

Notes on the European species of the genus *Asilus* Linnaeus, 1758

(Diptera: Asilidae)

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Abstract

Our knowledge on the robber flies *Asilus barbarus* Linnaeus, 1758 and *Asilus crabroniformis* Linnaeus, 1758 is reviewed. We discuss their ecology as well as their distribution. Complete illustrations of the male genitalia are provided for the first time.

Keywords: Asilinae, European distribution, genitalia

Résumé

Nos connaissances sur les mouches prédatrices *Asilus barbarus* Linnaeus, 1758 et *Asilus crabroniformis* Linnaeus, 1758 sont passées en revue. Nous discutons de leur écologie ainsi que de leur distribution. Des illustrations complètes des genitalia mâles sont fournies pour la première fois.

Samenvatting

Onze kennis over de roofvliegen *Asilus barbarus* Linnaeus, 1758 en *Asilus crabroniformis* Linnaeus, 1758 wordt herzien. Hierbij worden ecologie alsook verspreiding besproken. De mannelijke genitalia worden voor het eerst duidelijk in beeld gebracht.

Introduction

In 1758, Linnaeus described the family of Asilidae using the genus *Asilus* and the species *Asilus crabroniformis* as holotypes. This genus remains a large assemblage of species known only from the types and a review of these was necessary. HULL (1962) lists 57 specific names in the genus *Asilus* for the Palearctic Region, including 35 tentative species. LEHR (1979), in the catalogue of Palearctic Asilidae, retained only *A. barbarus* and *A. crabroniformis* Linnaeus, 1758. However, the same author added *A. baikalensis* Becker, 1926 in 1988 (LEHR, 1988).

Material and methods

The specimens studied can be found in the collections of the Royal Belgian Institute of Natural Sciences (RBINS) and the Faculty of Gembloux, FSAGX, (Uliège) Belgium. The morphological structure of the male genitalia of *A. barbarus* and *A. crabroniformis* have never been illustrated completely, therefore, some of the specimens were dissected with the genitalia glued on a cardboard attached to the pin of the corresponding specimen. The photographs for the habitus were taken by J. Mignon (FSAGX) with a Canon 90D equipped with a Canon EF 100mm f/2.8L Macro IS USM. The focus bracketing function was used and the image was compiled by stacking with the DPP 4.10 software. To make pictures of the genitalia a

stereoscope was used, Euromex DZ. 1105, equipped with a camera Euromex VC. 3036 and managed by logiciel Image Focus 4.0.

The maps were created using the Fauna-Flora (BARBIER & RASMONT, 2000). The occurrences were taken primarily from specimens stored in the collections of FSAGX and RBINS, but also from other museums visited by the author. We have also included information from literature, although unfortunately a large part of it is not usable as many notes only mention the country or region without specifying occurrences, location and date. Of course, our maps are not exhaustive (citizen science data was not used), but we have enough data to have a clear view of the geographical distribution.

ACRONYMS USED FOR THE COLLECTIONS

RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium
FSAGX = Faculté des Sciences Agronomiques de Gembloux, Liège, Belgium

Family Asilidae
Subfamily Asilinae Latreille, 1802
Tibu Asilini Latreille, 180
Genus *Asilus* Linnaeus, 1758

The genus *Asilus* is the only genus placed in the tribe Asilini DIKOW (2009)

LEHR traced the entire history of the genus *Asilus* and noted that the genus can be considered as an ancient group of the tribe Asilini with obvious specialisation traits. These are species that depend on a relatively stable environment (stenobiont species) and are adapted to a narrow range of environmental conditions, (specialized larval diets, oligophagy). While this genus taken in the wide sense is exceptionally large and, as presently understood, worldwide in distribution, there are comparatively few species that fall into the genus *Asilus* in the strict sense and these are much more limited in distribution. Species are believed to be mainly geophilic; larvae inhabit decomposing organic matter in dung and manure. This is one of the reasons why adult flies are often found in the pastures of horses and ruminants. Although individual specimens are quite rare, they can be found in fairly large numbers in small areas, especially in localities where there are pastures with horse dung or manure. Adults only hunt on smaller arthropods (LEHR, 1979).

***Asilus barbarus* Linnaeus, 1758**
(Figs 1-5)

Type-locality: "Mauritania".

It is the largest species of Asilidae in Europe (Fig. 1).

DISTRIBUTION.

From the central and southern Palearctic to the eastern end of China (Fig. 2). From literature we have noticed: Bezzi (1922) records 26 males and 20 females collected from the same site in Tunisia, alas without specifying the location. Ségué (1930) notes it is very common and widespread throughout Africa Minor where the species hunts hoverflies, wasps, tiger beetles and captures crickets in the flight. The female drives her eggs into the sand or into the ground.



Fig. 1. *Asilus barbarus* L., 1758 with her prey, lateral view. © J. Mignon.

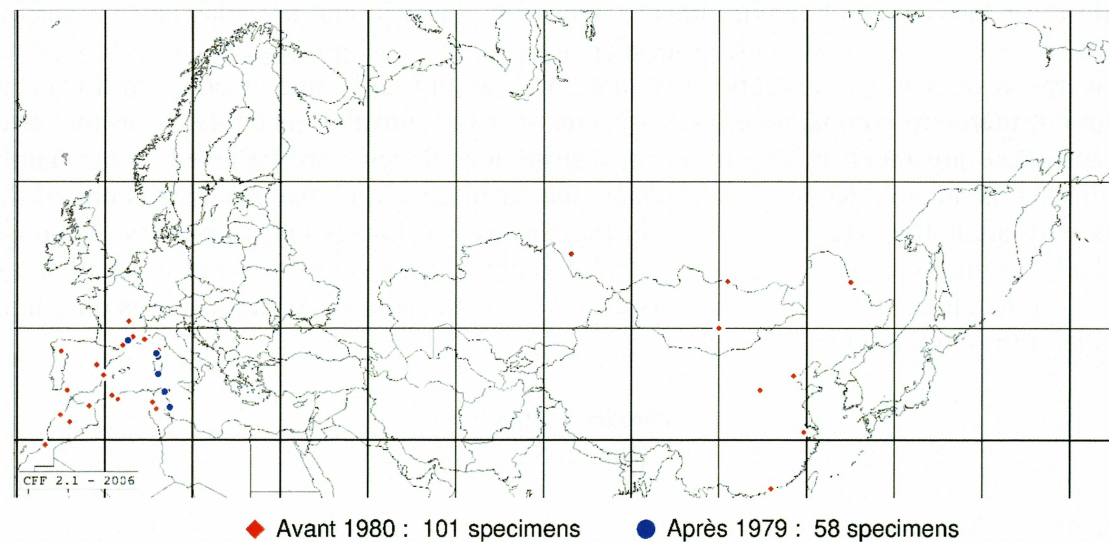


Fig. 2. Distribution map of *Asilus barbarus*.

It is not impossible that the young larvae attack locusts' egg capsules. Timon-David (1951) states it is very widespread in Morocco from the coastal region to the Middle Atlas. MUSSO (1978) and TOMASOVIC & MALDES (1997) consider this large and beautiful species to have disappeared from Lower Provence but she seems to be maintaining itself in Corsica (TOMASOVIC, 2003) (Fig. 3). LEHR (1979) informs that in Russia a female has been caught by the author near the border of Kazakhstan near the village of Anisimovka. It was found on the edge of a clearing in a place where cattle constantly grazes and rests. VASSEN (2019) showed photos of *A. barbarus* on the Massif M'Goun, Central High Atlas Mountains of Morocco.

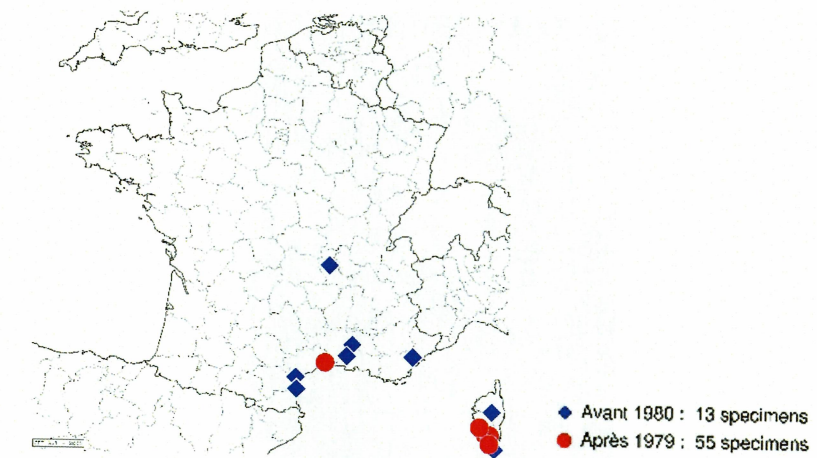


Fig. 3. *Asilus barbarus*. Map of France Distribution.

Study of male genitalia

MATERIAL EXAMINED. 2 ♂♂, Sahara, Air Rich, Ighouat, 2.VI.1888 and 9.VI.1888. Collector, A. Lameere (RBINS); 1 ♂, France, Le Châtelard (SA), 18.VII.1964. Leg. Brabant (FSAGX); 1 ♂, Spain, Valencia, Jaraco, 8.IX.1964. Leg. M. Leclercq (FSAGX).

Male genitalia (Fig. 4): Epandrium (E) with parallel-sided to the base with long and black serae, remarkably broader in the apical parts with rounded apex. Gonocoxite (G) triangular with ridges on the inner side. Dististylus (D) slightly curved and moderately broad, broader at the base, widening apically with a long rounded apical corner. Apodeme small, Phallus (P) short, distiphallus with three short and fines tubes.



Fig. 4. *Asilus barbarus* L., 1758, male genitalia. E, epandrium. P, phallus. D+G, dististylus & gonocoxite. G, Copy of Internal view of gonocoxite by Lehr (1987).

REMARK.

After the study of the structures of the genitalia we can see that the internal view of the gonocoxite of *A. barbarus* illustrated by LEHR (1987) is different enough of our own but unfortunately it does not indicate the provenance of the specimen (Fig. 4 G).

Asilus crabroniformis Linnaeus, 1758 (Figs 5-8)

Syst. Nat. Ed. 10, 1: 605 (*Asilus*). Type-locality: "intra Terram" (Europe).
Asilus crabroniformis, type species of the genus *Asilus* and type of the family Asilidae (LINNÉ, 1758).



Fig. 5. *Asilus crabroniformis* L., 1758, in copulation. © J. Mignon.

The species is instantly recognisable even to non-dipterists (Fig. 5).

YARROW (1939) and SKIDMORE (1966) provide interesting information on the biotopes as well as on the hunting behaviour of *A. crabroniformis* in Britain. SARA & SMERDEL (1953) gives a complete study of the thorax of *A. crabroniformis*. CLEMENTS & SKIDMORE (2002) describe the autecology in Wales.

DISTRIBUTION.

A. crabroniformis has a fairly wide distribution in altitude from 30°N to 64°N and in longitude reaches 90°E, further north but significantly less to the east than *A. barbarus*. (Fig. 6)

In literature we have notably recorded and encoded it for. Belgium, VERLINDEN (1982) and TOMASOVIC (1995,1996,1998); Belarus, SAKHAVON (2015); Britain and Ireland, YARROW (1939), DRAKE (1991); Bulgaria, HRADSKY & MOUCHA (1967); France, SÉGUY (1927, 1930), TIMON-DAVID (1951, 1953), MUSSO (1978), TOMASOVIC (1997), LIVORY (2005); Germany, GELLER-GRIMM (1996); Italy, CASTELLANI (1964); the Netherlands, VEEN (1996); Poland, TROJAN (1961), KACZMARZYK (1962); Romania, IONESCU & WEINBERG (1971); Spain, ÁLVAREZ FIDALGO *et al.* (2019); Turkey, ÇALISKAN (2003), HAYAT *et al.* (2007).

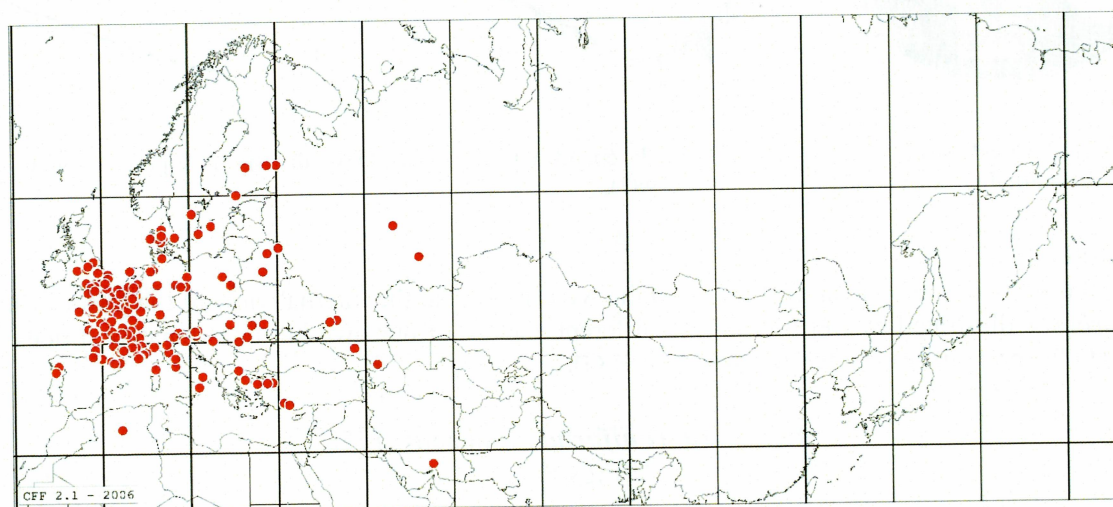


Fig. 6. Distribution map of *Asilus crabroniformis*.

Some authors give information on the environment of *A. crabroniformis*: SÉGUY (1927) notes "common everywhere, in fields, dry paths, sandy places, in the clearings of coniferous woods

on the droppings of large mammals." CASTELLANI (1964) reports that in Italy the species is common but localised and not easy to capture, it lands on cow dung. SAKHAVON & CAXBOH (2015) for Belarus reports 1 male and 1 female (in copula) on a sandy path near a river, 18.VIII.1991 and KÄSTNER (2016-2017) mentions the species' presence in Dresden on horse pasture.

Other authors discuss migration tendencies and abundance during the last decades. From Belgium *A. crabroniformis* has become noticeably rarer the last years according to VERLINDEN (1982) and TOMASOVIC (1995). In Britain this species is apparently extinct in East Anglia, DRAKE (1991) and there has been one further record of this species from northern England where it is now probably extinct (SKIDMORE, 1966). From Finland and Sweden *A. crabroniformis* is included in the WWF list of Finland as a vulnerable species. It is possible that the species has become extinct in Finland and its decline is also drastic in Sweden, where it has become rare due to the decrease in pasture area (VÄISÄNEN, 1982). We also note that MUSSO (1978) mentions the species in Provence but that it is in rarefaction.

WOLFF (2011) places *A. crabroniformis* on the red list from Germany which means it is threatened with extinction. KÄSTNER (2016-2017) noted that the species which was endangered was found for the first time in 2008 in almost 50 years and in the 2010; in 2015 there were more confirmations for Germany (see MATZKE-HAJEK & STRAUCH, 2011).

From Belgium *A. crabroniformis* has been seen in 2006, Prov. Namur Belgium, on meadows where horses were grazing and the species was observed on dung, more recently it's seen the 16/VIII/2020 on the reserve of Pelleu to Ave-et-Auffe (personal communication sent by J.Y. Bagnée, Service public de Wallonie, DGO3/DEMNA) (Fig. 7). Recent data on citizen science portals (i.e. waarnemingen.be), which we will not discuss in detail and were not integrated on our maps, suggests the species is getting more common again the last two decades, at least in Flanders. This is probably influenced by an increased use of cattle in nature reserves and increase of wild mammal populations generally. Possibly the species is also thermophilic and has some (in)direct advantages of climate change, but this is not clear.

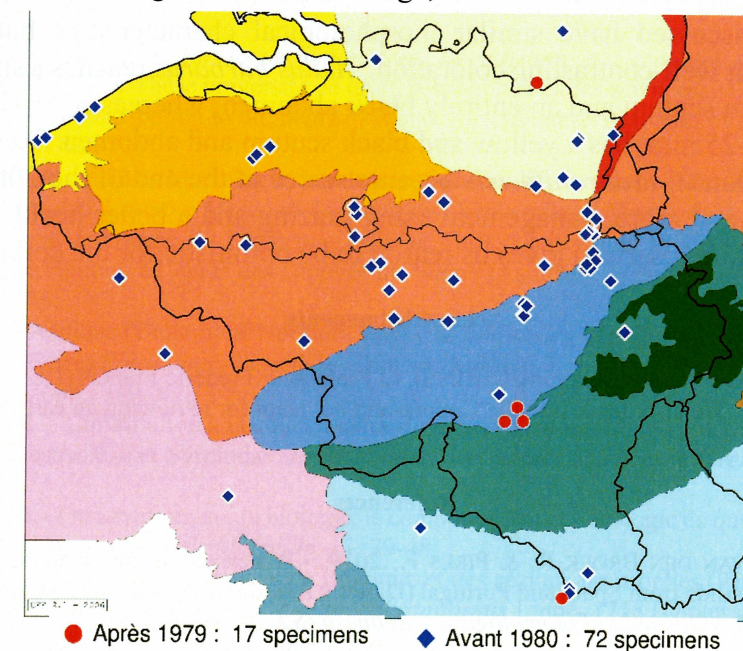


Fig. 7. *Asilus crabroniformis* L., 1758. Map of Belgium Distribution (literature, museum and personal data).

Study of male genitalia.

MATERIAL EXAMINED. 2 ♂♂, France (AM) Aspremond, 1.X.1949, 4.X.1949. Leg. Thomas. (FSAGX).

Genitalia male (Fig. 8): Epandrium oblong-triangular with rounded apex. Gonocoxite triangular with ridges on the inner side. Dististylus slightly curved and slender widening apically with a long and slender rounded apical corner. Apodeme small, Phallus short, distiphallus with three short and fines tubes.

We would like to point out that the genitalia of the two species studied have some similarities with those of the *Machimus (Tolmerus) costalis* Theodor, 1980 illustrated by THEODOR (1980).



Fig. 8. *Asilus crabroniformis* L., 1758, male genitalia. E, epandrium. P, phallus. G+D, gonocoxite & dististylus.

Discussion

The two species discussed have similar morphological characteristics but can easily be distinguished by their well-contrasting coloration. *Asilus barbarus* reaches a size of 25-35 mm, with a reddish-brown scutum and an entirely black abdomen, whereas *A. crabroniformis* only reaches a size of 20-25 mm, has a yellow and black scutum and abdomen. The genitalia of the males are very similar. *A. crabroniformis* became scarce at the end of the 20th century, but a conversion to more and more management using grazing and a better health management of livestock (e.g. in nature reserves) gives us reason to be optimistic for the coming years.

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