

## On habitat selection and phenology in six species of snakes in Canale Monterano (Tolfa Mountains, Latium, Italy) including data on reproduction and feeding in *Vipera aspis francisciredi* (Squamata: Viperidae)

Zur Habitatwahl und Phänologie von sechs Schlangenarten in Canale Monterano (Tolfa-Berge, Latium, Italien) mit Angaben zu Fortpflanzung und Nahrung von *Vipera aspis francisciredi* (Squamata: Viperidae)

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**ABSTRACT:** From nine species of snakes found in central Italy, six (*Coluber viridiflavus*, *Coronella austriaca*, *Elaphe longissima*, *Elaphe quatuorlineata*, *Natrix natrix*, *Vipera aspis*) are living practically sympatric in the territory of Canale Monterano being one of the richest places in central Italy as far as reptiles are concerned. Data on reproduction, annual activity, prey, and habitat selection of the snakes observed are given.

**KURZFASSUNG:** Im Gebiet von Canale Monterano, einer der reptilienreichsten Gegenden der zentralen Apenninenhalbinsel, leben sechs (*Coluber viridiflavus*, *Coronella austriaca*, *Elaphe longissima*, *Elaphe quatuorlineata*, *Natrix natrix*, *Vipera aspis*) der insgesamt neun Schlangenarten Mittelitaliens und kommen dort weitgehend sympatrisch vor. Angaben zur Fortpflanzung, Jahresaktivität sowie zu Nahrungs- und Habitatwahl der beobachteten Schlangenarten werden gemacht.

**KEYWORDS:** *Coluber v. viridiflavus*, *Coronella a. austriaca*, *Elaphe l. longissima*, *Elaphe qu. quatuorlineata*, *Natrix natrix helvetica*, *Vipera aspis francisciredi*, habitat selection, activity, prey, reproduction, Italy

## INTRODUCTION

The region of Canale Monterano (Tolfa Mountains, Rome, Latium, Italy) is especially interesting because of the coexistence of six species of snakes (*Vipera aspis francisciredi*, *Coluber v. viridiflavus*, *Coronella a. austriaca*, *Elaphe l. longissima*, *Elaphe qu. quatuorlineata*, *Natrix natrix helvetica* (morpha *lanzai*)), seven species of saurians (*Lacerta viridis*, *Podarcis muralis*, *Podarcis sicula*, *Hemidactylus turcicus*, *Tarentola mauritanica*, *Chalcides chalcides*, *Anguis fragilis*), and one turtle (*Testudo hermanni robertmertensi*) within an area of about 4 km<sup>2</sup>.

In the present work habitat selection as a particular aspect of the coexistence of these six species of snakes shall be examined. Some other biological considerations like the annual cycle of activity and bromatological observations are included.

## MATERIALS AND METHODS

Collections and observations were made from March until October in the years 1986, 1987, 1988 and 1989. 203 colubrid snakes and 73 vipers of both sexes and of any age (newborn, young, adult) were captured; 264 more snakes have just been observed during our excursions.

All species of reptiles except *Vipera aspis* are protected by a regional law in Latium. The gut contents were examined in two ways: larger snakes were squeezed to force them to regurgitate their prey, and set free immediately after this operation; specimens of less than 25 cm in length were examined by using the KJAERGAARD method (KJAERGAARD, 1981).

One of the authors (LUISELLI) examined the viper populations (density, cycle of activity, feeding etc.) marking the animals by applying coded cuts to the subcaudal scales. 56 (out of 73 marked) vipers (= 76.71 %) were recaptured in different periods of the years. The maximum number of recaptures of one individual registered was 17 times in a large female.

## RESULTS

### A. The area of research

The territory of Canale Monterano (Fig. 1) is, to a great extent, located at altitudes between 170 and 200 metres above sea level, and is totally represented on two maps: IGM 25000 143-III-NW ("Bagni di Stigliano") and IGM 25000 143-III-NE ("Bracciano").

The ancient ruins of Monterano (200 m above sea level) represent the centre of the area; in the SE of the ruins there is the valley of the Bicione torrent (3.5 km W of Manziana), with different types of woodlands and also some active solfataras. The ground is volcanic, tufaceous, and highly mineralized, in the hills with evident erosion. Water is very abundant; the torrent humidifies the habitats near-by, so willow-trees and alders can grow along its banks. In

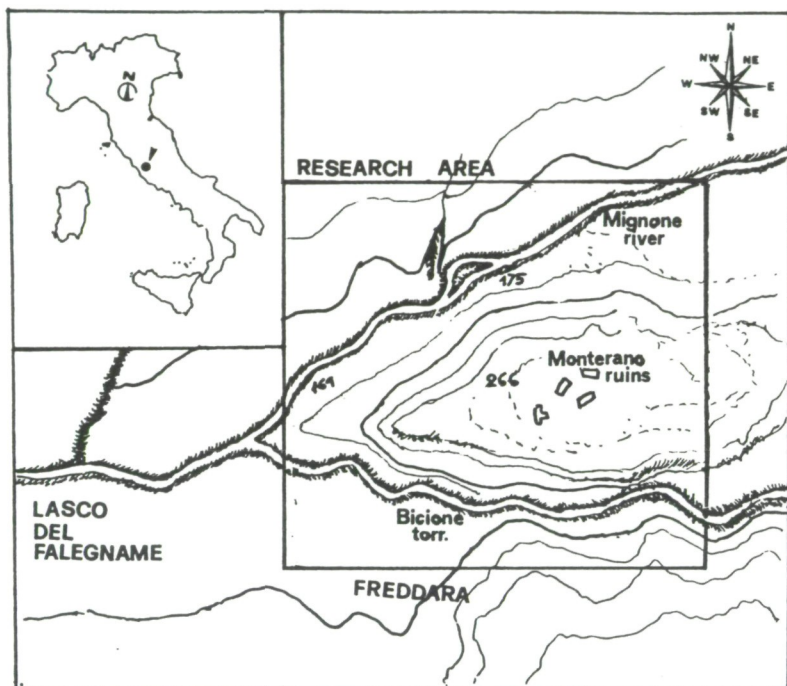


Fig. 1: The research area (central square) and its geographical position in Italy.

Abb. 1: Das Untersuchungsgebiet (Quadrat in Bildmitte) und seine geographische Lage in Italien.

the S, E, and SE of the ruins there are typical woodlands of *Quercus cerris* L. in the open areas, of *Castanea sativa* MILLER in fresh places, and of *Quercus ilex* L. on sunny rocks. *Alnus glutinosa* L. and *Salix purpurea* L. are common on the banks of Bicione; *Acer monspessulanum* L., *Fraxinus ornus* L., *Corylus avellana* L., *Pyrus pyraeaster* BURGSD., *Sorbus domestica* L., and *Cornus sanguinea* L. are variously present in the territory. On the trachitic or tufaceous rocks in the S-SE side of the hill of Monterano there is a very rich herbaceous coat formed by *Anogramma leptophylla*, *Pteridium aquilinum*, *Viola tricolor*, *Orchis papilionacea* etc. *Cytisus scoparius* is very common on the sunny sides and represents an important habitat for the local herpetofauna. *Trifolium subterraneum* is very common in the pastures near the ruins where *Veronica cymbalaria* BOD., *Ruta* sp., and *Fraxinus ornus* are present as well (MONTELUCCI, 1977).

## B. Habitat selection of snakes

Based on our observations two snakes are very common in the area:

*Natrix natrix helvetica* - 67 specimens of which 48 were adult, and 19 were young (males <70 cm and females <90 cm in overall length are considered young);

*Coluber viridiflavus viridiflavus* - 83 specimens of which 64 were adult, and 19 were young (males and females <80 cm are considered young which also correlates to the different livery of immature and mature individuals).

One species is common:

*Elaphe l. longissima* - of which 37 specimens were captured (29 of more than 80 cm (maximum a male, 136 cm) in overall length); We assign the Aesculapian Snakes of this area to the *nominata* race but cannot indicate close localities where the subspecies *romana* is found which is said to occur in the province of Rome (BRUNO & MAUGERI, 1984).

Two species are less common:

*Elaphe qu. quatuorlineata* - of which 13 specimens were captured (9 were more than 100 cm, the largest male was 164 cm, the largest female 197 cm in length);

*Vipera aspis francisciredi* - 73 individuals are on record of which 58 measured more than 34 cm in overall length. The number of vipers is high compared to the other species that we considered "less common", but since one of the authors (LUISELLI) studied *V. aspis* with particular care, an unproportional high number of vipers was recorded.

The rarest snake is:

*Coronella a. austriaca* - found only three times in the years of our research.

*Coronella girondica* is present about 20 km west of Canale Monterano in the Valle di Rio Fiume, 250 m asl. One specimen captured in Canale Monterano by S. BRUNO is stored in the collection of the Museo di Zoologia dell'Università di Firenze, but neither we nor other members of the University of Rome, La Sapienza, have observed any specimen of this species in the area of research.

Another snake, *Natrix tessellata tessellata*, is very common in some torrents and rivers near the study area, but we never found it in the territory investigated.

*Coluber viridiflavus* is very common all over the area, but is always less frequently found in the closed and humid places than in dry and sunny areas. Only 7.14% of the total number of individuals observed (i. e. 83 captured snakes and another 113 just watched) were recorded in areas with closed vegetation, at the borders of the torrents, in the depth of the woods of *Quercus* and *Castanea*. In this territory the cycle of activity lasts from the beginning of March to the end of October; the mating period lasts from the middle of April to the middle of June; oviposition usually takes place in the middle of July, and birth of the young occurs at the end of summer (mainly at the end of August). *Coluber viridiflavus* can be sympatric with all other species of snakes in the area.

*Natrix natrix* usually inhabits the banks of the torrents Bicione and Mignone (87% of observations), feeding mainly on frogs and fishes. Large individuals (in particular females) also inhabit woodlands of *Quercus cerris* and *Castanea sativa* (7%), or dry and rocky areas (3%), and pastures near the ruins (3%). This species can be sympatric with all other species of snakes, but it is found most frequently to occur with *Coluber viridiflavus* and *Elaphe longissima*.

*Elaphe longissima* is common in almost all types of habitats in the territory of Canale Monterano; it is present from the fresh and humid closed places to the dry and sunny rocky habitats. Aesculapian Snakes are rarely seen in the morning, males rather than females. This species inhabits humid and closed woodlands (31.8%), dry woodlands (27.2%), rocky and sunny areas near the old ruins (26%), and the sites where *Cytisus scoparius* grows (15%).

*Elaphe quatuorlineata*, being less common than the Aesculapian Snake, is confined to dry and sunny woodlands of *Quercus ilex* (36.7%), slight slopes with *Cytisus scoparius* (21.42%), and to semicultivated areas with olive groves (18.7%). The adult snakes usually feed on small mammals and birds, but to a large extent also on eggs of passerines and other small birds (27.9% of the adult snakes examined). The cycle of activity lasts from the end of March to the end of October; mating period usually is April and May, and deposition of the eggs is done in the end of June. Hatching occurs from the end of

August to the first part of September. 7 females captured in June and maintained in captivity until oviposition laid 9, 9, 10, 10, 10, 11, and 12 eggs respectively.

*Coronella austriaca* is considered to be very rare in the area of research, because only three live individuals were seen; one in the territory of the ruins in a humid place with *Pteridium aquilinum* and two in a rocky area among populations of *Cytisus scoparius*. Another locality (Mignone River, under the ruins) is quoted in the literature (BRUNO, 1977), but we have not seen a Smooth Snake in this place. The scarcity of this species in the area of research prevents us from providing data on habitat selection and biology.

*Vipera aspis francisciredi* is not very common in the territory of Canale Monterano. According to one of the authors (LUISELLI) who studied the biology of *Vipera aspis* in this area, the snake is present only in woodlands of average humidity formed by *Castanea sativa* (36.8%) and *Quercus cerris* (21.6%), near the banks of the torrents Bicione and Mignone (25.4%), and on the slight slopes covered by *Cytisus scoparius* (16.2%). These data suggest a strong preference for a heterogenous variety of habitats with a vertically structured flora at the borders of open areas with herbaceous vegetation.

There is a tendency to form small groups in winter and spring. In the years 1987, (1988), [1989] 45, (42), [39] individuals of more than 34 cm in length (24, (21), [23] males and 21, (21), [16] females respectively) were observed to stay constantly within an area of 10000 m<sup>2</sup> (accurately marked by pickets) from March until May, and to disperse towards new localities during summer. From June to August only 17 individuals remained in the marked area in 1987, 11 in 1988, and 8 in 1989.

The annual cycle of activity lasts from the middle of March to the end of October. Mating occurs in the middle of April. Feeding starts in April and ends in September, but there are differences between adult males, non-reproductive, and reproductive females, and young (see table 1). Reproductive females do not feed during the second half of gestation. Parturitions usually can be seen after September 10th (LUISELLI & AGRIMI, in prep.).

The food of adult vipers comprises small mammals (Muridae, Soricidae, and *Muscardinus avellanarius* in a single case), and, rarely, lizards (*Lacerta viridis*, *Podarcis muralis*). Vipers of less than 34 cm, that are considered young

by the authors, feed only on lizards of adequate size (*Podarcis muralis* in 96.3%, and *Podarcis sicula* in 3.7% of cases observed). In other parts of the Tofa Mountains the young vipers feed also on newborn mammals, but this was never observed when we examined the stomacal contents of vipers of Canale Monterano (LUISELLI & AGRIMI, in press). As in other species of vipers (ANDREN & NILSON, 1989) the weight status varied significantly in different years (LUISELLI & AGRIMI, in prep.).

Table 1: Feeding period of *Vipera aspis francisciredi* in Canale Monterano. (Data obtained from L. M. LUISELLI & U. AGRIMI during the years 1987 - 1989.)

Tab. 1: Die Periode der Nahrungsaufnahme bei *Vipera aspis francisciredi* in Canale Monterano. (Daten erhoben von L. M. LUISELLI & U. AGRIMI in den Jahren 1987 - 1989.)

Month	M	A	M	J	J	A	S	O	N
Reproductive females									
Non-reproductive females									
Males									
Young (<34 cm)									

### C. Thermal ecology of *Vipera aspis francisciredi*

The choice of substratum is very important for the thermoregulation of vipers. In March and in the first ten days of April the vipers display rather reduced activities, coiling up in sunny spots with dry grass and leaves. The minimum temperature of substratum, at which a viper was observed to bask was +19 °C (23.03.1989, a male on a pile of dry leaves at 09.15 a. m., LUISELLI leg.). Between +21 °C and +26 °C of temperature of substratum the vipers usually stay directly exposed to the sun, but as soon as temperatures rise (>+26 °C <+30 °C) they change their places to coil up in the high grass, with only one half of their bodies exposed to the sun, the other hiding in the shade. At temperatures >+30 °C, vipers inactively halt in the shade of a bush.

Females and males usually use the same kind of substratum for their thermoregulatory behaviour, but females, especially in April (9 of a total of 13 cases observed), climb up bushes as high as 30 - 70 cm above ground level, coiling up in suitable sunny spots. The gravid females usually utilize spots of dry

grass for their thermoregulatory requirements, and only chose substrata with a relatively high temperature (+20 - +30 °C). A total number of 7 couplings was observed. The temperatures of the substratum were recorded (table 2).

Table 2: Temperatures and type of substratum recorded in seven cases of coupling observed in *Vipera aspis francisciredi* of Canale Monterano. (Data obtained by L. M. LUISELLI.)

Tab. 2: Temperaturwerte und Art des Substrates bei 7 beobachteten Paarungen von *Vipera aspis francisciredi* in Canale Monterano. (Daten erhoben von L. M. LUISELLI.)

Date	Substratum	Temperature (°C) of substratum
16.04.87	dry grass	23.5
14.04.88	dry leaves	21.3
16.04.88	green grass	19.6
15.04.89	dry grass	21.0
15.04.89	sunny rock	24.8
17.04.89	dry leaves with grass	21.2
17.04.89	dry leaves	21.0

Table 3: Overall lengths of female *Vipera aspis francisciredi*, dates of birth, numbers of young, and their minimum and maximum lengths and weights.

Tab. 3: Gesamtlängen der *Vipera aspis francisciredi*-Weibchen, Geburtsdaten, Anzahl der Jungen und deren jeweils größte und kleinste Länge und Masse.

Overall length of female (mm)	Date of birth	Number of young	min./max. length of young (mm)	min./max. weight of young (gram)
510	12.09.1987	4	145/168	3.9/4.8
584	13.09.1987	5	177/180	5.4/5.5
590	10.09.1987	5	158/183	4.8/5.2
595	13.09.1987	7	149/186	4.1/5.3
602	11.09.1987	6	170/190	5.2/6.1
615	13.09.1987	4	177/190	4.8/5.5
630	11.09.1987	5	164/213	4.5/5.8
632	11.09.1987	5	176/184	5.6/6.0
635	15.09.1987	6	164/196	4.6/6.3
635	17.09.1987	8	149/193	4.0/5.9
655	12.09.1987	6	160/193	5.0/6.2
670	12.09.1987	8	171/189	4.9/5.8
675	10.09.1987	6	162/184	4.6/5.8
684	17.09.1987	11	169/213	5.1/6.3
687	15.09.1987	6	153/187	4.3/5.4
690	12.09.1987	8	163/220	4.8/6.9
715	15.09.1987	12	158/213	4.3/6.7
733	14.09.1987	10	168/213	4.8/6.2



# D. Reproductive biology of *Vipera aspis francisciredi*

A total of 18 gravid females was captured during August 1987 to obtain data on the number and size (length, weight) of the newborn (table 3). The number of young per female varied from 4 to 12 (mean value 6.77), the overall length from 145 to 220 mm, the weight from 3.9 to 6.9 g.

A positive correlation between overall length of adult females and number of young can be stated: all females that gave birth to a number of young exceeding nine had a length of at least 684 mm; 66.7% of the females that gave birth to a number of 8 young were longer than 669 mm, and the minimum number of offspring (4) was brought forth by a female shorter than 615 mm.

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## REFERENCES

- ANDREN, C. & NILSON, G. (1989): Reproduction in the adder *Vipera berus* and the effect of prey density; In: HALLIDAY & al. (Eds.): First World Congress of Herpetology, 11-19 September 1989, University of Kent at Canterbury, Abstract.
- BRUNO, S. (1977): Gli Anfibi e i rettili dei Monti della Tolfa (Antiappennino laziale).- Acc. Naz. Lincei, Roma; 227: 89-124.
- BRUNO, S. & MAUGERI, S. (1984): Serpenti d'Italia. Milano (Martello).
- KJAERGAARD, J. (1981): A method for examination of stomach content in live snakes and some informations on feeding habits in Common Vipers (*V. berus*) in Denmark.- *Natura Jutlandica*; 19: 45-48.
- LUISELLI, L. M. & AGRIMI, U.: Composition and variation in relation to age and to reproductive stage of the diet of *V. aspis francisciredi*, LAURENTI 1768 (Reptilia, Viperidae).- *Amphibia-Reptilia* (in press).
- LUISELLI, L. M. & AGRIMI, U.: Attività primaverile in *Vipera aspis* L.: studi ecologici ed etologici su alcune popolazioni dei monti laziali. (in prep.)
- MONTELUCCI, G. (1977): Note preliminari sulla flora e sulla vegetazione delle Cerrete di Manzianna e di Canale Monterano.- Acc. Naz. Lincei, Roma; 227: 51-73.

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