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DIET OF THE EURASIAN BADGER (*MELES MELES*) IN AN AREA OF THE ITALIAN PREALPS

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ABSTRACT - Samples of Eurasian badger faeces (n= 147) were collected at monthly intervals from October 1997 to December 1999 in an area of the Italian Prealps (58 km^2), on the eastern coast of Lario (Como Lake). The altitude of the area ranged from 200 to 1300 m.
Badger scats were analysed to estimate the relative volume and the frequency of occurrence of identifiable food items. Fruits, arthropodes, earthworms and mammals constituted the main food categories. Differences were found between the seasonal frequency of occurrences of arthropodes, earthworms and mammals, considering however that the small sample size in summer does not allow any definitive conclusions. The wide range of food items eaten by badgers and the seasonal differences would suggest that the badger is a "generalist" species which adopts an opportunist feeding strategy.

Key ***words:*** *Meles* **meles,** diet, mountain environment, Italy

INTRODUCTION

The Eurasian badger ***Meles meles*** (L., 1758) inhabits a very wide range of habitats over the whole of Europe and Asia between the Himalayas and the Arctic circle (Neal and Cheeseman, 1996): coniferous, broadleaf and mixed forests, pastures, cultivated areas, mediterranean maquis and urban areas (e.g. Kruuk ***et*** *al.*, 1979; Harris, 1984; Pigozzi, 1991; Brøseth ***et*** *al.*, 1997). There is very limited data concerning the ecology of badger populations living in mountainous environments, while the social and feeding behaviours of badgers in the plain forests, pastures and fields have been extensively studied. Several studies describe the badger as a specialist predator of earthworms (Kruuk and Parish, 1981, 1985; Henry, 1983), rabbits (Martin ***et*** *al.*, 1995) and other foods in different areas (Kruuk, 1989). Other authors consider badgers as opportunistic food generalists (e.g. Ciampalini and Lovari, 1985; Roper, 1994; Roper and Mickevicious, 1995; Neal and Cheeseman, 1996). Earthworms represent the staple food in most of north-western Europe (Wijngaarden and Peppel, 1964; Skoog, 1970; Kruuk, 1989), but also in the plains and pristine forests of central-eastern Europe (Goszczynski ***et*** *al.*, 2000), while in mediterranean areas fruits and insects represent the main food categories (Ciampalini and Lovari, 1985; Pigozzi, 1991). In mountainous areas badgers can utilize the altitudinal range of their territories to exploit different food resources (Kruuk and De Kock, 1981). The aim of this paper is to report on the diet of badgers which live in the submountain and mountain belts of an area of the Italian Prealps.

MATERIAL AND METHODS

Study area

Samples of badger faeces were collected in an area of 58 km^2 in the Lombard Prealps, in the Lecco area. The study area covers a *3* km wide strip between the eastern coast of Lario (the Como Lake) and the limit of the beech woods on the Grigne massif (from 200 to 1300 m a.s.l.). The territory is situated in the Municipalities of Perledo (46°01'N, 9°30'E), Lierna (45°96'N, 9°30'E), Mandel-

lo del Lario (45°92'N, 9°32'E) and Abbadia Lariana (45°90'N, 9°33'E). The climate is temperate sub-maritime with high rainfall (average 1713 mm/y) which is mostly distributed during autumn and spring. The mean temperatures range from 5.5 °C in January to 23.4 °C in July (Bini, 1986).
Large chestnut (*Castanea sativa* Mill., 1768) woods grow in the lowest vegetation belt, which have replaced most of the original species: the downy oak *(Quercus pubescens* Willd., 1796) and the hop-hornbeam (*Ostrya carpinifolia* Scop., 1772). Woods are mixed with cultivated or ex-cultivated land and fields with fruit-trees that are now growing wild again, such as the crab apple (*Malus sylvestris* Mill., 1768), the bird cherry *(Prunus avium* L., 1755) and the plum *(Prunus domestica* L., 1753). In the higher vegetation belt woods are dominated by beech (*Fagus sylvatica* L., 1753).
Badgers are known to be distributed over the whole study area, at unspecified density. During preliminary surveys (Marassi and Biancardi, 2002) we found 12 badger setts and several signs, tracks and latrines, which allowed us to collect faecal samples for this study.

Samples collection and analysis
The samples (n=147) were collected each month between October 1997 and December 1999 from 5 latrines and 22 temporary defecation sites (TDS, *sensu* Roper *et al.*, 1986) located near the main setts or badger paths. The mean sample size (+ S.D.) per season is 36.8 (± 25.2). The inspection of setts and latrines gave poor results in summer (Table 1), despite an increase in field effort in these months, as also suggested by Reynolds and Aebischer (1991). Due to the small sample size on an annual basis, data of the two years were pooled for analysis.
Dried scats were analysed with the method described by Kruuk and Parish (1981): faeces were soaked in a solution of water and formaline (2%) and washed through a 0.6 mm mesh sieve. Microfractions were collected in a 500 ml beaker, after 10 min a 1.5 ml sample was drawn from the bottom of the beaker and then washed into a Petri dish and analysed under a binocular microscope to identify earthworm chaetae. Macrofractions were separated into food categories and items, which were identified with specific keys (Brown *et al.*, 1989; Teerink, 1991), by comparison with museum collections and with the help of specialists. The total numbers of each kind of food item were counted or estimated. The number of earthworm's chaetae in ten areas of 1 cm^2 in the Petri-dish was counted and the mean calculated. Earthworm number were then assessed using the correlation between number of chaetae per cm^2 and number of earthworms (Kruuk and Parish, 1981; Wroot, 1985). The relative bulk of each food category was estimated, multiplying the number of items found in the sample by the estimated bulk of each item when eaten, then the estimated relative volume of each category of food ingested was scored for each sample, according to Kruuk & Parish (1981). Results are expressed as Frequency of occurrence (FO), Estimated volume of each food category when present (EV), Volume in total diet (VT= FO x EV).
A G-test of heterogeneity (Mouches, 1981) was used to analyse seasonal differences, while the standardized form of the Levins' index (Krebs, 1989) was used to evaluate the trophic niche breadth of the badger, as suggested by Hurlbert (1978):

$$BS = (B-1)/(n-1)$$

BS= Standardized Levins' index (Range= 0 to 1); $B = 1/(\sum p_i^2)$ (Levins' index, range= 1 to n); p_i= fraction of items in the food category (i); n= number of food categories

Table 1 - Seasonal variation of food categories in the diet of badgers, during the studied period (October '97 - December '99).

N. of scats	Winter 56	Spring 60	Summer 9	Autumn 22	TOTAL 147
		Frequency of occurrence (%)			
Castanea sativa	55.4	65.0	11.1	22.7	51.7
Celtis australis	26.8			4.5	10.9
Chaenomeles japonica	3.6		11.1	9.1	3.4
Cornus mas			33.3	18.2	4.8
Diospyros sp.	8.9				4.8
Ficus carica				22.7	3.4
Juglans regia	5.4	5.0		4.5	4.8
Malus sylvestris	8.9			13.6	5.4
Prunus sp.		21.7	77.8	27.3	17.7
Ribes rubrum	5.4		22.2	4.5	4.1
Vitis labrusca	7.1	3.3		9.1	5.4
Other fruits	30.4	33.3	22.2	31.8	31.3
TOTAL FRUITS	94.6	93.3	100.0	100.0	95.2
Carabidae	19.6	68.3	66.7	27.3	43.5
Geotrupidae	10.7	23.3	11.1	9.1	15.6
Scarabeidae		18.3	22.2		8.8
Other Coleoptera	12.5	13.3	22.2	4.5	12.2
Orthoptera	21.4	18.3		9.1	17.0
Other Insects	26.8	20.0	22.2	18.9	22.4
TOTAL INSECTS	53.6	85.0	77.8	54.5	68.0
Earthworms Lumbricidae	46.4	63.3	22.2	22.7	48.3
TOTAL EARTHWORMS	46.4	63.3	22.2	22.7	48.3
Mammals	23.2	5.0	11.1	22.7	15.0
TOTAL MAMMALS	23.2	5.0	11.1	22.7	15.0
Undetermined small birds	7.1			4.5	3.4
TOTAL BIRDS	7.1			4.5	3.4
Leaves, Grass, Roots	44.6	48.3	44.4	50.0	46.9
TOTAL PLANT MAT.	44.6	48.3	44.4	50.0	46.9
Cereals	3.6				1.4
TOTAL CEREALS	3.6				1.4
Gastropods		5.0	11.1		2.7
TOTAL GASTROPODS		5.0	11.1		2.7

RESULTS

Total diet

In our study a total of 597 items was detected (average: 4.1 items per scat) and divided into seven wide food categories. Fruits represented almost 54% in volume of the total diet (Fig. 1), with a very high frequency of occurrence (95.2% FO) as well as a high estimated volume when present (56.7% EV). Chestnut, which contains starch and is able to remain in litter for months, was the staple food for a great period of the year (Table 1). Insects are the second most important food source (17.5%

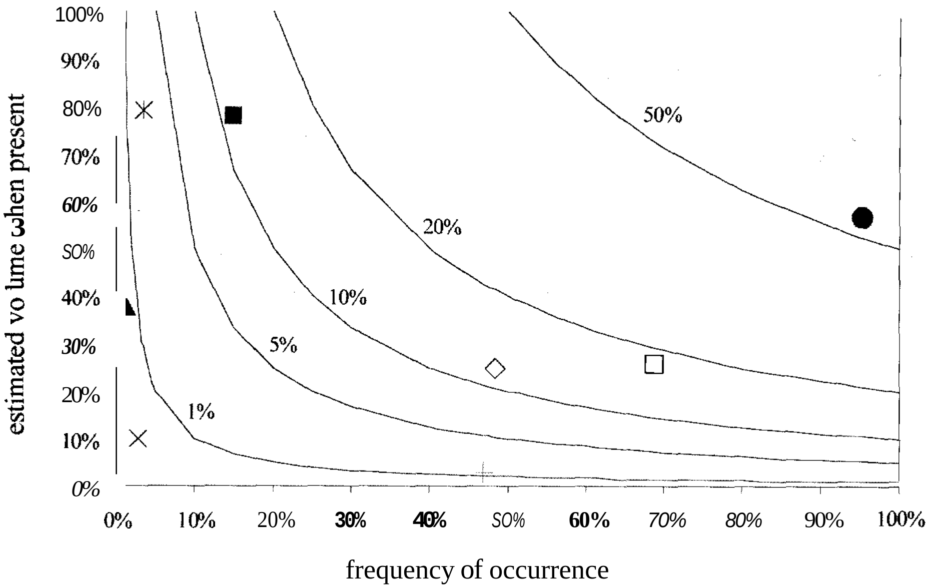

Figure 1 - Importance of food categories in badgers diet. Isopleths connect points of equal volume in the overall diet (n = 147).
(● Fruits; + Plant mat.; □ Insects; ◊ Earthworms; ■ Mammals; * Birds; **A** Cereals; x Gastropods)

VT), mostly represented by coleopters of the families carabidae and geotrupidae (Table 2).
Earthworms (***Lumbricus*** sp.) and mammals were secondary categories, with 12.0% VT and 11.7% VT respectively, while earthworms occurred in nearly half of the samples (48.3% FO), their estimated volume was always low. Mammals occurred only in 15.0% of the samples but in these cases they represented the largest estimated volume of the sample. Small rodents such as the house mouse (*Mus musculus* L., 1758), the ground vole (***Arvicola terrestris*** L., 1758) and soricidae insectivores such as the common shrew (***Sorex araneus*** L., 1758) and the bicoloured shrew (***Crocidura*** *leucodon* Hermann, 1780) were the most frequent preys of the badgers in this area. Rabbit (*Oryctolagus* ***cuniculus*** L., 1758) occurred only once, in winter.

Birds, vegetable food such as leaves or grass and some roots which might be swallowed by badgers while foraging for earthworms or coleopters, cereals and gastropods constituted the four least important categories.

Seasonal ***variations***

Seasonal results should be considered carefully, because of the small sample size, especially in summer. However, we can obtain some general indications from them (Fig. 2). The volume of fruits ranged between 48.5% VT in spring, with chestnuts, walnuts (*Juglans* ***regia*** L., 1753) and bird cherries in late spring, and 75.9% VT in summer, with bird cherries, plums, cherrie-laurels (*Prunus* ***laurocerasus*** L., 1753), red currant (*Ribes rubrum* L., 1753) and cornal cherries (***Cornus*** *mas* L., 1753). In late summer and autumn badgers added chestnuts to their diet again together with figs (***Ficus carica*** L.,

Table 2 - Frequency of occurrence (FO) of the determined Insects taxa found in the 147 analysed scats.

INSECTS TAXA	FO (%)
Abax sp.	34.7
Carabus coriuceus L., 1758	3.4
Carabus germari Sturm, 1815	3.4
Carubus sp.	2.7
Tanythrix edurus (Dejean, 1828)	2.7
Pterostichus dissimilis Villa, 1833	1.4
Cychrus italicus Bonelli, 1810	1.4
Carabus convexus Fabricius, 1775	0.7
Carubus catenulatus Scopoli, 1763	0.7
Pterostichus micans Heer, 1841	0.7
Pterostichus sp.	0.7
CARABIDAE	43.5
Anoplotrupes stercorosus (Scriba, 1796)	12.9
Trypocopris pyrenaeus (Charpentier, 1825)	2.7
GEOTRUPIDAE	15.6
Cetoniu aurata (L., 1761)	5.4
Undetermined Melolonthidae	2.0
Potosia cuprea (Fabricius, 1778)	0.7
Scarabeoidea larva	0.7
SCARABAEIDAE	8.8
Silpha carinata Herbst, 1783	2.7
Undetermined Elateridae	2.7
Undetermined Staphylinidae	2.7
Otiorhynchus sp.	1.4
Undetermined Coleoptera	1.4
Ocypus olens Muller, 1764	0.7
Morimus asper Sulzer 1776	0.7
OTHER COLEOPTERA	51.7
Undetermined Orthoptera	9.5
Gryllotalpa gryllotalpa (L., 1758)	5.4
Undetermined Gryllidae	2.7
ORTHOPTERA	12.2
Undetermined Diptera	8.2
Lymantria dispar L., 1758	3.4
Undetermined Geophilomorpha	2.7
Undetermined Apidae	2.0
Undetermined Dermaptera	2.0
Forficula auricularia L., 1758	1.4
Undetermined Insects	1.4
Bombus sp.	0.7
Undetermined Lepidoptera	0.7
Chelidura aptera (Charpentier, 1825)	0.7
Undetermined Chrysopidae	0.7
Undetermined Hemiptera	0.7
Undetermined Ixodidae	0.7
OTHER INSECTS	22.4

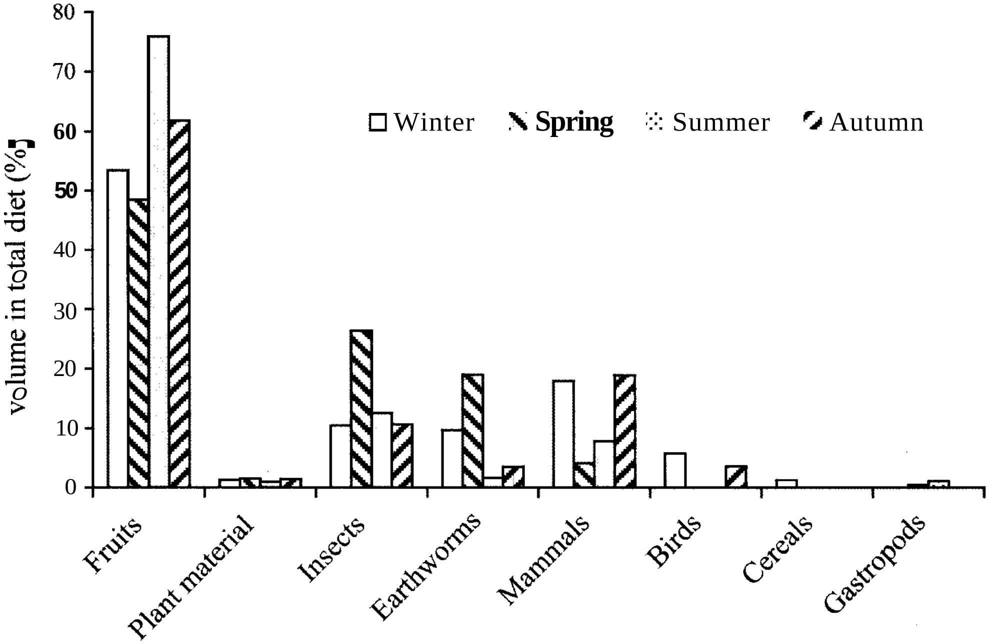

Figure 2 - Seasonal variations in badgers diet (% volume in total diet, VT).

1753), crab apples, japanese flowering quince *(Chaenomeles japonica* Thunb., 1834) and skunk grape *(Vitis labrusca* L., 1753). In winter chestnuts were eaten with hackberries *(Celtis australis* L., 1753), date-plums *(Diospyros lotus* L., 1753), kaki *(Diospyros kaki* Thunb., 1780) and walnuts. Although the volume of fruits showed a seasonal variation of nearly 25%, the frequency of occurrence of this food category did not show a significant change ($G = 3.496$; d.f. = 3; $p > 0.05$). On the other hand, differences were significant for arthropods ($G = 16.316$; d.f. = 3; $p < 0.01$), earthworms ($G = 14.293$; d.f. = 3; $p < 0.01$) and mammals ($G = 9.732$; d.f. = 3; $p < 0.05$).
Earthworms reached their highest percentage in volume (19.0% VT) only in spring while in the other seasons they were found to be always less important than mammals. Mammals were important food sources during the cold seasons when they can compensate for the shortage of insects and earthworms. In that period birds also appeared in badgers' diet.

Trophic niche breadth

For the analysis of trophic niche breadth we considered the 24 food categories as shown in Table 1 (e.g. Ciampalini and Lovari, 1985). Values of the Levins' index pointed to a medium-wide trophic niche, as would be expected for a generalist species (BS= 0.481). Standardized Levins' index reached its maximum value in autumn (BS= 0.689), when badgers exploit all the available food resources to increase their weight before the winter season (BS= 0.608). During spring (BS= 0.535) and summer (BS= 0.495) the trophic niche narrowed, probably because of the greater availability of some food categories, such as cherries, plums, earthworms, carabides and other coleopters.

Table 3 - Results obtained in other studies, in Italy. Food categories are expressed as % of the total volume (+: present; -: absent; *: relative frequency of occurrence).

STUDY AREA	FRUITS	INSECTS	EARTHWORMS	MAMMALS	CEREALS	REFERENCES
Italian Eastern Prealps	62.2	15.3	14.1	1.8		Kruuk and De Kock, 1981
Italian Central Prealps	53.9	17.5	12.0	11.7	0.5	Present work
Italian Central Prealps	50.7	17.5	11.2	8.0		Boesi and Biancardi, 2002
Italian Western Prealps	64.2	22.4	+	1.4	3.1	Biancardi *et al.*, 1995
Italian Alps		+		+		Rinetti, 1985
Italian Alps	8.9	65.4	11.6	11.8		Lucherini and Crema, 1995
Po Plain	13.0	10.1	28.2	3.7	25.4	Canova and Rosa, 1993
Maremma Natural Park	47.7	32.8	0.2	0.2		Ciampalini and Lovari, 1985
Maremma Natural Park	43.7	46.6	2.8	1.2		Pigozzi, 1991
Abruzzo National Park	39.4 *	42.0 *	2.5 *	1.6 *		De Marinis and Asprea, 2001

DISCUSSION

Our results fit very well with the other pre-alpine and alpine studies (Table 3). Biancardi *et al.* (1995) did not calculate the total volume of earthworms, but the frequency of occurrence reported in their study is very similar to that of the other studies.

Three previous studies in the Italian pre-alps (Kruuk and De Kock, 1981; Biancardi *et al.*, 1995; Boesi and Biancardi, 2002) gave similar results as regards the percentage of occurrence of different main food categories in the diet (Table 3). However, the food items eaten were different. In fact, olives (*Olea* ***europaea*** L., 1753) were the staple food on Monte Baldo (Kruuk and De Kock, 1981) whereas in Luinese chestnuts were mainly eaten (Biancardi and Rinetti, 1999). In our study chestnuts were also an important food source, but vertebrates became important in winter whereas in Luinese chestnuts were eaten all year-round. When an easily accessible food source, like olive or chestnut, is not available nor abundant, badgers have to switch to food sources that are more difficult to exploit and therefore must be of higher nutritional value. In support of this hypothesis, badger populations which live at higher altitudes in coniferous or beech woods, eat many more vertebrates (birds and mammals) than badgers of the heliofil broadleaf woods (e.g. Rinetti, 1987; Lucherini and Crema, 1995; Ferrari, 1997). Fruit and insects were the main food resources also for badgers in the Abruzzo National Park (central Italy), as recently reported by De Marinis and Asprea (2001).

Fruits were usually found in their season, but sometimes fruits remaining and even drying on branches for a long time, when they finally fell from trees to the ground were consumed by badgers: this could explain some species recorded out of their ripening period (i.e. skunk grape in late winter). On the other hand, fruits such as chestnut or walnut are well protected and are able to remain intact in litter for a long time.

Spring and summer were the best seasons for coleopters, orthopters and other insects. Badgers usually dig small holes when searching for terrestrial Insects, but sometimes they prey upon them on (or under) the tree bark: this being the case of the caterpillar of the gypsy ***Lymantria dispar*** (L., 1758), which was caught at the end of the winter, during the first sunny days, when this caterpillar starts to move around (Dajoz, 1980).

Given the design of the present study, where no attempts were made to relate use vs. availability of food resources, it is impossible to say if badgers are able to choose and select some food items or if the selection is essentially determined by availability, but certainly badgers can adapt their feeding strategy to different habitats. In cultivated fields of the Italian Po plain, the diet is similar to that of cultivated areas of England (Canova and Rosa, 1993); in mediterranean maquis, a seasonal shift between fruits and insects in badgers' diet was observed (Ciampalini and Lovari, 1985; Pigozzi, 1991). Climate change causes variations in food availability (Cavallini and Lovari, 1991), and the prealpine climate is subject to pronounced seasonal changes (Bini, 1986). This could be the principal cause of significant inter-seasonal differences in badger diet. Our data confirms that in mountainous environments badger feeding behaviour is typically generalist, with a diet that includes a wide range of food items from most of the potential food sources.

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REFERENCES

Biancardi, C.M., Pavesi, M. and Rinetti, L., 1995. Analisi della alimentazione del Tasso, ***Meles meles*** (L.), nell'Alto Luinese (Provincia di Varese, Italia) (Mammalia, Mustelidae). Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano, 134: 265-280.

Biancardi, C.M. and Rinetti, L., 1999. Badgers ***(Meles meles*** L., 1758) in a mountain area north of Varese (Lombardy - Italy). Small Carnivore Conservation, 21: 3-5.

Bini, A., 1986. Il clima delle Grigne. Materiali, Lecco, 1: 1-189.

Boesi, R. and Biancardi, C.M., 2002. Diet of the Eurasian badger ***Meles meles*** (Linnaeus, 1758) in the Natural Reserve of Lago di Piano, northern Italy. Mammalian Biology, 67(2): 120-125.

Brøseth, H., Knutsen, B. and Bevanger, K., 1997. Spatial organization and habitat utilization of badgers ***Meles meles:*** effects of food patch dispersion in the boreal forest of central Norway. Z. Saugetierk., 62: 12-22.

Brown, R., Ferguson, J., Lawrence, M. and Lees, D., 1989. Tracks and Signs of the Birds of Britain and Europe. Helm, London, 232 pp.

Canova, L. and Rosa, P., 1993. Badger ***Meles meles*** and Fox Vulpes vulpes food in agricultural land in the western Po plain (Italy). Hystrix, 5: 73-78.

Cavallini, P. and Lovari, **S.,** 1991. Environmental factors influencing the use of habitat in the red fox ***Vulpes vulpes.*** J. Zool., Lond., 223: 323-339.

Ciampalini, B. and Lovari, S., 1985. Food habits and trofic niche overlap of the badger and red fox in a mediterranean coastal area. Z. Saugetierk, 50: 226-234.

Dajoz, R., 1980. Ecologie des insectes forestiers. Gauthier-Villars, Paris, 489 pp.

De Marinis, A.M. and Asprea, A., 2001. Pattern of variation in the feeding habits of the Badger ***Meles meles*** in the Abruzzo National Park (central Italy). Small Carnivore Conservation, 24: 6-9.

Ferrari, N., 1997. Eco-ethologie du blaireau europeen ***(Meles meles*** L.,1758) dans le Jura suisse: comparaison de deux populations vivant en milieu montagnard et en milieu cultive de plaine. Phd. Thesis, University of Neuchatel, 252 pp.

Goszczynski, J., Jedrzejewska, B. and Jedrzejewski, W., 2000. Diet composition of badgers ***(Meles meles)*** in a pristine forest and rural habitats of Poland compared to other European populations. J. Zool., Lond., 250: 495-505.

Harris, S., 1984. Ecology of urban badgers ***(Meles meles):*** distribution in Britain and habitat selection, persecution, food and damage in the city of Bristol. Biol. Cons., 28: 349-375.

Henry, C., 1983. Position trophique du blaireau europeen ***(Meles meles*** L.) dans un foret du Centre de la France. Acta Oecol., 4: 345-358.

Hurlbert, S.H., 1978. The measurement of niche overlap and some relatives. Ecology, 59: 67-77.

Krebs, C.J., 1989. Ecological Methodology. Harper Collins, New York N.Y., 654 **pp.**

Kruuk, H., 1989. The social badger. Oxford University Press, Oxford, 156 pp.

Kruuk, H. and De Kock, L., 1981. Food and habitat of badgers ***(Meles meles*** L.) on Monte Baldo, northern Italy. Z. Saugetierk., 46: 295-301.

Kruuk, H. and Parish, T., 1981. Feeding specialization of the european badger ***Meles meles*** in Scotland. J. Anim. Ecol., 50: 773-788.

Kruuk, H. and Parish, T., 1985. Food, food availability and weight of badgers ***(Meles meles)*** in relation to agricultural changes. J. Appl. Ecol., 22: 705-715.

Kruuk, H., Parish, T., Brown, C.A.J. and Carrera, J., 1979. The use of pasture by the European badger ***(Meles meles).*** J. Appl. Ecol., 16: 453-459.

Lucherini, M. and Crema, G., 1995. Seasonal variation in the food habits of badgers in an alpine Valley. Hystrix, 7: 165-172.

Marassi, M. and Biancardi, C.M., 2002. Use of Eurasian badger ***(Meles meles)*** setts and latrines in an area of the Italian Prealps (Lombardy, Italy). Small Carnivore Conservation, 26: 17-19.

Martin, R., Rodriguez, A. and Delibes, M., 1995. Local feeding specialization by badgers ***(Meles meles)*** in a mediterranean environment. Oecol. (Berlin), 101: 45-50.

Mouches, A., 1981. Variations saisonnieres du régime alimentaire chez le blaireau européen ***(Meles meles*** L.). Rev. Ecol. (Terre et Vie), 35: 183-194.

Neal, E. and Cheeseman, C., 1996. Badgers. T. and A.D. Poyser ltd, London, 271 pp.

Pigozzi, G., 1991. The diet of the European badger in a Mediterranean coastal area. Acta Ther., 36: 293-306.

Reynolds, J.C. and Aebischer, N.J., 1991. Comparison and quantification of carnivore diet by faecal analysis: a critique, with recommendations, based on a study of the Fox ***Vulpes vulpes.*** Mammal Rev., 21: 97-122.

Rinetti, L., 1987. L'alimentazione estiva del tasso europeo, ***Meles meles*** L., nel Parco Nazionale del Gran Paradiso. Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano, 128: 261-264.

Roper, T.J., 1994. The European badger ***Meles meles:*** food specialist or generalist? J. Zool., Lond., 234: 437-452.

Roper, T.J. and Mickevicious, E., 1995. Badger ***Meles meles*** diet: a review of literature from the former Soviet Union. Mammal Rev., 25(3): 117-129.

Roper, T.J., Shepherdson, D.J. and Davies, J.M., 1986. Scent marking with faeces and anal secretion in the European badger ***(Meles meles):*** seasonal and spatial characteristics of latrine use in relation to territoriality. Behaviour, 97: 94-117.

Skoog, P., 1970. The food of the Swedish Badger, ***Meles meles*** L. Almquist and Wiksells, Uppsala, 115 pp.

Teerink, B.J., 1991. Hair of West-European Mammals. C.U.P., Cambridge, 224 pp.

Wijngaarden, A. Van and Peppel, J. Van De, 1964. The badger ***(Meles meles)*** in the Netherland. Lutra, 6: 1-60.

Wroot, **A.J.,** 1985. Aquantitative method for estimating the amount of earthworm ***(Lumbricus terrestris)*** in animal diet. Oikos, 44: 239-242.