

A new species of *Aphis* (Hemiptera: Aphididae) living on roots of *Thymus mastichina* (Lamiaceae) from Spain

169

Nicolás PÉREZ HIDALGO & Juan M. NIETO NAFRÍA

Department of Animal Biology, Universidad de León,
E-24071 León, Spain

Abstract – Apterous females (fundatrices and fundatrigeniae), alatae females, oviparous females and males of *Aphis mastichinae* nov. sp. from *Thymus mastichina* (Lamiaceae) are described. It is the only known species of the genus *Aphis* which is radicolous on Lamiaceae. It is mainly characterized by the short siphunculi, large and numerous abdominal marginal papillae and short setae. A key for the *Aphis* species living on *Thymus* species is given.

Résumé – Une nouvelle espèce d'*Aphis* (Hemiptera : Aphididae) vivant sur les racines de *Thymus mastichina* en Espagne. Les femelles vivipares aptères (fondatrices et fondatrigenes) et ailées, ainsi que les femelles ovipares et les mâles, aptères d'*Aphis mastichinae* nov. sp. sont décrits ; ils vivent sur *Thymus mastichina* (Lamiaceae). C'est l'unique espèce du genre *Aphis* radicolé sur Lamiacées. Elle est caractérisée essentiellement par des courtes cornicules, des larges et nombreuses papilles marginales sur l'abdomen et des soies très courtes. Une clé pour l'identification des espèces d'*Aphis* inféodées aux espèces de *Thymus* est présentée.

The genus *Aphis* Linnaeus, 1758 includes more than 500 valid species, the most part of which are Holarctic. In Europe 221 species have been recorded in three subgenera: *Aphis* (with 213 species), *Bursaphis* McVickar Baker, 1934 (with six species), and *Pseudoprotaphis* Kadyrbekov, 2001 (with three species). In the Iberian Peninsula 103, five and one species, respectively of each subgenus are recorded (García Prieto *et al.*, in press).

Sixteen Holarctic species of this genus lives on plants of the family Lamiaceae: *Aphis* (*Aphis*) *affinis* Del Guercio, 1911, *Aphis* (*Aphis*) *alienus* Theobald, 1915, *Aphis* (*Aphis*) *ballotae* Passerini, 1860, *Aphis* (*Aphis*) *brunellae* Schouteden, 1903, *Aphis* (*Aphis*) *clinepetae* Pashtshenko, 1993, *Aphis* (*Aphis*) *clinopodii* Passerini, 1862, *Aphis* (*Aphis*) *lamiorum* (Börner, 1950), *Aphis* (*Aphis*) *nepetae* Kaltenbach, 1843, *Aphis* (*Aphis*) *origani* Passerini, 1860, *Aphis* (*Aphis*) *passeriniana* (Del Guercio, 1900), *Aphis* (*Aphis*) *pulegii* Del Guercio, 1911, *Aphis* (*Aphis*) *salviae* Walker, 1852, *Aphis* (*Aphis*) *serpylli* Koch, 1854, *Aphis* (*Aphis*) *stachydis* Mordvilko, 1929, *Aphis* (*Aphis*) *teucris* (Börner, 1942) and *Aphis* (*Aphis*) *verti-*

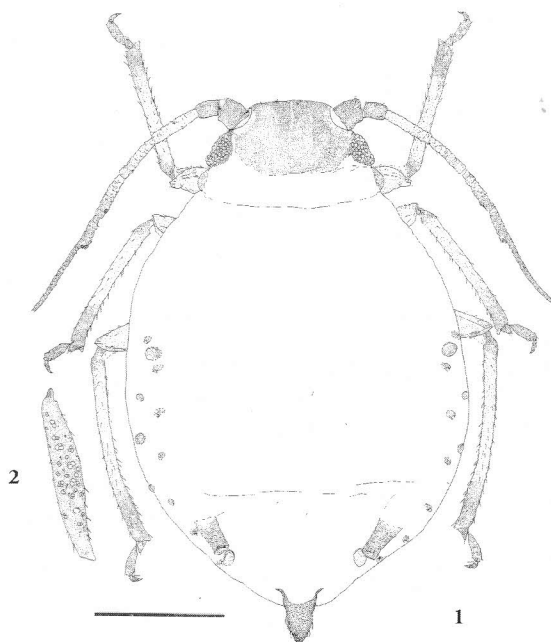
cillatae (Börner, 1940). The only one species living on *Thymus* is *Aphis* (*Aphis*) *serpylli*.

The Spanish Peninsular Territory is the richest European territory of this group of *Aphis*, because 13 species have been recorded from it, while for example 13 species are also known from Sicily (Italy), 12 from Czech Republic and Ukraine, 11 from Germany, Italian Peninsular Territory, Poland and Slovakia (Nieto Nafría *et al.*, 2004).

Aphis (*A.*) *mastichinae* nov. sp.

Type material – **Holotype**: viviparous apterous female "LE-2826, ap 2 (with another specimen) *Aphis* (*A.*) *mastichinae* / HOLOTIPO // *Thymus mastichina* / San Martín del Agostedo (León) 11-X-2003/N. Pérez Hidalgo leg."; collection of the University of León, Department of Animal Biology (León, Spain). **Paratypes**: apterous viviparous females (40 fundatrigeniae and three fundatrices), six alatae viviparous females, 40 oviparous females, and 14 males from the same locality as the holotype, 19-X-2003, 30-X-2003, 10-XI-2003, 22-V-2004; collections of the University of León (León, Spain), Natural History Museum (London, United Kingdom) and Muséum national d'Histoire naturelle (Paris, France).

Description – Apterous viviparous: Based on 41 specimens, 15 measured. Very small aphids, 0.90 to 1.20 mm long. Colour in life green matte, with brownish head and brown to black siphunculi and cauda. Mounted specimens (fig. 1) exhibit head, prothorax, siphunculi and cauda more or less pigmented; dorsal pigmentation on other thoracic and abdominal segments practically absent, only transversal bars are present on abdominal segments VII and VIII. Antennae (fig. 4) with 5 or 6 antennal segments, 0.51 to 0.67 mm long, 0.4 to 0.6 times body length, without secondary sensoria. Processus terminal 1.3 to 2.5 times the base of antennal article VI. Rostrum (0.25-0.32 mm) reaching the middle coxae. Ultimate rostral article 0.07 to 0.09 mm, 1.1 to 1.3 times second article of the hind legs and 1.7 to 2.1 times its basal width, with 2 complementary short setae. Tarsal formula 3.3.2. Big, large and cauliflower like marginal papillae on prothorax (20 to 60 μm of diameter), and abdominal segment I and VII (20 to 50 μm of diameter); 3 to 8 smaller marginal papillae (10 to 40 μm of diameter) present on abdominal segments II to VI (3-6 on segments II to IV, and 0-2 on V and VI). Siphunculi (fig. 8) are short (0.05-0.10 mm, 0.05-0.09 times body length and 0.6-1.0 times cauda length) and curved inside; its apical flange is inconspicuous or lacking. Genital plate (fig. 22) unpigmented on its discal zone, bearing 2 discal setae and 5 to 10 marginal-posterior ones. Cauda (fig. 9) triangular to fingerlike (somewhat narrowed in its basal half), 1.0 to 1.2 times its basal width, bearing a lot of strong black spinules and 3 to 6 short, robust and curved setae of 22 to 27 μm . Others setae are short or very short: 5 to 7 μm (0.2-0.5 times the basal



Figures 1, 2
Aphis (A.) mastichinae. – 1, apterous viviparous female, fundatrigenia, habitus. – 2, oviparous female, hind tibia. Scale bar = 0.4 mm.



Figures 3-7
Antennae of *Aphis (A.) mastichinae*, without pigmentation. – 3, fundatrix. – 4, apterous viviparous female. – 5, oviparous female. – 6, alatae viviparous female. – 7, male. Scale bar = 0.2 mm.

width of the antennal article III) on vertex, antennal article III and femora, up to 10 μm on tibiae, on abdominal segments (ventral and dorsal) and up to 17 μm on the ultimate rostral segment. Other characteristics in Table 1.

Fundatrices: Based on 3 specimens. Similar to the fundatrigeniae when both alive and mounted, though the antennae have five articles (fig. 3). Marginal papillae similar in distribution and size to the fundatrigeniae; they are present in number of three to six on abdominal segments II to VI. Other characteristics in Table 1.

Alatae viviparous females: Based on 6 specimens. When alive, similar in appearance to apterous specimens, thorax dark or black, antenna and femora more extensively and evenly pigmented. Abdominal segments I to VI with marginal sclerites (fig. 24); abdominal segments VI and VII sometimes with bar or isolated plates, abdominal segment VIII usually with a bar of varying size. Marginal papillae similar to the apterous females; present in number of five to eight on abdominal segments II to VI (5-6 on II to IV, and 0-2 on V and VI). Antennal article III

Table 1 – Metric characteristics of *Aphis mastichinae*: apterous viviparous females [fundatrigeniae (ap), fundatrices (fx)], alatae viviparous females (al), oviparous females (ov) and apterous males (m). Abbreviations used: AntIII, AntIV, AntV, AntVIb and AntVIpt are antennal articles III, IV, and V, base of antennal article VI and processus terminalis of antennal segment VI, respectively; Ht2 is second segment of hind tarsus; TbIII is tibia of hind legs; Urs is ultimate rostral segment.

	ap (n = 15)	fx (n = 3)	al (n = 6)	ov (n = 40)	m (n = 12)
Body (mm)	0.90-1.20	1.00-1.30	0.97-1.22	0.85-1.27	0.86-1.07
Antenna (mm)	0.51-0.67	0.53-0.67	0.62-0.67	0.46-0.67	0.64-0.85
TbIII (mm)	0.35-0.45	0.38-0.44	0.42-0.46	0.30-0.40	0.35-0.49
AntIII (mm)	0.08-0.12	–	0.13-0.16	0.07-0.09	0.12-0.18
AntIII (mm) (in specimens with 5 ant.)	0.14-0.15	0.14-0.18	–	0.12-0.16	–
AntIV (mm)	0.06-0.10	–	0.07-0.10	0.06-0.08	0.09-0.16
AntV (mm)	0.08-0.10	0.08-0.10	0.09-0.10	0.07-0.12	0.10-0.15
AntVIb (mm)	0.06-0.10	0.06-0.09	0.07-0.08	0.06-0.08	0.06-0.09
AntVIpt (mm)	0.11-0.17	0.11-0.13	0.14-0.17	0.12-0.16	0.14-0.19
Rostrum (mm)	0.25-0.32	0.20-0.30	0.23-0.26	0.23-0.30	0.23-0.29
Urs (mm)	0.07-0.09	0.08-0.09	0.07-0.08	0.06-0.08	0.06-0.08
Urs its basal width (mm)	0.03-0.04	0.03-0.04	0.03-0.04	0.02-0.04	0.03-0.04
Ht2 (mm)	0.06-0.07	0.07-0.08	0.06-0.07	0.05-0.07	0.05-0.07
Siphunculus (mm)	0.05-0.10	0.06-0.08	0.07-0.08	0.04-0.08	0.05-0.08
Siphunculus its width in the middle (mm)	0.03-0.06	0.03-0.04	0.02-0.03	0.02-0.04	0.02-0.03
Cauda (mm)	0.09-0.12	0.10-0.12	0.08-0.09	0.08-0.12	0.07-0.10
Cauda its basal width (mm)	0.08-0.10	0.09-0.10	0.07-0.08	0.07-0.12	0.08-0.09
Antenna/body (times)	0.4-0.6	0.4-0.5	0.5-0.7	0.4-0.6	0.6-0.9
AntVIpt/AntVIb (times)	1.3-2.5	1.3-1.7	1.7-2.4	1.6-2.3	1.6-2.5
AntIII/AntVIpt (times)	0.5-0.8	–	0.8-1.1	0.4-0.6	0.8-1.1
AntIII/AntVIpt (times) (in specimens with 5 ant.)	1.0-1.8	1.1-1.4	–	0.9-1.2	–
TbIII/body (times)	0.3-0.4	0.3-0.4	0.3-0.4	0.3-0.4	0.4-0.5
Siphunculus/its width in the middle (times)	1.0-2.8	1.8-2.6	2.5-3.2	1.1-2.8	1.8-2.6
Siphunculus/cauda (times)	0.6-1.0	0.6-0.7	0.7-0.9	0.4-0.8	0.6-0.9
Siphunculus/Body (times)	0.05-0.09	0.05-0.07	0.06-0.08	0.04-0.08	0.05-0.08
Siphunculus/Ht2 (times)	1.0-1.4	0.7-1.1	1.0-1.2	0.7-1.1	0.8-1.1
Cauda/its basal width (times)	1.0-1.2	1.0-1.2	1.0-1.2	1.0-1.4	0.9-1.1
Rostrum/Body (times)	0.2-0.3	0.2-0.3	0.2-0.3	0.2-0.3	0.2-0.3
Urs/its basal width (times)	1.7-2.1	1.8-2.3	1.6-2.3	1.5-2.1	1.6-2.1
Urs/Ht2 (times)	1.1-1.3	1.0-1.1	1.0-1.1	1.0-1.3	1.0-1.3
Urs/AntVIb (times)	0.8-1.2	0.9-1.2	0.8-1.1	1.0-1.3	0.8-1.2
Urs/siphunculus (times)	0.8-1.3	1.1-1.3	0.9-1.1	0.9-1.5	0.9-1.3

with one to six secondary sensoria, rounded and almost in line on outer side (fig. 6); antennal IV sometimes with one secondary sensorium. Fore wing broad (2.2-2.5 times as long as its maximum width) and very scaly. Siphunculi similar to those of apterous females and cauda less robust and more triangular (figs. 10 and 11). Other characteristics in Table 1.

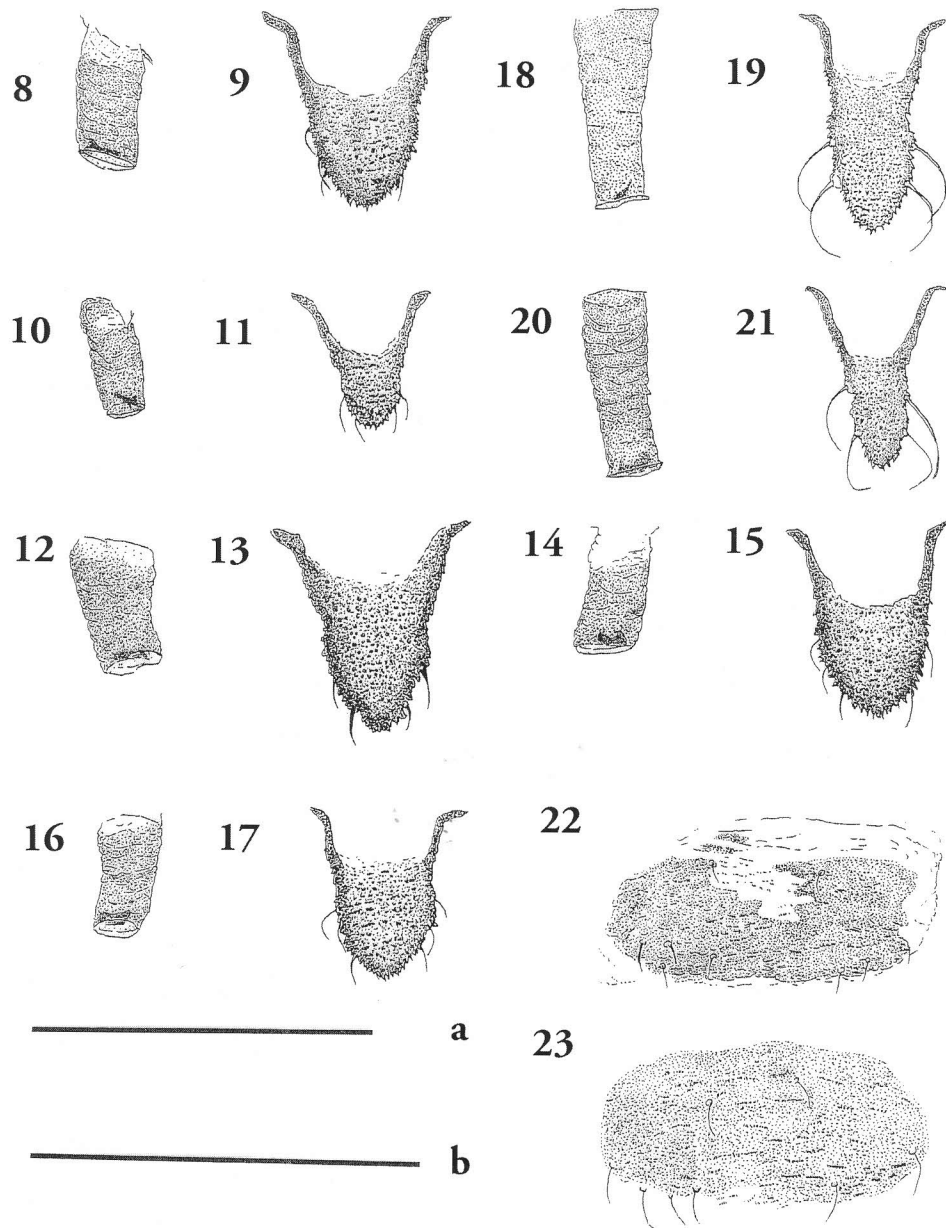
Oviparous females: Based on 40 specimens. When alive yellowish to orange. When mounted with similar pigmentation to viviparous females and also with genital plate pale in the middle. Antennae of 6 or 5 articles (fig. 5). Marginal papillae smaller (5 to

25 µm of diameter) than those of apterous females; three to six on abdominal segments II to VI (2-6 on II to IV, and 0-1 on V and VI). Siphunculi similar to those of viviparous females but with the base paler (fig. 14). Hind tibia swollen with 35-95 scent plates of different size and shape (fig. 2). Genital plate with 16 to 29 setae. Cauda with four to eight setae, similar in size and shape to the viviparous ones. Other characteristics in Table 1.

Males (apterous): Based on 14 specimens, 12 measured. Greenish-blue when alive. When mounted pigmentation and sclerotization similar to those apterous viviparous and oviparous

females. Marginal papillae resembling in size to those other forms; present in number of 0-6 on abdominal segments II to VI (0-5 on II to IV, and 0-1 on V and VI). Antennal articles III, IV and V with 5-23, 7-22, and 4-13 secondary sensoria, respectively, which

are rounded and relatively regularly distributed on outer side of articles (fig. 7). Siphunculi and cauda (figs. 16 and 17) similar to those apterous and oviparous females but with paler base. Other characteristics in Table 1.



Figures 8-17

Siphunculi and cauda of *Aphis (A.) mastichinae*. – 8-9, apterous viviparous female. – 10-11, alatae viviparous female. – 12-13, fundatrix. – 14-15, oviparous female. – 16-17, male. Scale bar (a) = 0.2 mm.

Figures 18-21

Siphunculi and cauda of *Aphis (A.) serpylli*. – 18-19, apterous viviparous female. – 20-21, alatae viviparous female. Scale bar (a) = 0.2 mm.

Figures 22, 23

Genital plate of apterous viviparous female of *Aphis (A.) mastichinae* (22) and *Aphis (A.) serpylli* (23). Scale bar (b) = 0.2 mm.



Figures 24, 25
Dorsum of abdomen of alatae viviparous female. – 24, *Aphis (A.) mastichinae*.
– 25, *Aphis (A.) serpylli*. Scale bar = 0.2 mm.

Bionomics – *Aphis mastichinae* is holocyclic and monocious; it lives on roots of *Thymus mastichina* subsp. *mastichina* L. forming colonies attended by *Lasius piliferus* Seifert, 1992 (Formicidae: Formicinae). The apterous forms display tanatosis when disturbed.

Geographic distribution – This species is known from only one locality in Spain, León province: San Martín del Agostedo (42° 25' N; 6° 10' W; 883 m.a.s.l.); but its distribution could coincide with that of its host plant, which is absent in the East of the Iberian Peninsula because of the preponderance of calcareous soils.

Etymology – The specific name is derived from the specific name of the aphid's host plant: *mastichina*, a Lamiaceae species endemic of the Iberian Peninsula.

Discussion – *Aphis mastichinae* nov. sp. differs from the other aphid species living on *Thymus* mainly for: (1) the short setae (ventro-abdominal and caudal ones included), (2) number, shape and size of the marginal papillae, and (3) its radicolous way of life. Only two species have been recorded on *Thymus* species (Blackman & Eastop, 2000): *Kaltenbachiella pallida* (Haliday, 1838) and *Aphis serpylli*. *Kaltenbachiella pallida* lives on roots, but it is yellowish white when alive and its characteristics are very different, because it belongs to the very different subfamily Eriosomatinae.

Aphis serpylli lives on the aerial part of these plants and all known forms can easily be separated from the new species using the following key:

- Abdominal segments II to VI without marginal papillae (sometimes one or two). Siphunculi long and curved outside (figs. 18, 20 and 25). Setae on the cauda of 30 µm at least (figs. 19 and 21). Genital plate entirely pigmented (fig. 23). Dark green when alive. On the aerial parts of several species of *Thymus* *A. (A.) serpylli* Koch
- Abdominal segments II to VI with marginal papillae, which are large and flat (figs. 1 and 24). Siphunculi short and curved inside (figs. 1, 8, 10, 12, 14 and 16). Setae on the cauda of 30 µm at most (figs. 9, 11, 13, 15 and 17). Genital plate unpigmented in the discal zone (fig. 22). Green, greenish blue or yellowish green when alive. On roots of *Thymus mastichina*
. *A. (A.) mastichinae* nov. sp.

The genus *Thymus* is widely distributed in North Africa, and Eurasia, as far as Greenland, its western limit; and some species have been introduced in Canada, Chile and New Zealand (Morales Valverde, 1986). The section *Serpyllum* has the widest distribution; that of the remaining sections of the genus (*Hyphodromi*, *Mastichina*, *Micantes*, *Piperella*, *Pseudothymbra* and *Thymus*) is circummediterranean with two important nuclei: (1) the Iberian Peninsula and northwest Africa, and (2) The Balkan Peninsula and Turkey. The genus probably originated somewhere in the Mediterranean basin in tertiary xerophytic flora, evolving most successfully due to the increasing predominance of arid stages, and diversifying even more from the Pliocene (Morales Valverde, 1986). Probably during the cold stages of the Quaternary, species (amongst them *Thymus mastichina*) adapted to enduring extreme temperatures and rainfall probably acquired importance they have today (Morales Valverde, 1986). This radiation coincides with the adaptive radiation of Aphidinae species between the start of the Miocene and the end of the Pliocene in the northern hemisphere (Heie, 1999).

Taking into account that around 75% of specific and subspecific taxa of the genus *Thymus* in Iberian-Balearic territories are endemic, the existence of other aphid species to date unknown cannot be discarded.

Acknowledgements – We are indebted to Prof. Georges Remaudière, Muséum national d'Histoire naturelle, Paris, for the critical reading of the manuscript and to Dr. Xavier Espadaler, Universitat Autònoma de Barcelona (CREAF-Unitat d'Ecologia), Bellaterra (Barcelona) for the identification of the ant species. This study was financed by the Spanish Government (Ministerio de Educación y Ciencia), "Fauna Ibérica VII" research project, subproject number: REN2001-1956-C17-03/GLO.

REFERENCES

- BLACKMAN R.L., EASTOP V.F. 2000 – *Aphids on the World's Crops. An identification guide (Second edition)*. – Chichester: 8 + 466 p.
- GARCÍA PRIETO F., PÉREZ HIDALGO N., MIER DURANTE M.P., NIETO NAFRÍA J.M. in press – Updated check-list of the Iberian-Balearic Aphidini (Hemiptera Aphididae). – *Graellsia*.
- HEIE O.E. 1999 – Aphids of the past (Hemiptera, Sternorrhyncha). – *Proceedings of the First Internacional Palaeoentomological Conference*, Moscow: 49-55.
- MORALES VALVERDE R. 1986 – Taxonomía de los géneros *Thymus* (excluida la sección *Serpyllum*) y *Thymbra* en la Península Ibérica. – *Ruizia*, 3: 3-324.
- NIETO NAFRÍA J.M., ANDREEV A.V., BINAZZI A., MIER DURANTE M.P., PÉREZ HIDALGO N., RAKAUSKAS R., STEKOLSHCHIKOV A.V. 2004 – Superfamily Aphidoidea. *In*: Fauna Europaea Service [on line in <http://www.faunaeur.org>].