CAPTIVE BREEDING OF *VIPERA URSINII URSINII (REPTILIA, VIPERIDAE)*

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INTRODUCTION

Vipera ursinii, a reptile found, especially in western Europe, in widely separated locations, is now in serious danger of extinction, and for this reason is included in CITES Appendix I (EEC regulation no. 3143/887, Commission of 19 October 1987). The decline of *V. ursinii* can be ascribed to different causes according to the distribution.

Numbers of *V. u. anatolica* are decreasing for reasons which have not yet been established (Honegger, 1978; Dodd, 1987); *V. u. rakosiensis* is in diminution in particular because of the destruction of the habitat and deliberate killing (Honegger, 1978 & 1981; Dodd, 1987); *V. u. renardi* for the progressive alteration or destruction of the habitat (borders of the Steppe and Steppe-forest) (Honegger, 1978 & 1981; Dodd, 1987; Kotenko, 1989); *V. u. ursinii* is affected by various factors (alteration of the habitat, capture and deliberate killing (Honegger, 1978 & 1981; Groombridge 1982; Dodd, 1987); and *V. u. wettsteini* suffers from the same combination of factors as *V. u. ursinii* (Honegger, 1978; Dodd, 1987).

Moreover, the very population structure characteristic of *V. ursinii* renders this reptile more susceptible to a further serious decline in numbers, above all in more western areas, such as the Gran Sasso d'Italia. The same is true for other small populations of European vipers which occupy areas at the borders of their territory, whether in terms of altitude or geographical distribution. For all the reasons given here, the capture of *V. ursinii* where no valid scientific reasons exist, is strongly to be discouraged.

CONDITIONS OF ACCLIMATIZATION

Although the literature on the subject states that the breeding of *V. ursinii* in captivity is extremely difficult (Bruno & Maugeri, 1976; Bruno, 1984), I have been able to show that this species will reproduce habitually in captivity as long as certain precise conditions are fulfilled:

- the specimens must be captured gently, preferably by being lifted by the tail.

- the specimens kept for breeding must be allowed to spend a period of at least 75-80 days in hibernation. It is not necessary to allow the reptiles an enormous amount of space, but it is essential to provide them with a habitat similar to that to which they are used in the wild; one, that is, which offers them a large number of hiding-places in which to take refuge at the first sign of danger.

The soil temperature should vary, according to the sector, from a minimum of 22°C to a maximum of about 30°C. The degree of humidity must be kept at around 78-84% (while I have found it possible to obtain mating and reproduction of *V. berus* with a level of humidity around 80-95%. An incandescent 60 watt lamp, turned on for between four and six hours a day, is sufficient for the heating. As far as lighting is concerned, white fluorescent 30 watt lamps, turned on for at least 8 hours a day, are needed. In my experiments I used conditions of 12 hours of light and 12 of darkness.

Since *V. ursinii* needs a considerable amount of cooling (reflecting the wide diurnal range of temperature in its habitat), it is worth lowering the nocturnal temperature to 12-16°C. In these conditions *V. ursinii* limits its activity to the daylight hours, retiring to its lair during the night. What is more, it exhibits trophically competitive behaviour less frequently, and less intensely, than *V. aspis, V. ammodytes* or *V. berus.*

It was later possible to feed the young vipers with newly metamorphosed frogs, small lizards and even with pieces of beef. The young vipers, like the adults under observation, tend to keep the prey in their mouths for a few minutes, whether it is fed to them alive or dead.

Plate 1. Adult *Vipera ursinii ursinii* photographed in sub-alpine sheep pasture, Abruzzo Italy, on 14th May, when much of the surrounding grassland was still covered by extensive patches of snow.

Photo: John Pickett

Plate 2. Adult female *Vipera ursinii ursinii* photographed in the wild basking at the edge of a dwarf Juniper bush *(Juniperus nana)* in montane grassland (approx. 1800m altitude), Abruzzo, Italy.

Photo: John Pickett

Plate 3. General view of sub-alpine habitat of *Vipera ursinii ursinii* in which female shown in Plate 2 was photographed. The vipers are abundant throughout this area of rolling grassland.

Photo: John Pickett

Plate 4. Mountain ridge inhabited by *Vipera u. ursinii* in Abruzzo, Italy. Altitude approx. 1800-2000 m.

Photo: John Pickett

OBSERVATIONS ON THE ADULTS

The adults that I kept in captivity all showed a watchful and irritable pattern of behaviour, even as long as two years after capture.

1 male and 2 females which I have kept since 26 April 1987 have reproduced twice to date (in both cases the same female gave birth, to 4 young on 15 August 1988, and to two, one dead and one alive, on 23 August 1989) while feeding in the meantime on live and dead prey. This consisted of rodents; newborn or recently weaned hamsters: and newborn rats, which proved to be the favourite food of these vipers in captivity (74% of the total food weight swallowed in two years of study). Large apterous *Orthoptera* were also popular (18%), above all in certain periods. The reasons behind the fluctuations in feeding preference are not clear, given the fact that the experimental conditions in which the vipers were kept did not vary in time. Lizards were occasionally swallowed (7.2%), frogs only on very rare occasions, and never when administered live to the vipers (0.8%).

In general, the females showed more willingness to accept prey of large dimensions than the males; this trait may well be characteristic of the species in the natural state, given that I have often come across cases of females preying on small mammals *(Microtus)*, while I have never observed the same phenomenon in males (Luiselli, in prep.).

I have only been able to observe mating on two occasions, first on 27 May 1988, then on 3 June 1989. In each case, both the courtship and the fertilization took place in the day, with behaviour similar to that of *V. berus*.

The growth of the animals was estimated by measuring at average intervals of 7 days, both the total length and the body weight. Figure 2 shows the progress in growth of the male and two females under observation. During the period in which the animals were kept active – from March to November of each year – the snakes each sloughed three times (at the end of May, June and July).

In the natural state, the sloughing cycle seems to be different, and growth on average to be slower (Luiselli, in prep.).

It must be remembered that each individual received an annual supply of food equal to about 300% of its initial body weight, and that in general the largest prey supplied weighed about 15% of the body weight of the snakes.

In the natural state, the yearly growth of this species is probably less.

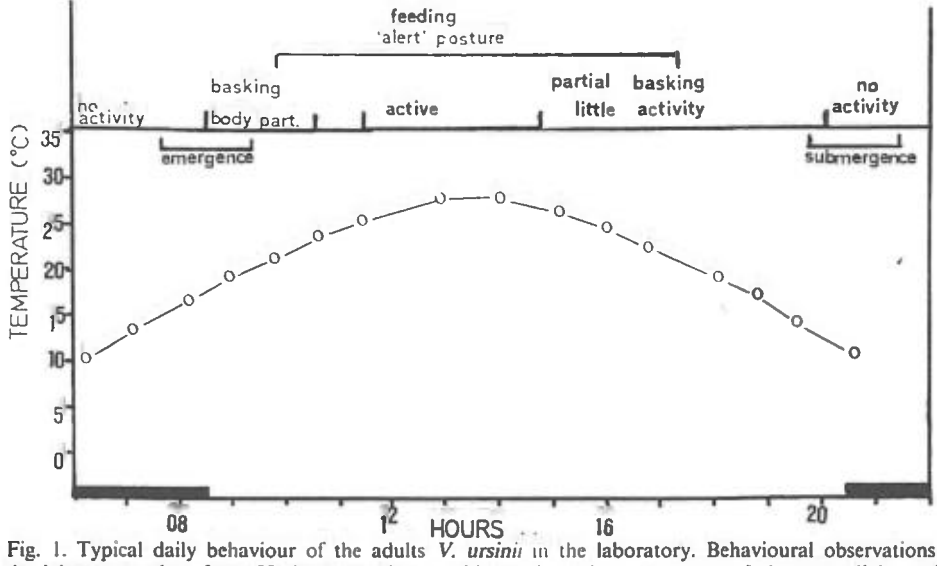

Fig. 1. Typical daily behaviour of the adults *V. ursinii* in the laboratory. Behavioural observations in the laboratory (data from 98 days) are shown with ambient air temperatures. Laboratory light period from 08.30 to 20.30. (As far as the symbols of the graph are concerned, these are derived from SPELLERBERG & PHELPS, 1977, though modified).

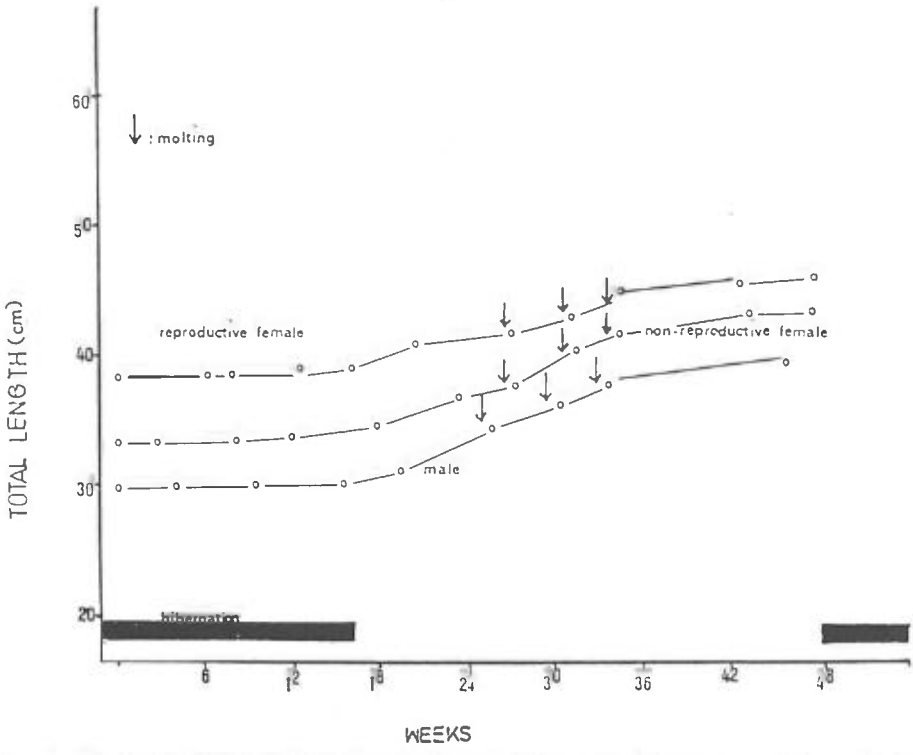

Fig. 2. The rate of growth and the sloughing periods of the adult *V. ursinii*, over a period of a year spent in captivity. The period of observation begins on 1 November 1988, and the numbers which follow are in relation to that date.

The graph shows a period of minimal growth (during hibernation) followed by one of maximal growth (from the end of hibernation to around the end of July (last sloughing of the year) and one of moderate growth (from August to October).

FEEDING AND GROWTH OF THE YOUNG

Newborn and young of *V. ursinii* in their first two years of life are extremely delicate and difficult to keep.

In the first place, none of the 5 young that I kept (4 born in August 1988 and 1 in the same month of the next year) began to feed spontaneously before the fifth week; two began to do so between the 6th and 7th week, and two more in the tenth week. One young viper, despite force-feeding, never learnt to eat unaided, and died at the age of 96 days.

Moreover, even when the young begin to feed themselves, they will only accept certain types of foods, and stubbornly refuse all others.

In the first year of life, the young vipers would only accept certain kinds of grasshopper, above all those belonging to the *Podismidae* and *Tettigonidae* families, and the species belonging to the genera of *Epipodisma, Halopodisma, Tettigoria, Phaneroptera, Decticus, Ephippigger* and *Troglophilus* were normally accepted without trouble. Members of the *Gryllidae,* such as *Acheta domesticus,* were normally refused, and accepted by one exceptionally active and voracious individual only.

Individuals of *Grillomorpha dalmatina* were occasionally accepted after the 8th week of life; other *Gryllidae* were devoured now and then after the 12th week, and with greater regularity between the 16th and 28th weeks. The young vipers particularly appreciated other types of food (pieces of newborn rodents) after the 13th week, but above all from the 30th week on, so that these eventually made up the basic element of the whole diet.

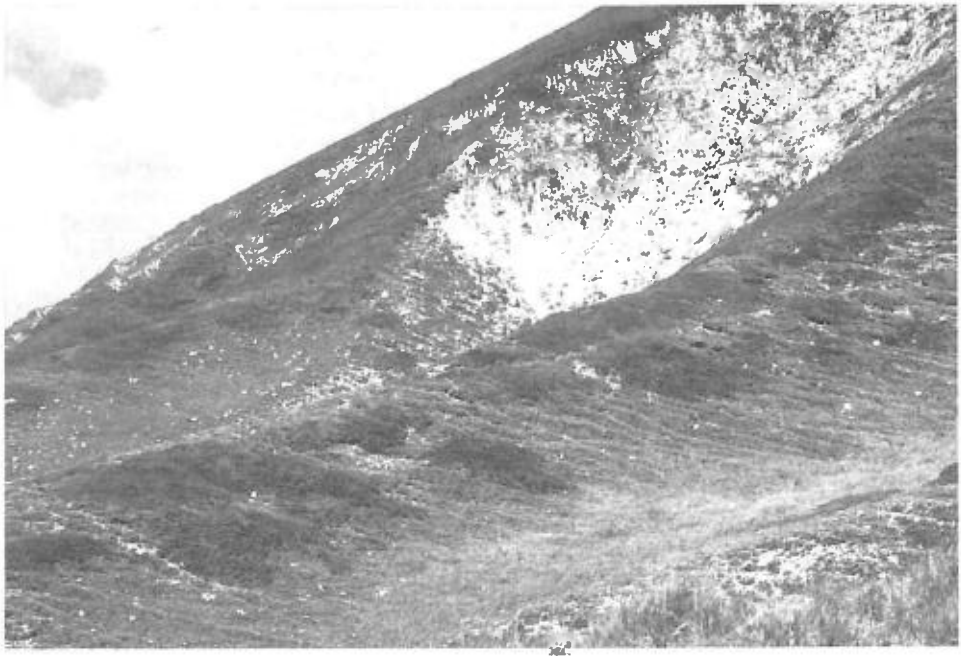

Plate 5. Detail of spurs of ridge shown in Plate 3 (above). Note the dwarf prostrate Junipers *(Juniperus nana)* characteristic of the habitat of this viper in its high-altitude populations in Europe.

Photo: John Pickett

THERMOREGULATORY BEHAVIOUR AND SLOUGHING CYCLE

Three cycles of thermoregulatory behaviour, a daily cycle, a feeding cycle and a sloughing cycle, are observable in the young, as in the young *Coronella austriaca* studied by Spellerberg (1977).

The daily behaviour usually follows the cycle of hours of light and hours of darkness: shortly after the lights are turned on, the young vipers come out of their hiding-places and thermoregulate under the lamp, positioning their bodies according to their thermal requirements. Like the young *V. berus* they are able from birth to flatten their trunks in a dorso-ventral direction, taking up a typically 'ribbon-like' position.

The daily period of basking lasts for a considerably longer time if digestion is taking place in the snake, or during the sloughing cycle. This lasts on average for 7-9 days, from the moment in which the ventral parts begin to become discoloured, to the moment of shedding; the eye usually becomes opaque 3-5 days after the first phase, and remains in this condition for 1-2 days. Finally the eye recovers its normal appearance, and the viper prepares to slough. Though they move very little, and only when disturbed, during the sloughing cycle, the young *V. ursinii*, like the adults, usually continue to feed. This kind of behaviour is fairly exceptional among European vipers, as is that of the females which, both in the natural state and in captivity, feed frequently even in the advanced stages of pregnancy.

Here it is worth mentioning that only 7 days before giving birth, the female in my possession killed and swallowed a hamster weighing 8 g.

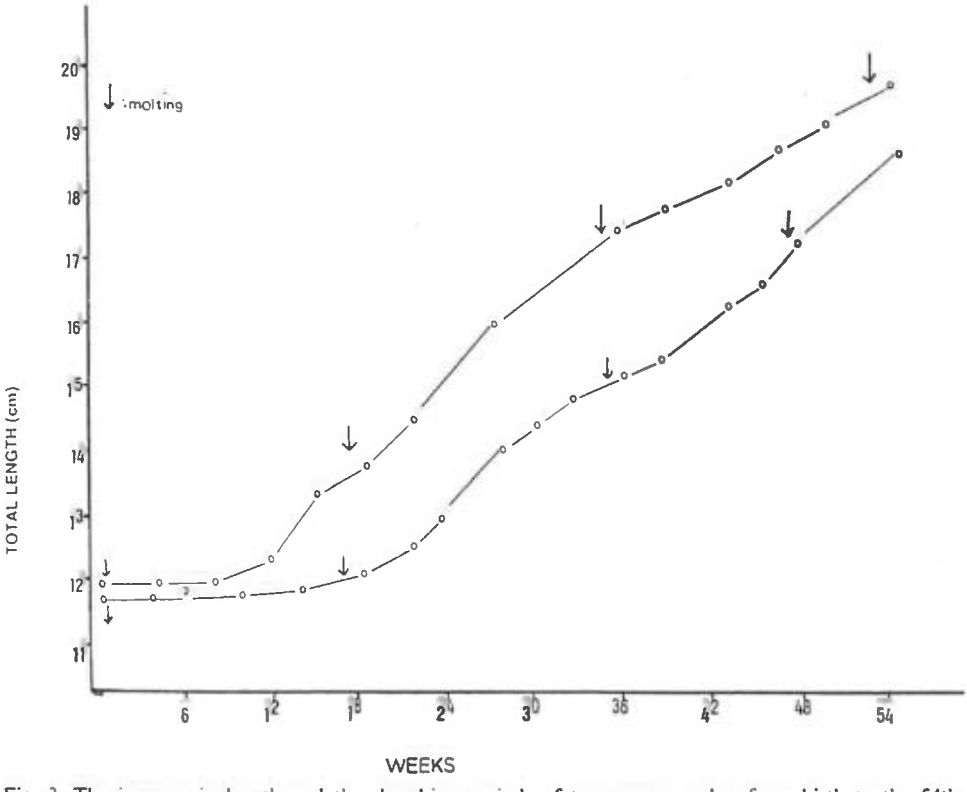

Fig. 3. The increase in length and the sloughing periods of two young snakes from birth to the 54th week of life. It can be seen that for the whole year of the study, the young vipers were not allowed to hibernate. The graph shows an initial phase in which the young vipers show only very limited growth, and a later phase characterized by rapid growth.

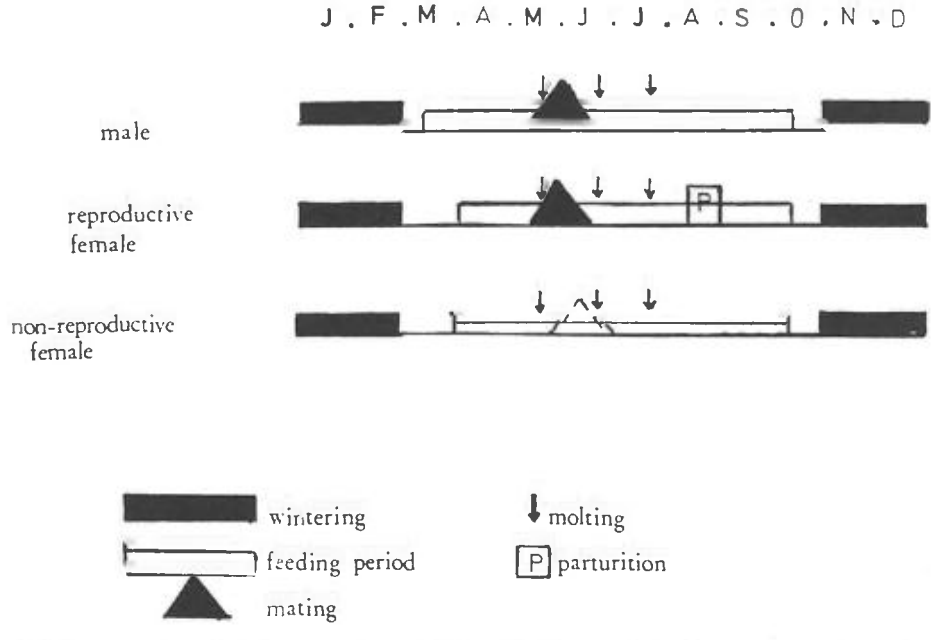

Fig. 4. Representation of the annual activity cycle for *Vipera ursinii ursinii* in experimental captive conditions (as far as the symbols are concerned, these are derived from Saint-Girons, Duguy & Naulleau, 1989, though modified).

GROWTH

The growth of the young is characterized by two clearly distinct stages:

a) a first stage (from birth to somewhere around the 6th-10th week) in which no significant increase in length can be noted, while a loss of weight of about 0.2-0.6 g (the original average birth weight of the young is 2.1-2.3 g) can be measured.

b) a second phase in which the vipers begin to gain weight and to increase in length as a result of beginning to feed. In this stage, the speed of their growth depends essentially on the frequency with which they feed.

CONCLUSIONS

It seems, therefore, that *V. ursinii*, though it cannot be compared with species such as *V. ammodytes*, is nevertheless capable of adapting to life in captivity, and can even be bred in captivity as long as a few precise rules are followed which take the animal's particular physiology into account. On the basis of my observastions, I believe it would be possible to set up a large-scale plan for the reproduction in captivity of this rare species of viper, with the aim (1) of reintroducing the reptiles into areas in which their population is seriously threatened with extinction, and (2) of studying in more detail the habits and the biology of this extremely interesting snake.

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