Species of *Anagrus* Haliday, 1833 (Hymenoptera, Chalcidoidea, Mymaridae) in Navarra (Spain)

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Species of Anagrus *Haliday, 1833 (Hymenoptera, Chalcidoidea, Mymaridae) in Navarra (Spain).*– Six species of *Anagrus*, collected with a Malaise trap and a sweep net, were captured during the study of the entomofauna of 60 corn fields in the province of Navarra. These species are *Anagrus atomus* (Linnaeus, 1767), *A. similis* Soyka, 1955, *A. incarnatus* Haliday, 1833, *A. obscurus* Förster sensu Soyka, 1955, *A. subfuscus* Förster, 1847 and *A. optabilis* (Perkins, 1905). All of these are new for the Iberian peninsula. Information about their hosts, and their role in biological control are given.

Key words: Hymenoptera, Mymaridae, *Anagrus*, *Zea mays*, Navarra, Spain.

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Introduction

The family Mymaridae was mentioned in Spain for the first time by García-Mercet (1912). Four species were later recorded by Annecke & Doutt (1961), Dysart (1971), Aeschlimann (1977), Worner et al. (1989) and Llorens (1990), but none pertaining to *Anagrus* Haliday. The first record of this genera in Spain is Chiappini et al. (1996) for *Anagrus vilis* Donev, 1989 in Toledo.

In Europe there are 18 species of *Anagrus* according to Chiappini (1989). The family Mymaridae has world-wide distribution and some species are useful for biological control.

Anagrus species are egg parasitoids of Cercopidae, Cicadellidae, Delphacidae, Miridae, Tingidae and Odonata (Huber, 1986; Bakkendorf, 1926).

In Navarra, corn is cultivated without insecticides because corn fields are surrounded by human use horticulture's. A large number of mymarids (Chalcidoidea, Mymaridae) were captured, especially *Anagrus atomus*, a parasitoid of *Zyginidia scutellaris* (Herrich-Schäffer, 1838), the most abundant cicadellid in the corn in Navarra.

The objective of this work is to increase the knowledge of the family Mymaridae in Spain, contributing figures that enable recognition of the species found and provide measures to compare the specimens captured with those of other regions.

This work is justified by the little, not to say null, knowledge of this family of Hymenoptera in the Iberian peninsula. In addition, the species mentioned for the first time for the Iberian peninsula.

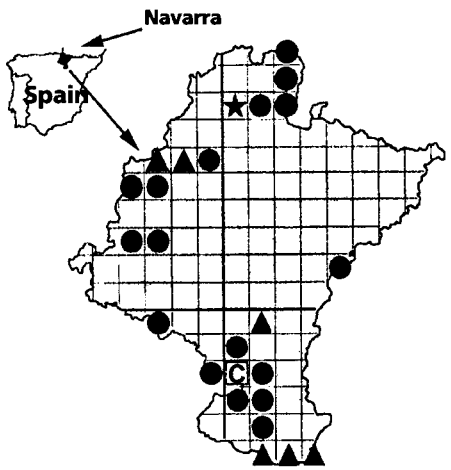


Fig. 1. Location of the capture of *Anagrus atomus* (all symbols), *Anagrus similis* (triangles), *Anagrus optabilis* (star). C. Locality of Cadreita, site of the Malaise Trap.

Localización de las capturas de Anagrus atomus *(todos los símbolos),* Anagrus similis *(triángulos),* Anagrus optabilis *(estrella). C. Localidad de Cadreita, lugar de la colocación de la trampa Malaise.*

Material and methods

Mymarids were collected with a Malaise trap in the locality of Cadreita, in the south of Navarra, from 18 VI 1992 to 3 IX 1992, and with a sweep net in sixty localities in corn fields around Navarra, between 1992 and 1995 (fig. 1). Some specimens were reared from corn leaves with cicadellid eggs. *Z. scutellaris* was the most abundant cicadellid, but *Macrosteles sexnotatus* (Fallén, 1806) and *Psammotettix alienus* (Dahlbom, 1951) were also present.

Localities: Ablitas, 30TXM14; Alsasua, 30TWN64; Amaiur, 30TXN28; Ancin, 30TWN62; Aniz, 30TXN17; Arbizu, 30TWN75; Arguedas-2, 30TXM16; Arrayoz, 30TXN17; Bacaicoa, 30TWN74; Cadreita, 30TXM07; Caparroso, 30TXM18; Castejón, 30TXM06; Cintruénigo, 30TWM95; Ciordia, 30TWN64; Corella, 30TXM06; Cortes, 30TXM24; Echarren, 30TWN95; Echarri-Aranaz, 30TWN75; Elgorriaga, 30TXN07; Elizondo, 30TXN27; Eulz, 30TWN72; Gabarderal, 30TXN41; Huarte-Araquil, 30TWN85; Irañeta, 30TWN85; Lacunza, 30TWN75; Lodosa, 30TWM79; Murieta, 30TWN62; Narvarte, 30TXN17; Oieregui, 30TXN17; Ribaforada, 30TXM24; Rincón de Soto, 30TWM97; Sangüesa, 30TXN41; Santesteban, 30TXN07; Tudela, 30TXM15; Urdax, 30TXN29; Urdiain, 30TWN74; Valtierra, 30TXM17; Villanueva de Araquil, 30TWN85.

Abbreviations used in the text: CISC. California Insect Survey Collection, University of California, Berkeley (USA); UCRC. University of California Riverside Collection (USA);

NHMW. Naturhistorisches Museum Wien (Austria); IRSNB. Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgique; F1-6. Female antenna funicle segments.

The studied material is deposited in the Department of Zoology and Ecology, Faculty of Sciences, University of Navarra.

A Digital Scanning Microscope (Model Zeiss 940 A) was used for the electron-microphotographs.

Results

From 94,083 arthropods extracted from samples, 7.72% were mymarids, 61.64% of which belonged to the genus *Anagrus*.

Anagrus Haliday, 1833

Anagrus Haliday, 1833. *Entomol. Mag.*, 1: 346.
Type-species: *Ichneumon atomus* Linnaeus, 1767. *Systema Naturae*, Editio duodecima reformata, 1(2) Holmiae: 941. England. Designated by Westwood (1840).

Antenna of the female nine-segmented (funicle six-segmented and undivided club) (figs. 5-9). Male antenna 13-segmented. Radicle fused with scape. Mandible three-thooted except for the female of *A. minutus* Chiappini & Lin, 1998. Postscutellum divided in two parts by a longitudinal groove (figs. 3-4). Macrochaetae distal to hypochaeta (figs. 10-11). Tarsi four-segmented. Metasoma sessile, with a long mesophragma.

The genus is divided in three subgenus: *Anagrella* Bakkendorf, *Paranagrus* Perkins and *Anagrus* Haliday (Graham, 1982). Chiappini (1989) includes a key and descriptions and separates the *Anagrus* subgenus in two groups: "*atomus*" (club with three sensory ridges and external plate of the ovipositor with one seta) and "*incarnatus*" (club with five sensory ridges and external plate of the ovipositor with two or three setae).

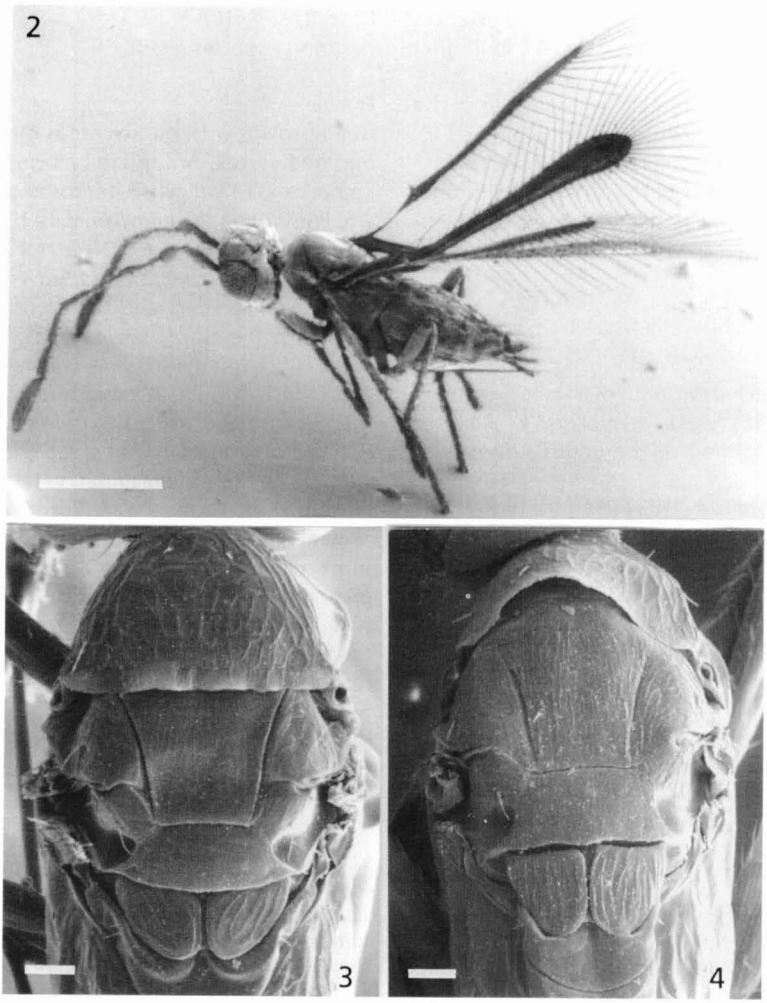
This genus of Mymaridae is the most studied for biological control; some species are used in natural control of various crops (Huber, 1986; Sutre & Fos, 1997). It has a world-wide distribution of 77 species, including 43 in the Palearctic Region (Chiappini et al., 1996; Chiappini & Lin, 1998).

Anagrus (Anagrus) atomus (Linnaeus, 1767) (figs. 2, 3, 5, 10)
"*atomus*" species group

Female
Head brown, with darker areas on the mandibles and vertex. Antennae brown, with scape, pedicel and F1 yellowish. Mesosoma, metasoma and legs brown to yellowish, with brown stripes on metasomal tergites. Distal tarsal segment and ovipositor valve apex darker. First segment of the funicle short and the second similar in length to the third. Sensory ridges on F4(1), F5(1), F6(2). Spindle-like sensilla on F4(0-1) F5(1-2) and F6(2) (fig. 5). Mesoscutum without setae (fig. 3). Forewing with a bare area on disc and 50-60 very long marginal setae (fig. 10). Hind wing with 30-45 marginal setae. Forewing length/width ratio = 9.72. Foretibia with 2-3 conical sensilla in the external face. Ovipositor short, not overlapping mesophragma, and not projecting from metasomal distal apex. Ovipositor/foretibia ratio = 1.81 in the specimens captured in Navarra (table 1). Ovipositor/foretibia ratios are lower than in the specimens studied by Chiappini (1989) (table 1). Research with other species of the family have demonstrated that the development in different hosts may modify the relative measures (Huber, 1988).

Since the original description by Linnaeus (1767), *A. atomus* has been cited in Sweden ex *Macrosteles sexnotatus* (Fallen, 1806) (Ahlberg, 1925; Tullgren, 1916), Hungary (Thuróczy, 1983), Yugoslavia ex *Erythroneura eburnea* Fieb. and *E. pallidifrons* Edw. (Donev, 1985b), Italy ex *Zyginidia pullula* (Boheman, 1845) on *Zea mays* L. (Vidano & Arzone, 1987), *Empoasca flavescens* Tull., *E. decipiens* Paoli, 1930 and *E. decedens* Paoli 1932 on beet-root (Chiappini, 1987), France ex *Zyginidia scutellaris* on *Zea mays* (Giustina & Caruhel, 1989) and ex *Hauptidia maroccana* Melichar on tomato (Maisonneuve et al., 1995), Switzerland ex *Empoasca vitis* (Goethe, 1875) on vineyard (Cerutti et al., 1989), Turkmenistan and Iran ex *Circulifer tenellus* (Baker, 1896) on red beet (Walker et al., 1997), Germany ex *E. vitis* (Maixner et al., 1998) and China (Chiappini & Lin, 1998).

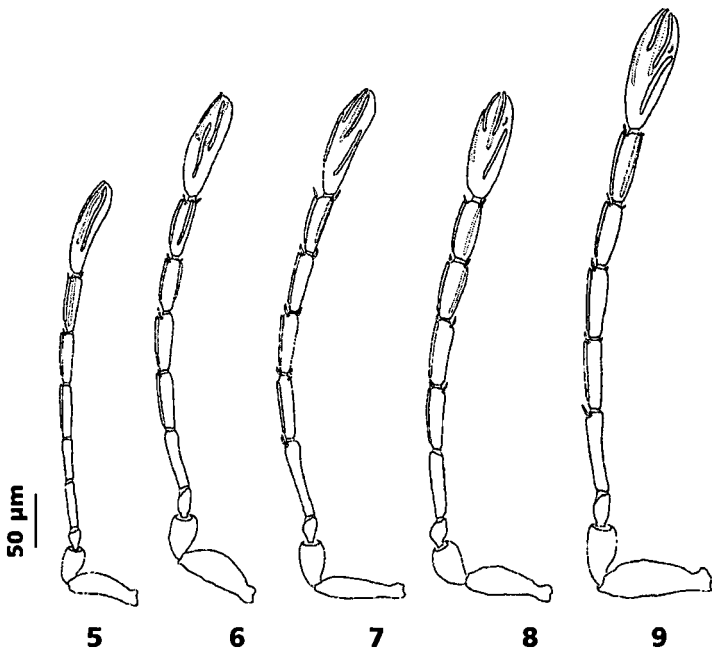
Material studied
Corn plant: Cadreita, 16 VII 93 9♀; 29 VII 93 6♀; 17 VII 94 8♀ 1♂; Valtierra, 19 VII 93 6♀; 25 VIII 93 22♀ 14♂; Arguedas, 17 VII 94 31♀ 36♂; Corella, 19 VII 93 2♀; 17 VII 94 1♀;



Figs. 2-4. 2. *Anagrus atomus,* habitus; 3. *A. atomus,* mesosoma, dorsal view; 4. *A. similis,* mesosoma, dorsal view. (Scales: 2, 200 µm; 3, 4, 20 µm.)

2. Aspecto de Anagrus atomus*; 3. Mesosoma de* A. atomus, *vista dorsal; 4. Mesosoma de* A. similis, *vista dorsal. (Escalas: 2, 200 µm; 3, 4, 20 µm.)*

Caparroso, 17 VIII 93 207♀ 111♂; 25 VIII 93 207♀ 141♂; Marcilla, 25 VIII 93 44♀ 73♂; Castejón, 25 VIII 93 19♀ 91♂; 17 VII 94 7♀ 1♂; Ribaforada, 27 VI 94 9♀ 2♂; Ablitas, 27 VI 94 25♀ 11♂; Tudela, 27 VI 94 33♀ 15♂; Buñuel, 27 VI 94 43♀ 21♂; Cortes, 27 VI 94 50♀ 11♂; Valtierra, 17 VII 94 26♀ 24♂; Lodosa 1, 19 VII 94 135♀ 137♂; Lodosa, 19 VII 94 270♀ 172♂; Rincón de soto, 19 VII 94 96♀ 89♂; Oieregui, 20 VII 94 2♀; Elizondo, 20 VII 94 1♀; Santesteban, 20 VII 94 3♀; Arrayoz, 20 VII 94 7♀ 2♂; Narvarte, 20 VII 94 3♀; Aniz, 20 VII 94 2♀; Amaiur; 20 VII 94 8♀ 1♂; Urdax, 20 VII 94 22♀ 5♂; Echarren, 20 VII 95 8♀ 3♂; Villanueva de Araquil, 20 VII 95 1♀; Irañeta, 20 VII 95 2♀; Huarte-Araquil, 20 VII 95 6♀; Lacunza, 20 VII 95 1♂; Arbizu,



Figs. 5-9. Female antennae of considered species of *Anagrus*: 5. *A. atomus*; 6. *A. similis*; 7. *A. incarnatus*; 8. *A. subfuscus*; 9. *A. obscurus*.

Antenas de las hembras de varias especies de Anagrus: *5.* A. atomus; *6.* A. similis; *7.* A. incarnatus; *8.* A. subfuscus; *9.* A. obscurus.

20 VII 95 2♀; Echarri-Aranaz, 20 VII 95 4♀; Bacaicoa, 20 VII 95 12♀; Urdiain, 20 VII 95 1♀; Alsasua, 20 VII 95 3♂; Ciordia, 20 VII 95 2♀; Eulz, 18 VIII 95 7♀ 4♂; Ancin, 18 VIII 95 11♀ 8♂; Murieta, 18 VIII 95 15♀ 4♂; Sangüesa, 28 VIII 95 186♀ 210♂. Malaise trap: Cadreita, 30 VI 92 22♀ 5♂; 20 VII 92 83♀ 2♂; 6 VIII 92 8♀ 2♂; 26 VIII 92 555 specimens; 4 VIII 92 423 specimens; 3 IX 92 255 specimens; 24 IX 92 166 specimens; 7 X 92 44 specimens; 30 X 92 12 specimens. Other material examined: *Anagrus atomus*, slide 1512 in CISC from Aranjuez, Spain.

Anagrus (Anagrus) similis Soyka, 1955 (figs. 4, 6, 11)
"*incarnatus*" species group

Female

Yellowish. Scape and pedicel lighter than the other antennal segments. Middle area of the legs darker than the rest. Propodeum with a brown spot. F1 subglobular and distally asymmetric, F2 equal or longer than F3. Sensory ridges on F3(0-1), F4-F5(1-2) and F6(2). Spindle-like sensilla on F3(0-1), F4(1) and F5-F6(2) (fig. 6). Adnotaular setae present (fig. 4). Foretibia with four conical sensilla and hindcoxae with small denticles on their front side. No bare area on forewings (fig. 11). Five to seven rows of setae on disc and over 70 marginal setae. The hypocheta is long and there are four parallel seta beside the placoid sensillae. Length/width ratio of the forewing = 9 (table 1). Postphragma not overlapping the ovipositor. Ovipositor short and slightly projecting from metasomal distal apex. Ovipositor / foretibia ratio = 2.14.

A. similis has been found in Germany (Soyka, 1955) and England ex specimens captured on *Holcus* sp. in Silwood Park (Eng-

land) and reared from eggs of *Dicranotropis hamata* (Boheman, 1847) on *Holcus mollis* L. (Poaceae) (Walker, 1979).

Material studied
Corn plant: Caparroso, 17 VIII 93 1♀ 3♂; Ribaforada, 27 VI 94 3 ♀; Ablitas, 27 VI 94 1♀; Cortes, 27 VI 94 1♀; Huarte-Araquil, 20 VII 95 1♀; Arbizu, 20 VII 95 1♀; Malaise trap: Cadreita, 30 VI 92 19♀; 20 VII 92 6♀; 6 VIII 92 9♀. Other material examined: slide 478 in NHMW, from Ickchens Hof (Malchin), Germany, *A. similis* Soyka, 1955, holotype.

Anagrus (Anagrus) incarnatus Haliday, 1833 (fig. 7)
"*incarnatus*" species group

Female
A. incarnatus is characterised by absence of setae in the mesoscutum. General colour yellowish to reddish (not brown in Spanish specimens) antenna darker than the body, except for the scape and pedicel. Head, mesoscutum and dorsal surface of metasoma also darker. First segment of funicle short, with three or four setae. F2 with its end enlarged and longer than the following four segments. There are sensory ridges on F3-F5(1) and F6(2). F2 with one spindle-like sensilla and F3 to F6 with two on the opposite sides of the segment (fig. 7). Adnotaular setae absent. Mesophragma short, slightly projecting into the metasoma and not overlapping the ovipositor. Foretibia with 5-7 conical sensilla in one or two rows. Forewings without bare area. One row of setae in the proximal half of the wing and 2-3 on disc. The marginal setae are very long, over 2.42 times the wing width. Length/width ratio of the forewing = 8.10 (table 1). The ovipositor projects slightly from the end of the metasoma. Ovipositor / foretibia length ratio = 2.2-2.8.

The species was first described from the British Isles; recorded again from England by Enock (1914), Belgium (Debauche, 1948; Mathot, 1969), Holland and Austria (Soyka, 1946, 1955), Bulgaria, Yugoslavia and Greece (Donev, 1978, 1985a, 1985b), Japan, Korea and Bangladesh (Sahad & Hirashima, 1984), Poland and Turkmenistan (Trjapitsyn, 1997). The reference of Sahad & Hirashima (1984) is doubtful according to Chiappini (1989) because the specimens studied have four sensory ridges on the club. The species hosts are *Cicadella viridis* L., 1758, *Delphacodes fairmairei* Perris, 1857 on *Juncus effusus* L. (Trjapitsyn, 1997) and other Jassidae, Delphacidae and Odonata (Bakkendorf, 1926; Whalley, 1956).

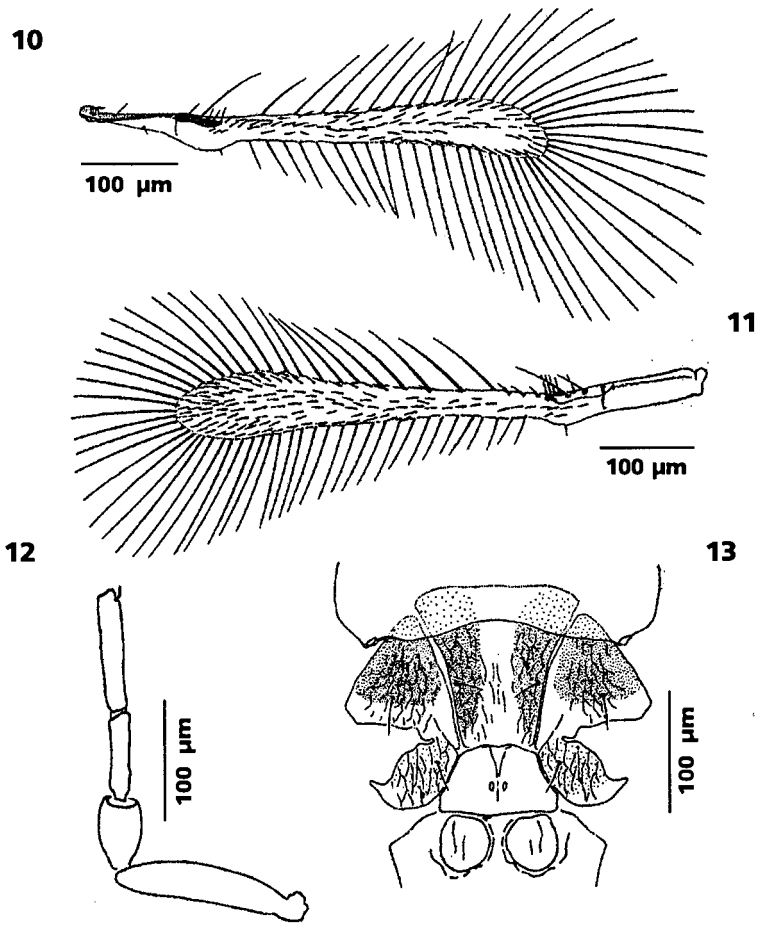
Material studied
Malaise trap: Cadreita, 20 VII 92 4♀; 24 IX 92 1♀. Other material studied: *A. pallidior* Soyka, 1955 (slide n° 452) and *A. neopallidus* Soyka, 1955 (slide n° 435), from Hundsheim, Austria. Holotypes (NHMW).

Anagrus (Anagrus) subfuscus Förster, 1847 (fig. 8)
"*incarnatus*" species group

Female
Head light brown, with the vertex darker. Scape, pedicel and F1 yellowish; following antennal segments darker. Mesoscutum very dark. Legs entirely yellowish except for the last tarsal segment, which is darker, like the last part of the ovipositor valves. Dorsal surface of the metasoma with five brown dorsal bands. F1 subglobular; club shorter than F5+F6. Sensory ridges on F3-F4 (1), F5-F6 (2). Spindle like sensillae on F3-F6 (2) (fig. 8). Two adnotaular setae presents. Mesophragma overlapping ovipositor. Length/wide ratio of the forewing = 8-8.5. Forelegs with five conical sensilla. Ovipositor/foretibia length ratio = 3-3.2 (table 1). Ovipositor projecting from the metasomal distal apex.

A. subfuscus was first described from Germany (Förster, 1847), Belgium (Debauche, 1948), Japan ex *Lestes temporalis* Selys (Sahad & Hirashima, 1984) and France, ex *Cicadella viridis* L. on *Carex paniculata* L. (Chiappini, 1989).

Material studied
Malaise trap: Cadreita, 3 IX 92 1♀; 7 X 92 3♀; 30 X 92 2♀. Other material examined: *Anagrus incarnatus subfuscus* (Förster, 1847) sensu Debauche, 1948. Slides 155 and 157 in IRSNB, from Campenhout, Belgium; slide 159 in IRSNB, from Héverlé, Belgium; slides 1 and 12 (University of Louvain) in IRSNB, from Eegenhoven, Belgium.



Figs. 10-13. 10. Forewing of *A. atomus*; 11. Forewing of *A. similis*; 12. Scape, pedicel and two first funicle segments of *A. optabilis* female antennae; 13. Dorsal colour pattern of mesosoma and posterior scutellum of *A. optabilis*.

10. Ala anterior de A. atomus; *11. Ala anterior de* A. similis; *12. Escapo, pedicelo y dos primeros segmentos del funículo de la antena de la hembra de* A. optabilis; *13. Coloración dorsal del mesosoma y escutelo posterior de* A. optabilis.

Anagrus (Anagrus) obscurus Förster sensu Soyka, 1955 (fig. 9)
"*incarnatus*" species group

Female
Dark brown, with darker head, anterior half of mesosoma and lateral part of metasoma. Antennal pedicel slightly paler than the other antennal segments. F1 subglobular with three or four setae. Sensory ridges on F3-F5(1), F6(2). Club very broad, 2.8 times longer than wide. Spindle-like sensilla on F2(1), F3-F6(2) (fig. 9). Very long adnotaular setae present. Postphragma long, overlapping ovipositor. Forewing with 4-5 rows of setae and marginal setae 2.12 times the wing width.

Table 1. Measurements (Min-max, mean±sd, in mm) of some females captured in Navarra: Aat. *A. atomus*; Asi. *A. similis*; Ain. *A. incarnatus*; Aob. *A. obscurus*; Asu. *A. subfuscus*; Aop. *A. optabilis*. B. Body; E. Escapo; P. Pedicel; F1-F6. Funicular articles; C. Clava; Lf. Length of forewing; Wf. Width of forewing; L/Wf. Length/width of forewing ratio; Lmsf. Longest marginal seta of forewing; Lh. Length of hindwing; Lmsh. Longest marginal seta of hindwing; T1. Length of the foretibia; Lo. Length of the ovipositor; O/T1. Ovipositor/length of foretibia ratio.

Medidas (Min-max, media±sd, en mm) de algunas hembras capturadas en Navarra. (Para las abreviaturas ver arriba.)

	Aat	Asi	Ain	Aob	Asu	Aop
B	0.65-0.75*	0.64-0.74*	0.72-0.76	0.76-0.81	0.66-0.73	0.850
	0.71±0.028	0.68±0.041	0.74±0.017			
E	0.082-0.090*	0.070-0.082*	0.090	0.100-0.105	0.080-0.082	0.105
	0.084±0.003	0.076±0.005	0.09			
P	0.040-0.045*	0.040-0.042*	0.040	0.045-0.047	0.038-0.041	0.040
	0.041±0.002	0.040±0.001	0.04			
F1	0.016-0.020*	0.020-0.022**	0.018-0.030	0.021-0.023	0.020-0.021	0.043
	0.018±0.001	0.021±0.001	0.022±0.005			
F2	0.046-0.058*	0.050-0.066**	0.062-0.070	0.060-0.072	0.054-0.061	0.063
	0.052±0.004	0.057 ± 0.005	0.066±0.004			
F3	0.047-0.051*	0.048-0.062**	0.058-0.063	0.060-0.063	0.051-0.055	0.062
	0.049±0.001	0.051±0.003	0.060±0.001			
F4	0.058-0.065*	0.047-0.057*	0.050-0.060	0.055-0.060	0.055-0.058	0.065
	0.061 ± 0.002	0.051±0.003	0.057±0.005			
F5	0.053-0.065*	0.045-0.055**	0.052-0.065	0.055	0.050-0.056	0.060
	0.060 ± 0.003	0.050±0.003	0.057±0.006			
F6	0.060-0.065*	0.045-0.055**	0.050-0.062	0.052-0.058	0.050-0.052	0.060
	0.063 ± 0.002	0.050±0.002	0.056±0.005			
C	0.103-0.110*	0.092-0.105**	0.100-0.105	0.100-0.110	0.100-0.100	-
	0.107 ± 0.003	0.098±0.003	0.103±0.003			
Lf	0.50-0.63**	0.54-0.69**	0.58-0.66	0.68-0.72	0.58-0.68	0.64
	0.59±0.022	0.59±0.033	0.62±0.034			
Wf	0.050-0.065**	0.060-0.075**	0.06-0.075	0.075-0.080	0.070-0.073	0.051
	0.061±0.004	0.066±0.005	0.068±0.006			
L/Wf	7.69-11.60**	8.00-9.66**	8.57-10.16	9.00-9.60	8.29-9.32	12.54
	9.72±0.642	8.98±0.41	9.15±0.625			
Lmsf	0.190-0.200*	0.18-0.23*	0.16-0.18	0.165-0.205	0.170-0.205	0.19
	0.198±0.004	0.194±0.017	0.17±0.008			
Lh	0.52-0.56*	0.51-0.58*	0.53-0.57	0.65-0.68	0.58	0.61
	0.53±0.012	0.55±0.026	0.56±0.020			

Table 1. (Cont.)

	Aat	Asi	Ain	Aob	Asu	Aop
Lmsh	0.14-0.16*	0.13-0.15*	0.13-0.14	0.1350.150	0.170	-
	0.15±0.006	0.14±0.006	0.138±0.005			
T1	0.11-0.14**	0.115-0.140**	0.125-0.140	0.150-0.168	0.121-0.125	0.15
	0.132±0.006	0.126±0.007	0.133±0.007			
Lo	0.22-0.26**	0.245-0.330**	0.29-0.35	0.33-0.36	0.38-0.38	0.36
	0.24±0.009	0.285±0.025	0.332±0.025			
O/T1	1.69-2.00**	2.00-2.56**	2.23-2.64	2.12-2.33	3.12-3.14	2.40
	1.81±0.066	2.26±0.151	2.49±0.162			
	*n=10 **n=55	*n=8 **n=29	n=4	n=3	n=2	n=1

Five conical sensilla on the foretibia, and small teeth on the anterior side of the hind coxa. Ovipositor projecting slightly from the metasoma distal apex (about 1/10 of total length).

The major differences between the Spanish specimens of *A. obscurus* and *A. similis* are coloration, number of sensory ridges [F3(0-1) and F4-F5(1-2) in *A. similis* and F3-F5(1) in *A. obscurus*] spindle-like sensilla [F3-F4(1) and F5-F6(2) in *A. similis* and F2(1) and F3-F6(2) in *A. obscurus*] the length of adnotaular setae, and some measures (see table 1).

FÖRSTER (1861) described this species from specimens captured in Austria. CHIAPPINI (1989) records its presence in Italy ex cicadellids on *Carex* sp. and *Juncus* sp.

Material studied
Malaise trap: Cadreita, 24 IX 92 1♀; 07 X 92 2♀.

Anagrus (Paranagrus) optabilis (Perkins, 1905) (figs. 12-13)

Female.
Head, mesosoma, metasoma and legs yellowish or pale brown. Antenna pale brown with the scape and pedicel lighter. Mesoscutum with four dark triangular areas: two lateral to central lobe and two on lateral lobes (fig. 13). Forewings with a dark longitudinal line. The metasomal distal apex and ovipositor are brown. Scape very long (six times as long as wide). F1 cylindrical, a little longer than pedicel, with a few setae and wider in its proximal portion (fig. 12); apex with a short spine (a modified seta). F2 and F3 similar, wider in the second half. F4 longer than F2 and F3, but shorter than F5. There are sensory ridges on F4-F5(1) and F6(2). Although SAHAD & HIRASHIMA (1984) said that there is one sensory ridge on F3, in our specimen there is not. Spindle-like sensilla present on F2(1) and F3-F6(2). The specimen studied has lost the club. Pronotum and mesosoma long and scaly. Two adnotaular setae present. Forewing 12.54 times as long as wide, with long marginal setae (58 in the specimen studied); the longest marginal setae 3.72 times the maximum width of forewing. The wing disk is divided longitudinally with a row of about 22 setae. In the wider distal third, there are two rows of three and seven setae, respectively. Between the macrochaetae and hypochaeta there is a small seta. Metasoma longer than mesosoma, with a characteristic dentate sculpture on dorsal part of last tergites.

A. optabilis was described from Queensland (Australia) (PERKINS, 1905). Some posterior records: Hawaii, Japan, Korea, Taiwan, Thailand and Bangladesh (SAHAD & HIRASHIMA, 1984), Malaysia, India, Sri Lanka, New Guinea, Indonesia, Mauritius, Philippines, Fiji, Samoa and Guam (TRJAPITSYN, 1995), Ecuador (DE SANTIS & FIDALGO, 1994) and South Africa (TRJAPITSYN, 1997). *A. optabilis* has been found ex eggs of *Nilaparvata lugens* (Stål),

Nilaparvata muiri China, *Sogatella furcifera* (Horváth), *Laodelphax striatellus* (Fallén), *Saccharosydne procerus* (Matsumura), *Zuleica nipponica* (Matsumura and Ishihara), *Leersia japonica* (Homoptera, Delphacidae) (Sahad & Hirashima, 1984), *Perkinsiella saccharicida* Kirkaldy, *P. thompsoni* Muir, *Pundaloya simplica* (Distant), (Homoptera, Delphacidae) (Chiappini et al, 1996). Together with other mymarids, it is considered responsible for the reduction of cicadellid and delfacid populations under the threshold of treatment in rice crops in Thailand (Denno & Perfect, 1993).

Material studied
Corn plant: Santesteban, 20 VII 1994 1♀. First record in Europe. Other material examined: one slide with 25♀ of *Anagrus optabilis* reared from eggs of Perkinsiella saccharicida on sugarcane, from Hawaii, Feb. 1916 from UCRC.

Discussion

Knowledge of the Mymaridae family in Spain is very limited. Having found great amounts of specimes of this family in a crop without insecticides suggests they contribute to the natural control of potential pests. Attention is drawn to the appearance of a specimen of the *Anagrus optabilis*, previously found in very distant geographic zones from the Iberian peninsula. Small differences in the measures between the specimens of Navarra and others have been found, but these do not justify its pertaining to different species.

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Resumen

Especies de Anagrus *Haliday, 1833 (Hym., Chalcidoidea, Mymaridae) en Navarra (N España)*

Se cita la presencia en Navarra (N España) de seis especies de *Anagrus* Haliday, capturadas mediante una trampa Malaise y una manga entomológica, a lo largo de toda la provincia, durante el estudio de la entomofauna de 60 campos de maíz. Las especies encontradas son *Anagrus atomus* (Linnaeus, 1767), *A. similis* Soyka, 1955, *A. incarnatus* Haliday, 1833, *A. obscurus* Förster sensu Soyka, 1955 y *A. optabilis* (Perkins, 1905). Todas son primeras citas para la península ibérica. El género *Paranagrus* es citado por primera vez para Europa. Se aporta información sobre sus hospedadores, su papel en control natural de plagas, figuras útiles para su identificación (figs. 1, 2-4, 5-9, 10-13), lugar de las capturas y una tabla con las principales dimensiones de los ejemplares capturados (tabla 1).

References

Aeschlimann, J. P., 1977. Notes on *Patasson lameerei* (Hymenoptera, Mymaridae), an egg parasitoid of *Sitona* spp. (Coleoptera, Curculionidae) in the Mediterranean region. *Entomophaga*, 22: 111-114.

Ahlberg, O., 1925. Zikaden-Parasiten unter den Strepsiteren und Hymenopteren. *Medd. Central Anst. försöks. jordbruks., Ent. Avd.*, 46(287): 79-86.

Annecke, D. P. & Doutt, R. L., 1961. The genera of the Mymaridae (Hymenoptera, Chalcidoidea). *Ent. Mem. Dept. Agric. South Africa*, 5: 1-71.

Bakkendorf, O., 1926. Recherches sur la biologie de l'*Anagrus incarnatus* Haliday microhyménoptere parasite (accidentel?) des oeufs de divers Agrionides. *Ann. Biol. Lacustre*, 14: 249-270.

Cerutti, F., Delucchi, V., Baumgartner, J. & Rubli, D., 1989. Research on the "vineyard" ecosystem in Ticino (Switzerland): II. Colonization of vineyards by the leafhopper *Empoasca vitis* Goethe (Homoptera: Cicadellidae, Typhlocybinae) and its parasitoid *Anagrus atomus* Haliday (Hymenoptera: Mymaridae). *Mitt. Schweiz.*

Entomol. Ges., 62: 253-267.

CHIAPPINI, E., 1987. Studies on the variability of *Anagrus atomus* (L.) (Hymenoptera: Mymaridae) and on a similar species living on bramble. *Boll. Zool. agr. Bachic., Ser. II*, 19: 71-97.

- 1989. Review of the European species of the genus *Anagrus* Haliday (Hymenoptera: Chalcidoidea). *Boll. Zool. agr. Bachic., Ser. II*, 21: 85-119.

CHIAPPINI, E. & LIN, N. Q., 1998. *Anagrus* (Hymenoptera, Mymaridae) of China, with descriptions of nine new species. *Ann. Entomol. Soc. Am.*, 91(5): 549-571.

CHIAPPINI, E., TRIAPITSYN, S. V. & DONEV, A., 1996. Key to the Holarctic species of *Anagrus* Haliday (Hymenoptera: Mymaridae) with a review of the Nearctic and Paleactic (other than European) species and descriptions of new taxa. *J. Nat. Hist.*, 30: 551-595.

DE SANTIS, L. & FIDALGO, P., 1994. Catálogo de Himenópteros Calcidoideos. *Ser. Acad. Nac. Agron. Vet.*, 13: 1-154.

DEBAUCHE, H. R., 1948. Etude sur les Mymarommidae et les Mymaridae de la Belgique (Hymenoptera: Chalcidoidea). *Mem. Mus. R. Hist. Nat. Belg.*, 108: 1-248.

DENNO, R. F. & PERFECT, T. J. (Eds.), 1993. *Planthoppers: their ecology & management*. Chapman & Hall, London.

DONEV, A., 1978. Unbekannten Gattungen und Arten Aus der Familie Mymaridae (Hymen. Chalc.) für die Fauna Bulgariens. *Nauchn. Tr. Plovdivski Univ. "Paisii Hilendarski"*, 16(4): 457-460.

- 1985a. A contribution to the studies on the specific composition and distribution of the family Mymaridae (Hym. Chalc.) in Greece. *Nauchn. Tr. Plovdivski Univ. "Paisii Hilendarski"*, 23(1): 61-64.
- 1985b. Mymaridae (Hym. Chalcidoidea) von Fruschka gora, Jugoslavien. *Nauchn. Tr. Plovdivski Univ. "Paisii Hilendarski"*, 23(1): 65-69.

DYSART, R. J., 1971. Distribution of *Anaphes flavipes* in Europe and sources of its importation into the United States. *Entomophaga*, 16(4): 445-452.

ENOCK, F., 1914. Fairy flies and their hosts. *J. Royal Hort. Soc.*, 40: 45-49.

FÖRSTER, A., 1847. Ueber die Familie der Mymariden. *Linn. Entomol.*, 2: 195-233.

- 1861. Ein Tag in den Hoch-Alpen. *Prog. Realsch. Aachen (1860-61)*: 1-44.

GARCÍA-MERCET, R., 1912. Mimáridos nuevos de España. *Bol. Soc. Esp. Hist. Nat.*, 12: 331-337.

GIUSTINA, W. DELLA & CARUHEL, P., 1989. La cicadelle du maïs dans le bassin parisien. *Phytoma*, 410: 21-26.

GRAHAM, M. W. R DE V., 1982. The Haliday Collection of Mymaridae (Insecta, Hymenoptera, Chalcidoidea) with taxonomic notes on some material in other collections. *Proc. R. Ir. Acad.*, 82b(12): 189-243.

HALIDAY, A. H., 1833. An essay on the classification of the parasitic Hymenoptera of Britain, which correspond with the Ichneumones minuti of Linnaeus. *Entomol. Mag.*, 1: 259-276, 333-350.

HUBER, J. T., 1986. Systematics, biology, and hosts of the Mymaridae and Mymarommatidae (Insecta: Hymenoptera): 1.758-1.984. *Entomography*, 4: 185-243.

- 1988. The species groups of Gonatocerus Nees in North America with a revision of the sulphuripes and ater groups. *Mem. Entomol. Soc. Can.*, 141: 1-109.

LINNAEUS, C., 1767. *Systema Naturae. Editio duodecima reformata*, 1(2): 940-941.

LLORENS, J. M., 1990. *Homoptera I. Cochinillas de los cítricos y su control biológico*. Pisa Ediciones, Alicante.

MAISONNEUVE, J.-CH., BLUM, J. & WARDLOW, L. R., 1995. Contre la cicadelle de la tomate en serre, un nouvel auxiliaire: *Anagrus atomus*. *Phytoma*, 471: 24-27.

MAIXNER, M., REINERT, W. & WEBER, A., 1998. Insect parasitoids and mite parasites of leafhoppers and planthoppers (Auchenorrhyncha) in vineyards. *Bull. OILB/SROP*, 21(2): 75-76.

MATHOT, G., 1969. Contribution a la connainssance des Mymaridae d'Europe et description d'especes nouvelles (Hymenoptera: Chalcidoidea). *Bull. Inst. r. Sci. nat. Belg.*, 45(7): 1-23.

PERKINS, R. C. L., 1905. Leaf-hoppers and their natural enemies. VI. Mymaridae, Platygastridae. *Bull. Exp. Stn. Hawaii Sugar Plant Assoc. Entomol. Serv.*, 1(6): 185-205.

SAHAD, K. A. & HIRASIMA, Y., 1984. Taxonomic studies on the genera *Gonatocerus* Nees and Anagrus Haliday of Japan and adjacent regions, with notes on their biology (Hymenoptera: Mymaridae). *Bull. Inst. Trop. Agric. Kyushu Univ.*, 7: 1-78.

SOYKA, W., 1946. Revision einiger Mymaridengattungen. *Zenbl. Gesamtgeb. Ent.*, 1: 33-44, 182.

- 1955. Uberblick Über das Genus *Anagrus* Haliday (Alaptidae, Mymaridae, Chalcidoidea, Hymenoptera). *Entomol. Nachrichtenbl. (Wien)*, 7(2): 23-26.

SUTRE, B. & FOS, A., 1997. Anagrus atomus. Parasitoïde naturel de cicadelles. *Phytoma*, 495: 40-44.

THURÓCZY, C., 1983. Négy, a faunánkra új fémfürkészfaj (Hymenoptera: Chalcidoidea, Mymaridae). *Folia ent. hung.*, 44(2): 338-340.

TRIAPITZYN, S. V., 1995. Taxonomic notes on the Australian species of *Anagrus* (Hymenoptera Mymaridae). *Russian Entomol. J.*, 4(1-4): 105-108.

- 1997. The genus *Anagrus* (Hymenoptera: Mymaridae) in America south of the United States: a review. *Ceiba*, 38(1): 1-12.

TULLGREN, A., 1916. Rosenstriten (*Typhlocyba rosae* L.) och en ny äggparasit på densamma. *Medd. Centrans. för Försoks. Jordbr.*, 132 (*Ent. Avd.*), 24: 3-13.

VIDANO, C. & ARZONE, A., 1987. Natural enemies of *Zyginidia pullula* (Rhynchota Auchenorrhyncha). *Proceedings of 6th Auchenorrhyncha Meeting, Turin. 7-11 Sept. 1987:* 581-590.

WALKER, G. P., ZAREH, N., BAYOUN, I. M. & TRJAPITSYN, S. V., 1997. Introduction of Western Asian egg parasitoids into California for Biological Control of Beet Leafhopper, *Circulifer tenellus*. Pan-Pac. *Entomol.*, 73(4): 236-242.

WALKER, I., 1979. Some British species of *Anagrus* (Hymenoptera: Mymaridae). *Zool. J. Linn. Soc. Lond.*, 67: 181-202.

WESTWOOD, J. O., 1840. *An introduction to the modern classification of Insects. Vol. II.* London.

WHALLEY, P., 1956. On the identity of species of *Anagrus* (Hym., Myrmaridae) bred from leaf-hopper eggs. *Entomol. mon. mag.*, Serie 4ª, 93: 147-149.

WORNER, S. P., GOLDSON, S. L. & FRAMPTON, E. R., 1989. Comparative ecoclimatic assessments of Anaphes diana (Hymenotpera, Mymaridae) and its intended host, *Sitona discoideus* (Coleoptera, Curculionidae), in New Zealand. *J. Econ. Entomol.*, 82(4): 1.085-1.090.