

# Distribution and a New Locality Record of the Invasive Asian Wasp, *Sceliphron curvatum* (F. Smith, 1870) (Hymenoptera: Sphecidae) in Europe and Turkey

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## ABSTRACT

In this study, the distribution of *Sceliphron curvatum* F. Smith, 1870 (Hymenoptera: Apocrita, Sphecidae) has been reported in Europe and Turkey. *S. curvatum* is an invasive species. Rapidly spreading to Europe from Southeast Asia. It is distributed throughout Europe today. There are also records from transoceanic America continent. For anthropophilic *S. curvatum* species, the first record was made from Turkey, in 2015. In this study, a new locality record was made for this species from the province of Ordu, which is in Central Black Sea Region on the coast of South Black Sea. This wasp species, which has very important role in the functioning of ecosystem, just like other bees, is not aggressive and it does not harm people.

## Article Information

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## Authors' Contribution

BT collected samples in the field and analysed the literature. ÖE and BT organised the work plan and wrote the manuscript.

## Key words

Invasive alien species, Antropofil, Biological invaders, Mud dauber, Sinantropic

## INTRODUCTION

There is a complexity regarding the taxonomical differences between hornets and other wasps of the family Vespidae, particularly the yellow jackets which are members of an identical subfamily. There are about 300 alien Hymenoptera species belonging to 30 families in Europe. Sphecidae family in this group consists of approximately 70 species and all of the species are alien. It is stated that four species from this family, *Sceliphron caementarium* (Drury, 1773) and *Isodontia mexicana* (de Saussure, 1867) are of North America origin, while *S. curvatum* (Smith, 1870) and *S. deformis* (Smith, 1856) are of Asia origin and they are alien species coming to Europe accidentally (Rasplus et al., 2010). Recently, the rapid spread of *Sceliphron curvatum* (Hymenoptera: Apocrita, Sphecidae) wasp, which is an invasive species, in Europe has attracted attention. This species is sinantropic, the origin of which is the mountainous areas of Asia (North India, Nepal, Pakistan, Kazakhstan, Tajikistan, etc.) and was first recorded in Europe in a village in the South east of Austria (Grätsch) in 1979 (Vecht, 1984). Mud dauber wasp first spread to Central and Southern Europe is today spread in the whole Europe. While *S. curvatum* forms

strong populations especially in towns and villages of South and Central Europe (Schmid-Egger, 2005; Bitsch and Barbier, 2006; Bitsch, 2010), it also has been recorded in the Alpines (Tyrol, Austria) (Schedl, 2016). This species is reported to reach from Middle East to the South and east of Ukraine which is in Eastern Europe (Crimea and Kharkiv, region) and to be present in almost the whole Ukraine and then advance to Europe (Tymkiv et al., 2015). A great number of scientific studies have reported records of *S. curvatum* species in European countries for more than 20 years. In Turkey, records are very recent and insufficient. Major recorded places for European countries and Turkey are given in Table I. Figure 1 shows the general distribution.

*S. curvatum* is an anthropophilic species. They generally make their nests in various places of houses and buildings such as ceilings, walls, curtains, clothes, closets, and books (Bitsch and Barbier, 2006). Making nests is one of the main activities of *Sceliphron* wasps (Chatenoud et al., 2012). Their nests are very special. Nests are made of mud, dry, as separate cylindrical nest series in the shape of barrels (Bitsch, 2010). Nests are full of spiders as in the other species of the genus (Schneider et al., 2014). Females carry paralyzed spiders to each nest as prey and then leave their eggs (Polidori et al., 2007). They close the opening of the hole when they leave the nest (Grandi, 1961). The larvae which get out of the egg grow by eating the prey and become adults.

*S. curvatum* has a distinctive characteristic chromatically

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since it has some yellow and reddish body parts. Thus, this species is easily recognisable among the other members of *Sceliphron* species in Europe (Schmid-Egger, 2005). *S. curvatum* are generally solitary wasps with a moderate to big body. Adults are generally fed with nectars and this way they help the plants to pollinate. Their larvae are carnivorous. Since these wasps are predatory, they also ensure the control of the population of insects and spiders they prey on. Thus, they contribute to biological balance of the nature (Bohart and Menke, 1976). *S. curvatum* is not aggressive; it does not sting if it is not harmed.

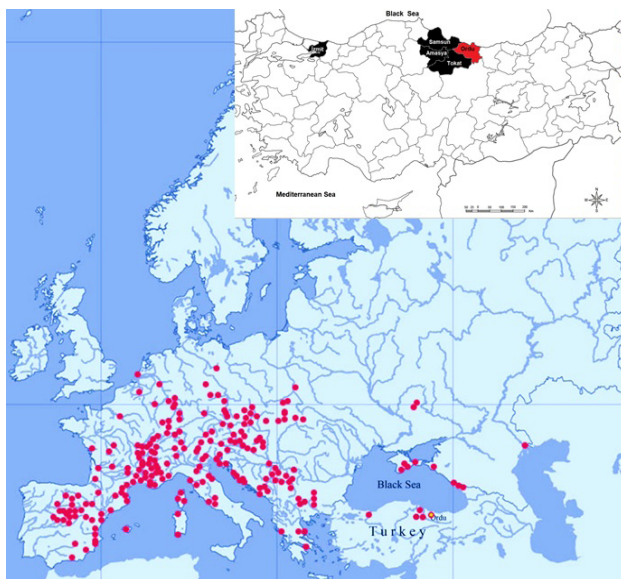


Fig. 1. Distribution of *Sceliphron curvatum* in Europe and Turkey (Ordu city, new record).

The first record of *S. curvatum* species in Turkey was from the provinces of Samsun, Tokat (Central Black Sea Region) and İzmit (Eastern Marmara Region) which are on the North of Anatolia (Gülmez and Can, 2015). *S. curvatum* was also recorded from Samsun, Vezirköprü town, Kunduz Mountains (Yıldırım *et al.*, 2016) and Tokat, Erbaa town (Gülmez and Dizer, 2016). This study reports a new locality record for *S. curvatum* in Turkey from the province of Ordu on South Black Sea shore.

## MATERIALS AND METHODS

*S. curvatum* samples and nests were collected from the province of Ordu (Fig. 1). Sampling localities: Central Black Sea Region, Ordu, Perşembe, Mersin District, 27 m altitude above sea level, at 41°06'47" N, 37°46'03" E coordinates, 15.VII.2016, 2♀, 10 wasp nests (with larvae). The nests were made on the bed cloth in a wooden village

house used as summer house. Four nests were found on the curtain: Central Black Sea Region, Ordu, Perşembe, Ortatepe District, 429 m altitude above sea level, at 41°03'16" N, 37°40'56" E coordinates, 12.IX.2017 and 06.II.2018, 2 wasp nests and 4 wasp nests (with larvae). The nests were made behind a photo frame in a concrete reinforced village house.

The wasps caught and the clay nests were carefully taken to the laboratory for examination. The mud dauber wasp samples were identified using Schmid-Egger (2005) and Bitsch and Barbier (2006).

## RESULTS

General classification of the species is as follows (Gargominy, 2017; Guala and Döring, 2017):

Order: Hymenoptera Linnaeus, 1758

Suborder: Apocrita

Superfamily: Apoidea

Family: Sphecidae Latreille, 1802

Tribe: Sceliphhrini Ashmead, 1899

Genus: *Sceliphron* Klug, 1801

Species: *Sceliphron curvatum* (F. Smith, 1870)

Synonyms: *Pelopaeus curvatum* (F. Smith, 1870)

The examined *S. curvatum* species is morphologically different from wasps which are commonly found in nature. They are big, slender and they have vivid colours. They are between 15 and 22 cm, they are black and they have yellow and red ornaments. The body has the head, thorax and abdomen parts distinctly. The long-cylindrical petiole structure of this species, which is also called slim-waist wasp, is characteristic. *S. curvatum*'s biology is similar to local species. The females build reproduction nests similar to cylindrical barrels from mud. They stick these nests next to each other on a ground with a specific order in places where human beings live. In Perşembe, Mersin samples, 10 nests were found on the bed cloth (Fig. 2). 4 nests were made on the curtain in the same room. When the nests were examined, it was seen that there were spiders placed in each one for the larvae to feed. In these nests, morphologically four different types of spiders were found (Fig. 2). The spiders were paralyzed, dead or fragmented.

Two clay nests in Ortatepe locality were found behind a photo frame, no wasp samples were caught. The colours of the wasp nests in Mersin and Ortatepe were found to be different from each other (Fig. 2). This difference results from the different soil structure where wasp samples live. When the larvae in nests were examined, it was found that the larvae in Mersin sample (summer larvae) were white, while the larvae in Ortatepe sample (autumn larvae) were yellow (Fig. 2).

**Table I. Alien sphecid wasp *S. curvatum* in Europe countries and Turkey.**

| Countries                           | Regions                        | References                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Austria                             | Central Europe                 | Vecht (1984); Gepp and Bregant (1986); Ebmer (1995); Gepp (1995, 2003); Dollfuss (1991); Guselneitler (1996a); Dollfuss <i>et al.</i> (1998); Kofler (1998); Schwarz <i>et al.</i> (1999); Schmid-Egger (2005); Schedl (2015; 2016)                                                                                                                                                                                                                  |
| Belarus                             | Eastern Europe                 | Khvir (2014)                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Belgium                             | Western Europe                 | Schneider <i>et al.</i> (2014)                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Bulgaria                            | Eastern Europe                 | Jacobs (2005); Schmid-Egger (2005); Ljubomirov (2006); Boch (2009); Guéorguiev and Ljubomirov (2009)                                                                                                                                                                                                                                                                                                                                                 |
| Croatia                             | Southern Europe                | Gusenleitner (1996b); Straka <i>et al.</i> (2004); Četković <i>et al.</i> (2004); Schmid-Egger (2005)                                                                                                                                                                                                                                                                                                                                                |
| Czech Republic                      | Central Europe                 | Straka <i>et al.</i> (2004); Bogusch <i>et al.</i> (2004, 2005); Dobosz (2010); Janšta and Bogusch (2017)                                                                                                                                                                                                                                                                                                                                            |
| France                              | Western Europe                 | Gonseth <i>et al.</i> (2001); Vernier (2003); Carrière (2004, 2005, 2009, 2010); Rahola (2003, 2005); Dumon (2006); Bitsch and Barbier (2006); Magdalou (2006); Bitsch (2010); Bitsch <i>et al.</i> (2013)                                                                                                                                                                                                                                           |
| Germany                             | Central Europe                 | Ohl (2001); Dorow and Jäger (2004); Schmid-Egger (2005); Reder (2006, 2007); Schardt <i>et al.</i> (2012); Köhler <i>et al.</i> (2014)                                                                                                                                                                                                                                                                                                               |
| Greece                              | Southern Europe                | Schmid-Egger (2005); Standfuss and Standfuss (2006)                                                                                                                                                                                                                                                                                                                                                                                                  |
| Hungary                             | Central Europe                 | Józan (1998, 2002, 2006); Fazekas (2012); Szinetár and Fazekas (2015)                                                                                                                                                                                                                                                                                                                                                                                |
| Iberian Peninsula (Spain, Portugal) | Western Europe                 | Gayubo and Izquierdo (2006); Castro (2007, 2010)                                                                                                                                                                                                                                                                                                                                                                                                     |
| Italy/Sicily/Malta                  | Southern Europe                | Scaramozzino (1995, 1996); Strumia (1996); Grillenzoni and Pesarini (1998); Pagliano (2000); Pagliano <i>et al.</i> (2000); Schmid-Egger (2003); Hellrigl (2001, 2004, 2005); Jacobi (2005); Pagliano and Negrisoló (2005); Polidori <i>et al.</i> (2007); Cillo <i>et al.</i> (2009); Pagliano (2009); Olivieri (2010); Ceccolini and Paggetti (2011); Strumia <i>et al.</i> (2012); Di Giovanni <i>et al.</i> (2017); Turrise and Altadonna (2017) |
| Lithuania                           | Eastern Europe                 | Budrys and Orlovskytė (2016)                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Luxembourg                          | Western Europe                 | Schneider <i>et al.</i> (2014); Ries and Pfeiffenschneider (2017)                                                                                                                                                                                                                                                                                                                                                                                    |
| Montenegro                          | Southern Europe                | Četković <i>et al.</i> (2004)                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Poland                              | Central Europe                 | Bury <i>et al.</i> (2009); Wiśniowski <i>et al.</i> (2013); Bilański <i>et al.</i> (2014)                                                                                                                                                                                                                                                                                                                                                            |
| Romania                             | Eastern Europe                 | Popescu (2014)                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Russia (European)                   | Eastern Europe                 | Prokofiev and Skomorokhov (2010)                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Serbia                              | Southern Europe                | Četković <i>et al.</i> (2004)                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Slovakia                            | Central Europe                 | Lukas (2003); Bogusch <i>et al.</i> (2005)                                                                                                                                                                                                                                                                                                                                                                                                           |
| Slovenia                            | Central-Southern Europe        | Gogala (1995)                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Switzerland                         | Central Europe                 | Gonseth <i>et al.</i> (2001); Vernier (2003)                                                                                                                                                                                                                                                                                                                                                                                                         |
| Turkey                              | Eastern Europe<br>Western Asia | Gülmez and Can (2015); Gülmez and Dizer (2016); Yıldırım <i>et al.</i> (2016)                                                                                                                                                                                                                                                                                                                                                                        |
| Ukraine                             | Eastern Europe                 | Shorenko (2003, 2007); Shorenko and Konovalov (2010); Četković <i>et al.</i> (2011); Fateryga and Kovblyuk (2013); Popov and Khomitskii (2014); Tymkiv <i>et al.</i> (2015); Mokrousova and Popov (2016)                                                                                                                                                                                                                                             |

## DISCUSSION

A great number of Asian origin sphecid *S. curvatum* wasps have been reported to be invasive in Europe. They spread rapidly to Austria at the end of 70s and to Southern Europe (especially south eastern Greece and the area around Montpellier on the South of France). *S. curvatum*

showed a trend of expansion to the North of Europe from the South after 2000s (Schmid-Egger, 2005; Bitsch and Barbier, 2006). New declarations are made for this species from Transoceanic and America (Barrera-Medina and Garcete-Barrett, 2008; Compagnucci and Roig-Alsina, 2008; Ramage *et al.*, 2015; Ramage, 2017). None of

the *S. caementarium* and *S. curvatum* species, which are allochthonous species, are brought to Europe on purpose; however, they may have come through passive transport, especially through nests that can be made on materials used for packaging (Strumia, 1996). It is strongly supported hypothesis that all the types of this species are distributed through passive transport and that these species have an ecological characteristic. Even if the ecological and/or etiological characteristics of a species endorse a strong distribution power to it, this advantage is not enough to ensure it to expand from its first distribution area (building steady populations in new areas). Other conditions should also be fulfilled (Ceccolini and Paggetti, 2011). The fact that the expansion of alien species' distribution areas in Europe corresponds to especially warm years shows that climate factors have an important role (Vernier *et al.*, 1996). "Sinantropic degree" of each species is not certainly insignificant in winter periods because they prefer buildings (headlining, basements, warehouses, stables, etc.) in order to protect from extreme colds (frost) (Gonseth *et al.*, 2001).

When the distribution of *S. curvatum* species throughout Europe is analysed in terms of chronological order in scientific studies, it can be seen that it is distributed in Slovenia, south western Hungary, westernmost Croatia, northern Serbia, central Bulgaria, coastal Montenegro, central (coastal) Greece and Romania in south eastern Europe (Ćetković *et al.*, 2011). The reason why this species was not recorded in Turkey until 2015 although it was recorded in Balkans at the end of 90s (it was recorded in Bulgaria in 1997) is not due to the expansion gap of the species, it is just due to the insufficiency of the number of researchers who make researches on this group spatially or the insufficiency of samples. The first records were in the provinces of Amasya, Samsun, Tokat and Kocaeli (İzmit) in Turkey (Gülmez and Can, 2015). 3♀ and 1♂ *S. curvatum* records were made from Samsun, Vezirköprü, Kunduz Mountain in 2014 (Yıldırım *et al.*, 2016). This study reports 2♀ records caught in July 2016 from Ordu, Perşembe, Mersin district on the east of Samsun. When the distribution of *S. curvatum* samples for Turkey is examined, it can be seen that they are distributed close to Black Sea coast on the north of Turkey and Central Black Sea Region (Fig. 2). Ordu and Samsun are important port cities in the coast of Southern Black Sea. These wasps can probably have been transported to these ports passively with loads coming by ship from Russia and Ukraine. As a conclusion, the place where the highest numbers of records are made for *S. curvatum* species in Turkey is Central Black Sea. It is possible to find out the presence of this species in different regions of Turkey, which is in mild temperature zone. Future studies should find out new

localities of this species throughout Turkey, its expansion should be monitored and population density should be found out during the global climate change process.

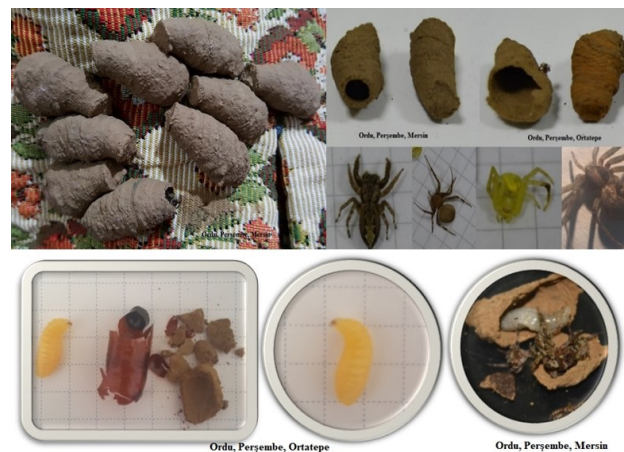


Fig. 2. *Sceliphron curvatum* nests, larvae and the spiders in the nests.

It should also be remembered that wasps work like ecosystem engineers and that they are an important living being group for the ecosystem because while wasps visit flowers and collect pollens and nectar from them, at the same time they are effective pollinators. This way, they play an active role in both plant production and in the distribution of herbaceous and woody plants. Wasps are in fact a biological agent in fighting some pests in nature. In addition, they provide pollination in plants like other bee types and they contribute to agricultural production. Thus, wasps should not be destroyed in order not to disturb the natural balance.

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## Statement of conflict of interest

The authors have declared no conflict of interest.

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