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**40 años sin Félix**  
**Homenaje al Dr. Rodríguez de la Fuente**



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## PARASITOID WASPS (HYMENOPTERA) OF ALBUFERA DE VALENCIA NATURAL PARK (SPAIN): DIVERSITY AND BIOLOGY

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**Abstract:** The diversity of parasitoid wasps (Hymenoptera) was studied in the Albufera Natural Park (Valencia, Spain). Sampling was carried out from May 2015 to November 2016. A total of 7,464 parasitic wasp specimens in seven superfamilies: Ceraphronoidea, Chalcidoidea, Cynipoidea, Evanioidea, Ichneumonoidea, Platygastroidea and Proctotrupoidea were collected. The phenology of both these seven superfamilies and the braconid subfamilies was analysed. The participation of **Félix Rodríguez de la Fuente** in the conservation of this wetland and the surrounding natural space until they were declared as an extraordinary natural park is highlighted.

**Key words:** Hymenoptera, parasitoids, protected area, Mediterranean, Spain, Valencia.

### Avispas parasitoides (Hymenoptera) del Parque Natural de la Albufera de Valencia (España): Diversidad y biología

**Resumen:** Se estudió la diversidad de las avispas parasitoides (Hymenoptera) del Parque Natural de la Albufera de Valencia (España). Se efectuaron muestreos desde mayo de 2015 a noviembre de 2016, recogiéndose un total de 7.464 especímenes de avispas parásitas de siete superfamilias: Ceraphronoidea, Chalcidoidea, Cynipoidea, Evanioidea, Ichneumonoidea, Platygastroidea y Proctotrupoidea. Se analizó la fenología de las siete superfamilias y de las subfamilias de los Braconidae. Se destaca la participación de **Félix Rodríguez de la Fuente** en la conservación de este humedal y del espacio natural circundante hasta el logro de ser declarados un extraordinario parque natural.

**Palabras clave:** Hymenoptera, parasitoides, espacio protegido, Mediterráneo, España, Valencia.

### Introduction

**Félix Rodríguez de la Fuente** highlighted for the first time on 31<sup>st</sup> May 1970 the problem of the desiccation of Spanish wetlands, especially the danger of urbanization facing the lagoon Albufera de Valencia (Valencia, Eastern Spain) in that moment (TVE, 1970a). In the TV-show “Vida Salvaje – Fábrica de patos”, from the minute 23:09 to minute 25:35, **Félix** proclaimed his personal involvement in the defence of this natural area: “*What is absolutely inconceivable is that the Albufera de Valencia, vital lagoon, is in danger by the purported desiccation of the heart of the Albufera. ...Personally, I am fully convinced that the Albufera, the old, the eternal and the ever new Albufera de Valencia must remain the Albufera de Valencia. ...We'll do whatever it takes to make sure no one endangers her...*”.

Only one month after, **Félix** remarked again on 28<sup>th</sup> June 1970 the importance of conservation of the lagoon and wetland of Albufera de Valencia due to its high ecological value and fauna composition (TVE, 1970b). In the TV show “Vida Salvaje – La Albufera de Valencia”, **Félix** exposed the critical conservation problems of the Albufera through comments such as: “*Undoubtedly, the ornithological richness of the Albufera de Valencia is impressive. There is no doubt that it is the most important enclave for waterfowl that exists in the entire western Mediterranean after the marsh of the Guadalquivir*”; “*Many important banding works are carried out in the Albufera. Thanks to them, we know how long birds live, which are their distribution areas and migration routes*”; “*Factory waste is being discharged in the Albufera*”; “*DDT infiltrations are pouring out of the rice fields*”; “*Different substances are being poured not only worsening the water quality, but also killing the ichthyological fauna*”.

However, pollution was not the only problem. In the sixties there was a tourism and construction boom in the Valencian coast and an urban plan was approved by the Valencia City Council to be developed on the Devesa del Saler, the forested strip that separates the Albufera from the Mediterranean Sea (Temes *et al.*, 1964; Martínez Lloréns, 2015). In this matter, **Félix** considered: “*it would be extremely dangerous to alter what remains of this beautiful Devesa del Saler*” where “*that forest, that community of Mediterranean plants truly unique in the Iberian Peninsula, should also remain in its entirety because it is part of the enclave of the Albufera de Valencia*” (TVE, 1970b).

After this program, **Félix** words were not well received by local authorities and by some Valencian newspapers, which harshly criticized the naturalist through several headlines. However, the mentality and pressure of some communication media opposed to urbanization were changing. The voice of scientists, citizens and environmental movement supporters to protect El Saler got the project stopped (Piqueras, 2017).

**Félix** actively participated in underlining the importance of the Albufera and in demonstrating his personal relationship with this space. He again announces news about the situation of the Albufera on his TV-show "El Planeta Azul - Los que conservan los paraísos" (TVE, 1974). **Félix** welcomed the measures taken "*to definitely save the famous Albufera and paralyse the invading urbanization that was destroying one of the most beautiful ecological complexes in the Mediterranean*". His desire to "*there could be located a truly extraordinary natural park*" would come true.

The democratic Valencia City Council definitively approved in 1983 the Special Plan for the Protection of the Devesa de L'Albufera that addressed its defence and regeneration and slowed down the urban planning developed in the sixties and seventies. And the Albufera (lagoon) and Devesa del Saler (forest and coastal dunes) were definitely declared as a Natural Park in 1986 by the regional government Consell of the Generalitat (DOGV, 1986).

Thanks to new local politicians, university scientists, the people's support movements and the role of **Félix Rodríguez de la Fuente** visiting the Albufera in 1970 and like naturalist involved from his television documentaries, the Albufera de Valencia stays and lives.

Currently, the Albufera de Valencia is a shallow coastal lagoon of 23.94 km<sup>2</sup> of extension located on the Mediterranean coast, south of Valencia (Fig. 1). The lagoon is surrounded by marshlands mainly devoted to rice crops which conform to stunningly beautiful landscape under sustainable human pressure (Soria, 2006). The lagoon is separated from the sea by the Devesa del Saler (Sanjaume *et al.*, 1992) which physical-natural characteristics that afford a great ecological and landscape interest (Fig. 1). The Devesa is an Aleppo pine forest (*Pinus halepensis* Mill.) which undergrowth is composed mainly by fan palms (*Chamaerops humilis* L.), mastic trees (*Pistacia lentiscus* L.), myrtle (*Myrtus communis* L.), kermes oak (*Quercus coccifera* L.), rosemary (*Rosmarinus officinalis* L.) and bindweed (*Smilax aspera* L.). Specimens of Canarian pine (*Pinus canariensis* C. Sm.) and red eucalyptus (*Eucalyptus camaldulensis* Dehnh.) are also distinguished. Among these forests appear marshes that are temporarily flooded between autumn and spring, whose predominant vegetation is the common reed (*Phragmites australis* (Cav.)) (Rubio-Delgado *et al.*, 1998). The fauna richness is remarkable, with presence of Mediterranean endemisms among crustaceans, bivalves and pupfish; it is an important site for aquatic birds in the wetland and insectivorous birds in the forest; species of toads, frogs, tortoises, snakes, lizards, geckos, bats and small mammals are present, as well as huge insect diversity (GVA, 2015).

Several entomological studies have been carried out in the Devesa de El Saler (Docavo, 1983; Tormos and Jiménez, 1986a; Tormos and Jiménez, 1986b; Anento and Selfa, 1997; Baixeras *et al.*, 2006; Bueno-Marí *et al.*, 2010; Chordá, 2014; Rueda *et al.*, 2017; Millán and Rueda, 2018). Among them it is highlighted, above all, the research carried out on Braconidae wasps (Docavo *et al.*, 1987; Falcó, 1991; Docavo *et al.*, 1992; Moreno *et al.*, 1992; Falcó *et al.*, 1993a, 1993b). The braconid parasitoids, their phytophagous hosts and vegetation interactions have been the aim of the study of the Laboratory of Entomology and Pest Control of the University of Valencia during more than 30 years.

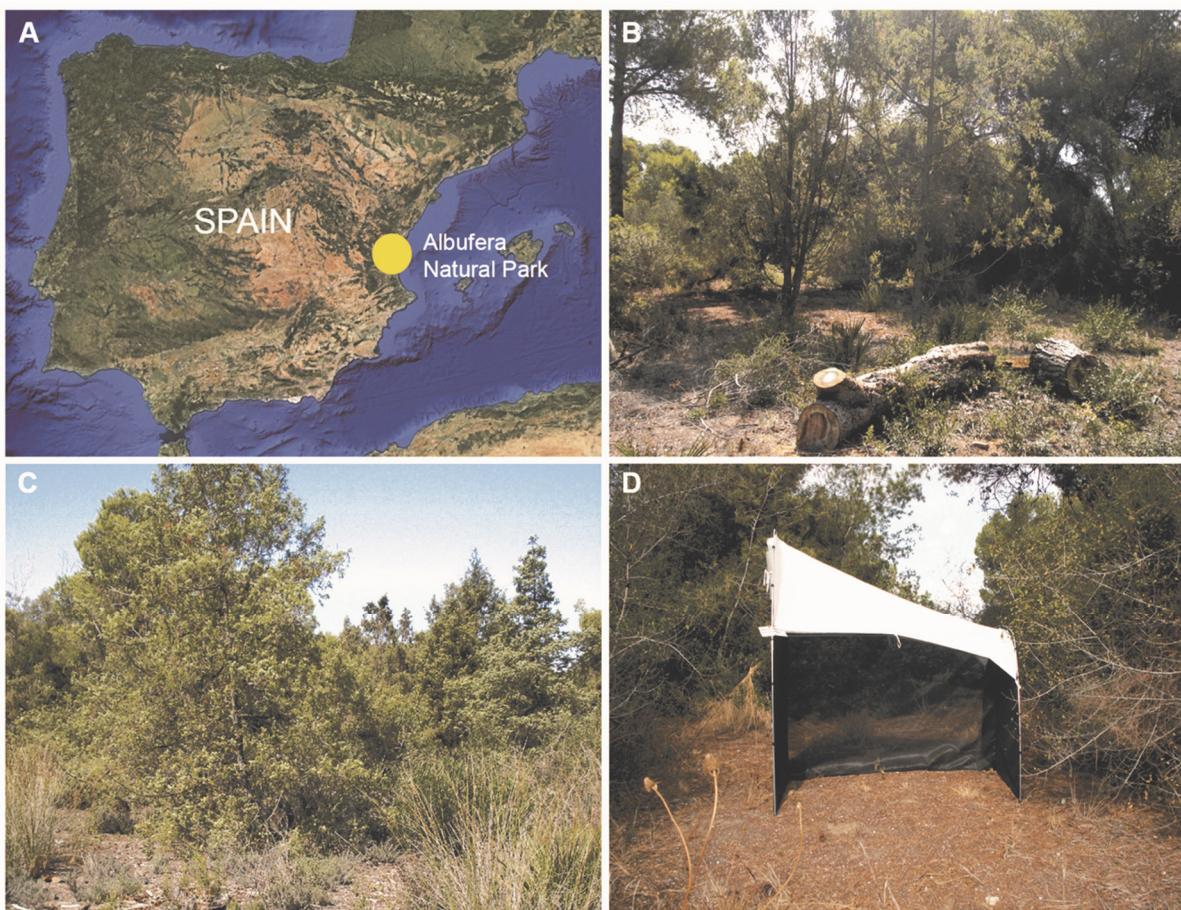
In the present work, the diversity, biology and phenology of several groups of parasitoid wasps inhabiting the Albufera Natural Park is studied. The information of the family Braconidae regarding previous knowledge is extended and new data about other parasitoid families and superfamilies are provided.

## Material and methods

Hymenoptera parasitoid fauna was studied in the Albufera Natural Park which is characterized by the typical Mediterranean climate of moderate temperatures, being an average of 17.8°C, and the irregular rainfall model of drought in summer and torrential rainfall in autumn but annual average values ranging from 300 mm to 450 mm.

Specimen capture was carried out by two Malaise traps (Townes model) located in different sites in the Park: one in Racó de l'Olla, between the Devesa and the lagoon, and other one in Tancat de la Creu, at the north border of Devesa. Both sites have the same vegetal physiognomy although the dominant trees are *Juniperus macrocarpa* Sibth. & Sm. and *Pinus halepensis* Mill., respectively (Fig. 1).

Sampling work took place from May 2015 to November 2016, being the collection of material every two weeks, with a few exceptions due to unforeseeable circumstances. Captured specimens were



**Fig. 1.** The Albufera Natural Park. **A.** Location. **B-C.** Landscape with *Juniperus macrocarpa* trees. **D.** Malaise trap.

preserved in ethanol 70%. Samples were revised and classified by insect orders. The hymenopteran material was specially studied and parasitoid families were preserved in labelled vials.

The identification to superfamily and family level was carried out using the guide to families by Goulet and Huber (1993) while Braconidae subfamilies were identified following the keys of van Achterberg (1993). The classification of Hymenoptera and its composition of suborders, superfamilies and families is in accordance with Aguiar *et al.* (2013). Biological comments are based on Goulet and Huber (1993). All collected material is deposited in the Colección Entomológica de la Universidad de Valencia (ENV; Valencia, Spain).

## Results and Discussion

A total of 7,464 specimens belonging to seven superfamilies of Hymenoptera Parasitica has been collected: Ceraphronoidea (106), Chalcidoidea (3,552), Cynipoidea (10), Evanioidea (680), Ichneumonoidea (788), Platygastroidea (2,087), and Proctotruipoidea (241). The list of the eleven families captured and its abundance is provided in Table I. All families of Chalcidoidea are considered as only one group.

Ceraphronoidea is composed by two families. Both Ceraphronidae and Megasilidae have been found in the Albufera Natural Park. Members are primary parasitoids of Diptera, Homoptera Coccoidea, Lepidoptera, Neuroptera, Thysanoptera and Braconidae Aphidiinae.

Chalcidoidea includes 22 families, of which 17 are present in Europe. The great diversity of species, about 22,800 worldwide, shows a high diversity of biological strategies; few are phytophagous or predators, but the vast majority are parasitoids of 12 insect orders, spiders and acari. It is clearly the most abundant superfamily in the Natural Park.

Cynipoidea comprises five families, but only three of them are recorded from Europe. Cynipidae is a phytophagous group, including gall formers and inquines of other gall-forming insects. Figitidae is biologically diverse with members parasitoids of larvae of Neuroptera Chrysopidae, hyperparasitoids

**Table I.** Family and superfamily abundance of specimens collected in the Albufera Natural Park. \*Chalcidoidea material not sorted by family groups.

Superfamily	Family	Specimens
Ceraphronoidea	Ceraphronidae	56
	Megaspilidae	50
Chalcidoidea	*	3552
Cynipoidea	Figitidae	10
	Evaniiidae	677
Evanoidea	Gasteruptiidae	3
	Braconidae	296
Ichneumonoidea	Ichneumonidae	492
	Platygastroidea	2087
Proctotruopoidea	Diapriidae	205
	Heloridae	17
	Proctotrupidae	19
<b>Total:</b>		<b>7464</b>

of Aphidae (Homoptera) through Braconidae (Aphidiinae) and Aphelinidae, hyperparasitoids of Psylloidea (Homoptera) through Encyrtidae, but mostly they are koinobiont parasitoids of Diptera. The rare family Ibaliiidae (Symphyta) has not been found in the studied area.

Evanoidea contains three families. Aulacidae parasitizes larvae of wood-boring Coleoptera and hymenoptera Symphyta; it is not present in the studied area. Gasteruptiidae shows ectoparasitoids or kleptoparasitoids in the nests of solitary bees or wasps. And Evaniiidae whose species are technically predators on eggs of cockroaches, but since only one evaniid egg is deposited into the ootheca, as a host unity, and only the larva consumes the insides, then they can be considered parasitoids; as far as is known the family parasitize only Blattodea egg-cases.

Ichneumonoidea is composed by the two largest families in the Hymenoptera: Braconidae and Ichneumonidae, with about 43,500 species together. Ichneumonoids parasitize mainly larvae and pupae of many holometabolous insects; some ichneumonids use egg cocoons or adults of spiders; many braconids parasitize nymphal Hemimetabola such as Homoptera Aphididae, Heteroptera, Isoptera, and Psocoptera, or also adult Coleoptera and Hymenoptera. They can be idiobiont or egg-larval and larva-pupal koinobiont parasitoids.

Platygastroidea is currently considered to be composed of only the family Platygastridae. The other (former) family group, Scelionidae, is now recognized at subfamily rank. The Scelioninae biological strategy is solitary idiobiont endoparasitism in eggs of insects, mainly Hemiptera, Lepidoptera and Orthoptera, and spiders. Platygastrinae includes solitary idiobiont parasitoids in eggs of Coleoptera, Diptera and Homoptera, or solitary and polyembryonic koinobiont parasitoids of gall-forming Diptera Cecidomyiidae. It is the second most abundant group in the Albufera Natural Park.

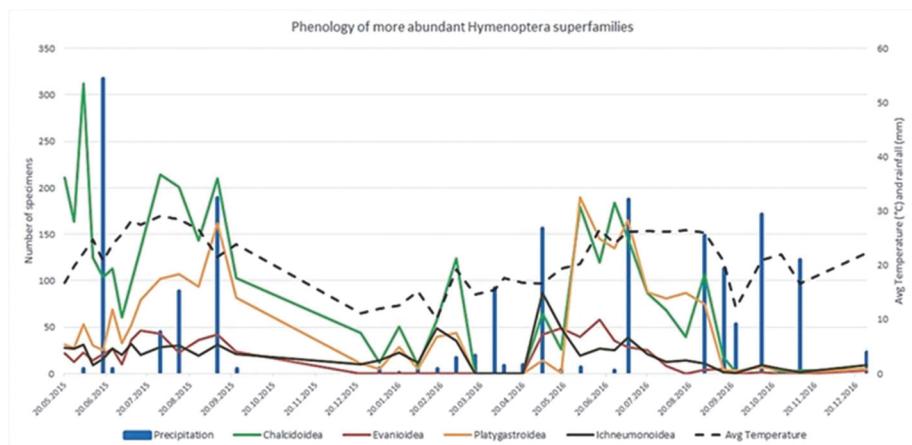
Proctotruopoidea contains eight families worldwide but only three are represented in Europe. Vanhorniidae parasitizes larvae of Coleoptera; it is not recorded from Spain. Heloridae includes endoparasitoids specifically in larvae of Neuroptera Chrysopidae, adults emerge from the host cocoon. Proctotrupidae species are mostly solitary or gregarious endoparasitoids of larvae of Coleoptera living in soil litter and rotten wood.

Diapriidae is included by some authors (Aguiar *et al.*, 2013) in its proper superfamily but phylogenetic studies are not definitive and, like many other authors (Goulet and Huber, 1993), here is included as family among proctotrupoids. Diapriids are larval-pupal or pupal endoparasitoids of Diptera; few of them attack Coleoptera and others Hymenoptera Dryinidae.

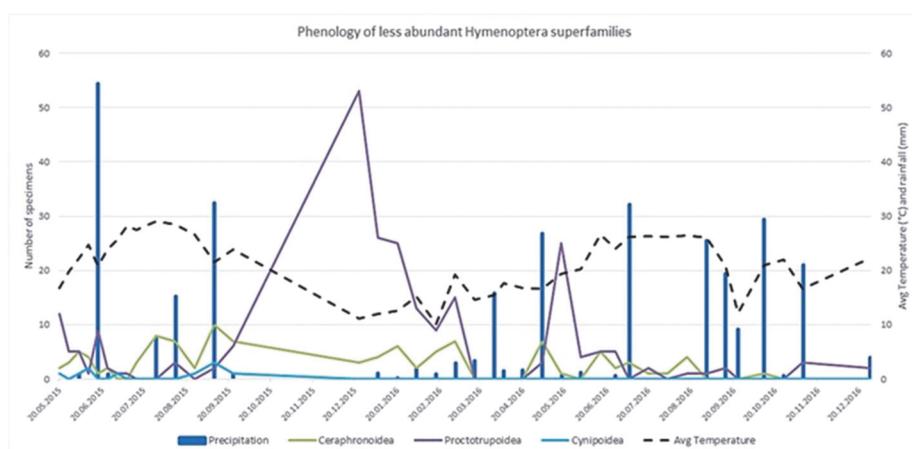
Another one of the main goals of this study has been the analysis of the phenology of the parasitoid groups collected in the Albufera Natural Park in order to emphasize the dates of occurrence of biological events in their annual cycle and how these ones are influenced by seasonal variations in climate and habitat factors (Figs. 2, 3).

During the collection period, it is possible to notice that specimens belonging to Hymenoptera Parasitica can be found throughout the year. The specimen abundance is higher from May to July (spring and early summer) and it is lower along the rest of the months. Several peaks throughout the studied period highlight the moments of maximum adult flight activity. These peaks correspond to the time taken by adult parasitoids to find the right host. The first one corresponds to spring and summer (May-September 2015), with minor fluctuations. This peak is composed mainly by chalcidoids, platygastroids, evanioids and ichneumonoids, listed in order of abundance. There is another flight peak, clear but not so apparent in the Albufera Natural Park; it occurs in late autumn and winter (December 2015 - April

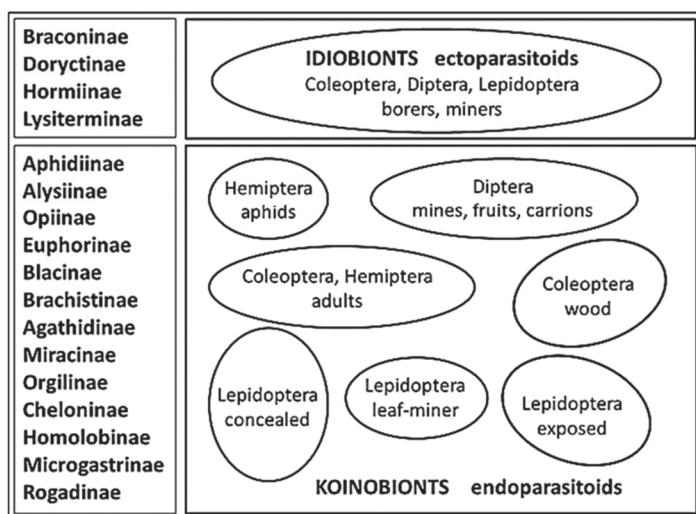
**Fig. 2.** Phenology of Hymenoptera Parastica superfamilies in the Albufera Natural Park: the four more abundant superfamilies (Chalcidoidea, Evanioidea, Ichneumonoidea and Platygastroidea).



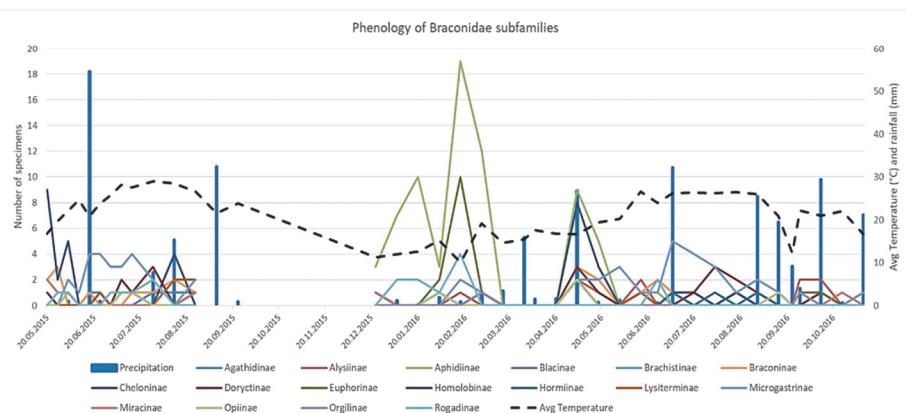
**Fig. 3.** Phenology of Hymenoptera Parastica superfamilies in the Albufera Natural Park: the three less abundant superfamilies (Ceraphronoidea, Proctotrupoidea and Cynipoidea).



**Fig. 4.** Braconidae biological strategies.



**Fig. 5.** Phenology of Braconidae subfamilies in the Albufera Natural Park.



2016) first due to proctotrupoids and then due to chalcidoids and platygastroids. In next spring and summer (May-August 2016) other flight peak is repeated, beginning by the apparition of ichneumonoids, evanioids and clearly maintained by chalcidoids and platygastroids. The potential autumn peak of 2016 is not so sharply manifested.

Comparing abundance peaks with climatic conditions (temperature and rainfall) (Figs. 2, 3), it is observed that the maximum peaks occur when the temperature ranges oscillate between 22°C and 29°C. Population abundance is affected by rain events, like the storm of June 2015 or the rains of autumn in 2016 which seem to have influenced the decrease in adult parasitoid activity.

Among all Hymenoptera Parasitica, the Ichneumonoidea superfamily and specifically the family Braconidae was analyzed in depth because its vast diversity in biological strategies.

A total of 296 braconids were collected during the study belonging to 17 subfamilies (Table II). Aphidiinae with 71 specimens is the most abundant subfamily, followed by Microgastrinae, Cheloninae, Braconinae and Doryctinae (55, 35, 23, 20, respectively). On the other hand, a group of three subfamilies (Alysiinae, Euphorinae and Rogadinae) is represented in a range of 10–20 specimens while Agathidinae, Hormiinae, Miracinae, Lysiterminae and Opiinae are represented by 5–10 specimens, and Blacinae, Brachistinae, Homolobinae and Orgilinae by only 1–2 specimens.

It is considered that braconids are represented in the European fauna by 33 subfamilies (van Achterberg, 2013), 17 of them have been collected in the Albufera Natural Park. This ensemble of parasitoids shows a very diverse set of biologies and groups of selected hosts. The biological strategies of Braconidae subfamilies are summarized in Fig. 4.

Some subfamilies are constituted by ectoparasitoids. Most members of Braconinae are idiobiont ectoparasitoids of concealed larvae of xylophagous and stem-boring Coleoptera and Lepidoptera larvae, and rarely of Diptera and Hymenoptera Symphyta.

The subfamily Doryctinae mostly incorporates solitary idiobiont ectoparasitoids of xylophagous and stem-boring Coleoptera larvae; while Hormiinae and Lysiterminae are gregarious ectoparasitoids of concealed Lepidoptera larvae.

All other collected subfamilies are endoparasitoids of several specific hosts. Alysiinae and Opiinae subfamilies are composed by solitary koinobiont endoparasitoids of exclusively Diptera Cyclorrhapha larvae. Aphidiinae includes solitary koinobiont endoparasitoids of nymphs and adults of Homoptera Aphididae. Endoparasitoids of Lepidoptera are the subfamilies Agathidinae, Cheloninae (solitary egg-larval parasitoids), Homolobinae, Microgastrinae (solitary or gregarious parasitoids), Miracinae, Orgilinae and Rogadinae; of Coleoptera larvae are the subfamilies Blacinae and Brachistinae. Finally, members of Euphorinae are koinobiont endoparasitoids of several different orders of insects including Coleoptera, Hemiptera, Hymenoptera, Neuroptera, Orthoptera and Psocoptera; usually parasitizing adult and nymphal stages.

The phenological study of this family and subfamilies showed that Braconidae can be found throughout the year (Fig. 5). Their abundance fluctuated in the number of collected specimens and two flight activity peaks. The first peak corresponds to February-May due to the high abundance, especially of Aphidiinae, Euphorinae and Microgastrinae. The second one is situated between June-August with Microgastrinae as the more abundant group. Both peaks correspond to moderate temperature ranges which oscillate between 14°C and 21°C. However, there are significant differences between subfamilies and it is possible to find subfamilies regularly present in the environment through the year such as Microgastrinae; subfamilies that appear only in the cold-moderate months (average of 11–20°C) such as Alysiinae, Aphidiinae or Euphorinae; or subfamilies such as Agathidinae, Braconinae, Cheloninae or Opiinae present in the habitat only when temperatures are moderate-warm (average of 22–26°C) (Table II).

To complete that table and obtain a better phenological representation, months where there is a potential high probability to find specimens in the field have also been marked as “presumed presence”. The selection has been determined by the absence of collecting specimens in traps in one month between two months of presence.

## Conclusion

The diversity and phenological analysis showed that parasitoid wasps are present in the Park throughout the year, carrying out the natural control of insect populations. However, clear differences in its biology and its adaptation to climatic conditions were found because, while some families and genera appear during the whole year, others are only found at specific seasons. These results are very similar to those previously found by Jiménez-Peydró and Peris-Felipo (2011), Falcó-Garí *et al.* (2014), and Safahani *et al.* (2018) where the most abundant period coincided with the greatest herbaceous diversity.

**Table II. Braconidae abundance and monthly occurrence by subfamily in the Albufera Natural Park.**

■ Registered presence ■ Presumed presence

Subfamily	Specimens	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Agathidinae	9			■			■						
Alysiinae	11	■	■			■	■				■	■	■
Aphidiinae	71	■	■	■	■	■	■					■	■
Blacinae	2		■										■
Brachistinae	1			■									
Braconinae	23					■	■	■	■	■	■		
Cheloninae	35												
Doryctinae	20					■	■	■	■	■	■		
Euphorinae	18	■	■	■	■	■					■	■	■
Homolobinae	1					■							
Hormiinae	6			■	■	■	■						
Lysiterminae	8							■					
Microgastrinae	55	■	■	■	■	■	■	■	■	■	■	■	■
Miracinae	9					■	■				■	■	■
Opiinae	7		■			■	■	■	■	■			
Orgilinae	2			■	■						■		
Rogadinae	18	■	■			■	■	■					
<b>Total</b>	<b>296</b>												

In conclusion, this study was conducted to show the biodiversity of the parasitoid wasps in the Albufera Natural Park. A biodiversity that not only indicates the number of groups of wasps but also reflects complex parasitoid-host-plant interactions. All this taxonomical and ecological diversity has remained until today because of the tenacity of all those who fought to keep this Natural Park alive; people like Félix.

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### References

- Achterberg, C. van 1993. Illustrated key to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea). *Zoologische Verhandeligen*, 283: 1–189.
- Achterberg, C. van 2013. *Fauna Europaea: Braconidae*. Fauna Europaea version 2017.06, <https://fauna-ue.org>. (Revised January 2020).
- Aguiar, A.P., A.E. Deans, M.S. Engel, M. Forshage, J.T. Huber, J.T. Jennings, N.F. Johnson, A.S. Lelej, J.T. Longino, V. Lohrmann, I. Miko, M. Ohl, C. Rasmussen, A. Taeger & D.S.K. Yu 2013. Hymenoptera. *Zootaxa*, **3703**(1): 51–62. doi: 10.11646/zootaxa.3703.1.12. In: Zhang, Z.-Q. (Ed.) Animal Biodiversity: An Outline of Higher-level Classification and Survey of Taxonomic Richness (Addenda 2013). *Zootaxa*, **3703**: 1–82.
- Anento, J.L. & J. Selva 1997. Primeros datos sobre la fauna de Ichneumoninae (Hymenoptera: Ichneumonidae) en tres parques naturales de Comunitat Valenciana. *Ecología*, **11**: 501–509.
- Baixeras, J., J.M. Michelet, P. González, F. Ocharan, C. Quirce, M.A. Marcos, E. Soler, J. Domingo, S. Montagud, A. Gutiérrez & M. Arles 2006. *Les libellules de la Comunitat Valenciana*. Generalitat Valenciana, Conselleria de Territori i Habitatge, Valencia, 170 pp.
- Bueno-Marí, R., E. Corella-López & R. Jiménez-Peydró 2010. Culicidoфаuna (Diptera: Culicidae) presente en los distintos enclaves hídricos de la ciudad de Valencia (Espanya). *Revista Colombiana de Entomología*, **36**(2): 235–241.
- Chordà, A. 2014. *Biología de mosquitos (Diptera: Culicidae) en enclaves representativos de la Comunidad Valenciana*. Tesis Doctoral. Universidad de Valencia. Valencia, 550 pp.
- Docavo, I. 1983. *La entomofauna de la Albufera y su entorno*. Institución Alfonso el Magnánimo, Valencia, 230 pp.

- Docavo, I., R. Jiménez, J. Tormos & M.J. Verdú 1987. Braconidae y Chalcidoidea (Hym., Apocrita, Terebrantia) parásitos de Agromyzidae (Dipt., Cyclorrhapha) en la Comunidad Valenciana. *Inv. Agrar.: Prod. Prot. Veg.*, **2**: 195–209.
- Docavo, I., J. Tormos, J.D. Asís & S.F. Gayubo 1992. Dacnusini (Hymenoptera, Braconidae, Alysiinae) en la provincia de Valencia (España). *Misc. Zool.*, **16**: 105–111.
- DOGV. 1986. *Decreto 89/1986, de 8 de julio, del Consell de la Generalitat Valenciana, de régimen jurídico del Parque Natural de la Albufera*. Diario Oficial de la Generalitat Valenciana (DOGV), núm 408 de 23.07.1986.
- Falcó, J.V. 1991. *Contribución al estudio de las subfamilias Braconinae, Doryctinae y Rogadinae (Hymenoptera, Braconidae) de España*. Tesis Doctoral. Universitat de València. 503 pp.
- Falcó, J.V., J. Moreno & R. Jiménez 1993a. Datos sobre Ciclostominos ibéricos: I. Braconinae (Hymenoptera, Braconidae). *Boletín de la Asociación española de Entomología*, **17**(1): 71–90.
- Falcó, J.V., J. Moreno & R. Jiménez 1993b. Datos sobre Ciclostominos españoles: II. Doryctinae (Hymenoptera, Braconidae). *Boletín de la Asociación española de Entomología*, **17**(2): 65–75.
- Falcó-Garí, J.V., F.J. Peris-Felipo & R. Jiménez-Peydró 2014. Diversity and phenology of the braconid community (Hymenoptera: Braconidae) in the Mediterranean protected landscape of Sierra Calderona. *Open Journal of Ecology*, **4**(4): 174–181. DOI: 10.4236/oje.2014.44018
- Goulet, H. & J.T. Huber (ed.) 1993. *Hymenoptera of the world: An identification guide to families*. Agriculture Canada, Research Branch, Publication 1894/E, Ottawa, Ontario. 668 pp.
- GVA 2015. *Fauna de L'Albufera*. Parques Naturales de la Comunitat Valenciana - L'Albufera. Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural. Generalitat Valenciana. <http://www.parquesnaturales.gva.es/es/web/pn-l-albufera/fauna-3817> (Revised January 2020).
- Jiménez-Peydró, R. & F.J. Peris-Felipo 2011. Diversity and community structure analysis of Opiinae (Hymenoptera: Braconidae) in the Forest Estate of Artikutza (Spain). *Florida Entomologist*, **94**(3): 472–479. DOI: 10.1653/024.094.0311
- Martínez-Lloréns, F. 2015. “*El Monte de la Dehesa del Saler*”, ordenación del destino turístico. Trabajo Final de Máster. Universitat Politècnica de València. 243 pp. <https://riunet.upv.es/bitstream/handle/10251/62045/Memoria.pdf?sequence=1>.
- Millán, A. & J. Rueda 2018. Coleópteros y hemípteros acuáticos de las malladas de la Devesa y del Racó de l’Olla (Parque Natural de L’Albufera, Valencia, España). *Boletín de la Sociedad Entomológica Aragonesa*, **62**: 141–148. Disponible en [www.sea-entomologia.org](http://www.sea-entomologia.org)
- Moreno, J., J.V. Falcó & R. Jiménez 1992. Sobre los Phanerotomini ibéricos. I. *Phanerotoma Wesmael*, 1838 (Hymenoptera, Braconidae). *Boletín de la Asociación española de Entomología*, **16**: 149–159.
- Piquerias, N. (coord.). 2017. *El Saler per al poble, ara!* Catàlegs d’Exposicions. Publicacions de la Universitat de València. 352 pp.
- Rubio-Delgado, J.L., V. Andreu-Pérez & E. Sanchis-Duato 1998. Los suelos de la Devesa de la Albufera. *Revista Valenciana d'Estudis Autònòmics*, **22**: 129–144.
- Rueda, J., R. Hernández, J.M. Benavent & V. Benedito-Durà 2018. Contribución al conocimiento de los mosquitos (Diptera, Culicidae) de la Devesa y del Racó de l’Olla, Parque Natural de l’Albufera de Valencia (España). *Anales de Biología*, **39**: 63–73. DOI: 10.618/analesbio.39.07
- Safahani, S., S.M. Madijzadeh & F.J. Peris-Felipo 2018. Contribution to the fauna and phenological knowledge of high mountains Opiinae (Hymenoptera, Braconidae) in Kerman province (Iran). *Journal of Insect Biodiversity and Systematics*, **4**(2): 73–83.
- Sanjaume, E., F. Segura, M.J. López & J. Pardo 1992. Tasas de sedimentación en l’Albufera de València. *Cuadernos de Geografía*, **51**: 63–81.
- Soria, J.M. 2006. Past, present and future of la Albufera of Valencia Natural Park. *Limnetica*, **25**(1–2): 135–142.
- Temes, V., L.F. Vivanco, J. Cano & C. Ochoa 1964. Proyecto de ordenación turística de la Albufera y playas de Saler. La gran megápolis mediterránea. *COAM, Revista Arquitectura*, **65**: 13–21.
- Tormos, J. & R. Jiménez 1986a. Esfécidos de la provincia de Valencia (Hym., Sphecoidea). *Graellsia*, **XLII**: 121–130.
- Tormos, J. & R Jiménez 1986b. Estudio comparativo de la esfécido fauna de la Dehesa del Saler (Hym., Sphecoidea). *Eos*, **LXII**: 315–318.
- TVE 1970a. *Vida Salvaje - Fábrica de Patos*. Serie El Planeta Azul. Diffusion date: 31/05/1970; duration: 26:22 min. <http://www.rtve.es/alacarta/videos/el-planeta-azul/planeta-azul-vida-salvaje-fabrica-patos/3013557/>.
- TVE. 1970b. *Vida Salvaje - La Albufera de Valencia*. Serie El Planeta Azul. Diffusion date: 28/06/1970; duration: 23:22 min. <http://www.rtve.es/alacarta/videos/el-planeta-azul/vida-salvaje-albufera-valencia/3013598/>.
- TVE 1974. *Los que conservan los paraísos*. Serie El Planeta Azul. Diffusion date: 18/01/1974; duration: 24:53 min. <http://www.rtve.es/alacarta/videos/el-planeta-azul/planeta-azul-conservan-paraisos/3013600/>.