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References


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Notes on cloacal temperatures of the adder, Vipera berus, in a glacial valley in north-eastern Italy

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The thermal ecology of Italian Vipera berus has not been studied, although data are available from elsewhere in the range of the species (Saint Girons and Saint Girons, 1956; Bui Ai et al., 1975; Saint Girons, 1975a, 1975b, 1978; Saint Girons et al., 1985; Naulleau, 1983, 1986). Field work in this study was carried out in the Duron Valley (1850-2200 m), at the upper end of the Fassa Valley, province of Trento, Italy. Some observations were also made in a small area on the Siusi Alp (1800-2300 m), a wide tableland in Bolzano province. The areas were visited in June-October 1986 and March-October 1987. Long leather gloves and a forked notched stick were used during capture of the adders; a fork without a central tooth was used to keep them on the ground. A Dyalit digital thermometer (accuracy ± 0.1°C) was used for temperature measurements. Weather conditions (i.e.: sunny, cloudy and rainy days) and the following temperatures were recorded: air (30 cm above ground), in grassy areas, in rocky areas (both within a 30 cm radius from the observation point, when these

Table 1. Adder cloacal and environmental temperatures for 1986 and 1987.

<table>
<thead>
<tr>
<th></th>
<th>1986</th>
<th></th>
<th>1987</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean</td>
<td>range</td>
<td>n</td>
</tr>
<tr>
<td>cloaca</td>
<td>12</td>
<td>26.36</td>
<td>(17.9-35.2)</td>
<td>11</td>
</tr>
<tr>
<td>grassy areas</td>
<td>22</td>
<td>21.63</td>
<td>(14.1-27.5)</td>
<td>7</td>
</tr>
<tr>
<td>rocky areas</td>
<td>18</td>
<td>25.81</td>
<td>(16.9-33.5)</td>
<td>3</td>
</tr>
<tr>
<td>air</td>
<td>22</td>
<td>18.58</td>
<td>(14.6-24.3)</td>
<td>10</td>
</tr>
</tbody>
</table>

features were present), and cloacal temperatures (2.5-3 cm inside the cloacal opening).
Only a few basking specimens were used for analysis of cloacal temperatures, to avoid disturbance and the possible migration of specimens away from the study area. Mean values for all temperatures, together with their ranges, are shown in table 1.
Cloacal temperatures did not change seasonally in either years (ANOVA; 1986: \( F = 1.185, 3 \) df, \( p = 0.39 \); 1987: \( F = 0.844, 4 \) df, \( p = 0.54 \)). Body temperatures were very often greater than ambient air and grass temperatures, but similar to rock ones, the differences ranging from 5.4 to 10.2°C in 1986 (\( N = 5 \)) and from 2.7 to 16.3°C in 1987 (\( N = 7 \)) (cloaca-air); from -1.9 to 8.3°C in 1986 (\( N = 7 \)) and from -3.1 to 7.8°C in 1987 (\( N = 5 \)) (cloaca-grass); from -5.3 to 0.2°C in 1986 (\( N = 4 \)) (cloaca-rock).
The environmental temperatures were not highly related to the cloacal temperatures. These data probably reflect a local microclimatic situation, as no thermal differences between the two years were observed at the nearest (but much lower) meteorological station (1400 m).
The observed cloacal temperatures were on average lower than those reported by Saint Girons and Saint Girons (1956), Duguy (1963), Bui Ai et al. (1975), Saint Girons (1975a, 1978) and Spellerberg (1976). It must be noted that temperatures in these studies were from the stomach (Bui Ai et al., 1975; Saint Girons, 1975a, 1978), from the body “dorsally above the heart” (Spellerberg, 1976) or generally referred to an “optimum thermic” (Duguy, 1963). It is evident that present data from basking animals represent mainly the status of temperatures of basking animals, not the “voluntary mean temperature” nor the “voluntary range” (sensu Spellerberg, 1976). The data are comparable with those obtained in Belgium by A. van Hecke and K. Claus via telemetry (experiments in progress, kindly communicated by G. van Spendonk, their collaborator, 1991).
The present research suggests that adder thermal biology is worth studying in more detail. In such a euryzonal and widespread species, several locally adapted ecotypes probably occur (cf. Spellerberg, 1976).

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