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Original article

A biosystematic study of new records of the marsh frog *Pelophylax ridibundus* (Pallas, 1771) (Amphibia: Ranidae) from the southeast of IranZeinolabedin Mohammadi^{a,*}, Asghar Khajeh^b, Fatemeh Ghorbani^a, Haji Gholi Kami^c^a Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran^b Department of Crop Productions Technology, Faculty of Agriculture and Natural Resource, University of Sistan and Baluchestan, Zahedan, Iran^c Department of Biology, Faculty of Science, Golestan University, Gorgan, Iran

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ABSTRACT

The marsh frog, *Pelophylax ridibundus*, is reported from all over Iran except from the southeast and central deserts. This study provides records of 12 specimens of *Pelophylax ridibundus* from the easternmost extent of its range in Iran, Zabol, Sistan, and Baluchestan Province. Morphological, morphometric, and karyological characteristics of the specimens were investigated and compared with populations from other parts of Iran. Zabol specimens demonstrated $2n = 26$, comprising one pair of metacentric, six pairs of submetacentric, and six pairs of subtelocentric chromosomes. Karyological results indicated Zabol specimens are the same as specimens from the central north of Iran. In addition, specimens from the southeast of Iran demonstrated a lower than average size except for tympanum and inter naris length compared with that of specimens from the north, and the northeast of Iran which may be the result of implications of Bergmann's rule due to the higher temperatures of the region.

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Introduction

The marsh frog, *Pelophylax ridibundus* (Pallas, 1771), was recorded from the northern coast of Caspian Sea and Volga River, for the first time. This species was nominated as *Rana ridibunda* until recently, but due to the paraphyletic situation of the genus *Rana* (Chen et al 2005; Che et al 2007; Frost et al 2006) the name changed to *P. ridibundus* (Frost 2013). However, both names have been used by different authors; we applied *P. ridibundus* because of its priority.

Biogeographically, the easternmost range of *P. ridibundus* is in Kazakhstan (Berezovikov et al 2001), a few restricted localities in China (Fei et al 1999; Ye et al 1993), and an introduced population in Siberia (Bannikov et al 1977; Kuzmin 1999). It has not been reported from the Indian peninsula or southern parts of Afghanistan beside the central and southeast region of Iran (Kuzmin et al 2009).

In addition, it has been excluded from the amphibian checklist of Pakistan (Khan 2008). It is distributed as far south as some isolated populations in Saudi Arabia (Schätti and Gasperetti 1994), Bahrain, and North Africa near the Nile River. In Europe, it is widely distributed as far west as the eastern coast of the Atlantic Ocean in France and some localities in the United Kingdom, Spain, Switzerland, and Belgium. The northern part of its range is in Latvia, however it seems that it is now extinct in Estonia (Arnold 2003; Kuzmin et al 2009). It has been reported to be widespread throughout Turkey but the taxonomic status of the different populations in the region has been problematic and subjected to much debate (Akin et al 2010; Arikan 1988; Arikan et al 1998; Beerli et al 1994; Sinsch and Schneider 1999).

Boulenger (1905) described *R. ridibunda susana* from the Shush, Khuzestan Province, southwestern Iran. In 1939, Schmidt reported *R. ridibunda ridibunda* from Esfahan, Fars, and Tehran Provinces (Schmidt 1939). Anderson (1963) reported only two species of anurans, *R. cyanophlyctis* and *R. ridibunda ridibunda* from Iran. Baluch and Kami (1995) reported *R. ridibunda* from all over Iran except southeast and central deserts of Iran. Rastegar-Pouyani et al (2008) mentioned *R. (Pelophylax) ridibunda ridibunda* in the checklist of amphibians and reptiles of Iran.

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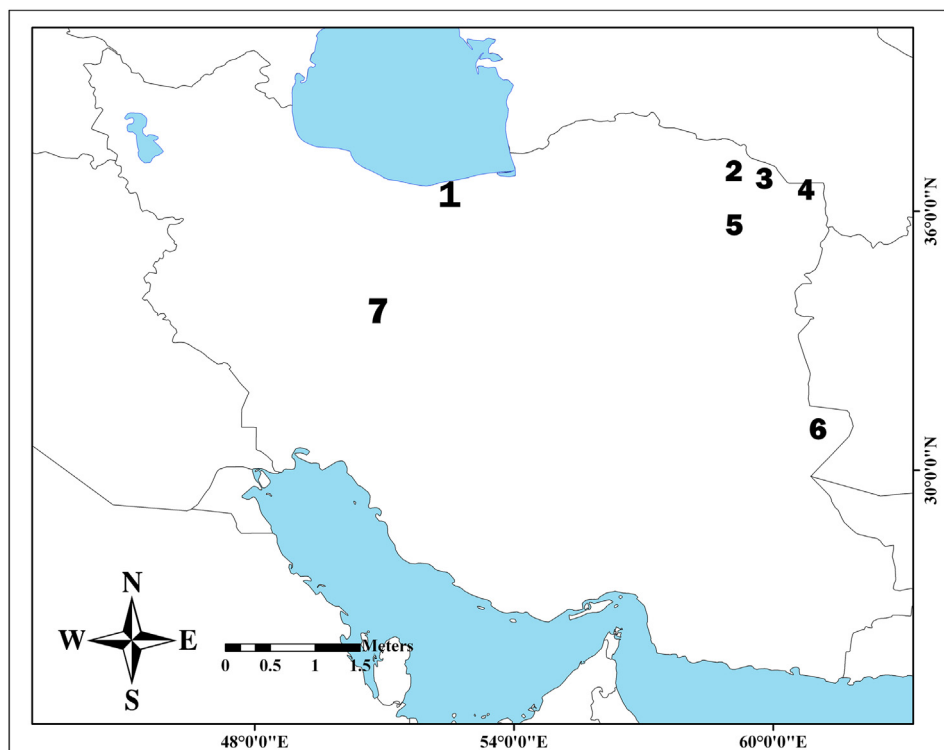


Figure 1. Map shows the sampling localities of *P. ridibundus* from Iran by different authors mentioned in the text and this study. 1, Mazandaran Province; 2, Dargaz; 3, Kalat; 4, Sarakhs; 5, Mashhad; 6, Zabol; 7, Markazi Province.

In recent years some limited studies were done on the populations of *P. ridibundus* in the different regions of Iran. Karyological and morphometric studies were carried out on populations of *P. ridibundus* from Mashhad, Sarakhs, Kalat, and Dargaz, in the northeast of Iran (Nemati 1998). Molavi (2000) studied the morphology, morphometry, and karyology of the genus *Rana* in Iran. Larval growth and evaluation of a population size on *R. ridibunda* in Anzali Wetland were reported by Mirzajani et al (2006). Hazaveh (2006) and Hasheminejad (2009) investigated the biology and ecology of *R. ridibunda* in the Markazi Province in central north Iran and Mazandaran Province in north Iran respectively. In this study, *P. ridibundus* was reported from Sistan and Baluchestan in the southeast of Iran, and its morphological and morphometric characters were investigated as well as its karyotype features.

Materials and methods

Study area

Specimens were collected from Zabol City, Sistan, and Baluchestan Province, southeastern Iran. Zabol City is located in the Iranian part of Sistan, which is a low altitude plain. Geographically, the Sistan Plain is in the western part of the Helmand block and was shaped during the Neogene. The region was covered with discharged alluvial from the Helmand River and Hamoon Lake (Whitney 2006). The most special characteristic of the region is the severe differences in temperature during day and night ($> 25^{\circ}\text{C}$ in the summer). The region even consists of a part of the Lut Desert, one of the most arid deserts in the world. Also, the region is a place of a gale-force wind called the “120 day wind”. It is a north to south wind blowing dust storm that takes place during the summer months. These dry winds cause a decline in the humidity of the

region during the summer. Additionally, the region has recently undergone a multi-year drought. In general, the region demonstrates Mediterranean rainfall with the highest precipitation occurring in the fall and winter (Pahlavanruiy 1997). Aridity of the region causes low diversity of amphibians except for some sparse aquatic habitats which have remained even after the control of the Helmand flow by the Afghanistan government. The dominant plant species of the area include *Alhagi maurorum*, *Salsola incanescens*, *Cyperus rotundus*, *Aeluropus litoralis*, and *Atriplex canescens*. Living amphibians of the region consist of *Duttaphrynus stomaticus*, *Duttaphrynus olivaceus*, *Bufo tessurdus*, and *Euphlyctis cyanophlyctis* (Baluch and Kami 1995; Rastegar-Pouyani et al 2008; Frost 2013; Khajeh et al 2014).

Materials

A total of three juvenile and nine adult marsh frogs were collected during this study from Zabol, Sistan, and Baluchestan Province (Figure 1) in March 2013 and July 2013. Specimens were

Table 1. Karyotypic characteristics of *Pelophylax ridibundus* from Iran; $2n$: diploid chromosome number.

Locality	$2n$	MP	SMP	STP	Authors
Mashhad, northeast Iran	26	5	7	1	Nemati 1998
Kalat, northeast Iran	26	7	4	2	Nemati 1998
Sarakhs and Dargaz, northeast Iran	26	5	5	3	Nemati 1998
Gorgan, north Iran	26	7	5	1	Molavi 2000
Markazi Province, central north Iran	26	1	6	6	Hazaveh 2006
Mazandaran, north Iran	26	4	5	4	Hasheminejad 2009
Mashhad, northeast Iran	26	2	6	5	Fakharzadeh et al 2009
Zabol, southeast Iran	26	1	6	6	Present study

MP = metacentric pairs; SMP = submetacentric pairs; STP = subtelocentric pairs.

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