http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 10 (8): 1321-1325, 2007
ISSN 1028-8880

Biosystematic Study of Anura in the Markazy Province of Central Iran

[1]Hezaveh Nasim, [1]Ghassemzadeh Fereshteh and [2]Tyler Michael
[1]Department of Biology, Faculty of Science, Ferdowsi University of Mashhad, Iran
[2]Environmental Biology, School of Earth and Evironmental Science,
The University of Adelaide, SA, Australia

Abstract: Only recently Anuran fauna of Iran has been studied systematically. In order to study the biosystematics of Anuran in the Markazy Province, 122 specimens were collected from six stations during spring and summer 2004-2005. Samples were transferred alive to the zoology laboratory, identified and were preserved. The samples composed of the marsh frog, *Rana ridibunda* and the green toad, *Bufo viridis*. The phenetic studies between populations of the two species, 14 characteristics in frog and 17 characteristics in toad were measured. T-test analysis between sexes were significant in 12 characteristics for frogs and only one characteristic for toads ($p<0.001$). One way ANOVA between populations for each species were significant in 13 characteristics for frogs and 6 characteristics for toads ($p<0.001$). Difference between multivariate mean vectors confirmed in T^2 Hotelling for populations and sexes of marsh frog ($p<0.001$). Length of foot and femur were discriminated distinct sexes based on discrimination analysis with 89% correct grouping for frogs and space between eyelids with 92% correct grouping for toads. Discrimination analysis between populations discriminated groups based on two functions with 78% correct grouping in frogs and 88% correct grouping in toads. Cluster analysis based on centroids grouped populations resulted from geographical and ecological conditions.

Key words: Amphibia, Anura, *Bufo*, *Rana*, Iran

INTRODUCTION

The development of vertebrates began in the water. Land was truly invaded when the amphibians moved on to it. Environmental factors are often more significant for them than for other vertebrate classes (Grzimek, 1986). Amphibian populations are declining in many part of the world (Blaustein *et al*., 1994; Blaustein and Kiesecker, 2002). The disappearance of frogs, toads and salamanders have been reported in areas of south, central and north America, Europe, Asia, Africa and Australia (Alford and Richards, 1999; Blaustin and Kiesecker, 2002). Because of significant in food chain and their potential for living sources, a worldwide decline of amphibians could have a huge impact on other organisms, including humans. Amphibians are integral components of many ecosystems, often constituting the major component of vertebrate biomass (Pounds and Crump, 1994).

Unfortunately Iran, a zoogeographically important country, lacks any recent, detailed survey of its amphibian fauna, except for the short review by Leviton *et al.* (1992) and Firouz (2005). Eighteen species of amphibians are known from Iran; these include seven salamander and 11 anurans (Baloch and Kamy, 1973). Anurans include a pelobatid (6%), a hylid (6%), six toads (33%) from three species groups and three ranids (17%) from two genera. However, karyological evidence demonstrate the occurrence of both diploid (*Bufo viridis*) and tetraploid (*Bufo danatensis*) species in the former Soviet Central Asia (Duellman, 2002). The majority (83%) of Iranian amphibians is composed of Palearctic elements. The northern (Southern Caspian Sea) and western (Urmia-Zagros) parts of Iran have a richer fauna than other parts. These differences might be explained by climatic or historical factors (Duellman, 1999, 2002). Since the Markazy Province is located in central Iran, it is important to identify its amphibian to compare with other parts of Iran such as Khorasan Province (Eastern Iran).

MATERIALS AND METHODS

Samples of males and females of *Rana ridibunda* and *Bufo viridis* were collected from the Markazy Province of central Iran during spring and summer 2004-2005. For a

Corresponding Author: Ghassemzadeh Fereshteh, Department of Biology, Faculty of Science, Ferdowsi University of Mashhad, Iran

Table 1: Conventional characteristics in frog and toad

Sr. No.	Characteristics	
1	Distance between eyelids	EL
2	Width of upper eyelid	UE
3	Eye diameter	ED
4	Diameter of tympanum	DT
5	Length of femur	F
6	Length of Tibia	T
7	Length of To.	L.To
8	Length of foot	L.F
9	Length of first toe	D.P
10	Body length	L
11	Head length	L.C
12	Distance between eye and external nostril	D.r.o
13	Distance between nostril	N.d
14	Length of C.int	C.int
15	Length of Parotid gland	Pa.l
16	Width of Parotid gland	Pa.w
17	Distance between parotid glands.	Pa.d

survey of phenetic variation between populations of two species 14 characteristics in frogs and 17 characteristics in toads were measured (Table 1). SPSS software was used to compare Markazy province with the Khorasan province populations.

RESULTS

T-test analysis comparing males and females in the populations at Markazy and Khorasan demonstrated that populations of *Bufo* were separated only by the distance between the parotid glands (Pa.d), ($p = 0.003$). In *Rana* populations, means of characteristics between sexes were not significant for two characteristics, Diameter of Trympanum (D.T), (0.193) and distance of nostrils (N.d), (0.925).

For study the means of between sexes, T^2 Hoteling analysis demonstrated that *Rana ridibunda* had sexual dimorphism ($p = 0.000$, $F = 7.63$) but *Bufo viridis* did not have sexual dimorphism ($p = 0.08$, $F = 1.7$). Difference between multivariate mean vectors confirmed in T^2 Hotelling for population of male marsh frog ($p = 0.000$, $F = 7.26$) and female marsh frog ($p = 0.000$, $F = 5.48$). For population of green toad ($p = 0.000$, $F = 9$). Principle Component Analysis (PCA), in male marsh frog population, exploited 2 means components ($p_1 = 9.2$, $p_2 = 1.17$). That first component expressed 66.3% changes and second component 8% changes.

Dispersion of specimen based upon 2 first components showed that Markazy and Khorasan populations were separated by first component (Fig. 1). Length of body (L), Tibia (T), Femur (F), head (L.C) and length of Foot (L.F) characteristics had the most effect on first component.

Discrimination analysis in male marsh frog exploited 4 means functions. Dispersion of male populations based upon first and second function showed that Markazy and Khorasan populations were separated by function 1 (Fig. 2). Length of Tibia (T) and Femur (F), had the most effect on function 1. Therefore base upon scale, in Khorasan province populations, Length of Tibia (T) and Femur (F) were longer than Markazy populations.

Cluster analysis based on centroids demonstrated that Markazy and Khorasan populations fall into two separate groups (Fig. 3).

Statistical analysis of female *Rana ridibunda* produced a similar result to males.

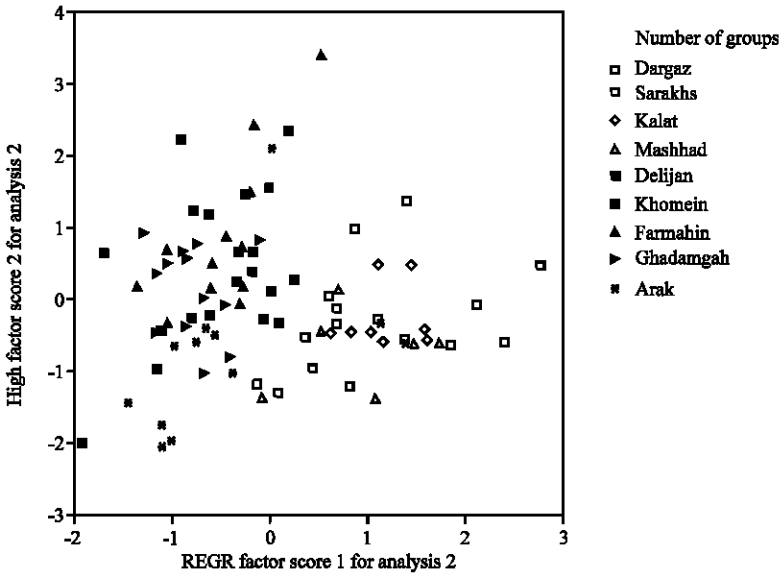

Fig. 1: PCA Dispersion of male *Rana ridibunda*

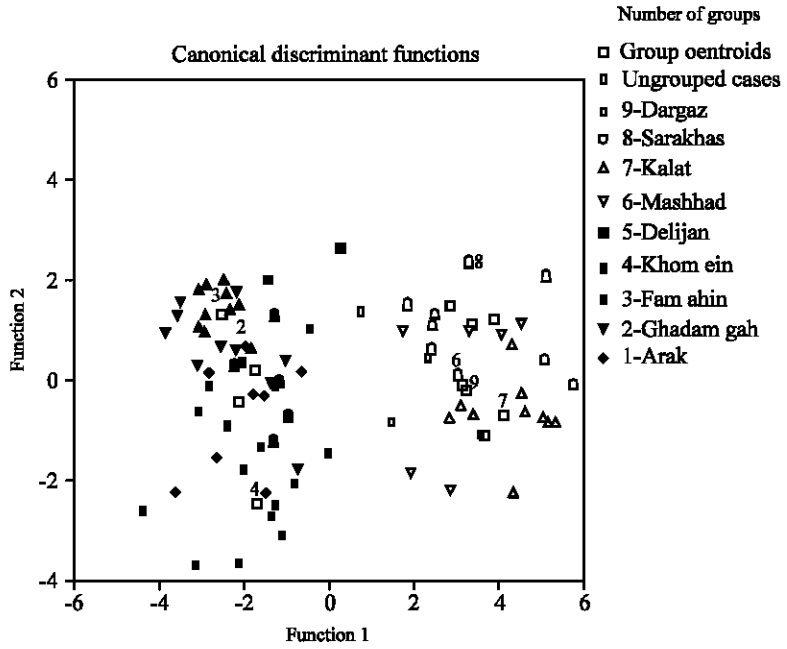

Fig. 2: Dispersion of male *Rana ridibunda* based on function 1, 2

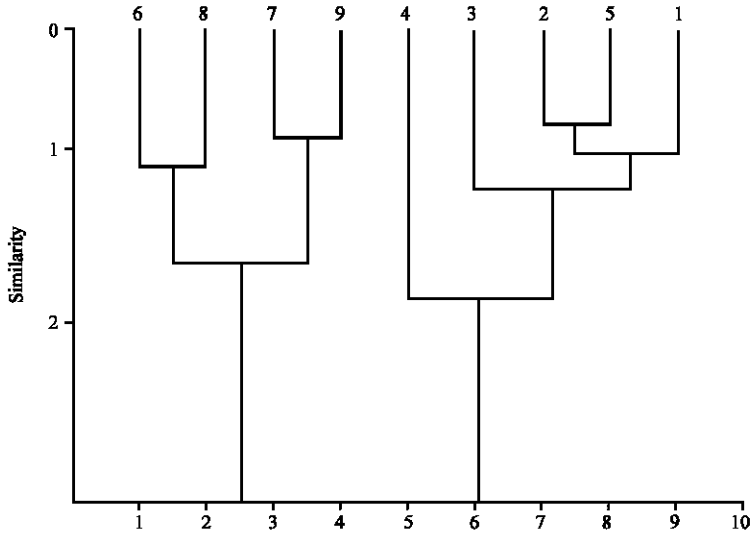

Fig. 3: Dendrogram of male *Rana ridibunda* (1-5, Markazy province and 6-9, Khorasan province)

Principle component analysis (PCA), in green toad populations, exploited 4 means components ($p_1 = 10.28$, $p_2 = 2.19$, $p_3 = 0.73$, $p_4 = 0.67$).

Dispersion of specimens based on 2 first components showed that Markazy and Khorasan populations were separated by component 1 (Fig. 4). Length of body (L), length of Foot (L.F) and length of Parotid glands (L.Pa), characteristics had the most effect on first component.

Discrimination analysis in green toad populations exploited 4 means functions. Populations dispersion based on first and second function showed that Markazy and Khorasan populations were separated by function 1 (Fig. 5). Length of Parotid glands (L.Pa), had the most effect on function 1. Therefore based upon scale, in Khorasan province populations, the length of parotid glands (L.Pa) was longer than Markazy populations.

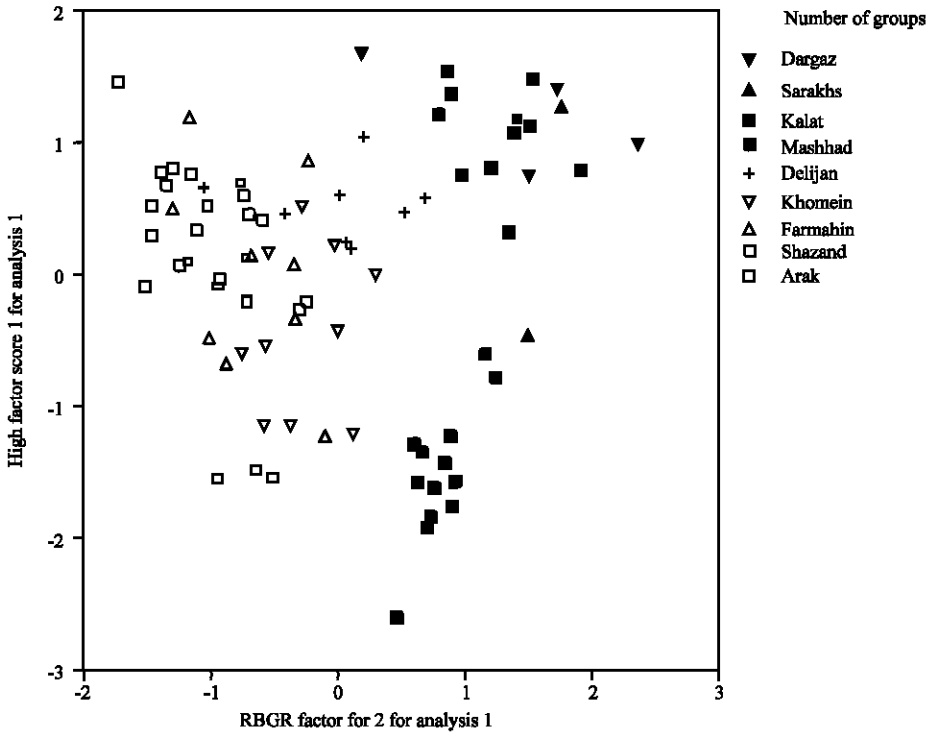

Fig. 4: PCA dispersion of *Bufo viridis*

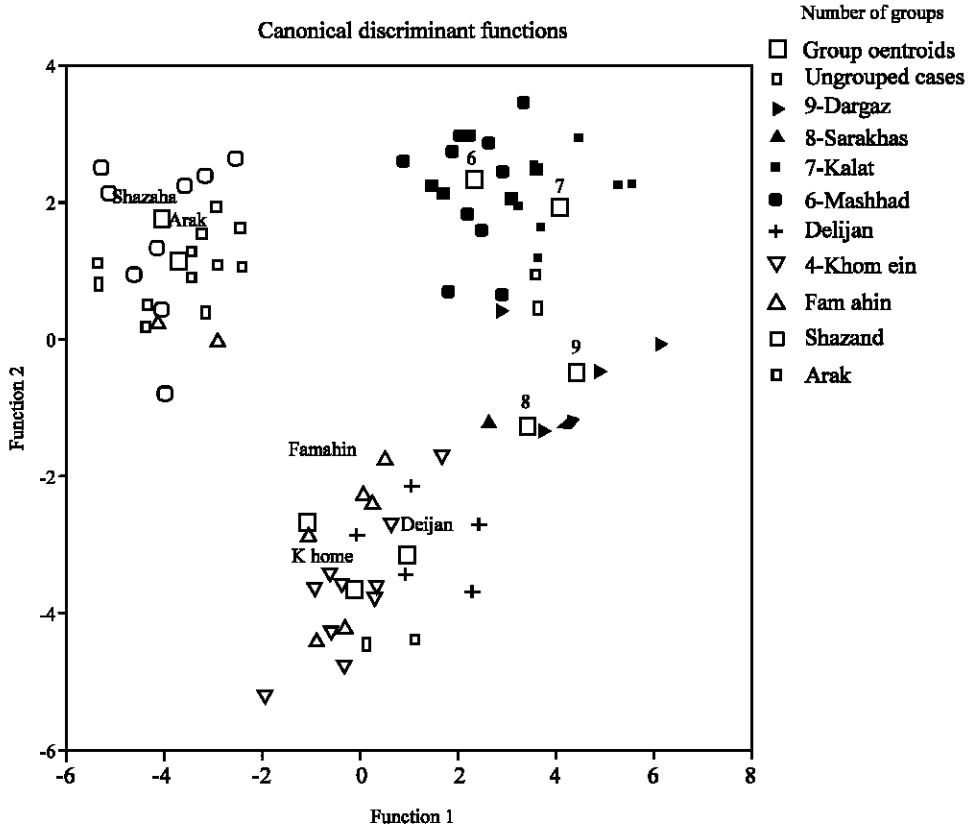

Fig. 5: Dispersion of *Bufo viridis* based on function 1,2

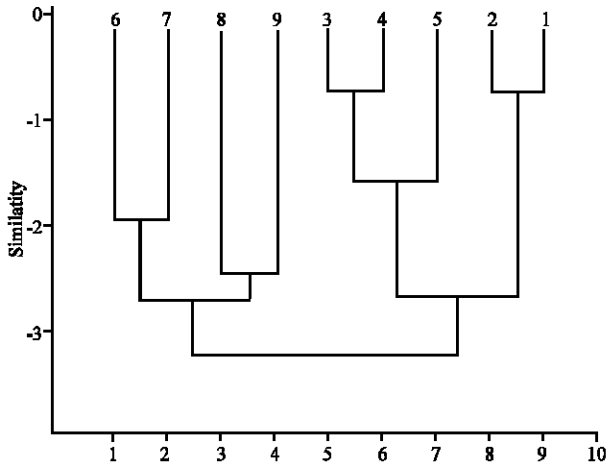

Fig. 6: Dendogram of *Bufo viridis* (1-5, Markazy province and 6-9, Khorasan province)

Cluster analysis based on centroids demonstrated that Markazy and Khorasan populations fell into two separate groups (Fig. 6).

DISCUSSION

ANOVA analysis conventional characteristic of the marsh frog (*Rana ridibunda*) showed sexual dimorphism, which corresponded with the result of previous research done in Khorasan province Fakharzadeh (2003), Nematy (1998) and Molavi (2000). Multivariate analysis showed separation of Khorasan populations and Markazy province. This study demonstrated that length of Femur (F) and length of body (L), have more variety between populations. The causes could be ecological conditions and genetic differences. The grouping of *Bufo viridis* populations in multivariate analysis was more significant than *Rana ridibunda* populations. This could be caused by Parotid glands features that have the most variety among populations.

REFERENCES

Alford, R.A. and S.J. Richards, 1999. Global amphibian declines. A problem in applied ecology. Ann. Rev. Ecol. Syst., 30: 133-165.

Baloch, M. and H. Gh. Kamy, 1973. Amphibians of Iran. Tehran University Press, pp: 177.

Blaustein, A.R., D.B. Wake and W.P. Sousa, 1994. Amphibian declines judging stability/persistence and susceptibility of populations to local and global extinctions. Conserv. Biol., 8: 60-71.

Blaustein, A.R. and J. Kiesecker, 2002. Complexity in conservation: Lesson from the global decline of Amphibian populations. Ecol. Lett., 5: 597-608.

Duellman, W.E., 1999. Patterns of Distribution of Amphibians. A Global Perspective. John Hopkins University Press, pp: 633.

Duellman, W.E., 2002. An Overview of Anura Phylogeny, Classification and Reproductive Modes. In: Reproductive Biology and Phylogeny of Anura. Jamieson, B.J.M. (Ed.). Vol. 2. Sci. Publ., pp: 1-18.

Fakharzadeh, F., 2003. Biosystematic study of north and north east of Khorasan province Anura. M.Sc Thesis, Faculty of Sciences, Ferdowsi University of Mashhad, pp: 156.

Firouz, E., 2005. The Complete Fauna of Iran. I.B.Tauris Publisher, pp: 322.

Grzimek, B., 1986. Animal Life Encyclopedia. Van Nostrand Reinhold, 5: 555.

Leviton, A.E., S.C. Adler, K. and S.A. Minton, 1992. Handbook to Middle East Amphibians and Reptiles, SSAR, Oxford, Ohio (Contribution to Herpetology No. 8), pp: 1-252.

Molavi, D.F., 2000. Biosystematic study of Rana genus in Iran. Msc. Thesis, Shahid Beheshty University, pp: 217.

Nematy, A., 1998. Boisystematic study of Khorasan Province Anura. MSc. Thesis, Ferdowsi University of Mashhad, pp: 177.

Pounds, J.A. and M.L. Crump, 1994. Amphibian declines and climate disturbance. Conserv. Biol., 8: 72-85.