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Contribution to the knowledge of the Nycteribiidae (Diptera) from Venetian Region

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Abstract. The flies belonging to the Nycteribiidae family are pupiparous, blood-sucking, obligatory ectoparasites of Chiroptera. Their biology and morphology are the result of the adaptation to an ectoparasitic life on their host: the bats. Nine species are reported from Italy, six from the region Veneto. Fly specimens, collected from bats belonging to the main colony (*Myotis myotis* and *Miniopterus schreibersii*, 200-250 individuals in 1975-1980) living into "La Bislonga" cave (1001 V/TV), were studied and identified as *Nycteribia latreillii*, new for Northern Italy, *N. schmidlii* and *Penicillidia dufourii*. These data confirm the host specificity of the parasite species, as previous quoted. The significant reduction in bat richness and abundance occurred in the last years has done direct effect on parasite distribution and in general on biodiversity.

Key words: *Nycteribia latreillii*, *Nycteribia schmidlii,* Chiroptera, cave, biodiversity.

The flies belonging to the Nycteribiidae family are pupiparous, blood-sucking, obligatory ectoparasites of Chiroptera. Their biology and morphology are the result of the adaptation to the ectoparasitic life on their host: the bats. The sternites of the thorax are fused into a broad plate, while the mesonotum is membranous, the opposite to the other flies. The pleurae are displaced dorsally and the legs are inserted on the dorsal surface. The head is kept folded back at rest, so that its dorsal surface rests on the mesonotum. It is rotated forward through 180° for feeding. Wings are absent in all Nycteribiidae, but halteres are present; they have a thin stalk and a spherical or ovoid head. The femora are thick and have a ring of weaker integument near the base, the tibiae vary in form in the different species, they are either laterally compressed or more or less cylindrical. The basitarsus is usually very long, sometime shorter, whereas others tarsal segments are short. The praetarsus triangular, broad, has two strong claws and pulvilli, whereas the empodium is absent (Theodor, 1975). The life cycle is rather uniform throughout the Nycteribiidae. The female ovaries produce one egg at time that descends into the uterus for developing after fertilisation. The larva feeds and growth within the female uterus, where it is nourished by the secretion of the "milk gland". The female leaves its host bat just before larviposition and usually deposits the larva on a vertical surface of the bat roost. The larva transforms into the pupal stage from which emerged after 20-40 days.

Three degrees of host-parasite specificity are present in the Nycteribiidae: (1) restriction to one species of host; (2) restriction to a genus or a family of host; (3) lack of specificity. The host specificity seems to be determined in some case by ecological factors and geographical isolation.

Today, twelve genera, with about two hundred fifty specie, are included in this family. The species are widely distributed in the world, mainly in the warmer regions. The family is believed to have had its centre of origin in the Malaysian subregion (Peterson and Wenzel, 1981). From the European region 15 species are reported (www.faunaeur.org). The knowledge about the flies parasites of bats present in the Italian territory (9 species of Nycteribiidae; 1 species of Streblidae) is still incomplete, although several data have been summarised by Stefanelli (1942) and Lanza (1999). The reports of Nycteribiidae from the Venetian region are scarce and occasional (Caoduro, 1994; Lanza, 1999; Ruffo, 1938; Vanin and Vernier, 2005) (Table 1).

The aims of this paper are (i) improve the knowledge on the Nycteribiidae-fauna in the Venetian region starting from new original data; (ii) point the "state of the art" on the knowledge of this family in Northern Italy, and (iii) propose a conservational reflection.

Material, methods and site description

Twenty wingless flies, kept in a vials containing also several acari, were studied. The specimens were collected on 30.07.1977, from bats belonging to the biggest colony of "La Bislonga" cave (1001 V/TV; Long 29 25 6, Lat 45 52 42 9) which is located in the Venetian Prealps, in Pederobba municipality (Province of Treviso). The cave is long 321 m, high 15, and ends with a small lake. The main bat colony, just reported since 1800, counted during the summer (reproductive period), in the years 1975-1980 about 200-250 individuals of the species *Myotis myotis* (Borkhausen, 1797), and *Miniopterus schreibersii* (Kuhl, 1817) (Vernier, 1977, 1996a, 1996b). Also few individuals of

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Table 1. Nycteribiidae reported from the Venetian region.

Species	Localities	Province	References
Nycteribia latreillii	Grotta La Bislonga (1001 V/TV) (Pederobba)	TV	Present study
Nycteribia pedicularia[1]	Grotta Regosse (Roverè)	VR	Ruffo, 1938; Lanza, 1999
Nycteribia schmidlii	Grotta La Bislonga (1001 V/TV) (Pederobba)	TV	Present study
	Covoli del Velo (44 V/VR)	VR	Ruffo, 1938; Lanza, 1999
Penicillidia dufourii	Grotta A del Ponte di Veja (117 V/VR)	VR	Caoduro *et al.*, 1994
	Buso del Pozzo Comune 19 (n.i. V/VR)	VR	Caoduro *et al.*, 1994
	Grotta della Guerra (127 V/VI)	VI	Vanin and Vernier 2005
	Grotta La Bislonga (1001 V/TV) (Pederobba)	TV	Present study
Penicillidia conspicua	Covoli del Velo (44 V/VR)	VR	Ruffo, 1938; Lanza, 1999
Phthiridium biarticulatum[2]	Grotta di Veja (117 V/VR)	VR	Ruffo, 1938; Lanza, 1999
	Grotta Regosse (Roverè)	VR	Ruffo, 1938; Lanza, 1999

[1] *Nycteribia kolenatii.*
[2] In the checklist of the Italian fauna (Minelli *et al.*, 1993-1995), this species is reported only from Southern Italy and Sardinia.

Myotis capaccinii (Bonaparte, 1837), and *Rhinolophus ferrumequinum* (Schreber, 1774) were reported (Vernier, 1996c). Since 1994 the main colony was drastically reduced to few individuals both for collapses and human disturb. The bat species recently observed in this cave (1994-2004), were few specimens of *Myotis daubentonii* (Kuhl, 1817) and *Myotis mystacinus/brandtii* (Vernier, unpublished data).

Results

The specimens of parasites, determined by one of the authors (S.V.), belong to *Nycteribia (N) latreillii* (Leach, 1817), 2♀♀, 1♂, *N. (N) schmidlii* (Schiner, 1853), 2♀♀, 4♂♂ and *Penicillidia dufourii* (Westwood, 1834) 9♀♀, 2♂♂. The specimens in alcohol 70% are in good conditions and are stored in the private collection of one of the authors in Padova (E.V.).

The specimens belonging to the seven species, known from the Palaearctic region, of the genus *Nycteribia* Latreille 1796, are small or medium size flies without eyes. The tibiae are laterally compressed and short. The genus is divided in two subgenus: *Nycteribia* and *Acrocholidia.* The first subgenus is present in the West-Palaearctic region with four species [*N. (N.) latreillii*, *N. (N.) kolenatii*, *N. (N.) pedicularia*,

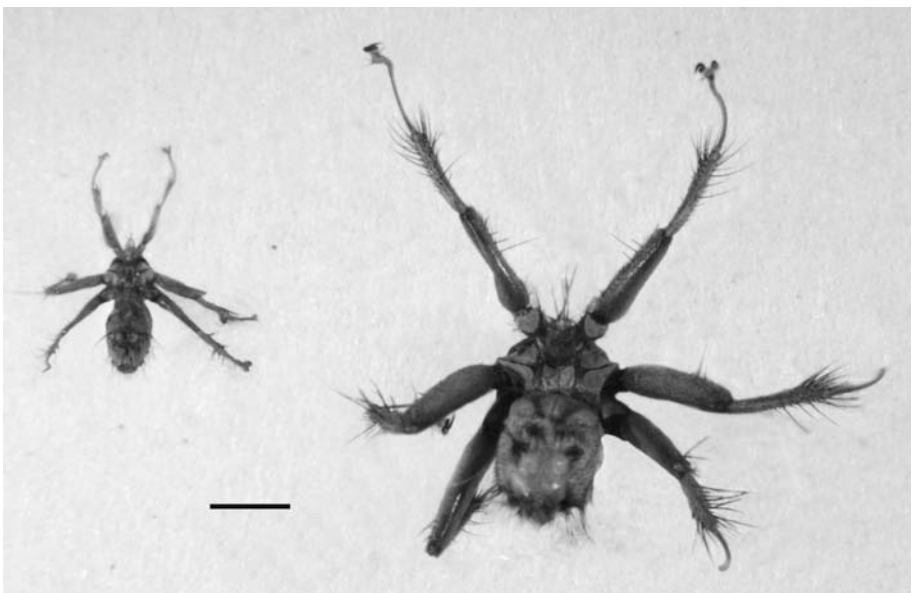

Figure 1. Male of *Nycteribia (Nycteribia) schmidlii* (left) and *Penicillidia dufourii* (right). Scale bar: 2 mm.

and *N. (N) schmidlii*] whereas the second one with only one species: *N. (A). vexata*.

The species of genus *Penicillidia* Kolenati, 1863, are big flies characterized by "unilobated" eyes, that in the dry specimens appear white. The genus is present in the Palearctic region with 4 species *P. conspicua* Speicer, 1901, *P. dufourii* (Westwood, 1835), *P. monoceros* Speiser, 1900 reported from Europe while *P. jenynsii* (Westwood, 1834) is reported from China, Taiwan and doubtfully from Japan (Soós and Hurka, 1986). Two species, *P. conspicua* and *P. dufourii*, are reported from Italy (Lanza, 1999; Vanin and Vernier, 2005).

Taxonomic account

Nycteribia (Nycteribia) latreillii (Leach, 1817)

Distribution: This species occurs from South Western Asia (Kazakistan, Kirghizistan, Asia) to Continental Europe and Northern Africa. In Italy it is reported from Abruzzo, Sicilia, Sardegna (Lanza, 1999).

Host: This species is reported specially on *Myotis myotis* and *M. blythii*. Moreover it was collected surely also from *Myotis capaccinii*, *M. emarginatus*, *Eptesicus serotinus*, *Miniopterus schreibersii*, *Rhinolophus euryale*, *R. ferrumequinum*, and *R. hipossideros* (Theodor, 1975; Lanza, 1999). Other dubious findings are not reported in this paper.

Nycteribia (Nycteribia) schmidlii Schiner, 1853

Distribution: This species shows the same distribution of the previous species, living from South Western Asia to Continental Europe and Northern Africa. In Italy it is reported from Lombardia, Trentino, Veneto, Emilia-Romagna, Toscana, Abruzzo, Lazio, Campania, Sardegna (Lanza, 1999).

Host: This species is reported specially on *Miniopterus schreibersii*, but it was found also on other cave bats (*M. blythii*, *M capaccinii*, *M. emarginatus*, *Myotis myotis*, *Rhinolophus euryale*, *R. ferrumequinum*, *R. hipossideros,* and *R. mehely*) and from bats living in crevice and tree clefts (*Barbastella barbastellus*, *Myotis bechsteinii*, *M. daubentonii*, *M. mystacinus*, *Plecotus auritus,* and *P. austriacus*) (Theodor, 1975; Lanza, 1999).

Penicillidia dufourii (Westwood, 1834)

Distribution: Species known from Europe, Central Asia and Northern Africa (Falcoz, 1926; Soós and Hůrka, 1986). In Italy individuals of this species are reported from Liguria, Piemonte, Lombardia, Trentino, Veneto (Table 1), Emilia, Toscana, Lazio, Puglia, Sicilia, Sardegna (Lanza, 1999).

Host: This species is reported on *Rhinolophus euryale* Blasius, 1853; *R. blasii* Peters, 1866; *R. hipposideros* (Bechstein, 1800); *R. ferrumequinum* (Schrebers, 1774); *Myotis capaccinii* (Bonaparte, 1837); *M. myotis* (Borkhausen, 1797); *M. blythii* (Tomes, 1857), *M. daubentonii*, *M. emarginatus*, *M. myotis*, and *Miniopterus schreibersii* (Falcoz, 1926; Lanza, 1999; Theodor, 1975).

Discussion and conclusion

The data, presented in this contribute, allow to count 6 species of Nycteribidae from North-Eastern Italy being *Nycteribia latreillii* a new record for this area. This species has been collected on bats belonging to the main colony of the studied cave, composed by *Myotis myotis* and *Miniopterus schreibersii.* This finding confirms the previous data about the hosts of this species. These two bat species, *M. myotis* and *M. schreibersii,* are typical cave-dwelling bats, and lives in caves also in large plurispecific colonies (Vernier, 1997). This fact allows the passage of the parasite from a species to an other. A same situation occurs also for the second fly species collected, *Nycteribia schmidlii,* that has been reported on *Miniopterus schreibersii* but also on other cave bats. It is worth mentioning that the caves "Grotta della Guerra" (127 V/VI) and "Grotta La Bislonga" (1001 V/TV) have a similar morphology and a comparable bat community (Vernier, 1977; 1998). In both these cave *Penicillidia dufourii* was collected.

The records of only 6 species is far to be exhaustive of the real composition of the Nycteribidae fauna in the Venetian region that shows an elevate heterogeneity of habitat and a high diversity of bats species. In the Venetian region 25 species of bats were reported (Bon *et al*., 1996) [the total number of Nycteribidae in the Italian territory is nine (Lanza, 1999), and the number of bats species is 30 (Vernier, 1997)].

The significant reduction in bat richness and abundance occurred in the last years, both for human and natural causes, in "La Bislonga" cave, as well as in other bat roosts, has direct effect also in their parasite and in general on the biodiversity. The loss of species, independently from their ecological role (predator, parasite, saprophage, etc.) has consequences on the biodiversity not only in a mathematical count as reduction in the species richness but also on the relationships within species with unpredictable consequences on the whole ecosystem. "The unpredictability of ecosystems is consequence of the particularity of the species that compose them. Each species is an entity with a unique evolutionary history and set of genes, and so each species responds to the rest of the community in a special way" (Wilson, 1992).

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