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DISTRIBUTION AND ECOLOGY OF LACERTA HORVATHI MÉHELY, 1904 (REPTILIA, LACERTIDAE) IN NORTH-EASTERN ITALY

DISTRIBUZIONE ED ECOLOGIA DI LACERTA HORVATHI MÉHELY, 1904 (REPTILIA, LACERTIDAE) IN ITALIA NORD-ORIENTALE

Abstract - The Authors present a synthesis of the distribution of Lacerta horvathi in north-eastern Italy and the first results of a research on its ecology in the same area.

Key words: Lacerta horvathi, Distribution, Ecology, NE Italy.

Riassunto breve - Gli Autori presentano una sintesi cartografica della distribuzione di Lacerta horvathi nel Nord Est italiano redatta secondo il sistema cartografico UTM con un reticolo di 10 chilometri di lato. Essi inoltre riferiscono i primi risultati di alcune ricerche sull’ecologia della specie condotte nella stessa zona.


1. Introduction

Lacerta horvathi Méhely, 1904 (hereinafter L.h.) is an East Alpine - North Dinaric species (sensu La Greca, 1963) dwelling in rocky mountain biotopes of Germany (Capula & Luiselli, 1991), Austria (Grillitsch & Tiedemann, 1986; Cabela et al., 1992; Tiedemann, 1992), Italy (Lapini, 1983; Lapini & Dolce, 1983), Slovenia and Croatia (De Luca, 1989). Up to now its relict range (Lapini & Dolce, 1983) seems to have at least three disjunctions, but this may perhaps be due to a scarcity of research (De Luca, 1989). In spite of its peculiar distribution there are no significant differences in morphology (De Luca, 1989) and karyology (De Luca & Dulic, 1988; Capula et al., 1989) among Italian, Slovenian and Croatian populations, and the species is considered monotypic(1).

(1) The discovery of L.h. in Germany has recently been questioned by Schmidler and his colleagues. They published an amazing mocking article, under “pseudonyms” (Faber, F. & Faber, H., 1991 - Zwischenbericht zur Ausbreitung des Archaeolacerta - horvathi - Komplexes in Bayern und seinen Nachbarländern. Die Eidechse, 4: 9 - 12), describing a new subspecies on the basis of ludicrous characters. See Capula & Luiselli, 1993 for further comments.
From the distributional point of view we made a synthesis of both bibliographical and original available data on Austrian, Italian and Slovenian localities inhabited by _L.h._, while the theatre of our ecological research was the Ucsea Valley (Resia, Udine, north-easter Italy), where the greatest Italian population of _L.h._ has been recently discovered (LAPINI, 1988).

The population studied by an ecological point of view dwells on the southern slopes of the Mts Sregone and Chia (Ucsea Valley, 700 - 800 m a.s.l.), in a deep valley with dinaric orientation and a very high raininess (IACUZZI & VAIA, 1980).

These environments are mainly covered by _Fagus sylvatica_ woods conspicuously modified by human activity (copse, mown meadows) and characterized by the instability of vast rocky surfaces partly colonized by scattered grass and shrubs (MAINARDI & SIMONETTI, 1991).

_L.h._ is syntopic in this locality with _Podarcis muralis_ (LAPINI, 1988), _Lacerta (Z.) vivipara, L. viridis, Anguis fragilis, Coronella austriaca_ and _Vipera berus_, but only the local ratio between Horvath’s Rock lizard and Wall lizard is high enough (4:1) to represent a true case of cohabitation.

We have recently studied the trophic niche overlap existing in these environments between syntopic _L.h._ and _Podarcis muralis_ (RICHARD & LAPINI, 1993).

The aim of this paper is to increase the knowledge on distribution and ecology of the poorly known Horvath’s Rock lizard (for a synthesis see BISCHOFF, 1984 and DE LUCA, 1992) also through the comparison with some ecological parameters of a syntopic population of _Podarcis muralis_ (hereinafter _P.m._).

These data may explain some ecological mechanisms which make possible a true syntopy between these lizards in the Julian Prealps.

2. METHODS

a - Distribution

The synthesis of the distributional records of _L.h._ in Austria, Italy and Slovenia has been realized using the UTM 10x10 km international grid system. A complete data bank is also given. A detailed analysis of the altitudinal and environmental preferences of _L.h._ is made too. These are compared in the text with those of _P.m._ in the same area.

b - Reproductive biology

A small number of pregnant lizards (23 _L.h._ and 6 _P.m._) was radiographed to determine the clutch size. This method, previously used on _Testudinidae_ and _Iguanidae_ (GIBBONS & GREENE, 1979; DUNHAM et al., 1988), permits a low impact on the populations since the pregnant lizards may be released in good conditions after their exposure to X-rays. However, considering the very poor calcification of the eggs of these lizards, we have positively verified this study method by dissecting 5 pregnant females previously X-rayed.

The information on breeding and oviposition periods was obtained in three years of field observations, while that about sex ratio is due to the individual marking of 394 _L.h._ and 199 _P.m._ specimens. The toe - clipping identification code is that of PILORGE (1981), but for this work it was modified in order to reduce the number of clipped toes in each paw.

c - Growth, moulting, hibernation

PILORGE’s (1981) individual marking technique was also employed to obtain data on the growth (snout/vent length) of these lizards particularly up to the first oviposition (females’ sexual maturity). Three years of field observations were necessary to determine the moulting periods of the lizards and the duration of their hibernation.

d - Micro - habitat selection

The micro - habitat selection operated by _L.h._ and _P.m._ was studied using the “Vegetation cover index” of tab. I (micro - habitats of tab. I were equally represented in the study area). The results were then tested using a G test performed with William’s correction (SOKAL & ROHLF, 1981); besides, these values were compared to the numerical results of a X² test with the same degrees of freedom (FISHER & YATES, 1974).

e - Vagility

A capture - marking - recapture method, performed by using the toe clipping code quoted in paragraphs 2.b and 2.c, was used to evaluate the vagility of _L.h._ and _P.m._ in the same environment.

The subsequent annual (seasonal) recaptures of 120 specimens of _L.h._ and 80 of _P.m._ in three years of research permitted to gather some data about the general mobility of these lizards which were then tested by means of a G test performed as shown in paragraph 2.d.

Unfortunately, these data cannot be correctly used to obtain information on the annual Home Range of the lizards because their habitat is not homogeneous enough to utilize the medium recapture radii method (TINKELE & WOODARD, 1967). In fact, considering the characteristics of the studied environment, the lizards’ Home Ranges cannot be circular, thus their extension might have been easily overestimated (ROSE, 1982).

The convex polygon method couldn’t be used because our recapture spots were surely too much aligned (cfr. ROSE, 1982).
However, the medium recapture radii method was equally applied to our data; the “Ideal Home Ranges” obtained are in fact very useful to point out the differences in general mobility of L.h. and P.m. in the studied habitats.

3. Results and discussion

a - Distribution

A UTM 10x10 international grid system synthesis is given (fig.1), and the relative data bank can be summarized as follows (MFSN Z/E=Herpetological Collection of the Museo Friulano di Storia Naturale di Udine):

Carnic Alps - UM26, Pierabech dнт., m 1100 (Forni Avoltri, Udine), LAPINI & DOLCE, 1983; UM36, Sestriale Fleos, m 1200 (Forni Avoltri, Udine), original; UM36, Hubertuskapelle, m 1140 (Wolfgangtal, Austria), BRIELFISCH & TIEDEMANN, 1986; UM55, Casera Peszol dнт., m 1500 (Pauluro, Udine), LAPINI & DOLCE, 1983; UM65, Cason di Lanza dнт., m 1552 (Pauluro, Udine), original, ingesta (MFSN Z/E 973) in Vipera berus (MFSN Z/E 250); UM65, Torrente Pontebbana, m 650 (Studena Bassa, Pontebbana, Udine), original; UM65, rocco lungo il Rio Prizotic, m 750 (Pontebbana, Udine), original; UM65, Casera di Rio Secco dнт., m 1200 (Moggio Udinese, Udine), original; UM65, rocco lungo la strada sotto la loc. Casarotta, m 1370 (Moggio Udinese, Udine), original; UM75, Val Rio Bianco, m 700 (Malborghetto-Vallbruna, Udine), original; UM75, Vallone di Malborghetto, rocco lungo la strada, m 750 (Malborghetto-Vallbruna, Udine), original; UM85, Vallone di Malborghetto, m 750-1200 (Malborghetto-Vallbruna, Udine), original.

Julian Alps and pre-Alps - UM84-94, Raibl, m 7? (Tarvisio, Udine), SOCHRUBEK, 1955; UM84-94, Raibl, m 900-1000 (Tarvisio, Udine), BRUNO, 1986; UM94 (Not UM84: DE LUCa, 1989), Passo di Predil, m 7? (Tarvisio, Udine), DE LUCa, 1989; UM94, M.te Mangart, m 1800-1900 (Tarvisio, Udine), DARSa, 1972; UM94, Mangart (Strmece), m 1094-1160 (Bovec, Slovenia), DE LUCa, 1989; UM94, M.te Porca, m 1650-2000 (Tarvisio, Udine), DARSa, 1972; UM74 (Not UM64: DE LUCa, 1989), Pian dei Spadovai, m 1080 (Digna, Udine), LAPINI & DOLCE, 1983; UM74, M.te La Veneziana, m 1000 (Pontevedra, Udine), LAPINI & DOLCE, 1983; STEHGUl, 1987; UM64, Pietratagliata dнт., m 600 (Pontevedra, Udine); UM83, Kanin, m 1100 (Bovec, Slovenia), BRELIH, 1962; UM83, Kanin, m 650-1050 (Bovec, Slovenia), DE LUCa, 1989; UM83, Svinjak, m 1200 (Bovec, Slovenia), BRELIH, 1962; UM83, Bala Pod Morezom, m 7? (Bavka, Slovenia), BRELIH, 1962; VM03, Planina Podska, m 1050 (Trenta, Slovenia), BRELIH, 1962; VM03, Crno Jezero-Dolina Triglavskih jezer, m 1340 (Triglav, Slovenia), BRELIH, 1954, 1962; VM02, Komačar, m 650 (Bohinj, Slovenia), BRELIH, 1962; VM23, Mrzli Studenec, m 7? (Pokljuka, Slovenia), DE LUCa, 1989; VM04, Vrsic, m 1200 (Kranjska Gora, Slovenia), DE LUCa, 1989; UM83, Fontanone Barman dнт., m 780 (Resia, Udine), original; UM83, Forte delle Chiusa di Piezzo, m 7? (Bovec, Slovenia), LAPINI & DOLCE, 1983; LAPINI, 1984; UM72, Strada sotto i Mt Polose e Nischeinac, m 730-750 (Resia, Udine), LAPINI, 1988; CAPUla et al., 1989; UM72, Zanarvolhera, m 812 (Lusevera, Udine), LAPINI, 1988; UM73, Versante Sud Est del Mt Chila, m 750-800 (Resia, Udine), LAPINI, 1988; UM73, Uccea dнт., m 700 (Resia, Udine), LAPINI, 1988; UM82, Krasji Vrh, m 1200-1600 (Slovenia), BRUNO, 1986; UM92, Uresource, m 1400-1500 (Kobarid, Slovenia), BRUNO, 1986; UM92, Trn M.te Vrata e M.te Nero, m 1400-1700 (Kobarid, Slovenia), BRUNO, 1986; UM93, Selja Nevea dнт., m 1000 (Chiusaforante, Udine), original; UM53, Val Lavurazza, m 1100 (Venezia, Udine), original; UM81, Bocche di Pradolinio,

m 480 (Pulfero, Udine), original; VL19, Trnovo Gost (Predmeje, Goljaki), m 1200-1500 (Ajdovscina, Slovenia), DE LUCa, 1989; VL44, Sveznik, Svisaki, m 1000-1050 (Ilirska Bistrica, Slovenia), DE LUCa, 1989; VL55, Sveznik, Svisaki, m 1240 (Leskova dolina, Slovenia), DE LUCa, 1989.

These data do not include some localities of the Austrian Carnic Alps and Caravanche (EGGEMBERGER in LAPINI, 1988; 210; CABELLA et al., 1992; TIEDEMANN, 1992), as requested by the Austrian Authors, and a wrong quotation (Val Rosandra, Trieste: CORBETT, 1989).

An analysis of the altitudinal preferences of L.h. (fig. 2) clearly shows that it particularly prefers rocky environments between 800 and 1200 m a.s.l., while its altitudinal range is now extended from 480 to 2000 m a.s.l.

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![Fig. 1 - Distribution of Lacerta horvathi in Italy, Austria and Slovenia](image-url)

- **Δ** bibliographic records before 1970
- **○** original records before 1970
- **▲** bibliographic data after 1970
- **●** original records after 1970
- **-** Distribuzione di Lacerta horvathi in Italia, Austria e Slovenia
  - **Δ** dati bibliografici anteriori al 1970
  - **○** dati originali anteriori al 1970
  - **▲** dati bibliografici posteriori al 1970
  - **●** dati originali posteriori al 1970
This last consideration supports the hypothesis that the present distribution of Horvath’s Rock lizard might be potentially continuous, with no real disjunctions. Even De Luca (1989), which reported on some new localities (of the Mount Sneznik) in the “Slovenian - Croatian classic disjunction” (cfr. Lapini & Dolce, 1983), hypothesized that no real disjunction existed in that zone.

78% of the localities inhabited by L.h. is covered by Fagus sylvatica, Abies alba, Pinus nigra or Larix decidua woods, while various cold types of Carpinus - Fraxinetum, Acri - Tilietum or Orno - Ostrietum usually cover the lower habitats of this rock lizard.

Usually, the species selects rocky mountain environments, but the lower populations of the Julian Prealps (e.g. UM81, Bocche di Pradolino, m 480) sometimes live in deep wooded canyons with termic inversion, screes and boulders.

Fig. 3 - Clutch size of Lacerta horvathi (●) and syntopic Podarcis muralis (○) in relation to snout-vent length.
- Portata gravida complessiva di Lacerta horvathi (●) e Podarcis muralis (○) in condizioni di sintopia in relazione alle dimensioni (apice muso - rima cloacale).

Fig. 4 - Growth of Lacerta horvathi (snout - vent length in mm) up to the first oviposition.
- Accrescimento di Lacerta horvathi (apice muso - rima cloacale in mm) fino alla prima deposizione.
- Linee verticali = intervalli di variazione dimensionale
- Segamenti orizzontali sottili = valori medi
- Segamenti verticali spessi = errori standard
In the localities studied, the Horvath’s Rock Lizard is often sympatric with various reptiles (P. m., Lacerta (Z.) vivipara, Lacerta viridis, Anguis fragilis, Coronella austriaca, Natrix matrix, Vipera berus and Vipera ammodytes), but only the Green Lizard, the Smooth snake, the Nose Horned Viper and the Adder (one documented case: UM 65, Cason di Lanza, m 1552 - Pontebba, Udine - VII.1969) can prey on it.

A true cohabitation with P. m. in the same biotope has been observed in at least four cases. On the other hand, it must be noted that the Wall Lizard, in the extreme north - east of Italy, can usually be found up to 800-900 m a.s.l., rarely reaching higher values (the maximum limit in the Friuli - Venezia Giulia region is 1640 m a.s.l.: Darsa, 1972). Therefore, the possibilities of cohabitation with L. h. are not so common.

b - Reproductive biology

In the study area L. h. breeds in the second half of May, and the oviposition occurs in the second half of July, lasting one week (fig. 5). The clutch size varies between 3 and 5 eggs (x= 3.7; SE= 0.13; n=23) (fig. 3), and births occur from the end of August to the first decade of September. Observing fig. 3 a situation of invariant clutch size could be hypothesized. This would contrast with the data of De Luca (1992) and perhaps may be due to the low altitude where the studied population lives. Anyway, because of the little size of the sample, we think that both trying statistic interpretations and drawing definitive conclusions could be hazardous. Sex ratio of adults: \( \varepsilon : \delta = 1.01 / \varphi : 1 \).

The interpretation of the same observations made on a syntopic population of P. m. seems to be quite contradictory. Breeding was observed in May and an oviposition in mid July, but X-rays revealed the presence of mature eggs also in two females caught at the end of May. Thus the presence of a first period of sexual activity in the second half of March must be hypothesized. The determination of the clutch size was also very difficult, due to the small number of pregnant P. m.. Anyway it varied between 3 and 4 eggs (x= 3.7; SE=0.21; n=6). Births were always observed from July to the end of August, but newborns were only rarely seen. Therefore a high mortality of the embryos can be hypothesized.

According to our data, L. h. seems to be clearly monostrous (see also De Luca, 1992). Considering the quite low altitude of the studied population, it may be hypothesized that this rock lizard shows a similar behaviour all over its range. These considerations enable us to note that L. h. has a lower absolute reproductive potential than P. m. (see Gruschwitz & Böhme, 1986 for a review), considering both the medium clutch size and the number of annual oviposition. From this point of view L. h. fairly resembles Lacerta (Z.) vivipara, the species best adapted to cold climate among palaeartic Lacertidae (Pilorge, 1981; Shine, 1983; Dely & Böhme, 1984). However, while this latter is ovoviviparous, L. h. is exclusively oviparous.
c - Growth, moult, hibernation

The data on growth and moult obtained by capture and recapture of marked specimens are not very abundant. For L.h. they might be summarized as follows (see also figs. 4 - 5), while for P.m. they are clearly non sufficient to support any interpretation.

The births of L.h. usually occur at the beginning of September; snout/vent length of the newborns averages 26.3 mm (min= 24.5; max= 28.5; SE= 0.24; n=20). At the end of the first year of life they measure 38.6 mm (min= 35.5; max= 44.5; SE= 0.91; n=10) and at 22 months they reach 42.3 mm (min= 39; max= 45; SE= 0.55; n=12). At 33 months, their average length is 49.8 mm (min= 47.5; max= 54; SE= 1.01; n= 6). Sexual dimorphism becomes evident at the end of the first year of life and the first oviposition occurs around 50 mm of snout - vent length. From these data it must be argued that the sexual maturity of the females occurs in their third year of life.

<table>
<thead>
<tr>
<th>Micro habitats</th>
<th>Vegetation Cover</th>
<th>Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare rock or cement (sometimes covered by close muck)</td>
<td>No lizards totally exposed to the sun</td>
<td>0</td>
</tr>
<tr>
<td>Scattered pioneer vegetation</td>
<td>Low (lizards well exposed to the sun)</td>
<td>1</td>
</tr>
<tr>
<td>Grassland ecotones</td>
<td>High (lizards partially in the shade)</td>
<td>2</td>
</tr>
<tr>
<td>Meadowy and bushy habitats, undergrowth</td>
<td>Total (lizards completely in the shade)</td>
<td>3</td>
</tr>
</tbody>
</table>

Tab. I - Vegetation Cover Index.
- **Indice di Copertura Vegetazionale**.

<table>
<thead>
<tr>
<th>Date</th>
<th>L. horvathi</th>
<th>P. muralis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V.C.1-0</td>
<td>V.C.1-1</td>
</tr>
<tr>
<td>14-6-82</td>
<td>74</td>
<td>70</td>
</tr>
<tr>
<td>14-8-90</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>21-6-90</td>
<td>62</td>
<td>55</td>
</tr>
<tr>
<td>1-10-90</td>
<td>98</td>
<td>91</td>
</tr>
<tr>
<td>7-5-90</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>28-5-90</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>15-7-90</td>
<td>66</td>
<td>58</td>
</tr>
<tr>
<td>19-9-90</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>13-8-90</td>
<td>65</td>
<td>64</td>
</tr>
<tr>
<td>20-8-90</td>
<td>69</td>
<td>67</td>
</tr>
</tbody>
</table>

Total: 598 | 560 | 93.79 | 36 | 6% | 2 | 0.34 |

Tab. II - Analytical results of the application of the "Vegetation Cover Index" (V.C.I.) to 750 sighting plots of syntopic *Lacerta horvathi* and *Podarcis muralis*.
- **Risultati analitici dell’applicazione dell’"Indice di Copertura Vegetazionale" (V.C.I.) a 750 avvistamenti puntiformi di Lacerta horvathi e Podarcis muralis in condizioni di sintopia**.
L.h. has a minimum of three molts per year: a spring molt (end of April - mid May), a summer molt (in July), and an autumn molt (mid September - mid October) (fig. 5), but other molts may be hypothesized for the younger specimens.

Hibernation lasts from the end of October - first decade of November to the end of February - first half of March (fig. 5) for both species. An uninterrupted hibernation probably occurs in the studied environment, since in winter these habitats are rarely exposed to the sun and they are often covered by snow.

d - Micro - habitat selection

The results of the application of the Vegetation Cover Index of tab. I (hereinafter V.C.I.) are analytically exposed in tab. II, while a graphic representation of the total results is given in fig. 6. Both lizards particularly select sunny micro - habitats with 0-1 V.C.I., but while L.h. is strictly bound to rocky vegetationless biotopes (V.C.I. = 0 in 93.65% of the sample), syntopic P.m. clearly operates a wider micro - habitat selection (V.C.I. = 0 in 69.08% of cases and V.C.I. = 1 in 28.95% of the sample). In our sample of sighting spots (relative to both species, for a total number of 750 individuals) only five lizards were observed in biotopes with V.C.I. = 2, while no lizard was observed in micro - habitats with V.C.I. = 3.

The difference of the habitat selection of L.h. and P.m. was then tested using a G test applied to the occurrences of the lizards in biotopes with 0 and 1 V.C.I. The results were:

<table>
<thead>
<tr>
<th>Podarcis muralis</th>
<th>Lacerta horvathi</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
</tr>
<tr>
<td>63.30, 20.50, 90.10, 40.70, 58.10, 7.45, 12.40, 15.30, 3.10, 15.30, 16.80, 6.5, 3.10, 8.4, 4.40, 7.10, 1.10, 3.75, 11.40, 1.90, 5.20, 10.40, 5.30, 24.40, 49.10, 2.30, 4.290, 11.3, 118.20, 35.30, 50.80, 8.2, 8.20, 22.20</td>
<td>0, 0.45, 0.6, 3.9, 0.24, 3.60, 12.10, 2.90, 3.7, 9.20, 1.90, 1.30, 10.70, 10.50, 2.10, 1.50, 9.40, 8.10, 1.50, 8.60, 1.45, 1.45, 4.60, 7.45, 2.05, 1.80, 4.0, 0.90, 0.83, 3.90, 7.80, 2.10, 5.90, 0.90, 10.10, 3.30, 4.10, 16.30, 6.40, 7.20, 1.40, 7.8, 27.90</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
</tr>
<tr>
<td>4.15.30, 1.50, 4.30, 4.30, 3.50, 30.90, 23.75, 16.40, 1.30, 3.20, 82.20, 8.30, 0.80, 20.10, 13.40, 6.30, 9.50, 3.30, 1.40, 17.50, 6.20, 4.30, 6.40, 1.40, 3.3, 8.40, 6.18.40, 23.10, 25.10, 1.90, 41, 1.50, 2</td>
<td>0, 0.0, 1.90, 0.50, 7.10, 6.60, 1.390, 2.40, 16.30, 0.0, 6.60, 1.65, 1.45, 0.0, 0.0, 7.90, 12.60, 0.2, 1.0, 2.95, 2.10, 3.05, 17.70, 2.70, 0.45, 6.50, 1.90, 1.25, 5.05, 10.20</td>
</tr>
<tr>
<td><strong>Juv.</strong></td>
<td></td>
</tr>
<tr>
<td>21.50, 21.20, 14.70, 4.40, 10.10, 10.40</td>
<td>8, 1.30, 17.50, 0.4, 3.30, 11.85, 3.30, 8.70, 12.10, 14.80, 5.80, 1.70, 0.70, 5.90, 4.40, 4.70, 0.50, 7, 1.40, 11.90, 3.10, 9.80, 7.10, 3.90, 1.50, 4.10, 3.40, 0.560, 17.60, 20.80, 0.60, 172.80, 4.10</td>
</tr>
</tbody>
</table>

Tab. III - Annual displacements of the studied lizards (in meters).
- Spostamenti annuali delle lucertole studiate (in metri).
re significant (1987: G=4,778; d.f.=1; 0,02<P<0,05 - 1988: G=4,867; d.f.=1; 0,02<P<0,05) or highly significant from a statistical point of view (1989: G=18,889; d.f.=1; P<0,001). Highly significant statistical results were also obtained by performing the same test on the total results of tab. II (G= 27,397; d.f.=1; P<0,001).

Our results seem to show that the Horvath’s Rock lizard should be considered as a stenotope species, with marked preferences for rocky (or stony) mountain vegetationless habitats. This is evidenced also by the study of the habitat selection of a sympatric population of P.m., which clearly shows a wider environmental adaptability (fig. 6). This agrees with literature data (GRUSCHWITZ & BÖHME, 1986) and makes possible a true cohabitation between these lizards. The study of the diet of these lizards in the same biotopes has shown a great trophic niche overlap (RICHARD & LAPINI, 1993). Therefore the diversity of the habitat selection must certainly play an important role in the ecological niche segregation when these species are sympatric (see also SCHÖNER, 1968). On the other hand, it must be noted that a better segregation of the ecological niche may be made easier also by some diversities in the cyrcadian or cycannual activities, or by a simple difference of thermal preferences. It must be in fact considered that L.h. has a quite low temperature of activity (DE LUCA et al., 1989; 1992).

e - Vagility

The measures of 120 successive annual displacements of L.h. and of 81 of P.m. are analytically exposed in tab. III. The Horvath’s Rock lizard surely exhibits a general lower mobility (figs. 7 - 9 - 10). The difference in spatial behaviour of these sympatric lizards became more evident after a logarithmic normalization of the data: the data on the vagility of P.m. complexly show Gaussian trends (fig. 8), while those on the mobility of L.h. are more characterized (fig. 8). A G test analysis of the total results shows a statistical significance of the differences in general vagility of L.h. and P.m. (G= 9,829; d.f.= 4; 0,02<P<0,05).

In both species (figs. 9 - 10) the displacements of males and females show quite similar trends, and the females exhibit the lower vagility.

In the studied area the medium recapture radius is 7,3678 m for L.h. (X = 3; n=50): 7,318 m; X = 3; n=36); 3,5958 m; X = 1; n=34); 11,1897 and 15,6656 m for P.m. (X = 3; n=38); 20,25 m; X = 3; n=37); 13,031 m; X = 3; n=6); 13,716 m). The “Ideal Home Range” of L.h. may be on average approximatively estimated in 170,453 sqm (X = 3; n=36); 168,1508 sqm; X = 3; n=40); 59,955 sqm; X = 3; n=37); 393,1575 sqm), while that of P.m. is surely wider (X = 3; n=34); 70,59 sqm; X = 3; n=38); 1287,5962 sqm; X = 3; n=37); 533,1938 sqm; X = 3; n=6); 590,7939 sqm). Besides it must be noted that in three years of research almost all the adult lizards (and particularly L.h.) have shown a marked preference for their activity area.

4. Conclusions

Our preliminary results enable us to make the following considerations:

1 - Lacerta horvathi is quite common in rocky mountain vegetationless biotopes of the Carnic and Julian Alps. In this area, its scattered relict distribution covers various cold montane and sub - montane environments from 480 to 2000 m a.s.l.

In the studied biotopes L.h. exhibits complexively a (4,52 times) lower mobility than P.m. (figs. 7 - 8), but it must be noted that the population density of the latter is fairly low. In such conditions, an increase in general mobility is already well known for the Wall lizard (GRUSCHWITZ & BÖHME, 1986).

In the study area, however, the higher vagility of P.m. surely favours a better reparation of the ecological resources making the cohabitation with L.h. still easier.
2. *Lacerta horvathi* is a cold climate stenotope rock lizard. These ecological trends seem to be particularly evidenced by its monoecy, small clutch size, very short reproductive cycle (De Luca, 1992; this work) and peculiar habitat selection (this work). Its low temperature of activity (De Luca et al., 1989, 1992), and its low vagility (this work) seem to support this interpretation, but it must be noted that the sympathy between *Lacerta horvathi* and *Podarcis muralis* in the study area may have extremized some ecological trends of both lizards.

3. *Podarcis muralis* is potentially more competitive than *Lacerta horvathi* both in terms of absolute reproductive rate (see Gruschwitz & Böhme, 1986 for a comparison) and of capacity to utilize the trophic (Richard & Lapini, 1993) and spatial (this work) resources, but its “colonizer” ecological strategy surely involves a relatively high(er) need of temperature to be completely realized (see also Saint Girons & Duguy, 1970). In the studied area, in fact, *Podarcis muralis* suffers a drastic reduction of the number of oviposition and perhaps a high mortality of the embryos due to the rigours of the climate.

4. A true cohabitation between these lizards is possible only in cold climate habitats, where *Podarcis muralis* forms very low density populations due to the decrease in its reproductive potential. This last consideration may perhaps explain why in all the observed cases of true sympathy between *Podarcis muralis* and *Lacerta horvathi*, the latter has the higher population density. In such conditions, however, the sympathy between these lizards is made easier by some diversities in habitat selection (this work), in thermal preferences (De Luca et al., 1989), in general mobility (this work), in trophic behaviour (Richard & Lapini, 1993) and perhaps in cyrcadian or cycraanvial activities.

5. In the eastern Alps the altitudinal vicariance between *Podarcis muralis* and *Lacerta horvathi* usually occurs around 700-900 m a.s.l., but the quote of possible sympathy between these reptiles may vary considerably according to orography, exposition and raininess. In north-eastern Italy, in fact, it may be potentially extended from 480 to 1640 m a.s.l.. This picture well agrees with the already known decrease in the altitudinal limits of physical and biological phenomena in south eastern Alps (Morandin, 1979; Gentilli, 1989; Lovrenčak, 1989).


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