Aphids on Cultivated Cereals in Tunisia with a New Reported Species *Forda formicaria*

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ABSTRACT

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A survey of the aphids associated with cultivated cereal in Tunisia was carried out during 2010 to 2012. Fourteen aphid species were recorded from eight regions (Cap Bon, Bizerte, Beja, Bousalem, Manouba, Zaghouan, Kef and Kairouan). For the first time a new species *Forda formicaria* was identified. Ten other winged species were also recorded in the suction trap of the Cap Bon region increasing the aphid richness to 24 species. From these aphid species listed, six are numerous and known for their economic importance: namely *Diuraphis noxia* as phloem feeder and *Metopolophium dirhodum, Rhopalosiphum padi, R. maidis, Schizaphis graminum*, and *Sitobion avenae* as virus vectors. Temporal activity of these species was established for 14 years by suction trap and their seasonal activity was discussed.

Keywords: Aphids, cereals, distribution, diversity, *Forda formicaria*, temporal activity

Cereals are the most important crop worldwide and the first source of food in Tunisia. Cultivated cereals (such as wheat and barley) are known to be infested by several aphid species. Aphids have the status of damaging insects as phloem-feeders, diverting for their own profit the nutrients necessary to plant growth and reproduction. They are considered as major pests particularly on winter wheat in Europe (Poehling et al. 2007). Mean annual losses induced by aphids were estimated at 700,000 t of wheat (Wellings et al. 1989). In Britain, losses in wheat attributed to aphids were about 10-13% (Tatchell 1989). Aphids also inject saliva that could be phytotoxic like that of *Diuraphis noxia* native from the southern former USSR. It subsequently spreads rapidly throughout wheat producing regions of the western USA where it caused hundreds of million dollars losses in wheat and barley crops, through reduced yields and increase pesticide treatment costs. Annual direct yield losses reached $274 million in 1988 and dropped to less than $10 million by 1993 (Michaud and Sloderbeck 2005). Aphid infestations not only reduce yield but also spoil the baking quality of the grains by inducing changes in their nutritional composition (Oakley et al. 1993). In addition, they can transmit numerous viruses. In fact, nearly 50% of insect-borne viruses (275 out of 600) are transmitted by aphids (Dedryver 2010). Barley Yellow Dwarf Virus (BYDV) is

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strictly and specifically transmitted by aphid vectors in a persistent and circulative manner. BYDV belongs to the Luteoviridae family which is widely spread throughout the world and responsible for considerable yield losses in major cereal crops particularly on barley (Rabbinge and Mantel 1981; Svanella-Dumas et al. 2013). BYDV infections induce fewer ears, less grain per tiller and lower thousand grain weights (Poehling et al. 2007). Even low populations of aphids can spread the virus. Four cereal aphids: *Rhopalosiphum padi, R. maidis*, *Sitobion avenae* and *Schizaphis graminum* are known as virus vectors of BYDV (Comas 1996).

In Tunisia, seven aphid species are reported by Dhouibi and Methnani (1990) among them the four cited vectors. Furthermore, a field survey showed that BYDV is most common in three regions (Zaghouan, Cap Bon and Bizerte) with an incidence estimated at 14-35% (Najar et al. 2017). Vector colonization and movement patterns influence the timing and pattern of virus epidemics linked to yield losses. Infections depend largely on aphid numbers, spread and weather conditions. The purpose of this study was to identify the species compositions of cereal aphids, list the potential vectors in Tunisia and describe the temporal flight activity of winged aphid by a suction trap.

MATERIALS AND METHODS

On cereal plants, heavy numbers of aphids have been recorded in 2010 at Kef region and the plants become sick and died; they were sampled to identify the species implicated in this big loss.

In March 2011, a damage of a mixed colony of aphids on roots was first observed at Manouba (North of Tunisia) and then in 2012 at Kef (North West). Aphids were collected from barley and wheat. Specimens were conserved on ethanol alcohol and then prepared as microscopic objects in Canadian balsam to be identified.

Furthermore, the inventory of aphid species was achieved through field surveys carried out in seven Tunisian regions. In total, 20 different fields were prospected during 2012: Cap Bon (2sites) (36°48′59″N10°34′07″E), Bizerte (3) (37°16′27″N9°52′26″E), Beja (3) (36°44’05’’N, 9°13’35’’E), Bousalem (2) (36°33’42”N 8°56’40”E), Manouba (1) (36°43’09”N 9°29’10”E), Zaghouan (2) (36°24′10″N 10°08′34″E), Kef (3) (36°11′10″N 8°42′00″E), and Kairouan (4) (35°39’50”N 9°59’10”E). In each site, 20 cereal plants infested with aphids were sampled between March and May. The frequency of aphid was calculated as the number of aphids divided by the total of collected aphids.

In addition, a 12.2 m suction trap is operated in Soliman (Cap Bon) from July 2002 until now. Aphids were collected every day from the suction trap. These aphid daily records allow us to know the aerial density of flying cereal aphids. We present here captures from 2003 to 2016 (there was a suction trap break during a long period of the year 2014 and little period of 2015, results are less in number compared to the other years). All aphid specimens were preserved in 96% ethanol until identification. Species were identified based on several keys (Blackman and Eastop 1994, 2000, 2006, 2012; Favret 2014; Jacky and Bouchery 1984; Nafría 2013; Remaudière and Seco Fernandez, 1990).

RESULTS

Aphid identification and distribution.

From more than forty cereal species worldwide, 14 aphid species (Table 1) were identified on cereals (wheat and barley) including *Diuraphis noxia*, *Metopolophium dirhodum*, *M. festucae,*

Rhopalosiphum padi, *R. maidis*, *R. rufulum*, *Sitobion avenae*, *Sitobion fragaria*, *Schizaphis graminum, Sipha maidis*, and *S. elegans*. Only at Manouba, *Geoica utricularia* was identified on roots. From Manouba and Kef samples, aphid colonies contain two more other *Forda* species on plant roots*:* namely *F. marginata* and *F. formicaria* recorded (Fig. 1). The latter is a new record added to the known Tunisian fauna.

The numbers of aphids recorded in 2012 show a real infestation of cereals sampled from Kairouan and Kef by aphids as compared to the other prospected regions. Generally, *R. maidis* was the most abundant species with 30% of the total aphids collected; *D. noxia* (26%) was the second abundant species, followed by *S. avenae* (22%) and *R. padi* (15%). However, *D. noxia* was the most frequent at Kef, *R. maidis* and *R. padi* the most prevalent at Kairouan, Beja, and Bousalem, *S. avenae* at Bizerte, Bousalem, Béja, Manouba and Cap Bon. *M. dirhodum* was only observed on Cap Bon, apterae and alatae on wheat. The Cap Bon region was the richest in terms of diversity of aphid species; it revealed 8 species out of 14 recorded.

Table1. Aphid identification and their distribution in the different prospected regions in 2012

Aphid species	Cap Bon	Zaghouan	Kairouan	Bizerte	Bousalem	Beja	Manouba	Kef	Total
Diuraphis noxia		14						1185	1199
Forda formicaria		18					62		80
Forda marginata							26		26
Geoica utricularia							47		47
Metopolophium dirhodum	69								69
Metopolophium festucae	12								12
Rhopalosiphum maidis			760	97	252	261		11	1381
Rhopalosiphum padi	31		245	65	165	177		9	692
Rhopalosiphum rufulum			5		26	14			45
Schizaphis graminum	4		4				7		15
Sipha elegans	2								2
Sipha maidis	44								44
Sitobion avenae	101	56	75	244	201	193	123	5	998
Sitobion fragaria	23								23
Total	286	88	1089	406	644	645	265	1210	4633
Aphids/plant	14	4	54	20	32	32	13	60	

The evolution of the numbers of the different species corresponds to the phenological development of wheat. In fact, *R. maidis* and *R. padi* occurred in early March while *S. avenae* colonies were observed late in the season (late April) especially in the ears at Kef region (Table 2).

Table2. Infested cereal organs by aphids depending on sampling month in Kef (2012)

Aphids/plant organ	Leaves		Ears	
	March	April	March	April
Diuraphisnoxia	326	859	0	0
Rhopalosiphumpadi	2	5	0	0
Rhopalosiphummaidis	1	8	0	0
Sitobionavenae	0	0	0	5

The specific information for the two species are reported below.

- *Diuraphis noxia* has occurred on 2010 at Kef region and all the plants in the field become sick, dwarf and diedleading to considerable yield losses to the farmers of this region (Fig. 1 a). In some years, Russian wheat aphid (RWA) can be the most serious insect pest on wheat and barley in the arid region of Kef resulting from damage to the flag leaf. High colonies of RWA induce yellow to purpling of the damaged leaves and plant remained weak, dwarf and younger stages killing of the plant. The aphid feeds on the youngest leaves within the whorl of the upper leaves, causing the leaf to remain tightly rolled. Its feeding has a rapidly toxic effect on the plant; the leaves become rolled (Fig.1 e) and desiccated and infested ears become bent. RWA is enclosed in the rolled leaf and inaccessible to natural enemies and insecticides. Severely damaged plants appear stunted and stressed, and tillers become prostrate.
- *F. formicaria,* is recorded for the first time in Tunisia. The apterae are medium-sized, oval with dorsal surface of body highly domed, and short appendages, varying in color from off-white to dull yellow, to various shades of dark green (Fig.1 f); they were observed on roots of cereals as their secondary host. Alata have a dull green abdomen with dark dorsal transverse bands. The plants attacked by this species are dwarf with dried leaves. Colonies of *Geoica utricularia* were also noted in a mixture with *F. formicaria* (Fig.1 f).

Aphid flight phenology.

A total of 28.133 cereal winged aphids were captured at Soliman site using suction trap between 2003 and 2016. Ten further species were identified and added to the species previously observed on cereal sampling foliage (*Triticum* and *Hordeum*): namely *Anoecia corni, Aploneura lentisci, Rhopalosiphum rufiabdominalis, Hysteroneura setariae, Schizaphis minuta, Tetraneura ulmi, Baizongia pistaceae, Geoica lucifuga, Paracletus cimiformis, Pemphigus* spp. The species richness reached now 24 cereal aphid species in Tunisia both on wheat/barley and aerial sampling. The mean aphid's numbers counted between 2003 and 2016 varied from 4 to 5896 individuals. Thus, they were separated into

three groups: group 1 with more than 1200, group 2 between 102-606 and group 3 with less than 90 individuals (Fig.2-A,B,C).

Fig. 2 also shows the aphid density patterns for 14 years, characterized by peak densities where *A. lentisci, R. padi, R. maidis* and *S. graminum* were the most abundant in the suction trap. The three last ones were frequent both on foliage and in the trap. They present a peak of populations on 2006, 2007, and 2008. A population decline was observed from 2010 to 2013 and then another peak recorded in 2016. The group 2 composed of *S. avenae*, *M. dirhodum* and *S. fragaria*, known as vectors of BYDV, were of less importance in numbers as compared to group1. Peaks were noted in 2004, 2007, 2010 and 2016 for these populations.

No vectors were known from the group 3 which contained a limited number of populations and seemed not damaging to cereals. Only in 2008, they showed a relatively important peak.

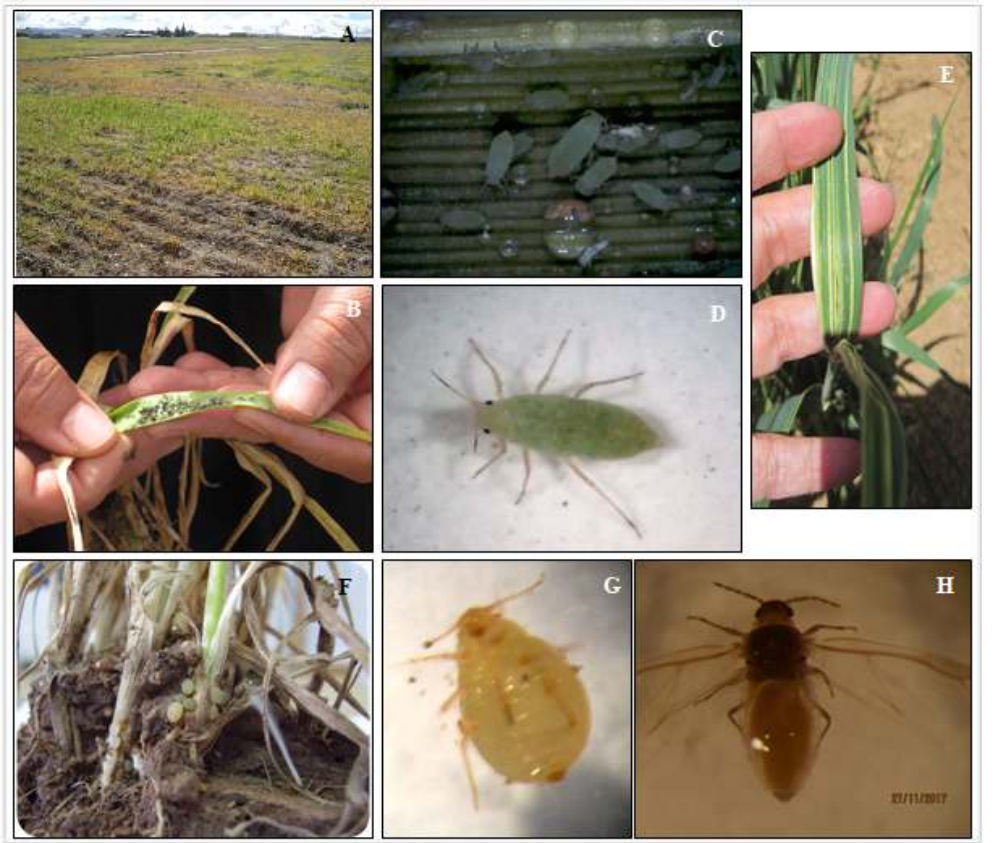

Fig. 1. Cereal aphids. *Diuraphis noxia*, damage at Kef region in 2010 (A), colonies (B, C), wingless adult (D), yellow chlorotic streaks on leaves (E); *Forda formicaria*, colony on roots (F), wingless adult (G), winged adult (H).

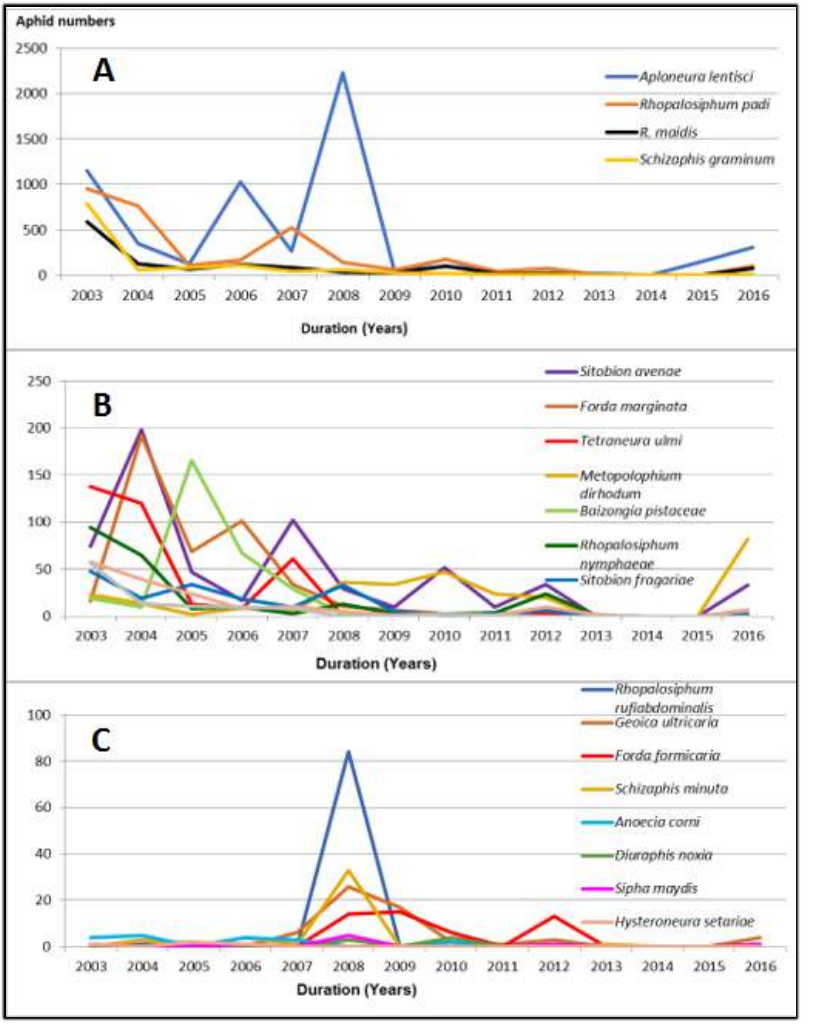

Fig. 2. Cereal aphid's flight in the suction trap of Soliman (Cap Bon) during 2003-2016 period. Group1 (A), group 2 (B), and group 3 (C).

Furthermore, flight activity of all aphid species generally occurred during two distinct seasons, both March and May during cereal growing season (spring) and a second one in the fall from September to November (Fig. 3). This is probably in relation with annual holocycle life cycle of heteroecious species which alternate between secondary and primary host. However, it appears that different species fly at different periods of the year. For example, *R. padi* flight was observed much earlier (in January) than most of other aphids. *R. maidis* was the second most frequent aphid after *R. padi* and was mainly observed in February and March. Both *M. dirhodum* and *S. graminum* have a peak population in March while *S. avenae* and *S. fragaria* in April.

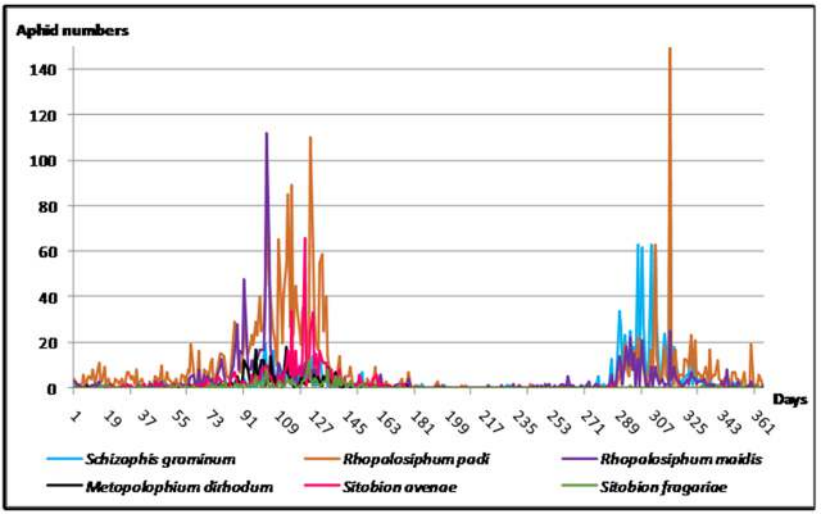

Fig.3. Temporal variation of different cereal aphid species in the suction trap of Soliman (Cap Bon), expressed as an average number by species, calculated during the 2003- 2016 period.

DISCUSSION

The present work brings to a total of 24 the number of aphid species associated with wheat and barley host cereal species. Five recovered species are of economic importance (namely *M. dirhodum, R. padi, R. maidis, S. graminum,* and *S. avenae*) and are known to transmit plant viruses in Tunisia. Their occurrence was high during the growing season suggesting their ability to propagate BYDV once present in the field. *R. padi* was captured in high numbers in April and in October but its flying decreased rapidly in the second half of October as also reported by Hullé et al. (1994).

Cereal aphidofauna does not show special characteristics and it consists of species already known in other European countries including those from the Mediterranean basin. According to Blackman and Eastop (1984, 2000), 32 aphid species are reported in the world while Holman (2009) mentioned 26 species on *Hordeum* and 41 on *Triticum*. In Tunisia, previous survey of aphid species showed the presence of seven species (Dhouibi and Methnani 1990), five of them were also listed by Harbaoui et al. (2008). A brief description of the identified species is presented below.

- *Diuraphis noxia* (Kurdjumov 1913), is an important pest of wheat and barley in several countries of North Africa and West Asia, e.g., Morocco, Algeria, Tunisia, Ethiopia, Yemen, Turkey, and Iran (El Bouhssini et al. 2011). *D. noxia* is originated in Europe and Central Asia. Feeding damage caused by *D. noxia* to plant leaves results in characteristic longitudinal white, yellow or red chlorotic streaks with a convoluted rolling of the leaf. Rolling of leaves reduces photosynthetic area and protects aphids from contact with insecticides and natural enemies (Khan et al. 2010). The symptoms observed on RWA infested plants are suggested to be partly due to the aphid's ability to

inflict severe damage on the phloem transport. This damage leads to noticeable reduction in the transport of assimilates within 72 h of RWA infestation and a significant reduction during prolonged feeding which, in most cases, results in total cessation of phloem transport (Saheed 2010).

- *F. formicaria* (von Heyden, 1837) is a very common Mediterranean species on *P. terebinthus* and was reported by many authors. *F. formicaria* is one of the gall-forming aphids on *Pistacia* trees (Anacardiaceae). The primary hosts of *F. formicaria* are *P. terebinthus* and *P. atlantica*. The aphid has a typical 2-year holocycle involving alternation between *P. terebinthus* and roots of the secondary hosts including Gramineae (*Agropyron, Agrostis, Bromus, Cynodon, Dactylis, Hordeum, Lolium, Poa, Triticum*…) in winter, various grasses (Zwolfer 1958). *F. formicaria* is also present in Europe, the Middle East, Central Asia, Siberia, and North America.
- *F. marginata* (Koch1957) apterae on grass roots are small to medium sized with reduced legs and antennae; body highly domed dorsally, brownish yellow or greenish yellow in color. Primary hosts are *Pistacia mutica, P. palestina*, and *P. terebinthus*. Secondary hosts are numerous species of Gramineae including *Agropyron, Agrostis, Avena, Bromus, Dactylis, Festuca, Hordeum, Poa, Secale*, and *Triticum* genera. The species is distributed in Europe, the Mediterranean region, the Middle East, Central Asia, Siberia, and North America. *F. marginata* is heteroecious holocyclic in the Mediterranean region and Middle East, forming galls on *Pistacia* by folding and swelling the edges of the leaflets (Blackman and Eastop 2006).
- *Geoica utricularia* (Passerini, 1856) is a species of temperate habitats that feeds mostly on root grasses. This aphid is globally distributed throughout most temperate regions of the world. It has a great range of hosts and is known to feed on roots of at least 40 species of grasses (Poaceae). It is particularly important on *Agrostis, Avena, Bromus, Festuca, Poa, Sorghum, Zea*, and other grasses. It also attacks 6 species of *Pistacia* (Anacardiaceae), some composite (Asteraceae), and *Plantago* (Plantaginaceae). It has not been involved in the transmission of any plant virus (Blackman and Eastop 2006).
- *Metopolophium dirhodum* (Walker 1849) is widely distributed in Europe, the Middle East, Africa, Central Asia, Japan, Australia, New Zealand, North America, and South America. Its primary hosts are cultivated and wild *Rosa* spp., and occasionally *Agrimonia* and *Fragaria* spp. Numerous species of grasses and cereals are secondary hosts of this species. *M. dirhodum* is a vector of Barley Yellow Dwarf Luteovirus (Blackman and Eastop 2000).
- *Metopolophium festucae* (Theobald 1917) is mainly found on cereals (*Avena, Hordeum, Secale, Triticum*) sometimes on other Gramineae especially *Lolium perenne* and *Phleum pratense*. This species is known from Europe and is monocious on Gramineae.
- *Rhopalosiphum maidis* (Fitch 1856) collected in Cap Bon, Beja, Kef, Kairouan, apterae on wheat and barley. It generally feeds in the whorl of the plant and extremely heavy infestation can induce honeydew. *R. maidis* is

Asiatic in origin but is now almost cosmopolitan in distribution. It is found on young leaves of grasses belonging to more than 30 genera. The species is heteroecious holocyclic with *Prunus* spp. as primary hosts in Asia, but apparently is entirely anholocyclic elsewhere although males occur sporadically (Blackman and Eastop 2006). *R. maidis* is probably the most important aphid pest of cereals in tropical and warm temperate climates (Blackman and Eastop 2000). It is an important vector of the BYDV.

- *Rhopalosiphum padi* (Linnaeus 1758) apterae and alatae occurs on leaves of wheat (*Triticum* sp.), on oats (*Avena sativa*) and colonies are in the underside of leaves from April to June. Alatae was captured in the suction trap. *R. padi* is a cosmopolitan species of Palaearctic origin. In Europe the species is heterocious holocylic between *Prunus* species, especially *P. padi* (the primary host) and Poaceae; it is anholocyclic on its secondary host plants in mild winter climates. *R. padi* is able to transmit a number of plant viruses (Blackman and Eastop 2000) and particularly the strain BYDV-PAV and Cereal yellow dwarf virus-RPV.
- *Rhopalosiphum rufulum* (Richards 1960) is a Nearctic species (Hidalgo et al. 2012) distributed in Canada and Europe (Denmark, England, Germany, Netherlands, former Czechoslovakia, Turkey) (Blackman and Eastop 2012; Holman 2009; Nafría 2013; Shenol et al. 2015). Primary host populations had not until recently been observed in the field in Europe, although gynoparae and alate males are produced in large numbers in autumn, and oviparae developed and laid numerous eggs which hatched to produce fundatrices on *Crataegus monogyna* under insectary conditions (Stroyan 1972). However, apterae of this species were recently collected in July on a *Crataegus* sp. in Turkey (Senol et al. 2015).
- *Schizaphis graminum* (Rondani 1852) (Aphidinae: Aphidini: Rhopalosiphina), apterae and alatae on *Triticum* sp. and is found in the suction trap. It is known from Southern Europe, the Middle East, Central Asia, parts of southern Asia, Japan, and North, Central and South America; it is often called greenbug. It has a monoecious holocycle in cold temperate climates but overwinters anholocyclically wherever winter conditions permit (Blackman and Eastop 2000). The aphids feed on the leaves of many species of grasses and cereal crops, often causing yellowing. Greenbug is a serious pest of cereal crops because it is the vector of several serious plant viruses including barley yellow dwarf Luteovirus (especially strain BYDV-SGV), miller red Luteovirus, sugarcane mosaic Potyvirus and Maize dwarf mosaic Potyvirus, among others that reduce yield (Blackman and Eastop 2000).
- *Sipha elegans* (Del Guercio 1905) usually forms colonies on the upper surfaces of the leaf blades of grasses and cereals, often causing them to roll upwards and develop yellow patches. Their plant hosts are *Agropyron* spp., *Festuca pratensis*, *Hordeum murinum* but sometimes on wheat and barley (Blackman and Eastop 2006).
- *Sipha maydis* (Passerini 1860) apterae were collected on *Hordeum* and *Triticum* in the Cap Bon region. Alatae were caught in the suction trap. *S. maydis* is found in Europe and the Mediterranean Region, the Middle East, Central Asia, India, Pakistan, North and South Africa. It occurs on numerous species in more than 30

genera of Poaceae. *S. maydis* is anholocyclic; it also has a monoecious holocycle with alatae males. It is a cereal crop pest in drier climates outside North-West Europe and is known to transmit Cucumber Mosaic Cucumovirus and Barley Yellow Dwarf Luteovirus (Blackman and Eastop 2000, 2006).

- *Sitobion avenae* (Fabricius 1775) was collected on *Triticum* sp. It occurs in Europe, the Mediterranean, the Middle East, Central Asia, India, Nepal, Pakistan, Africa, and North, Central and South America (Blackman and Eastop 2006). It feeds on both cultivated and wild species of Poaceae (Roberti 1993) and many other monocots. *S. avenae* has a monoecious holocycle, but in mild climates, it is anholocyclic, with asexual overwintering. This species is damaging to cultivated cereals and pasture grasses, and it is a vector of Barley Yellow Dwarf Luteovirus especially BYDV-PAV and BYDV-MAV and at least three other plant virus diseases (Blackman and Eastop 2000).
- *Sitobion fragariae* (Walker 1848) apterae and alatae on *Avena sativa*, on *Hordeum* sp., *S. fragariae* is found in Europe and Asia and has been accidentally introduced to South Africa, North and South America (Blackman and Eastop 2006). Its primary hosts are *Rubus* species, also *Fragaria*, *Rosa* and *Geum* spp., and it is polyphagous on secondary hosts in various unrelated plant families (Holman 2009). *S. fragariae* has a heteroecious holocycle (Blackman and Eastop 2006), an anholocycle and a possible paracycle (Roberti 1993). The species heavily infests blackberry and cereals and is a vector of Barley Yellow Dwarf Luteovirus (Blackman and Eastop 2000).

Few minorities (10%) of aphid species complete their life cycle on two completely different hosts and are known to be dioecious (Dixon1998). This requires that they often move between primary host (perennial) and secondary one (herbaceous) during their life cycle. Several species have this behavior such as *R. padi*. It migrates from *Prunus* and colonizes the cereals in February exploiting the complementary growth patterns of herbaceous and woody plants host-alternating and can overcome the constraints imposed by the seasonal changes in temperature.

The increase or the decline of the abundance of aphids between years (Fig. 2) is due mainly to variations in environmental conditions. It is well documented that a gradual change in climate, as well as local or regional climate characteristics, can affect population abundance (Martin 1998) and species distribution (Parmesan 1996). Aphids are tending to arrive earlier in the growing season (Fig.3) when crops are more susceptible to feeding damage and to viruses transmitted by aphids. For cereal, warmer winters increase the risk from BYDV because they lead to a greater prevalence of anholocycle and hence continued parthenogenesis on cereal (Harrington 2003).

Finally, it is important to comment the average of aphid numbers calculated by sampling field which is exceeding (except for Zaghouan) the nuisance threshold known around 7 to 10 aphids per tiller (Hansen 2000; Larsson 2005). The population density of aphids and hence the frequency and intensity of damages is expected to be amplified in the future by climate change. A large number of aphids were captured in early spring and in the fall. Suction trap catches indicate the aphid population abundance in the Cap Bon region. The cosmopolitan species *R. padi*,

R. maidis, S. graminum, S. avenae and *M. dirhodum* are among the most abundant species in the suction trap samples. They were found in wheat and barley and seem responsible for vectoring BYDV. English grain aphid, *S. avenae*, was the last species to colonize wheat each season, and the most abundant. *S. avenae*can be responsible for late-season virus transmission and causes direct yield loss by feeding on heads and flag leaves. Pest management efforts should focus on suppressing these aphid species to limit virus propagation and reduce yield losses.

Other aphids as *D. noxia* on leaves, *G. utricularia, F. formicaria* and *F. marginata* on roots are damaging to crop by their extraordinary capacity for population increase, mainly by parthenogenetic reproduction and their feeding on phloem of cereal plants. These species have also to be considered for reducing pest populations in wheat and barley in the future.

RESUME

Boukhris-Bouhachem S., Ben Fekih, I. et Souissi R. 2018. Pucerons sur les céréales cultivées en Tunisie avec le signalement d'une nouvelle espèce *Forda formicaria*. Tunisian Journal of Plant Protection 13 (1): 79-91.

Une étude sur les espèces de pucerons associées aux céréales cultivées en Tunisie a été réalisée entre 2010 et 2012. Quatorze espèces de pucerons ont été recensées dans 8 régions (Cap Bon, Bizerte, Béja, Bousalem, Manouba, Zaghouan, Kef et Kairouan). Pour la première fois une nouvelle espèce *Forda formicaria* a été identifiée. Dix autres espèces ailées ont également été enregistrées dans le piège à succion de la région du Cap Bon, ce qui élève la richesse des pucerons à 24 espèces. Parmi ces espèces, six sont abondantes et connues pour leur importance économique dont *Diuraphis noxia* comme suceur de sève et *Metopolophium dirhodum, Rhopalosiphum padi, R. maidis, Schizaphis graminum* et *Sitobion avenae* comme vecteurs de virus. L'activité temporelle de ces espèces a été établie pendant 14 ans par un piège à succion, la variation saisonnière des espèces de pucerons a été discutée.

Mots clés: Activité temporelle, céréales, distribution, diversité, *Forda fomicaria*, pucerons

ملخص

سنية بوريص-بوهاشم، ابتسام بن فقيه ورابحة السويسي. 2018. حشرات المن على الحبوب المزروعة في تونس مع تسجيل نوع جديد *Forda formicaria*. Tunisian Journal of Plant Protection 13 (1): 79-91.

قمنا بدراسة استقصائية عن حشرات المن التي تضر بمزارع الحبوب بثمانية مناطق من البلاد التونسية وهي الوطن القبلي وبنزرت وباجة وبوسالم ونوبة وزغوان والكاف والقيروان بين 2010 و 2012. سجلنا وجود 14 نوعا من هذه الحشرات. تم لأول مرة تسجيل نوع جديد من المن الذي يضر بجذور النبتة وهو *Forda formicaria*. إضافة إلى ذلك، تم الحصول على عشرة أنواع أخرى بواسطة مصيدة الالتصاص المركزة بجهة الوطن القبلي ما ساهم في إثراء عدد الأنواع إلى 24. من بين الأنواع المدرجة هناك ستة ذات أعداد وافرة ومعروفة من حيث دى خطورة تأثيرها على المحاصيل سواء كانت بواسطة تغذيتها على النسغ النباتي مثل *Diuraphis noxia* أو كناقلة للفيروسات مثل *Metopolophium dirhodum* و *Rhopalosiphum padi* و *R. Maidis* و *Schizaphis graminum* و *Sitobion avenae*. تم تأسيس النشاط الزماني لهذه الأنواع لمدة 14 عاما عن طريق مصيدة الالتصاص ومناقشة تغيراتها الموسمية.

كلمات مفتاحية: تنوع، توزيع، حبوب، حشرات المن، نشاط زماني، *Forda formicaria*

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