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Species of Megastigmidae from Morocco (Hymenoptera, Chalcidoidea)

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Abstract

Species of Megastigmidae from Morocco (Hymenoptera, Chalcidoidea). This study presents the first comprehensive catalogue of the Megastigmidae from Morocco. After sorting through the existing bibliography and visiting various museums, we identified two genera occurring in this country: *Bootanomyia* Girault, 1915 and *Megastigmus* Dalman, 1820 represented by one and ten species, respectively. Here we provide data on the known distribution and biology of each of the species in Morocco.

Dataset published through GBIF (DOI: 10.15470/mr3xom)

Key words: Chalcidoidea, Megastigmidae, Catalogue, Geographical distribution, Morocco

Resumen

Especies de Megastigmidae en Marruecos (Hymenoptera, Chalcidoidea). Este estudio presenta el primer catálogo exhaustivo de Megastigmidae de Marruecos. Después de revisar la bibliografía existente y visitar varios museos, identificamos dos géneros que se encuentran en este país: *Bootanomyia* Girault, 1915, y *Megastigmus* Dalman, 1820, representados por una especie el primero y diez el segundo. Aportamos datos sobre la distribución y la biología conocidas de cada especie.

Datos publicados en GBIF (DOI: 10.15470/mr3xom)

Palabras clave: Chalcidoidea, Megastigmidae, Catálogo, Distribución geográfica, Marruecos

Resum

Espècies de Megastigmidae del Marroc (Hymenoptera, Chalcidoidea). Aquest estudi presenta el primer catàleg exhaustiu de Megastigmidae del Marroc. Després de revisar la bibliografia existent i després de visitar diversos museus, vam identificar dos gèneres que es troben en aquest país: *Bootanomyia* Girault, 1915, i *Megastigmus* Dalman, 1820, representats per una espècie el primer i deu el segon. Aportem dades sobre la distribució i la biologia conegudes de cada espècie.

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Paraules clau: Chalcidoidea, Megastigmidae, Catàleg, Distribució geogràfica, Marroc

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Introduction

Megastigmidae were formerly considered a subfamily (Megastigminae) within the Torymidae family, but a new status has been established for this group of chalcids by placing it at taxonomic rank of family (Janšta et al., 2018). *Megastigmus* comprises over 200 species, currently classified in 14 valid genera (Janšta et al., 2018; Böhmová et al., 2022; Popescu and Gostin, 2023). The most speciose genus is *Megastigmus* Dalman, 1820, with 156 species described to date (Noyes, 2023).

As far as is known, Megastigmidae include not only ectoparasitoids of various gall–making insects [mainly Diptera (Cecidomyiidae) and Hymenoptera (Cynipidae and Chalcidoidea) but also Lepidoptera (Lasiocampinae) and Hemiptera (Coccoidea)] and seed–feeders of several plants (mainly Rosaceae, Pinaceae, Anacardiaceae and Cupressaceae) (Gibson, 1993; Grissell, 1999, 2000; Zerova and Seregina, 1994; Grissell and Prinsloo; 2001; Roques et al., 2016].

Although the Megastigmidae species were first recorded in Morocco in 1904 (Kissayi et al., 2020), studies focused on this fauna were not carried out until the 1990s (El Alaoui El Fels, 1998, 1999; El Alaoui El Fels et al., 2013; El Alaoui El Fels and Roques, 2006). Our aim is to provide the first catalogue of chalcids of the Megastigmidae family in Morocco.

Material and methods

The data used as a basis for this study comprise the species observed during K. Kissayi's museum visits and also the compilation of records obtained after an exhaustive bibliographic search.

For each of the species, we provide new studied material, its world distribution (following Noyes, 2023 and van Noort, 2024) and its biology.

The list of acronyms and abbreviations used throughout the text are: AR, Alain Roques; FSSM, Faculty of Sciences Semlalia, Marrakech, Morocco; MNHN, Museum National of Natural History, Paris, France; MNHN–SI, Museum National of Natural History, Scientific Institute, Rabat, Morocco.

Results

We identified 11 Megastigmidae species valid for Morocco, divided into two genera: *Bootanomyia* Girault, 1915 (represented by a single species) and *Megastigmus* Dalman, 1820 (represented by 10 species) (see also dataset published through GBIF, DOI: 10.15470/mr3xom

Megastigmidae species recorded in Morocco

Superfamily Chalcidoidea Latreille, 1817

Family Megastigmidae Thomson, 1876

Genus *Bootanomyia* Girault, 1915

Bootanomyia stigmatizans (Fabricius, 1798)

Studied material: Tangier–Tetouan–Al Hoceïma: Cap Spartel, 1♀, 1904, G. Buchet leg., MNHN–SI [under the name of *Megastigmus stigmatizans* (Fabricius, 1798)] (Kissayi et al., 2020: 149).

World distribution: Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Iran, Italy, Morocco [Fes–Meknes in Delucchi (1962) and Tangier–Tetouan–Al Hoceïma in Kissayi et al. (2020)], the Netherlands, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, Ukraine, and the United Kingdom.

Biology: *Bootanomyia stigmatizans* is a primary parasitoid associated with oak gall wasps (Askew, 1966; Askew et al., 2013) associated with *Quercus* spp. (Fagaceae). In Morocco, adults of this species have been reared from galls of *Biorhiza* Westwood, 1840 (Hymenoptera: Cynipidae), probably *B. pallida* (Olivier, 1791) (Delucchi, 1962), *Andricus hispanicus* (Hartig, 1856) and *A. quercustozae* (Bosc, 1792) on *Quercus faginea* Lamarck, 1785 (Fagaceae) (Askew et al., 2013).

Genus *Megastigmus* Dalman, 1820

Megastigmus aculeatus (Swederus, 1795)

Studied material from AR: Marrakech–Safi: Ijoukak, 54♀♀ 1♂, V.2009; Ait Elqaq, 1♀, V.2009; Oukaïmden route, 5♀♀, V.2009; Tahannoute, 3♀♀, V.2009; Idni, 67♀♀ 1♂, V.2009; Ait qatoun, 1♀, V.2008; Ijoukak, 37♀♀, V.2010; Ijoukak, 1♀, V.2010; Idni, 47♀♀, V.2010; Oukaïmeden route, 13♀♀, V.2011.

World distribution**:** Armenia, Australia, Austria, Bosnia and Herzegovina, Bulgaria, Caucasus, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iran, Iraq, Italy, Japan, Kazakhstan, Moldova, Montenegro, Morocco (Bouček (1977), in Roques and Skrzypczyńska, 2003; material studied herein), the Netherlands, New Zealand, Poland, Romania, Russia, Serbia, Slovakia, Somalia, Spain, Sweden, Switzerland, Tadzhikistan, Turkmenistan, Ukraine and the United Kingdom (Noyes, 2023). It has been recently reported from Belgium (Verheyde et al., 2023) and China (Chen et al. 2023, introduced). It was introduced also in Argentina and Chile (Lediuk et al., 2012), Ethiopia (Milliron, 1949, according to Roques and Skrzypczynska, 2003), South Africa (Roques and Skrzypczynska, 2003) and the USA (Jesse et al., 2013).

Biology: *Megastigmus aculeatus* is a seed–feeder of Rosaceae (Bouček, 1971; Roques and Skrzypczńska, 2003). In Morocco, this species has been obtained from fruits of *Rosa* spp. by Roques and Skrzypczńska (2003) and by A. Roques (pers. comm.).

Megastigmus amicorum Bouček, 1969

Studied material from AR: Marrakech–Safi: High Atlas; Asni; Marrakech, 4♀♀ 4♂♂, 27.VI.1989, A. El Hassani leg.; Tizrag, 6♀♀ 5♂♂, VII.1999; idem, 3♀♀ 2♂♂, VII.1999.

World distribution: Algeria (Roques and Skrzypczyńska, 2003), Bosnia and Herzegovina, Bulgaria, Croatia, France, Georgia, Greece, Italy, Montenegro, Morocco (Fez–Meknes (Middle Atlas) by Roques and Skrzypczyńska, 2003; material studied herein), Portugal, Russia, Serbia, Spain, Sweden, Tunisia and Ukraine.

Biology: *Megastigmus amicorum* is recognized as a seed–feeder of Cupressaceae (Roques and Skrzypczyńska, 2003). In Morocco, this species has been obtained from seeds of *Juniperus phoenicea* Linnaeus, 1753, *J. oxycedrus* Linnaeus, 1753 and *J. thurifera* Linnaeus, 1753 (Cupressaceae) (El Hassani and Messaoudi, 1986; El Alaoui El Fels, 1998; Askew et al., 2001; Roques and Skrzypczyńska, 2003; El Alaoui El Fels and Roques, 2006).

Megastigmus atlanticus Roques and Skrzypczyńska, 2003

Studied material from AR: Marrakech–Safi: Amzmiz, Holotype 1♀, 20.IX.1995, collected in summer, M. A. El Alaoui El Fels leg.; same locality, Paratypes 3♀♀, 20.IX.1995, (MNHN); Marrakech, 5♀♀, 14.X.1998, collected VIII.1998, (FSSM); same locality, 2♀♀, 10.X.1998, M. A. El Alaoui El Fels leg.; Idni 1,700 m, High Atlas, 8♀♀, 5.X.1999.

World distribution: Algeria and Morocco (Roques and Skrzypczyńska, 2003; material studied herin).

Biology: *Megastigmus atlanticus* is reported as a seed–feeder of Cupressaceae (Roques and Skrzypczyńska, 2003). In Morocco, this species has been reared from seeds of *Cupressus atlantica* Gaussen, 1950 and *C. sempervirens* Linnaeus, 1753 (Cupressaceae) (Roques and Skrzypczyńska, 2003).

Megastigmus bipunctatus (Swederus, 1795)

Studied material from AR: Fez–Meknes: Middle Atlas, A. El Hassani leg. Marrakech–Safi: High Atlas; Jbel Tizrag, Oukaïmeden region, 3♀♀ 2♂♂, VII.1999; 3♀♀ 2♂♂, VII.2000; same locality, 4♀♀ 5♂♂, VII.1999; Lazaden, VII.1999, M. A. El Alaoui El Fels leg.

World distribution: Austria, Bulgaria, Denmark, Estonia, Finland, France, Germany, Hungary, Iran, Italy, Kazakhstan, Montenegro, Morocco (Roques and Skrzypczyńska, 2003; material studied herein); the Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, the United Kingdom, and Uzbekistan.

Biology: *Megastigmus bipunctatus* has been cited as a parasitoid of Lepidoptera (Gelechiidae, Momphidae), and as a seed–feeder of Cupressaceae and Ericaceae (Bouček, 1977; Roques et al., 1984; Jensen and Ochsner, 1999; Roques and Skrzypczyńska, 2003). In Morocco, this species has been reared from seeds of *J. thurifera* (El Alaoui El Fels, 1998; Roques and Skrzypczyńska, 2003).

Megastigmus pinsapinis Hoffmeyer, 1931

Studied material: Fez–Meknes: Azrou, 2♀♀ (AR), V.1985, A. El Hassani leg. (Roques and Skrzypczyńska, 2003: 181); Middle Atlas, 1980, J.–P. Fabre leg; Tangier–Tetouan–Al Hoceïma: Rif, 1980, J.–P. Fabre leg. (Fabre et al., 1999: 211).

World distribution: Algeria, France, Italy, Spain and Morocco (Roques and Skrzypczyńska, 2003; material studied herein).

Biology: *Megastigmus pinsapinis* is recognized as a seed–feeder of Pinaceae (Pintureau et al., 1990(1991); Roques and Skrzypczyńska, 2003). In Morocco, this species has been reared from seeds of *Cedrus atlantica* (Manetti ex Endlicher) Carrière, 1855 (Pinaceae) (Fabre et al., 1999).

Megastigmus pistaciae Walker, 1871

Studied material: Oriental: Oujda, Figuig, El Aïoun, Taourirt, Jerada, Aïn Beni Mathar, Rchida, Rif oriental, Debdou, Lamrija (A. Roques, pers. comm.).

World distribution: Afghanistan, Algeria (Roques and Skrzypczyńska, 2003), Armenia, Australia, Bulgaria, China, Croatia, Cyprus, France, Georgia, Greece, Iran, Israel, Italy, Kyrgyzstan, Montenegro, Morocco (Davatchi, 1958 in Roques and Skrzypczyńska, 2003; material studied herein), Portugal, Russia, Spain, Syria, Tadzhikistan, Tunisia (Jarraya and Bernard, 1971), Turkey, Turkmenistan, Ukraine and Uzbekistan (Noyes, 2023). It has also been introduced into Mexico, Kenya and the USA (according to Roques and Skrzypczyńska, 2003).

Biology: *Megastigmus pistaciae* is cited as a seed–feeder of Anacardiaceae and Myrtaceae (Bouček, 1977; Grissell and Prinsloo, 2001; Roques and Skrzypczyńska, 2003). In Morocco, this species has been obtained from seeds of *Pistacia* spp. (Anacardiaceae) (A. Roques, pers. comm.).

Remarks: this species can be found wherever *Pistacia* spp. (Anacardiaceae) is present; that is, it occurs in all 12 regions of Morocco (A. Roques, pers. comm.).

Megastigmus suspectus Borries, 1895

Studied material: Fez–Meknes***:*** Middle Atlas (El Hassani and Messaoudi, 1986). Tangier–Tetouan–Al Hoceïma: Rif (Fabre, 1983 in Pintureau et al., 1990(1991): 282).

World distribution: Algeria (Pintureau et al., 1990(1991), Austria, Caucasus, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Italy, Kazakhstan, Montenegro, Morocco (Fabre, 1983; material studied herein), the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey, Ukraine and the United Kingdom. Recently recorded from Belgium (Verheyde et al., 2023).

Biology: *Megastigmus suspectus* is cited as a seed–feeder of Pinaceae [*Abies* spp., *Cedrus* spp.] (Bouček, 1977; Pintureau et al., 1990(1991); Roques and Skrzypczyńska, 2003; Auger–Rozenberg et al., 2006). In Morocco, this species has been obtained from seeds of *Cedrus atlantica* (El Hassani and Messaoudi, 1986).

Megastigmus thuriferana Roques and El Alaoui, 2006

Studied material from AR: Marrakech–Safi: Tizrag, High Atlas, 2,500 m, holotype 1♀, 18.VII.1999; Paratypes, 7♀♀ 9♂♂, MNHN; same data as holotype, 3♀♀ 5♂♂, M. A. El Alaoui El Fels leg.

World distribution: France, Morocco (Auger–Rozenberg et al., 2006; material studied herein) and Spain.

Biology: *Megastigmus thuriferana* is reported as seed–feeder of Cupressaceae [*Juniperus thurifera*] (Auger–Rozenberg et al., 2006; El Alaoui El Fels and Roques, 2006).

Megastigmus transvaalensis (Hussey, 1956)

Studied material from AR: Marrakech–Safi: Chichaoua, 22♀♀ 18♂♂, X.2000 G. Rouault leg.; Marrakech, 46♀♀ 42♂♂, II.2000. Souss–Massa: Agadir, 2♀♀ 1♂, X.2000 G. Rouault leg.

World distribution: France, Israel, Kenya, Morocco (Scheffer and Grissell, 2003: Marrakech–Safi: Chichaoua, Marrakech and Ighil; material studied herein), Portugal, South Africa and Zimbabwe. It has also been introduced in Argentina (according to Wheeler et al., 2001), Brazil (Ferreira–Filho et al., 2015), the Canary Islands (Grissell, 1979), Chile (Fernandes et al., 2014), Colombia (Pujade–Villar and Caicedo, 2010), Hawaii (Hight et al., 2003), Mexico (Roques and Skrzypczyńska, 2003), Mauritius, Réunion and the USA (Habeck et al., 1989).

Biology: *Megastigmus transvaalensis* is cited as a seed–feeder of Anacardiaceae and Myrtaceae (Grissell and Hobbs, 2000; Grissell and Prinsloo, 2001; Scheffer and Grissell, 2003; Doğanlar et al., 2013). In Morocco, this species has been reared from seeds of *Rhus tripartita* (Urtica) Grande, 1916, *Schinus* sp., *S. molle* Linnaeus, 1753 (Anacardiaceae) (Scheffer and Grissell, 2003).

Megastigmus wachtli Seitner, 1916

Studied material from AR: Marrakech–Safi: Marrakech, 4♀♀ 3♂♂, IX.1997; idem, 3♀♀ 2♂♂, IX.1997, M. A. El Alaoui El Fels leg.

World distribution: Albania, Algeria (Bouaziz and Chakali, 1998), Croatia, France, Greece, Italy, Malta, Montenegro, Morocco (Roques and Skrzypczyńska, 2003), Portugal, Slovenia, Tunisia (Roques and Skrzypczyńska, 2003) and Turkey.

Biology: *Megastigmus wachtli* is recognized as a seed–feeder of Cupressaceae [*Cupressus* spp.] (Rasplus et al., 2000; Roques and Skrzypczyńska, 2003; Auger–Rozenberg et al., 2006). In Morocco, this species has been reared from seeds of *Cupressus sempervirens* and *C. atlantica* (Cupressaceae) (Roques and Skrzypczyńska, 2003).

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