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Comparative morphology and ecology of the *Pelophylax esculentus* complex in Croatia

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Abstract. The Eurasian *Pelophylax esculentus* hybridogenetic complex, including *Pelophylax ridibundus* (R), *P. lessonae* (L), and their hybrid *P. kl. esculentus* (E), is considered to be one of the most complicated animal hemiclinal systems. It has been attracting the attention of evolutionary and molecular biologists as well as ecologists for decades. Despite the considerable number of studies describing population structure, reproductive modes, and distribution of the species complex, data on the rarely observed REL scenario, i.e., the presence of all three species at one site, are lacking. This study compared the morphological (morphometry, external morphology) and ecological (diet) profiles of all three species from a REL complex population located in the northwestern part of Croatia (Bjelovar-Bilogora County). In terms of external morphology, the species varied interspecifically, but some features, for example, the yellow or green femoral coloration found in *P. ridibundus*, had not been expected. All three species exhibited a strong predilection for terrestrial prey, but interspecific differences were noticed. This paper aims to provide a better and more comprehensible insight into the ecological relationships of the REL complex, allowing comparisons with other study areas across Europe.

Key words. *Pelophylax esculentus* complex, morphometry, morphology, diet, niche breadth.

Introduction

The *Pelophylax esculentus* complex is one of the most peculiar hybridogenetic complexes of the entire animal kingdom and has attracted the attention of evolutionary and molecular biologists, and ecologists alike for several decades. It is widespread throughout Europe and consists of three green frog species: *Pelophylax kl. esculentus* (LINNAEUS, 1758) (edible frog) is derived by the primary hybridisation of *Pelophylax ridibundus* (PALLAS, 1771) (marsh frog) and *Pelophylax lessonae* (CAMERANO, 1882) (pool frog). In comparison with other vertebrate hybrid complexes, which are usually unisexual, the *P. esculentus* complex is specific for the presence of both female and male fertile hybrid individuals with the capability of producing gametes with hybridogenetic characters (SCHULTZ 1969, TUNNER 1973). This complex is also considered one of the generally most complicated hemiclinal systems, due to pronounced diversities in population structures and reproduction modes (GRAF & POLLS-PELAZ 1989). *Pelophylax esculentus* population complexes at various localities differ in structure and several types have been reported: the

LE complex (the most widespread population type, comprising *P. kl. esculentus* and *P. lessonae*); the RE complex (comprising *P. ridibundus* and *P. esculentus*); the REL complex (very rarely observed; all three species are present); and all-hybrid populations (consisting only of *P. kl. esculentus*) (BERGEN et al. 1997, GRAF & POLLS-PELAZ 1989, HOLENWEG et al. 2002, PRUVOST et al. 2013). Although the population structure, reproductive modes, and population type distribution of the *P. esculentus* complex have been investigated, data on morphological and ecological differences between the three species involved are still scarce. This study aimed to compare morphological (morphometry, external morphology) and ecological (diet) characters of all three species comprising this complex in order to gain better insights into their ecological requirements and niche overlaps. *Pelophylax kl. esculentus* usually lives in syntopy with one or both of its parental species (HOLENWEG et al. 2002) since it is reproductively dependent on at least one (with the exception of pure hybrid populations, known only from the northern parts of the complex' distribution range, that have overcome this reproduction dependence by the mechanism of meiotic hybridogenesis;