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Distribution and Electrophoretic Aspects of Blood-Serum Proteins of the Genus *Spermophilus* (Mammalia: Rodentia) in Eastern Turkey and Iran

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Abstract: Blood-serum proteins of 36 specimens of the genus *Spermophilus* from Turkey and Iran were analysed electrophoretically. Two species of *Spermophilus xanthopyrmnus* and *Spermophilus fulvus* were recorded from Iran. There are 9-11 bands in globulin zone, 1-2 bands in post albumin zone, 2 bands in prealbumin zone and 2-3 bands in fast zone in *S. xanthopyrmnus* and 9-11 bands in globulin zone, 1-2 bands in post albumin zone, 3 bands in prealbumin zone and 2-3 bands in fast zone in *S. fulvus*. Prealbumin of blood-serum proteins distinguished *S. xanthopyrmnus* from *S. fulvus*. *S. xanthopyrmnus* is the first record for rodent fauna of Iran.

Key words: Globulin, albumin, prealbumin, SDS-PAGE, Turkey, Iran

INTRODUCTION

Bennet (1835) first described *S. xanthopyrmnus* from Erzurum (Turkey). In the latest taxonomic study in Turkey, Doğramacı *et al.* (1994) stated that ground squirrels in Central Anatolia is *S. xanthopyrmnus*. *Citellus fulvus fulvus* recorded by Ellerman and Morison-Scot (1951) and *S. fulvus* by Etemad (1977) from Iran.

According to Wilson and Reeder (1993), *S. xanthopyrmnus* extends over Anatolia-Turkey, *S. fulvus* is distributed in Kazakhstan, from the Caspian Sea and the Volga River to Lake Balkash; South trough Uzbekistan, W Tadzhikistan and Turkmenistan to NE Iran and N Afganistan; W Xinjiang (China). These findings confirmed the presence of *S. xanthopyrmnus* and *S. fulvus* in east Anatolian-Turkey and Iran. The aim of present study is to analysis patterns of blood serum proteins of *S. xanthopyrmnus* from East Anatolian-Turkey of *S. fulvus* from Iran and contribute to their taxonomic status.

MATERIALS AND METHODS

Electrophoretic analysis was performed on 36 live specimens of *S. xanthopyrmnus* (n = 27) and *S. fulvus* (n = 9) (Fig. 1).

Blood was taken by cardiac puncture from the animals anaesthetised with ether. After blood clotting the separated sera were centrifuged at 12000 rpm for 3 min. The sera were mixed with a sample buffer containing 0.0625 M Tris Cl, pH 6.8, 2% SDS, 10% Glycerol, 5% 2-Mercaptoethanol and 0.01% Bromphenol Blue (Laemmli, 1970) and the sera was adjusted to 5% in the mixture. Samples were boiled for 3 min and stored at -70°C until electrophoresis. Amount of protein loaded to gel was qualitatively determined by the method of Esen (1978). Samples of 10 to 15 μL were applied to gels in different experiments. Electrophoresis was carried out using Consort E 863 model vertical slab gel electrophoresis apparatus. SDS-polyacrylamide denaturing gels, separating gels (7.5 %) and stacking gels (4 %) were prepared as described by Sambrook *et al.* (1989). Electrophoresis buffer contains 0.025 M Tris, 0.192 M Glycine, 0.1% SDS at pH 8.3 (Sambrook *et al.*, 1989). Molecular Weight Marker (Sigma MW-SDS-200) consists of carbonic anhydrase (29.000 D), egg albumin (45.000 D), bovine albumin (66.000 D), phosphorylase B (97.400 D), β-galactosidase (116.000 D), myosin (205.000 D).

Constant voltage (8 V cm^{-1}) was applied to stacking gel. After tracing the dye attained the separating gel, the voltage was adjusted to 15 V cm^{-1}. After electrophoresis, gels were stained with 0.25% Coomassie Brillant Blue R250 in 90 mL of methanol: water (1: 1 v/v) and 10 mL glacial acetic acid and destained in methanol: water: acetic acid (45: 45: 10) (Sambrook *et al.*, 1989).

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RESULTS

***Spermophilus xanthoprymnus* (Bennet, 1835)**

Habitat: *S. xanthopyrymnus* lives in step area with sparse grass and sometimes cultivated area in Turkey and Iran.

Distribution: We recorded firstly *S. xanthopyrymnus* from Makü (Iran). Also, Üzümlü, Digor, Doğubeyazit, Özalp are new localities for *S. xanthopyrymnus* (Fig. 1).

Blood Serum Proteins: There are 9 bands in globulin zone of 16 specimens of *S. xanthoprymnus* from Erzincan, Erzurum, Özalp, Başkale and Digor, 10 bands in 6 specimens from Makü and 11 bands in one specimen from Makü; one band in postalbumin zone of 15 specimens from Erzincan, Erzurum, Özalp, Doğubeyazit and Başkale and 2 bands in 9 specimens from Digor and Makü. Variation in albumin zone was not observed. All specimens of *S. xanthoprymnus* fixed to 2 bands in prealbumin zone. Six specimens from Başkale had 3 bands in fast zone, while the other specimens have two bands (Fig. 2 and 3).

***Spermophilus fulvus* (Lichtenstein, 1823)**

Habitat: *S. fulvus* inhabits in dry step area with sparse grass and edge of cultivated area.

Distribution: Hamedan is new locality for *S. fulvus* (Fig. 1).

Blood serum proteins: Globulin zone contains 9 bands in two specimens from Zanjan and Mashad, 10 bands in 4 specimens from Hamedan and Zanjan as well as 11 bands in 3 specimens from Mashad. One band in five specimens from Zanjan and Mashad was detected, whereas 3 specimens from Hamedan and Mashad had two bands. There was only a single band in specimens from all localities. Prealbumin zone had 3 bands in *S. fulvus*. Three bands appeared in fast zone in one specimen from Zanjan and two bands in the others (Fig. 2 and 3).

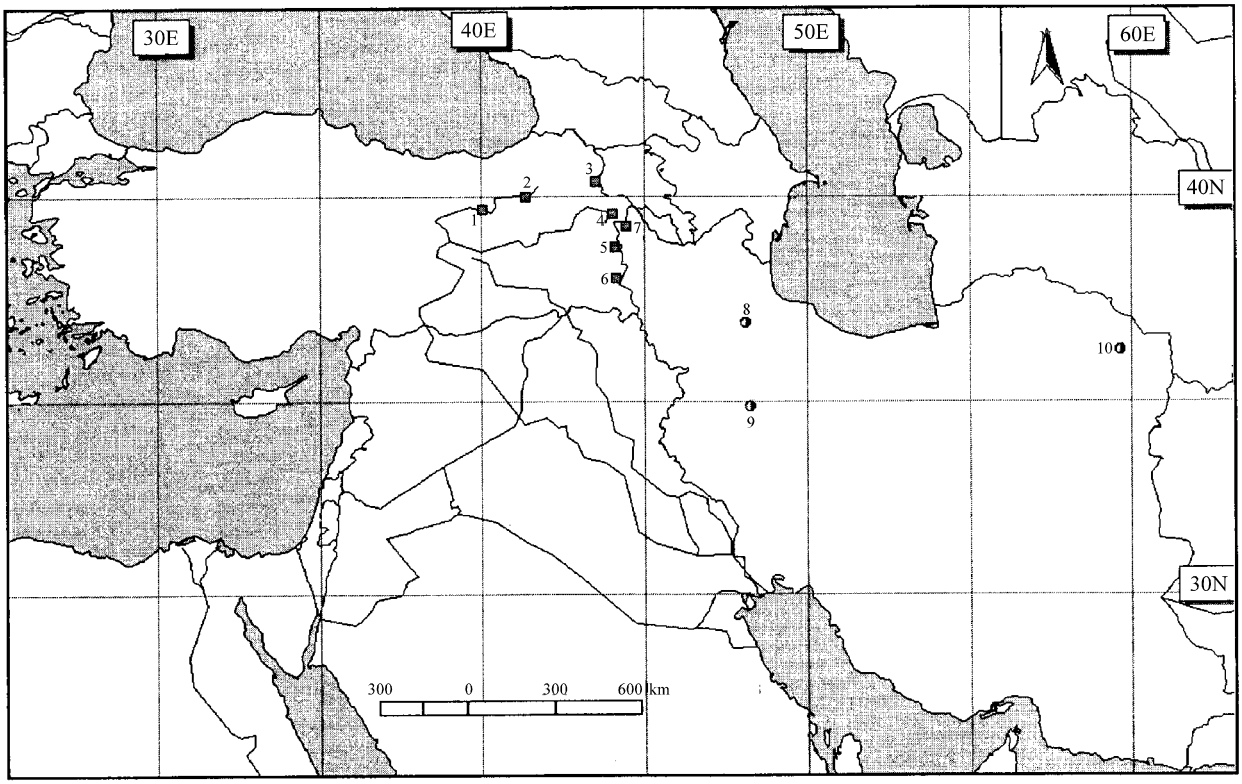

Fig. 1: Map showing localities of *S. xanthopyrmnus* 1.Erzincan (Üzümlü), 2. Erzurum, 3. Kars (Digor), 4.Ağri (Doğubeyazit), 5. Van (Özalp), 6. Van (Başkale), 7. Makü and *S. fulvus* (8. Zanjan, 9. Hamedan, 10. Mashad)

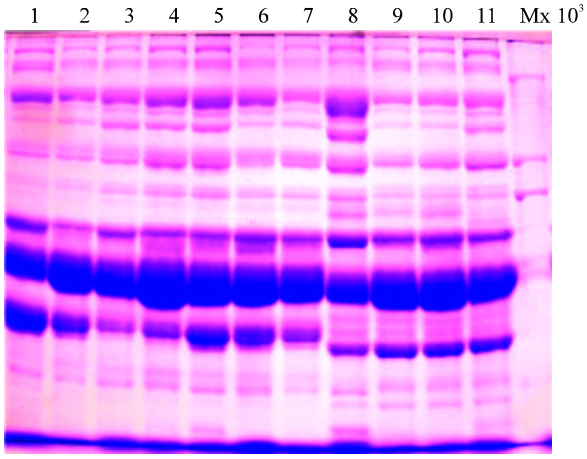

Fig. 2: SDS-PAGE zymogram of blood-serum proteins of *S. xanthoprymnus* (1. Erzincan, 2. Erzurum, 3. Kars, 4, 5. Van, 6. Ağri, 7. Makü) and *S. fulvus* (8, 9. Zenjan, 10; Hamedan, 11. Mashad). M: Marker

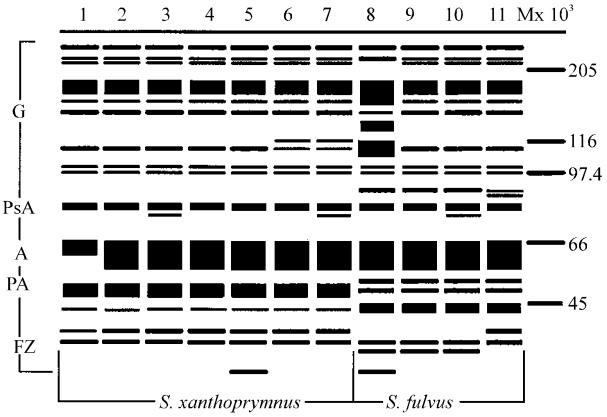

Fig. 3: SDS-PAGE patterns of blood-serum proteins of *S. xanthoprymnus* (1. Erzincan, 2. Erzurum, 3. Kars, 4, 5. Van, 6. Ağri, 7. Makü) and *S. fulvus* (8, 9. Zenjan, 10. Hamedan, 11. Mashad,). G: Globulin; PsA: Postalbumin; A: Albumin; PA: Prealbumin, FZ: Fast zone, M: Marker

DISCUSSION

Mursalolu (1964, 1965) described *Citellus citellus thracius* from in Thrace and *Citellus citellus gelengius* from Cihanbeyli (Konya) and stated that *Citellus citellus xanthoprymnus* is distributed in Anatolia base on the morphological and biometrical aspects. Doğramaci *et al.* (1994) also reported *S. citellus* from Thrace and *S. xanthopyrmnus* from Anatolia based on karyological aspects. Çolak and Özkurt (2002) determined 9 to 10 bands in globulin region of *S. xanthopyrmnus* from Anatolia. According to Çolak and Özkurt (2002), there is also variation in populations from Anatolia in respect to the prealbumin zone, exception to Akseki population. We analysed specimens from northern Turkey and western Iran and found 9-11 bands in globulin zone, 1-2 bands in post albumin zone, 2 bands in prealbumin zone and 2-3 bands in fast zone in *S. xanthopyrmnus*, 9-11 bands in globulin zone, 1-2 bands in post albumin zone, 3 bands in prealbumin zone and 2-3 bands in fast zone in *S. fulvus*. These findings showed that prealbumin distinguished *S. xanthopyrmnus* from *S. fulvus*. Also, we recorded firstly *S. xanthopyrmnus* from Iran.

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