Zootaxa 3919 (2): 335–342
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3919.2.6
http://zoobank.org/urn:lsid:zoobank.org:pub:C62E553A-A401-4399-863B-8E2CEDA74DC5

A new species of *Acyrthosiphon* (Hemiptera, Aphididae) from France and Spain

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Abstract

A new species in one of the largest genera of Macrosiphini (Hemiptera, Aphididae), *Acyrthosiphon pilosum* **sp. n.**, is described from apterous and alate viviparous females and oviparous females from French and Spanish Mediterranean localities, living on species of *Ononis* (Fabaceae), mainly *O. natrix*. The new species is characterized by the presence of many accessory setae on the ultimate rostral segment, and usually five setae on the first tarsal segments, a combination that is not present in any other known *Acyrthosiphon* species; in addition marginal tubercles are present on prothorax and several of abdominal segments 2–5.

Key words: Aphids, Macrosiphini, *Acyrthosiphon pilosum*, *Ononis*, Mediterranean fauna

Aphids belonging to *Acyrthosiphon* collected from *Ononis* (Fabaceae) in French and Spanish localities with 5 setae (exceptionally 4 or 3) on first tarsal segments, 19-36 accessory setae on the ultimate rostral segment, and marginal tubercles on abdominal segments 2-5 have been studied and are here described as a new species. The species has been included in the genus *Acyrthosiphon* Mordvilko, 1914 (Aphididae, Aphidinae, Macrosiphini) taken into account the generic characteristics exposed by Hille Ris Lambers (1947), Eastop (1971) and Heie (1994).

Acyrthosiphon pilosum Nieto Nafría, Aldea & Castro, sp. n.

Diagnosis. Aphids 2.1–3.8 mm long; green when alive; brownish yellow when mounted. First segment of tarsi with 5 setae (infrequently 4 or 3); ultimate rostral segment with 19–36 accessory setae, and longer than second segment of hind tarsus; marginal tubercles present on prothorax and several abdominal presiphuncular segments; antennal and dorsal abdominal setae at least 0.4 times the basal width of antennal segment III; antennal segment III with 3–11 secondary sensoria (exceptionally up to 22) on its proximal half in apterous viviparae and 12–30 along length of segment in alate viviparae.

Description. Apterous viviparous females (Figure 1), described from 166 specimens, of which 117 have been measured. Shiny green when alive. Brownish yellow in general (see details below) when mounted (Figure 1A). Metric and meristic features in Table 1. Head (including clypeus, labrum and mandibular and maxillar laminae) brownish. Frons with prominent lateral tubercles (approximately 0.5 times length of antennal segment I), wide frontal sinus and small and flat medial tubercle. Dorsum of head smooth. Antennal segments I–III usually as pale as head (darker in pigmented specimens); segments I and II smooth, proximal part of segment III with small spinules, remaining length of this segment imbricated (Figure 1B); segments IV–VI also imbricated, darker than the previous ones, especially in pigmented specimens. Secondary sensoria round and flat, ventrally aligned on proximal third to half of segment III (Figure 1B). Cephalic dorsal and antennal setae stiff and with diffuse apices. Rostrum reaching hind coxae and darkening to apex. Last rostral segment provided with many accessory setae, which are long and slightly curved (Figure 1C); ultimate rostral segment elongate wedge shaped. Dorsum of thorax and abdomen in general paler than dorsum of head and more-or-less wrinkled. Legs mostly pale like abdominal dorsum, tarsi and apices of tibiae pale brown (Figure 1A). First segments of tarsi usually with 5 setae (Figure 1D),

Accepted by D. Ouvrard: 21 Nov. 2014; published: 17 Feb. 2015

but the eight specimens of one sample—from Le Casset—have 3 or 4 setae. Prothorax and several of abdominal segments 2–5 with marginal tubercles that are unusually large for an *Acyrthosiphon* species (Figure 1E). Spinal tubercles absent on head and abdomen. Thoracic and abdominal dorsal setae similar in shape to cephalic ones. Intersegmental and spiracular sclerites usually inconspicuous (Figure 1A), only evident in darkest specimens. Marginal areas of abdominal segment 6 (postsiphuncular), and transverse bands of segments 7 and 8 with spinules. Siphunculi pale, very variable in length, even in specimens from the same sample, subcylindrical, with enlarged base, thin but sometimes slightly swollen on the distal third, scabrous or imbricated over their entire length, and with subapical incision (with 1-3 transversal lines) and flange (Figure 1F). Cauda pale or dusky, broad triangular, with obtuse apex; caudal setae thick and slightly curved (Figure 1G). Subgenital plate also pale, and anal plate pale or dusky (Figure 1A).

TABLE 1. Metric and meristic features of *Acyrthosiphon pilosum* **sp. n.**; ap.viv.fem., apterous viviparous females, al.viv.fem., alate viviparous females, ov.fem., oviparous females; into parenthesis, exceptional values.

	apt.viv.fem.	al.viv.fem.	ov.fem.
Body [mm]	2.400–3.725	2.125–3.525	2.400–2.600
Antenna [mm]	2.260–3.360	2.530–3.300	2.610–2.620
Antenna / Body [times]	0.80–1.22	0.85–1.19	1.00–1.01
Antennal segment III [mm]	0.56–0.88	0.60–0.81	0.52–0.64
Antennal segment IV [mm]	0.38–0.66	0.42–0.65	0.35–0.43
Antennal segment V [mm]	0.29–0.47	0.36–0.49	0.30–0.36
Antennal segment VI base [mm]	0.10–0.19	0.13–0.18	0.12–0.14
Antennal segment VI processus terminalis [mm]	0.65–1.06	0.80–1.05	0.71–0.85
Antennal segment VI processus terminalis / Ant. segm. III [times]	1.03–1.44	1.09–1.48	1.28–1.37
Antennal segment VI: processus terminalis / base [times]	4.65–7.00	5.11–6.71	5.86–6.07
Secondary sensoria on Ant. segment III [number]	3–11(22)	12–30	2–5
Ultimate rostral segment [mm]	0.15–0.24	0.18–0.23	0.18–0.19
Ultimate rostral segment / its basal basal width [times]	2.05–4.00	2.22–3.64	2.53–2.53
Ultimate rostral segment / hind tarsus 2nd segment [times]	1.00–1.62	1.06–1.68	1.31–1.46
Hind femur [mm]	0.80–1.28	0.85–1.23	0.78–0.85
Hind tibia [mm]	1.42–2.30	1.60–2.30	1.42–1.60
Scent plates (pseudosensoria)	——	——	102–125
Hind tarsus 2nd segment [mm]	0.13–0.18	0.13–0.17	0.13–0.15
Abdominal (segment 2-5) marginal tubercles [number on one side]	3–4	3–4	4
Siphunculus [mm]	0.52–1.09	0.62–0.88	0.60–0.65
Body / Siphunculus [times]	2.91–5.18	3.43–4.86	3.93–4.06
Siphunculus / head diameter [times]	1.30–2.31	1.44–2.02	1.50–1.67
Siphunculus / Ant. segment III [times]	0.87–1.37	0.89–1.24	1.00–1.17
Siphunculus / its basal width [times]	4.27–7.54	4.47–8.86	4.57–5.55
Siphunculus / its middle width [times]	8.83–19.60	10.83–15.40	10.00–10.83
Siphunculus / Cauda [times]	1.63–2.50	1.74–2.48	2.21–2.26
Cauda [mm]	0.30–0.47	0.25–0.43	0.27–0.29
Cauda / its basal width [times]	1.50–2.37	1.68–2.77	1.80–1.81
Setae on …			
… antennal segment I [number]	4–15	5–12	7–8
… antennal segment II [number]	3–9	4–11	5–6
… antennal segment III [number]	15–37	20–34	17–22

.....continued on the next page

TABLE 1. (Continued)

	apt.viv.fem.	al.viv.fem.	ov.fem.
… antennal segment III [µm]	15.0–42.5	17.5–27.5	25.0–25.0
… antennal segment III / basal width ant. segment III [times]	0.4–1.1	0.5–0.9	0.6–0.7
… vertex [µm]	32.5–55.0	32.5–50.0	37.5–50.0
… vertex / basal width ant. segment III [times]	0.9–1.8	1.0–1.5	1.1–1.3
… ultimate rostral segment [number]	19–36	21–30	23–28
… hind femur, ventral [µm]	15.0–40.0	20.0–30.0	20.0–35.0
… hind femur dorsal / basal width ant. segment III [times]	0.5–1.3	0.5–0.8	0.6–1.0
… hind femur ventral / basal width ant. segment III [times]	0.4–1.3	0.5–0.9	0.6–0.9
… hind tibia, dorsal [µm]	20.0–42.5	23–35	27.5–35.0
… hind tibia / tibial diameter (at middle) [times]	0.4–1.0	0.5–0.8	0.5–0.6
… abdominal segment 3 [number]	8–16	8–14	10
… abdominal segment 3 [µm]	20.0–50.0	25.0–40.0	27.5–40.0
… abdominal segment 3 / basal width ant. segment III [times]	0.5–1.7	0.7–1.3	0.8–1.1
… abdominal segment 7 [number]	5–14	6–14	7–9
… abdominal segment 8 [number]	4–9	4–8	6–8
… abdominal segment 8 [µm]	32.5–65.0	32.5–52.5	45.0–57.5
… abdominal segment 8 / basal width ant. segment III [times]	0.8–1.9	0.9–1.9	1.3–1.5
… cauda [number]	7–15	9–12	12–14
… genital plate, discal [number]	4–25	8–16	14–16
… genital plate, marginal [number]	8–23	13–20	16–17

Alate viviparous females (Figures 2A–B) described from 37 specimens, 27 of which have been measured. Colour when alive unknown. Head brown with areas around ocelli darker; other parts of head pigmented as in aptera; prothorax pale brown; pterothorax brown with darker spots; marginal abdominal and postsiphuncular sclerites conspicuous but sometimes completely pale, with spinules; transverse sclerites on abdominal segments 7 and 8 also pale or tenuously smoky, and also with spinules; antennae; legs and sometimes siphunculi more intensely and extensively pigmented than in aptera (Fig. 2A). Secondary sensoria more-or-less in a line over entire length of segment (Figure 2B). Other qualitative features like those in aptera. Meristic and metric characters in Table 1.

Oviparous females (Figures 2C–D), described from 3 specimens, all of them measured. Colour when alive unknown. Metric and meristic features in Table 1. Mounted specimens similar in shape and pigmentation to apterous viviparous females, but they have antennae and legs more extensively pigmented, spiracular and intersegmental sclerites always conspicuous and pigmented, siphunculi brown, and genital plate with two symmetric dusky spots (Figure 2C). Tibiae of hind legs slightly enlarged on the proximal half, with round and small scent plates on proximal three-quarters of their length (Figure 2D).

Biology. *Acyrthosiphon pilosum* **sp. nov.** lives on *O. natrix*, also on *O. ramosissima*, *O. spinosa* and possibly on other species of *Ononis*. Oviparous females were collected at two locations in southern France in mid-October, indicating that this species is holocyclic and monoecious, like other species of the genus.

Distribution. The type specimens were collected in three localities of southern Spain and in eight localities of south-eastern France. It could be assumed that this species also lives in areas of the Mediterranean coastal strip of Spain and France, but it must be very rare, since it has never been collected in the eastern Spanish provinces of Castellon, Valencia and Alicante, which have been intensively sampled by several authors. The known altitudinal range of the species is wide, from the sea level to 1700 m.

Types. *Holotype*: viviparous apterous female, FRANCE: Hautes-Alpes: Guillestre à Ceillac (1400 m), 23.VIII.1987, on *O. natrix*; G. Remaudière *leg.*; collection of the *Muséum national d'Histoire naturelle* (Paris, France), sample 15425, measured specimen number 17. *Paratypes*: 65 viviparous apterous females and 6 alate females belonging to the same sample that the holotype; 66 apterous viviparous females, 27 alate viviparous

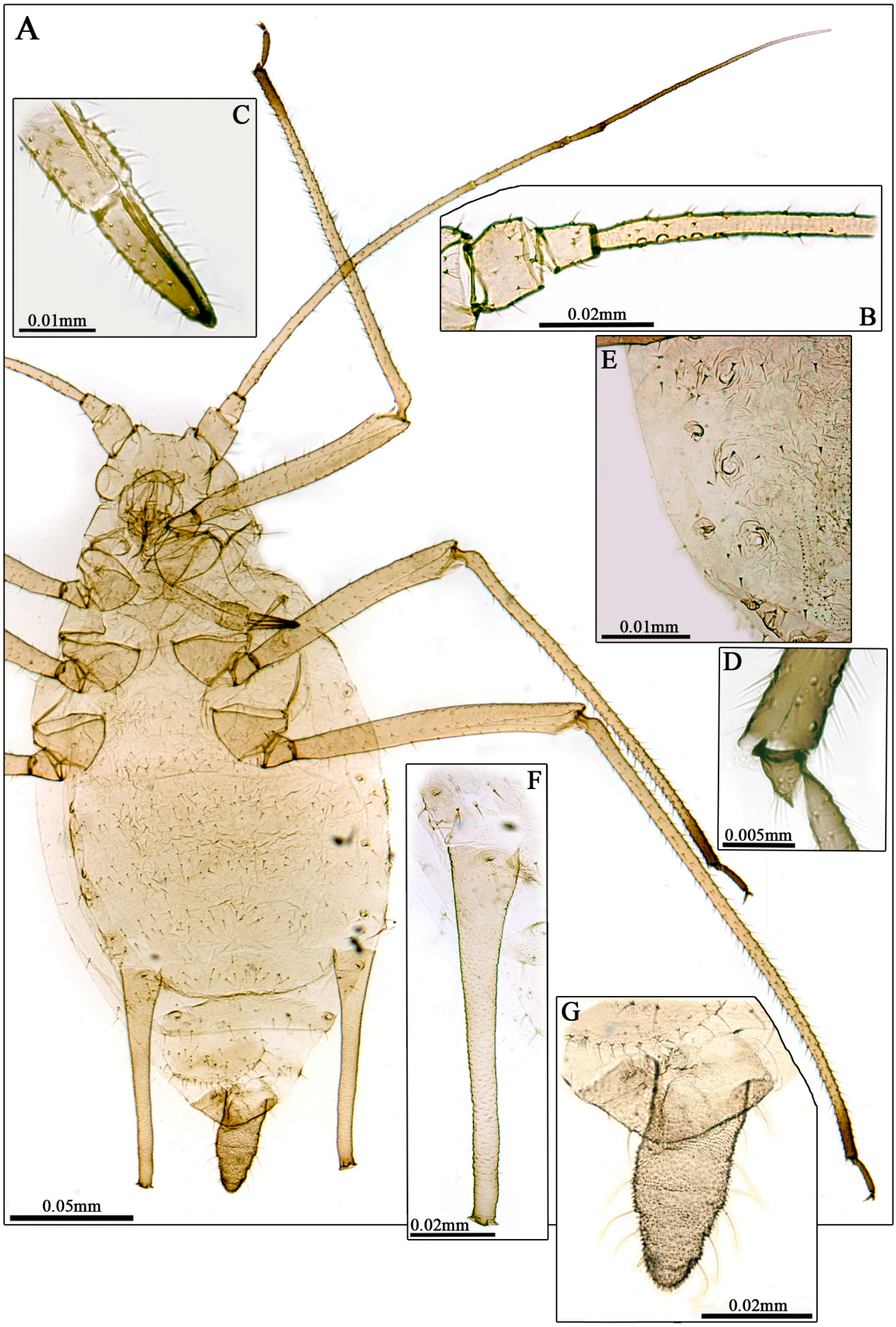

FIGURE 1. *Acyrthosiphon pilosum* **sp. n.**, apterous viviparous female: **A**, habitus; **B**, antenna, proximal; **C**, rostrum, distal; **D**, marginal zone of abdominal segment 1–5, with marginal tubercles; **E**, end of tibia and tarsus (in part) of a hind leg; **F**, siphunculus; **G**, cauda, and anal and genital (in part) plates.

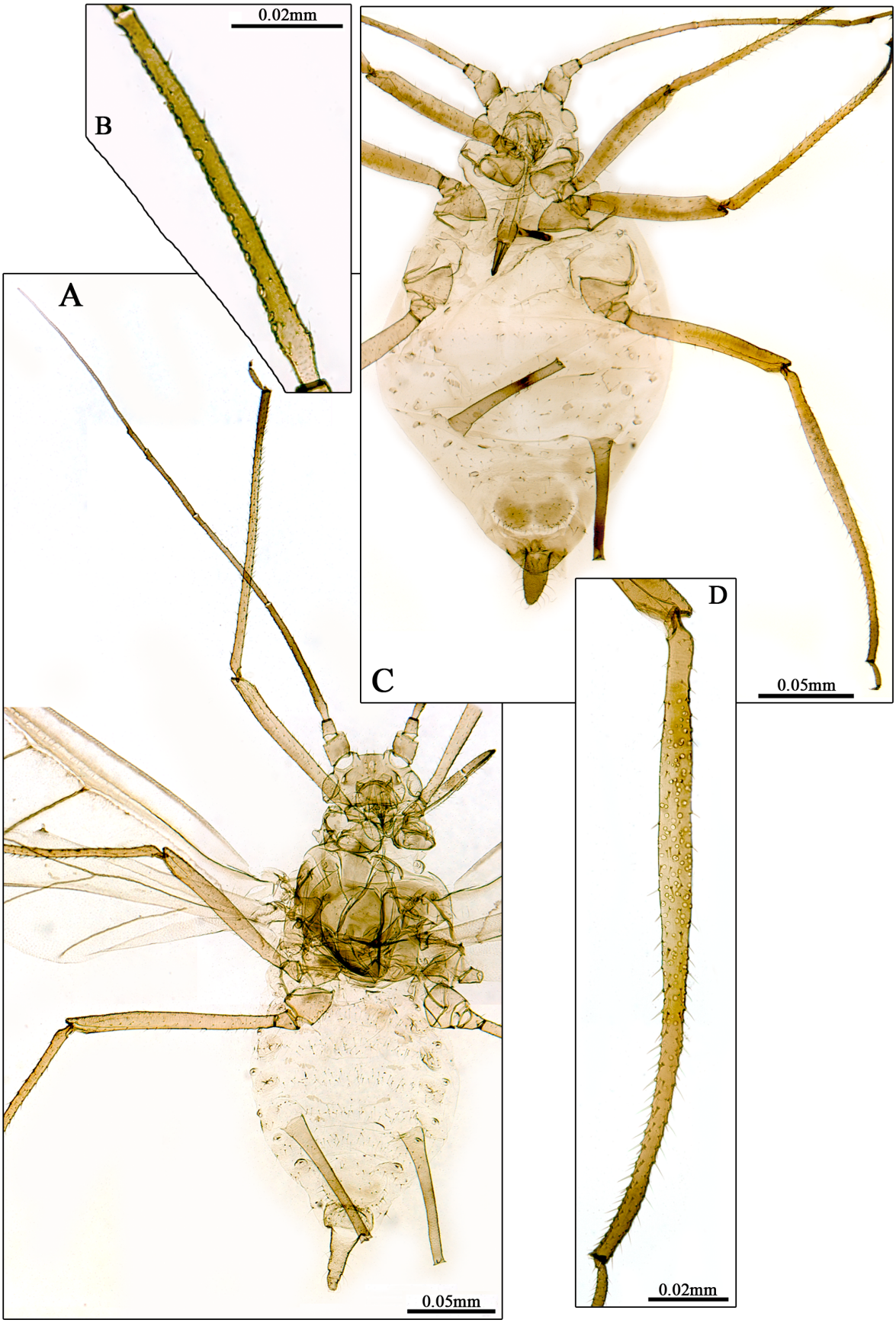

FIGURE 2. *Acyrthosiphon pilosum* **sp. n.**, **A–B**, alate viviparous female, **C–D**, oviparous female: **A**, **C**, habitus; **B**, III antennal segment; **D**, hind tibia.

females, FRANCE: Alpes-Maritimes: Coursegoules (640 m), 24.VI.1990, on *O. natrix*; 1 apterous viviparous female, FRANCE: Hautes-Alpes: Guillestre à Ceillac (1400 m), 23.VIII.1987, on *O. spinosa*; 1 oviparous female, FRANCE: Hautes-Alpes: La Grave (1520 m), 19.X.1986, on *O. natrix*; 8 apterous viviparous females, FRANCE: Hautes-Alpes: Le Casset (1600 m), 9.VIII.1965, on *O.* sp.; 4 apterous viviparous females, 2 oviparous females, FRANCE: Hautes-Alpes: Risoul (1700 m), 16.X.1986, on *O. natrix*; 8 apterous viviparous females, 4 alate viviparous females, FRANCE: Hautes-Alpes: Vars, nord (1550 m), 26.VII.1969, on *O. natrix*; 1 apterous viviparous female, FRANCE: Hautes-Alpes: Villeneuve-la-Salle (1400 m), 19.VIII.1987, on *O. natrix*; 4 apterous viviparous, SPAIN: Almería: El Alquián (5 m), 24.V.1980, on *Ononis* sp.; 2 apterous viviparous, SPAIN: Cádiz: Alcalá de los Gazules (170 m), 12.VI.1984, on *Ononis ramosissima*; 6 apterous viviparous females, SPAIN: Granada: Lanjarón (660 m), 28.VI.1984, on *O. natrix*; French specimens collected by G. Remaudière, and Spanish ones collected by Mier Durante & Nieto Nafría *Muséum national d'Histoire naturelle* (Paris, France) and *Universidad de León* (Leon, Spain) collections.

Etymology. The specific epithet of the new species, *pilosum*, is a Latin adjective in nominative singular and neutral gender, which means "hairy" and refers to the high number of setae that these aphids have on the first tarsal segments and on the distal segments of the rostrum.

Taxonomic discussion

On the world's *Ononis* species three species of *Acyrthosiphon* were hitherto known; *A. loti*, *A. ononis* and *A. pisum*. All three have 3 setae on first segments of tarsi and less than 13 accessory setae on the ultimate rostral segment, while *A. pilosum* **sp. n.** has 5 and 19-36 setae respectively. With low magnification the species can be identified by the presence of conspicuous abdominal marginal tubercles.

Acyrthosiphon is one of the largest genera of Macrosiphini; the current lists of species included in the genus by Blackman & Eastop (2014), which only include species with known host-plants, and by Favret (2014), differ in the status (species or subspecies) of a few taxa, for example *Acyrthosiphon ononis* in the first list versus *A. pisum ononis* in the second one. An integrated list with 91 subjective valid species is shown in Table 2. Fifty-seven were mentioned in the only monograph devoted to this genus (Eastop, 1971), although 21 of them are not included in the identification keys because of the absence of the necessary data at that time. Knowledge of *A. emeljanovi*, *A. kamtshatkanum*, *A. norvegicum* and *A. orientale* (the four without known host plants) and *A. navozovi* (recorded on an unidentified umbelliferous plant) has not been added to in recent years. Another 34 species have been established since Eastop's monograph. Numbers of setae on the first tarsal segments and on the ultimate rostral segment are good discriminating characters in aphids in general; both features are very useful for separating two small groups of *Acyrthosiphon* species from the rest.

In most *Acyrthosiphon* species, including *A. emeljanovi*, *A. kamtshatkanum* and *A. orientale*, (information kindly provided by A. V. Stekolshchikov), the first tarsal segments bear 3 setae (exceptionally 4 or 2 on one or two legs of some specimens), but they carry 2 setae in *A. elaeocarpi* and *A. wasintae*, probably 6 setae in *A. navozovi* (this last information also provided by A. V. Stekolshchikov), and 5 setae in *A. capitellum*, *A. cyparissiae* (exceptionally up to 7), *A. pentatrichopus*, and *A. pilosum* **sp. n.** (exceptionally down to 3). The ultimate rostral segment has less than 15 accessory setae in most *Acyrthosiphon* species, but it has up to 23 (from 6) in *A. malvae*, 16–25 in *A. lactucae*, *A. porrifolii* and *A. scariolae* (these three species are part of the *lactucae* complex), 25–31 in *A. auriculae*, 19–36 in *A pilosum* **sp. n.**, and about 40 in *A. vandenboschi* (Eastop, 1971; Hille Ris Lambers, 1974; Martin, 1981; Zhang & Qiao, 1998; Remaudière & Leclant 2000; Blackman & Eastop, 2014).

Acyrthosiphon capitellum, *A. cyparissiae* and *A. pentatrichopus* have been recorded respectively from Fujian (China) on *Fragaria vesca* (Rosaceae), from several European and Asiatic countries from Spain to China on *Euphorbia* spp. (Euphorbiaceae), and from Colorado and Utah (U.S.A) on *Rosa* spp. (Rosaceae). These three species have less than 10 accessory setae on the ultimate rostral segment and have no marginal tubercles, while *A. pilosum* has at least 19 accessory setae and has marginal tubercles. In addition: *A. cyparissiae* has black or very dark appendages and frons, and shorter ultimate rostral segment; *A. capitellum* has longer antennae (nearly 1.5 times body length) and dorsal setae wih capitate apices; *A. pentatrichopus* has shorter ultimate rostral segment (approx. 0.10 mm) and setae on antennal segment III shorter than 10 µm. From information provided by A. V. Stekolshchikov, the only known specimen of *A. navozovi*, an alate female, has 6 setae on first tarsal segments,

although it has lost both front legs and one hind leg; in addition to this differential character, from Mordvilko (1914) the femora and tibiae of the *A. navozovi* alata are pigmented on their distal halves, and the setae on antennal segment III are shorter than those of *A. pilosum*.

TABLE 2. Integrated list of current subjective valid species of *Acyrthosiphon* from the lists by Blackman and Eastop (2014) and Favret (2014). In the species names the generic name (*Acyrthosiphon*) has been omitted. Notes: 1, possibly a *Macrosiphum* species; 2, possibly a *Sinomegoura* species.

Species included in Eastop's monograph on *Acyrthosiphon* (1971)		
Species included in the identification keys		
astragali Eastop	*gossypii* Mordvilko	*parvum* Börner
auctum (Walker)	*ignotum* Mordvilko	*phaseoli* Chakrabarti, Ghosh (A.K.) & Raychaudhuri
bidenticola Smith	*ilka* Mordvilko	*pisum* (Harris
boreale Hille Ris Lambers	*knechteli* (Börner)	*primulae* (Theobald)
brachysiphon Hille Ris Lambers	*kondoi* Shinji	*pseudodirhodum* (Patch)
brevicorne Hille Ris Lambers	*lactucae* (Passerini)	*purshiae* (Palmer) [note 1]
caraganae (Cholodkovsky)	*loti* (Theobald)	*rubi* Narzikulov
chelidonii (Kaltenbach)	*macrosiphum* (Wilson)	*scalare* (Richards)
cyparissiae (Koch)	*malvae* (Mosley)	*scariolae* Nevsky
dauricum Szelegiewicz	*moltshanovi* Mordvilko	*svalbardicum* Heikeinheimo
euphorbiae Börner	*nigripes* Hille Ris Lambers	*thracicum* Tashev
ghanii Eastop	*ononis* (Koch)	*wasintae* (Hottes)
Species not included in the identification keys		
elaeocarpi Tao	*gossypicola* Shinji	*pamiricum* Nevsky
emeljanovi Mordvilko	*hissaricum* Umarov	*papaverinum* Nevsky
ericetorum Hille Ris Lambers	*kamtshatkanum* Mordvilko	*porrifolii* (Börner)
evodiae (Takahashi) [note 2]	*mordvilkoi* Nevsky	*rumicis* Narzikulov
fragariaevescae Nevsky	*navozovi* Mordvilko	*soldatovi* Mordvilko
genistae Mordvilko	*norvegicum* Mordvilko	*sophorae* Narzikulov & Umarov
glaucii (Narzikulov)	*orientale* Mordvilko	*valsiljevi* Mordvilko
Species established after the preparation of Eastop's monograph		
argus Miyazaki	*extremiorientale* Pashchenko	*pentatrichopus* Hille Ris Lambers
artibreve Zhang	*fragum* Zhang	*pisivorum* Zhang
assiniboinensis Robinson	*hamiense* Zhang, Chen, Zhong & Li	*ranunculum* Ghosh (L.K)
auriculae Martin	*kapustjanae* Pashchenko	*rubifoliae* Raychaudhuri, Ghosh (M.R.) & Basu
bistorti Ivanoskaja	*lambersi* Leclant & Remaudière	*sanguisorbae* Secombe
capitellum Zhang, 1998	*leleji* Pashcshenko	*saussureae* Pashchenko
churchillense Robinson	*leonurae* Pashchenko	*shinanonum* Miyazaki
corsicae Remaudière & Leclant	*lobkovae* Pashchenko	*supranubius* Carnero Hernández & Nieto Nafría
crepidis Holman & Szelegiewicz	*matilei* Remaudière & Leclant	*umarovi* Narzikulov
daphnidis Ilharco	*myricae* Pashchenko	*vandenboschi* Hille Ris Lambers
dryasae Pashchenko	*papaverisuctum* (Zhang, Chen, Zhong & Li)	
echinospartii Nieto Nafría & Mier Durante	*pareuphorbiae* Zhang	and *pilosum* Nieto Nafría *et al.* **sp. n.**

Acyrthosiphon auriculae is known in England and Corsica on species of *Primula* (Primulaceae); *A. lactucae* has been recorded on several species of *Lactuca* (Asteraceae) and it is known from several countries of Palaearctic realm and has been introduced in other parts of the World; *A. porrifolii* is only known in Austria on *Hieracium porrifolium* (Asteraceae); *A. scariolae* has been recorded from Central Asia and several European countries on *Lactuca scariola*; and *A. vandenboschi* is known in California on *Potentilla glandulosa* (Rosaceae). None of these species ever has 5 setae on first segments of tarsi. In addition: *A. auriculae* does not have abdominal marginal tubercles, secondary sensoria on antennal segment III are extended over 0.70–0.92 of the length of segment, and the processus terminalis is shorter (3.3–4.4 times base of antennal segment VI); viviparous females of the *lactucae* group species (*A. lactucae*, *A. porrifolii* and *A. scariolae*) when alive are finely white wax-powdered (*pilosum* is shiny green) and their setae in general, and especially those on frons and antennal segment III, are shorter than those in *A. pilosum*; *A. vandenboschi* has neither abdominal marginal tubercles nor secondary sensoria, and its siphunculi are longer (1.2–1.5) than those of *A. pilosum*. Several specimens of *A. malvae*, mainly of its subspecies *A. malvae agrimoniae* (Börner), can have more than 18 accessory setae on the ultimate rostral segment (the minimal and maximal numbers in the species are 6 and 23). It is a native palaearctic species that is widespread in the world on species of Geraniaceae, Malvaceae or Rosaceae; «a complex taxon, in which several forms with more specific host plant associations are recognised as subspecies, although slide-mounted specimens cannot usually be identified to subspecies level unless large samples are available» (Blackman and Eastop, 2014). Quantitative characters of *A. pilosum* and *A. malvae* overlap between them, and the most useful discriminant characters are the absence of abdominal marginal tubercles in *A. malvae*, and its shorter setae.

We could not obtain information about the numbers of setae on the first segments of tarsi and accessory setae on ultimate rostral segments in *A. norvegicum*. This species has a relatively shorter processus terminalis (2.5–2.6 times base of antennal segment VI), and the setae on antennal segment III are shorter than those in the new species, 8–12 µm, 0.4–1.1 times the basal width antennal segment III (Eastop, 1971; Mordvilko, 1914).

Acknowledgements

We are grateful to G. Remaudière —who passed away when the manuscript of this article was in its last steps— and to *Muséum national d'Histoire naturelle* in Paris for the facilities given us to study of French specimens. We also acknowledge the important assistance of Andrey V. Stekolshchikov (Zoological Institute of Russian Academy of Sciences, Saint Petersburg) for providing information on characteristics of the type specimens of four species described by Mordvilko. Many thanks to M.P. Mier Durante for her suggestions and critical reading of the manuscript. Reviewers of the manuscript made constructive comments; our thanks to them. L.M. Fernández Blanco took the microphotographs and composed the figures.

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