The feeding habits of fire salamander,*Salamandra infraimmaculata semenovi (*Amphibia:Caudata:Salamandridae) from three population in western iran , Kurdistan and Kermanshah provinces , examined using a nonlethal technique .

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Abstract :

Feeding habit in three populations of fire salamander, *Salamandra infraimmaculata semenovi* have been studied at Zagros mountain in western part if Iran, Kurdistan and Kermanshah provinces in June 2011. We conducted study using adut *S.i.semenovi* to determine (1) the prey composition of adult salamander , (2) probability differences between food habits of this species in three populations ,(3) whether adult size affects the diversity of prey items and (4) whether nonlethal stomach flushing is an effective technique for examining the diet of *S.i.semenovi* , and is there a significance differences in results of prey item examination between nonlethal technique (Stomach – Flushing) and direct observation (dissection). *S.i.semenovi* s adults consumed a wide diversity of prey items including small terrestrial invertebrates specially insects , The feeding habits obtaining data shows that Coleopteran with 38.3% of prey items have the most frequency in food contents . Gastropoda with 31.7% have the second place in the prey items

frequencies . Hymenoptera with 3.3% of prey item have the least frequency in *S.i.semenovi* food content. We found some differences in prey items frequency between three populations. The results show that the larger salamander (distinguished with S.V.L character, snout – vent length to the posterior tip of vent) consumed a wider diversity of prey items than smaller individuals. Our result also suggested that nonlethal stomach flushing did not affect survivorship and also there is no significance difference in result of prey items examination using the stomach flushing and dissection , so using the stomach flushing for feeding habit examination according to the number limitation and IUCN (2010) that categorized *S.i.semenovi* as near threatened is essential .These finding suggest that *S.i.semanovi* is a generalist predator that play important trophic roles in terrestrial ecosystems .

Keywords: *Salamandra infraimmaculata semanovi*, feeding habit, stomach content, terrestrial invertebrate.

Introduction:

In the absence of fish , salamanders are often the top predators in first – order strams and may structure ecosystem communities via predation (David and Welsch , 2004) examining diet composition and factors that affect the diet of salamander is important step in developing a more complete understanding of their role as predator in natural habitats (Cecala etal ., 2007) .There is a limit number of caudate in Iran , including species from *Neurergus* , *Triturus* , *Batrachuperus* and *Salamandra* genera (Balouch and kami , 1995) .There is only one species from *Slamandra* genus in western of Iran (central Zagros mountain) and it has also distribution in Iraq and Turkey too (Balouch and kami , 1995). The existence of fire salamander (*Salmandra infraimmaculata semenovi*)in Iran for the first time reported by Nesterove (1916) in Siah Guves village near Iran – Iraq border

(Balouch and kami,1995).Later this subspecies had been found in mountain areas around Sarvabad city in Kurdistan province (Rastegar – pouyani and Feizi , 2006) and also new extension to this species of salamander in paveh , Kermanshah province , western of Iran is discovered.In iran *S.i.semenovi* is considered to be vulnerable encountered at their habitats. New data regarding the distribution of this species shows that the altitude limit reached even 700m in Paveh , Kermanshah province . *S.i.semenovi* mainly lives in mountains springs, with cool, slow flowing water. In the steep slope of valleys with permanent slow water flow, they occult themselves under large stones on the shore or in humid soil covered with carious plants.Most of the time they are in approximately perpetual shaded places whit no clear sunshine during the day times. The mountain amphibian specially salamanders may play important roles as a predators within their habitat but we know little about actual predation by mountain-resident salamanders,specially *Salamandra infraimmaculata semenovi* on other organisms . The use of the food resources is a very important feature of the life history of a species , because its affects survival (Cuello etal ., 2006) .

There is no clear data about the food composition of *S.i.semenovi* There is evidence that other species of genus *Salamandra* , for example *Salamandra salamandra* , totally consume Annelidae , Gastropoda and Aracnidae as its prey items , in addition of invertebrates in *Salamandra salamandra* stomach contents , the plants fragment and small calculus have been found (lezau etal .,2010) .Such these researches can obvious the note worthy points about feeding behavior and species life cycle . During the year 2011 , field research was carried out to investigate some aspect of *S.i.semenovi* natural history.One of the most interesting traits is its feeding habits . This study has been conducted to determine : (1) trophic spectrum by describe prey composition of *S.i.semenovi* in three Localities

(Sarvabad , Nowgol , Paveh) and determining the probability similarities or differences of food items composition in these three populations(2) whether specimen size affects the diversity of prey items , (3) whether nonlethal stomach flushing is an effective technique for examining the diet of *S.i.semenovi* and is there any significant difference between the result of non lethal technique (Stomach – Flushing) and dissection , this inspection has been done according to conservational approaches for saving *S.i.semenovi* individuals as its categorized near threatened in IUCN (2010) .

Material and methods :

We analyzed stomach contents of 60 *Salamandra infraimmaculata semenovi* collected from three population (Sarvabad , Nowgol and Paveh) in western part of Iran. Salamanders were collected primarily in their natural habitats from April through June 2011. The S.V.L of all individuals examined was between 50 mm and 150 mm (measured to the posterior edge of the cloac to the nearest millimeter).After capturing we individually marked each animal and divided them coincidental in two groups. We examine stomach contents with two ways. First randomly 30 salamanders with miscellaneous sizes had been choose and collected their stomach contents with dissection. The other individuals used a non lethal procedure modified from the technique outlined by Griffith (1986) to remove stomach contents. During the capture time we anesthetized individuals with solution of 1 g Orajel ® /1 liter of tap water (Cecala etal .,2007) .The salamander were removed from anesthesia rinsed with distilled water. We used a sterile 10 ml syringe with a 20 – gauge needle and attached a sterile 30 mm long , 1.19 mm diameter section of silastic tubing (Dow corning , Catalog number 508 – 003), to the end of the needle to insert into each salamander oral cavity. We inserted 4-8 mm of tube in to the oral cavity of each salamander, then pumped 5 ml of distilled

water in to the gastric cavity so their stomach content flash out .For assurance that all stomach contents have been removed , we repeated the procedure until visual examination revealed no remaining prey items . Following all procedures individuals were returned to their point of capture within approximately two hours (maximal processing time, Figure 1). We collected the prey items in airtight tube and preserved them in 95%ethanol. The prey items have been identified to the lowest taxonomic group as possible. In one instance we were able to identify one group of prey items to Family but the other were identified only to orders .We used chi-square(sig = %47 < a = %5) to examine the significance differences between the result of food items in three studied populations. To examine the effect of stomach flushing method and dissection on the prey items we use descriptive comparison of results .We also used recoding and Pearson chi-square (sig = %47<a=%5) method to examining the relationship between S.V.L and diversity of prey items consumption.

Result:

We obtained 107 food items from 60 *Salamandra infraimmaculata semenovi* individuals. The food items were identified in to nine different taxonomic groups (Coleoptera , Gastropoda , Araneida , Hemiptera , larve of Lepidoptera, Homoptera , Diplopoda , Diptera and Hymenoptera).The most frequently consumed prey were Coleopteran (Family : Staphylinidae) which comprised 38.3% of all organisms ingested . Gastropoda 17.8% , Araneida 12.10% , Hemiptera 8.4% , larver of ;epidoptera 6.5% , Homoptera 6.5% , Diplopoda 4.7% , Diptera 3.7% and Hymenoptera have the least frequently consumed prey with 1.9% frequency .All prey items were terrestrial invertebrates(Figure 2 and Table 1). There are significance differences between the frequencies of food items in three populations. Sarvabad with 73.3% frequency for Coleoptera has the most

consummation for this prey items. Paveh with 66.7% and Nowgol with 58.3% have second and third places of Coleoptera consumption(Table 2). We found positive correlation between the S.V.L character of all individuals and the diversity of prey items(Table3). There is no significance difference between the result of food items examination by two dissection and stomach flushing methods(Figure 2 and 3).

Discussion:

Quantitative information up on the role of the amphibians in the ecosystems are important (Whiles etal .,2006). *Salamandra infraimmaculata semenovi* consume approximately a wide variety of prey items , suggesting that they are generalist predators similar to many other amphibians (Burton and ikens , 1976 ; Brophy , 1980 ; Parker and Goldstein , 2004) . The parallel researches that had done according to the stomach dissection and examination of it contants show that 70% of prey items of Leurognathus are Ephemeroptera and Tricoptera (Martof and Scott ,1957) . The study of red salamander food habits (*Plethadon cinereus*) shows that although this species has a miscellaneous food habit in different times during the year but Coleoptera , Oligochaeta and Isopoda are the most momentous food items (Maerz etal .,2006). The other investigation about *Plethadon cinereus* larva food habit showed that there is a positive correlation between the speed of feeding and water temperature and even larva with bigger size have more various food items than smaller ones. Such these investigation can obvious the note worthy points about the feeding behavior of the species. For example *Salamandra lanzai* has been recognized as opportunist predators that use various species of invertebrates. For this salamander terrestrial insects like carabidae are the most consumed prey items but in its digestive containing some aquatic Trichoptera larva have been found too (Andreone etal.,1999). There are also some little stone fragments in the stomach contents of salamander *Leurograthus* too (Martof and Scoh ,1957). We