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Barbastella barbastellus.

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Barbastella Gray, 1821

Barbastella Gray, 1821:300. Type species *Vespertilio barbastellus* Schreber, 1774. See below.

Synotus Keyserling and Blasius, 1839:305. Type species *Vespertilio barbastellus* Schreber, 1774.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae. As presently understood, the genus *Barbastella* contains two extant species: the mainly European *B. barbastellus* (Schreber, 1774), the western barbastelle, and the mainly Asian *B. leucomelas* (Cretzschmar, 1830—as defined by Mertens, 1925), the eastern barbastelle (Corbet and Hill, 1991). A key to species, based on Kuzyakin (1950). Schober and Grimmberger (1989) and Strelkov (1989), follows:

Forearm 31–43 mm; condylobasal length 12.4–14.1 mm; usually a lobe protruding from outer edge of pinna; maximum width of baculum 0.27–0.30 mm .... *B. barbastellus*

Forearm 41–45 mm; condylobasal length 14.2–15.0 mm; no lobe at edge of pinna; maximum width of baculum 0.40–0.57 mm .... *B. leucomelas*

Barbastella barbastellus (Schreber, 1774)

Western Barbastelle

Vespertilio barbastellus Schreber, 1774:168, plate 55. Type locality Burgundy, France. Description based largely on Daubenton, 1759.

Vespertilio barbastelle Müller, 1776: Register-Band, 17. Type locality Burgundy, France.

Barbastellus daubentonii Bell, 1836:63. Type locality Burgundy, France.

Barbastella communis Gray, 1838:495. Renaming of *V. barbastellus* Schreber.

Barbastella barbastellus Miller, 1897:385. First use of current name combination.

CONTEXT AND CONTENT. Context same as for genus. There are presently no recognized subspecies of *B. barbastellus*.

DIAGNOSIS. The western barbastelle *B. barbastellus* (Fig. 1) is unmistakable among European bats due to its short, broad ears that face foreward and join across the forehead (Miller, 1912). In the eastern Caucasus, however, the range overlaps with that of the very similar but slightly larger (see key; Schober and Grimmberger, 1989) eastern barbastelle *B. leucomelas* (Bobrinskij et al., 1965; Rakhmatulina, 1989). *B. leucomelas* also has a distinctly different baculum (Strelkov, 1989), and somewhat longer, narrower ears, which lack the lobe that normally protrudes from the middle outer margin of the pinna in *B. barbastellus* (Kuzyakin, 1950). However, there is geographical variation in the expression of the ear lobe in *B. barbastellus*, and it may even be absent (Hackethal et al., 1988). The two forms may also may be distinguished by other external and cranial measurements (Harrison and Makin, 1988).

GENERAL CHARACTERS. The western barbastelle is of medium size and the general form is slender and delicate. Legs are long, and the tail is about as long as the head and body. Wings are broad but pointed. The tail membrane is very large, with the lateral membrane starting at the base of the toe and the calcar reaching ca. 50% the length of the tail membrane. The postcalcarial lobe is very narrow. Fur color is very dark brown, almost black, with whitish or yellowish-white tips dorsally, giving a frosty appearance. The venter is dark gray. The naked parts of the face and ears are black. Wing membranes are gray-brown to black-brown (Schober and Grimmberger, 1989). Partial albinism occurs (1.2%, n = 3,700) with males about three times more affected than females (Červený, 1980). Ears are broad and short and joined across the forehead. Nostrils open upward and outward on a flat median space between two high lateral swellings and behind a prominent median pad (Miller, 1912). Eyes are small and the gape of the mouth is very narrow (Schober and Grimmberger, 1989).

Ranges of external measurements (in mm) of females and males combined are: length of head and body, 45–60; length of forearm, 31–43; wingspan, 245–280; length of tail, 36–52; length of ear, 11.8–18.3. Body mass is 5.6–13.7 g (Hůrka, 1989; Kowalski and Ruprecht, 1981; Spitzenberger, 1993; Stebbings, 1991). Males are significantly smaller than females; in the Czech Republic the forearm mean of 51 males was 38.6 mm and that of 41 females was 39.5 mm (Hůrka, 1989).

The skull (Fig. 2) is lightly built. It has a rather long, rounded brain case and a short and weak rostrum, the upper surface of which is occupied with a shallow, flattened, and concave area that extends from the nares to the faintly developed supraorbital ridges. The auditory bullae are not enlarged (Miller, 1912). Ranges of skull measurements (in mm) of females and males combined are: condylobasal length, 12.4–14.1; zygomatic width, 7.0–8.2; interorbital width, 3.4–3.9; length of maxillary toothrow (C-M3) 4.3–5.0; length of mandible, 8.4–9.5 (Hůrka, 1989; Kurskov, 1981; Menu and Popelard, 1987; Spitzenberger, 1993).

DISTRIBUTION. The distribution of *B. barbastellus* is mainly European (Fig. 3). It ranges from southern Wales and northeastern England (Arnold, 1993), southeastern Norway (northernmost occurrence at 60°N near Oslo—Syvertsen et al. 1995), southern Sweden (Rydell, 1983) and Latvia (Andrushaitis, 1985; Grevé, 1909; G. Petersons, pers. comm.), south to the southern European peninsulas, and east to western Belarus (Grodno and Brest—Kurskov, 1981), central Ukraine (Kiev, Kirovograd), and the mountains of the Crimea (Abeljentsev et al., 1956) through the Great Caucasus eastward to Daghestan and Azerbaijan (southeast to Lenkoran at the Caspian Sea and to Lerik in the foothills of the Talysh mountains—Amirkhanov, 1980; Kuzyakin, 1950; Rakhmatulina, 1988, 1989, 1995) and southeast to the Lesser Caucasus (Borshom in Georgia—Ognev, 1928; Lake Sevan in Armenia—Vereshchagin, 1959).

FIG. 1. *Barbastella barbastellus* from Griebenow (Kreis Greifswald, Vorpommern), eastern Germany. Photograph by E. Grimmberger.

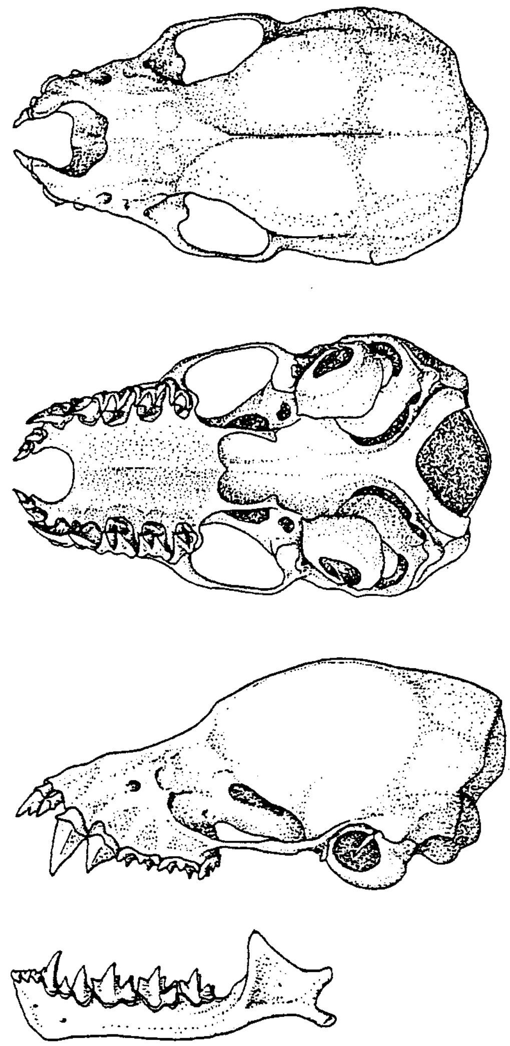

FIG. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of *Barbastella barbastellus* from Zorleni, Romania. Condylobasal length is 13.6 mm. Reproduced with permission from Lanza (1959).

Barbastella barbastellus is missing in much of the lowlands of Europe but occurs in hills and mountains and in some isolated coastal pockets south to Portugal (Palmeirim, 1990), the mountainous areas of Spain (south to the Sierra Nevada—Benzal et al., 1991), Italy south to Calabria (Lanza, 1959; Vernier, 1987), Croatia (Djulić, 1954), Serbia (Mirić, 1990), Macedonia (Kryštufek et al., 1992), Greece (Helversen and Weid, 1990), Bulgaria (Horáček et al., 1974), and northeastern Turkey (Helversen 1989; Steiner and Gaisler, 1994). The western barbastelle is also known from the Balearic Islands in the Mediterranean Sea (Pons et al., 1993), Corsica (Courtois et al., 1992), Sardinia (Gulino and Dal Piaz, 1939), and Sicily (Kahmann, 1957).

Outside Europe *B. barbastellus* occurs in the coastal Jebala mountains and the High Atlas in Morocco (Ibañez, 1988; Panouse, 1955) and on the Canary Islands Tenerife and La Gomera (Trujillo and Barone, 1991). It has been recorded at 1,725 m in the Tatra mountains (Nowosad et al., 1992), at 1,800 m in south-east Azerbaijan (Rakhmatulina, 1989), at 1,990-2,000 m in the western and eastern Alps (Aellen, 1962; Spitzenberger, 1993), and at 2,260 m in the Pyrenean mountains (Bertrand, 1992).

FOSSIL RECORD. Fossil bats that belong to the genus *Barbastella* have been described from many Pleistocene and Holocene localities in Europe. *B. barbastellus* or very closely related forms have been identified from lower Pleistocene deposits of Romania, Hungary, and the former Czechoslovakia (Horáček, 1976; Jánossy 1986), and also from the middle and upper Pleistocene of France

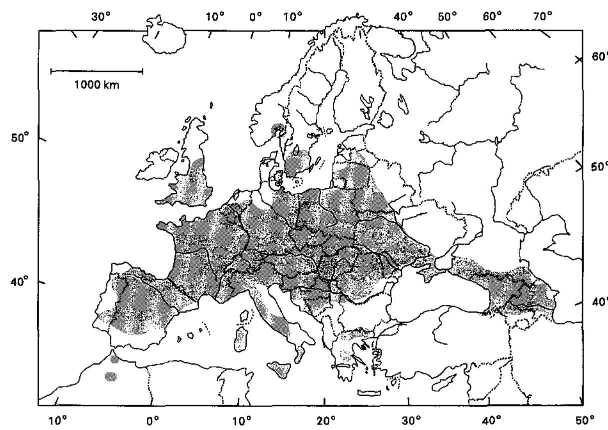

FIG. 3. Distribution of *Barbastella barbastellus*. Confirmed occurrences on Tenerife and La Gomera in the Canary Islands and a possible occurrence in Senegal, West Africa, are not shown. References in text.

(Jullien, 1976), Italy (Kotsakis and Petronio, 1981), the former Yugoslavia (Malez, 1986), Bulgaria (Horáček, 1982), Hungary (Jánossy, 1986), Germany (e.g., Brunner, 1954), Poland (Wołoszyn, 1987), and the former Czechoslovakia (Horáček, 1976). Middle and upper Pleistocene *B. barbastellus* also have been found in Spain, some of them in cave deposits from the southern part of the country, which is outside the present range of the species (Sevilla, 1989, 1991).

Barbastella barbastellus also has been found throughout the Holocene at many localities in central and western Europe (e.g., Bauer, 1978; Brunner, 1957; Horáček, 1976; Horáček and Ložek, 1988; Spitzenberger 1993; Wołoszyn, 1987). In the early Holocene, it was one of the dominant bat species in the Carpathian basin (Kordos, 1982).

The Pleistocene forms *B. schadleri* from Drachenhöhle in Austria (Wettstein-Westersheim, 1924), *B. rostrata* from Tarkő in Hungary (Topál, 1970), and *B. barbastellus carnunti* from Hundsheim in Austria (Rabeder, 1972) do not seem to be closely related to *B. barbastellus* (Schreber, 1774). They should all most probably be synonymized as *B. schadleri* (Rabeder, 1974; Wołoszyn, 1982).

FORM AND FUNCTION. The western barbastelle has a wing span (25.8 cm) that is average in size for an insectivorous bat, and the wings are rather long, broad and with rounded tips. Aspect ratio is 6.0 and wing loading is 9.1 N/m^2 (Norberg and Rayner, 1987). Hence the species is predicted to fly rather slowly and to be highly maneuverable (Norberg and Rayner, 1987). Flight has been described as "slow and deliberate" (Gordon, 1946:12), sometimes nearly hovering (Ahlén, 1990), or "low . . . heavy and fluttering" (Stebbings, 1991:130), but also, in contrast, as fast and skillful (Schober and Grimmberger, 1989). Indoors, flight is slow and maneuverable, but faster than in *Plecotus* (Ryberg, 1947).

The hairs on the middle of the back are 7–8 mm long, at most 15.5 μm in diameter, and more or less circular in cross-section. Cuticular scales shielding the guard hairs are frilled and lack dentation (Teerink, 1991; Tupinier, 1973).

Sounds may be emitted through the nose as well as through the mouth. The anatomy of turbinal bones in the nasal cavity of *B. barbastellus* is similar to those of some vespertilionids (e.g., *Plecotus auritus*) and rhinolophids which call through their noses (Kolb, 1971). The large forward-pointing ears strongly facilitate the directionality of hearing (Konstantinov and Makarov, 1981). The audiogram shows highest sensitivity between 20 and 30 kHz and also ca. 60 kHz. These frequencies coincide with the fundamental and the second harmonic of the louder of the two types of echolocation calls (see below). There is no evidence for increased sensitivity at lower frequencies (Konstantinov and Makarov, 1981), indicating that the species does not forage extensively by passive listening.

The adductor muscles involved in lowering the wings comprise 57.6% of the total muscle mass of the pectoral limbs. The abductors, which raise the wing, are smaller (19.5%). The extensors (18.1%) provide most of the power to move the wing forward, whereas antagonistic flexors (6.2%) control the backward wing movement (Kovtun, 1984).

In active but nonflying bats (36.2–37.7°C rectal temperature), the average metabolic rate is 4.9 and 16.3 cm³ O_2 $g^{-1}h^{-1}$ at surrounding temperatures of 37°C and 19–20°C, respectively, and in torpid bats 0.2 cm³ O_2 $g^{-1}h^{-1}$. The rise in body temperature is more rapid than the corresponding drop (Hanuš, 1959).

The brain of *B. barbastellus* was described by Sigmund and Zajícová (1970). The index of encephalization is 117, which is higher than the average for the subfamily (95—Stephan et al., 1987). The relative number of nerve cells in the spiral ganglion reflects the dense innervation of the cochlea, and the cells of the basilar membrane—>1800 cells per mm length—may be used in coding acoustic stimuli. The fibers of the cochlear nerve are thick, and this may induce quicker impulse conductivity in the nerve during echolocation (Firbas and Welleschik, 1973). The tuberculum acusticum is composed of four layers, with highly differentiated cell structure (Kameneva, 1980). The cholinesterase activity in the central nervous system is similar to that of *Plecotus auritus* and much higher than in some nonflying mammals (Tonkoglas and Skvortsov, 1974). Five carotenoids (mainly beta-cryptoxanthin) were identified in a male caught in late August in Poland (Czeczuga and Ruprecht, 1985).

Heart mass is ca. 0.11 g, or 1.25% of body mass (Kurskov, 1981). The blood of three males caught in winter or spring had hemoglobin levels of 90–130%, 11.7–15.9 × 10^6 erythrocytes/mm³, and 2.0–4.6 × 10^3 leukocytes/mm³ (Grundboeck and Krzanowski, 1957).

Dental formula is i 2/3, c 1/1, p 2/2, m 3/3, total 34. The teeth are small; P2 is very small and hidden by P4 in external view. The first two lower molars are nyctalodont (Menu and Popelard, 1987; Menu and Sigé, 1971).

The hyoid apparatus is described by Romankowowa (1963), the sesamoid bones in the limbs by Romankowowa (1961) and Červený (1976), the humerus by Felten et al. (1973), and the scapula by Žalman (1971). The vertebral formula is 7C, 11T, 5L, 4S, 10Ca, total 37 (Kovtun, 1984).

The baculum is situated in the glans penis and is 0.76–0.85 mm long, broadening proximally, and narrowing distally (e.g., Strelkov, 1989; Topál, 1958). The prostate consists of two parts situated one under the other, with the lower part 50% the size of the upper. The seminal vesicles lie under the prostate. Ampullary glands are absent. The ducts of Cowper's glands enter the urethra at the root of the penis (Tiunov, 1989). The placenta is discoidal. The corpus uteri is longer and larger than the cornua (Wood-Jones, 1917). There is one pair of mammary glands (Schober and Grimmberger, 1989).

ONTOGENY AND REPRODUCTION. As in most vespertilionids, there is sexual segregation in summer (June–August), when reproductive females congregate and form maternity colonies. The few such colonies found consisted of 5–30 females and in one case 80 females (Grimmberger, 1987; Richarz, 1989; Spitzenberger, 1993).

Females may become sexually mature during their first year of life (Dolch and Arnold, 1989). In the Ukraine, mating occurs during late summer and early autumn, and sometimes also in winter (Abeljentsev et al., 1956). However, winter matings do not seem to occur in the large hibernaculum at Nietoperek in Poland (Urbańczyk, 1992). Litter size is usually one, sometimes two (Ryberg, 1947). Young grow rapidly and reach adult size in 8–9 weeks (Kurskov, 1981) or earlier (Abeljentsev et al., 1956).

ECOLOGY. In the northern part of the range, winter roosts of western barbastelles are most frequently situated in fissures in underground quarters such as cellars, caves, and mines (e.g., Bogdanowicz and Urbańczyk, 1983; Braun, 1991; Lina, 1987; Rybář, 1975, Rydell 1983), but sometimes also in buildings above ground (Strelkov, 1969). *B. barbastellus* is one of the most numerous bat species in the tunnels of the Nietoperek bat reserve in western Poland, where several hundred individuals hibernate each year (Bagrowska-Urbańczyk and Urbańczyk, 1983; Urbańczyk, 1991). In underground shelters, relatively exposed and ventilated sites with low ambient temperatures (ca. 0–5°C) and dry air (75–90% relative humidity) are preferred (Bogdanowicz and Urbańczyk, 1983; Braun, 1991; Richarz 1989; Rydell, 1983; Strelkov, 1969). Extreme temperatures recorded near hibernating western barbastelles are −6°C (Řehák, 1992) and 9.5°C (Harmata, 1969). Hibernation sites with hundreds or thousands of western barbastelles also are known from southern Germany (Frank, 1960; Richarz, 1989), the Czech Republic (Rumler, 1985; Rybář, 1975) and Slovakia (Danko and Mihók, 1988; Uhrin 1995).

In summer, maternity colonies of western barbastelles have been found in crevices in houses and church attics (Ryberg, 1947) and, in central Europe, typically behind wooden window shutters (Dolch and Arnold, 1989; Heddergott, 1992; Richarz, 1989; Spitzenberger, 1993). Maternity roosts also may occur in hollow trees (Panouse, 1955) or, in the south, in caves (Fernández and Ibáñez, 1989). Males usually roost alone in summer but sometimes may form small colonies (Kowalski and Ruprecht, 1981).

In central and southern Europe, the western barbastelle is associated with forested upland areas (Fernández and Ibáñez, 1989). In Austria, for example, known localities range from 170 to 1,990 m altitude but are concentrated in the submontane and montane belt (Spitzenberger, 1993). The species is regarded as stationary in western Russia (Strelkov, 1969), but several recaptures far from the place of banding are known from central Europe and suggest that migrations may occur (Aellen, 1983). The longest movement recorded was 290 km between Austria and Hungary (Kepka, 1960). Movements of 180 km in Czechoslovakia (Gaisler and Hanák, 1969) and 145 km in Germany (Hoehl, 1960) have also been recorded.

Prey items taken by barbastelles range in size from large moths (*Hepialus humuli*—Gordon, 1946) to small nematoceran flies (Stebbings, 1991). In western Belarus, the diet consists of microlepidopterans (mainly Tineidae) and nematoceran flies, the latter belonging to the families Tipulidae, Chironomidae, Culicidae, Simuliidae, and Bibionidae (Kurskov, 1968). In Germany and Switzerland, moths are the most important prey item (70–90% by volume), followed by nematoceran and brachyceran flies, including Tipulidae, Calliphoridae, Muscidae, and many smaller forms (Beck, 1995; Rydell et al., 1996). Occasionally, the diet also includes Trichoptera, Neuroptera, Hemiptera, and spiders (Araneae) as well as ectoparasitic mites (Acarina), the latter presumably ingested following grooming of the fur (Rydell et al., 1996). In contrast to many other bats in Europe, the barbastelle does not catch dung-beetles or other relatively large, hard bodied insects (Rydell et al., 1996), perhaps because of difficulties in handling such insects with the narrow mouth and small teeth characteristic of *B. barbastellus* (Schober and Grimmberger, 1989).

In southwestern Germany and northern Czech Republic, 85–90% of hibernating adult western barbastelles of both sexes returned to the same site in subsequent years, suggesting a high annual survival rate, at least under favorable conditions (Frank, 1960; Gaisler et al., 1993). In western Poland, the annual survival rate, based on capture-recapture in a hibernaculum, was 57% for males and 52% for females, implying mean life expectancies of 1.8 and 1.5 years and predicted life spans of 10 and 7 years, respectively (Urbańczyk, 1992). These figures are similar to those obtained by Unikauskajte (1990) in Lithuania, who also found that annual mortality is higher in young individuals than in adults and that 61% of hibernating individuals (n = 28) were <1 year old, 29% were ca. 1.5 years, and 11% were ca. 2.5 years or more. Estimates were based on counting of annual dental layers in the teeth, estimates of tooth wear, and decrease in pulp cavity. In Bohemia in the Czech Republic, mean longevity (which usually is close to life expectancy) was 5.5 years (Hůrka, 1989). Recaptures of banded individuals have shown that the western barbastelle may reach ages of 19 years 8 months (Hůrka, 1989) and 21 years 9 months (Abel, 1970). The maximum age of 23 years reported by Schober and Grimmberger (1989) and Gebhard (1991) was an error (V. Aellen, pers. comm.).

Remains of western barbastelles have been found in pellets from several owl species including *Tyto alba*, *Asio otus*, *Aegolius funereus*, *Strix aluco*, and *Bubo bubo* (Abeljentsev et al., 1956; Frey and Walter, 1987; Obuch, 1989; Ruprecht, 1990). Generally, however, remains of western barbastelles comprise <3% of bats eaten by owls, and hence this is one of the rarest bats in their diet (Krzanowski, 1973; Ruprecht, 1990). *B. barbastellus* may also be taken by the beech marten *Martes foina* (Urbańczyk, 1981) and killed in traffic (Kiefer et al., 1995). A western barbastelle has been observed to attack an owl, probably *Tyto alba*, in Poland (Krzanowski, 1958).

Barbastella barbastellus is heavily infested with ectoparasitic arthropods, mainly acarines, including Spinturnicidae, Macronyssidae, Demodicidae, Myobiidae, Argasidae, and Trombiculidae (Anciaux de Faveaux, 1971; Dusbábek, 1972; Estrada-Peña et al., 1991; Haitlinger, 1979). Females are usually, but not always, more infested than males. Four mite species (*Acanthophthirius pantopus, Macronyssus barbastellus, Spinturnix barbastelli,* and *S. punctatus*) are monoxenic (Deunff et al., 1986; Dusbábek, 1972; Haitlinger, 1979). The western barbastelle also serves as one of the principal hosts for two species of fleas of the family Ischnopsyllidae (*Ischnopsyllus hectactenus* and *Nycteridopsylla pentactena*) and as an occasional host for several others (*Ischnopsyllus octactenus, I. simplex, I. mysticus, I. intermedius, I. variabilis, I. elongatus, Nycteridopsylla eusarca, N. longiceps,* and *N. dictena*—Aellen, 1960; Haitlinger, 1979; Hůrka, 1963*a*, 1963*b*; Medvedev and Mazing, 1987; Skuratowicz, 1988; Walter and Kock 1994). Ectoparasites also include the bat-flies *Nycteribia schmidlii* (family Nycteribiidae—Hutson, 1984), *N. kolenatii* (Farafonova and Mazing, 1985; Haitlinger, 1979), and *Phthiridium biarticulatum* (= *N. biarticulata*—Estrada-Peña et al., 1991).

Endoparasitic helminths found in *B. barbastellus* include the trematodes *Lecithodendrium linstowi, Prosthodendrium ascidia, P. longiforme, Pycnoporus heteroporus, P. megacotyle, Alassogonoporus amphoraeformis, Parabascus joannae, Plagiorchis vespertilionis,* and *P. asperus* (Andrejko, 1973; Hůrková, 1964; Matskási, 1967; Zdzitowiecki, 1969), the larvae of the nematodes *Seuratum mucronatum* and *Physocephalus sexalatus* (Andrejko, 1973; Marozaw, 1961; Mészáros, 1967) as well as the tapeworms *Myotolepis crimensis, Vampirolepis skrjabinariana,* and *Milina grisea* (Andrejko, 1973; Davtyan et al., 1990; Tkach, 1995). The intraerythrocytic bacterium *Grahamella* sp. and a piroplasm *Babesia* sp. have been found in the blood of *B. barbastellus* from the Czech Republic (Kučera, 1979) and Azerbaijan (Zeyniev and Rakhmatulina, 1990), respectively. None of several individuals examined in Germany showed signs of paradentosis (Vierhaus, 1981). Rabies is not known to occur in this species (WHO, 1990).

BEHAVIOR. In continental Europe hibernating western barbastelles sometimes form large clusters, containing hundreds of individuals of the same species (Uhrin, 1995; Urbańczyk, 1992), or of different species (Bogdanowicz, 1983). Clustering does not occur further north in Scandinavia, where western barbastelles usually hibernate alone (Rydell, 1983). In central Europe, hibernation occurs from November to March, and lasts 120–140 days, as estimated from changes in body mass (Lesiński, 1986; Urbańczyk, 1991). Loss of body mass over the whole hibernation period amounts to 29–30% in females and 31–37% in males, and the rate of loss is higher in autumn and early winter than in late winter (Krzanowski, 1961; Urbańczyk, 1991). On average, hibernating western barbastelles awaken every 2 weeks (Hanzal and Průcha, 1988). The maximum duration of uninterrupted hibernation that has been observed is 101 days (Rybář, 1975). The lower lethal temperature is −16.5°C (Abeljentsev et al., 1956).

Only anecdotal information is available on flight and foraging behavior. Feeding usually takes place in regular paths along rows of trees 4–5 m above ground (Ahlén, 1990; Gordon, 1946; Welander, 1929). A captive individual adroitly picked house flies off the ceiling and consumed them in flight (Poulton, 1929), thus indicating that the species may also use a gleaning foraging style. Like many gleaning bats, it sometimes consumes its food in a hanging position (Ryberg, 1947). However, the occurrence of small flies in the diet suggests that the western barbastelle also may hunt insects by aerial-hawking. It sometimes forages near mercury vapor streetlamps in Switzerland, and thus one can monitor it with a bat detector from a car (Zingg, 1994).

The echolocation calls of the western barbastelle are unique among European bats (Ahlén, 1981, 1990). The pulses have a short (1–1.5 ms) narrow-band component in the beginning and end with a short downward frequency-sweep. These pulses are 4–5 ms long and are repeated 8–9 times per second. Pure frequency-modulated pulses with lower intensity also may be used, and in many situations the two pulse types may alternate. When alternating pulses are used, *B. barbastellus* is unmistakable and easy to recognize with a bat detector, particularly if a time expansion unit is used. With a heterodyne bat detector, the alternating pulses are heard as short and hard castanet-like smacks. The constant frequency pulses have greatest power near 32 kHz and the sweeps are best heard ca. 40 kHz (Ahlén, 1981, 1990; Konstantinov and Makarov, 1981; Patlakevich, 1980). The loudest pulses can be heard ca. 20 m away with a heterodyne bat detector (Barataud, 1993). There may be geographical variation in the echolocation calls, because individuals ($n = 3$) from Moldavia and Ukraine emitted different frequencies (Patlakevich, 1980).

GENETICS. In both barbastelle species the diploid chromosome number is 32 and the fundamental number is 50 (Zima and Horáček, 1985). The chromosome number is the same as in *Plecotus* spp. and is the lowest among the European vespertilionids (Volleth, 1985; Volleth and Heller, 1994). The chromosome banding pattern and the location of nucleolus organizer regions are almost identical with that of *Plecotus* spp., which suggests a close phylogenetic relationship with that genus (Volleth, 1987).

CONSERVATION STATUS. *Barbastella barbastellus* is more or less rare throughout its range and is legally listed as either "endangered" or "vulnerable" in most European countries (Stebbings, 1988). However, its status appears to be much worse in western Europe, where it generally is considered lost or disappearing (e.g., Daan et al., 1980; Stebbings and Griffith, 1986), than in some countries of central and eastern Europe, where it is still relatively common and populations are stable in many places (e.g., Spitzenberger, 1993; Uhrin, 1995; Urbańczyk, 1991; Zima et al., 1994). The population density of western barbastelles in the Czech Republic was estimated to be 1/1000 ha (Hůrka, 1989).

Reasons for the decline of *B. barbastellus* are unknown, but rapid disappearances from many hibernation sites have been associated with large scale human disturbance such as cave tourism and research involving banding (e.g., Hoehl, 1960; Richarz, 1989). In the northern Czech Republic, the return rate to hibernacula the year after banding was ca. 50%, after 5 years ca. 25%, and after 10 years almost zero (Sklenář, 1981). About 50% of hibernating barbastelles permanently left a hibernation site in the Czech Republic as a result of banding (Rybář, 1973).

REMARKS. The name *Barbastella barbastellus* may be derived from the Latin *barba,* meaning beard and *stella,* meaning star. Viewed from the side, the upper lip appears superficially to have a beard (Daubenton, 1759), or rather a moustache (which, however, was also called a beard at that time—C. Denys, pers. comm.). *Barbastello* is also an Italian synonym for bat. Frost and Timm (1992) recently proposed the name *B. barbastella* rather than *B. barbastellus.* However, "the specific name *barbastellus* is a masculine substantive, and does not change its termination when combined with a feminine generic name" (Miller, 1897:385).

The taxonomy of the barbastelles is uncertain, particularly with respect to populations from the Middle East and Africa south of the Sahara. *B. l. leucomelas* (Cretzschmar, 1830), known from the Arava-valley in Israel, Sinai in Egypt (terra typica), and Masawa in Eritrea, has also been reported from four or five localities in Senegal (Rochebrune, 1883), although no specimens have been collected from the latter country. *B. l. leucomelas* has the relatively long, narrow ears of eastern barbastelles from Asia (*B. l. caspia* from the Greater Caucasus to Iran and *B. l. darjeelingensis* from Afghanistan to Japan), and it also lacks the lobe of the pinna which typically occurs in *B. barbastellus.* However, it is markedly smaller (length of forearm, 37.3–39.5 mm; condylobasal length, 13.0–13.2 mm—Harrison and Makin, 1988) than Asian *B. leucomelas,* and similar in size to *B. barbastellus.* Hence, the taxonomic identity of southern barbastelle populations is ambiguous.

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