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HAIR MORPHOLOGY OF SOME MAMMALIAN SPECIES IN TURKEY

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ABSTRACT

This study is based on a morphological investigation of hair specimens which belong to 41 species of mammalian orders; *Insectivora, Chiroptera, Rodentia, Carnivora* and *Arctiodactyla*, occured in Turkey. From the hair morphology point of view 8 main hair types have been distinguished namely, spicate, mosaic, wavy crenated, annular, lanceolate, vase, diamond and chevron type. The morphological characteristics of hair have been examined separately and their photographs given.

INTRODUCTION

Various research methods serve well to the investigations of species under threat imposed by the destruction of nature. Thus the research seeking for the biology, ecology and taxonomy of the species could be carried out without distributing the wild animals number of which is continuously decreasing.

Hair is one of the characterizing features of the Classis Mammalia. Due to the fact that the hair remain unchanged during digetion, it given an easy access to the investigations about the feeding ecology and distributions of the species, and the density and fluctuations of the populations through the analysis of fecal materyal (Day 1966; Day and Linn 1972; Jenkins 1980; Birks, 1982; Putnam, 1984; Birs and Dunstone, 1984, 1985; Elgmark and Ruser, 1991).

The hair morphology as a diagnostic tool may sometimes be distingishing aspect to the taxa (Day, 1966; Gaisler, 1971). The hair morphology has also significance in criminology in case needed for the proof of crime.

The aim of this study is to investigate the hair morphology of some mammalian species for the first time in Turkey so that such study could be a base in progressing the relevant research activities in the area.

MATERIALS and METHODS

For this study the hair specimens from a total of 41 species belonging *Insectivora, Chiroptera, Rodentia, Carnivora* and *Arctiodactyla* orders present in Turkey were collected. The hair specimens were obtained from the research materials in collections at the Department of Biology and mammals in zoo.

The guard hairs were taken from dorsal parts between shoulder blades (in hedgehog, from flank). The hair specimens were lied on a slide covered with colourness fingernail polish, acrylic polymer as a surface film. Casts hair were acquired after waiting about half minute (Day, 1966). About five hair specimens from each species were examined to determine variations. Owing to that much less variations occured on the shaft compared to the tip and base of hairs, only the shaft of each hair specimen was photographed separately by using PM 10 A camera system adapted on Olympus Vanox microscope with various magnifications. Eight different types were determinde from hair casts as taxonomical characteristics. Of them, 5 patterns (Mosaic wavy crenated chevron lanceolate diamond) were closely resembled to those given by Day (1966) and the same names were used to define them in order to provide consistency. The remaining 3 (Annular, Spicate, Vase) were named by approximating their pattern to the nearest resembling object. The species were given according to Corbet's systematics order (Corbet, 1978).

The original name, valid name, habitat, pelage colour and hair mophology of each species are given in brief.

RESULTS

The hair morphology of two species belonging to *Insectivora* have been examined.

Erinaceus concolor Martin 1838

1838. *Erinaceus concolar* Martin, P.Z.S. 1837: 103.
Type locality: Near Trebizond, Asia Minor.

Habitat: It is found in woodlands, agricultural and residental areas and barns in villages.

Pelage colour: Ventral parts are yellowish dirty white.

Hair morphology: It has annular type (Figure 1).

Crocidura suaveolens (Pallas, 1811)

1811. *Sorex suaveolens* Pallas, Zoogr. Ross. As., 1: 132-133.
Type locality: Khersones, Crimea, Southern Russia.
1873. *Crocidura suaveolens* Brondt. Bullet. soc. Imp. Natur de Moscov, 46: 22-27.

Habitat: It lives on banks of brooks, thickets and under dense vegetation cover, and wet and humid areas.

Pelage colour: Dorsal parts are somewhat grayish brown and ventral parts are light grayish white.

Hair morphology: It has a lanceolate type (Figure 2).

The hair morphology of twenty species belonging to *Chiroptera* Have been examined.

Rousettus aegyptiacus (Geoffroy, 1810)

1810. *Pteropus egyptiacus* Geoffroy, Ann. Mus. Hist. Nat., Paris, 5: 96. (misprint), corrected to *aegyptiacus* in 1818, Description de l'Egypte, H.N. 2: 134, pl. 3, fig. 2.
Type locality: Great Pyramid, Giza, Egypt.
1902. *Roussettus aegyptiacus*, Anderson and de Winton, Zool. Egypte, Mamm. p. 84, pl. XV.

Habitat: It lives in big caves and sheds.

Pelage colour: Dorsal parts are gray-brown and ventral parts are dirty buffy brown.

Hair morphology: It has spicate type (Figure 3).

Rhinolophs ferrumequinum (Schreber, 1771)

1774. *Vespertilio ferrum-equinum* Schreber, Säugethiere, I, pl. LXII, upper figures; description, I, p. 174.
Type locality: Burgundy, France.
1853. *Rhinolophus ferrumequinum*, Blasius, Wegmann's Arch. Naturgesch., 19(1): 51-52.

Habitat: It lives in vaves, mines and tunnels.

Pelage colour: Dorsal parts are yellowish drabby brown and ventral parts are rather lighter than dorsal parts.

Hair morphology: It has vase type (Figure 4).

Rhinolophus hipposideros (Bechstein, 1800)

1800. *Vespertilio hipposideros* Bechstein, Thomas Pennant's Allgemeine Uebersicht der vierfüssigen Thiere, II, p. 629.
Type locality: France.

1857. *Rhinolophus hipposideros*, Blasius Säugeth., Deutchland, 29.

Habitat: It lives in caves and attics of houses.

Pelage colour: Dorsal parts are light gray-brown and ventral parts yellowish gray-brown or sometimes approaching dirty white.

Hair morphology: It has vase type (Figure 5).

Rhinolophus euryale Blasius, 1853

1853. *Rhinolophus euryale* Blasius, Wiegmann's Arch. Naturgesch., 19(1): 49-51.
Type locality: Milan, Italy.

Habitat: It lives in caves and dens.

Pelage colour: Dorsal parts are light yellowish gray and ventral parts whitish gray.

Hair morphology: It has vase type (Figure 6).

Rhinolophus mehelyi Matschie, 1901

1901. *Rhinolophus mehelyi* Matschie, Sitz. Ber. Ges. Natf. Frde, Berlin, 225.
Type locality: Bucharest, Roumania.

Habitat: It lives in caverns and big crevices of stones and rocks.

Pelage colour: Dorsal parts are slightly grayish brown and ventral parts whitish buffy brown.

Hair morphology: It has annular type (Figure 7).

Myotis mystacinus (Kuhl, 1819)

1819. *Vespertilio mystacinus* Kuhl, Ann. Wetterau Ges. Naturk., 4(2): 202-204
Type locality: Germany.

1900. *Myotis mystacinus*, Mehely monogr. Chiropt. Hungariae, Budapest 200-206.

Habitat: It lives in attics of houses or buildings.

Pelage colour: Dorsal parts are slightly yellowish graybrown and ventral parts smoky gray.

Hair morphology: It has vase type (Figure 8).

Myotis brandti (Eversmann, 1845)

1845. *Vespertilio brandti* Eversmann, Uralensibus observati. Bull. Soc. Nat., Moscou, 2: 505-508.
Type locality: Urals foothills, Sakmara River, USSR.
1970. *Myotis brandti* Gauckler and Kraus, Zeit. Saugetirekunde, 35(2): 124-133.

Habitat: It lives in attics of wooden buildings.

Pelage colour: Dorsal parts are dark brown with metallic glare.

Hair morphology: It has vase type (Figure 9).

Myotis emarginatus (Geoffroy, 1806)

1806. *Vespertilio emarginatus* Geoffroy, Ann. Mus. Hist. Nat., 8: 198-199.
Type locality: Charlemont, Givet, Ardennes, France.
1900. *Myotis emarginatus* Mehely, Monogr. Chiropt. Hungariae, Budapest, 170-178.

Habitat: It lives in old buildings, caves and crevices of rocks.

Pelage colour: Dorsal parts are slightly redish gray and ventral pars yellowish gray.

Hair morphology: It has annular type (Figure 10).

Myotis bechsteini (Kuhl, 1818)

1818. *Vespertilio bechsteini* Kuhl, Ann. Wetterau, Ges. Naturk. 40(1): 30-33.
Type locality: Hanau, Hessen, Germany.
1900. *Myotis bechsteinii*, Mehely, Monogr. Chiropt. Hungariae, Budapest, 184-190.

Habitat: It lives in hollow trees and it was encountered only in an ancient bath.

Pelage colour: Dorsal parts are slightly gray-brown and ventral parts whitish gray.

Hair morphology: It has vase type (Figure 11).

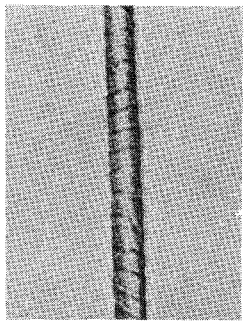

Fig. 1. *E. concolar*

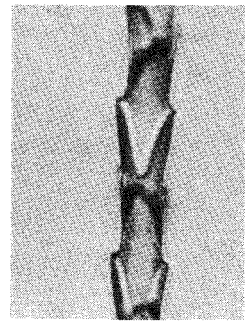

Fig. 2. *C. suaveolens*

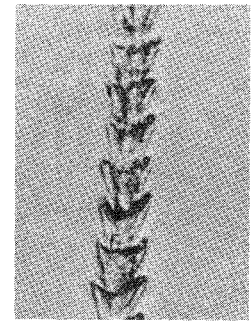

Fig. 3. *R. aegyptiacus*

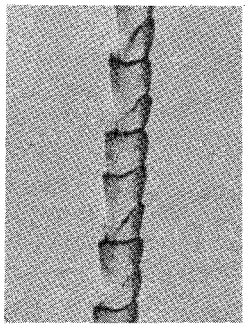

Fig. 4. *R. ferrumequinum*

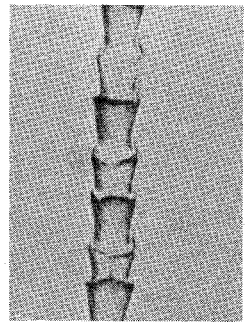

Fig. 5. *R. hipposideros*

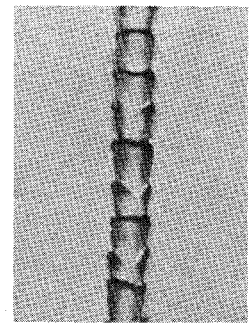

Fig. 6. *R. euryale*

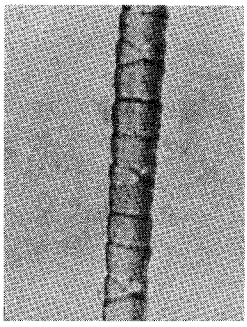

Fig. 7. *R. mehelyi*

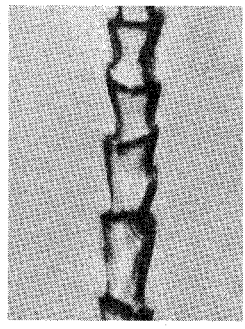

Fig. 8. *M. mystacinus*

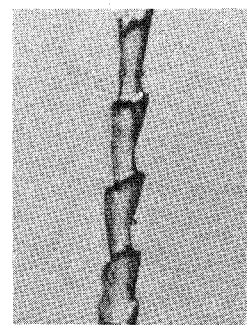

Fig. 9. *M. brandti*

Myotis myotis (Borkhausen, 1797)

1797. *Vespertilio myotis* Borkhausen, Deutsche Fauna, 1: 80.
Type locality: Thüringen, Germany.
1897. *Myotis myotis*, Miller, Ann. Mag. Nat. Hist., 20(6): 383.

Habitat: It lives in caves, caverns and ruins.

Pelage colour: Dorsal parts are slightly pale brownish gray and ventral parts yellowish dirty white.

Hair morphology: It has annular type (Figure 12).

Myotis blythi (Tomes, 1857)

1857. *Vespertilio blythi* Tomes, Proc. Zool. Soc., London 53-54.
Type locality: Nasirabad, Rajputana, India.
1951. *Myotis blythi*, Ellerman and Morrison-Scott, Checklist of palaearctic and Indian Mammals 1758-1946. Brit. Mus. (Nat. Hist.), 144-145.

Habitat: It lives in caves, old buildings and bridge ruins.

Pelage colour: Dorsal parts are yellowish pale gray-brown and ventral parts slightly dirty white.

Hair morphology: It has annular type (Figure 13).

Myotis capaccinii (Bonaparte, 1837)

1837. *Vespertilio capaccinii*, Bonaparte, Faun. Ital., 1(20).
Type locality: Sicily.
1901. *Myotis capaccinii*, Thomas, Proc. Zool. Soc., London, 37.

Habitat: It lives in caves.

Pelage colour: Dorsal parts are pale brownish gray and ventral parts dirty white.

Hair morphology: It has vase type (Figure 14).

Pipistrellus pipistrellus (Schreber, 1774)

1774. *Vespertilio pipistrellus* Schreber, Säugethiere, I, p. 167 (France; based on name "la pipistrelle"-Daubenton L., comte de Buffon, Histoire Natur., VIII, pp. 129-30).
Type locality: France.
1897. *Pipistrellus pipistrellus* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384.

Habitat: It is found in attics of old buildings and in between the two hihgly adjacent buildings.

Pelage colour: Dorsal parts are brown and ventral parts light brown.

Hair morphology: It has spicate type (Figure 15).

Pipistrellus nathusii (Kayserling and Blasius, 1839)

1839. *Vespertilio nathusii* Keyserling and Blasius, Wiegmann's Arch. Naturgesch., 5(1): 320.
Type locality: Berlin, Germany.
1900. *Pipistrellus nathusii* Mehely, Monogr. Chiropt. Hungariae, Budapest, p. 276.

Habitat: It is found under eaves of buildings.

Pelage colour: Dorsal parts are slightly yellowish gray-brown and ventral parts straw gray-whitish.

Hair morphology: It has spicate type (Figure 16).

Pipistrellus kuhli (Kuhl, 1819)

1819. *Vespertilio kuhli*, Ann. Wetterau. Ges. Naturk., 4(2): 190-202.
Type locality: Trieste, Austria-Hungary.
1900. *Pipistrellus kuhlii*, Mehely, Monogr. Chiropt. Hungariae, Budapest, 261.

Habitat: It is found in attic of houses and under roof.

Pelage colour: Dorsal parts are pale yellowish gray-brown and ventral parts yellowish dirty white.

Hair morphology: It has spicate type (Figure 17).

Pipistrellus saviii (Bonaparte, 1837)

1837. *Vespertilio saviii* Bonaparte, Iconogr. Faun. Ital., 1(2).
Type locality: Pisa, Italy.
1910. *Pipistrellus savii* and *P. savii ochromixtus* Trouessart, Faune Mamm. d'Europe, pp. 13-14.

Habitat: It is encountered in attics of old buildings.

Pelage colour: Dorsal parts are pale, light yellowish gray or pale grayish brown and ventral parts dirty white.

Hair morphology: It has chevron type (Figure 18).

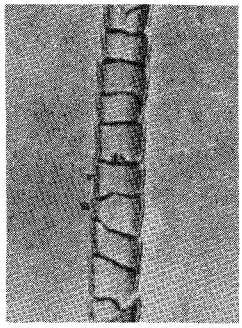

Fig. 10. *M. emarginatus*

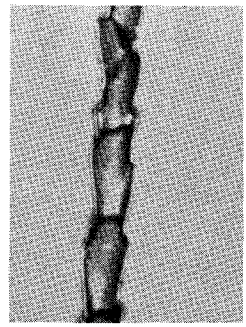

Fig. 11. *M. bechsteini*

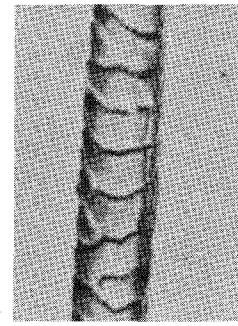

Fig. 12. *M. myotis*

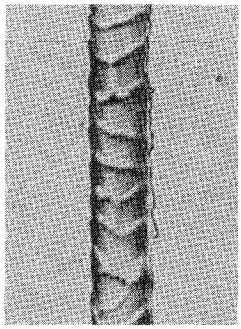

Fig. 13. *M. blythi*

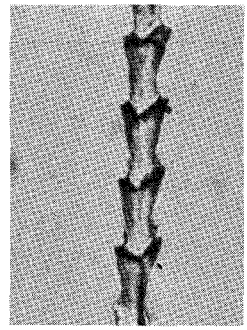

Fig. 14. *M. capaccinii*

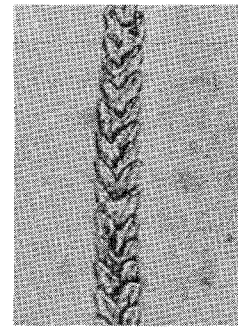

Fig. 15. *P. pipistrellus*

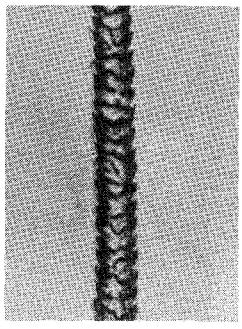

Fig. 16. *P. nathusii*

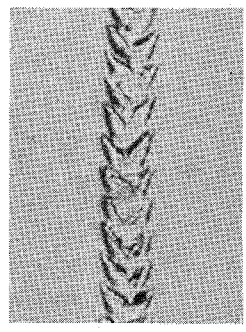

Fig. 17. *P. kuhli*

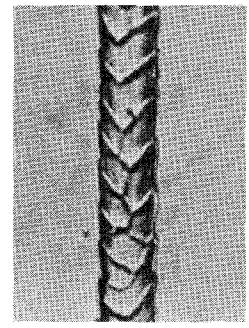

Fig. 18. *P. savii*

Eptesicus serotinus (Schreber, 1774)

1774. *Vespertilio serotinus* Schreber, Säugeth., 1(53): 167.
Type locality: France.
1990. *Eptesicus serotinus*, Mehely, Monogr. Chiropt. Hungariae, Budapest, 209.

Habitat: It is found in attics of buildings and under roof.

Pelage colour: Dorsal parts are dark coffee-brown and ventral parts light yellowish brown.

Hair morphology: It has annular type (Figure 19).

Plecotus auritus (Linnaeus, 1758)

1758. *Vespertilio auritus* Linnaeus, Carolus, Systema Naturae, I. ed. 10: 32.
Type locality: Sweden.
1818. *Plecotus auritus* Geoffroy, Description de l'Egypte, 11: 118.

Habitat: It is found in old buildings and inhabits ruins.

Pelage colour: Dorsal parts are pale, somewhat yellowish gray and ventral parts yellowish white.

Hair morphology: It has spicate type (Figure 20).

Miniopterus schreibersi (Kuhl, 1819)

1819. *Vespertilio schreibersi*, Kuhl, Ann. Wetterau, Ges. Naturk., 4(2): 185.
Type locality: Kulmbazer Cave, mountains of sothern Bannat, Hungary.
1857. *Miniopterus schreibersi*, Blasius, Säugeth. Deutschland, 46-48.

Habitat: It lives in caves and caverns.

Pelage colour: Dorsal parts are pale dark brownish gray ventral parts light smoky gray.

Hair morphology: It has vase type (Figure 21).

Tadarida teniotis (Rafinesque 1814)

1814. *Cehpalotes teniotis* Rafinesque, Prec. des De Couv. Somiol, 12.
Type locality: Sicily.
1951. *Tadarida teniotis*, Ellerman and Morrison-Scott, Checklist of Palaearctic and Indian Mammals 1758-1946. Brit. Mus. (Nat. Hist.), London, 134.

Habitat: It lives in crevices of rocks in the valley of rivers.

Pelage colour: Dorsal parts are brownish gray and ventral parts light brownish gray.

Hair morphology: It has spicate type (Figure 22).

Spermophilus xanthaphyrmnus (Bennett, 1835)

1835. *Citellus citellus xanthaprymna* Bennett, P.Z.S. 90.
Type locality: Erzurum, Turkey.
1984. *Spermophilus xanthaphyrmnus* Zima and Kral, Acta, Sc. Nat. Brno, 18(8): 1-62.

Habitat: It lives in open areas and agricultural lands with meadows.

Pelage colour: Dorsal parts are yellowish gray and ventral parts yellowish white.

Hair morphology: It has wavy crenated type (Figure 23).

Cricetulus migratorius Pallas, 1773

1773. *Cricetulus migratorius* Pallas, Reis, II, p. 703.
Type locality: Lower River Ural, Western Siberia.
1917. *Cricetulus migratorius vernula* Thomas Ann. Mag. N. H. 19: 453.

Habitat: It lives in grasslands, agricultural lands and open forests.

Pelage colour: Dorsal parts are dark gray and ventral parts light ash colored.

Hair morphology: It has annular type (Figure 24).

Clethrionomys glareolus (Schreber, 1780)

1780. *Mus glareolus* Schreber, Säugeth. 4: 680.
Type locality: Lolland Island, Denmark.
1936. *Clethrionomys glareouls*, Neuhäuser, Zeit. Säuget. 11: 185.

Habitat: It lives in forest, at the side of agricultural area, brooke and river.

Pelage colour: Dorsal parts are redish brown and ventral parts gray.

Hair morphology: It has wavy crenated type (Figure 25).

Microtus epiroticus Ondrias, 1966

1966. *Microtus arvalis epiroticus* Ondrias, Säuget. Mitt. 14: 59.
Type locality: Perama, Epirus, Greece.

1975. *Microtus epiroticus* Ruzic, Petrov, Zivkoviç and Rimsa, Arch. Poljopriv, Nauka, Beograd, 28(104): 153-160.

Habitat: It generally lives in forests and sometimes in gardens, grosslands and vineyards.

Pelage colour: Dorsal parts are light, blackish gray-brown and ventral parts light gray.

Hair morphology: It has chevron type (Figure 26).

Spalax leucodon (Nordmann, 1840)

1840. *Spalax typhlus leucodon* Nordmann, Observations sur la Faune Pontique A. Demidoff, Voyage dans la Russie Meridion, 3: 35.
Type locality: Odessa, Russia.
1838. *Spalax leucodon* Migulin A.A., Mammals of the Ukrainian SSR, p. 345.

Habitat: It lives in agricultural lands, vineyards and open areas.

Pelage colour: Dorsal parts are gray-brown with slightly yellowish red and ventral parts yellowish gray.

Hair morphology: It has chevron type (Figure 27).

Apodemus mystacinus (Danford and Alston, 1877)

1877. *Mus mystacinus* Danford and Alston, Proc. Zool. Soc., 279.
Type locality: Zebil, Bolkar mountain, Mersin, Turkey.
1915. *Apodemus mystacinus* Allen, Bull. Mus. Comp. Zool. Harvord, 59: 10.

Habitat: It lives in areas which has forest, rocky with thorny plants like blackberry bush.

Pelage colour: Dorsal parts are brownish-gray and ventral parts whitish gray.

Hair morphology: It has chevron type (Figure 28).

Apodemus flavicollis (Melchior, 1834)

1834. *Mus flavicollis* Melchior, Dansk estoats ag Norges Pattardya, 99.
Type locality: Sielland, Denmark.
1912. *Apodemus flavicollis* Miller, Brit. Mus, Nat. Hist. London, 828.

Habitat: It lives in humid forests or bushy areas.

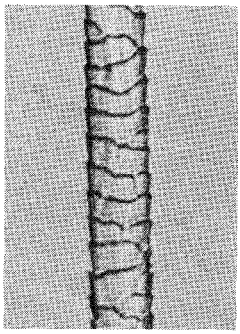

Fig. 19. *E. serotinus*

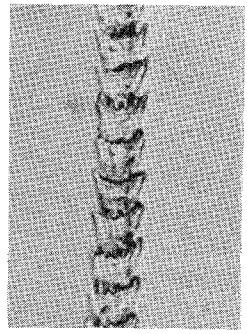

Fig. 20. *P. auritus*

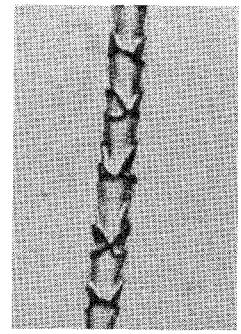

Fig. 21. *M. schreibersi*

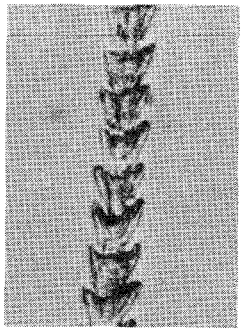

Fig. 22. *T. teniotis*

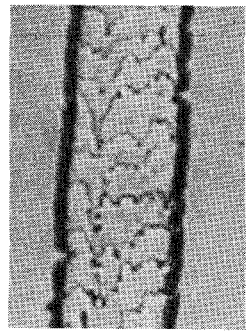

Fig. 23. *S. xanthaphrymnus*

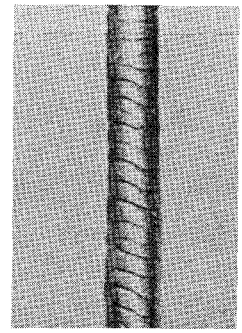

Fig. 24. *C. migratorius*

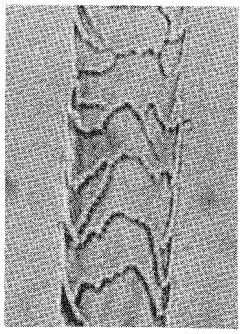

Fig. 25. *C. glareolus*

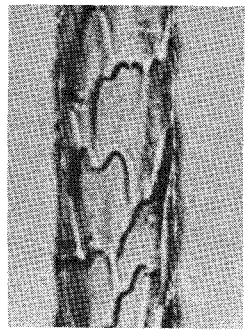

Fig. 26. *M. epiriticus*

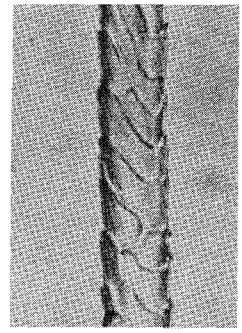

Fig. 27. *S. leucodon*

Pelage colour: Dorsal parts are dark brown and ventral parts grayish white.

Hair morphology: It has diamond type (Figure 29).

Mus musculus Linnaeus, 1758

1758. *Mus musculus* Linnaeus, Syst. Nat., 62.
Type locality: Sweden.

Habitat: It lives around houses or buildings.

Pelage colour: Dorsal parts are light gray and ventral parts grayish white.

Hair morphology: It has mosaic type (Figure 30).

Glis glis (Linnaeaus, 1766)

1766. *Sciurus glis* Linnaeaus, Syst. Nat. 12th ed. I: 87.
Type locality: Germany.
1947. *Glis glis* Ognev, S.I. Mammals of the U.S.S.R. and adjacent countries, Moskva, V: 378.

Habitat: It lives in forests, woodlands, parks and fruit gardens.

Pelage colour: Dorsal parts are grayish brown and ventral parts grayish white.

Hair morphology: It has mosaic type (Figure 31).

The hair morphology of 8 species belonging to *Carnivora* have been examined.

Canis lupus Linnaeaus, 1758

1758. *Canis lupus* Linne Syst. Nat., 39.
Type locality: Sweden.

Habitat: It lives in forests, open areas and mountain systems.

Pelage colour: Dorsal parts are dark brownish green and ventral parts grayish dirty white.

Hair morphology: It has wavy crenated type (Figure 32).

Ursus arctos Linnaeus, 1758

1758. *Ursus arctos* Linnaeus, Syst. Nat., 47.
Type locality: Sweden.

Habitat: It lives in open areas, steep mountains and mixed forests.

Pelage colour: Dorsal parts are grayish brown and ventral parts are lighter than dorsal parts.

Hair morphology: It has mosaic type (Figure 33).

Lutra lutra (Linnaeus, 1758)

1758. *Mustela lutra* Linnaeus, Syst. Nat. 10th ed. I: 45.
Type locality: Upsala, Sweden.
1887. *Lutra lutra* var. *japonica* Nehring, S.B. Ges. Nat. Fr. Berlin, No. 3: 22.

Habitat: It lives in coastal waters and on bank of lakes.

Pelage colour: Dorsal parts are slightly yellowish light brown and ventral parts buffy brownish white.

Hair morphology: It has a lanceolate type (Figure 34).

Felis silvestris Schreber, 1777

1777. *Felis* (Catus) *silvestris* Schreber, Säuget. 3: 397.
Type locality: Germany.

Habitat: It lives in some cranny in the rocks and pits beneath cliffs in open areas or hollow trees.

Pelage colour: Dorsal parts are dirty yellowish gray with irregular transverse dark bands and ventral parts dirty whitish yellow.

Hair morphology: It has mosaic type (Figure 35).

Felis lynx Linnaeus 1758

1758. *Felis lynx* Linnaeus, Syst. Nat. 1. 43.
Type locality: Sweden.

Habitat: It lives in mixed forests and open areas with steep rocky formation.

Pelage colour: Dorsal parts are smoky brown with dark spots and ventral parts silvery white.

Hair morphology: It has mosaic type (Figure 36).

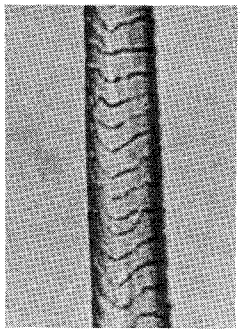

Fig. 28. *A. mystacinus*

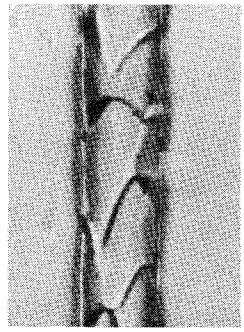

Fig. 29. *A. flavicollis*

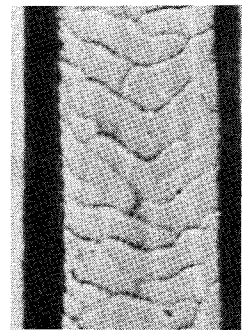

Fig. 30. *M. musculus*

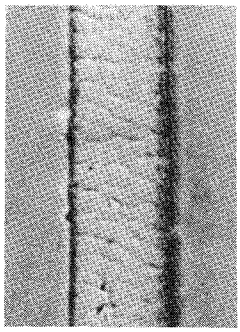

Fig. 31. *G. glis*

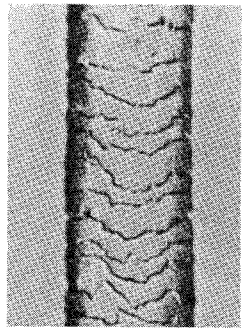

Fig. 32. *C. lupus*

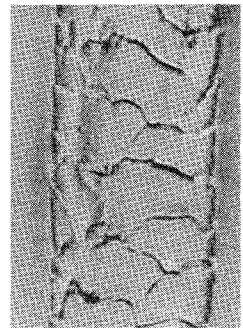

Fig. 33. *U. arctos*

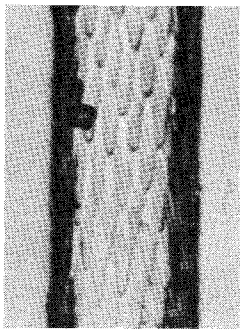

Fig. 34. *L. lutra*

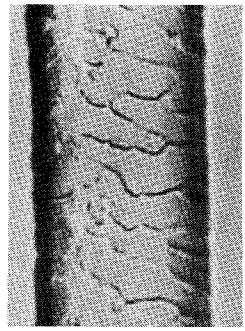

Fig. 35. *F. silvestris*

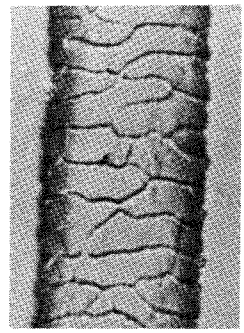

Fig. 36. *F. lynx*

Panthera pardus (Linnaeus, 1758)

1758. *Felis pardus* Linnaeus, Syst. Nat. 10th ed. I: 41.
Type locality: Egypt.
1951. *Panthera pardus*, Ellerman, J.R. and Morrison, S. Checklist of Palaearctic and Indian Mammals 1758-1946. British Museum (Nat. Hist.), 1-810.

Habitat: It lives in steep rocky areas covered bushes and shrubs and, in big and deep valleys.

Pelage colour: Dorsal parts are yellowish-orange gray with black spots and ventral parts light rusty orange.

Hair morphology: It has diamond type (Figure 37).

The hair morphology of 4 species belonging to *Arctiodactyla* have been examined.

Sus scrofa Linnaeus, 1758

1758. *Sus scrofa* Linnaeus, Syst. Nat. I., 49.
Type locality: Germany.

Habitat: It lives in deciduous woodlands, steppe areas and places covered with rushes.

Pelage colour: Dorsal parts are black sprinkled with gray and ventral parts smoky gray-white.

Hair morphology: It has mosaic type (Figure 38).

Rupicapra rupicapra (Linnaeus, 1758)

1758. *Capra rupicapra* Linnaeus, Syst. Nat., 68.
Type locality: Switzerland.
1951. *Rupicapra rupicapra*, Ellerman, J.R. and Morrison, S. Checklist of Palaearctic and Indian Mammals 1758-1946. British Museum (Nat. Hist.), 1-810.

Habitat: It lives in open rocky areas and in vallys upon forest line and in valleys covered by trees.

Pelage colour: Dorsal parts are reddish brown-gray and ventral parts paler yellowish gray.

Hair morphology: It has mosaic type (Figure 39).

Cervus elaphus Linnaeus, 1758

1758. *Cervus elaphus* Linnaeus, Syst. Nat. I., 67.
Type locality: Sweden.

Habitat: It lives in mixed forests and deciduous forests.

Pelage colour: Dorsal parts are reddish brown in summer and gray-brown in winter. Ventral parts are lighter than dorsal parts.

Hair morphology: It has mosaic type (Figure 40).

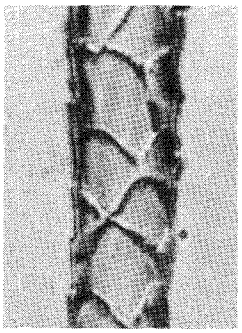

Fig. 37. *P. pardus*

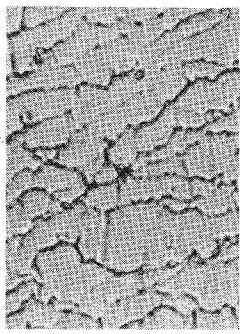

Fig. 38. *S. scrofa*

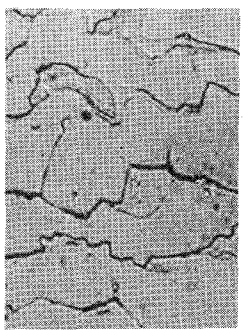

Fig. 39. *R. rupicapra*

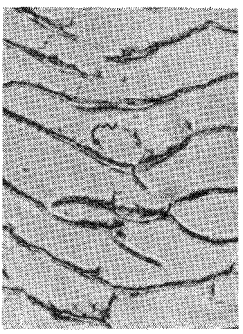

Fig. 40. *C. elaphus*

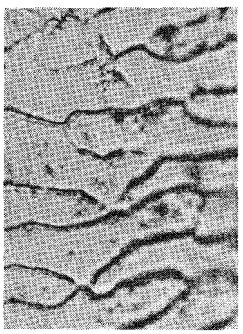

Fig. 41. *G. subgutturosa*

Gazella subgutturosa (Guldenstadt, 1780)

1780. *Antilope subgutturosa* Guldenstadt, Acta. Ac. Sci., Petrop, 251.
Type locality: Turkistan.

1951. *Gazella subgutturosa*, Ellerman, J.R. and Morrison, S. Checklist of Palaearctic and Indian Mammals 1758-1946. British Museum (Natural History), 1-810.

Habitat: It lives in uneven steppes, open forests on sandy soil and between desert and steppe regions.

Pelage colour: Dorsal parts are brick-red coloured and ventral parts are lighter than dorsal parts.

Hair morphology: It has mosaic type (Figure 41).

DISCUSSION

According to our results on hair morphology *Insectivora* has annular and lanceolate types; *Chiroptera* annular, chevron vase and spicate; *Rodentia*, chevron mosaic, wavy crenated annular and diamond; *Carnivora* mosaic wavy crenated, diamond and lanceolate; *Archiodactyla* mosaic type.

It was assumed that the separation could only be accomplished at the species level if additional parameter such as hair colour and size are included in the investigation. If a need arises for an undoubted separation feces, remains of skeleton and teeth should then be considered.

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DE L'UNIVERSITE D'ANKARA

FACULTY OF SCIENCES
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Séries C: Biology, Geological Engineering and Geophysical Engineering

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