Community structure of aquatic macro invertebrates inhabiting Wadi Al-Arj, Taif, Kingdom of Saudi Arabia.

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Abstract: The present work aims to evaluate the community structure of aquatic macro invertebrates inhabiting Wadi Al-Arj, Taif, Kingdom of Saudi Arabia. Random 154 qualitative samples were collected from different localities every two weeks along a period of one year, from the beginning of February 2012 to the end of February 2013. During the sampling period some environmental factors (air and water temperature, pH and TDS) were measured. Twenty macro invertebrates' taxa were recorded. They belong to three phyla; Annelida, Arthropoda and Mollusca. The recorded invertebrates' taxa have been divided into constancy classes; five dominant, four accessory and eleven accidental taxa. The composition of monthly invertebrate community ranged from 13 taxa in April and July to 19 taxa in February. However, Shannon diversity index ranged between 1.42 and 2.03. The maximal number of collected invertebrates was recorded during March, whereas the minimal number was recorded during April. The invertebrate's composition mostly related to water temperature followed by air temperature and water pH, while TDS has relatively small effects.
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1. Introduction

The majority of desert streams are spatially and temporally intermittent, with flow alternating between the surface and the alluvial zone. Wadis are the relative Arabic name for these intermittent desert streams. They represent ecosystems distinct from streams in more temperate climes chemically and biologically (Busch and Fisher, 1981; Grimm *et al*., 1981; Boulton *et al*., 1992; Boulton and Stanley, 1995; Clinton *et al*., 1996 and Burt, 2003).

Freshwater biota are changing rapidly worldwide (Moyle and Leidy, 1992 and Allan and Flecker, 1993). Streams and rivers are the most vulnerable ecosystems that humans impact (Allan and Castillo, 2007 and Bernhardt and Palmer 2007). Many studies have demonstrated that a loss of habitat diversity caused by negatively effects on the abundance and richness of stream biota, including fishes and macro invertebrates. Therefore, extensive efforts have been devoted to restoring the corrupted streams to conditions closer to their natural state (Malmqvist *et al*., 1991; Quinn *et al*., 1992; Bis *et al*., 2000; Brown, 2000; Muotka *et al*., 2002; Purcell *et al*., 2002; Moerke *et al*., 2004; Alexander and Allan, 2006; Nakano *et al*., 2008 and Shin *et al*., 2011).

Wadi Al-Arj is the downstream part of Wadi Wajj that flows from SW to NE through Taif city, western Saudi Arabia. The wadi collects rainfall runoff during the rainy seasons from the high Hijaz Mountains and flows northeastward through the city of Taif and ends in the interior plains (Al-Shaibani, 2008). There are several agricultural and municipal activities along the Wadi that can be considered as sources of contamination. These are poultry farms, private agricultural farms, a wastewater treatment plant, and settlements along the Wadi banks. Raza, (2004) studied the groundwater quality and vulnerability assessment of Wadi Al-Arj alluvium aquifer. This study indicates that the Wadi Al-Arj aquifer is vulnerable to pollution. Part of Taif sewage system and storm runoff releases water just north of the city to Wadi Al-Arj and waste products are dumped into the stream (Al-Shaibani, 2008 and Abueshey, 2012).

Rosenberg and Resh (1993) illustrated that macro invertebrates are good indicator organisms for biomonitoring water quality and in stream environments of stream ecosystems. The use of biological indicators for water quality monitoring is well established in many parts of the world (Ofenböck *et al*., 2010). Unfortunately, knowledge of freshwater fauna in the Arabian Peninsula is extremely limited (Victor and Al-Mahrouqi, 1996 and Burt, 2003). Balian *et al*. (2008) highlight the lack of data from the Afrotropical (e.g. Southeast Asia) about biodiversity in freshwater ecosystems. Therefore, the present study aims to evaluate the community structure of aquatic macro invertebrates inhabiting Wadi Al-Arj, Taif, Kingdom of Saudi Arabia.

2.Materials and Methods

Random 154 qualitative samples were collected from different localities of Wadi Al-Arj in Taif province, Kingdom of Saudi Arabia (Fig. 1). Macro invertebrates were located visually and collected by hand. The sampling was carried out every two weeks along a period of one year, from the beginning of February 2012 to the end of February 2013. During the sampling period some environmental factors were measured, including air temperature (C˚), water temperature (C˚), Water pH and total dissolved salts (TDS) as ppm. The collected specimens were preserved in 70% Ethanol solution until they were examined for identification purposes.

In laboratory, specimens were examined under a binocular microscope. Several published papers and keys were used to identify the collected invertebrates including; Walker (1959), Klemm (1972), Sawyer (1972), Neubert (1998), Kalkman *et al*. (2008), Nesemann *et al*. (2011) and Abd El-Wakeil *et al*. (2013). In addition to Identified specimens that are deposited in Educational Museum of Egyptian Fauna, Zoology Department, Faculty of Science, Assiut University, Egypt.

The recorded invertebrates were divided into frequency classes according to the system adopted by Weis-Fogh (1948) as following: Constant species that are present in more than 50% of the samples, accessory species that are present in 25–50% of the samples and accidental species in less than 25% of the samples. Shannon wiener diversity index (H`) was calculated to show the invertebrates diversity within the monthly collected communities by using shannon-wiener equation $H` = -\sum pi\ (\ln pi)$, where ***pi*** is the proportion of individuals belonging to the i^{th} species. Invertebrates' richness of these communities were calculated.

Analysis of Variance on SPSS software package (version 17) (SYSTAT statistical program) was used to test the present data. In case of significant differences, the Duncan test was selected from the PostHoc window on the same statistical package to detect the distinct variances between means. Probability values ≤ 0.05 were defined as significant throughout the present study; however the values > 0.05 were defined as non-significant. Probability values between 0.05 and 0.01 (both are included) were evaluated as significant, where the values < 0.01 were defined as highly significant. The program Canoco for windows 4.5 was used for canonical corresponded analysis (CCA) as a unimodal method to analyze the response of the benthic community composition to environmental variables.

3. Results

Site description

The bed and substrate of collecting site varies between muddy soil, sandy soil and even gravel soil. Some vertebrates like dogs, cats, sheep, goats, Cipridae fish, tadpole, frog and little egret were observed. The collecting site at Wadi Al-alj is rich in filamentous algae and plants with some dominant species including *Acacia* spp, *Calotropis procera*, *Chrozophora oblongifolia*, *Coronopus didymus*, *Datura inoxia*, *Lycium shawii*, *Mentha longifolia*, *Pluchea dioscoridis*, *Ricinus communis*, *Solanum incanum*, *Tamarix nilotica* and *Xanthium strumarium*

Environmental factors:

Monthly mean records of air and water temperature, pH and total dissolved salts (TDS) during the period of investigation, from February 2012 to February 2013, are shown in table (1). Along the year of the study, the air temperature fluctuated in the range of 13.7 ˚C in January and 29.2 ˚C in May, while the water temperature ranged between 19.4 ˚C in January and 24.7 ˚C in November. The pH values varied between 8.1 in May, September, October and 8.8 in January. TDS values ranged between 330.9 ppm in November and 535.8 ppm in October. All these factors show a significant differences (p<0.01) between months (Table 1).

Macro invertebrates composition

Twenty macro invertebrates' taxa were recorded from Wadi Al-Arj during the study period. The recorded taxa belong to three phyla; Annelida, Arthropoda and Mollusca. Annelida represented by one species and Arthropoda represented by fifteen taxa that belong to twelve Families and three orders, all of them are Insecta. Mollusca represented by four species related to four families and two orders of Gastropoda (Table 2). The composition of monthly invertebrate community fluctuated throughout the period of study (Table 3).

The recorded invertebrates' taxa have been divided into constancy classes. The constant taxa are five: Protoneuridae nymph (Tillyard) with a frequency of 84% of the samples, *Melanoides tuberculata* (O.F. Müller) with a frequency of 69% of the samples, *Ambrysus sp.* (Stål) with a frequency of 68% of the samples, *Physa acuta* (Draparnaud) with a frequency of 68% of the samples) followed by *Biomphalaria arabica* (Melvill & Ponsonby) with a frequency of 62% of the samples. The accessory taxa are four: Corduliidae nymph (Kirby) with a frequency of 45% of the samples, *Pseudosuccinea columella* (Say) with a frequency of 44% of the samples, *Libellula forensis* nymph (Hagen) with a frequency of 27% of the samples and Synlestidae nymph (Tillyard) with a frequency of 25% of the samples. The accidental taxa are eleven: *Cybister* *fimbriolatus* larvae (Wilke) with a frequency of 22% of the samples, *Libellula* sp. Nymph (Linnaeus) with a frequency of 21% of the samples, Cordulegastridae nymph (Tillyard) with a frequency of 14% of the samples followed by Coenagrionidae nymph (Kirby) and *Nepa apiculata* (Uhler) 12% of the samples for each, *Cybister fimbriolatus* (Wilke) with a frequency of 8% of the samples, *Haemopis grandis* (Verrill) with a frequency of 6% of the samples, *Anisops deanei* (Brooks) with a frequency of 5% of the samples, *Basiaeschna* sp. nymph (Selys) with a frequency of 4% of the samples, Gomphidae nymph (Rambur) with a frequency of 3% of the samples and *Anax* sp. nymph (Leach) with a frequency of 2% of the samples.

Macro invertebrates seasonal variations

A great difference in the stock of invertebrates was noticed during the studied months. As shown in table (3), Invertebrates abundance has seasonal fluctuations. The total catch of the invertebrates showed significant differences between months ($F= 4.76$, $P= 0,001$). Their maximal number was recorded during March (mean= 194 individuals), whereas the minimal number was recorded during April (mean= 20 individuals) as seen in Fig. 2.

It was noticed that the monthly variations of taxa richness was statistically significant ($F= 3.76$, $P= 0.003$), while the variations of Shannon diversity index was not significant ($F= 1.502$, $P= 0.195$). Taxa richness ranges between 13 that was recorded during April and July and 19 that was recorded during February. However, Shannon diversity index ranges between 1.42 in April and 2.03 in March (Fig. 3).

Response of macro invertebrates to the environment factors—CCA

The results of canonical correspondence analysis (CCA) ordination was performed on twenty macro invertebrates taxa and the corresponding studied environmental variables (air and water temperature, pH and TDS) for the twelve monthly samples. Diagram of canonical correspondence analyses are shown in Fig. 4. The first two CCA axes together account for approximately 53% of the relations between invertebrates and environmental data. The results of CCA reveal that the invertebrates composition mostly related to water temperature followed by air temperature and water pH. TDS has relatively small effects in invertebrates. Water and air temperatures show negative correlation with second canonical axis, while water pH indicates positive correlation.

Table 1. Mean ± standard deviation (SD) of environmental factors for studied months at investigated sites (The similar characters for each factor show no significant difference).

Sites	Air temperature			Water temperature			Water pH			TDS		
	Mean	±	SD	Mean	±	SD	Mean	±	SD	Mean	±	SD
January	13.7	±	6.3	19.4	±	1.1	8.8	±	0.7	478.8	±	25.0
		a			**a**			**c**			**d.e**	
February	19.0	±	5.5	22.0	±	1.3	8.4	±	0.4	447.6	±	83.0
		b.c			**b**			**a.b**			**c**	
March	22.8	±	3.1	22.0	±	1.6	8.0	±	0.3	472.2	±	14.3
		d			**b**			**a**			**c.d**	
April	23.4	±	2.9	22.4	±	1.2	8.3	±	0.2	515.1	±	22.0
		d			**b**			**a.b**			**g.h**	
May	29.2	±	3.7	24.4	±	1.3	8.1	±	0.1	494.2	±	12.6
		f			**e**			**a**			**d.e.f.g**	
June	27.9	±	5.0	23.7	±	1.3	8.2	±	0.4	508.3	±	11.6
		e.f			**c.e**			**a**			**e.f.g.h**	
July	25.4	±	5.5	23.0	±	0.7	8.2	±	0.1	512.2	±	22.6
		d.e			**b.c**			**a**			**f.g.h**	
August	24.8	±	5.6	24.4	±	2.0	8.4	±	0.3	481.2	±	24.5
		d.e			**e**			**a.b**			**d.e.f**	
September	23.8	±	4.0	23.1	±	0.7	8.1	±	0.3	524.4	±	22.0
		d			**b.c**			**a**			**g.h**	
October	22.1	±	5.2	22.9	±	1.0	8.1	±	0.5	535.8	±	24.5
		c.d			**b.c**			**a**			**h**	
November	16.2	±	3.5	24.7	±	0.8	8.2	±	0.5	330.9	±	19.0
		a.b			**e**			**a**			**a**	
December	16.4	±	5.0	22.8	±	2.7	8.7	±	0.7	417.1	±	64.4
		a.b			**b.c**			**b.c**			**b**	

Table 2. Invertebrate taxa of Wadi Al-arj in Taif, KSA with their percentages of frequency (154 samples during the period of investigation). Constant taxa (a), accessory taxa (b), accidental taxa (c).

Phylum	Class	Order	Suborder	Family	Famliy/Genus/Species	F %
Annelida						
	Hirudinida					
		Arhynchobdellida				
			Hirudiniformes			
				Haemopidae	*Haemopis grandis* (Verrill, 1874), **c**	6
Arthropoda						
	Insecta					
		Coleoptera				
			Adephaga			
				Dytiscidae	*Cybister fimbriolatus* (Wilke, 1920), **c**	8
					Cybister fimbriolatus larvae (Wilke, 1920), **c**	22
		Hemiptera				
			Heteroptera			
				Naucoridae	*Ambrysus* sp.(Stål, 1862), **a**	68
				Notonectidae	*Anisops deanei* (Brooks, 1951), **c**	5
				Nepidae	*Nepa apiculata* (Uhler, 1862), **c**	12
		Odonata				
			Zygoptera (Damselflies)			
				Coenagrionidae	Coenagrionidae nymph (Kirby, 1890) Narrow-winged damselflies nymph, **c**	12
				Protoneuridae	Protoneuridae nymph (Tillyard, 1917) Threadtails damselflies nymph, **a**	84
				Synlestidae	Synlestidae nymph (Tillyard 1917) Sylphs damselflies nymph, **b**	25
			Anisoptera (Dragonflies)			
				Aeshnidae	*Basiaeschna* sp. nymph (Selys, 1883) Springtime Darner nymph, **c**	4
					Anax sp. nymph (Leach, 1815) Darner nymph, **c**	2
				Cordulegastridae	Cordulegastridae nymph (Tillyard, 1917) Spiketails nymph, c	14
				Corduliidae	Corduliidae nymph (Kirby, 1890) Emeralds nymph, **b**	45
				Gomphidae	Gomphidae nymph (Rambur, 1842) Clubtails nymph, **c**	3
				Libellulidae	*Libellula* sp.Nymph (Linnaeus, 1758) Pond skimmers nymph, **c**	21
					Libellula forensis nymph (Hagen, 1861) Eight-spotted Skimmer nymph, **b**	27
Mollusca						
	Gastropoda					
		Pulmonata				
			Basommatophora			
				Lymnaeidae	*Pseudosuccinea columella* (Say 1817), **b**	44
				Physidae	*Physa acuta* (Draparnaud, 1805), **a**	68
		Sorbeoconcha		Planorbidae	*Biomphalaria arabica* (Melvill & Ponsonby, 1896), **a**	62
			Discopoda			
				Thiaridae	*Melanoides tuberculata* (O.F. Müller, 1774), **a**	69

Table 3. Seasonal variation of the frequency of Invertebrate taxa collected from Wadi Al-arj in Taif, KSA.

Invertebrate taxa	January		February		March		April		May		June		July		August		September		October		November		December	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Haemopis grandis	1	7	0	0	1	7	1	7	0	0	2	14	0	0	1	14	2	14	0	0	1	7	1	7
Cybister fimbriolatus	1	7	1	7	3	21	1	7	1	7	3	21	1	14	0	0	0	0	0	0	0	0	2	14
Cybister fimbriolatus larvae	2	14	2	14	4	29	0	0	1	7	5	36	3	43	2	29	7	50	4	29	1	7	3	21
Ambrysus sp.	9	64	12	86	10	71	12	86	8	57	11	79	5	71	6	86	4	29	9	64	10	71	9	64
Anisops deanei	1	7	2	14	2	14	0	0	0	0	0	0	0	0	1	14	0	0	1	7	0	0	0	0
Nepa apiculata	0	0	1	7	4	29	0	0	2	14	2	14	1	14	2	29	4	29	1	7	1	7	0	0
Coenagrionidae nymph	0	0	1	7	6	43	1	7	5	36	1	7	0	0	0	0	1	7	2	14	0	0	1	7
Protoneuridae nymph	12	86	12	86	14	100	8	57	7	50	12	86	6	86	5	71	13	93	11	79	17	121	12	86
Synlestidae nymph	1	7	3	21	4	29	2	14	2	14	4	29	2	29	5	71	6	43	5	36	2	14	2	14
Basiaeschna sp. nymph	0	0	2	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	3	21
Anax sp nymph	0	0	2	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7
Cordulegastridae nymph	4	29	2	14	0	0	1	7	4	29	2	14	1	14	2	29	0	0	0	0	1	7	5	36
Corduliidae nymph	9	64	10	71	10	71	4	29	5	36	4	29	3	43	0	0	5	36	7	50	4	29	9	64
Gomphidae nymph	0	0	1	7	0	0	0	0	1	7	0	0	0	0	0	0	0	0	1	7	0	0	1	7
Libellula sp.Nymph	3	21	5	36	8	57	0	0	4	29	3	21	0	0	1	14	1	7	2	14	1	7	5	36
Libellula forensis nymph	7	50	6	43	5	36	1	7	2	14	1	7	1	14	2	29	2	14	3	21	3	21	8	57
Pseudosuccinea columella	6	43	8	57	13	93	3	21	4	29	3	21	2	29	2	29	9	64	7	50	4	29	6	43
Physa acuta	11	79	12	86	14	100	6	43	7	50	11	79	6	86	6	86	10	71	8	57	4	29	9	64
Biomphalaria arabica	9	64	11	79	13	93	2	14	6	43	12	86	6	86	5	71	11	79	8	57	5	36	7	50
Melanoides tuberculata	13	93	11	79	10	71	3	21	6	43	9	64	7	100	5	71	12	86	9	64	9	64	13	93

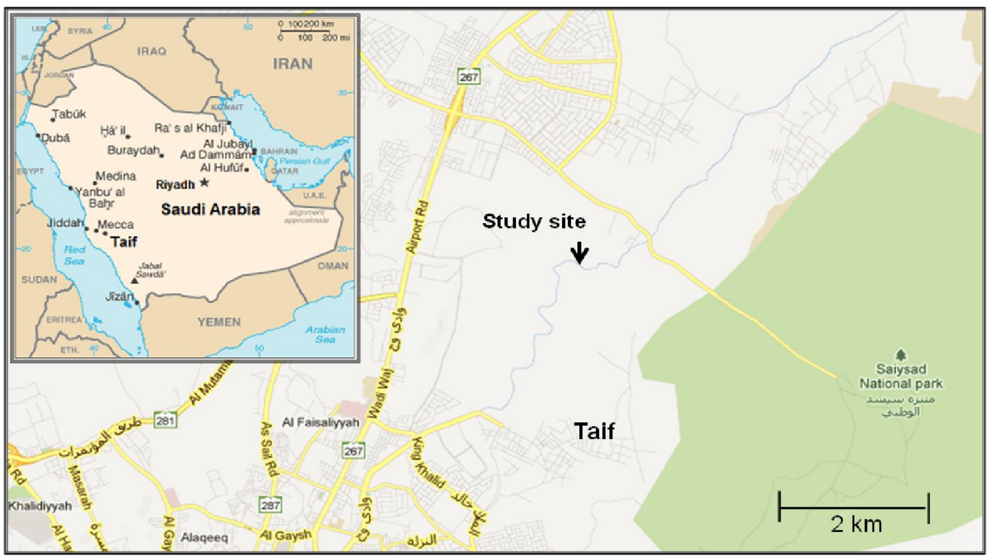

Figure1. Map showing study site (Wadi Al-Arj) in Taif province, Kingdom of Saudi Arabia.

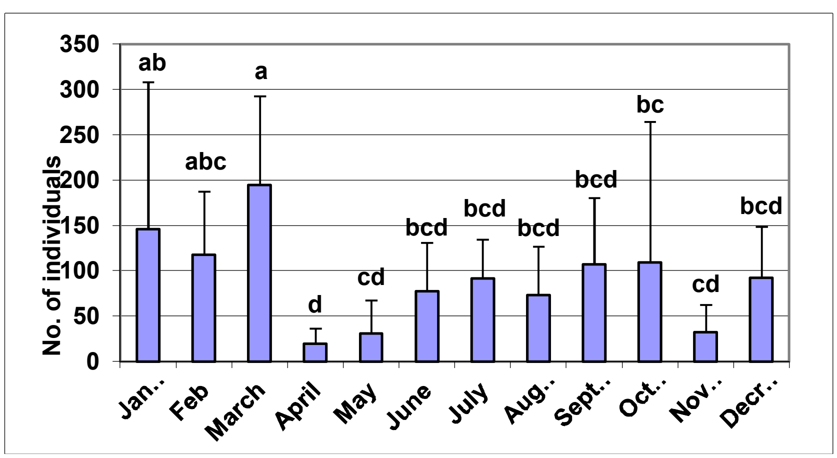

Figure 2. Monthly variations for the mean density (number of individuals) of Invertebrate taxa collected from Wadi Al-Arj stream during the period of study (The similar characters show no significant difference).

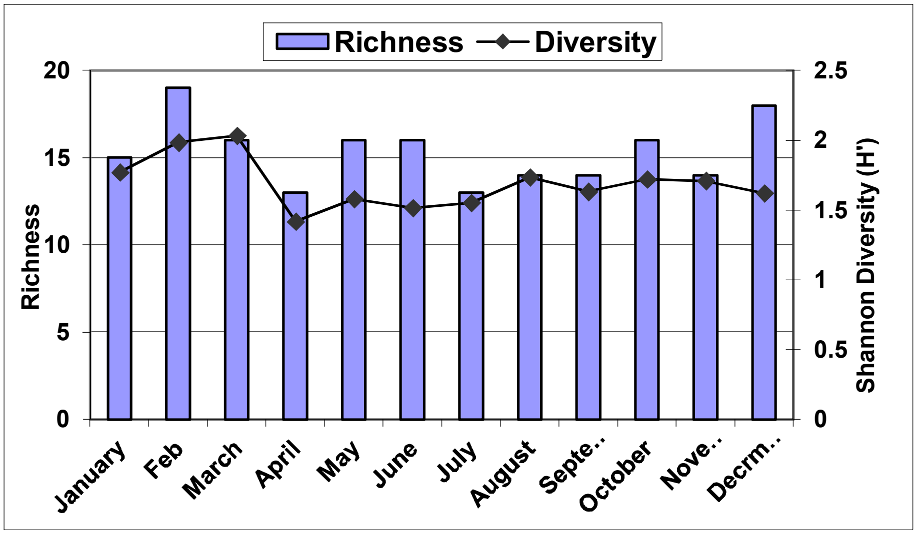

Figure 3. Monthly variations of species richness (S) and Shannon-Wiener's index of general diversity (H) of Invertebrate taxa collected from Wadi Al-Arj stream during the period of study.

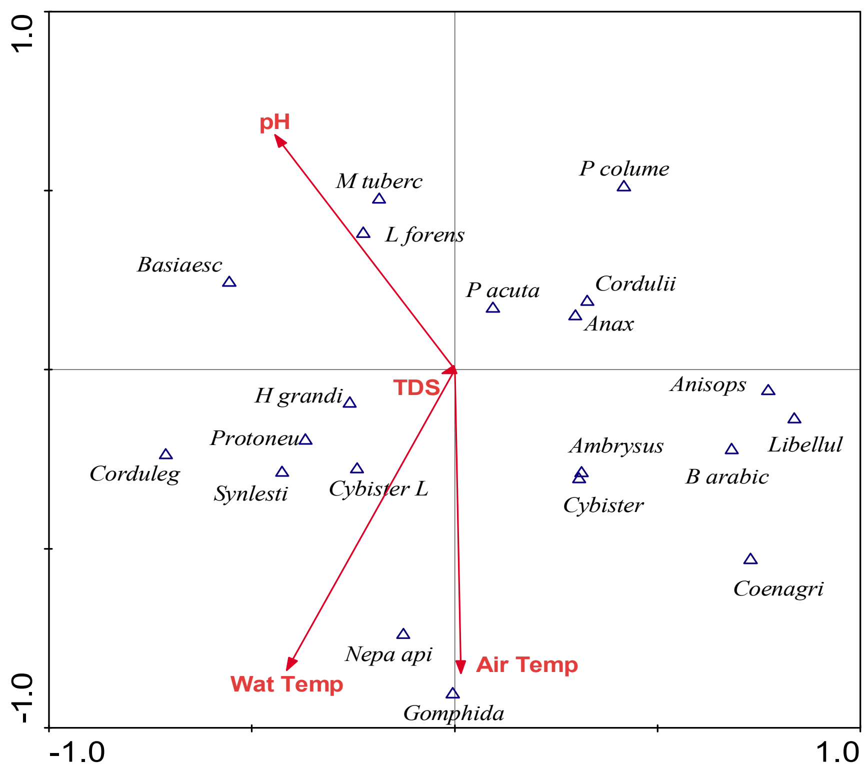

Figure 4. Ordination diagrams of canonical correspondence analyses (CCA) of macro invertebrate taxa abundance data (20 taxa) and corresponding environmental factors sampled form Wadi Al-Arj during the period of study. Invertebrate notation: *H grandi- Haemopis grandis*, *Cybister- Cybister fimbriolatus*, *Cybister* L-*Cybister fimbriolatus* larva, *Ambrysus-Ambrysus* sp., *Anisops- Anisops deanei*, *Nepa api- Nepa apiculata*, Coenagri-Coenagrionidae nymph, Protoneu- Protoneuridae nymph, Synlesti- Synlestidae nymph, *Basiaesc-Basiaeschna* sp. nymph, *Anax- Anax* sp nymph, Corduleg- Cordulegastridae nymph, Cordulii- Corduliidae nymph, Gomphida-Gomphidae nymph, *Libellul- Libellula* sp. nymph, *L forens- Libellula forensis* nymph, *P columel- Pseudosuccinea columella*, *P acuta- Physa acuta*, *B arabic-Biomphalaria arabica*, *M tuberc- Melanoides tuberculata*. Environmental factors notation: Air Temp – air temperature, Wat Temp- water temperature, pH- water pH, TDS-total dissolved salts.

4. Discussion

The present study considers the first inclusive examination of freshwater macro invertebrate fauna for Saudi Arabia. Prior comprehensive examinations of macro invertebrate fauna for the Arabian Peninsula was the study of Wadi Bani Habib of Jebel Akhdar, northern Oman (Victor and Al-Mahrouqi 1996) and study of aquatic macro invertebrates of Wadi Qahfi in the arid Hajar Mountains, Oman (Burt, 2003). In comparison to these studies, there are similarities in environmental characters to high extend between Wadi Bani Habib and Wadi Qahfi with the result recorded in the present study for Wadi Al-Arj. Water in Wadi Al-Arj has pH ranged between 8 to 8.7. Burt (2003) illustrated that this slightly alkaline may be due to the influence of algal mats and limestone deposits in the stream.

Information regarding freshwater invertebrate fauna from the Arabian region is scarce. Aquatic taxonomy remains an area in need of substantial development (Burt, 2003). Aside from molluscs, few studies have examined the composition of aquatic communities in the Arabian Peninsula (Victor and Al-Mahrouqi, 1996; Roberts and Irving-Bell, 1997; Victor and Victor, 1997; Neubert, 1998; Al-Akel and Suliman, 2012). Burt (2003), mentioned that there is very little information on the larval stages of aquatic insects in the Fauna of Saudi Arabia series, the primary taxonomic resource for the region, and a common naturalist guide, lnsects of Eastern Arabia (Walker and Pittaway, 1987), only has an incorrectly identified larval dragonfly (Schneider and Dumont, 1997). The present study identified 10 of Odonata larva; 3 Zygoptera (damselflies) nymphs and 7 Anisoptera (dragonflies) nymphs.

Twenty macro invertebrates' taxa were recorded in Wadi Al-Arj during the present study. All of these taxa are first record in Taif except *Biomphalaria arabica*. This is a relatively low number when compared to other tropical streams (Victor and Ogbeibu, 1985, 1991; Ogbeibu and Victor, 1989; Victorr and Al-Mahrouqi 1996 and Burt, 2003). The low number of invertebrates recorded here may be rebated to that the present study concerned with marco fauna only. Another reason that Wadi Al-Arj sufer from several human activities along the Wadi that can be considered as sources of contamination (Raza, 2004). This anthropogenic impact in survival of invertebrates in the stream. Also, the relatively few species may be related to tolerate the roughness of the environmental conditions associated with the hot and arid climate (Louw and Seely, 1982; Carl, 1989). This reason may be explain the relatively low taxon diversity. Since, the high species diversity values usually indicate that good water quality and a healthy aquatic environment exist in the streams (Wilhm and Dorris, 1968; Hussain and Pandit 2012). It is evident that the composition and distribution of macro invertebrates in streams is governed by numerous physical, chemical and biological factors which need to be taken into consideration in any study of stream macro invertebrates. In addition, it may be said that the composition and distribution of stream macro invertebrates is a reflection of the stream health and thus can be used as robust bioindicators (Hussain and Pandit 2012).

The differences between studied environmental factors between months seem related to differences between seasons. Generally, difference of environmental factors indicates conditions capable of supporting a diverse biota (APHA, 1985; Bass, 1994). In the present study, a great difference in invertebrates abundance was noticed during the studied months. Such seasonal fluctuations in stream faunal communities were recorded in previous study (Bass 1994; Victorr and Al-Mahrouqi, 1996; Argerich *et al*., 2004). In an aquatic ecosystem, the seasonal changes played a major role in structuring the benthic community (Ngqulana, (2012). The number of species in a benthic community varies greatly with depth and sediment type. A typical trend observed is a significant decrease in species number with depth. Food availability (Simboura *et al*., 2012). Sediment deposition and the formation of longitudinal gradients (Vannote *et al.,* 1980). These factors directly or indirectly influence the resident biological communities (Ward, 1998).

Schneider and Dumont (1997), studied the dragonflies and damselflies (lnsecta: Odonata) of Oman csdand updated and annotated checklist of Odonata in Arabian pensulia. They recorded one species; *Elattoneura khalidi* (Schneider) at Wadi Bani Khalid in Oman belonged to family Protoneuridae. There are 245 species belonged to 25 genera of family Protoneuridae 4 genera (37 species) were recorded in Afro tropical region (Kalkman *et al*., 2008). The present study shows that Protoneuridae nymph (Tillyard) is the most abundant taxa with a frequency of 84% of the samples.

In the present study Mollusca species were the most dominant invertebrate in Wadi Al-Arj. *Melanoides tuberculata* (O.F. Müller) is one of the most dominant present collected invertebrates with a frequency of 69% of the samples. This species is by far the most common freshwater snail of the Arabian Peninsula. Due to its parthenogenetic mode of reproduction, a single specimen is sufficient to build up a complete population. *Melanoides tuberculata* is widespread all over the world owing to human activities which may originate from the Indopacific area (Neubert, 1998). Another dominant species in this study is *Physa acuta* (Draparnaud) with a frequency of 68% of the samples. *Ph. acuta* is spread widely by human activity; its origin is doubtful, northern America (Neubert, 1998). This species is known from a few localities in the Arabian Peninsula at Khobar, Medina Province; small canals near Riyadh (Brown and Wright, 1980). One more dominant species in present study is *Biomphalaria arabica* (Melvill & Ponsonby) with a frequency of 62% of the samples. This species is widespread in all freshwater habitats in the western part of the Arabian Peninsula (Neubert, 1998). The taxonomic position of this species has to be re-evaluated as conspecificity with *Biomphalaria pfeifferi* (Krauss) from Africa (Brown 1994). It recorded in Wadi al-Sharan at the road from Taif to al-Baha of Bani Sa'ad (Neubert, 1998).

In the present investigation, the factors measured which affect the distribution of invertebrate taxa in the areas of investigation, were air and water temperature, pH and salinity (TDS). The results of CCA reveal that the invertebrates composition mostly related to water temperature followed by air temperature and water pH. This corroborate previous evidence on the influence of water chemistry on macroinvertebrate abundance (Peterson *et al.,* 1993; Buss *et al.,* 2002; Benstead *et al*., 2005; Nicola *et al.,* 2010; Abd El-Aziz, 2012). Aquatic chemistry variables are frequently used to explain the variation in macro invertebrate communities in ecosystems (Heino 2000; Ferreira *et al*., 2009).

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