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Genus *Berosus* Leach, 1817 in southern Iran (Coleoptera: Hydrophilidae)

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Abstract
A faunistic study on the *Berosus* species in five southern provinces of Iran is presented. A total of 2415 specimens of *Berosus* species were collected in Bushehr, Fars, Kerman, Hormozgan and Kohgiluyeh -and- Boyer-Ahmad provinces from 1970 to 2003 and during 2012. The species represent including *Berosus asiaticus*, *Berosus bispina*, *Berosus chinensis*, *Berosus spinosus*, *Berosus insolitus*, *Berosus nigriceps* and *Berosus pulchellus*. A comparison between recent samplings and old ones showed a drastic reduction in number of specimens, habitats and species diversity which could be due to rapid urban developments, habitat/ water pollution and drought. Some species such as *Berosus chinensis, Berosus insolitus* and *Berosus nigriceps* was not found again in recent collecting attempts because of destruction of natural habitats.

Keywords: Coleoptera, Hydrophilidae, Berosus, fauna, Iran

1. Introduction
The genus *Berosus* Leach, 1817, one of the five genera comprising the tribe Berosini, is the largest genus of Hydrophiloidea, with 273 species, and is distributed worldwide [1]. All known species are aquatic as adults and larvae and generally good swimmers [2]. *Berosus* species live in all parts of aquatic habitats, stagnant, fresh or mainly eutrophic waters, shallow pools or ponds, with grassy and somewhat clayey bottom, poorly vegetated and temporary ponds with muddy bottom [3].

Seven of twelve species which are known from Iran occur in the southern part of the country according to literature and information by specialists. They included, *B. chinensis* Knisch, 1922, Hormozgan (Bandar Abbas, Minab), Sistan and Baluchestan (Zahedan, Nikshahr, Iranshahr) [4]. *B. asiaticus* Kuwert, 1888, Fars (Marvdasht, Masiri) [4]. *B. bispina* Reiche & Saulcy, 1856, Khuzestan (Ahvaz), Gorgan (Golestan), Fars (Jahrom) [4], Gilan (Amlash) [5]. *B. spinosus* (Steven, 1808), Sistan and Baluchestan (Zabol, Zahak, Hamoon), Kerman (Anbar Abad), Khuzestan (Ahvaz), Esfahan (Isfahan, Nikabad), Khorasan (Razavi, Mashhad), Gorgan (Golestan), Karaj (Alborz), Gilan (Lahijan) [4], (Langarud) [5], Azerbaijan (Urmia) [4], Mazandaran (Nowshahr, Abbas Abad, Kelardasht) [4], (Qaemshahr) [4, 5], (Babol, Sari) [5]. *B. insolitus* d'Orchymont, 1937, Hormozgan (Bandar Abbas), Fars (Darab), Khorasan Razavi (Gonabad), Khorasan Northern (Jajarm) [6]. *B. nigriceps* (Fabricius, 1801), Hormozgan (Bandar Abbas, Minab, Bandar Lengeh, Roodan), Sistan and Baluchestan (Iranshahr), Kerman (Anbar Abad) [6]. *B. pulchellus* Macleay, 1825, Hormozgan (Minab), Sistan and Baluchestan (Nikshahr, Iranshahr, Sarbaz, Chabahar) [6]. Some water insects such as aquatic beetles are biological indicators. The use of bioindicators is essential for environmental monitoring [7]. Environmental changes can cause different kinds of effects on the indicator species, including physiological changes or changes in species number or abundance [8]. There is an evidence that some *Berosus* species like *B. (Enoplorus) fulvus* and *B. (Berosus) luridus* are vulnerable and near threatened respectively in Great Britain after human intrusion, such as drainage of wetlands and loss of heathlands (a shrubland habitat found mainly on free-draining infertile, acidic soils) which are the two main causes of habitat loss [9]. Conservation status of individual species of *Berosus (Berosus) hispanicus* in Czech Republic (CZ) is classified as regionally extinct [10]. The aim of this research is a comparison between the material sampled in 1970 and even older ones with the recently collected materials in number of specimens and species diversity. Their distribution in South of Iran is discussed here too.

2. Material and Methods

During the years between 1970 and 2003 and again in 2012 more than 200 locations in five provinces were visited in south of Iran including, Fars, Bushehr, Kohgiluyeh -and-Boyer-Ahmad, Kerman and Hormozgan (Fig 1). A total of 2415 adult specimens were collected (Fig 2). The specimens are deposited in Zoology Museum of Biology Department of Shiraz University (ZM-CBSU), Shiraz, Iran.

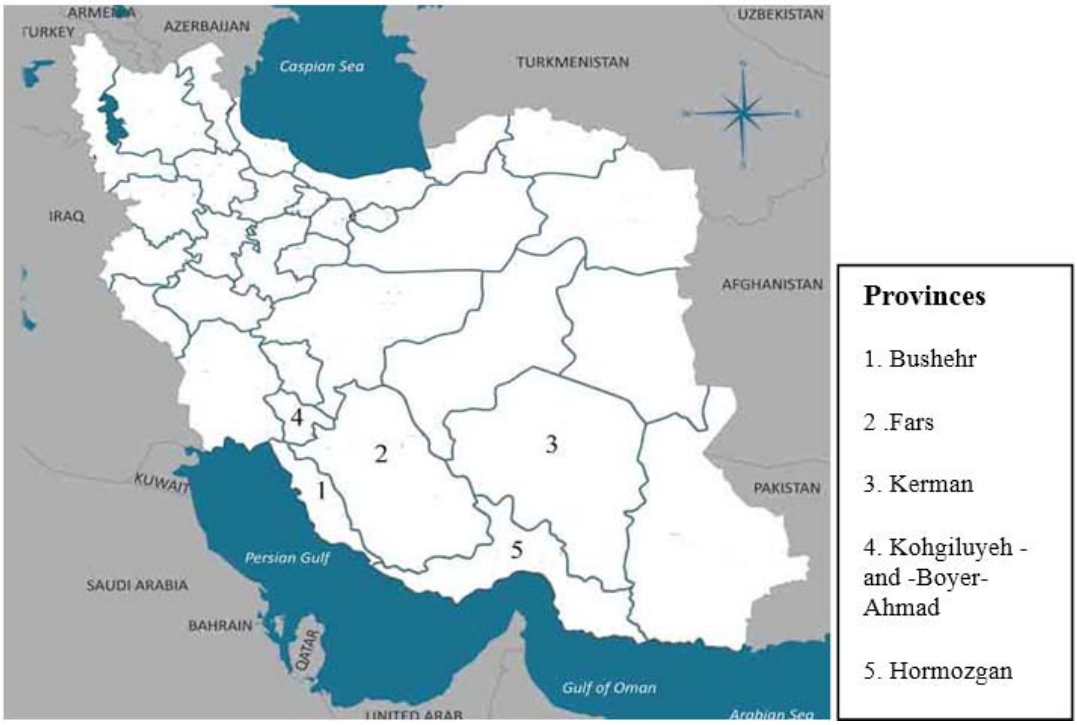

Fig 1: Location of the study Area in south of Iran.

Table 1: Total number of identified specimens

Name of provinces	Species								
	Between 1970 and 2003							In 2012	
	B. asiaticus	***B. bispina***	***B. chinensis***	***B. insolitus***	***B. nigriceps***	***B. pulchellus***	***B. spinosus***	***B. asiaticus***	***B. spinosus***
Bushehr	19	82	_	35	147	_	_	_	_
Fars	303	148	34	502	46	_	52	123	22
Kerman	_	20	_	_	2	_	_	_	_
Kohgiluyeh and Boyer Ahmad	12	_	_	_	_	_	14	_	_
Hormozgan	15	_	20	105	458	66	4	_	_
Total	349	250	54	642	653	66	70	123	22

3. Result

The samplings from more than 200 localities between 1970 and 2003 and again in 2012 from south and southwest of Iran (Bushehr, Fars, Kerman, Hormozgan and Kohgiluyeh -and-Boyer-Ahmad provinces) have yielded seven species (Fig 2). Number of identified specimens in each habitat between 1970 and 2003 were noted again in 2012 (Fig 2, 3). Selected localities summarized in appendix.

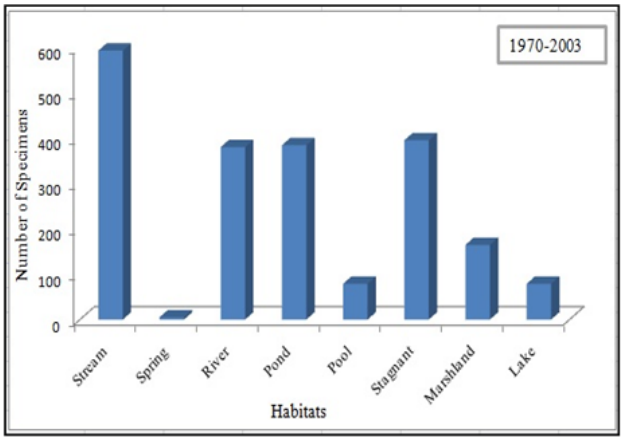

Fig 2: Number of identified specimens in each habitat, between 1970 and 2003.

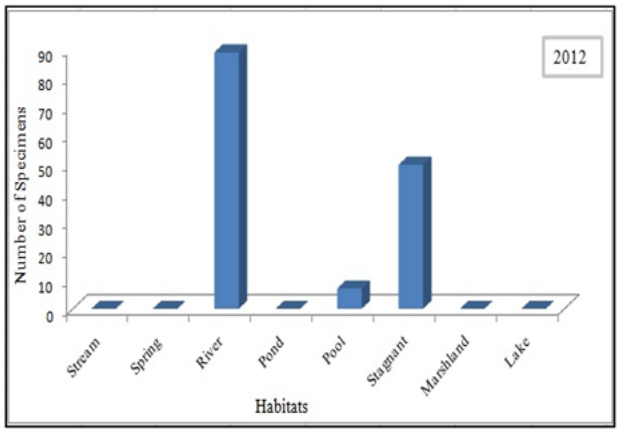

Fig 3: Number of identified specimens in each habitat in 2012.

4. Discussion

All seven known species from southern Iran could not be found in 2012. It is noticeable that only two of seven species were found in five new localities in Fars province and three new localities in Kohgiluyeh and Boyer-Ahmad province. This means that 58% of all *Berosus* species occurring in Iran could be collected in south between 1970 and 2003. This represent a high diversity of genus *Berosus* in this region. We could not re-collect some species in some of the localities where they had been found previously. This may be due to drought and changes of natural habitats and/or man-made influences.

Specimens of *B. nigriceps* were found in the most habitats: Therefore the assumption can be made that this species has lower habitat preference than others. *B. pulchellus* which was found in the smallest number of habitats seems to be most specialized species with high habitat preference. On the other hand, the highest diversity of *Berosus* species was found in stagnant water bodies such as ponds and running waters such as stream habitats. It seems that ponds are the best habitats for *B. chinensis*, *B. bispina*, and *B. nigriceps*, *B. insolitus* and *B. pulchellus*. Many habitats in different collection sites which has been examined during 1970 to 2003 and again in 2012, were found entirely destroyed in our recent survey. It should be noted that most of water beetles are very sensitive to pollution and often suggested as bioindicators of habitats' quality. They are also suitable for conservation studies and management of freshwater habitats. Due to their ecological demands and physiological features (feeding, microhabitat preferences, body size, flying capacity and etc.), many species are sensitive to changes in environmental conditions [11-13], resulting in rapid changing in their assemblages [14, 15]. A comparison between the material sampled between 1970 and older ones with the recently collected material showed a noticeable reduction in number of specimens and species diversity (Fig 2, 3). This could partly be due to water pollution from increased activity in the agriculture, mining, manufacturing and rapid urban development. In addition to habitat alternation, decreasing precipitation in most parts of the country has severely affected quality of aquatic habitats. The females of *B. spinosus* and *B. asiaticus* (186 specimens in our samplings) cannot be distinguished reliably. The total number of identified specimens of each species in its locality was summarized in table 1.

5. Acknowledgments

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Appendix

Selected sampling localities from southern provinces of Iran.

Name of Species	Bushehr province		
	County	**Coordinate of location**	**Altitude**
B. asiaticus	Tangestan,12 km S Ahrom city, Amar village 2 km NW Bandar Kangan	28°51'31"N 51°17'11"E 27°51'04"N 52°03'04"E	50 m 28 m
B. bispina	Tangestan, 10 km S Borazjan, Abolfiruz village Ganaveh, 35 km SE Bandar Rig city, Ahsham-e Ahmad village	29°09'48"N 51°12'05"E 29°14'05"N 50°44'08"E	70 m 6 m
B. insolitus	Tangestan, 4km S Delvar city, Mohammad Ameri town Dashtestan, 53 km W Borazjan city, 5 km W Khalifeh village, Shoor	28°43'15"N 51°04'45"E 29°32'27"N 50°47'56"E	7 m 20 m
B. nigriceps	Bushehr, Bhmani town 57 km E Ganaveh, Bandar Rig city, Chahr Rustai village	28°54'38"N 50°49'39"E 29°32'36"N 50°48'16"E	22 m 23 m

Name of Species	Kerman province		
	County	**Coordinate of location**	**Altitude**
B. bispina	Narmashir	28°56'40"N 58°41'34"E	754 m
B. nigriceps	Anbar Abad, Abdollah Abad village	28°22'04"N 57°53'38"E	612 m

Name of Species	Kohgiluyeh -and- Boyer Ahmad Province		
	County	**Coordinate of location**	**Altitude**
B. asiaticus	Boyer Ahmad, 5 km SW Yasuj city, Kord Laghari village, Shah Mokhtar Road	30°39'00"N 51°33'34"E	1744 m
B. spinosus	10 km N Dena, Sisakht city, Toot Nadeh village	30°53'07"N 51°20'17"E	1687 m

Name of Species	Fars Province		
	County	**Coordinate of location**	**Altitude**
B. asiaticus	64 km NW Shiraz, Haft Barm village Larestan, Juyom city, Nasir Khani village	29°49'15"N 52°02'49"E 28°21'04"N 53°59'17"E	2164 m 1089 m
B. bispina	21 km E Lar, Lar- Bandar Abbas Road 74 km W Safashahr	27°41'07"N 54°28'36"E 30°47'04"N 52°32'48"E	788 m 2349 m
B. chinensis	Larestan, Juyom city, Fereshteh jan village 53 km N Khonj	28°12'48"N 53°56'17"E 28°14'15"N 53°09'18"E	847 m 643 m
B. insolitus	N Shiraz, 2 km Beyza town, Shah Qotboddin village Shiraz, Arjan town, Cheshmeh Bardi village	29°58'27"N 52°23'32"E 29°30'56"N 52°14'15"E	1647 m 1873 m
B. nigriceps	85 km N Shiraz, Banesh town 53 km N Khonj, Jahreh village	30°05'35"N 52°25'05"E 28°14'27"N 53°09'31"E	1643 m 647 m
B. spinosus	7 km E Shiraz, Pol Brenji town 16 km E Shiraz, Kaftarak town Road	29°35'31"N 52°35'10"E 29°34'45"N 52°41'32"E	1510 m 1482 m

Name of Species	Hormozgan Province		
	County	**Coordinate of location**	**Altitude**
B. asiaticus	89 km NE Minab, Posht Gourband town Sirik, Gerouk city	27°19'23"N 56°59'36"E 26°35'15"N 57°05'14"E	35 m 10 m
B. chinensis	27 km SW Haji Abad	28°10'41"N 55°48'01"E	701 m
B. insolitus	Parsian, Rostam Abad village Bandar Khamir, 33 km SE, Khamir city, Bandare Pol town	27°14'00"N 53°01'12"E 27°00'55"N 55°44'03"E	49 m 11 m
B. nigriceps	9 km S Minab 17 km S Haji Abad	27°03'12"N 57°03'42"E 28°12'09"N 55°49'02"E	14 m 708 m
B. pulchellus	51 km NW Bandar Jask, Jask city, Garuk-e-payin village 54 km E Bandar Jask, Jask city, Darobast village	25°51'52"N 57°25'47"E 25°48'45"N 58°30'50"E	19 m 87 m
B. spinosus	143 km S Bandar Abbas, Sarzeh village	27°34'01"N, 56°07'33"E	320 m