *Tuta absoluta* (Lepidoptera: Gelechiidae). Agricultural and Forest Entomology, 2(2): 147-153.
8. Siqueira, H.A.A., R.N.C. Guedes, D.B. Fragoso and L.C. Magalha 2001a. Abamectin resistance and synergism in Brazilian populations of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). International J. Pest Management, 47(4): 247-251.
9. Liettii, M., E. Bottoii and R. Alzogaray, 2005. Insecticide resistance in Argentine populations of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Neotropical Entomology, 34(1): 113-119.
10. Loni, A., E. Rossi and K. Van Achterberg, 2011. First report of *Agathis fuscipennis* in Europe as parasitoid of the tomato leafminer *Tuta absoluta.* Bulletin of Insectology, 64(1): 115-117.

11. Papp Jenö, 1998. Contributions to the braconine fauna of Cyprus (Hymenoptera, Braconidae: Braconinae). Entomofauna, 19(14): 241-252.
12. Fallahzadeh, M. and N. Saghaei, 2010. Checklist of Braconidae (Insecta: Hymenoptera) From Iran. Mun. Ent. Zool., 5(1): 170-186.
13. Beyarslan, A., Ö.C. Erdogan and M. Aydogdu, 2005. A Survey of Braconinae (Hymenoptera, Braconidae) of Turkish Western Black Sea Region. Linzer Biol. Beitr., 37(1): 195-213.
14. Beyarslan, A., O.C. Erdogan and M. Aydogdu, 2010. A synopsis of *Bracon* species of Turkey with description of a new species (Hymenoptera: Braconidae: Braconinae) Biologia (Section Zoology), 65(1): 104-109.
15. Yu, D.S.K. and C. Van Achterberg, 2010. Taxapad Ichneumonoidea (May 2009 version). In: Species 2000 &IT IS Catalogue of Life: 2010 Annual Checklist (Bisby, F.A., Y.R. Roskov, T.M. Orrell, D. Nicolson, L.E. Paglinawan, N. Bailly, P.M. Kirk, T. Bourgoin, G. Baillargeon, Eds). DVD, Species 2000, Reading, UK.
16. Péricart, J., 1996. Family Anthocoridae Fieber, 1836 - flower bugs, minute pirate bugs. pp: 108-140. In: AUKEMAB. & RIEGER Ch. (eds.): Catalogue of the Heteroptera of the Palaearctic Region. Vol. 2.Cimicomorpha I. The Netherlands Entomological Society, Amsterdam, xiv + 361pp.
17. Karaman, A.G., M. Mandarawy, A.H. Gharib and H. El-Gepaly, 2009. Studies on Predatory Insects In Maize and Sorghum Fields In Upper Egypt. Arab J. Pl. Prot. 27, Special Issue (Supplement): 20. (Abstract).
18. Hamdan, A.J. and I. Abu-Awad, 2007. Effect of Host Plants on Predator Prey Relationship between Predatory Bug, *Orius laevigatus* (Fiber) (Hemiptera: Anthocoridae) and Tobacco Whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) An-Najah Univ. J. Res., (N. Sc.), 21: 85-99.
19. Ghahari, H., D.L. Carpintero and H. Ostovan, 2009. An annotated catalogue of the Iranian Anthocoridae (Hemiptera: Heteroptera: Cimicomorpha) Acta Entomologica Musei Nationalis Pragae, 49(1): 43-58.
20. European and Mediterranean Plant Protection Organization. 2002. List of biological control agents widely used in the EPPO region. Bulletin OEPP/EPPO Bulletin, 32: 447-461.
21. Urbaneja A., Monton H. &Molla O. 2009. Suitability of the tomato borer *Tuta absoluta* as prey for *Macrolophus pygmaeus* and *Nesidiocoris tenuis.* J. Appl. Entomol., 133: 292-296.
22. Katbeh-Bader, A., Attilio Carapizza and Mazen Akkawi, 2000. Heteroptera of Jordan: Specimens preserved in the University of Jordan Insects Museum (Insecta). Atti Dell'Accademia Roveretana Degli Agiati, a. 250, ser. VII, vol. X, B: 111-137.