

# BATS OF LATIUM: A REVIEW OF PAST AND RECENT STUDIES AND THE CONTRIBUTION OF B. LANZA

PIERANGELO CRUCITTI

Società Romana di Scienze Naturali, Via Fratelli Maristi 43, 00137 Roma, Italy  
E-mail: info@srsn.it

Received 16 September 2010; accepted 7 March 2011

**ABSTRACT** - After briefly reviewing past research, the present status of our knowledge on the bats of Latium, Central Italy, one of the richest biodiversity districts of the Central Mediterranean Ecoregion, is outlined, highlighting the contribution of Benedetto Lanza.

**Keywords:** Chiroptera, Central Italy, ecology, distribution, conservation

**RIASSUNTO** - *I pipistrelli del Lazio: una sintesi degli studi condotti e il contributo di Benedetto Lanza.* Dopo aver brevemente ripercorso la storia delle ricerche, si commenta lo status attuale delle conoscenze sui pipistrelli del Lazio, Italia centrale, uno dei distretti con la maggiore biodiversità della Ecoregione Mediterraneo Centrale, evidenziando il contributo fornito da Benedetto Lanza.

**Parole chiave:** Chiroptera, Italia centrale, ecologia, distribuzione, conservazione

DOI: 10.4404/Hystrix-22.1-4505

## INTRODUCTION

Latium (17,227 km<sup>2</sup>, 5.7% of the Italian political territory) is located in the Central Mediterranean Ecoregion. Fifteen different bioclimatic units have been described in this district (Blasi 1994) and, consequently, it provides a wide variety of habitats: plain and hilly areas, mountain chains with limestone caves, Mediterranean and temperate woodlands, volcanic lakes and temporary ponds, river systems, urban and suburban areas of ancient origin, *e.g.* the City of Rome, and marine coastal ecosystems. From about 40% to over 60% of species recorded in Italy occur in Latium, including 3228 species and subspecies of vascular plants (2000 in the Province of Rome) out of 7634 species in the entire country, 57 out of 91 dragonflies, 151 out of 257 butterflies, 90 out of 230 ants, and 70 out of 118 terrestrial mammals. Chiroptera are not

an exception: out of 33 bat species recorded in Italy (Dietz et al. 2009), 23 (69.7%) occur in the Province of Rome (5,353 km<sup>2</sup>, 31.1% of Latium surface), of which 19 are in the urban area of Rome (Amori et al. 2009).

Their ability to fly, small size and long life, nocturnal and secretive lifestyle coupled with the complexity of reproductive strategies and the variety of roosts (tree cavities, rock crevices, buildings, caves and mines), make bats intriguing subjects of research and challenge us to study them intensively.

## AN OUTLINE OF BAT RESEARCH IN LATIUM DURING THE 20<sup>th</sup> CENTURY

The first comprehensive checklist of vertebrate species of Rome and surroundings (Carruccio, 1898) included two families, seven genera and 15 species of bats. Forty years later, Gulino and Dal Piaz (1939)

published the first checklist of Italian bats with 27 species, of which 17, (three families and eight genera) have been recorded for Latium. These monographs are rich in morphological information, though generally lacking biological and ecological details (Crucitti et al. 1999).

Stefanelli (1942 a, b, c, 1948) investigated the specificity of host-parasite relationships, focusing on six species of bats. He described the morphological characters useful for their identification and some ecological features of hibernation, together with seven species of bat flies (Nycteribiidae, Diptera), of which one, *Nycteribosca africana* (Walker, 1849) (currently *Brachytarsina flavipennis* Macquart, 1851 (= *Nycteribosca kollari* Frauenfeld, 1859) was new to the Italian fauna. Some pertinent observations on the ecology and behaviour of *Myotis capaccinii* (Bonaparte, 1837), considered at that time as an uncommon bat, were also reported (Stefanelli, 1942 c). In the same period, Marcello Ricci reported the presence in Latium of *Myotis daubentonii* (Kuhl, 1817) (Ricci, 1953).

Working extensively with specimens from Latium, Ernesto Capanna, a student of Stefanelli, was able to investigate the pattern of nerve supply in the wing membrane of three species of bats (Capanna and Beccari, 1966). He also described the karyotype of nine Microchiroptera and assessed the DNA content of post-kinetic nuclei (lymphocytes), highlighting the importance of this analysis for the reconstruction of microevolutionary events (Capanna et al. 1968; Capanna and Manfredi Romanini, 1973).

The mammal fauna of the Tolfetano-Cerite district, north-western Latium, for which 11 species of bats have been recorded, was investigated by Contoli (1977). During the sixties and the seventies, the activity of the “Circolo Speleologico Romano” (the speleological club of Rome) made possible the publication of up-to-date list of the caves of Latium (see Crucitti et al. 1999), a useful tool for the investigation of cave species.

Carchini et al. (1982) published a contribution on the biota of the Valmarino Cave (Province of Latina), in which six species of bats were recorded. Other people and organizations were engaged for many years in the study of bats in this region.

In the period 1958-1973, Giovanni Dinale banded thousands of bats living in limestone caves, focusing on homing experiments and the development of sexual maturity (Dinale, 1960, 1963, 1968). Finally, field observations on the bat fauna of Latium started in 1970, following the foundation (1967) of the “Società Romana di Scienze Naturali” (SRSN) – an Italian institution promoting research on natural sciences (see Crucitti et al. 1999, 2006, 2009, Amori et al. 2009), which gathered an important theriological collection including at least 20 species of European bats.

#### THE CONTRIBUTION OF BENEDETTO LANZA TO BAT RESEARCH IN LATIUM

In this context, the contribution of Benedetto Lanza, who began his scientific career at the University of Florence in the 1950s, is, properly, of a more general interest. His enormous scientific production includes, at present, more than 500 papers, with numerous monographs, books and textbooks on many botanical and zoological topics (see the Introduction to this volume). Lanza began his scientific activity working on biospeleological topics, compiling the first list of the caves of Tuscany and the annotated checklist of the Tuscan cave-dwelling fauna. During the years 1951-1961, he published 12 papers on the distribution of Chiroptera in central and southern Italy. A brief paper dealt with the bats found in the archaeological site of Ostia Antica, near Rome, and included ecological observations on *Rhinolophus euryale* Blasius, 1853, *Myotis myotis* (Borkhausen, 1797), *Myotis oxygnathus* Monticelli, 1885, *Vespertilio serotinus* Schreber, 1774 (now *Eptesicus serotinus*) and, above

all, *Miniopterus schreibersii* (Kuhl, 1817) and *Myotis capaccinii* (Lanza, 1958). Among his books, it is impossible to overlook his checklist of Italian bats (Lanza, 1959), for which he examined hundreds of specimens from Latium, belonging to 19 taxa: *Rhinolophus euryale*, *R. ferrumequinum* (Schreber, 1774), *R. hipposideros* (Bechstein, 1800), *Miniopterus schreibersii*, *Myotis emarginatus* (Geoffroy, 1806), *M. capaccinii*, *M. myotis*, *M. oxygnathus*, *Pipistrellus pipistrellus* (Schreber, 1774), *P. kuhlii* (Kuhl, 1817), *P. savii* (Bonaparte, 1837) (currently *Hypsugo savii*), *Nyctalus noctula* (Schreber, 1774), *Plecotus auritus* (Linnaeus, 1758), *Barbastella barbastellus* (Schreber, 1774), *M. mystacinus* (Kuhl, 1817), *M. nattereri* (Kuhl, 1817), *M. daubentonii*, *Vespertilio serotinus* and *Tadarida teniotis* (Rafinesque, 1814). A further general contribution of Lanza was the annotated checklist of 756 parasite taxa found on/in 30 species of Chiroptera belonging to the European and Italian fauna: 2 Myconta, 3 Acanthocephala, 1 Mallophaga, 2 Anoplura, 11 Heteroptera and c. 37 Neobacteria, 25 "Protozoa", 55 Cestoda, 105 Digenea, 62 Nematoda, 324 Acari, 65 Diptera and 64 Siphonaptera (Lanza, 1999).

We must also remember his contribution to the first chorological analysis applied to Italian bats (Lanza and Finotello, 1985) just coming between La Greca (1962, 1964, 1975) and Vigna Taglianti et al. (1993, 1999), more general contributions to the classification of chorological types.

#### CURRENT STATUS AND OPEN PROBLEMS OF BAT RESEARCH IN LATIUM

Since the foundation of the "Gruppo Italiano Ricerca Chiroterri" (GIRC; Italian study group for bat research) in 1999, field research on Italian bats has greatly improved, leading, together with the recent development of molecular techniques, to an increase in the number of species known. The current status of our knowledge on bat distribution and ecology in Latium and rela-

ted open problems are briefly reported.

#### 1. Species number and patterns of distribution

Some decades after Lanza monograph (1959), two updated checklists of Latium's bats have been published (Crucitti and Tringali 1985; Crucitti et al. 1999). The discovery of *Myotis bechsteinii* (Kuhl, 1817) in Latium represents a recent, though not unforeseeable, event (Mastrobuoni et al. 2005a; Crucitti et al. 2007). To acquire evidence of the presence of a migratory species such as the giant noctule *Nyctalus lasiopterus* (Schreber, 1780) has been a hard task. Information about the distribution of the so called "small" *Myotis*, the bats of the genus *Nyctalus*, *P. nathusii* (Keyserling and Blasius, 1839), *P. pygmaeus* (Leach, 1825) and *B. barbastellus* is still lacking, while the occurrence of *M. mystacinus*, based on very old records, needs confirmation. General considerations on the biogeography of Italian bats are stressed in a more recent paper of Lanza and Agnelli (2002).

#### 2. Bats and woodland

In recent years, the role played by old-growth forests and deadwood for the maintenance of biological diversity has been long debated (Burrascano et al. 2008; Blasi et al. 2010). There is a relationship between the extreme rarity of old-growth forests and that of some strictly dendrophilous taxa, such as *Nyctalus lasiopterus*, *N. leisleri* (Kuhl, 1817), *N. noctula* and *Barbastella barbastellus*, whose last report in Latium dates back to 1973 (Crucitti and Tringali, 1985).

#### 3. Bats and caves

There are about 1,450 limestone caves in Latium and over 200 are complex karstic systems covering more than 100 m<sup>2</sup> (Mecchia et al. 2003). Cellars, old mines and

man-made underground corridors are also widespread suitable roosts for bats. At least seven species are strictly cave-dwelling: three *Rhinolophus*, two “large” *Myotis*, *M. capaccinii* and *M. schreibersii*. In Latium there are winter roosts of several bat species, where thousands of bats may dwell, e.g. some volcanic caves near Blera and artificial ones (old mines) near Allumiere, Tolfa Mountains (Crucitti et al. 1992, 1998). Periodic surveys carried out in artificial and natural, volcanic and limestone, caves of Latium, allowed the outlining of many interesting aspects of the winter social structure of *M. capaccinii* and the analysis of mixed aggregations of the long-fingered bat and *M. schreibersii* (Crucitti, 1978, 1981, 1988, 1993).

#### 4. Bats and urban ecosystems

Bats are opportunistic mammals; suitable roosts are often represented by human buildings, especially ancient and unrestored ones. Regrettably, many roosts have been destroyed or deserted by bats owing to human disturbances. However, Latium is rich in ancient buildings and monuments, especially in the urban ecosystem of Rome. At least seven species are well-known synanthropes, *R. ferrumequinum*, *R. hipposideros*, *P. kuhlii*, *P. pipistrellus*, *H. savii*, *E. serotinus* and *M. emarginatus*, while the fact that *T. teniotis* is a “recent” synanthrope highlights its ecological flexibility (Agnelli et al. 2009).

#### 5. Threatened species

Bats are the Italian mammals with the highest number of threatened species. At least six species are vulnerable (Vu: A2c; *R. euryale*, *R. hipposideros*, *M. bechsteinii*, *M. capaccinii*, *M. emarginatus* and *B. barbastellus*) and at least four species are near threatened (LR; *R. ferrumequinum*, *M. myotis*, *N. leisleri*, *M. schreibersii*); a total of, 10 species, 41.7% of all the species of Latium. In contrast, while the conservation

status of *M. capaccinii* is considered “unfavourable bad” in all European regions (Life Focus, 2010), Latium is one of the Italian region in which this species is still relatively abundant and widespread (see also Biscardi et al. 2007) and a special effort to study of its distribution and life cycle should be undertaken.

#### CONCLUDING REMARKS

Considering above all the bibliographical data, we have at our disposal sound biological information on about ten species of bats, especially cave- and house-dwelling ones. The area of the Province of Rome is one of the better investigated territories of Latium in this respect. Moreover, we have recent information for some scattered territories: the Lepini Mountains, southern Latium, in which 12 species were recorded (Amori et al. 2002); some protected areas, e.g. the Veio Regional Park in which 9-10 species were recorded (Biscardi and Russo, 2008) and the Circeo National Park, in which 14 species were recorded (Mastrobuoni et al. 2005b). In contrast, little information is available for several important biotopes of the region, e.g. the Simbruini Mountains, suggesting that we have much work still to do (Crucitti et al. 2009).

#### ACKNOWLEDGEMENTS

When I started to cooperate actively with Benedetto Lanza, over twenty years ago, I soon became fully aware of the width of his interests and unusual range of his zoological culture together with his willingness to share information with students. He was a precious source of inspiration and encouragement for all of us; and with his marvellous wife Paola Giorgio, a solicitous friend for his collaborators. Thank you very much Bettino!

The Author is especially thankful to Giovanni Amori, Marco Riccucci and Claudio Prigioni for their several valuable sugges-

tions and to some anonymous referees for their comments. The Author is also indebted with Davide Brocchieri and Federica Emiliani for their help with the references.

## REFERENCES

- Agnelli P., Martinoli A., Patriarca E., Russo D., Scaravelli D., Genovesi P. (a cura di). 2004. Linee guida per il monitoraggio dei Chiroterteri: indicazioni metodologiche per lo studio e la conservazione dei pipistrelli in Italia. Quad. Cons. Natura 19, Min. Ambiente - Ist. Naz. Fauna Selvatica 216 pp.
- Agnelli P., Biscardi S., Guaita C., Russo D. 2009. Chiroterrofauna: minacce e strategie per la conservazione. In: Amori G., Battisti C., De Felici S. (Eds.). I Mammiferi della Provincia di Roma. Dallo stato delle conoscenze alla gestione e conservazione delle specie. Provincia di Roma, Assessorato alle Politiche dell'Agricoltura, Stilgrafica, Roma 307-312.
- Amori G., Corsetti L., Esposito C. 2002. Mammiferi dei Monti Lepini. Quad. Cons. Natura 11, Min. Ambiente - Ist. Naz. Fauna Selvatica 210 pp.
- Amori G., Battisti C., De Felici S. (a cura di) 2009. I Mammiferi della Provincia di Roma. Dallo stato delle conoscenze alla gestione e conservazione delle specie. Provincia di Roma, Assessorato alle Politiche dell'Agricoltura, Stilgrafica, Roma 347 pp.
- Biscardi S., Russo D., Casciani V., Cesari D., Mei M., Boitani L. 2007. Foraging requirements of the endangered long - fingered bat (*Myotis capaccinii*): the influence of micro - habitat structure, water quality and prey type. *J. Zool.* 273: 372-381.
- Biscardi S., Russo D. 2008. Censimento dei pipistrelli (chiroterrofauna) del Parco di Veio. Atti del Convegno "La Biodiversità del Parco di Veio a 10 anni dalla sua istituzione (1998-2008). Parco di Veio, 14 novembre 2008. Ente Regionale Parco di Veio.
- Blasi C. 1994. Fitoclimatologia del Lazio. Università "La Sapienza", Regione Lazio, Assessorato Agricoltura - Foreste Caccia e Pesca, Usi Civici 56 pp.
- Blasi C., Burrascano S., Maturani A., Sabatini F.M. 2010. Contributo tematico alla Strategia Nazionale per la Biodiversità. Foreste Vetuste in Italia. National Focal Point. Ministero dell' Ambiente e della Tutela del Territorio e del Mare, Direzione per la Protezione della Natura e del Mare - Società Botanica Italiana - Centro di Ricerca Interuniversitario "Biodiversità, Fitosociologia ed Ecologia del Paesaggio" Sapienza Università di Roma-Dipartimento di Biologia Vegetale. Palombi & Partner S.r.l., Roma.
- Burrascano S., Lombardi F., Marchetti M. 2008. Old-growth forest structure and deadwood; Are they indicators of plant species composition ? A case study from central Italy. *Plant Biosyst.* 142: 313-323.
- Capanna E., Beccari E. 1966. Osservazioni preliminari sull'innervazione del ptagio alare dei Microchiroterteri. Accademia Nazionale dei Lincei. Rendiconti della Classe di Scienze fisiche, matematiche e naturali 34: 359-366.
- Capanna E., Civitelli M.V., Spagnuolo C. 1968. Contributo alla carilogia del genere *Myotis*. Considerazioni sulla evoluzione del cariotipo dei Vespertilionidi (Mammalia - Chiroptera). *Caryologia* 21: 225-240.
- Capanna E., Manfredi Romanini M. G. 1973. Contenu en ADN des noyaux postkinetics et évolution du caryotype chez les Chiroptères. *Period. biol.* 75: 55-60.
- Carchini G., Giglio G., Rampini M., Sbordoni V. 1982. Studi ecologici nella grotta di Valmarino. I: Morfologia, clima, datazione e popolamento faunistico. *Lavori Soc. it. Biog. N.S.* 7: 869-892.

- Carruccio A. 1898. Indications principales sur les vertébrés de la nouvelle collection régionale du Musée Zoologique de la R. Université de Rome. Boll. Soc. romana St. zool. 7: 178-203.
- Contoli L. 1977. Mammiferi del Tolfetano-Cerite (Lazio). Rassegna bibliografica e osservazioni Originali, situazione e prospettive. In: AA.VV. (Eds.). Ricerche ecologiche, floristiche e faunistiche nel comprensorio Tolfetano-Cerite-Manziate, Accademia Nazionale dei Lincei, Quaderno n. 227: 191-226.
- Crucitti P. 1978. Osservazioni ecologiche su *Myotis capaccinii* nella regione laziale (Chiroptera Vespertilionidae). Natura - Soc. ital. Sci. nat. Museo civ. Stor. nat. e Acquario civ. Milano 69: 153-162.
- Crucitti P. 1981. Studi sull'organizzazione sociale dei Chiroterri. I. Struttura sociale di *Myotis capaccinii* (Chiroptera Vespertilionidae). Atti Soc. ital. Sci. nat. Museo. civ. Stor. nat. Milano, 122: 236-242.
- Crucitti P. 1988. Dati preliminari sulla temperatura nelle colonie di *Miniopterus schreibersi* (Natt.) (Chiroptera, Miniopteridae). Biologia oggi 2: 291-296.
- Crucitti P. 1993. Caratteristiche della aggregazione *Miniopterus schreibersi* - *Myotis capaccinii* nel Lazio, Italia centrale (Chiroptera). Boll. Mus. reg. Sci. nat. Torino 11: 407-422.
- Crucitti P., Tringali L. 1985. Sulla distribuzione di alcuni Chiroterri italiani, particolarmente della regione laziale (Mammalia Chiroptera). Atti Soc. ital. Sci. nat. Museo. civ. Stor. nat. Milano 126: 257-267.
- Crucitti P., Andreini M., Leopardi M. 1992. Una comunità troglifila di Chiroterri del Lazio Settentrionale (Italia Centrale) (Chiroptera). Atti Soc. ital. Sci. nat. Museo. civ. Stor. nat. Milano 132: 89-104.
- Crucitti P., Andreini M., Morelli R., Rotella G. 1998. The structure and dynamics of a rhinolophid bat community of Latium (Central Italy) (Chiroptera). Hystrix It. J. Mamm. (n.s.) 10: 3-11.
- Crucitti P., Malori M., Rotella G. 1999. Bat research in Latium, Central Italy: topics, history and perspectives. In: Dondini G., Papalini O., Vergari S. (Eds.). Atti Primo Convegno Italiano sui Chiroterri. Castell'Azzara 51-61.
- Crucitti P., Cavalletti L., Leone M. 2006. Struttura e dinamica delle aggregazioni invernali di *Rhinolophus hipposideros* in un'area protetta dell'Italia centrale (Mammalia, Chiroptera: Rhinolophidae). Aldrovandia 2: 61-67.
- Crucitti P., Buccedi S., Malori M. 2007. Catalogo delle Collezioni Zoologiche. *Subphylum Vertebrata* (Collezione Vertebratologica "Benedetto Lanza") (aggiornato al 30 aprile 2007). Società Romana di Scienze Naturali SRSN Roma 41 pp.
- Crucitti P., Emiliani F., Malori M., Pernice S., Tringali L. 2009. I Rinolofidi (Chiroptera Rhinolophidae) del Parco Naturale Regionale dei Monti Simbruini. In: Dondini G., Fusco G., Martinoli A., Mucedda M., Russo D., Scotti M., Vergari S. (Eds.). Chiroterri Italiani: stato delle conoscenze e problemi di conservazione. Atti del Secondo Convegno Italiano sui Chiroterri. Serra San Quirico. Parco Regionale Gola della Rossa e di Frasassi 149.
- Dietz C., Von Helvesen O., Nill D. 2009. Bats of Britain, Europe & Northwest Africa. A & C Black Publishers Ltd., 400 pp.
- Dinale G. 1960. Guida all'inanellamento dei pipistrelli. Rassegna Speleologica Italiana. Guide didattiche vol. IV. Como, 30 pp.
- Dinale G. 1963. Studi sui Chiroterri italiani I. Osservazioni sul *Rhinolophus euryale* in Liguria e nel Lazio. Ann. Mus. Civ. Stor. Nat. "G. Doria" Genova 74: 1-29.

- Dinale G. 1968. Studi sui Chiroterri italiani: VII. - Sul raggiungimento della maturità sessuale nei Chiroterri europei ed in particolare nei Rhinolophidae. *Archivio Zoologico Italiano* 53: 51-71.
- Gulino G., Dal Piaz G. 1939. I Chiroterri Italiani. Elenco delle specie con annotazioni sulla loro distribuzione geografica e frequenza nella penisola. *Boll. Musei Zool. Anat. Comp. Torino* 47: 61-103.
- La Greca M. 1962. Tipi fondamentali di distribuzione geografica degli elementi della fauna italiana. *Archivio Botanico e Biogeografico Italiano* 38: 1-19.
- La Greca M. 1964. Le categorie corologiche degli elementi faunistici italiani. *Atti della Accademia Nazionale Italiana di Entomologia, Rendiconti* 11: 231-253.
- La Greca M. 1975. La caratterizzazione degli elementi faunistici e le categorie corologiche nella Ricerca zoologica. *Animalia* 2: 101-129.
- Lanza B. 1958. Inanellamento di Chiroterri nella zona di Ostia Antica (Roma) e risultati di esperienze sul ritorno al luogo di cattura. *Doriana, suppl. ann. Mus. Civ. St. Nat. (G. Doria), Genova* 2: 1-8.
- Lanza B. 1959. Chiroptera Blumenbach, 1774 (pp. 187-473). In: Toschi A., Lanza B. *Fauna d'Italia, IV. Mammalia, Generalità, Insectivora, Chiroptera*. Bologna, Edizioni Calderini VIII + 485 pp.
- Lanza B. 1999. I parassiti dei pipistrelli (Mammalia, Chiroptera) della fauna italiana. *Museo Regionale di Scienze Naturali - Torino, Monografie XXX* 318 pp.
- Lanza B., Finotello P.L. 1985. Biogeografia dei Chiroterri italiani. *Bollettino del Museo Regionale di Scienze Naturali - Torino* 3: 389-419.
- Lanza B., Agnelli P. 2002. Chiroterri (pp. 44 - 142). In: Spagnesi M., De Marinis A.M. (a cura di). *Mammiferi d'Italia. Quaderni di Conservazione della Natura; Ministero dell'Ambiente e della Tutela del Territorio, Direzione Conservazione della Natura e Istituto Nazionale per la Fauna Selvatica "Alessandro Ghigi"* 311 pp. + 1 compact disk.
- Life Focus 2010. *Life Improving the Conservation status of species and habitat*. Publication Office of the European Union, Luxembourg. 81 pp.
- Mastrobuoni G., Gaiba G., Ragno R. 2005 a. Prima segnalazione per il Lazio (Italia Centrale) di Vespertilio di Bechstein, *Myotis bechsteinii* (Chiroptera: Vespertilionidae). *Boll. Mus. reg. Sci. nat. Torino* 22: 525-530.
- Mastrobuoni G., Garofano F., Zerunian S. 2005b. I Chiroterri del Parco Nazionale del Circeo. In: Zerunian S. (Ed.). 2005. *Habitat, flora e fauna del Parco Nazionale del Circeo*. Uff. Gestione Beni ex ASFD di Sabaudia - Parco Nazionale del Circeo, 111-131.
- Mecchia G., Mecchia M., Piro M., Barbati M. 2003. Le grotte del Lazio. I fenomeni carsici, elementi della geodiversità. Regione Lazio, Assessorato all'Ambiente e Cooperazione tra i Popoli - Direzione Ambiente e Cooperazione tra i Popoli - ARP, Agenzia Regionale per i Parchi. Copyright della Agenzia Regionale per i Parchi, Roma.
- Ricci M. 1953. Contributo alla conoscenza degli ectoparassiti dei Chiroterri italiani. I. Insecta. *Riv. Parassitologia* 14: 219-226.
- Stefanelli A. 1942a. Il parassitismo della "*Nycteribosca africana*" Walk (fa. "Streblidae, Diptera Pupipara"). *Reale Accademia d'Italia, Rendiconti della Classe di Scienze Fisiche, Matematiche e Naturali*. Roma, Reale Accademia d'Italia serie VII - III: 1-6.
- Stefanelli A. 1942b. Il parassitismo dei "*Nycteriibidae* (Dipt. Pup.)" come ri-

- sulta da infestazioni sperimentali di varie specie di Chiroteri. Reale Accademia d'Italia, Rendiconti della Classe di Scienze Fisiche, Matematiche e Naturali. Roma, Reale Accademia d'Italia, serie VII - III: 323- 332.
- Stefanelli A. 1942c. Affinità sistematiche dei Chiroptera e parassitismo dei Nycteriidae, Diptera Pupipara. Riv. Parassitologia 6: 1-44.
- Stefanelli A. 1948. Studi sui Chiroteri della Sardegna e sui loro ectoparassiti. Rendiconti del Seminario della Facoltà di Scienze della Università di Cagliari 18: 1-4.
- Vigna Taglianti A., Audisio P.A., Belfiore C., Biondi M., Bologna M.A., Carpaneto G.M., De Biase A., De Felici S., Piattella E., Racheli T., Zapparoli M. 1993. Riflessioni di gruppo sui corotipi Fondamentali della fauna W-Palaartica ed in particolare italiana. Biogeographia 16: 159-179.
- Vigna Taglianti A., Audisio P.A., Biondi M., Bologna M.A., Carpaneto G.M., De Biase A., Fattorini S., Piattella E., Sindaco R., Venchi A., Zoia S., Zapparoli M. 1999. A proposal for a chorotype classification of the Near East fauna, in the framework of the Western Palaearctic Region. Biogeographia (n.s.) 20: 31-59.
- Whitaker J.O. Jr., Ritzi M.C., Dick C.W. 2009. Collecting and Preserving Bat Ectoparasites for Ecological Study. In: Kunz T. H., Parsons S. (Eds.). Ecological and Behavioral Methods for the Study of Bats. The John Hopkins University Press, Baltimore 806-827.