

Culex (Culex) torrentium Martini (Diptera: Culicidae) a new species from Spain

Carlos Aranda¹, Roger Eritja¹, Francis Schaffner² and Raül Escosa³

¹Consell Comarcal del Baix Llobregat, Barcelona, Spain, ²EID Méditerranée, Montpellier, France,

³Consorci de Serveis Agroambientals de les Comarques del Baix Ebre i Montsià, Tarragona, Spain.

Email: arandapc@diba.es

Abstract

Culex torrentium is reported from Spain for the first time in the summer of 1999 from the region of Cerdanya, province of Girona. *Cx. torrentium* was associated with *Anopheles petragani*, *Culiseta longiareolata*, *Cs. annulata*, *Culex impudicus*, *Cx. hortensis* and/or *Cx. pipiens*. Although different taxonomic characters for larvae and females have been tentatively used to separate *Cx. torrentium* from *Cx. pipiens*, only male genitalia can be used as a reliable diagnostic character.

Introduction

The mosquito *Culex torrentium* Martini is widely distributed in the Palaearctic region. Since first described in 1924 from Germany, it has been recorded in several countries of western and northern Europe and western Asia (Knight & Stone, 1977; Harbach, 1988). This species shares similar ecological requirements and morphology with *Culex pipiens* (Service, 1968; Dahl, 1988) and, despite several attempts to use different taxonomic characters to separate the two species, they can be distinguished reliably only using details of the male genitalia (Dahl, 1988; Onyeka, 1982; Raymond, 1995). Genetic analysis of sympatric samples from Italy found three diagnostic loci that totally differentiate *Cx. torrentium* from *Cx. pipiens* (Urbanelli *et al.*, 1981).

Although never previously recorded from Spain, the presence of this species has been suspected, especially in the Pyrenees, because of its distribution in France and its correlation with altitude (Sicart, 1954; Doby & Rault, 1960). In England, where this mosquito was first recorded by Mattingly in 1951, it was found by checking specimens in museum collections (Service, 1968) that this species had been present since at least 1900.

These facts and the difficulty of separating *Cx. torrentium* from *Cx. pipiens* led the authors to sample mosquitoes in Cerdanya, in the Pyrenees, in order to attempt to detect the presence of *Cx. torrentium*.

Study area and methods

The valley of Cerdanya is of lacustrine origin and it is located in the Pyrenees, between Spain and France (42°18'-42°31' N; 1°35'-2°08' E). Its situation and characteristics make it rich in water and therefore a suitable habitat for mosquito development.

Mosquitoes were sampled on July 31st and August 1st 1999 on the Spanish side of Cerdanya, in the Province of Girona. Altitude ranged from 1100m to 2150m. During this study, all possible aquatic sites were sampled for larvae and pupae. Resting or biting mosquito adults were also collected. Most of the mosquito larvae and pupae were allowed to develop and emerge, although some individuals died before reaching the adult stage.

Although only males can be used for identification, the authors also checked some of the taxonomic characters for larvae and females that have been previously suggested for the separation of these two species. Larval seta 1-X, usually double, and setae 1-III-V, with 3-6 branches (usually 4 or 5) in *Cx. torrentium*, were checked. In females of this species, wing cell R2 is usually less than 4.0 times the length of vein R2+3 and pre-alar scales are present on the sternopleuron (Jupp, 1979; Harbach, 1988; Sabatinelli & Romi, 1997).

Male specimens were identified as *Cx. torrentium* using the following criteria: In *Cx. pipiens*, the dorsal arm of the phallosome does not reach the level of the crown of spines of the paraproct, it is tubular and distinctly truncated at its tip, whereas in *Cx. torrentium* it is about on a level with the crown, it is pointed

at the tip and has a median wing-like projection. The basal lateral arm of the paraproct is well developed in *Cx. torrentium* and vestigial in *Cx. pipiens* (Service, 1968; Jupp, 1979). Larvae and females of *Cx. pipiens* and *Cx. torrentium* were recorded as *Cx. pipiens/torrentium*.

As a supplement to the study, larvae and adults of other species occupying the habitats were identified using the keys of Marshall (1938), Rioux (1958) and Encinas Grandes (1982).

Results and discussion

During the study, eight sites were sampled. When females or larvae of *Cx. pipiens/torrentium* were recorded, the presence or absence of pre-alar scales, R2/R2+3 ratio and number of branches of setae 1-X and 1-III-V are given for each individual when possible. Many individuals lacked some characters and these data are omitted or are indicated as "?". Results were as follows:

1. Queixans. A small pond on the edge of Segre river, altitude 1100m. *Anopheles petragani* Del Vecchio (1F emerged). *Culiseta annulata* (Schrank) (4L, 3M, 2F emerged). *Culex hortensis* Ficalbi (4L). *Cx. impudicus* Ficalbi (1L, 1M, 1F emerged). *Cx. torrentium* (1M emerged). *Cx. pipiens/torrentium* (1F). For *Cx. pipiens/torrentium* female, pre-alar scales were 0 right side/2 left side and R2/R2+3 was 3.5.

2. An abandoned freezer in the pond at Queixans. *Cs. annulata* (1L, 1M, 3F emerged). *Cx. torrentium* (8M emerged). *Cx. pipiens/torrentium* (1L, 1F, 2F emerged). For *Cx. pipiens/torrentium* larva, setae 1X were double and for females, pre-alar scales were 0/0, 1/2, 2/1 and R2/R2+3 were 4.0, 4.0, 6.0.

3. Queixans. A pile of discarded tyres, altitude 1100m. *Cx. torrentium* (5M emerged). *Cx. pipiens/torrentium* (5L, 3F, 3F emerged). For *Cx. pipiens/torrentium* larvae, setae 1X were double, setae 1-III-V with 2 branches, and for females, pre-alar scales were 0/0, 3/2, ?/? , ?/? , ?/? , ?/? and R2/R2+3 were 4.9, 5.2, ?, 3.8, 3.7, 4.0. Near the tyres, in vegetation: *Aedes vexans* (Meigen) (1F), *Cs. longiareolata* (Macquart) (3L), *Cx. pipiens* (1M).

4. Puigcerdà. A flooded grass field partially polluted by cattle, altitude 1100m. *Cx. impudicus* (1F emerged). *Cx. pipiens* (2M emerged). *Cx. torrentium* (6M emerged). *Cx. pipiens/torrentium* (4L, 3F emerged). For *Cx. pipiens/torrentium* larvae, setae 1X double, setae 1-III-V with 3 branches, and for females, pre-alar scales were 3/2, 3/4, ?/? , and R2/R2+3 were 3.0, 3.4, ?.

5. Meranges. A stream pool, altitude 2150m. *Cx. hortensis* (3L, 2M emerged, 2F emerged). *Cx. impudicus* (1F emerged). *Cx. torrentium* (5M emerged). *Cx. pipiens/torrentium* (1F emerged). For *Cx. pipiens/torrentium* female, pre-alar scales were 2/3 and R2/R2+3 was 3.4.

6. Meranges. A stone fountain containing freshwater covered with vegetation, altitude 1500m. *Anopheles* sp. (1 L-II). *Cx. hortensis* (1L). *Cx. impudicus* (1M emerged). *Cx. torrentium* (1M emerged). *Cx. pipiens/torrentium* (2F emerged). For *Cx. pipiens/torrentium* females, pre-alar scales were 0/0, 8/7 and R2/R2+3 were ?, 3.2.

7. Alp. A flooded grass field, altitude 1200m. *An. petragani* (1L). *Cx. pipiens/torrentium* (1L). For *Cx. pipiens/torrentium* larva, setae 1X simple, setae 1-III-V with 3 branches.

8. Soriguerola. Discarded tyres on agricultural silage close to a river, altitude 1100m. *Cx. hortensis* (1F emerged). *Cx. pipiens* (1M emerged). *Cx. pipiens/torrentium* (5L, 6F emerged). For *Cx. pipiens/torrentium* larvae, setae 1X double, setae 1-III-V with 3 or 4 branches, and for females, pre-alar scales were 0/0, 0/0, 0/0, 0/0, ?/? , ?/? and R2/R2+3 were 3.0, 3.8, 5.3, 4.5, 4.1, 6.5.

Culex torrentium is thus reported in Spain for the first time and 26 males of this species were determined. Larvae of *Cx. torrentium* were present in most of the habitats together with *An. petragani*, *Cs. longiareolata*, *Cs. annulata*, *Cx. impudicus*, *Cx. hortensis* and/or *Cx. pipiens*. On the evidence of emerged males, *Cx. torrentium* has also been found above 1000m, on two occasions, in a proportion of *Cx. pipiens/Cx. torrentium* of 1/5 and 2/6.

Cx. torrentium was first recorded in the Iberian Peninsula in Portugal (Ribeiro *et al.*, 1977) in the Regions of Beiras, Tras-os-Montes and Alto Douro (Ribeiro *et al.*, 1992) from 200 to 1050m and was considered rare. These data and the distribution of this species in relatively cold areas in Europe suggest that *Cx. torrentium* may be found in the Iberian Peninsula in hilly and mountainous areas, even in southern Spain. *Cx. torrentium* has also been reported in France from sea level to alpine level, but with a predilection for mountainous areas (Doby & Rault, 1960; Gilot, 1968). *Cx. torrentium* is found alone in alpine and subalpine levels, and at lower levels associated with *Cx. pipiens* (F. Schaffner, personal observation).

It was not possible to separate larvae and females into *Cx. torrentium* and *Cx. pipiens* using morphological criteria. The use of concomitant characters such as number of pre-alar scales and R2/R2+3 ratio was not effective for females. Apart from genetic differentiation, only male genitalia remain as a reliable diagnostic character to separate these two species.

References

- Dahl, C. (1988) Taxonomic studies on *Culex pipiens* and *C. torrentium*. pp 149-175 in: Service, M.W. (ed.) *Biosystematics of Haematophagous Insects*. Clarendon Press. Oxford. 363 pp.
- Doby, J. M. & Rault, B. (1960) Complément à l'étude des caractères morphologiques différentiels de *Culex pipiens* Linné, 1758 et de *Culex torrentium* Martini, 1924 (Diptera Culicidae). *Cahiers des Naturalistes, nouvelle série* 16, 113-122.
- Encinas Grandes, A. (1982) Taxonomía y biología de los mosquitos del Área Salmantina. CSIC. Universidad de Salamanca. Salamanca. 437 pp.
- Gilot, B. (1968) Introduction à l'écologie des Culicinae de la région Grenobloise. Etude de la "chorologie verticale". Thèse, Université mixte de médecine et pharmacie, Grenoble. 243 pp + annexes.
- Harbach, R. (1988) The mosquitoes of the subgenus *Culex* in southern Asia and Egypt (Diptera: Culicidae). *Contributions of the American Entomological Institute* 24. 240 pp.
- Jupp, P.G. (1979) *Culex* (*Culex*) *pipiens* and *Culex* (*Cx.*) *torrentium* (Diptera: Culicidae) in England: notes on their taxonomy and biology. *Mosquito Systematics* 11, 121-126.
- Knight, K. & Stone, A. (1977) *A catalog of the mosquitoes of the world*. The Thomas Say Foundation 6. 611 pp.
- Marshall, J.F. (1938) *The British mosquitoes*. British Museum (Natural History). London. 341 pp.
- Onyeka, J.O.A. (1982) The taxonomic value of pre-alar scales in the identification of *Culex* (*Culex*) *pipiens* L. and *Culex* (*Cx.*) *torrentium* Martini (Diptera: Culicidae). *Mosquito Systematics* 14, 41-51.
- Raymond, M. (1995) On the breeding period of *Culex pipiens* and *C. torrentium* (Diptera, Culicidae) in Uppsala, Sweden. *Entomologisk Tidskrift* 115, 65-67.
- Ribeiro, H., da Cunha Ramos, H., Antunes Capela, R. & Alves Pires, C. (1977) Research on the mosquitoes of Portugal (Diptera, Culicidae) III - Further five new mosquito records. *Garcia de Orta, Série de Zoologia, Lisboa* 6, 51-60.
- Ribeiro, H., da Cunha Ramos, H., Antunes Capela, R. & Alves Pires, C. (1989) [1992] Research on the mosquitoes of Portugal (Diptera: Culicidae) XI - The mosquitoes of the Beiras. *Garcia de Orta Série de Zoologia, Lisboa* 16, 137-161.
- Rioux, J-A. (1958) *Les Culicides du "Midi" Méditerranéen*. Ed. Paul Lechevalier. Paris. 303 pp.
- Sabatinelli, G. & Romi, R. (1997) *Moskeytos identification software*. Istituto Superiore di Sanità. Roma.
- Service, M.W. (1968) The taxonomy and biology of two sympatric sibling species of *Culex*, *C. pipiens* and *C. torrentium* (Diptera, Culicidae). *Journal of the Zoological Society of London* 156, 313-323.
- Sicart, M (1954) Présence de *Culex torrentium* dans les Pyrénées et comparaisons avec *Culex pipiens* du même gîte. *Extrait du Bulletin de la Société d'Histoire naturelle de Toulouse* 89, 228-230.
- Urbanelli, S., Sabatini, A. & Bullini, L. (1981) Tassonomia morfologica e biochimica di *Culex pipiens* e *Culex torrentium*. *XI Congresso Nazionale della Società Italiana di Parassitologia. Parassitologia* 23, 279-281.