Korsós, Z. & Kiss, I. (eds) (1992)
Proc. Sixth Ord. Gen. Meet. S. E. H., Budapest 1991, pp. 347-350.

Vertical distribution pattern of green lizard species (*Lacerta* s. str.) in the Pindos Mountain Chain in central Greece

HANS-K. NETTMANN, ROLF DÜLGE, BRIGITTE HIELEN,
ULF RAHMEL and CORNELIA SCHNAUDER

The Herpetofauna of the Mountain ridge of Central and Southern Greece has been somewhat neglected compared to the island fauna. Especially the vertical distribution of species is scarcely documented, perhaps due to the poor accessibility of these parts of Greece. Only recently the Greek mountains have come in focus of herpetologists, mainly induced by questions about the distribution of vipers.

Green lizards (*Lacerta* s. str.) are a well defined group, in which the different species need different thermal conditions for egg incubation, which results in different northern distribution boundaries (RYKENA 1987). Southern boundaries and vertical distributions have been discussed by some authors (BÖHME 1978, 1989, NETTMANN & RYKENA 1984a, 1984b, RYKENA 1987, SCHMIDTLER 1986), but detailed studies are still rare. As *L. agilis* was recently detected in Central Greece (NILSON & ANDRÉN 1987), this region appeared to be appropriate to analyse the vertical distribution pattern of three green lizard species. The results of a preliminary study are presented here.

Methods

In May 1989 several excursions were made by wandering up and down the slopes in groups of two or three persons. Observations were documented and animals, if possible, caught. Body proportions and pholidotic data as well as photos were taken in the field before the animals were released again. No animal was collected except some dead specimens, which were found killed on the roads.

Determination

Adult animals could easily be determined just during observation, if the head was visible clearly enough. Because the *L. viridis* in the area have clearly blue throats (males) or white to pale blue throats (females), while *L. trilineata* are bright yellow ventrally with sublabial and submaxillar shields at least green, but never white or bluish. (In other parts of Greece, e. g. Euböa Island, also *L. viridis* has a yellow belly and a throat without any blue, thus difficult to distinguish from *L.*

trilineata). Juveniles could not be distinguished by simple observation because the *L. trilineata* juveniles occurred in the unstriped morph only. Therefore the very few captured juveniles only were undoubtly determined by pholidosis.

Areas and results

1. Peristeri Mountain

Some kilometers south of Metsovo a NW slope was studied from May 10th to 13th. We started from a valley at 670 m and walked up to 1800 m, but did not intend to reach the summit at about 2300 m. Vegetation was an *Alnus* forest in the valley, than a grazed decidous brushwood (shiblyak), mainly with shrubs of *Carpinus, Ostrya, Fraxinus, Corylus* and *Acer*, mixed with *Juniperus* and, above 1000 m *Fagus*. These forests are mixed with meadows, which are increasing above 1200 m. Single decidous trees and also single pine trees exist only up to 1500 m at this slope while at the Katara pass, some kilometers north of Peristeri beech forests are present at 1700 m. Thus timber line is mainly induced by grazing cattle and differs according to the accessibility and exposition of the slopes. Above 1500 m subalpine meadows occur in which rocks and spiny shrubs like *Juniperus* and *Astragalus* increase above 1700 m.

Sixtyone determinable specimens of the green lizard group were observed, which allows the description of distribution boundaries, but not of relative abundance or population density.

L. trilineata and *L. viridis* coexist from 670 m up to 1100 m. Between 1100 m and 1500 m only *L. viridis* was observed while from 1500 m to 1700 m no green lizard could be found. Above 1700 m L. agilis was found, as NILSON & ANDRÉN (1987) have described already. According to these authors sand lizards occur at least up to 2000 m.

Concerning possible interactions between the species it was obvious, that there is no contact between *L. agilis* and *L. viridis*. In the region, where L. *viridis* and *L. trilineata* occur, no differences in habitat structure are visible and animals of both species were seen together in the same bush. But an important difference in the activity cycle was obvious, as all *L. viridis*, even those from 1500 m, were nearly at the end of their (first?) mating period while the *L. trilineata* were just appearing from hibernation with no signs of sexual activity.

2. Timfristos

Around the northern sides of this mountain fir forests (*Abies cephalonica*) are dominating up to a timber line at about 1450 m. Above subalpine meadows and rocky scrubs are present. The 16th and 17th of May were spent here between 900 m and 1900 m, resulting in only 4 observed green lizards, due to unfavourable wheather conditions. Only *L. viridis* was observed, although the existence of *L. agilis* can still be expected because an alpine zone with *Vipera ursinii* was found

here as at the Peristeri. Due to the low number of observed lizards no further comment to this place is justified.

All *L. viridis* observed in both areas looked like typical animals of the nominate subspecies in pattern, coloration and proportions, similar to green lizards from Istria and different from *L. viridis* populations of Euböa and from Puglia in Italy. No animals with proportions or pattern of the subspecies *L. v. meridionalis* were seen.

Discussion

Northern and upper distribution boundaries in green lizard species are well understood as climatically induced, although the sensitive stage in the animals lifecycle is still in discussion (mainly egg incubation (RYKENA 1987) versus adult temperature preference (BÖHME 1978, 1989). But in any case the southern and lower boundaries are not clearly understood and competitive interactions between the species have been discussed as possible causes (NETTMANN & RYKENA 1984a, 1984b, RYKENA 1987). SCHMIDTLER (1986) has adopted this view, when he discussed the vertical distribution of green lizard species in Northern Anatolia while BÖHME (1989) denied competitive exclusion, based on unpublished observations of sympatric green lizards in Greek lowlands.

Our observations only represent one aspect in May and a different pattern may occur in July. But the observed pattern is in good accordance to climatically induced upper boundary differences, which could be expected from the analysis of northern boundaries (RYKENA 1987). Competitive exclusion hypothesis for lower boundaries of species distribution are not supported. As a contact zone between sand lizard and green lizard is lacking, *L. viridis* cannot be responsible for the limitation of *L. agilis*. Only if *L. viridis* will be found climbing up to 1700 m, perhaps at hatching time of the early hatching sand lizards, a direct influence of this large species to the smaller sand lizard may occur. Such speculative view needs confirmation by further observations. The broad zone of sympatric and syntopic existence of *L. viridis* and *L. trilineata* also does not indicate intensive competition, although the important differences in the activity cycle reveal niche differences which should be studied in detail, like STRIJBOSCH et al. (1989) have done in the Evros Province in northeast Greece. In a several months observation period these authors have found slight differences in habitat use as well as differences in activity cycle between these two species in a lowland region, despite of the overall aspect of syntopic coexistence. So far the situation in Greece is quite different from that described by SCHMIDTLER (1986) from Northern Anatolia, where the large green lizard species are clearly separated in different altitudinal zones with nearly no overlap, although using structurally similar habitats. Further observations concerning these lizards distribution and ecology are necessary, but also the regional differences in morphology should be studied in order to understand the differentiation of these taxa on the southern Balkan Peninsula.

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Authors' address: **Hans-Konrad Nettmann, Rolf Dülge, Brigitte Hielen, Ulf Rahmel & Cornelia Schnauder**

AG Evolutionsbiologie, Fachbereich 2
Universität Bremen
Postfach 330440, D-2800 Bremen
Germany