Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2015; 3(3): 324-327

Received: 06-04-2015
Accepted: 09-05-2015

Lassaad Mdellel
High Agronomic Institute of Chott-Mariem, University of Sousse, Tunisia, P.B. 47, 4042 Chott-Mariem, Sousse, Tunisia.

Monia Ben Halima Kamel
High Agronomic Institute of Chott-Mariem, University of Sousse, Tunisia, P.B. 47, 4042 Chott-Mariem, Sousse, Tunisia.

Correspondence:
Lassaad Mdellel
High Agronomic Institute of Chott-Mariem, University of Sousse, Tunisia, P.B. 47, 4042 Chott-Mariem, Sousse, Tunisia.

Effect of host plant on morphology of *Pterochloroides persicae* Cholodkovsky 1899 (Hemiptera, Aphididae)

Lassaad Mdellel, Monia Ben Halima Kamel

Abstract
Morphological differentiation of insect population in relation to the use of different host plants is an important phenomenon that leads to ecological specialization. In this study, we describe the morphological variation of *Pterochloroides persicae* Cholodkovsky 1899 individuals originating from three host-plants, peach, almond and plum, from two localities in Tunisia which has similar climatic conditions. 13 morphological characters were investigated in 90 wingless aphids collected from plants of the three host species. A significant difference was observed in length of antennal segment I, IV and V, in length of body and in length of siphunculi. Results indicate that host plant species can affect the morphology of *P. persicae*.

Keywords: *Pterochloroides persicae*, morphological variation, host-plant, Tunisia.

1. Introduction
Aphids are a group of herbivorous insects which have been considered as pests of agriculture, horticulture and forestry [1]. Among aphids, the brown peach aphid *Pterochloroides persicae* Cholodkvsky (Hemiptera, Aphididae) has been known as a pest of peach, almond, plum, apricot, apple and citrus [2, 3, 4, 5, 6]. It has assumed pest status on these plants in several countries in southern Europe, Asia, the eastern Mediterranean and North Africa where it has been reported causing severe damages [2, 3, 7, 8, 9]. The detrimental influence of large population on their hosts and their ability to transmit virus, gives them an economic importance that far outweighs their diversity. As for morphology, winglessness aphid are large, shiny, oval, dark brown to black, the wingless have a characteristic pigmented areas on the forewings [10, 2, 11, 3]. The seasonal biology and population dynamics are described by Talhouk (1977) [10], Darwich *et al.*, (1989) [2] and Khan *et al.*, (1998) [11] where aphids can display both holocyclic and anholocyclic life cycle depending on environmental conditions. Thus, in the countries where winter temperatures drop below freezing, *P. persicae* usually has a holocyclic life cycle like in Turkey, Central Asia, India and Syria [10] and remain anholocyclic in warmers areas [2, 11, 3]. Although, a clear identification of *P. persicae* is necessary in order to establish properly its diversity and population dynamic on trees of the genus *Prunus*. Aphids have undergone morphological and physiological changes in order to live in different host plant species. The morphological criteria for aphid's species may be affected by several factors such environmental factors and physiological status of the host plant [12, 13, 14]. Gorur (2003) [15] showed the ability of aphid to express an alternative morphology and behavior in response to environmental changes is called phenotypic plasticity. Via *et al.*, (1995) [16] demonstrated that the degree of aphids can be defined by their capacity for making physiological, morphological and behavioral adjustments to response to the nutritional chemical and physiological structure of the host plant. Gorur (2003) [15] proved that aphid do not manage to feed on different host plants unless they show appropriate morphological changes in addition to physiological ones and the morphological characters of aphids have important roles in the adaptation to different hosts plants. Via & Shaw (1996) [17] mentioned that different host plants act as agents of natural selection, and therefore morphology may reflect host-specific behavioral adaptations. Nevertheless, other aphid's species can represent a similar morphology and use a single plant family or genus to feed [18, 19, 13].
In this context, the purpose of the present study was to find out the relative importance of different host plant effects on morphological characters of the brown peach aphid *P. persiace*.

2. Materials and methods

2.1 Aphid sampling

P. persicae specimens were collected in the field between April and May 2008. Since environmental conditions can affect the morphology, all of the studied aphid's individuals were collected from an area which has similar climatic conditions. Ninety individuals were obtained from colonies living on almond, peach and plum from Tunisia (30 from almond, 30 from peach and 30 from plum) and were kept in 70% ethanol for morphometric analysis [20].

2.2 Morphometric measurement and analysis

Adult viviparous of *P. persicae* collected from different host were cleared and individually mounted on microscope slides using the techniques described by Blakman and Eastop (1984) [21]. To determine the difference in size and shape between samples, we measured characters that had been found useful in other studies of aphid's morphometrics [22, 23]. We selected 13 continuous characters for analyses: Antennal segment I length (Characters 1), Antennal segment II length (Characters 2), Antennal segment III length (Characters 3), Antennal segment IV length (Characters 4), Antennal segment V length (Characters 5), Antennal segment VI length (Characters 6), Body length (Characters 7), Basal part of antennal segment VI length (Characters 8), Processus terminalis length (Characters 9), Siphunculus length (Characters 10), Cauda length (Characters 11), Hind femora length(Characters 12) and Hind tibia length (Characters 13). Morphological measurements were examined and recorded.

2.3 Statistical analysis

The parameters recorded for different individuals of *P. persicae* from different host plant were subjected to one factor analysis of variance (ANOVA). Statistical analysis was performed using SPSS (version 17) and means were separated by Duncan range test at the 5% level

3. Results

A summary of measurement considering 13 morphological characters of *P. persicae* population associated with three host plants are given in table 1. Results show a morphological difference between wingless adult of *P. persicae* collected from peach, almond and plum at five characters. The measurement the body length of wingless of *P. persicae* demonstrate that aphids collected from peach were bigger in size (4.552±0.70) compared to those collected from almond and plum (4.078±0.36 and 4.38±0.011 mm respectively) and a significant difference (F=16.32, df=2, P=0.017) was demonstrated. A significant difference was observed in antennal segment I length (character number 1) between individuals collected from peach compared to those from almond and plum (F=9.01, df=2, P=0.026). A significant difference in antennal segment IV length (character number 4) between individuals collected from the three different host (F=28.51, df=2, P=0.022) (table 1) was also demonstrated. Our results of statistical analysis revealed a significant difference between lengths of antennal segment V (character 5) for individuals collected from peach and plum compared to those for individuals from almond (F=9.1, df=2, P=0.028). We noted also a significant difference (F=72,82, df= 2, P=0.008) in character number 10 (siphunculi length). However, no significant difference was observed for the rest of measurement parameters.

Table 1: Range and mean of the length of 13 morphological traits of 30 *Pterochloroidespersicae* from different host plant (mm)

Character Number	Peach (n=30)	Almond (n=30)	Plum (n=30)
1 Mean ±S.E Range	0.129±0.01[a] (0.123-0.148)	0.138±0.011[b] (0.111-0.148)	0.140±0.014[b] (0.123-0.148)
2 Mean ±S.E Range	0.131±0,011 (0.123 - 0.185)	0.136±0.009 (0.111-0.148)	0.134±0.01 (0.116-0.148)
3 Mean ±S.E Range	0.59±0.02 (0.579-0.629)	0.60±0.019 (0.543-0.629)	0.618±0.019 (0.530-0.654)
4 Mean ±S.E Range	0.23±0.014[a] (0.243-0.296)	0.26±0.008[b] (0.259-0.271)	0.260±0.01[c] (0.234-0.308)
5 Mean ±S.E Range	0.264±0.006[b] (0.283-0.296)	0.290±0.012 [a] (0.234-0.296)	0.266±0.03[b] (0.234-0.333)
6 Mean ±S.E Range	0.21±0.018 (0.209-0,222)	0.21±0.017 (0.209-0.222)	0.217±0.03 (0.197-0.234)
7 Mean ±S.E Range	4.552±0.70[a] (4.448-6.024)	4.078 ±0.36[b] (4.984-5.784)	4.18±0.011[b] (4.08-4.984)
8 Mean ±S.E Range	0.15±0.008[b] (0.148-0.156)	0.153±0.013[b] (0.144-0.153)	0.157±0.018[a] (0.153-0.162)
9 Mean ±S.E Range	0,058±0,008 (0,054-0,062)	0,053±0,013 (0,058-0,068)	0,053±0,011 (0,048-0,056)
10 Mean±S.E Range	0.144±0.12 (0.136-0.154)	0.144±0.03 (0.148-0.156)	0.142±0.034 (0.136-0.148)
11 Mean ±S.E Range	0.172±0.026 (0.168-0.176)	0.172±0.022 (0.164-0.182)	0.175±0.024 (0.164-0193)
12 Mean ±S.E Range	0.745±0.02 (0.726-0.754)	0.745±0.02 (0.678-0.692)	0.82±0.016 (0.814-0.836)
13 Mean ±S.E Range	2.02±0.03 (1.984-2.098)	1.96±0.01 (1.865-2.036)	1.92±0.02 (1.864-2.016)

Different letters with mean values in a row indicate significant differences between the treatments by Duncan test at P=0.05.

4. Discussion

The present study revealed the presence of a morphological difference between individuals of *P.persicae* collected from peach, almond and plum hosts plants from in several characters.

Apterous viviparous morphs of *P. persicae* from peach host plant were found to be bigger in comparison to those from almond and plum. This study demonstrated significant difference of length of antennal segment I, IV and V. These differences could be attributed to the differences in phenology of the three host plants which are quite different in terms of their relative sizes and growth rates. A number of studies of insects herbivores have found significant intra-specific variation in characters associated with host plant use [24]. Wool and Hales (1997) [25] and Margaitopoulus *et al.* (2000) [26] show that species and physiological condition of the host plant can significantly affect the aphid morphology. Indeed, morphometric studies that have been carried out in Greece showed that the tabacco feeding form of *Myzus persicae* is morphologically different from those on other crops [27]. Incidence of host plants on morphology of aphids was also demonstrated in Paulios *et al.* (2007) [28] studies carried out in Greece. Authors show a morphometric difference of individuals of *Hyalopterus pruni* complex in field collected from various *Prunus* species. A morphological characters

variability of *Lipaphis pseudobrassicae* Kaltenbach 1843 (Hemiptera, Aphidiae) collected from the two crop species *Brassica campestris* Linnaeus 1753 and *Rorippa indica* Linnaeus 1896 was also demonstrated in Agarwala *et al.*, (2009) [29] works. Ruiz- Montoya *et al.* (2005) [30] demonstrate a morphological variation of population of *Brevicoryne brassicae* Linnaeus 1758 associated with two host species, *Brassica oleracea* L. 1753 and *Brassica campestris* L. 1753, occurring in the same habitat. Same, Madjdzadeh *et al.*, (2009) [31] observed morphological differences among *Brachycaudus helichrysi* Kentelbach 1843 (Hemiptera, Aphididae) individuals associated with *Pulicaria dysenterica* (Asteracae) which is possibly due to the fact that the plant has secondary metabolites that can change the chemical components of the plant resulting in changing the composition of plant sap which is the diet of aphids. This different diet can affect indirectly the morphological characters of related aphids. The difference obtained in the present study might reflet some environmental factors in addition to plant phenology such us temperature which can affect both isometric and allometric growth in aphids [11]. Although factors such as environmental conditions and natural enemies may have considerable effect on aphid morphology [32, 26], it seems that the morphological separation in this study is mostly due to host-related differences because samples were collected from host plants in a small scale range with similar climatic conditions during about two month in the spring. Morphomoetric variation of *P. persicae* in the present study can be due to genetic structure variation of aphids related to aphis host plant adaptation. Agarwala *et al.* (2009) [29] proved that plant hosts species can affect the genetic structure of aphid which has the potential to adapt to new host plants and to develop phenotypic and genotypic changes in new food environments. Nevertheless, Mdellel *et al.*, (2012) [33] studies of impact of hosts plants species on genetic structure of *P. persicae* demonstrated after phylogenetic analysis of mitochondrial COI and Opsin gene sequences of individuals collected from peach, almond and plum in Tunisia that aphids have the same sequence and host plant haven't an effect on genetic structure of *P. persicae*.

The results presented here demonstrate the incidence of host plant on morphology of *P. persicae*. Moreover, it's interesting to study the effect of geographical origin on morphology of *P. persicae*. Obviously, a more exhaustive sampling from geographical regions is necessary in order to have definitive picture. Also, furthers investigations on effect of host plant on dynamic and cycle life of *P. persicae* are necessary for establishing a biological control strategy.

5. Acknowledgements

We are grateful to Mr. Bourourou Tawfik and Ms Bchir Amani for their comments on earlier versions of this manuscript.

6. References

1. Blackman RL, Eastop VF. Taxonomic Issues, In: Aphids as Crop Pests (Eds. H. F. van Emden and R. Harrington) CABI, UK, 2007, 1-29.
2. Darwish ETE, Attia MB, Kolaib MO. Biology and seasonal activity of giant brown bark aphid *Pterochloroides persicae* (Cholodkovsky) on peach trees in Egypt. Journal of Applied Entomology 1989; 107:530-533.
3. Kairo MTK, Poswal MA. The brown peach aphid *Pterochloroides persicae* (Lachninae, Aphididae): Prospects for IPM with particular emphasis on classical biological control. Biocontrol News and Information 1995; 16:41-47.
4. Stoetzel MBS, Miller G. Aphids (Homoptera: Aphididae) colonizing peach in the United States or with potential for introduction. Florida Entomologist 1998; 81(3):325-345.
5. Ateyyat MA, Abu-Darwish MS. Insecticidal activity of different extracts of *Rhamnus dispermus* (Rhamnaceae) against peach trunk aphid *Pterochloroides persicae* (Homoptera: Lachnidae). Spanish Journal of Agricultural Research 2009; 7(1):160-164.
6. Mdellel L, Ben Halima Kamel M, Teixeira Da Silva JA. Effect of Host Plant and Temperature on Biology and Population Growth of *Pterochloroides persicae* Cholodv (Hemiptera, Lachninae). Pest technology 2011; 5(1):74-78.
7. Khan AN, Khan IA, Poswal MA. Evaluation of different hosts and developmental biology and reproductive potential of brown peach aphid, *Pterochloroiddes persicae* (Lachninae, APhidiae) under laboratory conditions. Sarhad Journal of Agriculture 1998; 14:369-376.
8. Rakhshani E, Talebi AA, Stary P, Manzari S, Rezwani A. Re-description and Biocontrol Information of *Pauesia antennata* (Mukerji) (Hym., Brachonidae) Parasitoid of *Pterochloroides persicae* (Chol) (Hom., Aphidoidea, Lachnidae). Journal of the Entomological Research Society 2005; 7(3):59-69.
9. Blackman RL, Eastop VF. Aphids on the World's Crops. An Identification and Information Guide 2nd ed John Wiley & Sons, Chichester, 2000, 414.
10. Talhouk AS. Contribution to the knowledge of almond pests in East Mediterranean countries. VI. The sap sucking pest. Zeitschrift für Angewandte Entomologie 1977; 83:248-25.
11. Blackman RL, Eastop VF. Aphids on the World's Trees. An Identification and Information Guide CAB International, Wallingford, Oxon, 1994, 987.
12. Fabre F, Plantegenest M, Mieuzet L, Dedryver C. Leterrier JL, Jacquot E. Effects of climate and land use on the occurrence of viruliferous aphids and the epidemiology of barley yellow dwarf disease. Agriculture Ecosystem Environment 2005; 106:49-55.
13. Lozier JD, Roderick GK, Mills NJ. Genetic evidence from mitochondrial, nuclear and endosymbiont markers for the evolution of host plant associated species in the aphid genus *hyalopterus* (hemiptera: aphididae. Evolution 2007; 61:1353-1367.
14. Hazell SP, Groutides C, Neve BP, Blackburn TM, Bale JS. A comparison of low temperate tolerance traits between closely related aphids from the tropics, temperate zone, and Arctic. Journal of Insect Physiology 2010; 56:115-122.
15. Gorur G. Phenotypic plasticity of morphological characters in cabbage aphid reared on both radish and cabbage. Italian Journal of Zoology 2003; 70:310-303.
16. Via S, Gomulkiewicz R, de Jong G, Scheiner SM, Schlichting CD, Van Tienderen PH. Adaptive phenotypic plasticity: consensus and controversy. Trends Ecolology Evolution 1995; 10:212-217.
17. Via S, Shaw JA. Short-term evolution in the size and shape of pea aphids. Evolution 1996; 50:163-173.
18. Bernays E, Graham M. On the evolution of host specificity in phytophagous arthropods. Ecology 1988; 69:886-892.
19. Jaenike J. Host specialization in phytophagous insects. Annual Review of Ecology, Evolution, and Systematics 1990; 21:243-273.

20. Leclant F. Etude Bioécologique des Aphides de la région méditerranéenne. Implications agronomiques.- Thèse d'Etat Université des sciences et techniques du Languedoc, Montpellier, France, 1978, 327.
21. Blakman RL, Eastop VF. Aphids on the world's crops. - An identification guide Natural history, 1984, 465.
22. Lykouressis DP. Key for identification of the instars of the English Grain Aphid, Sitobionavenae (F.) (Hemipetra: Aphididae). Entomophaga Hellenica 1983; 1:47-51.
23. Agarwala BK, Das K, Raychoudhry P. Morphological, ecological and biological variations in the mustard aphid, *Lipaphis pseudobrassicae* (Kaltenbach) (Hemiptera, Aphididae) from different host plants. Journal of Asia-Pacific Entomology 2009; 12:169-173.
24. Via S. Ecological genetics and hosts adaptation in herbivorous insects: the experimental study of evolution in natural and agricultural systems. Annual Review of Entomology 1990; 35:421-442.
25. Wool D, Hales D. Phenotypic plasticity in Australian cotton aphid (Homoptera: Aphididae): host plant effects on morphological variation. Annals of the Entomological Society of America 1997; 90:316-328.
26. Margaritopoulos JT, Tsitsipis JA, Zintzaras E, Blackman RL. Host-correlated morphological variation of *Myzus persicae* (Homoptera: Aphididae) populations in Greece. Bulletin of Entomolological Research 2000; 12:233-244.
27. Margaritopoulos JT, Tsitsipis JA, Goudoudaki S, Blackman RL. Life cycle variation of *Myzus persicae* (Hemiptera: Aphididae) in Greece. Bulletin of Entomolological Research 2002; 92:309-319.
28. Poulios KD, Margaritopoulos JT, Tsitsipis JA. Morphological separation of host adapted taxa within the *Hyalopterus pruni* complex (Hemiptera: Aphididae). European Journal of Entomology 2007; 104:235-242.
29. Ruiz-Montoya L, Nùñez-Farfán J, Domínguez CA. Changes in morphological traits of the cabbage aphid (*Brevicoryne brassicae*) associated with the use of different host plants. Ecological research 2005; 20:591-598.
30. Madjdzadeh SM, Mehrparvar M, Abolhasanzadeh F. Morphometric discrimination of host-adapted populations of *Brachycaudus helichrysi* (Keltenbach) (Hemiptera, Aphididae). Redia 2009; XCII:143-145.
31. Dixon AFG. Aphids Ecology 2nd Edition. Chapman and Hall. New York USA, 1998, 1-58.
32. Mdellel L, Martinez –Torres D, Ben Halima Kamel M Two mitochondrial haplotypes in *Pterochloroides persicae* (Hemiptera: Aphididae: Lachninae) associated with feeding sites. Insect Sciences, 2012, 1-6.