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Original article

Comparison of morphometric and gravimetric measurements of Common Skittering Frog (*Euphlyctis cyanophlyctis*) from paddy fields and urban wetlands

Muhammad Jawad Jilani [a], Muhammad Rais [b,*], Muhammad Arslan Asadi [a], Tariq Mahmood [b]

[a] Wildlife and Conservation Management Services, Barari Forest Management, Sir Bani Yas Island, Abu Dhabi, United Arab Emirates
[b] Department of Wildlife Management, PMAS-Arid Agriculture University Rawalpindi, Muree Road, Shamsbabad, Rawalpindi 46000, Pakistan

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ABSTRACT

Frogs are common in aquatic habitats such as marshes, edges of water bodies and paddy fields. High prevalence of deformed frogs as well as reduction in body length, head length, limb size, growth rate and increase in liver weight are known from various frog species occurring in pesticide contaminated sites. We hypothesized that snout-vent length, liver, kidney, body weight and growth of Common Skittering Frog inhabiting areas contaminated by pesticides and fertilizers such as paddy fields of District Gujranwala, Punjab, Pakistan, do not differ than those from areas with less pesticide and fertilizer use such as urban wetlands in Rawalpindi-Islamabad Districts. Our results revealed statistically significant differences in measurements such as in snout-vent length, inter-orbital width, distance from front of eyes to the tip of snout, distance between the nostrils, inter-nasal space, distance from front of eyes to the nostrils, distance from nostrils to the tip of snout, distance from tympanum to the back of eyes, forelimb length and body weight of frogs from paddy fields and urban wetlands. We found a strong significant relationship between snout-vent length and body weight of female frogs collected from paddy fields and urban wetlands and of male frogs collected from paddy fields only. We found that Common Skittering Frog had a higher growth in paddy fields, presumably due to abundance of food. Our study documented first record of a deformity (micromelia) and an abnormality (gas bubble disease) in Common Skittering Frog from Pakistan. We suggest detailed studies on food availability and consumption by Common Skittering Frog in the paddy fields and urban wetlands to understand factors influencing the growth pattern.

1. Introduction

It is estimated that about 30% of the anurans species are threatened globally (Stuart et al., 2004). Studies suggest that more than 500 populations of frogs, toads, and salamanders are declining (Alford and Richards, 1999). The phenomenon of amphibian decline and underlying causes are yet not fully understood. However, it is believed that numerous factors such as climate change, increased exposure to ultraviolet radiation, pathogens, introduced species, habitat destruction and modification, acid rain, and chemical stressors such as pesticides and fertilizers are the main threats to amphibian populations (Blaustein et al., 2003; Boone and Bridges, 2003).

Frogs are closely linked to well watered areas such as marshes, edges of water bodies and croplands particularly paddy fields (Bambaradeniya et al., 2004; Rais et al., 2015). Extensive use of fertilizers and pesticides has greatly altered habitat quality of agricultural sites affecting anuran populations (Manna et al., 2009). Anuran fauna of Pakistan is represented by 25 species belonging to four families (Pratihar et al., 2014). Frog species such as *Euphlyctis cyanophlyctis* and *Fejervarya limnocharis* are quite abundant in the plain areas of Pakistan, and are associated with a variety of wetland habitats such as paddy fields (Khan, 2006).

Reductions in body length, head length, limbs size, growth rate and increase in liver weight are known from frog species occurring in pesticide contaminated sites (Crawshaw and Weinkle, 2000;

* Corresponding author.
E-mail address: sahil@uaar.edu.pk (M. Rais).

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Amor et al., 2009; Thammachoti et al., 2012). High prevalence of deformed frogs is reported from the vicinity of agricultural areas with extensive pesticide and fertilizer use (Hayes et al., 2002; Khan and Law, 2005; Taylor et al., 2005). It is believed that toxic effects of pesticides, fertilizers and heavy metals result in deformities in anurans (Alford et al., 2001; Story and Cox, 2001; Fort et al., 2006).

The most recent studies on anurans in Pakistan focus on estimating abundance of frog species. Yousaf et al. (2010) recorded mean population densities of Bull Frog (*Hoplobatrachus tigerinus*) and Common Skittering Frog (*Euphlyctis cyanophlyctis*) as 25.07 frogs ha^{-1} from the paddy fields of Gujranwala, Punjab Province. Tabassum et al. (2011) reported mean population density of Common Skittering Frog as 0.46 ± 0.11 frogs ha^{-1} from Rawal Lake, Islamabad. Shaikh et al. (2012) recorded variations in dorsal body color, body length and body weight of 23 specimens of Common Skittering Frog collected from different sites of Province Sindh, Pakistan.

Review of the literature revealed that farmers in areas under rice cultivation in Pakistan use chemical fertilizers to obtain a good yield of rice crop. About 81% of farmers used 100–150 Kilograms of chemical fertilizer per acre (GoP, 2008). Likewise, about 96% of farmers use pesticides such as fungicides: Topsin-M (thiopenate methyl); herbicides: Acetachlor (acetachlor), Butachlor (butachlor) and insecticides such as Cartap (cartap hydrochloride) in the paddy fields (Asghar, 2010). Further, it is estimated that cotton crop accounts for about 80% of Pakistan's pesticide use (NFDC, 2002). On contrary, croplands of Potohar such as Chakwal, Attock and Rawalpindi-Islamabad receive very less pesticide application (Hussain et al., 2006). The cotton and rice crops are not grown in Rawalpindi-Islamabad.

Knowledge on the effect of pesticide and fertilizer on body measurements of frog species, inhabiting areas differing in level of pesticide and fertilizer usage, from Pakistan is lacking and not yet reported in the literature. We hypothesized that snout-vent length, liver, kidney and body weight and growth of Common Skittering Frog inhabiting areas contaminated by pesticides and fertilizers such as paddy fields of District Gujranwala, Punjab, Pakistan, do not differ than those from areas with less pesticide and fertilizer use such as urban wetlands in Rawalpindi-Islamabad Districts.

2. Methods

2.1. Study area

We collected frogs from the paddy fields (42 ♀, 33♂) of District Gujranwala, Punjab, Pakistan (Fig. 1A, B) and from ponds, referred to as urban wetlands from here onwards, (41 ♀, 34♂) in Pir Mehr Ali Shah Arid Agriculture University Rawalpindi (PMAS AAUR) campus, Rawalpindi, and Rawal Lake, Islamabad (Fig. 2C, D). The district is the second largest (over 500,000 tons) rice producer in Pakistan. Rice crop is sown during April to June and is harvested from October to December.

The areas of Rawalpindi-Islamabad experience a humid subtropical climate with long and very hot summers, a short monsoon

Fig. 1. Paddy Fields in Gujranwala, Punjab, Pakistan (A&B); Urban Wetlands: Pond near tube well at PMAS Arid Agriculture University Rawalpindi (C) and irrigation canal (D) at Rawal Lake, Islamabad.

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