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***Calamoceras marsupus* BRAUER 1865 (Trichoptera, Calamoceratidae) in France: a rediscovered species¹**

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A b s t r a c t : *Calamoceras* is the only genus of the Calamoceratidae (Trichoptera) in the West Palearctic Region. *C. marsupus* occurs in western Europe and Morocco. The occurrence of this species in France has been known since the end of the XIXth century, but between 1930 and 2000 this species was found only once. During the last decade, larvae and adults of this species were found again in several stations especially in the catchment area of the Vienne River, different rivers from the south of the Massif Central and from the east of the Pyrenees and also in Brittany. The reasons for this rediscovery are briefly discussed.

K e y w o r d s : Trichoptera, *Calamoceras*, France, adult, larva, distribution maps.

Introduction

Calamoceras is the only genus of Calamoceratidae in the West Palearctic Region. There are two species: *Calamoceras marsupus* BRAUER, 1865 which occurs in France, the Iberian Peninsula and Morocco (BERLAND & MOSELY 1936, GONZALES et al. 1992, BONADA et al. 2008) and *Calamoceras illiesi* KUMANSKI & MALICKY 1974, which occurs in Bulgaria (KUMANSKI 1988), Greece (MALICKY 2005) and Turkey (SIPAHILER 2005) (Fig. 1).

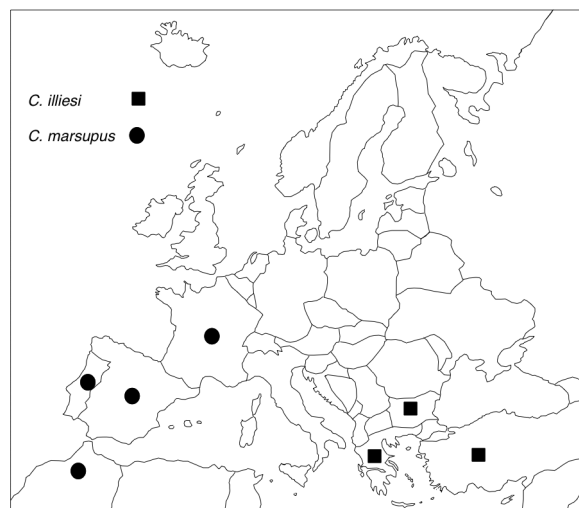


Fig. 1: Distribution of *Calamoceras marsupus* and *C. illiesi* in Europe, Turkey and Morocco. Black circles: *C. marsupus*; black squares: *C. illiesi*. (origin of data, see text).

¹ This paper is dedicated to Prof. Dr. Hans Malicky on the occasion of his 75th birthday.

Calamoceras marsupus was discovered for the first time in France in 1886 (MCLACHLAN 1886), followed by several isolated discoveries at the beginning of the XXth century, then, for almost seventy years, the species disappeared from publications devoted to running freshwaters. It is in this last decade only that *C. marsupus* has been rediscovered in France. This publication provides the latest data concerning the distribution of *C. marsupus* in France and discusses the reasons for this long disappearance.

The larvae sampled during the last decade were in good condition, thus providing the means to improve seriously the first descriptions based on specimens which had stayed a long time in preservative fluid. This revised description forms the second aspect of this publication.

Methods

The adults were collected with a sweepnet and/or with a light trap (ultraviolet lamp, 15 W). The larvae came from samples taken with a hand net or a Surber net in different types of microhabitats. The objective of these samples was to define a biotic index to assess the water quality of running freshwaters. For adults, as for larvae, the sampling methods were not selective, the occurrence of *C. marsupus* in a sample is by chance only.

Results

Distribution of *Calamoceras marsupus* in France

All the of data concerning the distribution of *C. marsupus* in France were collected over more than a century, with two distinct periods, the first one between 1886 and 1930 and, the second one after 1960.

C. marsupus in France from 1886 to 1930 (Fig. 2A)

MCLACHLAN (1886) discovered, for the first time in France, an adult of *C. marsupus* in the Creuse River, a tributary of the Vienne. This species was rediscovered later in the Creuse, and in one of its tributaries: the Gartempe (LACROIX 1912, 1916, 1917; MARTIN 1892, 1895). LACROIX (1912, 1916, 1917) found this species in two coastal rivers: the Sèvre-Niortaise and the Charente. In 1930, DESPAX, in BERLAND & MOSELY (1936), found *C. marsupus* in two coastal streams close to the city of Montpellier (Département of Hérault). From 1930 to 1963, there was no capture of *C. marsupus* in France.

C. marsupus in France after 1960 (Fig. 2B)

COINEAU & JACQUEMART (1963) found in a small stream close to the locality of Banyuls (Département of Pyrénées-Orientales, France) larvae, pupae and adults of *C. marsupus*. The description of the male adult and of the pupa is sufficiently precise to identify a *C. marsupus*. Unfortunately, the choice of characteristics to identify the larva is not relevant, thus it is impossible to recognize a larva of Calamoceratidae.

C. marsupus is common in the Iberian Peninsula, but the larva remained unknown. GARCIA DE JALON et al. (1987), using relevant characteristics, gave a first description of the larva. TACHET et al. (2000) and VIEIRA-LANERO (2000) provided new characteristics to complete the description provided by GARCIA DE JALON et al. (1987).

In France, from 2001 to 2009, 21 adults were caught and more than two hundred larvae were sampled: 31 in the final instar, and 183 young larvae (second and third instars). At the level of a French département, by reference to the old data (i.e. before 1930), *C. marsupus* was not found in the Deux-Sèvres and the Charente-Maritime, it was found again in the Hérault and the Vienne, and it was found, for the first time, in the Finistère-Sud, the Morbihan, the Pyrénées-Orientales, the Aude and the Gard (Table 1 and Fig. 2B).

C. marsupus occurs in streams and rivers having their source:

- in the Massif Central. In the north-west, *C. marsupus* occurs in the Vienne River catchment, in the east in the Gardon River and, in the south in the Hérault River, the Lez River, the Orb River and in the Mosson stream,
- in the eastern part of the Pyrenees: in some tributaries of the Aude River, in the Agly River, and in tributaries of streams such as the Ballaury and the Riberata,
- in the south of the Armorican Massif, in three coastal rivers: the Ellé and the Isole, two tributaries of the Laïta and in the Blavet.

C. marsupus is absent from the Bassin Parisien, from the east of France (Alsace, Lorraine, the Vosges, the Jura and the Alps including, in this last case, the Alpes-Maritimes where, nevertheless, the climate is Mediterranean, thus similar to the climate of the Iberian Peninsula). This species is also absent from Corsica.

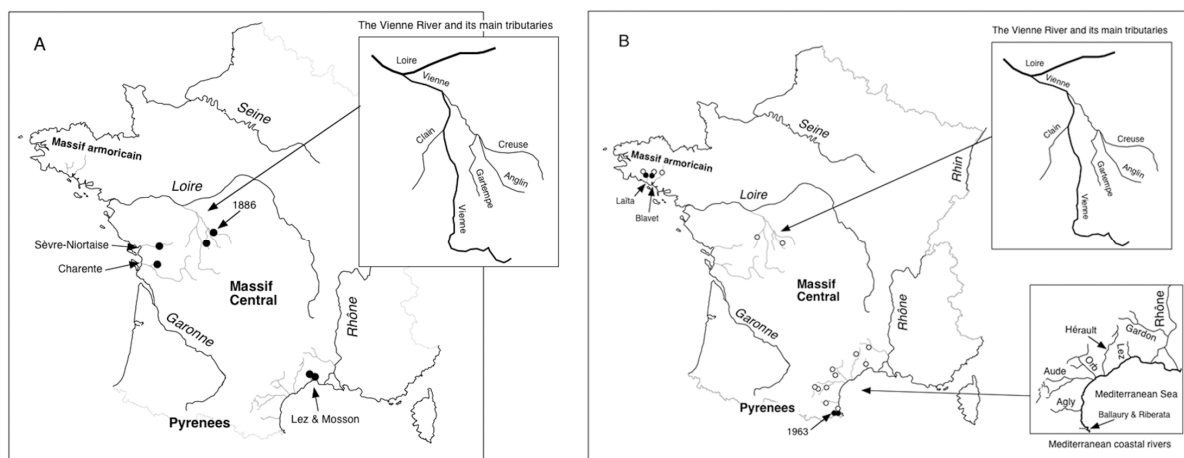


Fig. 2: Distribution of *C. marsupus* in France in different streams or rivers; (A) Catches (adults only: black circles) between 1886 (arrow) and 1930 (see also text); (B) Except for point 1963 (arrow), all other points refer to the presence of *C. marsupus* from 2001 to 2009 in different streams or rivers. Black circles: adults, white circles: larvae. See also Table 1.

Redescription of the larva of *C. marsupus*

The descriptions of GARCIA DE JALON et al. (1987) and TACHET et al. (2000) were based on larvae that had been preserved for a long time in alcohol. The soft parts (and especially the humps of the first abdominal segment) had completely collapsed and the cuticle is uniformly brownish; it is impossible, in this last case, to see differences in the pigmentation patterns. Thanks to the help of several contributors (see list in the Appendix 1) we have obtained several recently caught larvae with well-preserved characteristics: the turgidity of the humps and the pigmentation patterns of the sclerites are clearly visible.

We will consider firstly the larvae of the final instar and secondly the young larvae (second and third instars).

1. Final instar larva

In the final instar, the length of the larva varies from 15 to 17 mm. *C. marsupus* presents a set of original characteristics that we have ranked by order of relevance and facility of examination.

- The anterolateral corners of the pronotum are extended and pointed (Fig. 3A).
- The fore trochantin is hooked (Fig. 3A).
- The pronotum is, in its posterior half, slightly bulging. The posterior margin of the pronotum is thick and black except for two parts on each side which are lightly coloured ; close to the median ecdysial line, the posterior margin is swollen and black. The mesonotum bears two slightly sclerotized plates. At the anterior margin of each plate, along the median line, there is a black, pointed thickening. Laterally, on each side, there is an elongated sclerite bearing several setae directed forward. The metanotum is almost entirely membranous except for four very small sclerites each one bearing one seta and, laterally, on each side, an elongated sclerite bearing several setae directed forward. (Figs 3A & B).
- There are three humps on abdominal segment one. The dorsal hump is very prominent, the lateral humps (in lateroventral position) are cylindrical with close to the tip, a sclerotized band covered in rows of minute spines. In specimens that have spent a long time in alcohol, the humps have collapsed.
- There are abdominal gills on segments 2 to 7. The dorsal gills bear 2 to 4 branches, the lateral gills bear 2 to 3 branches, the ventral gills have 3 to 4 branches. There is a lateral fringe on abdominal segments 2 to 6. This lateral fringe separates the row of dorsal gills from the row of lateral gills. Abdominal segment VIII bears a lateral row of tubercles.
- The anal claws are slightly spread out and bear an accessory hook (Fig. 3C).
- The head capsule is chestnut brown, with light-colored oval-shaped muscle scars (Fig. 3D).
- The labrum has a transverse row of approximately 22 stout setae across the central part (Fig. 3E). This original setation of the labrum is a common characteristic of the larvae of Calamoceratidae, but it is clearly visible only under the microscope, thus the characteristics provided above (from 1 to 7) visible with up to 50 X magnification of a stereo microscope are perfectly relevant (and sufficient) to identify a larva of *C. marsupus*.

In Europe, the case of *C. marsupus* is made of woody detritus variously arranged (see photographs in VIEIRA-LANERO 2000). In Morocco (BONADA et al. 2008), some cases are made entirely of sand.

2. Young larvae

Thanks to Vincent BOUCHAREYCHAS (see Appendix 1), we have been able to examine larvae of the second and third instars. Some characteristics are not yet visible: the anterolateral corners of the pronotum are angular only, the head is ochre and the muscle scars are inconspicuous, the abdominal gills have one or two branches only, but three characteristics are already conspicuous and make it possible to identify a *C. marsupus* larva:

- the first abdominal segment with its three humps is the minute counterpart of that of the final instar larva. (Fig. 3A).
- the last abdominal segment, in dorsal view, is a minute counterpart of that of the final instar larva, (Fig. 3C).
- close to the median ecdysial line, each mesonotal sclerite bears anteriorly one black sclerotized point. (Fig. 3B).

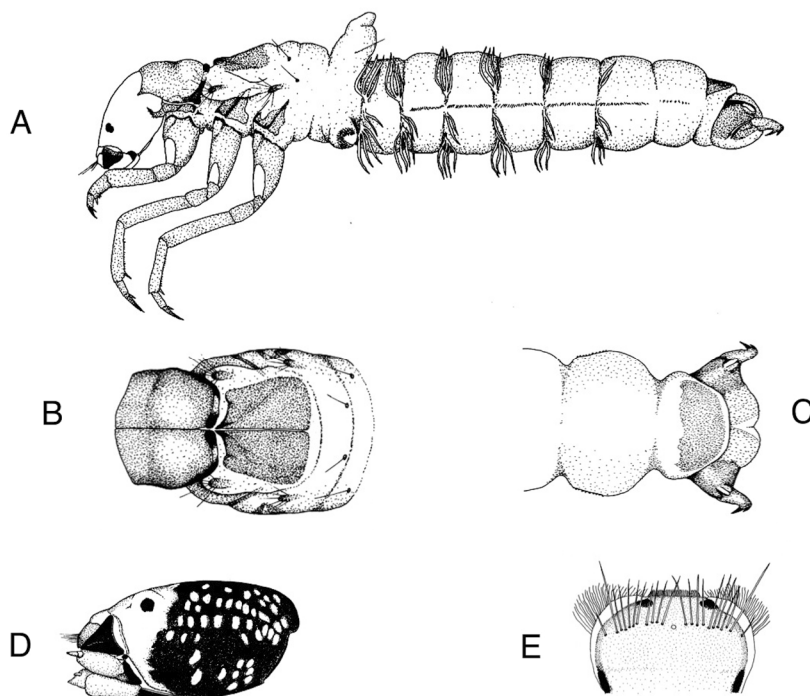


Fig. 3: Larva of *Calamoceras marsupus*; (A) Last instar larva, lateral. Only the outline of the head is drawn. The setation is reduced to setae on the meso- and metathorax; (B) Pro-, meso- and metathorax, dorsal; (C) Abdominal segments VIII & IX, dorsal; (D) head, lateral; (E) labrum, dorsal. See also comments in text.

Pupa

The pupa of *C. marsupus* has been described by COINEAU & JACQUEMART (1963) and TACHET & GONZALES (2005). The pupa of *C. illiesi* have been described by SIPAHILER (2006).

Discussion

The main question concerning the distribution of *C. marsupus* in France is how a Trichoptera of about 15 mm in length is able «to disappear» for seventy years – if we except the isolated discovery of COINEAU & JACQUEMART (1963) – and to reappear in the last decade? Several explanations are possible without referring to pollution.

Research on Trichoptera continued after the inventory of BERLAND & MOSELY (1936-1937), but, unlike to catches made everywhere in France before 1930, this research was confined to

more reduced areas. For example DÉCAMPS (1967) studied in particular the Trichoptera communities of the Hautes-Pyrénées Département, GIUDICELLI (1968) studied the Trichoptera of some rivers of Corsica, and VERNEAUX (1973) studied the Trichoptera of the River Doubs. From 1950 to 2000, no sizeable study of the Trichoptera was carried out in Brittany, around and within the Massif Central, in the Region of Languedoc and Roussillon and in the Region of Vendée and Charentes.

However, at the end of the sixties, the increasing pollution of streams and rivers led the River Basin Agencies (Agences de l'eau) to manage different studies in order to assess the river water quality at several thousand sampling stations in France. This assessment is based on the calculation of a biotic index. This index is generally based on the macroinvertebrates. Unfortunately this index takes into account only the aquatic stages (thus essentially larvae) and restricts the identification to the family level. Larvae of Calamoceratidae were certainly sampled during this period, but as the larva was unknown, these larvae were probably confused either with Limnephilinae (Limnephilidae) larvae: branched gills, cases made of woody detritus or, perhaps, with larvae of *Sericostoma* (Sericostomatidae) because the anterolateral corners of the pronotum in *Sericostoma* are extended and pointed as in *Calamoceras*.

The larva of *Calamoceras marsupus* was described by GARCIA DE JALON et al. (1987) in an international journal, but curiously, it is only after the description of TACHET et al. (2000) and VIEIRA-LANERO (2000) that French hydrobiologists began to discover larvae of *C. marsupus* in their samples.

The adults were described a long time ago (see recent descriptions in MALICKY 2004), thus there is no reason to explain why they were not found during these last forty years. Of course, the very detailed studies of DECAMPS (1967), GIUDICELLI (1968) and VERNEAUX (1973) were carried out in areas where, as we know today, *C. marsupus* does not occur, but, why was there no catch elsewhere before 2001?

The rediscovery of adults of *C. marsupus* in this last decade is related to the appearance of the notion of biodiversity at the beginning of the nineties. In France, the web site of the OPIE Benthos (www.invfmr.org) was created to set up, among different projects, an inventory of freshwater species, firstly of the Ephemeroptera, then of the Trichoptera (see TACHET & BRULIN 2005) and of the Plecoptera. This new approach began in 2000 for the Trichoptera, the first data were obtained in 2001, but, unfortunately, the number of collectors is still low.

Thanks to a revised description of the larva (present publication), thanks also to the use of internet which provides the possibility of fast and numerous exchanges between hydrobiologists, it will be possible to complete and improve the map of distribution of *C. marsupus* in France. We recommend that hydrobiologists search for this species (as larva or as adult) in regions where it is probably present, but where it has not yet been found, especially in the rivers of the western part of the Massif Central.

Acknowledgements

The authors would like to thank all those (see Appendix 1) who helped to draw a map of the present distribution of *C. marsupus* in France. They would also like to thank those who have sent recently collected larvae. Thanks to their kind help, it was possible to improve perceptibly the earlier descriptions of the larva. We also thank Vincent Bouchareychas who sent us young larvae, thus providing a means to identify a larva of *C. marsupus* as early as the second instar, and thus increasing the chances of finding this species. We thank Glyn Thoiron for her helpful linguistic advice.

Résumé

Calamoceras est le seul genre de Calamoceratidae de la Région Ouest Paléarctique. *C. marsupus* est présent dans le sud-ouest de l'Europe et au Maroc. La présence de cette espèce en France est attestée depuis 1886, mais entre 1930 et 2000 cette espèce n'est plus retrouvée. Depuis 2001 des adultes et des larves de *C. marsupus* sont régulièrement trouvés notamment dans des cours d'eau issus du Massif central, de l'est des Pyrénées et en Bretagne. Les raisons de cette «disparition» sont brièvement discutées.

Zusammenfassung

Calamoceras ist die einzige Gattung der Calamoceratidae in der Westpaläarkt; *C. marsupus* kommt in Westeuropa und Marokko vor. Obwohl das Vorkommen in Frankreich seit dem Ende des 19. Jahrhunderts bekannt war, wurde die Art zwischen 1930 und 2000 nur einmal gefunden. In den letzten zehn Jahren wurden Larven und Adulte an mehreren Stellen gefunden, vor allem im Einzugsbereich des Flusses Vienne, in verschiedenen Flüssen im Süden des Massif Central, in den Ostpyrenäen und auch in der Bretagne. Die Gründe für diese Wiederentdeckung werden kurz besprochen.

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Tab. 1: Captures of adults and larvae (ranked by chronological order) of *Calamoceras marsupus* in France from 2001 to 2009.

| Locality | Dpt* | Rivers (main river) Ru.: small stream | Date | Contributors see App. 1 | ♂ ♂ | ♀ ♀ | | |
|--|------|--|------------|----------------------------|-----|-----|------------|---------------------------|
| A d u l t s | | | | | | | | Methods of capture |
| Locunolé | 29 | Ellé (Laïta), Ty Nadan | 09.06.2001 | 4 & 10 | 1 | 1 | | ? |
| Le Faouet | 29 | Ellé (Laïta), Tanguy bridge | 23.06.2001 | 8 & 10 | 1 | | | ? |
| Mellac | 29 | Isole (Laïta), Schluz bridge | 31.07.2001 | 10 | 1 | | | ? |
| Tremeven | 29 | Ellé (Laïta), La Pêcherie | 20.05.2004 | 4 | 1 | | | ? |
| Banyuls | 66 | Ru. des Vignes | 28.05.2009 | 6 | 3 | 1 | | sweepnet |
| Banyuls | 66 | Junction Ru. des Vignes- Ru. Pouara | 28.05.2009 | 6 | 4 | 2 | | sweepnet |
| Banyuls | 66 | Downstream Ru. des Vignes- Ru. Pouara | 28.05.2009 | 6 | 4 | | | sweepnet |
| Banyuls | 66 | Ru. des Vignes, upstream La Ballaury | 29.05.2009 | 6 | 2 | 1 | | light trap 15 W |
| L a r v a e | | | | | | | No. | Comments |
| Premian | 34 | Jaur (Orb) | 03.08.2001 | 3 | | | 3 | |
| Saint-Etienne d 'Albagnac | 34 | Jaur (Orb) | 03.08.2001 | 3 | | | 2 | |
| Prades s / Vernazobre | 34 | Vernazobre (Orb) | 03.08.2001 | 3 | | | 1 | |
| Ceilhes & Rocazels | 34 | Orb | 07.08.2001 | 3 | | | 113 | young larvae |
| Saint-Paul-de-Fenouillet | 66 | Agly, bridge on D117 | 22.09.2002 | 3 | | | 70 | young larvae |
| Prissac** | 36 | Sonne (Anglin) | 10.08.2005 | 5 | | | 1 | |
| Saint-Thurien | 29 | Isole (Laïta) | 04.10.2005 | 12 | | | 1 | |
| Arzano | 29 | Ellé (Laïta) | 04.10.2005 | 12 | | | 4 | |
| Arzano | 29 | Ellé (Laïta) | 19.09.2006 | 12 | | | 4 | |
| Vignevielle | 11 | Orbieu (Aude), 500 m upstream D212 | 19.11.2006 | 9 | | | 2 | |
| Chasseneuil-du- Poitou | 86 | Auxance (Clain) | 31.07.2007 | 2 | | | 3 | |
| Olargues | 34 | Jaur (Orb) | 31.08.2007 | 7 | | | 1 | |
| Prades-le-Lez | 34 | Lez | 31.08.2007 | 7 | | | 1 | |
| Saint-Jean-de-Bueges | 34 | Bueges (Hérault) | 31.08.2007 | 7 | | | 1 | |
| Neuillac | 56 | Blavet, bridge on D125 | 11.09.2007 | 11 | | | 2 | |
| Anduze | 30 | Gardon d'Anduze | 10.10.2007 | 7 | | | 1 | |
| Ginols- les-Bains | 11 | Le Coulent (Aude) | 09.07.2008 | 1 | | | 1 | |
| Ladern-sur-Lauquet | 11 | Le Lauquet (Aude) | 13.08.2008 | 7 | | | 2 | |
| Soredes | 66 | Ru. Les Mouchouses (la Riberata) | 25.05.2009 | 6 | | | 1 | |
| Dpt*: Département number | | | | | | | | |
| Prissac**: 11 larvae in 2006, 4 larvae in 2007, 1 larvae in 2009 | | | | | | | | |

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