

The Biology of the Persian Mountain Salamander, *Batrachuperus persicus* (Amphibia, Caudata, Hynobiidae) in Golestan Province, Iran

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Abstract. - The Persian Mountain Salamander, *Batrachuperus persicus*, is a hynobiid endemic to Iran and is distributed in specific localities of Hyrcanian forests in four northern provinces of Iran. The biology of this salamander was studied at four localities in Golestan Province of Iran, especially in Shirabad Cave, between 1996 and 1999. Information is presented about the cave and other localities. This salamander has four fingers and toes. The larval stages of the salamander are found at all times of year and probably don't transform during the first year. The head form of small larvae is wider posteriorly while the head form of large larvae, juveniles and adult specimens is more or less rectangular. Juveniles have more yellow spots than adults. Juvenile and adult specimens are found inside and outside of water in the cave but in other localities they can be found in burrows around springs and are not active during the day. They feed on larval and adult forms of insects and other arthropods. Adults also feed on small specimens of bats (*Myotis blythii*) inside of the cave. Some large specimens are cannibalistic and feed on larvae and juveniles of *B. persicus* in natural habitats and in the laboratory. This species does not hibernate inside the cave and is active all times of the year. The total length of the longest specimen was 268.5 mm.

Key words. - Amphibia, Hynobiidae, *Batrachuperus persicus*, Iran.

Introduction

The Persian Mountain Salamander, *Batrachuperus persicus* Eiselt and Steiner 1970, was described based on five salamander larvae collected near Asalem in the Talesh Mountains in Gilan Province of Iran (Eiselt and Steiner, 1970) (See editorial note and Ebrahimi et al., 2004). Subsequently J. J and J. F Schmidtler collected some larvae in Weyser, southeast of Chalus, in Mazandaran Province, Iran, in 1970. These transformed in captivity and a brief description of juvenile specimens was presented (Schmidtler and Schmidtler, 1971). Primary information was presented on adult specimens in Ardabil Province of Iran (Baloutch and Kami, 1995). New distribution records were published some years ago (Kami and Vakilpoure, 1996). Adult specimens of this species were described for the first time together with their habitats in Gilan and Ardabil provinces of Iran (Kami, 1999).

The biology of this salamander has been studied in the laboratory and in natural habitats especially in Shirabad Cave of Khanbebain. Students of Gorgan University and I have visited Shirabad Cave twelve times between 1996 and 1999. Detailed information on the other localities is sparse and these localities must be studied more in the future.

Study areas. - *Batrachuperus persicus* is distributed in the four northern provinces of Iran (Fig. 1). Figure 2 shows new localities of *Batrachuperus persicus* in



Figure 1. The four provinces of Iran that encompass the distribution of *Batrachuperus persicus*. 1- Ardabil; 2- Gilan; 3- Mazandaran; 4- Golestan.

Golestan Province. Most of the research was done at locality 1 (Shirabad Cave), other localities were visited only one time. Climatic information for five cities of Golestan Province is summarized in Table 1.

Locality 1. Shirabad Cave- Shirabad Cave (36° 57' N, 55° 03' E) is situated 70 km East of Gorgan, southeast of Khanbebain and Shirabad Village at about 420 m above sea level (Fig. 3, 4). The cave and waterfalls were designated as a National Park by the Department of

Tab 1. Summary of climatic information (15 years) in five cities of Golestan province of Iran.

station (city)	elevation (m)	Annual precipitation (mm)	Mean of Air temperature (°C)	Mean of minimum temperature (°C)	Mean of maximum temperature (°C)	Mean of relative moisture (%)	Annual evaporation (mm)
Azadshahr	129	847.6	17.1	0.7	31.9	71.6	--
Ramian	200	883.1	16.2	-1.0	35.0	65.0	497.0
Minoudasht	155-180	765.3	17.3	-1	36.0	82.1	482.5
Gonbad-e- kavous	30-45	388.3	18.2	-3.5	36.5	68.6	510.0
Gorgan	160	642.7	17.7	2.8	36.4	---	---

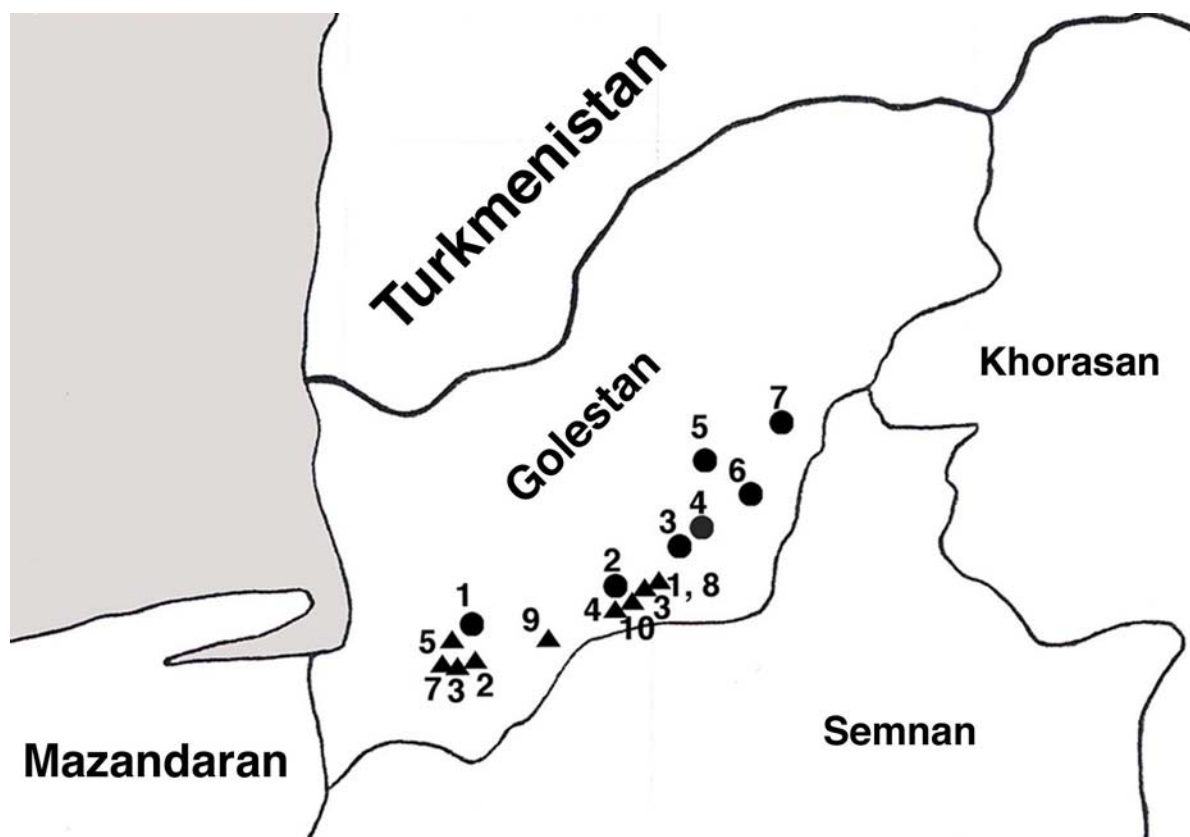


Figure 2. Localities of *Batrachuperus persicus* in Golestan Province, Iran: 1- Shirabad Cave; 2 - Vantakhteh; 3- Near Shirabad Cave; 4- Spring of Khoulou; 5- Barankouh ($36^{\circ} 45' N$, $54^{\circ} 25' E$), about 10 km south west of Gorgan, almost 1100 m elevation; 6- Spring of Khonakou, situated south southwest of Gorgan, Jahannama Protected Area, Valley of Sorkhcheshmeh, below elevations of Pir-e-zan (elevations of Pahlavan Ghaleh), 1800 m elevation; 7- elevations of Yakhkesh ($36^{\circ} 42' N$, $54^{\circ} 23' E$) about 15 km south of Gorgan, 2300 m elevation; 8- Water falls of Shirabad; 9- Valley of Loushan, inside of valley, ($36^{\circ} 42' N$, $54^{\circ} 41' E$) about 30 km southeast of Gorgan; 10- Region of Aram-e-Sorkhcheshmeh opposite side of Siah Marzkouh, Village of Aliabad. Circles are cities: 1- Gorgan; 2- Aliabad; 3- Ramian; 4- Azadshahr; 5- Gonbad-e-kavous; 6- Minoudasht; 7- Kalaleh.

Table 2. Dates of study, air and water temperature of four localities in Golestan province of Iran.

Locality	Dates of study	Air temperature (°C)	Water temperature (°C)	Time
Shirabad Cave	1996/11/1	---	12	
	1997/2/28	---	11	
	1997/4/11	---	10-10.5	
	1997/4/17	12.5-13	11	
	1997/7/10	19.5-21	13	1045-1100
	1997/10/2-3	---	12	
	998/4/17	---	11	
	998/5/8	18	10	1200
	1998/5/15	18	13	1430
	1998/5/19	15	12	
	1998/7/10	---	13	
	1998/9/2	17	11	
Vantakhteh	1996/11/25	2-6	6.5-7	1330-1530
Near Shirabad	1997/7/10	20-23.5	19	1000
Khouklou Spring	1999/5/26	26-27	12	1230

Environment of Gorgan and Gonbad-e-Kavous in 1998. There are seven waterfalls below the cave. The entrance of the cave is about 15 m high and is at least 3-4 m high in other parts of the cave. It is almost 240 m long and is completely dark. Water emerges from the mouth of the cave and flows to the river and waterfalls at all times of the year.

No plant species live inside the cave, but there is *Lycopodium* sp on the floor of cave from the entrance to about 10 m inside of it on large flat stones. Some plant species that were identified outside the entrance of the cave on 28 February 1997 and 17 April 1997 are: *Pteridium aquilinum*, *Adiantum capillus-veneris*, *Athyrium filix-mas*, *Phyllitis scolopendrium*, *Funaria* sp, *Celtis australis*, *Evonymus latifolia*, *Convulvulus* (= *Calistegia*) *sepium*, *Hedera pastochowii*, *Lamium album*, *Carex pendula*, *Rubus hyrcana*, *Ficus carica*, *Danae racemosa*, *Acer insigne*, *Parrotia persica*, *Carpinus betulus*, *Cyclamen elegans*, *Marcantia* sp.

The water temperature of cave is 10-13°C (Mean 11.6°C) and is constant from the entrance to end of cave. Air temperature of cave varied between 12.5-21°C over six visits. The inside of the cave is a little warmer than the entrance of the cave (Table 2).

Locality 2. Vantakhteh. - The Spring of Vantakhteh (36° 40' N, 54° 25' E) is about 18 km south of Gorgan City and 5 km southwest of Ziarat Village at about 1200-1300

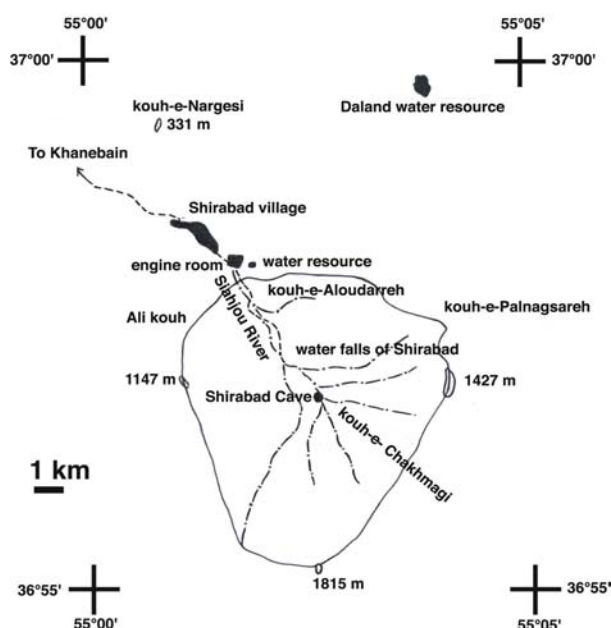


Figure 3. That National park that includes the cave and waterfalls of Shirabad (1650 Hectares).

m elevation. Salamanders were observed in this locality in 1979 and later in Yakhkesh (2300 m elevation) on 25 November, 1999. There are two springs in this locality that are formed from soil and limestone and situated to east. Water flows from springs to the Souteh River.

The sides of the river were frozen and snowy. The springs are 3-4 m above the river. Water temperature of one spring was 6.5 and other 7°C. Air temperature was 6°C at 13:30 and 2°C at 15:30. Snow was melted in east side of the springs. Some plant species found around the springs are as follows: *Rosa albicans*, *Berberis vulgaris*, *Juniperus communis*, *Carpinus orientalis*, *Juncus effusus*, *Cirsium nekarmanicum*, *Stachys bizantica*. Five salamanders, all metamorphosed, were found inside of burrows near the springs.

Locality 3. Near Shirabad Cave. - Locality 3 is a small pond (about 2m x 2m) in southwest of Shirabad Village and 20 m above Shirabad Cave. Water depth was almost 50 cm. Around this shady pond were stones, lichens and trees (*Danae racemosa*, *Quercus* sp). A Grass Snake (*Natrix natrix*), Marsh Frogs (*Rana ridibunda*), crabs (*Potamon* sp.) and larvae of *Batrachuperus persicus* with total length of 3-4 cm were observed. No adult or metamorphosed salamanders were seen. Air temperature was 20-23.5°C and water temperature was 19°C at 1000 on 10 July 1997. Some larvae such as Gerridae (Heteroptera), Chironomidae (Diptera), Ephemeroptera, and Amphipoda (Gamaridae), earthworms (Lumbricidae), and Gastropoda were collected inside and around the pond under decaying logs.

Table. 3. Measurements of living *Batrachuperus persicus* inside of Shirabad cave of Golestan province of Iran. All specimens were released after measuring. All measurements are in mm.

Date and number	Form	Total length	Head length	Trunk length	Tail length
1996/11/1n=6	larva	80	10	28.4	41.8
	larva	104.4	11.8	36.1	54.1
	larva	88.2	9.8	33.1	45.2
	larva	79.2	9.7	29.6	40.0
	larva	84.8	10.6	30.9	43.2
	adult	236.5	24.5	85	127
1997/2/28n=4	larva	70	-	-	-
	larva	83	-	-	-
	larva	79	-	-	-
	larva	74	-	-	-
1997/4/17n=4	larva	50	-	-	-
	larva	80	-	-	-
	adult	240	-	-	-
	adult	245	-	-	-
1997/7/10n=19	adult	229.2	26.6	78.6	124
	adult	227.7	24.8	81.9	121
	adult	-	29.3	84.2	-
	juvenile	97.3	11.9	37.5	48.6
	larva	45	-	-	-
	larva	57	-	-	-
	juvenile	90	-	-	-
	larva	80	-	-	-
	larva	86	-	-	-
	larva	62	-	-	-
	larva	52	-	-	-
	larva	50	-	-	-
	larva	67	-	-	-
	larva	56	-	-	-
	larva	103	-	-	-
	larva	108	-	-	-
	larva	94	-	-	-
	larva	55	-	-	-
	adult	217	-	-	-
1998/5/19n=13	larva	105	-	-	-
	adult	225	-	-	-
	adult	225	-	-	-
	adult	230	-	-	-
	adult	235	-	-	-
	larva	100	-	-	-
	larva	75	-	-	-
	larva	40	-	-	-
	larva	41	-	-	-
	larva	42	-	-	-
	larva	42	-	-	-
	larva	44	-	-	-
	larva	55	-	-	-
1999/4/26n=5	larva	37.9	-	-	-
	larva	36.8	-	-	-
	larva	36.2	-	-	-
	larva	36.9	-	-	-
	larva	75.5	-	-	-

Tab. 4 . Morphometric and meristic characters of larvae and juveniles of *Batrachuperus persicus* in Golestan province of Iran.

ZMGU	Form	Total length	Head length	Head width	Head form	Upper eyelids	Between eyelids	Between nostrils	Trunk	Tail	Cloaca	Forelimb digits	Forelimb grooves	Hindlimb digits	Hindlimb grooves	Axilla-groin	Costal grooves
428	larva	38.5	6.6	-	rear wider	-	-	-	15.4	-	-	-	-	-	-	-	-
429	larva	38.7	-	-	rear wider	-	-	-	15.3	-	-	-	-	-	-	-	-
282	larva	39.2	6.6	8.4	rear wider	-	2.2	-	15	-	-	-	-	3>2=4>1	4.9	10.7	-
286	larva	40.1	6.8	7.6	rear wider	-	2.0	-	-	-	-	6.7	2=3>1>4	2.6	2.6	11.5	-
281	larva	40.4	6.1	7.6	rear wider	-	1.8	2	15.7	17.2	-	6.2	2>3>4=1	5.4	5.4	11.1	-
427	larva	42.0	6.6	6.5	rear wider	-	-	-	21.2	18.0	-	6.4	-	-	-	-	-
278	larva	42.3	7.3	7.8	rear wider	-	2.1	-	22.1	19.3	-	-	-	2.7	2.7	11.3	-
283	larva	51	7.4	9.8	rear wider	-	1.8	2.2	-	-	-	5.4	2>3>4=1	7.3	7.3	14.3	-
284	larva	55.1	8.0	9.5	rear wider	-	2.2	2.0	26.5	19.3	-	8.3	2>3>4>1	7.4	7.4	15.0	-
333	larva	75.5	-	-	rear wider	-	-	-	33.7	22.4	-	8.0	-	-	-	-	-
285	larva	-	10.6	12.1	rear wider	-	2.9	3.9	22.9	25	-	-	2>3>4>1	10.4	10.4	17.0	-
343	larva	84.8	10.8	11.0	rear wider	-	3.7	2.7	41.2	-	1.4	10.7	2=3>4=1	12.9	12.9	20.4	-
246	larva	-	12.3	11.3	rectangular	9	2.5	4.1	32.1	-	0.9	11.8	3>2>4>1	11.5	11.5	16.8	12-12
248	larva	104.8	12.5	12.4	rectangular	1.5	3.2	4.2	35.9	40.3	2.4	11.5	3>2>4>1	16.2	16.2	30.1	12-11
430	juvenile	84.1	11.0	8.1	rear narrower	1.9	3.1	4	72.6	-	3.4	13.9	2>3>4>1	13.3	13.3	19.0	?-13
278	juvenile	102.1	14.8	10.9	rear narrower	2.8	3.1	3.9	15.4	51.1	4.1	12.9	3>2>4>1	16.6	16.6	22.5	-
276	juvenile	164.5	21.7	15.7	rectangular	3.9	4.5	6.0	15.3	41	4.5	13.8	3>2>4>1	28.2	28.2	51.1	13-14

Locality 4. Spring of Khouklou. - The Spring of Khouklou (36° 44' N, 54° 53' E) is situated almost 23 km south of Aliabad at about 1500 m elevation. This spring is 200 m west of Chenarbin and along side of the Khouklou River and situated to north beneath a large rock. This locality was studied on 26 May 1999. Six specimens were seen and three of them were collected. All specimens had external gills.

Materials and Methods

Shirabad Cave was studied 12 times and the other localities only one time between 1996 and 1999. Air and water temperature of the cave and two other localities measured on some dates. Important plant species of localities were identified. Measurements (total, head, trunk, and tail lengths) were done on living specimens of salamanders inside the cave. Some specimens (larval and transformed) collected and brought to aquaria at the zoology laboratory of Gorgan University and kept with ice. Some specimens (30) were fixed in alcohol or formalin. Almost all fixed transformed salamanders were dissected and stomach contents and sexes were noted. Morphometric and meristic characters of specimens were taken. The behavior of salamanders was studied inside the cave and in the laboratory. On each visit the total number of salamanders was counted from the entrance to the end of the cave.

Preserved specimens of *Batrachuperus persicus* studied for this research are as follows: ZMGU 67, 273, Shirabad Cave collected by H. Naghghash and M. Rahmani in 1994; ZMGU 246, 281, 282, 283, 284, near Shirabad Cave collected by H. Kami, A. Maghsoudlou, M. Rahmani, M. Azma on 10 July 1997; One specimen without number collected in Shirabad Cave by A. Maghsoudlou on 8 May 1998; ZMGU 267, Shirabad Cave, collected by A. Maghsoudlou on 21 May; ZMGU 266, 268, 269, 270, 272, 285, 286, 427, 428, 429, collected by H. Kami, M. Fatemi, N. Okhli, N. Moghaddam, J. Ghasemi, M. Mahmoudi, R. Zakeri, on 19 May 1998; ZMGU 275, 430, Shirabad Cave, probably collected by H. Kami, S. Afzali, R. Ghaemi on 28 February 1997; ZMGU 276, Jahannama Protected Area, south of Gorgan and Ziarat Spring of Khonakou, collected by N. Torbatinejad on 10 June 1997; ZMGU: 277, 278, Vantakhteh, collected by H. Kami, S. Afzali, M. Firouznia, H. Rezaee, Y. Shakoumahalli, Y. Nariman, on 25 November 1996; ZMGU 279, 280 without correct information (probably Vantakhteh or Shirabad); ZMGU 333, 335, Shirabad Cave, collected by M. Goli, S. Afzali and eight other students of Gorgan University on 27 April 1999; ZMGU 343, Spring of Khouklou, collected by H. Absalan, S. Hosseini, on 26 May 1999.

Table 5. Morphometric and meristic characters of adult forms of *Batrachuperus persicus* in Golestan province of Iran (ZMGU 75 from Ardabil province, ZMGU 270 is dried specimen, rear narr = rear narrower, rear wid = rear wider, rectan = rectangular, F = Female, M = Male).

ZMGU	Total length	Head length	Head width	Head form	Upper eyelids	Between eyelids	Between nostrils	Trunk	Tail	Cloaca	Forelimb	Forelimb digits	Hindlimb	Hindlimb digits	Axilla-groin	Costal grooves	Sex
67	-	21.6	15.1	rear narr	4.1	4.5	5.4	86.5	-	5.9	25.0	2>3>1=4	26	3>2>4>1	41.9	11-12	M
335	93.3	25.3	18.9	rear narr	4.5	5.6	7.7	78.6	-	8.1	32.6	3>2>4>1		3>2>4>1	53.1	13-13	F
270	10.6	24.6	15.2	rear narr	3.5	5.3	6.4	72.4	89.4	-	-	3>2>1=4	-	-	-	11	-
-	23.2	24.9	18.6	rear wid	-	-	-	74	113.6	9.6	-	3>2>4>1	-	3>2=4>1	-	12-11	F
275	23.8	28.9	20.4	rectang	4.8	5.4	7.5	80.1	124.3	4.2	32.8	2=3>4>1	34.5	3>2>4>1	54.9	11-11	M
279	28.6	27.2	21.8	rear narr	3.8	5.9	7.1	82.8	114.8	7.5	29.9	2=3>4>1	37.1	3>4>2>1	57.7	13-12	F
273	29.2	26.7	19.2	rear narr	4.2	5.9	7.6	91.0	118.6	5.9	31.8	3>2>1=4	37.4	3>4>2>1	51.4	12-11	F
269	30.4	28.7	21.0	rectang	5.2	6.3	8.5	84.8	111.5	7.3	35.9	3>2>4>1	36.4	3>2>4>1	52.7	13-12	F
280	32.7	25.4	21.4	rectang	4.4	5.7	7.9	82.4	116.9	5.5	35.5	3>2>4>1	37.4	3>2>4>1	43.9	12-13	F
266	35.1	26.0	20.6	rear narr	-	5.5	7.8	88	124.9	5.9	37.3	3>2>4>1	39.7	3>2>4>1	59.0	14	M?
75	36.6	25.1	18.4	rectang	4.8	5.8	7.6	78.7	121.1	8.1	30.6	3>2>4>1	34.9	3>4>2>1	43.8	12-13	M
272	37.8	23.9	18.7	rectang	4.7	5.0	4.7	92.0	132.8	6.6	31.6	3>2>4>1	35.9	3>2=4>1	54.0	14-12	F
277	46.6	26.0	21.0	rectang	5.3	6.2	8.5	83.9	121.9	7.8	33.6	3>2>4>1	31.5	3>2>4>1	50.9	12-13	F
267	68.5	28.8	19.3	rear narr	5.1	6.1	8.3	90.6	136.7	6.3	34.6	3>2>4>1	-	3>2=4>1	-	13-11	F

Table 6. Summary of information on the feeding of *B. persicus* in Golestan province of Iran. ZMGU 75 is from Ardabil province.

ZMGU	Form	Total length	Stomach and intestine contents
267			Two hairless Bats (<i>Myotis blythii</i>), one digested (~3 cm) and another undigested (~6 cm). Soft material is mixed with undigested bones in large intestine.
276	adult	268.5	One butterfly larva (chrysalid) 28 mm; ~45 vermiform larvae of Diptera (probably Tabanidae), each ~1 cm; two species of black beetle, (Coleoptera), ~45 mm; stomach of salamander was full.
277	adult	>164.5	Soft unidentifiable material.
75	adult	246.6	One larva of <i>B. persicus</i> with snout - vent length >32 mm, mostly digested.
333	adult	236.6	Two mayfly larvae (Ephemeroptera). Specimen was fed on larvae of Iranian wood frog in laboratory before fixation.
335	adult	75.5	Some algae and a semidigested Earwig (Dermaptera) found in feces.
343	adult	84.8	Two undigested larvae of <i>B. persicus</i> with a total length of 30 mm emerged one day after collecting.

Results

Measurements of specimens from the localities are presented in Table 3. Morphometric and meristic characters of preserved salamanders are summarized in Table 4 and Table 5. The maximum total length of this species expected 15-20 cm (Schmidtler and Schmidtler 1971). The total length of the longest specimen was 268.5 mm.

Description of larvae. - In small larvae (Total length less than 80-100 mm), the head is large, depressed, more or less triangular with rounded end anteriorly, wider posteriorly, with small eyes and poorly developed eyelids; black horny margin present in lower jaw; gills large; vomerine tooth-bundle arc-shaped, situated anterolaterally, and extending in front of the choanae, short, in the middle hardly discernibly separated from one another. Trunk with 11-14 costal grooves, vertebral groove often present, forelimbs are longer than hind limbs, tips of fin-

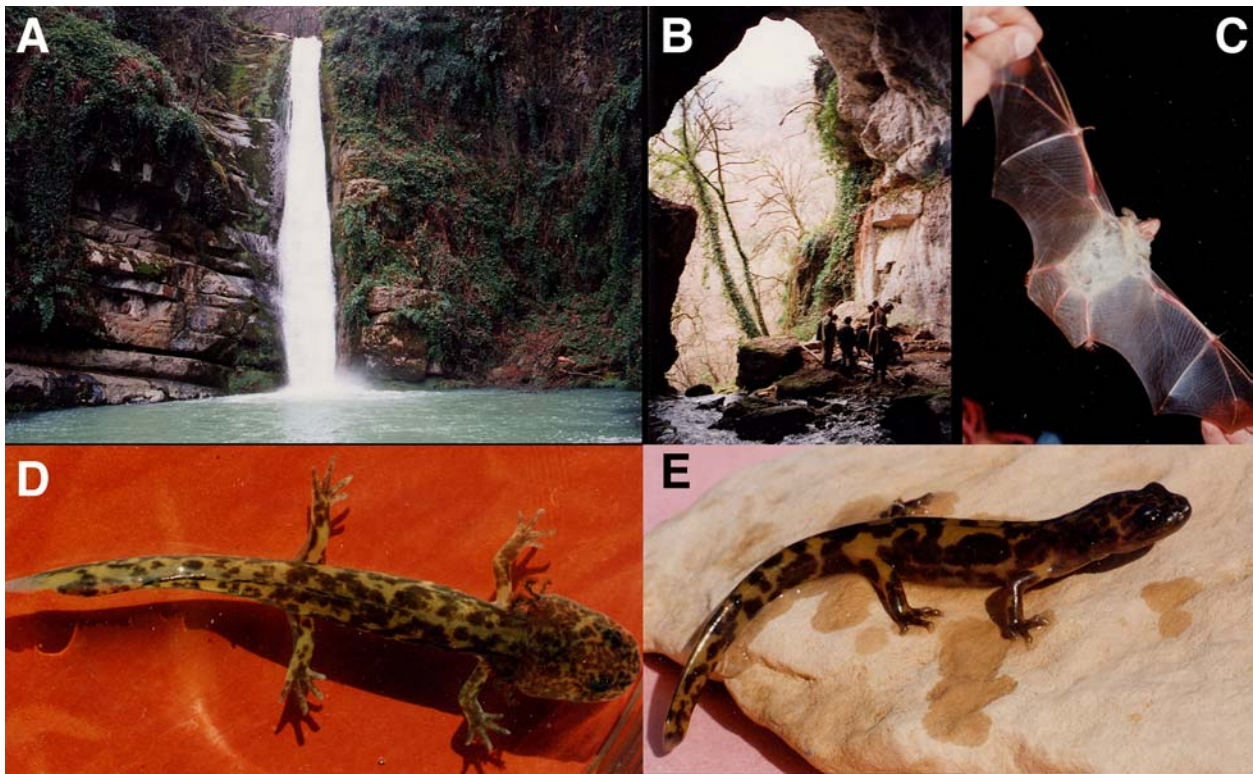


Figure 4. A- One of seven waterfalls of Shirabad Cave (Golestand Province, Iran). *Batrachuperus persicus* are found in the water near the edges of the pond (Photo by R. Ghaemi 2/28/97); B- The entrance of Shirabad Cave (Photo by R. Ghaemi 2/28/97); C- *Myotis blythii*, an abundant bat species of Shirabad Cave and one of the food items of *Batrachuperus persicus*; D- Larval specimen of *Batrachuperus persicus* from Shirabad Cave collected 2/28/97 (Photo by A. Sanaee 3/11/1997); E- Juvenile specimen of *Batrachuperus persicus* about 10 days after metamorphosis. Collected from Shirabad Cave 2/28/97 (Photo by A. Sanaee 4/8/97).

gers with black horny pads, their arrangements are $3>2>4>or<1$; arrangement of toes are often $3>2>4>1$; adpressed limbs not overlapping; tail highly compressed from laterally, upper caudal fin very distinct, reaching to occiput in some specimens, lower caudal fin reaching to posterior of cloaca, cloacal aperture is oval or elliptical. In larger larvae the head is more or less rectangular, adpressed limbs overlapping, upper and lower caudal fins not clearly distinct. The 12 larvae specimens examined (fixed or living) in this study (see Tables 3, 4) have a tail length which is smaller (Table 4) or longer (Table 3) than the head plus body length.

Description of juveniles. - Head more or less elliptical, decreasing toward the rear, adpressed limbs overlapping, upper and lower caudal fins are not distinct, tail more or less rounded especially at base of it. Four juvenile specimens examined in this study (see Tables 3, 4), have a tail length which is often smaller than the head plus body length.

Description of adults. - Head form is more or less rectangular, or wider anteriorly. Eyelids well developed and movable, width of eyelid is less than distance of inter-

eyelids (interoculars), distance of external nostrils are longer than distance of nostril to anterior of eye, nostrils are semi-circle; vomerine tooth-bundle is different from that of larvae, inner portion of it is longer than outer one. Trunk with 11-14 costal grooves, adpressed limbs overlapping. Tail compressed laterally in some specimens and with thin upper and lower caudal fins, and in some specimens more or less rounded especially at base. Cloacal aperture is longitudinal and in some specimens cross-shaped, and longitudinal protuberance is present inside of cloaca in others. The 16 adult specimens examined in this study (see Tables 3, 5) have a tail length which is longer than head plus body length except two specimens (ZMGU 273, 335) which have tail lengths smaller than head plus body length.

Coloration. - Small larvae (Total length 40 mm) are in general light yellow without any distinct spots; dark eyes very distinct in small larvae, larger larvae have irregular dark gray spots, ventral portion of larvae light and without spots; dorsum of ZMGU 285 is dark gray; Iris yellowish, pupil dark, bases of all limbs yellow, yellow color of forelimbs not reaching to knee but in hindlimbs reaching to knee. Yellow spots of larvae are

more than in adults. Juveniles are darker than larvae. Yellow spots are less in adult, and ZMGU 269 is deep violet and have only one yellow spot beside of vertebral groove. Yellow spots of adults are often in vertebral groove.

Feeding. - *Batrachuperus persicus* feeds on larvae and adult forms of some orders of insects and probably other arthropods. They also feed on bats (*Myotis blythii*) in Shirabad Cave (Fig. 4). Some specimens are cannibalistic and feed on smaller specimens of *B. persicus* especially in captivity. Algae, that may be eaten with other insects, was found in one larva. Stomach is white with a thin wall. Total length of digestive system of ZMGU 267 was 337 mm from anterior of stomach to posterior of cloaca. Contents of stomachs of some dissected *B. persicus* are shown in Table 6.

Behavior. - Small larvae and adult large salamanders are usually almost motionless inside of cave. They have no reaction to light. Adults escape to water. Adults swim more slowly than larvae under water. Adults are active in Shirabad Cave in all times of year but in other localities are not active during the daytime.

Parasites. - Many nematodes and mastigophorans were found inside the cloaca of one salamander from locality 2. Some nematodes moved freely and some were inside of a cyst.

Metamorphosis. - Larvae are found at all times of the year in Shirabad Cave and probably don't transform during the first year. A newly transformed juvenile was found on February 25 1997. Larvae transform rapidly in captivity probably as a result of starvation and higher temperature.

Habitat. - *Batrachuperus persicus* was studied in four localities and observed in some other localities in Golestan Province of Iran. Larvae were found inside of small shady ponds. Juveniles and adults were found inside and outside of water in Shirabad Cave but in other localities live in borrows about 20 cm long. Some specimens found above stones, and some in grooves of stones near water in Shirabad Cave. One specimen was 1 meter away of water and moved 0.5 meter on the stone which was in an almost vertical position.

Measurements. - Measurements are summarized in Tables 3, 4, and 5. Total length of the smallest larvae was 36.2 mm and of the longest one was 105 mm. Juveniles are smaller than the largest larvae. Total length of the longest adult was 268.5 mm.

Distribution. - *Batrachuperus persicus* collected or observed by students of Gorgan University, staffs of Department of Environment of Gorgan and Gonbad-e-Kavous, and by me in many localities in Golestan Province of Iran. These localities are listed on figure 2.

Discussion

These salamanders are active at all times of year in Shirabad Cave, but in other localities found in borrows of near of springs during daytimes and are probably active at night. Larval salamanders have morphological adaptations that correlate with the environments that the larvae inhabit (Noble 1927 in Petranka 1988). One dichotomy is that between species that typically breed in running versus standing water habitats. In this division larvae of *Batrachuperus persicus* are "stream-type" larvae. A third group of aquatic larvae ("mountain brook" larvae) was recognized by Valentine and Dennis (1964) that is perhaps better viewed as an extreme form of the stream-type morphology (Petranka, 1998). It is better recognized larvae of *B. persicus* to this type of larvae. Feeding on bats by adults of *B. persicus* may be unique in the world of salamanders.

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Editor's Note

The name *Batrachuperus persicus* Eiselt and Steiner, 1970. Ann. Naturhist. Mus. Wien, 74:77 (Holotype: NHMW 19435:4 [larval specimen], type locality: Talysch Mountains near Assalem, Gilan Province, Iran, small creek about 800 m) has priority over

Batrachuperus gorganensis Clerque-Gazeau and Thorn, 1979. Bull. Soc. Hist. Nat. Toulouse 114:455 (Holotype: MNHMP 1978-1982, type locality: At the edge of a cavernous stream on a clay bank 200 m inside the entrance of a cave, situated between the village of Gorgan and Ali-Abad, Elborz Mountain Range of north-central Iran, near the southeast shore of the Caspian Sea and with an elevation of 400 m above sea level). The type localities of the two nominal taxa lie at the extreme western and eastern ends respectively of the known Iranian range of *Batrachuperus*. Most recent authors have considered the two specimens conspecific and a small number of populations distributed between the two type localities have been discovered. However, the taxonomic status of *B. gorganensis* as well as that of intermediate populations remains unsettled. Unsettled; see also discussion of the problem in Ebrahimi et al. (2004). Indeed, Risch (1984, Alytes, Paris 3:44) made *B. gorganensis* the type of his monotypic genus, *Paradactylodon*. SCA

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