

New contributions to the Eulophidae fauna from Morocco (Hymenoptera, Chalcidoidea) with comparison in the North African region

K. Kissayi, S. Benhalima, A. Benhoussa

Kissayi, K., Benhalima, S., Benhoussa, A., 2019. New contributions to the Eulophidae fauna from Morocco (Hymenoptera, Chalcidoidea) with comparison in the North African region. *Arxius de Miscel·lània Zoològica*, 17: 161–177, Doi: <https://doi.org/10.32800/amz.2019.17.0161>

Abstract

New contributions to the Eulophidae fauna from Morocco (Hymenoptera, Chalcidoidea) with comparison in the North African region. We present an update of the Moroccan Eulophidae following samples collected in the Maâmora forest between 2012 and 2014, and completed with a thorough bibliographic study. We report seven genera for the first time in Morocco: *Allocerastichus* Masi, 1924; *Euderomphale* Girault, 1916; *Eulophus* Geoffroy, 1762; *Euplectrus* Westwood, 1832; *Microlycus* Thomson, 1878; *Tamarixia* Masi, 1924 and *Trjapitzinichus* Kostjukov & Kosheleva, 2006 and six species: *Baryscapus impeditus* (Nees, 1864); *Ceraninus menes* (Walker, 1839); *Elachertus lateralis* (Spinola, 1808); *Elasmus atratus* Howard, 1897; *Microlycus biroi* (Erdős, 1951) and *Trjapitzinichus politus* (Graham, 1991). A possible new species (*Baryscapus* n. sp.) and two unidentified species (*Allocerastichus* sp. and *Euderomphale* sp.) are included in the list of Moroccan Eulophidae.

Data published through GBIF ([Doi: 10.15470/wpyzuh](https://doi.org/10.15470/wpyzuh))

Keys word: Hymenoptera, Chalcidoidea, Eulophidae, Additions, Morocco

Resumen

Nuevas aportaciones a la fauna de Eulophidae de Marruecos (Hymenoptera, Chalcidoidea) y comparación con la de la región del norte de África. En este artículo se presenta una actualización de los Eulophidae de Marruecos tras un estudio de las muestras recolectadas en el bosque de Maâmora entre 2012 y 2014, completándose con una minuciosa revisión bibliográfica. Se han registrado por primera vez en Marruecos siete géneros: *Allocerastichus* Masi, 1924; *Euderomphale* Girault, 1916; *Eulophus* Geoffroy, 1762; *Euplectrus* Westwood, 1832; *Microlycus* Thomson, 1878; *Tamarixia* Masi, 1924 y *Trjapitzinichus* Kostjukov & Kosheleva, 2006 y seis especies: *Baryscapus impeditus* (Nees, 1864); *Ceraninus menes* (Walker, 1839); *Elachertus lateralis* (Spinola, 1808); *Elasmus atratus* Howard, 1897; *Microlycus biroi* (Erdős, 1951) y *Trjapitzinichus politus* (Graham, 1991). Se han incluido en la lista de Eulophidae de Marruecos una posible nueva especie (*Baryscapus* n. sp.) y dos especies no identificadas (*Allocerastichus* sp. and *Euderomphale* sp.).

Datos publicados en GBIF ([Doi: 10.15470/wpyzuh](https://doi.org/10.15470/wpyzuh))

Palabras clave: Hymenoptera, Chalcidoidea, Eulophidae, Adiciones, Marruecos

Resum

Noves aportacions a la fauna d'Eulophidae del Marroc (Hymenoptera: Chalcidoidea) i comparació amb la de la regió del nord d'Àfrica. En aquest article es presenta una actualització dels Eulophidae del Marroc després d'un estudi de les mostres recol·lectades al bosc de Maàmora entre 2012 i 2014 i es completa amb una minuciosa revisió bibliogràfica. S'han registrat per primera vegada al Marroc set gèneres: *Allocerastichus* Masi, 1924; *Euderomphale* Girault, 1916; *Eulophus* Geoffroy, 1762; *Euplectrus* Westwood, 1832; *Microlycus* Thomson, 1878; *Tamarixia* Masi, 1924 i *Trjapitzinichus* Kostjukov i Kosheleva, 2006 i sis espècies: *Baryscapus impeditus* (Nees, 1864); *Ceraninus menes* (Walker, 1839); *Elachertus lateralis* (Spinola, 1808); *Elasmus atratus* Howard, 1897; *Microlycus biroi* (Erdős, 1951) i *Trjapitzinichus politus* (Graham, 1991). S'han inclòs a la llista d'Eulophidae del Marroc una possible nova espècie (*Baryscapus* n. sp.) i dues espècies no identificades (*Allocerastichus* sp. i *Euderomphale* sp.).

Dades publicades a GBIF ([Doi: 10.15470/wpyzuh](https://doi.org/10.15470/wpyzuh))

Paraules clau: Hymenoptera, Chalcidoidea, Eulophidae, Adicions, Marroc

Received: 17/04/2019; Conditional acceptance: 03/09/2019; Final acceptance: 17/09/2019

Khadija Kissayi, Department of Forestry Development, National Forestry School of Engineers, B. P. 511, Tabriquet, 11 000 Salé, Morocco.– Souâd Benhalima, Laboratory of Geo–Biodiversity and Natural Heritage (GEOBIO), Scientific Institute, Research Center (GEOPAC), Mohammed V University, Avenue Ibn Battouta, B. P. 703, Agdal, 10 106 Rabat, Morocco.– Abdelaziz Benhoussa, Department of Biology, Mohammed V University, Faculty of Sciences, Ibn Battouta Avenue, B. P. 1014, Agdal, 10 106 Rabat, Morocco.

Corresponding author: K. Kissayi. E–mail: Kissayi_k@yahoo.fr

Research Gate profile: https://www.researchgate.net/Khadija_Kissayi

Introduction

The family Eulophidae (Hymenoptera, Chalcidoidea) currently comprises 6,038 species belonging to five subfamilies (Noyes, 2019). Several phylogenetic studies have been carried out on this family (Gauthier et al., 2000; Burks et al., 2011; Munro et al., 2011; Heraty et al., 2013). Members of the Eulophidae family are recognized as parasitoids of many insects belonging to Coleoptera, Diptera, Hemiptera, Hymenoptera, and Lepidoptera (Noyes, 2019). They parasitize older larvae or nymphs of holometabolous insects and paralyze them or kill them by multiple bites of the laying female that feeds on the host's juices (Blanchot 1992). Thus, a large number of species in this group have been used in biological control against various crop pests (Cochereau, 1969; Lecoustre et al., 1980; Clair et al., 1987; Etienne and Dumbardon–Martial, 2013; Yefremova et al., 2015).

In their notes on agricultural and forestry entomology in Morocco, De Lépiney and Mimeur (1932) mentioned many parasitoids, including five eulophids [*Dibrachys cavus* (Walker, 1835), *Di cladocerus westwoodii* Westwood, 1832, *Neochrysocharis formosus* (Westwood, 1833), *Pachyneuron vindemmiae* (Rondani, 1875), *Tetrastichus epilachnae* (Girard, 1895)].

Another species, *Chrysocharis pubicornis* (Zetterstedt, 1838), was later cited by Jourdan and Rungs (1934). Two years after this, Rungs (1936) reported *Tetrastichus inunctus* (Nees, 1834) and Smirnov (1950, 1956) cited *Aprostocetus minutus* (Howard, 1881). A few years later, Delucchi (1962) published a first monograph of the Eulophidae fauna in Morocco, composed of 12 species. At the end the 1990s, other researchers reported the presence of several further species such as *Semiela cher petiolatus* (Girault, 1988) and *Citrostichus phyllocnistoides* (Narayanan, 1960) used in biological control in agriculture (Nia et al., 1997; Abbassi et al., 1999; Rizqi et al., 2003; Pintureau et al., 2003; Delvare et al., 2011; Smaili et al., 2013). Meantime, in the forest domain, Eulophidae species have been described by El Alaoui El Fels et al. (1999), Maatouf and Lumaret (2012) and Kissayi and Benhalima (2018). In summary, according to a recent study by Noyes (2019), 36 species of Eulophidae are known from Morocco, but 14 previously described species were not included in their study (2019). Therefore, we consider that before our study, a total of 50 species were known from Morocco. The aim of this study was to provide an updated annotated checklist of the Moroccan Eulophidae with new data, general distribution, and host preferences.

Material and methods

Study area

Samples were collected at three stations in the Maâmora forest (fig. 1): Taïcha (Station 1), 34° 13' 29,5" N, 6° 39' 04,8" W, 36 m; Aïn Johra (Station 2), 34° 06' 34,2" N, 6° 19' 04,0" W, 175 m; Aïn Assou Kceïbia (Station 3), 34° 12' 07,9" N, 6° 15' 10,8" W, 84 m.

This work has been completed through a bibliographic research.

Collection method

The samples were collected once a week using Malaise traps during the following periods: from May 26th to October 8th in 2012, from May 24th to September 23rd in 2013, and from November 27th to June 14th in 2013. After sorting, the specimens were preserved in alcohol at 70° for identification.

Terminology used

Identifications are based on Narendran (2011); Triapitsyn and Headrick (1995); Protasov et al. (2007a, 2007b); Bouček (1959, 1977, 1988); Erdős (1954); Harris (1979); Delucchi and Remaudière (1966); Bouček and Askew (1968a); Graham (1987, 1991); Doğanlar et al. (2011); LaSalle (1994).

The work of the determinations of this family was preceded by a thorough bibliographical study.

Abbreviations

CIRAD, Center for International Agricultural Cooperation for Development, Montpellier, France.

INAV, National Agronomic and Veterinary Institute Hassan II, Rabat, Morocco.

CKK, Khadija Kissayi Collection.

* genus or species new to Moroccan fauna identified during this study.

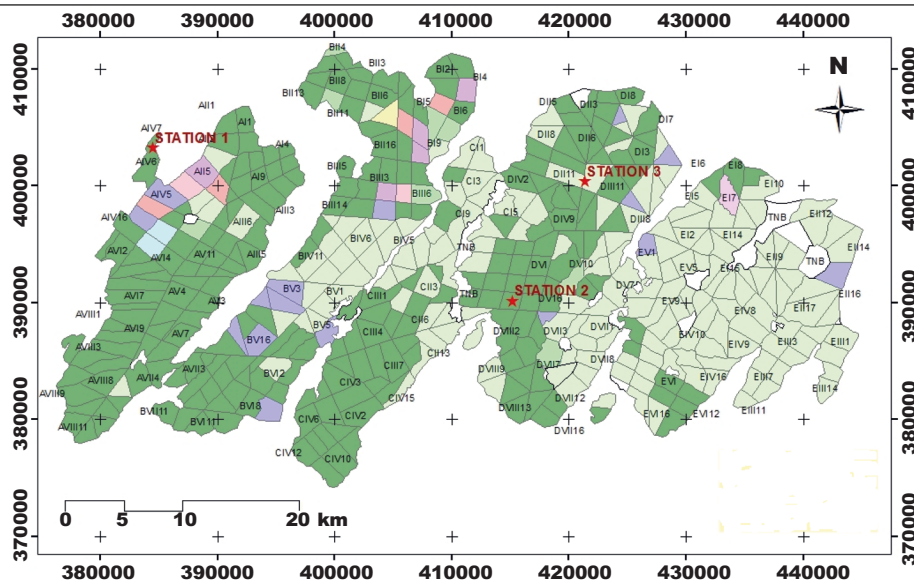


Fig. 1. Study sites (★) and location of sampling traps in Maâmore forest.

Fig. 1. Emplazamientos de estudio (★) y localización de las trampas de muestreo en el bosque de Maâmore.

Results

Morocco currently has 56 species of Eulophidae, of which 36 had previously been reported from Morocco (Noyes, 2019). The biodiversity of this family has increased by seven genera, six species, one new species (*Baryscapus* n. sp.) and two unidentified species (*Allocerastichus* sp. and *Euderomphale* sp.) following the new faunal surveys in Maâmore complemented by our investigations of Moroccan and international documentary research. Of these, several publications contained faunal data that have not been recorded previously to date or are absent from any catalog.

Commented list of newly named Eulophidae species in Morocco

Below we report the list of Eulophidae species present in Morocco ([see dataset published in GBIF, doi: 10.15470/wpyzuh](https://doi.org/10.15470/wpyzuh)), with updated names, geographical distribution (when the locality is not available one notes 'Morocco'), references, hosts and distributions on the global scale according to Noyes (2019).

Order Hymenoptera L., 1758
Superfamily Chalcidoidea Latreille, 1817
Family Eulophidae Westwood, 1829
Sufamily Entedoninae Förster, 1856

****Ceraninus* Walker, 1842**

****Ceraninus menes* (Walker, 1839)**

Material studied: Maâmora Forest, canton D, Aïn Johra commune, Al Maha 34° 06' 34,2" N, 6° 19' 04,0" W, 75 m, 1 ♀, 30 V 2013, K. Kissayi leg. (CKK).

Insects hosts: Thysanoptera, Thripidae (Noyes, 2019).

General distribution: Afrotropical, Indomalaya, Neotropical, Palaearctic (Bulgaria, Canary Islands, Czech Republic, Czechoslovakia, France, Germany, Greece, Hungary, Ireland (north and south), Israel, Italy, Japan, Korea, Korea, South, Moldova, Montenegro, Netherlands, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, USSR and Morocco).

***Chrysocharis* Förster, 1856**

***Chrysocharis pubicornis* (Zetterstedt, 1838)**

(= *C. aeneiscapus* (Thomson, 1878) = *C. syma* Walker, 1839)

Distribution in Morocco: species previously mentioned in Morocco by Jourdan and Rungs (1934, p.210) in Rabat, 10 III 1932; Fedala, 23 II 1932, Kozlowsky leg.; these records are not included in Noyes (2019).

Insects hosts: Diptera, Agromyzidae, Cecidomyiidae, Drosophilidae, Tephritidae; Lepidoptera, Gracillariidae, Lyonetiidae, Nepticulidae, Tischeriidae, Tortricidae (Thompson, 1955; Hansson, 1985). In Morocco the species was obtained on pupae of *Phytomyza atricornis* Meigen, 1838 (Diptera, Agromyzidae) living on peas (Jourdan and Rungs, 1934).

General distribution: Holarctic, Australia, New Zealand, India and Yemen.

***Closterocerus* Westwood, 1832**

***Closterocerus chamaeleon* (Girault, 1922)**

Distribution in Morocco: species previously mentioned in Morocco by Kissayi and Benhalima (2018, p. 296): this record is not included in Noyes (2019).

Material studied: Maâmora Forest, canton D, Aïn Johra commune, Al Maha 34° 06' 34,2" N, 6° 19' 04,0" W, 175 m, 1 ♀, 03 VII 2012; Kceïbia commune, Aïn Assou 34° 12' 07,9" N, 6° 15' 10,8" W, 84 m, 1 ♂, 25 II 2014; canton A, Sidi Taïbi commune, Taïcha 34° 13' 29,5" N, 6° 39' 04,8" W, 36 m, 1 ♀, 14 V 2014, K. Kissayi leg. (CKK) (Kissayi and Benhalima, 2018, p. 296).

Insects hosts: Hymenoptera, Eulophidae [*Ophelimus eucalypti* (Ashmead) and *O. maskelli* (Ashmead)], gall wasps of *Eucalyptus* spp. (Protasov et al., 2007a). In Morocco, this species was obtained as a parasitoid of *Ophelimus maskelli* (Ashmead) (Hymenoptera, Chalcidoidea: Eulophidae) infesting *Eucalyptus camaldulensis* (Myrtaceae) (Kissayi and Benhalima, 2018). General distribution: Australia and introduced in the Mediterranean Basin.

****Euderomphale* Girault, 1916**

****Euderomphale* sp.**

Material examined: Maâmora forest, canton D, commune Kceïbia, Aïn Assou 34° 12' 07,9" N, 6° 15' 10,8" W, 84 m, 1 ♀, 02 VII 2013, K. Kissayi leg. (CKK).

***Horismenus* Walker, 1843**

***Horismenus hipparchia* (Cameron, 1913)**

Distribution in Morocco: species previously mentioned in Morocco by Crunze–Fisher (2017) but this record is not included in Noyes (2019).

Insects hosts: Lepidoptera, Limacodidae [*Phobetron hipparchia* (Cramer)] (De Santis, 1979; Hansson, 2009).

General distribution: Guyana and introduced in Morocco.

***Neochrysocharis* Kurdjumov, 1912**

***Neochrysocharis formosus* (Westwood, 1833)**

(= *Closterocerus formosus* Westwood, 1833)

Distribution in Morocco: species previously mentioned in Morocco from Rabat (De Lépiney and Mimeur, 1932, p. 60, 109) but this record is not included in Noyes (2019).

Insects hosts: Coleoptera, Chrysomelidae, Curculionidae; Diptera, Agromyzidae, Cecidomyiidae, Drosophilidae, Tephritidae; Hemiptera, Aleyrodidae, Aphididae; Hymenoptera, Cimbicidae, Diprionidae, Pamphiliidae, Tenthredinidae; Lepidoptera, Bucculatricidae, Coleophoridae, Elachistidae, Gelechiidae, Gracillariidae, Heliozelidae, Lasiocampidae, Lyonetiidae, Momphidae, Nepticulidae, Pyralidae, Yponomeutidae (Noyes 2019). In Morocco the species was obtained on *Agromyza* sp. mining the leaves of *Chrysanthemum* L. (De Lépiney and Mimeur, 1932). General distribution: Afrotropical, Indomalaya, Nearctic, Neotropical and Palaeartic.

***Subfamily Entiinae Hedqvist, 1974**

****Allocerastichus* Masi, 1924**

****Allocerastichus* sp.**

Distribution in Morocco: Fir forest Talassemtane National Park (Benyahia, 2016, p. 167).

Remarks: the specimen collected has affinities with the species *Allocerastichus doderi* Masi, 1924.

Subfamily Eulophinae Westwood, 1829

***Cirrospilus* Westwood, 1832**

***Cirrospilus vittatus* Walker, 1838**

Distribution in Morocco: species previously mentioned in Morocco from Belksiri, Sidi Slimane (Smaili et al., 2013, p. 158) but not included in Noyes (2019).

Insects hosts: Coleoptera, Curculionidae; Diptera, Agromyzidae, Cecidomyiidae; Hemiptera, Aleyrodidae, Asterolecaniidae; Hymenoptera, Argidae, Braconidae, Cimbicidae, Diprionidae, Tenthredinidae; Lepidoptera, Bucculatricidae, Coleophoridae, Elachistidae, Eriocraniidae, Gelechiidae, Gracillariidae, Heliozelidae, Lyonetiidae, Momphidae, Nepticulidae, Tischeriidae, Yponomeutidae (Noyes, 2019). In Morocco, this species has been observed on *Phyllocnistis citrella* Stainton, 1856 (Lepidoptera, Gracillariidae) living on citrus fruits (Smaili et al., 2013). General distribution: Palaeartic and Nearctic.

***Di cladocerus* Westwood, 1832**

***Di cladocerus westwoodii* Westwood, 1832**

(= *Solenotus viridis* Förster, 1856)

Distribution in Morocco: species previously mentioned in Morocco from Rabat (De Lépiney and Mimeur, 1932, p. 60, 108) but this record is not included in Noyes (2019).

Insects hosts: Diptera, Agromyzidae, Ephydriidae; Lepidoptera, Coleophoridae, Gelechiidae, Scythrididae, Tortricidae, Yponomeutidae (Herting, 1978). In Morocco, this species was obtained on *Agromyza pusilla* Meigen, 1830 living on Alfalfa (De Lépiney and Mimeur, 1932). According to Smirnov (1950), this species is recognized as a hyperparasitoid of the encyrtid *Homalotylus flaminus* (Dalman, 1820).

General distribution: Western Palaeartic, Neotropical, Nearctic and India.

***Elachertus* Spinola, 1811**

***Elachertus artaeus* (Walker, 1839)**

Distribution in Morocco: species previously mentioned in Morocco from Ras Al Ma, Azrou, Aïn Kahla (Mouna, 2013, p. 9) but this record is not included in Noyes (2019).

Insects hosts: Lepidoptera, Gelechiidae, Gracillariidae, Noctuidae, Notodontidae, Tortricidae

(Herting, 1975; Trjapitzin, 1978; Bouček and Askew, 1968; Tomov, 2002). In Morocco, this species was obtained as a parasitoid on the third stage of the caterpillars of *Acleris undulana* (Walsingham, 1900) (Lepidoptera, Tortricidae) (Mouna, 2013).

General distribution: Palaearctic and Australia.

****Elachertus lateralis* (Spinola, 1808)**

Material studied: Maâmora forest, canton A, Sidi Taïbi commune, Taïcha, 34° 13' 29,5" N, 6° 39' 04,8" W, 36 m, 1 ♀, 08 V 2014; canton D, Aïn Johra commune, Al Maha, 34° 06' 34,2" N, 6° 19' 04,0" W, 175 m, 1 ♂, 02 IV 2014; 1 ♀, 03 VII 2012, K. Kissayi leg. (CKK).

Insects hosts: Lepidoptera, Coleophoridae [*Coleophora* sp.]; Noctuidae [*Mamestra brassicae* (L., 1758)]; Tortricidae [*Olethreutes variegana* Hübner, 1799] (Noyes, 2019).

General distribution: Nearctic, Yemen and Palaearctic (Austria, Bulgaria, Canary Islands, China, France, Germany, Hungary, Italy, Korea, South, Madeira, Moldova, Netherlands, Romania, Russia, Spain, Sweden, Ukraine, United Kingdom, USSR and Morocco).

***Elasmus* Westwood, 1833**

***Elasmus atratus* Howard, 1897**

Distribution in Morocco: species previously mentioned in Morocco from Talassemrane National Park, Fir forest, 1 specimen, 19 VII 2013, colored trap, Y. Benyahia leg. (Benyahia, 2016, p. 172) but this record is not included in Noyes (2019).

Insects hosts: Lepidoptera, Arctiidae, Tortricidae, Lymantriidae, Pterophoridae, Pyralidae (Peck, 1963; Herting, 1975; Thompson, 1955).

General distribution: Canada, United States of America and Morocco*.

****Microlycus* Thomson, 1878**

****Microlycus biroi* Erdős, 1951**

Material studied: Maâmora forest, canton D, Kceïbia commune, Aïn Assou; 34° 12' 07,9" N, 6° 15' 10,8" W, 84 m, 1 ♂, 19 IX 2012, K. Kissayi leg. (CKK).

Hosts: not indicated.

General distribution: Western Palaearctic: Germany, Austria, Bulgaria, Hungary, Czech Republic, Russia, Slovakia, Sweden, Czechoslovakia and Morocco.

***Necremnus* Thomson, 1878**

***Necremnus artynes* (Walker, 1839)**

Distribution in Morocco: species previously mentioned in Morocco from Souss Massa region (Delvare et al., 2011, p. 1) but this record is not included in Noyes (2019).

Insects hosts: Lepidoptera, Momphidae (Bouček, 1977).

General distribution: Western Palaearctic and USA.

***Necremnus leucarthros* Nees, 1836**

Distribution in Morocco: species previously mentioned in Morocco from Ain Kahla, Azrou, Ras El Ma (Mouna, 2013, p. 9) but this record is not included in Noyes (2019).

Insects hosts: Coleoptera, Anthribidae, Apionidae, Chrysomelidae, Curculionidae, Staphylinidae; Diptera: Agromyzidae, Cecidomyiidae, Chloropidae; Lepidoptera, Coleophoridae, Eriocraniidae, Tortricidae, Yponomeutidae (Bouček, 1959; Bouček and Askew, 1968; Herting, 1975; Trjapitzin, 1978). In Morocco, the species is recognized as a parasitoid of the chrysalis of *Dichelia numidicola* Chambon (Lepidoptera, Tortricidae) (Mouna, 2013).

General distribution: Palaearctic, India, United States of America.

Subfamily Opheliminae Westwood

***Ophelimus* Haliday, 1844**

***Ophelimus maskelli* (Ashmead, 1900)**

Distribution in Morocco: species previously mentioned in Morocco from Rabat, Mohammedia, Oued Cherrat, Temara, Skhirate, Bouznika, Benslimane, Casablancan, Settat, El Jadida, Kenitra, Sidi Kacem, Sidi Slimane, Khemisset, Meknes, Larache and Khouribga (Kissayi and Benhalima, 2018, p. 294) but this record is not included in Noyes (2019).

Material studied: Maâmora forest, Kceïbia commune, Aïn Assou, 34° 12' 07,9" N, 6° 15' 10,8" W, 84 m, 3 ♀, 31 VII 2012, K. Kissayi leg. (CCK).

Insects hosts: Hemiptera, Psyllidae [*Ctenarytaina eucalypti* (Maskell)] (Thompson, 1955). Hosts plants: *Eucalyptus* spp. (Protasov et al., 2007b; Mendel et al., 2007; Mifsud, 2012). In Morocco, this species has caused serious damage to *Eucalyptus camadulensis* (Myrtaceae) (Kissayi and Benhalima, 2018).

General distribution: Australia, New Zealand, United States of America, Indonesia, Vietnam, United Kingdom, South Africa, Mediterranean Basin (introduced).

Subfamily Tetrastichinae Förster, 1856

***Baryscapus* Förster, 1856**

****Baryscapus impeditus* (Nees, 1864)**

Material studied: Maâmora Forest, canton D, Aïn Johra commune, Al Maha, 34° 06' 34,2" N, 6° 19' 04,0" W, 175 m, 1 ♀, 26 IX 2012, K. Kissayi leg. (CKK).

Insects hosts: Hemiptera, Aphididae [*Diuraphis noxia* Kurdjumov], Coccidae [*Pulvinaria* sp.]; Neuroptera, Chrysopidae [*Chrysopa* sp., *C. flavifrons* (Brauer), *Chrysoperla carnea* (Stephens)] (Domenichini, 1966b; Bouček, 1977; Graham, 1991).

General distribution: Indomalaya (India, Pakistan) and Palaearctic (Andorra, Bulgaria, Croatia, Czech Republic, Czechoslovakia, France, Germany, Italy, Moldova, Netherlands, Russia, Serbia, Slovakia, Sweden, Turkey and Morocco).

***Baryscapus nigroviolaceus* (Nees, 1834)**

Distribution in Morocco: species previously mentioned in Morocco from Aïn Kahla, Azrou, Ras El Ma (Mouna, 2013, p. 9) but this record is not included in Noyes (2019).

Insects hosts: Coleoptera, Curculionidae; Diptera, Cecidomyiidae; Lepidoptera, Gracillariidae, Heliozelidae, Lasiocampidae, Lyonetiidae, Tineidae, Tortricidae, Yponomeutidae (Bouček, 1961; Domenichini, 1966; Herting, 1975; Graham, 1991; Del Bene and Landi, 1993; Hellrigl and Ambrosi, 2000; Baur, 2005; Yefremova et al., 2007; Özbek and Coruh 2010). In Morocco, this species has been reported as a parasitoid of caterpillars of *Acleris undulana* (Walsingham, 1900) (Lepidoptera, Tortricidae) (Mouna, 2013).

General distribution: Palaearctic.

***Baryscapus phytomyzae* Kostyukov, 1978**

Distribution in Morocco: species previously mentioned in Morocco from region of Fez and Meknes (Klein, 1995, abstract only; Klein and Korschel, 2002, p. 263) but this record is not included in Noyes (2019).

Insects hosts: Diptera, Agromyzidae [*Phytomyza orobannchia* (Kaltenbach)] (Graham, 1991). In Morocco, this species was obtained from the same Diptera living on *Orobanche crenata* Forsskal, 1775; *O. aegyptiaca* Persoon, 1807 and *O. foetida* (Poiret, 1789) (Orobanchaceae) (Klein and Korschel, 2002).

General distribution: Armenia, Egypt, Moldova, Uzbekistan, Russia and Morocco.

****Baryscapus* sp.**

Material studied: Maâmora Forest, canton A, Sidi Taïbi commune, Taïcha, 34° 13' 29.5" N, 6° 39' 04.8" W, 36 m, 1 ♀, 09 IX 2013, K. Kissayi leg. (CKK).

Remark: this specimen proved to be a new species for science (Gérard Delvare, pers. comm.). It will benefit from a detailed description and will be published soon.

***Pronotalia* Gradwell, 1957**

***Pronotalia orobanchiae* Graham, 1991**

Distribution in Morocco: species previously mentioned in Morocco from the region of Fez and Meknes (Klein, 1995, abstract only; Klein and Korschel, 2002, p. 263) but this record is not included in Noyes (2019).

Insects hosts: Diptera, Agromyzidae [*Phytomyza orobannchia* (Kaltenbach)] (Graham, 1991). In Morocco, this species was obtained from the same Diptera living on *Orobanche crenata* Forsskal, 1775; *O. aegyptiaca* Persoon, 1806 and *O. foetida* (Poiret, 1789) (Orobonchaceae) (Klein and Korschel, 2002).

General distribution: Western Palearctic (Bulgaria, Iran, Uzbekistan, Yugoslavia and Morocco).

***Tetrastichus* Haliday, 1844**

***Tetrastichus inunctus* (Nees, 1834)**

Distribution in Morocco: species previously mentioned from Fez (Rungs, 1936, p. 19) but this record is not included in Noyes (2019).

Insects hosts: Diptera, Cecidomyiidae [*Paradiplosis abietis* (Agevab) (= *Agevillea abietis* Hubault), *Rabdophaga heterobia* (Loew), *Resseliella theobaldi* (Barnes) (= *Thomasiniana theobaldi* Barnes)] (Thompson, 1955). In Morocco, this species is recognized as parasitoids of *Mayetiola destructor* (Mayede) pupae (= *Mayetiola mimeuri* Mesnil) (Diptera, Cecidomyiidae) living on wheat (Rungs, 1936).

General distribution: Western Palearctic (Germany, Bulgaria, Hungary, Poland, United Kingdom and Morocco).

****Trjapitzinichus* Kostjukov and Kosheleva, 2006**

****Trjapitzinichus politus* (Graham, 1991)**

Material studied: Maâmora forest, canton D, Kceïbia commune, Aïn Assou, 34° 12' 07.9" N, 6° 15' 10.8" W, 84 m, 1 ♀, 08 IV 2014, K. Kissayi leg. (CKK).

Hosts: not indicated

General distribution: Bulgaria, Italy, Montenegro, Yugoslavia and Morocco.

Discussion

This work has enriched the family of Eulophidae in Morocco by adding one new species (scientific description underway), two unidentified species, seven genera, and 20 species, 14 of which have not been listed previously and six are newly identified in addition to the 36 species previously cataloged. Thus, the new number of Eulophidae species in the Kingdom is currently 59. This is a relatively low number and represents only about 1% of this family worldwide according to the catalog of Noyes (2019). Moreover, the majority of genera and species identified in this study belong to the subfamily Eulophinae (14 genera / 27 species), followed by Tetrastichinae (10 genera/19 species), Entedoninae (8 genera/11 species) and finally Opheliminae and Entiinae (recently identified) (1 genus/1 species).

Concerning the Great Maghreb, the Eulophidae currently has 52 genera and 132 binomial species. In addition, some genera have been newly found in Morocco and will be published soon. All these species are included in the annex 1. Moreover, the figures reveal that the entomofauna of the southern shore of the Mediterranean is generally little represented

compared to Eulophidae of countries on the north shore, which have many more, such as in France (411 species), Italy (355 species), Spain (232 species), Croatia (165 species), Greece (101 species) and Montenegro (99 species), according to Noyes (2019). This suggests that the entomofauna of the North African region is still poorly known.

The comparison of Moroccan Eulophids with those of the Maghreb countries reveals that Morocco has a relatively rich diversity of this family (59 species is 33%), almost equitable to Egypt (55 species or 32%). Egyptian wildlife has been enriched with 15 species thanks to the work of Gadallah et al. (2015). Paradoxically, in Algeria, Tunisia, Libya and Mauritania, the number of species mentioned is respectively 33 (19%), 16 (9%) [knowing that *Leptocybe invasa* is not catalogued (Dhahri et al., 2010)], 9 (5%) and 3 (2%) species. It is likely that these figures do not reflect reality because no studies or revisions are currently available in these countries.

The comparative study of Eulophids based on available bibliographic data on fauna of North African indicates a clear difference in faunistic composition. Most of the species have a restricted distribution in North Africa; few are found in more than three or four countries. In fact, of the 132 species mentioned from the total group of Maghreb countries only two species (*Baryscapus servadeii* (Domenichini) and *Necremnus tutae* Ribes and Bernardo) are common to four of the six countries in the region.

In addition, Mauritania has the lowest biodiversity of this family, with only three species belonging to three genera: *Meruacesa* Koçak and Kemal, *Trichospilus* Ferrière and *Tamarixia* Mercet. This last genus has recently been identified in Morocco (Benyahia, 2016).

Four genera, *Allocerastichus* Masi, *Ceraninus* Walker, *Microlycus* Thomson, and *Trjapitzinichus* Kostjukov and Kosheleva are mentioned for the first time in North Africa (Morocco), each represented by a single species.

On the other hand, *Aprostocetus* Westwood is the most diversified genus of this family, not only in the Maghreb (11 species) in general but also in Morocco (5 species). It is a widespread Mediterranean genus, being known on European shores in Spain and France (Askew et al., 2013), Italy (Conti et al., 2000), Greece (Graham, 1987), Montenegro (Bouček, 1977), and Cyprus (Thompson, 1955), and on Asian shores in Turkey (Fry, 1989), Lebanon (Domenichini, 1966) Syria, and Israel (Japoshvili et al., 2015). It is also known on the African east shore in Algeria (Kostjukov, 1989), in the west in Tunisia (Lo Verde et al., 2010) and east in Egypt (Doğanlar and Elsayed, 2013). This genus is also reported in Eastern Europe in Slovenia (Graham, 1987) and Croatia (Bouček, 1977). Some rather diverse genera in the Maghreb, such as *Cirrospilus* Westwood and *Baryscapus* Förster (8 species), *Chrysocharis* Förster and *Entedon* Dalman (6 species), occupy a region that goes from Morocco to Egypt, passing through at least two of the following countries: Algeria, Tunisia, and/or Libya. These genera have shown the ability to adapt and settle in these diversified places along a horizontal trajectory. They were also widely represented in several European Mediterranean countries as far as Turkey, Israel and Syria for the genus *Baryscapus*.

Other genera, such as *Diglyphus* Walker, *Elasmus* Westwood and *Tetrastichus* Haliday (four species), are better represented in the countries of the northern shore of the Mediterranean (France, Spain, Italy, Croatia, Turkey and Israel) and less diversified in the southern shore *Neochrysocharis* Kurdjumov (two species) and *Sigmophora* Rondani (one species) are

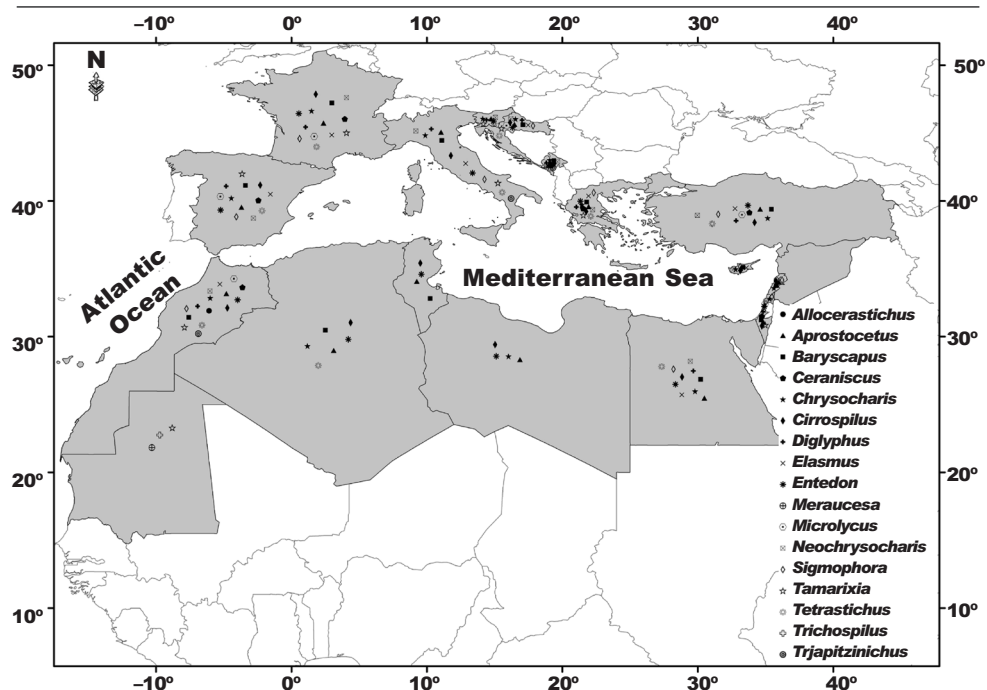


Fig. 2. Geographical distribution of most of the genera compared in countries of the Mediterranean Sea.

Fig. 2. Distribución geográfica comparativa de la mayor parte de géneros en países mediterráneos.

reported in the west of Morocco and Egypt in the east while they are absent from Algeria, Tunisia and Libya. This gap in space cannot be explained for the moment, but it probably due to a lack of research and only partial knowledge of this entomofauna in these Maghreb countries. The genus *Neochrysocharis* is most highly represented in Spain, Italy, Croatia, Greece, Montenegro and Turkey, unlike *Sigmophora* that is represented in the Mediterranean countries only by two species, *S. brevicornis* (Panzer) and *S. italica* (Domenichini) (fig. 2).

Being located in the West–Palaeartic region, Morocco is known for its rich and diverse ecosystems and habitats, and should in principle therefore shelter a greater number of species. Knowledge of the Moroccan heritage should be improved by carrying out research programmes on this Hymenoptera group in several regions of Morocco in order to discover and enrich our knowledge of this fauna. The same applies to all the countries of the Great Maghreb which should be part of this research logic since they are among the biodiversity hotspots.

Acknowledgements

Our sincere thanks and acknowledgments go to Dr. Gérard Delvare (CIRAD, France) for contribution and support in identifying specimens. Our thanks also go to the reporters for agreeing to review this work.

References

- Askew, R. R., Melika, G., Pujade-Villar, J., Schonrogge, K., Stone, G. N., Nieves-Aldrey, J. L., 2013. Catalogue of parasitoids and inquilines in cynipid oak galls in the West Palaearctic. *Zootaxa*, 3643: 1–133.
- Abbassi, M., Harchaoui, L., Rizqi, A., Nadori, E. B., Nia, M., 1999. Lutte biologique contre la mineuse des agrumes *Phyllocnistis citrella* stainton. Proceedings of the 5th International Conference on Pest in Agriculture, Montpellier, France, 1999 Dec 7–9; *Annales de l'ANPP*, Tome III: 609–615.
- Baur, H., 2005. Determination list of entomophagous insects nr 14. *Bulletin. Section Régionale Ouest Paléarctique, Organisation Internationale de Lutte Biologique*, 28(11): 1–71.
- Benyahia, Y., 2016. Inventaire de la Biodiversité entomologique (Coléoptères et Hyménoptères) pour une gestion patrimoniale de la sapinière du Parc National de Talassemtane (Rif, Maroc). PhD thesis, Université Hassan II, Faculté des Sciences Ben M'Sik.
- Blanchot, P., 1992. Nouveau répertoire bibliographique et nouvelles données biologiques sur les parasites de *Musca domestica* L. (Dipt.: Muscidae). *EPHE, Biologie et Évolution des Insectes*, 5: 1–54.
- Bouček, Z., 1959. A study of central European Eulophidae, I: Eulophinae (Hymenoptera). *Sborník Entomologického Oddelení Národního Musea v Praze*, 33: 117–170.
- 1961. Notes on the chalcid fauna (Chalcidoidea) of Moldavian SSR. *Trudy Moldavskogo Nauchno-Issledovatel'skogo Instituta Sadovodstva, Vinogradarstva i Vinodeliya. Kishinev*, 7: 5–30.
- 1977. A faunistic review of the Yugoslavian Chalcidoidea (Parasitic Hymenoptera). *Acta Entomologica Jugoslavica*, 13(Suppl): 1–145.
- 1988. *Australasian Chalcidoidea (Hymenoptera). A biosystematic revision of genera of fourteen families, with a reclassification of species*. CAB International, Wallingford, Oxon, UK; Cambrian News Ltd, Aberystwyth, Wales.
- Bouček, Z., Askew, R. R., 1968. Hym. Chalcidoidea. Palearctic Eulophidae (excl. Tetrastichinae). In: *Index of Entomophagous Insects* 3. 191–222 [V. Delucchi, G. Remaudière, Eds.] Paris: Le François.
- Burks, B. D., 1979. Eulophidae. In: *Catalog of Hymenoptera in America North of Mexico 1 Symphyta and Apocrita (Parasitica)*. 990–1003 [K. V. Krombein, P. D. Hurd, D. R. Smith, B. D. Burks, Eds.] Smithsonian Institution Press, Washington, D.C.
- Burks, R. A., Heraty, J. M., Gebiola, M., Hansson, C., 2011. Combined molecular and morphological phylogeny of Eulophidae (Hymenoptera: Chalcidoidea), with focus on the subfamily Entedoninae. *Cladistics*, 27: 581–605.
- Clair, D. J., Dahlsten, D. L., Hart, E. R., 1987. Rearing *Tetrastichus gallerucae* (Hymenoptera: Eulophidae) for biological control of the elm leaf beetle, *Xanthogaleruca luteola*. *Entomophaga*, 32: 457–461.
- Cochereau, P., 1969. Installation de *Tetrastichus brontispae* Ferr. (Hymenoptera, Eulophidae), parasite de *Brontispa longissima* Gestro var. *Froggati* Scharp (Coleoptera, Chrysomelidae, Hispinae) dans la presqu'île de Nouméa. *Cahiers ORSTOM. Série Biologie*, (7): 139–141.
- Conti, E., Roversi, P. F., Bin, F., 2000. Morphofunctional Adaptations of Parasitoids Attacking Concealed Eggs of Two Arboreal Mirids in Italy. *Journal of Hymenoptera Research*, 9(2): 385–394.
- Crunze-Fisher, H., 2017. Insectoid.Info [online] <<https://insectoid.info.websiteoutlook.com/>> [visited: 17 Jun 2017].
- Del Bene, G., Landi, S., 1993. Natural enemies of *Dasineura gleditchiae* (O.S.) (Diptera, Cecidomyiidae) in Italy. *Redia*, 76(1): 1–16.
- De Lépiney, J., Mimeur, J. M., 1932. Notes d'entomologie agricole et forestière du Maroc. *Mémoires de la Société des Sciences Naturelles du Maroc*, 31: 1–195.
- Delucchi, V. L., 1962. Hyménoptères chalcidiens du Maroc. *Al Awamia*, 5: 53–66.

- Delucchi, V. L., Remaudière, G., 1966. Index of Entomophagous Insects 1. Hymenoptera: Eulophidae. Palearctic Tetrastichinae. International Organisation of Biological Control. Paris.
- Delvare, G., Lacordaire, A. I., Ramel, J.-M., 2011. *Necremnus artynes* (Walker, 1839) (Eulophidae), a potential beneficial for the biological control of *Tuta absoluta* (Meyrick, 1917). International Symposium on Management of #*Tuta absoluta*#, 2011 November 16–18; Agadir. Morocco.
- De Santis, L., 1979. Catálogo de los himénopteros calcidoideos de América al sur de los Estados Unidos. Publicación Especial Comisión de Investigaciones Científicas Provincia de Buenos Aires.
- Dhahri, S., Ben Jamaa, M. L., Lo Verde, G., 2010. First Record of *Leptocybe invasa* and *Ophelimus maskelli* Eucalyptus Gall Wasps in Tunisia. *Tunisian Journal of Plant Protection*, 5(2): 229–234.
- Doğanlar, M., Elsayed, A. K., 2013. Parasitoids complex of *Asphondylia conglomerata* De Stefani (Diptera: Cecidomyiidae) on the Mediterranean Saltbush, *Atriplex halimus* L. (Chenopodiaceae) in Egypt, with descriptions of new species from Eulophidae and Torymidae (Hymenoptera: Chalcidoidea). *Linzer Biologische Beiträge*, 45(2): 1799–1811.
- Doğanlar, M., Gumovsky, A., Doğanlar, O., 2011. A review of *Ceranisus* (Hymenoptera: Eulophidae) of Ukraine, with description of two new species. *Türkiye Entomoloji Derneği*, 35 (2): 215–229.
- Domenichini, G., 1966. Hym. Eulophidae. Palearctic Tetrastichinae. In: The Index of Entomophagous Insects, 1. 48–49 [V. Delluchi, G. Remaudière, Eds.] Paris: Le François.
- El Alaoui El Fels, M. A., Roques, A., Boumezzough, A., 1999. Les arthropodes liés aux galbules et aux graines du genévrier thurifère, *Juniperus thurifera* L., dans les Atlas marocains. *Ecologia mediterranea*, 25(1): 95–110.
- Erdős, J., 1954. Eulophidae hungaricae indeseptae. *Annales historico-naturales Musei Nationalis hungarici* (S.N.), 5: 323–366.
- Etienne, J., Dumbardon–Martial, E., 2013. *Quadrastichus erythrinae* Kim: un redoutable ravageur pour les érythrinae de Guadeloupe et de Martinique (Hymenoptera, Eulophidae, Tetrastichinae). *Bulletin de la Société entomologique de France*, 118 (2): 155–158.
- Fry, J. M., 1989. *Natural enemy databank, 1987. A catalogue of natural enemies of arthropods derived from records in the CIBC Natural Enemy Databank*. CAB International, Wallingford, Oxford, UK.
- Gadallah, N. S., Yefremova, Z. A., Yegorenkova, E. N., Soliman, A. M., El-Ghiet, U. M., Edmardash, Y. A., Edmardash, Y. A., 2015. A review of the family Eulophidae (Hymenoptera: Chalcidoidea) of Egypt, with thirty three new records. *Zootaxa*, 4058(1): 66–80.
- Gauthier, N., LaSalle, J., Quick, D. L. J., Godfray, H. C. J., 2000. Phylogeny of Eulophidae (Hymenoptera: Chalcidoidea) with a reclassification of Eulophinae and the recognition that Elasmidae are derived eulophids. *Systematic Entomology*, 25: 521–539.
- Graham, MWR de V., 1987. A reclassification of the European Tetrastichinae (Hymenoptera: Eulophidae), with a revision of certain genera. *Bulletin of the British Museum (Natural History) (Entomology)*, 55(1): 1–392.
- 1991. A reclassification of the European Tetrastichinae (Hymenoptera: Eulophidae): revision of the remaining genera. *Memoirs of the American Entomological Institute*, 49: 1–322.
- Hansson, C., 1985. Taxonomy and biology of the Palaearctic species of *Chrysocharis* Forster, 1856 (Hymenoptera: Eulophidae). *Entomologica Scandinavica (supplement)*, 26: 1–130.
- 2009. The genus *Microdonophagus* Schauff (Hymenoptera: Eulophidae), with description of a new species. *Zootaxa*, 2200: 54–60.
- Harris, R. A., 1979. A glossary of surface sculpturing. *Occasional Papers of the Bureau of Entomology of the California Department of Agriculture*, 28: 1–31.
- Hellrigl, K., Ambrosi, P., 2000. Distribution of the horse chestnut leaf miner *Cameraria ohridella* Desch. & Dimic (Lepid., Gracillariidae) in the south Tyrol–Trentino region. *Anzeiger*

- für Schädlingkunde, 73(2): 25–32.
- Heraty, J. M., Burks, R. A., Cruaud, A., Gibson, G. A. P., Liljeblad, J., Munro, J., Rasplus, J.-Y., Delvare, G., Janšta, P., Gumovsky, A., Huber, J., Woolley, J. B., Krogmann, L., Heydon, S., Polaszek, A., Schmidt, S., Darling, D. C., Gates, M. W., Mottern, J., Murray, E., Dal Molin, A., Triapitsyn, S. V., Baur, H., Pinto, J. D., van Noort, S., George, J., Yoder, M., 2013. A phylogenetic analysis of the megadiverse Chalcidoidea (Hymenoptera). *Cladistics*, 29(5): 466–542.
- 1975. *Lepidoptera, Part 1 (Microlepidoptera). A catalogue of parasites and predators of terrestrial arthropods. Section A. Host or Prey/Enemy*. 6. Commonwealth Agricultural Bureaux, Commonwealth Institute of Biological Control.
- 1978. *Neuroptera, Diptera, Siphonaptera. A catalogue of parasites and predators of terrestrial arthropods. Section A. Host or Prey/Enemy*. 5(1). Commonwealth Agricultural Bureaux, Commonwealth Institute of Biological Control.
- Japoshvili, G., Spodek, M., Ben-Dov, Y., 2015. The parasitoid species (Hymenoptera: Chalcidoidea) of five Kermes species (Hemiptera: Coccoidea: Kermesidae) in Israel. *Phytoparasitica*, 43: 541–551.
- Jourdan, M.-L., Rungs, Ch., 1934. Observations sur quelques Hyménoptères du Maroc. *Bulletin de la Société des Sciences Naturelles du Maroc*, 15: 204–213.
- Kissayi, K., Benhalima, S., 2018. *Ophelimus maskelli* (Ashmead) et son parasitoïde *Closterocerus chamaeleon* (Girault) (Hymenoptera: Eulophidae) au Maroc. *Bulletin OEPP/EPPO Bulletin*, 48(2): 293–299.
- Klein, O., 1995. Untersuchungen zur Populationsdynamik und zur Verwendung von *Phytomyza orobanchia* in der biologischen Bekämpfung von *Orobanche* spp. in Marokko. [M.Sc. thesis]. University of Hohenheim, Hohenheim (DE).
- Klein, O., Kroschel, J., 2002. Biological control of *Orobanche* spp. With *Phytomyza orobanchis*, a review. *BioControl*, 47: 245–277.
- Kostjukov, V. V., 1989. New species of the genus *Tetrastichus* (Hymenoptera, Eulophidae) from Algeria. *Trudy Zoologicheskogo Instituta. Akademiya Nauk SSSR*, 191: 60–64.
- 2004. New species of *Neotrichoporoides* (Hymenoptera, Eulophidae) from Russia, Turkmenistan and Algeria. *Biologicheskaya Zashchita rasteniy – osnova stabilizatsii agrozkosistem*, 2: 159–170.
- LaSalle, J., 1994. North American genera of Tetrastichinae (Hymenoptera: Eulophidae). *Journal of Natural History*, 28: 109–236.
- LaSalle, J., Schauff, M. E., 1994. Systematics of the tribe Euderomphalini (Hymenoptera: Eulophidae): parasitoids of whiteflies (Homoptera: Aleyrodidae). *Systematic Entomology*, 19: 235–258.
- Lecoustre, R., Mariau, D., Philippe, R., Desmier De Chenon, R., 1980. Contribution à la mise au point d'une lutte biologique contre *Coelaenomenodera*. II. Introduction en Côte-d'Ivoire d'un hyménoptère Eulophidae du genre *Chrysonotomyia* Ashmead, de Madagascar. *Oléagineux*, 35(4): 177–186.
- Lo Verde, G., Dhahri, S., Ben Jamâa, M. L., 2010. First record in Tunisia of *Closterocerus chamaeleon* (Girault) parasitoid of the Eucalyptus Gall Wasp *Ophelimus maskelli* (Ashmead) (Hymenoptera Eulophidae). *Naturalista siciliano* S. IV, 34(1–2): 207–210.
- Maatouf, N., Lumaret, J.-P., 2012. Eco-éthologie des nouveaux ravageurs invasifs des Eucalyptus du Maroc. *Annales de la Société Entomologique de France* (n.s.), 48(3–4): 289–297.
- Mendel, Z., Protasov, A., Blumberg, D., Brand, D., Saphir, N., Madar, Z., La Salle, J., 2007. Release and Recovery of parasitoids of the Eucalyptus gall wasp *Ophelimus maskelli* in Israel. *Phytoparasitica*, 35: 330–332.
- Mifsud, D., 2012. *Leptocybe invasa* Fisher & La Salle, 2004 and *Ophelimus maskelli* Haliday, 1844 – two new records of gall forming Eulophidae from Malta (Hymenoptera, Chalcidoidea). *Bulletin of the Entomological Society of Malta*, 5: 189–193.

- Mouna, M., 2013. Les insectes du cèdre de l'Atlas (*Cedrus atlantica* Manetti) dans le Nord de l'Afrique. *Travaux de l'Institut Scientifique, Série Zoologie*, 48: 1–81.
- Munro, J. B., Heraty, J. M., Burks, R. A., Hawks, D., Mottern, J., Cruaud, A., Rasplus, J.-Y., Jansta, P., 2011. A Molecular Phylogeny of the Chalcidoidea (Hymenoptera). *Plos One*, 6(11): e27023. [online] <<https://doi.org/10.1371/journal.pone.0027023>> [accessed on 13 July 2017].
- Narendran, T. C., 2011. Fauna of India and the adjacent countries; Eulophinae (Hymenoptera: Eulophidae). *Zoological Survey of India, Kolkata*, 1–342.
- Nia, M., Abbassi, M., Rizqi, A., Zemzami, M., Nadori, E. B., 1997. Introduction d'auxiliaires et perspectives de lutte biologique au Maroc contre la mineuse des feuilles des agrumes *Phyllocnistis citrella* Stainton. ANPP. Quatrième Conférence Internationale sur les ravageurs en Agriculture. Montpellier, France.
- Noyes, J. S., 2019. Universal Chalcidoidea Database. World Wide Web electronic publication. [online] <www.nhm.ac.uk/entomology/chalcidoids/index.html> [accessed on 10 February 2019].
- Özbek, H., Coruh, S., 2010. Egg parasitoids of *Malacosoma neustria* (Linnaeus, 1758) (Lep.: Lasiocampidae) in Erzurum province of Turkey. *Türkiye Entomoloji Dergisi*, 34(4): 551–560.
- Pinturaeu, B., Bourarach, K., Rohi, L., 2003. Preliminary inventory of Hymenopteran egg parasitoids from Morocco. *Actes de l'Institut Agronomique et Vétérinaire (Maroc)*, 23(2–4): 163–183.
- Peck, O., 1963. A catalogue of the Nearctic Chalcidoidea (Insecta; Hymenoptera). *Canadian entomologist, supplement*, 30: 1–1092.
- Protasov, A., Blumberg, D., Brand, D., LaSalle, J., Mendel, Z., 2007a. Biological control of the eucalyptus gall wasp *Ophelimus maskelli* (Ashmead); taxonomy and biology of the parasitoid species *Closterocerus chamaeleon* (Girault), with information on its establishment in Israel. *Biological Control*, 42(2): 196–206.
- Protasov, A., La Salle, J., Blumberg, D., Brand, D., Saphir, N., Assael, F., Fisher, N., Mendel, Z., 2007b. Biology, revised taxonomy and impact on host plants of *Ophelimus maskelli*, an invasive gall inducer on Eucalyptus spp. In the Mediterranean Area. *Phytoparasitica*, 35 (1): 50–76.
- Rizqi, A., Nia, M., Abbassi, M., Rochd, A., 2003. Establishment of exotic parasitoids of citrus leafminer, *Phyllocnistis citrella*, in citrus groves in Morocco. *IOBC/wprs Bulletin*, 26 (6): 29–36.
- Rungs, Ch., 1936. Observations sur quelques hyménoptères du Maroc (deuxième note). *Bulletin de la Société des Sciences Naturelles du Maroc*, 16: 15–31.
- Smaili, M. C., Abbassi, M., Boutaleb, J. A., Blenzar, A., 2013. Richesse spécifique des ennemis naturels associés aux vergers d'agrumes au Maroc: Intérêt et implication pour la lutte biologique. *Bulletin OEPP/EPPO Bulletin*, 43(1): 155–166.
- Smirnoff, W., 1950. Sur la biologie au Maroc de *Rhizobius (Lindorus) lophantae* BLAISD. (Col., Coccinellidae). *Revue de Pathologie Végétale et d'Entomologie Agricole de France*, 29(4): 190–194.
- 1956. Observations sur les prédateurs et parasites des cochenilles nuisibles du Maroc et sur leurs ennemis. *Service de la défense des végétaux. Travaux originaux*, 11: 1–59.
- Thompson, W. R., 1955. *A catalogue of the parasites and predators of insect pests. Section 2. Host parasite catalogue, Part 3. Hosts of the Hymenoptera* (Calliceratid to Evaniid). Commonwealth Agricultural Bureaux, The Commonwealth Institute of Biological Control, Ottawa, Ontario, Canada.
- Tomov, R., 2002. Species composition of parasitoids (Hymenoptera) on apple feeding *Phyllonorycter* (Lepidoptera: Gracillariidae) in Bulgaria. In: *Parasitic wasps: evolution, systematics, biodiversity and biological control*: 437–442 (G. Melika, C. Thuroczy, Eds). Agroinform, Budapest, Hungary.
- Triapitsyn, S. V., Headrick, D. H., 1995. A review of the Nearctic species of the thrips attack-

- ing genus *Ceranisus* Walker (Hymenoptera: Eulophidae). *Transactions of the American Entomological Society*, 121(4): 227–248.
- Trjapitzin, V. A., 1978. Hymenoptera II. Chalcidoidea 13. Eulophidae (excl. Tetrastichinae). *Opredeliteli Nasekomykh Evropeyskoy Chasti SSR*, 3: 381–430.
- Yefremova, Z., Ebrahimi, E., Yegorenkova, E., 2007. The subfamilies Eulophinae, Entedoninae and Tetrastichinae in Iran, with description of new species (Hymenoptera, Eulophidae). *Entomofauna*, 28(30): 321–356.
- Yefremova, Z., Strakhova, I., Kravchenko, V., von Tschirnhaus, M., Yegorenkova, E., 2015. Parasitoid complex (Hymenoptera: Eulophidae) of the leaf-mining fly *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) in Russia. *Phytoparasitica*, 43(1): 125–134.

Annex 1. Checklist of Eulophidae species in Morocco and the neighboring countries of the North African region: Mo, Morocco; Alg, Algeria; Tun, Tunisia; Mau, Mauritania; Lyb, Lybia; Egy, Egypt; + present.

Anexo 1. Lista de especies de Eulophidae en Marruecos y en los países vecinos de la región del norte de África: Mo, Marruecos; Alg, Argelia; Tun, Túnez; Mau, Mauritania; Lyb, Libia; Egy, Egipto; + presente.

Taxa	Mo	Alg	Tun	Mau	Lyb	Egy
Subfamily Entedoninae Förster, 1856						
<i>Achrysocharoides parva</i> (Delucchi, 1956)	+					
<i>Ceranisis menes</i> (Walker, 1839)	+					
<i>Chrysocharis aegyptiensis</i> Hansson, 1985						+
<i>Chrysocharis albicoxis</i> Erdős, 1958						+
<i>Chrysocharis amanus</i> (Walker, 1839)		+				
<i>Chrysocharis gemma</i> (Walker, 1839)	+					+
<i>Chrysocharis pallipes</i> (Nees, 1834)	+					
<i>Chrysocharis pubicornis</i> (Zetterstedt, 1838)	+				+	
<i>Closterocerperus chamaeleon</i> (Girault, 1922)	+	+	+			
<i>Euderomphale</i> sp.	+					
<i>Entedon auratus</i> (Masi, 1924)	+		+			
<i>Entedon calvescentitus</i> Szelenyi, 1977		+				
<i>Entedon ergias</i> Walker, 1839						+
<i>Entedon lucasi</i> Gumovsky, 2007		+				
<i>Entedon secundarius</i> (Masi, 1924)					+	
<i>Entedon sparetus</i> Walker, 1839	+					
<i>Euderomphale chelidonii</i> Erdős, 1966						+
<i>Euderomphale ezzati</i> Abd-Rabou, 1998						+
<i>Horismenus hipparchia</i> (Cameron, 1913)	+					
<i>Neochrysocharis conglomeratae</i> Doğanlar, 2013						+
<i>Neochrysocharis formosus</i> (Westwood, 1833)	+					+
<i>Pediobius amaurocoelus</i> (Waterston, 1915)						+
<i>Pediobius bruchicida</i> (Rondani, 1872)		+			+	+
<i>Pediobius facialis</i> (Girault, 1863)						+
<i>Pediobius metallicus</i> (Nees, 1834)						+
<i>Pediobius rotundatus</i> (Fonscolombe, 1832)		+	+			
<i>Pediobius saulius</i> (Walker, 1839)						+
Subfamily Entiinae Hedqvist, 1974						
<i>Allocerastichus</i> sp.	+					
Subfamily Euderinae Erdős, 1856						
<i>Aulogymnus balani</i> Pujade i Villar, 1991			+			
<i>Parasecodes simulans</i> Mercet, 1924		+				
<i>Wichmannia decorata</i> Ruschka, 1916		+				
Subfamily Eulophinae Westwood, 1829						
<i>Cirrospilus elongatus</i> Bouček, 1958		+				
<i>Cirrospilus ingenuus</i> Gahan, 1932	+		+			+
<i>Cirrospilus lyncus</i> Walker, 1838						+
<i>Cirrospilus pictus</i> (Nees, 1834)	+	+			+	
<i>Cirrospilus pulcher</i> Masi, 1911	+					
<i>Cirrospilus staryi</i> Bouček, 1958		+				
<i>Cirrospilus viticola</i> (Rondani, 1877)						+
<i>Cirrospilus vittatus</i> Walker, 1838	+	+	+			
<i>Clotildiella numidica</i> Erdős, 1964		+				
<i>Colpoclypeus florus</i> (Walker, 1839)	+					
<i>Diadocerus westwoodii</i> Westwood, 1832	+					+
<i>Diglyphus crassinervis</i> Erdős, 1958	+					+
<i>Diglyphus isaea</i> (Walker, 1838)	+					+
<i>Diglyphus minoicus</i> (Walker, 1838)						+
<i>Diglyphus poppoea</i> Walker, 1848	+					
<i>Elachertus artaeus</i> (Walker, 1839)	+					
<i>Elachertus affinis</i> Masi, 1911	+					
<i>Elachertus lateralis</i> (Spinola, 1808)	+					
<i>Elasmus atratus</i> Howard, 1897	+					
<i>Elasmus flabellatus</i> (Fonscolombe, 1832)	+					+
<i>Elasmus phthorimaeae</i> Ferrière, 1947						+
<i>Elasmus platydrae</i> Ferrière, 1935						+
<i>Eulophus gummiferae</i> Fairmaire, 1879			+			
<i>Euplectrus flavipes</i> (Fonscolombe)						+
<i>Euplectrus liparidis</i> Ferrière, 1941		+				
<i>Hemiptarsenus fulvicollis</i> Westwood, 1833						+
<i>Hemiptarsenus ornatus</i> (Nees, 1834)	+					+
<i>Hemiptarsenus unguicellus</i> (Zetterstedt, 1838)	+					
<i>Hemiptarsenus walesellae</i> Nowicki, 1929		+				
<i>Hemiptarsenus waterhousii</i> Westwood, 1833						+
<i>Hemiptarsenus zilahisebessi</i> Erdős, 1951						+
<i>Hyssopus aegyptiacus</i> Tawfik and Ramadan, 2006						+
<i>Microlycus biroi</i> Erdős, 1951	+					
<i>Meruacesa liriomyzae</i> Bouček, 1988				+		
<i>Miotropis unipuncta</i> (Nees, 1834)	+					
<i>Miotropis virens</i> Erdős, 1951		+				
<i>Necremnus artynes</i> (Walker 1839)	+					
<i>Necremnus leucarthros</i> Nees, 1836	+	+				
<i>Necremnus rugulosus</i> Delucchi, 1962	+					
<i>Necremnus tutae</i> Ribes and Bernardo, 2015	+	+	+		+	
<i>Notanisomorphella bicolor</i> (Delucchi, 1962)	+					
<i>Pnigalio agraulis</i> (Walker, 1839)						+
<i>Pnigalio mediterraneus</i> Ferrière and Delucchi, 1957		+	+		+	
<i>Pnigalio pectinicornis</i> (Linnaeus, 1758)						+
<i>Pnigalio soemius</i> (Walker, 1839)						+
<i>Semielacler petiolata</i> (Girault, 1988)	+	+	+			
<i>Stenomiesius japonicus</i> (Ashmead, 1904)						+
<i>Stenomiesius rufescens</i> (Retzius, 1783)						+
<i>Sympiesis acalle</i> (Walker, 1848)						+
<i>Sympiesis asepta</i> Delucchi, 1962	+					
<i>Sympiesis flavopicta</i> Bouček, 1959						+
<i>Sympiesis gordius</i> (Walker, 1839)						+
<i>Sympiesis gregori</i> Bouček, 1958	+					
<i>Sympiesis sericeicornis</i> (Nees, 1834)						+
<i>Tamarixia radiata</i> (Waterston, 1922)				+		
<i>Trichospilus pupivorus</i> Ferrière, 1930				+		
<i>Zagrammosoma variegatum</i> (Masi, 1907)	+				+	
Subfamily Opheliminae Westwood						
<i>Ophelimus maskelli</i> (Ashmead, 1900)	+	+	+			
Subfamily Tetrastichinae Förster, 1856						
<i>Aceratoneuromyia indica</i> (Silvestri, 1819)			+			
<i>Aprostocetus alexandrianensis</i> Doğanlar, 2015						+
<i>Aprostocetus alveatus</i> Graham, 1961	+					
<i>Aprostocetus ceroplastae</i> (Girault, 1916)	+				+	+
<i>Aprostocetus hofferi</i> (Kostjukov, 1989)		+				
<i>Aprostocetus lachares</i> (Walker, 1839)						+
<i>Aprostocetus lycidas</i> (Walker, 1839)	+					
<i>Aprostocetus marinikius</i> Kostjukov, 1989		+				
<i>Aprostocetus microfuniculus</i> (Kostjukov, 1989)		+				
<i>Aprostocetus minutus</i> (Howard, 1881)	+					
<i>Aprostocetus neglectus</i> (Domenichini, 1957)	+					
<i>Aprostocetus zosimus</i> (Walker, 1839)			+			
<i>Baryscapus bouceki</i> Askew and Shaw, 2005			+			
<i>Baryscapus crassicornis</i> (Erdős, 1954)						+
<i>Baryscapus endemus</i> (Walker, 1839)						+
<i>Baryscapus haeselbarthi</i> Doğanlar, 1993		+				
<i>Baryscapus impeditus</i> (Nees, 1864)	+					+
<i>Baryscapus nigroviolaceus</i> (Nees, 1834)	+					
<i>Baryscapus phytomyzae</i> Kostjukov, 1978	+					+
<i>Baryscapus servadeii</i> (Domenichini, 1965)	+	+	+			+
<i>Baryscapus</i> sp.	+					
<i>Citrostichus phyllocnistoides</i> (Narayanan, 1960)	+					
<i>Hyssopus aegyptiacus</i> Tawfik and Ramadan, 2006						+
<i>Kolopterna aymani</i> Doğanlar, 2013						+
<i>Leptocybe invasa</i> Fisher and La Salle, 2004	+	+	+			
<i>Neotrichoporoides algericus</i> Kostjukov, 2004		+				
<i>Neotrichoporoides cynodontis</i> (Domenichini, 1967)		+				
<i>Neotrichoporoides hofferi</i> Kostjukov, 2004		+				
<i>Neotrichoporoides horaki</i> Kostjukov, 2004		+				
<i>Neotrichoporoides magribicus</i> Kostjukov, 2004		+				
<i>Neotrichoporoides mediterraneus</i> Graham, 1986						+
<i>Neotrichoporoides nyemitawus</i> (Rohwer, 1921)						+
<i>Neotrichoporoides szelenyii</i> (Erdős, 1951)						+
<i>Oomyzus scoparius</i> (Thomson, 1878)						+
<i>Oomyzus sempronius</i> (Erdős, 1954)						+
<i>Oomyzus sokolowskii</i> (Kurdjumov, 1912)						+
<i>Pronotalia orobanchiae</i> Graham, 1991	+					
<i>Puklina amblyteles</i> Graham, 1991					+	
<i>Quadrastichus citrella</i> Reina and La Salle, 2004	+					
<i>Sigmophora brevicornis</i> (Panzer, 1804)	+					+
<i>Stepanovia eurytomae</i> (Nees, 1834)	+					
<i>Tamarixia radiata</i> (Waterston, 1922)				+		
<i>Tetrastichus epilachnae</i> (Giard, 1896)	+					
<i>Tetrastichus giffardianus</i> Silvestri, 1915						+
<i>Tetrastichus inunctus</i> (Nees, 1834)	+					
<i>Tetrastichus sinope</i> (Walker, 1839)		+				
<i>Trjapitzinichus politus</i> (Graham, 1991)	+					