

Predation on bats by genets *Genetta genetta* (Linnaeus, 1758): a review

MARIA MAS^{1*}, ADRIÀ LÓPEZ-BAUCELLS¹ & ANTONI ARRIZABALAGA¹

¹ Granollers Natural History Museum, Chiroptera Research Department
Av. Francesc Macià 61, 08402 Granollers, Catalonia (Spain).

*Corresponding author e-mail: maria.masnavarro@gmail.com

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Abstract: Bats have partially evolved in response of predation pressure and have developed several strategies to cope with these threats. Nevertheless, the role played by many predators and their true impact on bat populations is poorly known and to date have only ever been considered superficially in studies. In this manuscript we review the role of genet as potential bat predator. We herein present an in-depth literature review of bats as prey of genets and also provide 4 new reports from scat analysis and 1 opportunistic event in a mist net placed next to a cave entrance. While the fact that only few reports of genet predation on bats have been detected seems to suggest that they only hunt bats occasionally, other repeated reports from South Portugal inside hibernating roosts (Palmeirim & Rodrigues 1991) and our new predation event next to a cave entrance suggests that genets could also repeatedly hunt bats in some caves (not as occasionally as usually considered).

Key words: *Genetta genetta*, predation, chiroptera, carnivores, survival.

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In Europe, only the mammals carnivores Beech marten (*Martes foina* Erxleben 1777), European pine marten (*Martes martes* Linnaeus 1758), Genet (*Genetta genetta* Linnaeus 1758) and non-wild carnivores as cats, have been reported as occasional bat predators (Romanowski & Lesinski 1991, Palmeirim & Rodrigues 1991, Clevenger 1993, Arrizabalaga 1984, Freixas et al. 2010, Ancillotto et al. 2013). According to Baker (1962) these mesopredator are more likely to take advantage of congested caves and roosts or eating carcasses of dead bats, rather than prey on solitary individuals (also in Palmeirim & Rodrigues 1991). Nevertheless, most available literature reports the occurrence of single bats, rather than multiple individuals: e.g. a single *Vespertilio murinus* (Linnaeus 1758) was identified from a skull found in a Beech marten's faecal sample in Romania (Romanowski & Lesinski 1991).

In this manuscript we aimed to review the role of genet as potential bat predator. Thus, a thorough revision was carried out using online databases (Google Scholar & Web of Knowledge) with the following keywords: 'chiroptera', 'bats', 'diet', 'dietary composition', 'mortality', 'predator', 'predation' and '*Genetta genetta*' in English, Spanish, Portuguese and French. As a result, a wide range of studies

were retrieved for Genet diet description considering its whole distribution (Portugal, France, Spain and North Africa), but only few revealing bats on those diets.

Genetta genetta (Viverridae) is a medium-sized opportunistic carnivore with a euryphagous diet (Larivière & Calzada 2001) found only in the Iberian Peninsula, southern France, North Africa and the Balearic Islands (Clevenger 1993; Virgos & Casanovas 1997; Larivière & Calzada 2001; Fig. 1). It is commonly classified between the specialist European Otter (*Lutra lutra*, Linnaeus 1758) and the generalist European Badger (*Meles meles*, Linnaeus 1758). In fact, several studies have investigated the species' diet throughout its distribution by the analysis of scats (Arrizabalaga & Montagud 1984, Cugnasse & Riols 1984, Ariagno 1985, Delibes et al. 1989, Lodé et al. 1991, Amdine et al. 1993, Ruiz-Olmo & López-Martín 1993, Clevenger 1995, Gil Sánchez 1998, Rosalino & Santos-Reis 2002, Virgós et al. 1999, Carvalho & Gomes 2003, Mostefai et al. 2003, Torre et al. 2003, Amroun et al. 2007, Sánchez et al. 2008, Le Jacques & Lode 2009, Freixas et al. 2010, Palazón & Rafart 2010, Camps 2012, Torre et al. 2013). Small mammals (mostly *Apodemus* sp., Torre et al. 2013) represent more than 90% of the species' diet and the remaining is usually composed



Fig. 1 – Genet distribution in the Mediterranean area. Red spots: bat predation events.

in equal proportions by invertebrates, reptiles, amphibians and birds depending on resource availability (Virgós et al. 1999, Arrizabalaga et al. 2002, Rosalino and Santos-Reis 2002). However, despite the species' preference for small mammals, bats have only rarely been detected in the diet of this mammal (Arrizabalaga 1984, Freixas et al. 2010) We herein present an in-depth literature review of bats as prey of genets and also provide four new reports.

Only three incidents of bat predation by genets are currently available in the literature, namely: 1 serotine bat (*Eptesicus serotinus*, Schreber 1774) and an unidentified bat individual in genet scats from the Iberian Peninsula (Arrizabalaga & Montagud 1984, Freixas et al. 2010, respectively; Table 1) and several Schreiber's Bent-winged Bat (*Miniopterus schreibersii* Kuhl 1817), partially consumed inside some caves in South Portugal (Palmeirim & Rodrigues 1991).

We add one unidentified vespertilionid bat (4 pieces) in scats from 1983, another *E. serotinus* from the same scats analysed by Arrizabalaga & Montagud (1984) and another *E. serotinus*, found in faecal samples from 2000 (Table 1). Bone rests and skulls found in scats were identified using own collections from the Museum of Natural Sciences of Granollers and published identification keys (Gallego & López 1991).

We also report one opportunistic predation event of a *G. genetta* upon an individual of *M. schreibersii* (Kuhl 1817) entangled in a mist net. This 3m mist net was placed at the emergence point of a *M. schreibersii* equinoctial cave roost in a periurban natural park near Barcelona (Collserola Park: UTM ED50 418385, 4586771, Fig. 2). The individual of

M. schreibersii was found dead close to the ground in the first bag of the mist net. When the presence of the genet was detected near the mist net (another conspecific individual was also sighted simultaneously in the same area near the cave entrance), the bat was already dead and had numerous bite marks. As the bat could not be properly extracted from the mist net by the genet, we removed it and it is now deposited in the mammal collection of the Granollers Natural History Museum. Due to our presence, both genets left the area and were not detected again during any other field surveys of this cave.



Fig. 2 – Cave entrance.

Table 1. Literature review and new reports of bats as prey of genets.

| Species | % in diet | Source | Location | Other vertebrates in the faeces |
|------------------------------------|-----------|--------------------------------|--|--|
| Vespertilionid (unidentified) | 0.0015% | (Unpublished 1983, own data) | Guilleries Natural Park, Sant Llorenç de Folgueroles, Catalonia. | <i>Talpa europaea</i> (4); <i>Sorex minutus</i> (9); <i>Neomys anomalus</i> (1); <i>Suncus etruscus</i> (5); <i>Crocidura russula</i> (7); <i>Rattus rattus</i> (1); <i>Elyomys quercinus</i> (6); <i>Sciurus vulgaris</i> (6); <i>Mus spretus</i> (15); <i>Apodemus</i> sp. (250); <i>Apodemus sylvaticus</i> (238); <i>Apodemus flavicollis</i> (51); <i>Clethrionomys glareolus</i> (45); <i>Microtus agrestis</i> (4); <i>Arvicola sapidus</i> (3); <i>Microtus duodecimcostatus</i> ; <i>Mustela nivalis</i> (1), <i>Oryzotolagus cuniculus</i> (2), <i>Reptilia</i> (5), <i>Chiroptera</i> sp. |
| <i>Eptesicus serotinus</i> (2 ind) | | (Arrizabalaga & Montagud 1984) | El Corredor Natural Park, Vallès Oriental, Barcelona, Catalonia. | Unavailable. |
| <i>Eptesicus serotinus</i> | 0.005% | (Unpublished 2000, own data) | Montseny, Sant Marçal, Barraca el Sot de les Illes, Catalonia. | <i>Crocidura russula</i> (1); <i>Glis glis</i> (2); <i>Elyomys quercinus</i> (1); <i>Sciurus vulgaris</i> (1); <i>Apodemus</i> sp. (50); <i>Apodemus sylvaticus</i> (85); <i>Apodemus flavicollis</i> (44); <i>Clethrionomys glareolus</i> (5); <i>Birds</i> (5) |
| Bat #2 (unidentified) | 0.0018% | (Freixas et al. 2010) | Poblet Area of Natural Interest (Prades), Catalonia | <i>Sorex minutus</i> (6); <i>Crocidura russula</i> (32); <i>Suncus etruscus</i> (9); <i>Sciurus vulgaris</i> (4); <i>Apodemus sylvaticus</i> (394); <i>Apodemus</i> sp. (79); <i>Mus spretus</i> (10); <i>Microtus duodecimcostatus</i> (1); <i>chiroptera</i> sp (1); <i>Sauria</i> (7); <i>Snake</i> (2); <i>birds</i> (9) |
| <i>Miniopterus schreibersii</i> | | Current work | Collserola Park. Can Rabella. Barcelona, Catalonia. | Unavailable |
| <i>Miniopterus schreibersii</i> | | (Palmeirim & Rodrigues, 1991) | Portugal | Unavailable |



Fig. 3 – Genet (*Genetta genetta*) © Ignasi Torre.

This predation event represents the first report of a *M. schreibersii* being predated by a genet in Spain and it corresponds to similar predation events than previously cited in Portugal (Palmeirim & Rodrigues 1991). Nevertheless, although some bats have been detected in genet faecal samples (collected by the Granollers Natural History Museum), they always represent less than 0.1% of their diets.

According to scat analysis and previous cited reports, conclusive answers to these questions remain unknown. While the few reports of genet predation on bats (detected though scat analysis) seem to suggest that genets only hunt bats occasionally, other reports from South Portugal (Palmeirim & Rodrigues 1991) affirm that genets repeatedly hunt bats in some caves (not opportunistically) taking advantage of bat roosting behaviour. This predation pressure caused relevant disturbance to these bat populations, being the cause of the uncompleted bat occupation in what would be the best hibernating cave in Portugal. Regarding our opportunistic predation report, and considering the behaviour of the two genets (which seemed to perfectly know the territory and the entrance of the cave), it could be another case of repeated hunting attempts in cave roosting bat colonies, leading us to consider often these genets could use this colony as an available food resource.

We must highlight the presence of *Eptesicus serotinus*, which is the most concurrent bat species on a genet diet. Being a typical opportunist and common bat, which usually roosts on rock crevices, wood crevices and old buildings, and considering that genets usually forage up on trees and they move through urbanized, and they take advantage of dead carcasses, it seems plausible that genets are not selecting this species, but taking advantage of their weakness.

As stated previously, it is hard to extrapolate and quantify genet predation rates upon bats as there are few reports and capture events are probably underestimated (Tuttle & Stevenson 1982). Indeed, as a result of all this predation pressure, bats have adopted several defensive strategies to avoid aerial predators and, for example, some bat species habitually evade predators by emerging from roosts in groups (Erkert 1982, Speakman 1991, Speakman et al. 1995). Assuming that aerial hunters pose the greatest threat, it still remains to be seen what effect predation by terrestrial predators has on bats.

Thus, we consider essential to report all witnessed predation events – even opportunistic ones – to provide more information on the diet of this secretive species. Due to lack of information, many questions still remain unanswered. Does this occur all year round or is it a more common practice during hibernation? Are there more non reported cases of genets visiting caves or forest roosts time and time again to hunt bats?

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Genet (*Genetta genetta*) © Ignasi Torre.

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