

Seasonal abundance and biology of sporophagous thrips and notes on other thrips (Insecta, Thysanoptera) on the Mediterranean oak, *Quercus rotundifolia* L. in Navarra (N Spain)

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Seasonal abundance and biology of sporophagous thrips and notes on other thrips (Insecta, Thysanoptera) on the Mediterranean oak, Quercus rotundifolia L. in Navarra (N Spain).— This paper records the seasonal abundance of four species of sporophagous thrips collected on the Mediterranean oak, *Quercus rotundifolia* L., in the Mediterranean area of Navarra (N Spain). The life cycles of *Compsothrips albosignatus* (Reuter), *Priesneriella clavicornis* (Knechtel), *Megalothrips bonannii* Uzel and *Cryptothrips nigripes* (Reuter) are reported, and notes given about habitat specificity and wing development. Notes about host specific Terebrantia thrips of the Mediterranean oak are also reported.

Key words: Thysanoptera, Tubulifera, Seasonal abundance, Life cycle, Sporophagous thrips, *Quercus rotundifolia*.

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Introduction

Few reports have been published on the seasonal dynamics and habitat specificity of sporophagous thrips (Thysanoptera, Phlaeothripidae, Idolothripinae), although such data is of significant interest for the understanding of their biology and life cycle. Most of the taxonomic literature on thrips in Spain involves species' description and locality records (BERZOSA, 1983, 1988, 1990; TITSCHACK, 1976) with little precise biological information and only for pest species has the seasonal dynamics and biology been studied in depth in this country (LACASA PLASENCIA, 1987, 1988; LACASA PLASENCIA et al., 1988, 1990; BIELZA et al., 1996a, 1996b). In Navarra, the host plants and distribution of Terebrantia and Tubulifera have been reported (GOLDARAZENA & MOUND, 1998, 1999; GOLDARAZENA et al., 1998, in press) and the ecology and life cycle of ectoparasitic enemies of thrips in the Basque Country have been investigated (ZHANG & GOLDARAZENA, 1996; GOLDARAZENA et al., 1997; GOLDARAZENA & ZHANG, 1998). This lack of biological information contrasts with the detailed observations on the behaviour of some fungus feeding Phlaeothripines in North America (CRESPI, 1986a, 1990) and in England (CRESPI, 1986b). However, the recent book by LEWIS (1997), particularly the chapter on biological diversity (MOUND, 1977), indicates the scarcity of biological information on thrips other than a few pest species. The purpose of this article is to record observations on the seasonal abundance and life cycle of sporophagous thrips associated with *Quercus* trees in central and southern Navarra, and to determine their precise habitats within the oak trees they occupy. Throughout the study, many Thripidae were also collected from *Q. rotundifolia*, living in the flowers and feeding either on pollen and flower tissues or predated on other thrips. These collections are summarised in table 1.

Material and methods

The study sites were located in a Mediterranean forest in Tafalla (Navarra, N Spain). Field collections were made at monthly in-

tervals throughout 1997 and January 1998. Samples were taken from branches of *Quercus rotundifolia* L. by beating dead branches, with or without dried leaves, and also live branches with lichens, over a plastic dish of about 40 cm in diameter. A bar 20 cm steel bar was used for beating. The specimens were stored in vials containing AGA (60% ethanol 10 parts, glycerol 1 part, acetic acid 1 part), and examined with a phase contrast microscope in semipermanent slide preparations made with Hoyer's mountant and sealed with commercial varnish. Recognition of the biological stages was carried out under a stereomicroscope.

Three oak trees and microhabitats chosen for sampling are described in Results. Samples were taken monthly during 1997, and each microhabitat was beaten for 20 minutes each time. Thrips were also extracted from leaf litter of *Q. rotundifolia* with a Berles-Tullgren funnel. The populations of sporophagous thrips and their microhabitats were detected previously during faunistic studies carried out in a six-year survey of the Mediterranean area of Navarra (GOLDARAZENA, 1996).

Results

The richness of thrip habitats in the Mediterranean oak

The Mediterranean oak, *Q. rotundifolia* L., is one of the most representative tree species in the Mediterranean area of Spain. Four sporophagous thrips were found, living in three different microhabitats on branches of this tree, but other thrip species feed on the flowers and foliage or are predators.

Dead fallen branches with dried leaves

One collection site consisted of four large branches which had fallen on the ground. The leaves were attacked by a brown fungus throughout the year. The large Idolothripine species, *Megalothrips bonannii* Uzel, was found in this habitat.

Leafless dead fallen branches

At the second site, several dead branches were

Table 1. Thrips associated with the Mediterranean oak *Quercus rotundifolia* L.: F. Flowers; L. Leaves. Db. Dead branches with or without leaves; B. Branches with lichens.
Thrips asociados con la encima Mediterránea Quercus rotundifolia L.: F. Flores; L. Hojas; Db. Ramas muertas con o sin hojas; B. Ramas con líquenes.

Thrip family / species	F	L	Db	B
Thripidae				
<i>Thrips minutissimus</i> Linnaeus	+			
<i>Thrips tabaci</i> Lindeman	+	+		
<i>Thrips angusticeps</i> Uzel	+	+		
<i>Oxythrips quercicola</i> Bagnall	+			
<i>Oxythrips ulmifoliorum</i> (Haliday)	+			
<i>Drepanothrips reuteri</i> Uzel		+		
Aeolothripidae				
<i>Aeolothrips melaleucus</i> Haliday	+			
<i>Aeolothrips gloriosus</i> Bagnall	+			
Phlaeothripidae				
<i>Megalothrips bonnanii</i> Uzel			+	
<i>Priesneriella clavicornis</i> (Knechtel)			+	
<i>Cryptothrips nigripes</i> (Reuter)			+	
<i>Compsothrips albosignatus</i> (Reuter)				+

completely covered by a black microscopic fungus throughout the year. *Cryptothrips nigripes* (Reuter) and *Priesneriella clavicornis* (Knechtel) were found in this habitat.

Live branches partially covered with lichens

The third site was an oak tree with branches covered with different species of lichens. *Compsothrips albosignatus* (Reuter), one of the largest thrips in Europe, was collected in this habitat.

Flowers of *Quercus rotundifolia*

Many species of Thripidae were collected in the flowers of the Mediterranean oak during 1991-98, but only the species listed in table 1 breed on this plant. Their larvae feed on pollen, and or leaves, or preying on other thrips associated with this tree.

The four species studied belong to the Subfamily Idolothripinae Bagnall. A revised classification of this subfamily (MOUND & PALMER, 1983) recognised a world total of 600 species in 78 genera, two tribes and nine subtribes. Idolothripines have broad maxillary stylets, which form a tube through which whole fungal spores are ingested into their bodies. Presumably the Mediterranean oak and their microhabitats mentioned above provide optimal conditions of temperature and humidity for the development of the particular fungi on which these thrips feed.

Seasonal abundance of the sporophagous thrips

The seasonal abundance of *Compsothrips albosignatus* is indicated in fig 1. Females, males and larvae were collected throughout

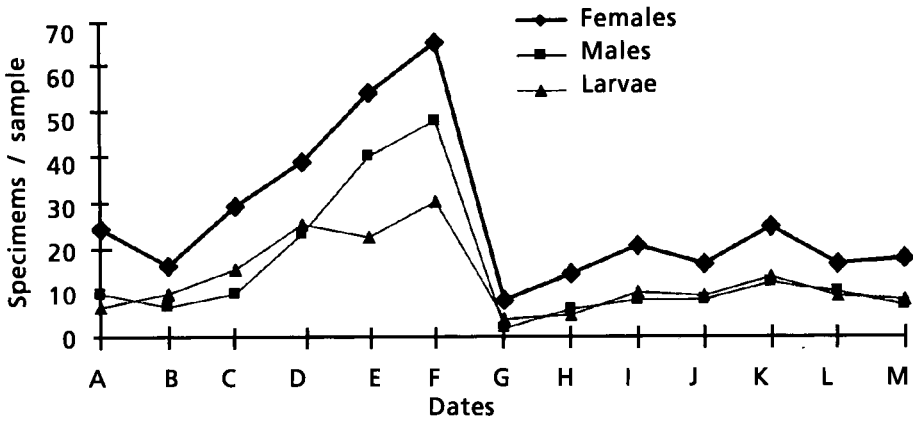


Fig. 1. Seasonal abundance of *Compsothrips albosignatus* on branches of *Quercus rotundifolia*. Dates: A. 18 I 1997; B. 10 II 1997; C. 25 III 1997; D. 5 IV 1997; E. 10 V 1997; F. 20 VI 1997; G. 15 VII 1997; H. 3 VIII 1997; I. 6 IX 1997; J. 2 X 1997; K. 30 XI 1997; L. 20 XII 1997; M. 25 I 1998.

Abundancia estacional de Compsothrips albosignatus en las ramas de Quercus rotundifolia. (Para las abreviaturas de las fechas ver arriba.)

the year from January 1997 to January 1998. The maximum number of specimens on the branches was found in late June, and the minimum in mid-July. The sharp decrease in the thrip population from late June to 15 July, was probably due to the high summer temperatures during this fortnight. The thrip fauna extracted with a Berlese funnel from three 5 kg samples of leaf litter collected under the tree during August is presented in table 2. The number of *Co. albosignatus* specimens collected from leaf litter is similar to the number captured on the tree in late June. The thrips presumably migrate from the branches to the cooler and more humid leaf litter under the trees in response to the high summer temperatures. The thrips were also found in the litter during late July. From August to November the number of thrips captured on the branches increased, but it decreased again in December. All the specimens collected were apterous. The males varied between 0.25-0.74% of the population during the sampling period (table 3).

In the same forest as the oak trees, large

populations of *Compsothrips maroccanus* Priesner were collected under the rhizomatous grasses *Lygeum spartium* and *Lavandula latifolia*. However, this thrip species seems to be restricted to these habitats, and was not found on *Quercus* trees in Navarra at any time. All the specimens were apterous.

The seasonal abundance of *Cryptothrips nigripes* (Reuter) is shown in figure 2. All life stages were collected in small numbers throughout the sampling period. The greatest number of specimens was taken in late June, and the minimum in January and February. Although most specimens collected were apterous, macropterous females were collected from March to August and represented 30% of the total females captured (fig. 3). The only males found in these samples were macropterous. Natural enemies of this species were not observed. The presence of macropterous and apterous females in late winter to summer suggests that the winged females disperse and colonise new habitats whilst the wingless females feed and breed in the old sites. The male population during the sampling period was between 0.20-0.71%.

Table 2. Thrip fauna extracted between July and August with the Berlese funnel from the soil under the tree of *Quercus rotundifolia* where the sampling of *Compsothrips albosignatus* was made.

Fauna de tisanòpteros extraïda entre julio y agosto con el embudo de Berlese del suelo bajo la encina donde se realizó el muestreo de Compsothrips albosignatus.

Thrip family / species	Sample 1 15 VII 1997	Sample 2 3 VIII 1997	Sample 3 20 VIII 1997
Thripidae			
<i>Thrips minutissimus</i> Linnaeus	22	15	8
<i>Thrips tabaci</i> Lindeman	6	0	2
<i>Chirothrips manicatus</i> (Haliday)	43	28	2
<i>Aptinothrips elegans</i> Priesner	56	41	23
<i>Aptinothrips rufus</i> (Haliday)	19	9	10
<i>Dendrothrips saltator</i> Uzel	3	0	1
Aeolothripidae			
<i>Aeolothrips intermedius</i> Bagnall	8	4	2
Phlaeothripidae			
<i>Cephalothrips coxalis</i> Bagnall	8	7	2
<i>Cephalothrips monilicornis</i> (Reuter)	28	35	12
<i>Haplothrips setiger</i> (Priesner)	6	1	0
<i>Compsothrips albosignatus</i> (Reuter)	87	73	59
<i>Amphibolothrips marginatus</i> (Buffa)	3	0	1
Weight of the sample (kg)	5.300	5.225	5.289

Table 3. Total number of specimens, sex ratio and variation of the percentage of males during the sampling in trees of *Quercus rotundifolia*.

Número total de ejemplares, sex ratio y variación del porcentaje de machos a lo largo del muestreo en los árboles de Quercus rotundifolia.

	<i>C. albosignatus</i>	<i>C. nigripes</i>	<i>M. bonannii</i>	<i>P. clavicornis</i>
Total number of females	342	47	342	345
Total number of males	191	12	145	178
Sex ratio	1:2	1:3	1:2.5	1:2
Proportion of males	0.25-0.74	0.20-0.71	0.08-0.39	0.33-0.69

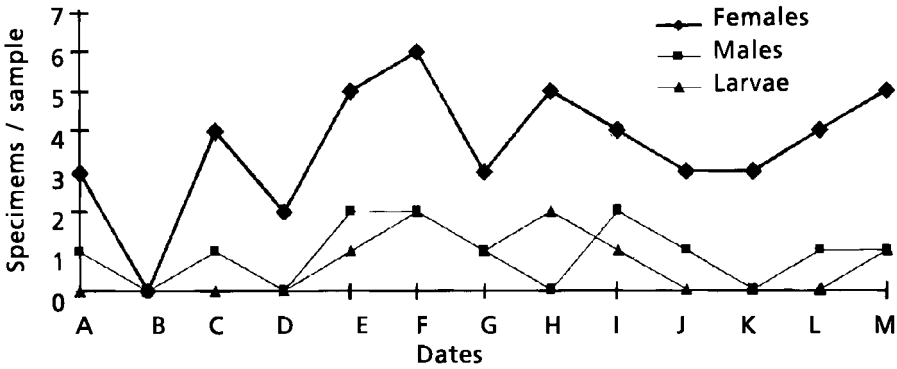


Fig. 2. Seasonal abundance of *Cryptothrips nigripes* on dead branches of *Quercus rotundifolia*. (For abbreviations see fig. 1.)

Abundancia estacional de *Cryptothrips nigripes* en ramas muertas de *Quercus rotundifolia*. (Para las abreviaturas ver fig. 1.)

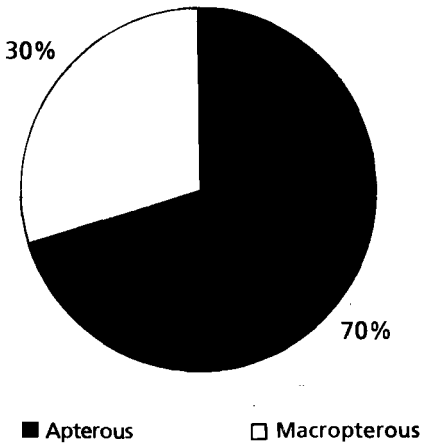


Fig. 3. Wing development in the female populations of *Cryptothrips nigripes*.

Desarrollo alar en las poblaciones de hembras de *Cryptothrips nigripes*.

The seasonal abundance of *Priesneriella clavicornis* (Knechtel) is shown in figure 4. Females, males and larvae were collected throughout the year. The maximum number of specimens was captured in late June and the minimum number from January to March. All the specimens taken were apterous. They were found on dead branches of *Q. rotundifolia*, and none were found in leaf litter samples. The males made up between 0.33-0.69% of the population during the sampling period.

The seasonal abundance of *Megalothrips bonannii* Uzel is shown in figure 5. Females, males and larvae were collected throughout the sampling period, but the maximum number of adults was taken in late May and June. A few pupal specimens were collected from May to August. The population of adults increased suddenly from February to March and decreased in winter. Only macropterous adults were collected, and the male population varied between 0.08-0.39%. Two natural enemies of *M. bonannii* were found in this population (GOLDARAZENA et al., 1997). The ectoparasitic mite *A. dactylidium moundi* Goldarazena et al. feeds on the eggs of these

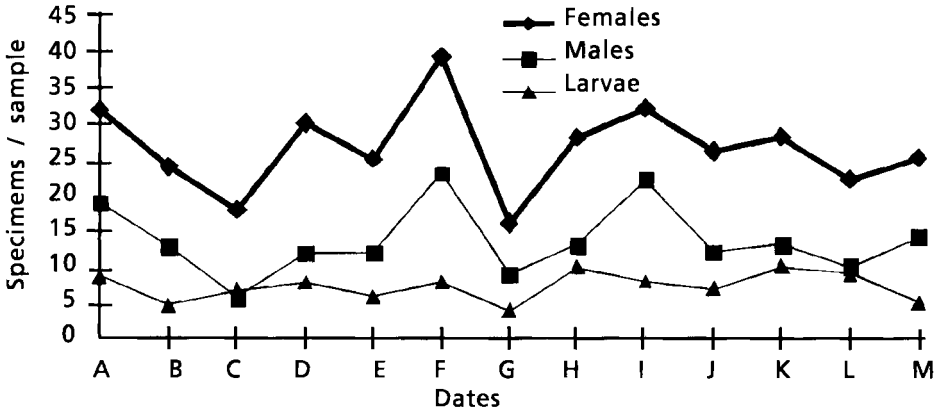


Fig. 4. Seasonal abundance of *Priesneriella clavicornis* on dead branches of *Quercus rotundifolia*. (For abbreviations see fig. 1.)

Abundancia estacional de *Priesneriella clavicornis* en ramas muertas de *Quercus rotundifolia*. (Para las abreviaturas ver fig. 1.)

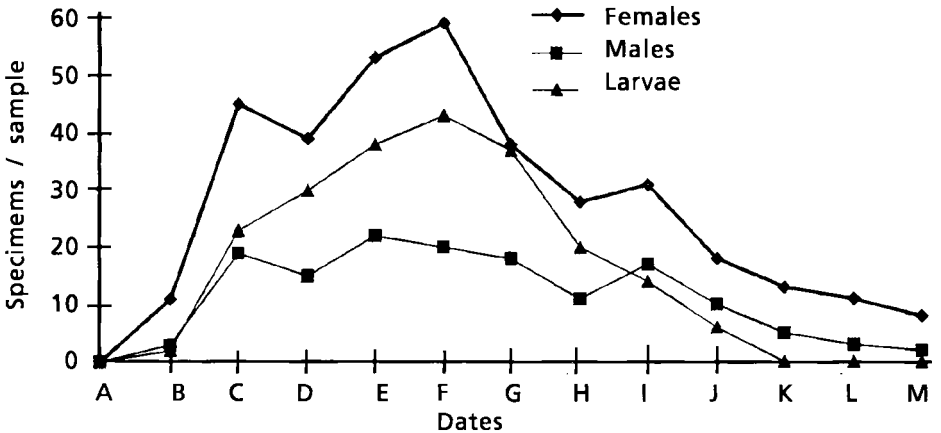


Fig. 5. Seasonal abundance of *Megalothrips bonannii* on dead fallen branches of *Quercus rotundifolia*. (For abbreviations see fig. 1.)

Abundancia estacional de *Megalothrips bonannii* en ramas muertas caídas de *Quercus rotundifolia*. (Para las abreviaturas ver fig. 1.)

thrips and on the haemolymph of the adults. The seasonal abundance of this mite and a revision of the genus *Adactylidium* is presently under study. A new species of *Thripastichus* (Hymenoptera, Eulophidae) was found attacking the second instar larvae of *M. bonannii* (GOLDARAZENA & LOOMANS, in press).

Resumen

Abundancia estacional y biología de trips esporófagos y notas sobre otros trips (Insecta, Thysanoptera) de la encina Mediterránea, Quercus rotundifolia Linneo en Navarra (N España)

En este trabajo se estudia la abundancia estacional de cuatro especies de tisanópteros esporófagos capturados en la encina mediterránea, *Quercus rotundifolia* L., en la región mediterránea de Navarra (N España). Se ha estudiado la distribución estacional de *Compothrips albosignatus* (Reuter) (fig. 1), *Cryptothrips nigripes* (Reuter) (fig. 2), *Priesneriella clavicornis* (Knechtel) (fig. 4), *Megalothrips bonannii* Uzel (fig. 5) y a lo largo del año 1997 y se aportan datos sobre la especificidad del hábitat en el que se encuentran estos trips en la encina, sobre la variación en la proporción de machos respecto a las hembras a lo largo del muestreo (tabla 3) y la evolución en el desarrollo alar de las especies mencionadas (fig. 3). Así mismo se citan las especies de tisanópteros Terebrantia que son específicos de las flores y las hojas de la encina mediterránea en Navarra, como resultado de la prospección faunística realizada durante los años 1993-1995 (tabla 1).

Los tisanópteros esporófagos, pertenecientes a la subfamilia Idolothripinae, han sido encontrados en tres tipos de microhábitat: a. Ramas muertas caídas que portan hojas secas, b. Ramas muertas caídas sin hojas; c. Ramas vivas cubiertas parcialmente de líquenes. Se describen las dinámicas estacionales, la proporción de machos y hembras para las especies esporófagas mencionadas en el párrafo anterior y se comenta la posible migración de *Co. albosignatus* desde la encina al suelo durante la estación más calurosa del verano (fig. 1, tabla 2).

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References

- BERZOSA, J., 1983. Tisanópteros de la Sierra de Guadarrama IV. Phlaeothripidae Uzel, 1895. *Graellsia*, 39: 127-137.
- 1988. *Karnyothrips americanus* (Hood, 1912) en la Península Ibérica (Thysanoptera: Phlaeothripidae). *Boln. Asoc. Esp. Ent.*, 12: 137-141.
- 1990. Nuevos datos sobre el género *Allothrips* Hood, 1908 (Thysanoptera: Phlaeothripidae) *Redia*, 73(2): 355-363.
- BIELZA, P., TORRES VILA, L. M. & LACASA PLASENCIA, A., 1996a. Incidencia cuantitativa y cualitativa de *Haplothrips tritici* Kurd. (Thysanoptera: Phlaeothripidae) en la producción de trigo. *Bol. San. Veg. Plagas*, 22(2): 277-288.
- 1996b. Efecto del laboreo en la supervivencia de las larvas invernantes de *Haplothrips tritici* Kurd. (Thysanoptera: Phlaeothripidae). *Bol. San. Veg. Plagas*, 22(2): 289-296.
- CRESPI, B. J., 1986a. Size assesment and alternative fighting tactics in *Elaphrothrips tuberculatus* (Insecta: Thysanoptera). *Anim. Behav.*, 34: 1.324-1.335.
- 1986b. Territoriality and fighting in a colonial thrips, *Hoplothrips pedicularius*, and sexual dimorphism in Thysanoptera. *Ecol.*

- Entomol.*, 11: 119-130.
- 1990. Subsociality and female reproductive success in a mycophagous thrips: an observational and experimental analysis. *J. Insect Behav.*, 3: 61-74.
- GOLDARAZENA, A., 1996. Contribución al conocimiento de los tisanópteros de Navarra (Insecta, Thysanoptera). Tesis doctoral, Universidad de Navarra.
- GOLDARAZENA, A., JORDANA, R. & ZHANG, Z.-Z., 1997. *Adactylidium moundi* and *A. costarricensis*, two new species of Acarophenacidae (Acari: Tarsonemida) parasitic on Thysanoptera. *Internat. J. Acarol.* 23(4): 261-268.
- GOLDARAZENA, A. & LOOMANS, A. M. (in press). Natural enemies of Thysanoptera in Navarre (Northern Spain): an introduction. *Sixth Internat. Symposium of Thysanoptera, 1988 Antalya, Turkey.*
- GOLDARAZENA, A. & MOUND, L. A., 1998. Introducción a la fauna de los Tisanópteros (Cl. Insecta: O. Thysanoptera) de Navarra-Nafarroa, sus plantas hospedadoras y su distribución. I Suborden Terebrantia. *Est. Mus. Cienc. Nat. de Álava*, 12: 167-202.
- 1999. *Hindsiothrips* from Spain with the first record of *Tylothrips osborni* (Hinds) from Europe (Thysanoptera, Phlaeothripidae). *Entomol. Month. Mag.*, 134: 319-324.
- GOLDARAZENA, A., MOUND, L. A. & JORDANA, R. (in press). Introduction to the thrips fauna of Navarre (Cl. Insecta: O. Thysanoptera), with their host-plants and distribution. Suborder Tubulifera. *Sixth Internat. Symposium of Thysanoptera, 1998 Antalya, Turkey.*
- GOLDARAZENA, A. & ZHANG, Z.-Z., 1998. Seasonal abundance of *Abrolophus neobrevicollis* larvae (Acari: Erythraeidae) ectoparasitic on *Thrips trehernei* (Thysanoptera: Thripidae) in the Basque Country (Spain). *Syst. Appl. Acarol.*, 3: 125-129.
- LACASA PLASENCIA, A., 1987. Un trips de reciente introducción en Europa, nueva plaga en los cultivos hortícolas y frutales españoles. *Agrishell*, 37: 4-8.
- 1988. Los tisanópteros en horticultura: su implicación parasitaria. *Tercer Symposium Nacional de Agroquímicos, Sevilla*: 33-52.
- LACASA PLASENCIA, A. & MARTINEZ, M. C., 1988. Notas sobre la biografía de *Hercinothrips femoralis* Reuter (Thysanoptera: Thripidae) potencial plaga en las plantas ornamentales. *Bol. San. Veg., Plagas*, 14: 67-75.
- LACASA PLASENCIA, A., MARTINEZ, M. C. & ALLIAGA, J., 1990. Los trips en los frutales de hueso del Sureste español: su implicación parasitaria y ecología. *Bol. San. Veg., Plagas*, 16: 425-426.
- LEWIS, T., 1997. *Thrips as crop pests*. Ed. CAB International, Wallingford, England.
- MOUND, L. A., 1997. Biological diversity. In: *Thrips as crop pests*: 197-215 (T. Lewis, Ed.). Ed. CAB International, Wallingford, England.
- MOUND, L. A. & PALMER, J., 1983. The generic and tribal classification of spore-feeding Thysanoptera (Phlaeothripidae: Idolo-thripinae). *Bull. Brit. Mus. Nat. Hist.*, 46(1): 1-174.
- TITSCHACK, E., 1976. Verzeichnis der bis jetzt aus dem spanischem territorium bekannt gewordenen tubuliferen thysanopteren. *Dtsch. Entomol. Z.*, 23: 131-152
- ZHANG, Z.-Z. & GOLDARAZENA, A., 1996. *Abrolophus* and *Grandjeanella* larvae (Acari: Erythraeidae) ectoparasitic on thrips (Thysanoptera: Thripidae). *Syst. Appl. Acarol.*, 1: 127-144.