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EFFECT OF WATER POLLUTION ON THE DISTRIBUTION OF WEEDS ASSOCIATED WITH THE CROPS ALONG BAHR EL BAQAR DRAIN

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ABSTRACT: The effect of water pollution used for irrigation on the distribution of the weeds associated with the cultivated crops were studied in nine sites along Bahr El Baqar drain. The field survey revealed the presence of 63 species belonging to 22 families along the studied sites. The most dominant families were Poaceae, followed by Asteraceae, Amaranthaceae and Cyperaceae; while Euphorbiaceae, Tamaricaceae and Apiaceae were the lowest-represented families. Canonical Correspondence Analysis (CCA) of the soil chemical constituents showed that sodium, electrical conductivity (EC), sulphates and chloride were the most effective soil variables controlling the weed distribution along Bahr El Baqar drain in studied nine sites. Data showed that salinity indicator species as *Spergularia marina* (L.) Besser, *Cressa cretica* L. and *Imperata cylindrica* (L.) Raeusch. were common at high salinity and EC; while waste land indicator species such as *Arundo donax* L., *Dysphania ambrosioides* (L.) Mosyakin & Clemants and *Chenopodium murale* L. were also documented. This work includes the taxonomic studies of the species distributed along Bahr El Baqar drain, including the species identification and updates classification. Finally, this study highlights the negative effect of the polluted water used for irrigation on soil and crop-associated weeds.

Keywords: Distribution, weeds, Bahr El Baqar drain, water pollution

INTRODUCTION

The sustainable irrigated agriculture in Egypt is threatened by water stress making the reuse of wastewater an alternative option for the newly cultivated soils (Abuzaid, 2018). Abbas *et al*. (2020) reported that limited freshwater coupled with the ever-growing population has forced the farmers in Egypt to reuse non-traditional water sources for irrigation purposes. However, a precise evaluation of such water quality is necessary to avoid its potential risks to both soil and cultivated crops.

Abuzaid and Jahin (2021) investigated the effects of different water sources on soil quality at two different sites. These sites were irrigated using either agricultural drainage water (ADW) or sewage effluent water (SEW), and compared to soil irrigated with freshwater from the Nile. They concluded that irrigation with low-quality water caused minor changes in soil properties. The soil chemical quality index was negatively affected by increasing the pH, electrical conductivity, and exchangeable sodium percentage. While, the available (Fe, Mn, Zn, and Cu) in SEW-irrigated soils were increased. Parent materials governed soil total contents of Cr, Co, and Ni, while contents of Cd, Cu, Pb, and Zn were closely related to irrigation water. The environmental quality index showed an increasing trend in the ADW-irrigated soils, while a decrease in the SEW-irrigated soils. According to the environmental quality index, there was a noticeable rise in the quality of the ADW-irrigated soil, while a decrease in the SEW-irrigated soils.

The weed associated to the cultivated crops, reflect both of soil and water quality, previous works treated this topic among them Jan *et al.* (2012) studied the distribution of forty-three weed species belonging to 42 genera in 25 families in wheat fields of district Bannu, Khyber Pakhtunkhwa Pakistan. Ahmad *et al*. (2016) studied the weed species composition and distribution pattern in the maize crop in Pakistan. Mukhtar and Abdalla (2021) made a weed survey in six locations in Khartoum area to determine the most common and prevalent weed species associated with *Vicia faba* L. crop cultivation.

As a result of water scarcity and the inevitability of agricultural expansion to keep pace with the increase in the population, it was necessary to take advantage of non-conventional water sources. Therefore, this research aims to study the effect of water pollution on the distribution of weeds associated to the cultivated crops along Bahr El Baqar drain, which irrigated from Bahr al-Baqar drain.

MATERIALS AND METHODS

Study area:

Bahr El-Baqar drain is located in the eastern part of Nile Delta. It originates at the confluence point of the Belbies and Qalubia drains. Bahr El-Baqar drain which was originally designed to transport the agriculture drainage water as well as both domestic and industrial wastewater over the last few decades via Belbies and Qalubia drains. The annual quantity of drainage water transported through Bahr El-Baqar drain amounts to 1.63 billion m^3. Bahr El-Baqar drain runs 106.5 Km before discharged into Manzala Lake by gravity (Fig., 1).

Plant material:

The weeds associated to the cultivated crops were collected between November 2019 and December 2020 from nine sites along Bahr El Baqar drain [El Mashmas, Qaryah (Abu Omar center), Izbat Ad Deiba (Sharqiya), Izbat Al Gytanya (Faqous), Izbat Ouda (Zagazig-Belbeis), Izbat Zaafarana (Minya Al-Qamh), Al Hamidiyyah (Sunhot), Kafr Ata Allah (Nubqas Road-Qalyubia) and Mushtuhur]. The sites were selected using the Global Positioning System (GPS) as shown in Fig. (1). Identification and updated nomenclature were revised and confirmed using the available literature among them; Boulos (1995, 1999, 2000, 2002, 2005 and 2009).

Water and soil analyses:

Surface soil samples at depths of 0-30 cm and water samples used in irrigation were collected from the nine studied sites of water at Bahr El-Baqar drain.

Water samples were collected from each site in pre-cleaned high-density polyethylene bottles which were pre-prepared according to the method described by Environment Protection Authority "EPA" (Duncan *et al.*, 2007) and Rocky Mountain Research Station "RMRS" (Musselman, 2012). Samples were brought into the lab in an ice tank and stored at 4 °C until analysis. The soil samples, were air dried, sieved through a < 0.2 mm sieve and stored in the labeled polythene sampling bags according to Adepetu *et al*. (2000).

Chemical analyses of detriment according to ICARDA (Estefan *et al.*, 2013); water was acidified with HNO_3 (1 ml nitric acid for 100 ml water) and filtered according to Eaton *et al*. (2005) for detriment soluble (Fe, Mn, Cu, B, Cd, Co, Cr, Ni and Pb). Soils digested by using aqua regia (HCl and HNO_3) mixture (3:1) at 150 °C for two hours according to Cottenie *et al*. (1982) and Estefan *et al.* (2013) for detriment total elements (Fe, Mn, Cu, B, Cd, Co, Cr, Ni and Pb).

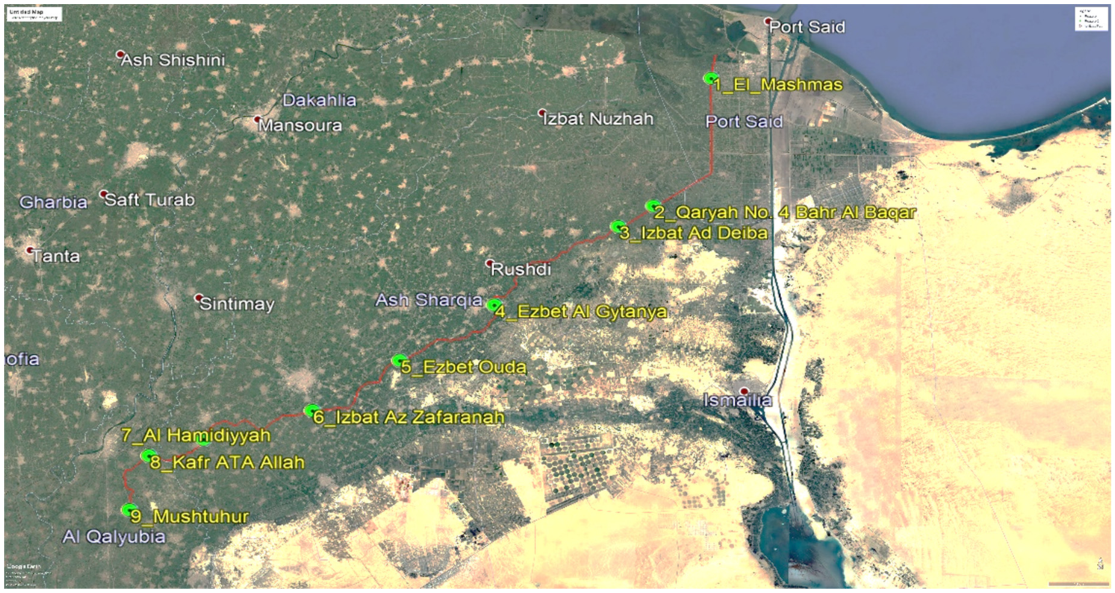

Fig. 1. Study area showing the selected sites along Bahr El Baqar main drain.

Geographic coordinates: Site 1 (31º 09' 07.1'' N, 32º 11' 59.6'' E); Site 2 (30º 54' 15.4'' N, 32º 05' 24.1'' E); Site 3 (30º 52' 25.01'' N, 32º 02' 31.61'' E); Site 4 (30º 43' 34.95'' N, 31º 49' 52.11'' E); Site5 (30º 31' 57.37'' N, 31º 31' 49.13'' E); Site 6 (30º 37' 26.25'' N, 31º 40' 24.72'' E); Site 7 (30º 27' 38.37'' N, 31º 19' 59.99'' E); Site 8 (30º 26' 40.06'' N, 31º 15' 29.49'' E); Site 9 (30º 21' 14.9'' N, 30º 14' 10.5'' E).

Elements in water and soil were determined by Inductively Coupled Plasma Spectrometry (ICP) (Ultima 2 JY Plasma), according to the procedure of Environmental Protection Agency "EPA" (Clark, 1991).

Data analysis:

Canonical Correspondence Analysis (CCA) was used to examine the relationship of soil factors with species distribution pattern and indicators. CCA was performed using Past statistical software.

RESULTS AND DISCUSSION

The weeds associated with the cultivated crops namely clover, wheat, maize, and cotton crops as well as those that escaped from cultivation on roadsides among the studied areas were also documented. In selected nine sites along Bahr El Baqar drain were identified as 55 genera and 63 species distributed among 22 families. The most common families were Poaceae (18 genera and 20 species), followed by Asteraceae (6 genera and 6 species), Amaranthaceae (4 genera and 5 species), Cyperaceae (1 genus and 4 species), Polygonaceae, Fabaceae (3 genera and 3 species each), Brassicaceae, Caryophyllaceae, Convolvulaceae, Malvaceae (2 genera and 2 species each), Euphorbiaceae, Tamaricaceae (1 genus and 2 species each), Apiaceae, Apocynaceae, Lamiaceae, Oxalidaceae, Plantaginaceae, Pontederiaceae, Portulacaceae, Primulaceae, Ranunculaceae and Solanaceae (1 genus and 1 species each) as shown in Fig. (2).

1. Evaluation of chemical analyses in water along Bahr El-Baqar drain of the nine sites:

The chemical characteristics of the irrigation water from Bahr El-Baqar drain are summarized in Table (1). Data showed that pH values for water were alkaline and ranged from 8.20-8.66. The pH reached up to 8.5, showed the highest permissible limits in sites No. 1, 2, 3, 4, 5 and 7 according to the guidelines for water quality irrigation (Ayers

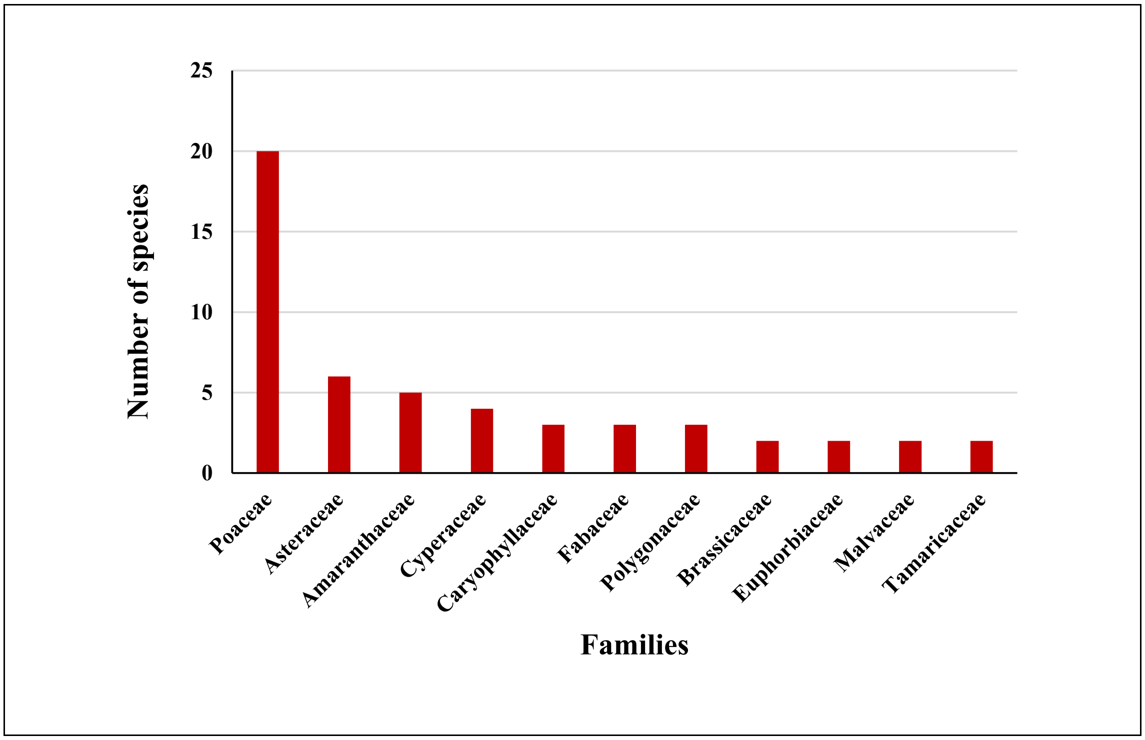

Fig. 2. Species-rich families in the studied 9 sites along Bahr El Baqar drain.

Table 1. Chemical analyses in water along Bahr El-Baqar drain.

Sites No.	pH	EC dSm^{-1}	Soluble Anions (cm molc l^{-1})				Soluble cations (cm molc l^{-1})				SAR
			CO_3^{-2}	HCO_3^-	Cl^-	SO_4^{-2}	Ca^{2+}	Mg^{2+}	Na^+	K^+	
1	8.65	1.42	0.00	1.69	8.24	4.24	3.22	2.55	8.10	0.30	4.77
2	8.66	1.43	0.00	1.64	8.30	4.33	3.65	2.90	7.42	0.30	4.10
3	8.54	1.46	0.00	1.71	8.47	4.35	3.47	3.00	7.75	0.31	4.31
4	8.6	1.52	0.00	1.73	8.82	4.62	3.65	2.60	8.60	0.32	4.86
5	8.5	1.55	0.00	1.67	8.99	4.81	3.74	2.40	9.00	0.33	5.14
6	8.4	1.38	0.00	1.64	8.01	4.14	3.35	2.30	7.85	0.29	4.67
7	8.6	1.60	0.00	1.67	9.28	5.04	3.82	3.20	8.63	0.34	4.61
8	8.4	1.75	0.00	1.64	10.15	5.68	4.35	3.55	9.20	0.37	4.63
9	8.2	1.8	0.00	1.64	10.44	5.88	4.55	4.11	9.05	0.25	4.35
Nile water	7.7	0.4	0.00	2.34	0.83	0.81	1.60	1.01	1.12	0.25	0.98
Minimum	8.20	1.38	0.00	1.64	8.01	4.14	3.22	2.30	7.42	0.25	4.10
Maximum	8.66	1.80	0.00	1.73	10.44	5.88	4.55	4.11	9.20	0.37	5.14
Average	8.51	1.55	0.00	1.67	8.97	4.79	3.76	2.96	8.40	0.31	4.60
Guidelines	6.5-8.40[a]	0.7-3.0[a]	-	1.5-8.5[a]	4.0-10[a]	-	-	-	3.0-9.0[a]	-	10.18[b]

a: Ayers and Westcot (1985) and b: Motsara and Roy (2008)
SAR= sodium adsorption ratio

and Westcot, 1985). The increase in pH leads to the transformation of the soils into alkaline soils. In general, all the water in the studied sites was found to be alkaline. The lowest pH value was found in site No. 9. This may be attributed to the discharge of water resulted from different factories and the acidic fertilizers in the agricultural drainage.

Concerning the EC and SAR in Bahr El-Baqar drain, the mean values, were 1.55 dS m^{-1} and 4.60, respectively. The highest value for EC was found in site No. 9 followed by site No. 8. As well as the highest value for SAR was found in site No. 5 followed by site No.4.

All sites were observed to be alkaline with remarkably moderate EC and low SAR values along Bahr El-Baqar drain. These results agree with El-Shakweer and Abdel-Hafeez (2008) who showed that the salinity levels of drainage waters of some drains generally ranged between high to very high, denote a salinity hazardous as well as such water is categorized as low-medium hazardous.

2. Evaluation of some soluble, micronutrients and heavy metals content in water along Bahr El-Baqar drain of the nine sites:

The concentrations of soluble micronutrients and heavy metals (Fe, Mn, Zn, Cu, B, Cd, Cr, Ni and Pb) were presented in Table (2). The obtained results revealed that all micronutrients and heavy metals were traced in the irrigation water within the permissible limits for uses such water in irrigation according to Ayers and Westcot (1985). This may be due to the adsorption of the elements on the fine colloids suspended in the water stream and their deposition at the bottom of the stream.

3. Evaluation of chemical analyses for soils irrigated from Bahr El Baqar drain of the nine sites:

The chemical analysis of the soil irrigated from Bahr El Baqar drain is summarized in Table (3). Fig. (3) shows the pattern of the distribution of the species concerning the prevailing soil variables. Sites 9 and 8 showed the highest concentrations of (Na^+ :12.65 cm molc l^{-1} and 12.42 cm molc l^{-1}, respectively; EC: 2.95 dS m^{-1} and 2.85 dS m^{-1}, respectively; SO_4^-: 13.29 cm molc l^{-1} and 13.02 cm molc l^{-1}, respectively). These high salinity and EC were reflected on the crop weeds which appeared as salinity indicator species among them are: *Alhagi graecorum* Boiss., *Cressa cretica* L., *Cynanchum acutum* L. subsp. *acutum*, *Imperata cylindrica* (L.) Raeusch., *Spergularia marina* (L.) Besser, *Beta vulgaris* L., *Tamarix nilotica* (Ehrenb.) Bunge and *Tamarix tetragena* Ehrenb. Abbreviations of the species in Fig. (3) are listed in Table (4).

The achieved result in this work is consistent with that of Zahran *et al*. (1990) who mentioned that *Cressa cretica* and *Phragmites australis* (Cav.) Trin. ex Steud. located in the saline parts during their studies on vegetation types of the deltaic Mediterranean coast of Egypt. Moreover, Ungar (1967), Cheeseman *et al*. (1985) and Akcin *et al*. (2015) stated that: *Spergularia marina* is an annual halophytic herb. *Spergularia marina* is commonly found in cultivated fields and wastelands of saline habitats (Ghazanfar and Nasir, 1986). Moreover, *Tamarix nilotica* is an excretive halophyte (Walter, 1961) which grows in a variety of habitats and various forms. This was also in agreement with almost other relevant studies (Hegazy *et al*., 2004 and Mahdy, 2010).

The relatively high soil alkalinity where the pH value in sites 1 (8.85) and site 2 (8.88) were linked with the presence of *Ammi majus* L., *Brassica nigra* (L.) Koch, *Bromus catharticus* Vahl, *Lolium perenne* L., *Melilotus indicus* (L.) All., *Paspalidium geminatum* (Forssk.) Stapf, *Poa annua* L., *Polypogon monspeliensis* (L.) Desf., *Rumex dentatus* L., *Sonchus oleraceus* L. and *Trifolium resupinatum* L., while the *Phragmites australis* (Cav.) Trin. ex Steud. is of wide ecological range (occur in all sites), this is agreed with Clevering *et al.* (2001) and Packer *et al*. (2017). The presence of *Phragmites australis* acts as a phytoremediation system of wastes by

Table 2. Soluble, micronutrients and heavy metals content in water along Bahr El-Baqar drain.

Sites No.	Soluble elements content mg l^{-1}								
	Fe	Mn	Zn	Cu	B	Cd	Cr	Ni	Pb
1	0.172	0.023	0.045	0.002	0.461	0.007	0.009	0.011	0.029
2	0.178	0.021	0.025	0.003	0.586	0.001	0.013	0.039	0.040
3	0.142	0.014	0.011	0.002	0.554	0.002	0.015	0.086	0.034
4	0.089	0.015	0.016	0.003	0.596	0.011	0.013	0.083	0.015
5	0.168	0.012	0.040	0.004	0.645	0.006	0.015	0.030	0.029
6	0.032	0.003	0.010	0.001	0.098	0.005	0.001	0.002	0.011
7	0.142	0.019	0.014	0.002	0.568	0.011	0.017	0.022	0.033
8	0.076	0.016	0.011	0.002	0.586	0.022	0.013	0.032	0.022
9	0.808	0.054	0.042	0.034	0.578	0.001	0.002	0.001	0.005
Nile water	0.172	0.023	0.045	0.002	0.461	0.007	0.009	0.011	0.029
Minimum	0.032	0.003	0.010	0.001	0.098	0.001	0.001	0.001	0.005
Maximum	0.808	0.054	0.045	0.034	0.645	0.022	0.017	0.086	0.040
Average	0.201	0.020	0.024	0.006	0.519	0.007	0.011	0.034	0.024
Guidelines	5.00 [a]	0.20 [a]	2.00 [a]	0.20 [a]	0.70 [a]	0.01 [a]	0.10 [a]	0.20 [a]	5.00 [a]

a: Ayers and Westcot (1985)

Table 3. Chemical analysis for soils irrigated from Bahr El Baqar.

Sites No.	pH	EC dS m^{-1}	Soluble Anions (cm molc l^{-1})				Soluble cations (cm molc l^{-1})				SAR
			CO_3^{2-}	HCO_3^-	CL^-	SO_4^{-2}	Ca^{2+}	Mg^{2+}	Na^+	K^+	
1	8.85	2.53	0.00	2.55	14.32	8.43	7.65	4.65	12.35	0.65	4.98
2	8.88	2.55	0.00	2.65	12.65	10.20	7.80	5.20	11.95	0.55	4.69
3	8.75	2.60	0.00	2.75	13.25	10.00	7.95	5.10	12.45	0.50	4.87
4	8.75	2.65	0.00	2.80	12.45	11.25	8.52	5.00	12.53	0.45	4.82
5	8.72	2.62	0.00	2.82	12.50	10.88	8.05	5.50	12.15	0.50	4.67
6	8.72	2.58	0.00	2.70	12.75	9.05	7.25	4.75	12.08	0.42	4.93
7	8.65	2.63	0.00	2.72	12.45	11.13	8.10	5.25	12.50	0.45	4.84
8	8.55	2.85	0.00	2.83	12.65	13.02	9.70	5.85	12.42	0.53	4.45
9	8.50	2.95	0.00	3.00	13.21	13.29	9.95	6.37	12.65	0.53	4.43
Nile water	7.85	1.20	0.00	2.50	1.75	7.75	6.45	3.60	1.50	0.45	0.67
Minimum	8.50	2.53	0.00	2.55	12.45	8.43	7.25	4.65	11.95	0.42	4.43
Maximum	8.88	2.95	0.00	3.00	14.32	13.29	9.95	6.37	12.65	0.65	4.98
Average	8.71	2.66	0.00	2.76	12.91	10.81	8.33	5.30	12.34	0.51	4.74

SAR= sodium adsorption ratio

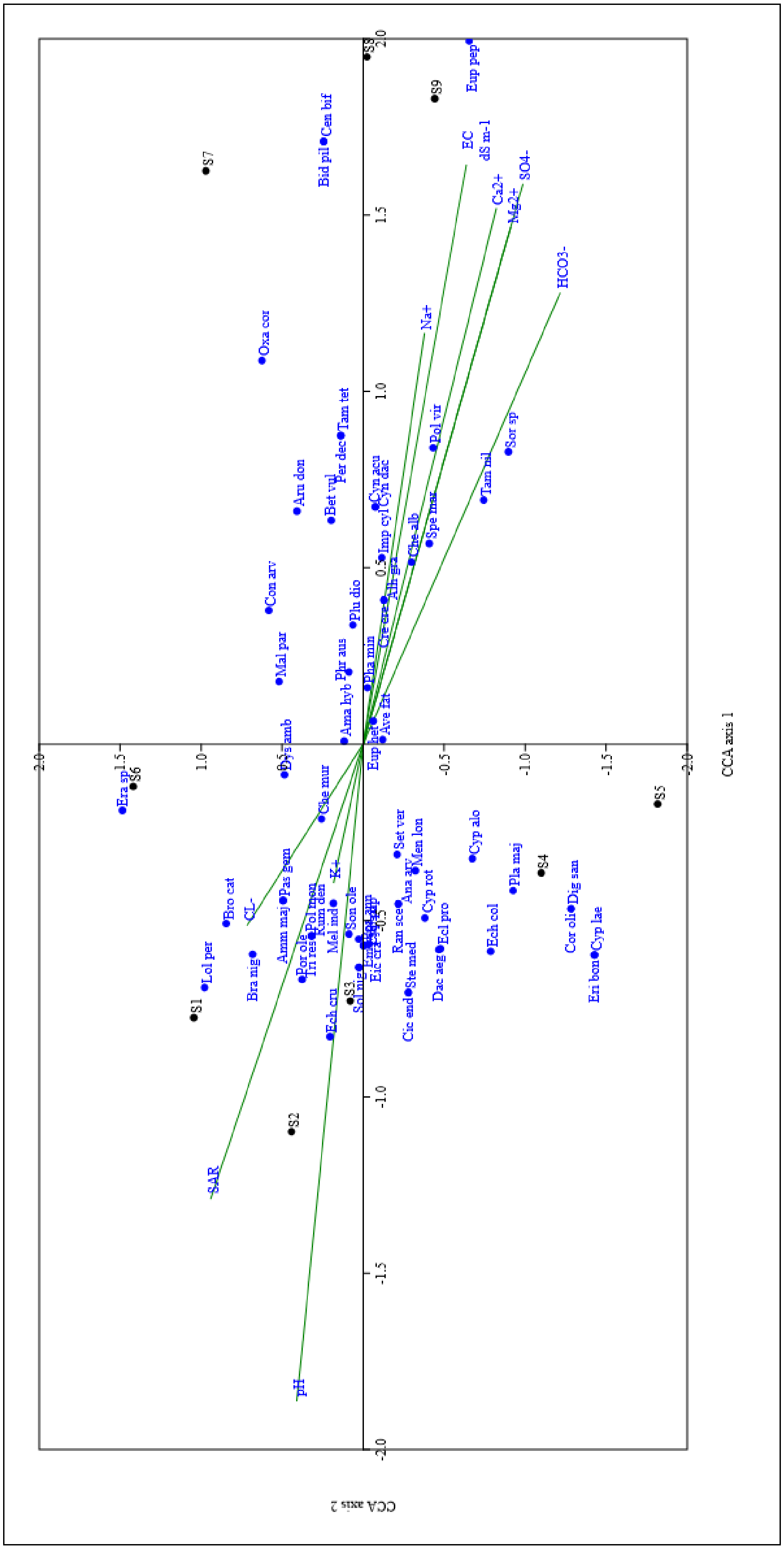

Fig. 3. CCA ordination diagram of distributed species along Bahr El Baqar drain, based on the data obtained from the chemical analyses of soil samples. Abbreviations of species are listed in Table (4), S= site.

Table 4. Abbreviations (Abbriv.) of the weed species associated with the crops which recorded in the selected nine sites along Bahr El Baqar drain.

Species	Abbrev.	Species	Abbrev.
Alhagi graecorum Boiss.	*Alh gra*	*Eragrostis* sp	*Era sp*
Amaranthus hybridus L.	*Ama hyb*	*Eruca sativa* Mill.	*Eru sat*
Ammi majus L.	*Amm maj*	*Euphorbia heterophylla* L.	*Eup het*
Anagallis arvensis L.	*Ana arv*	*Euphorbia peplis* L.	*Eup pep*
Arundo donax L.	*Aru don*	*Imperata cylindrica* (L.) Raeusch.	*Imp cyl*
Avena fatua L.	*Ave fat*	*Lolium perenne* L.	*Lol per*
Beta vulgaris L.	*Bet vul*	*Malva parviflora* L.	*Mal par*
Bidens pilosa L.	*Bid pil*	*Melilotus indicus* (L.) All.	*Mel ind*
Brassica nigra (L.) K.Koch	*Bra nig*	*Mentha longifolia* (L.) L.	*Men lon*
Bromus catharticus Vahl	*Bro cat*	*Oxalis corniculata* L.	*Oxa cor*
Cenchrus biflorus Roxb.	*Cen bif*	*Paspalidium geminatum* (Forssk.) Stapf	*Pas gem*
Chenopodium album L.	*Che alb*	*Phalaris minor* Retz.	*Pha min*
Chenopodium murale L.	*Che mur*	*Phragmites australis* (Cav.) Trin. ex Steud.	*Phr aus*
Cichorium endivia L. subsp. *divaricatum*	*Cic end*	*Plantago major* L.	*Pla maj*
Convolvulus arvensis L.	*Con arv*	*Pluchea dioscoridis* (L.) DC.	*Plu dio*
Erigeron bonariensis L.	*Eri bon*	*Poa annua* L.	*Poa ann*
Corchorus olitorius L.	*Cor oli*	*Polypogon monspeliensis* (L.) Desf.	*Pol mon*
Cressa cretica L.	*Cre cre*	*Persicaria decipiens* (R.Br.) K.L.Wilson	*Per dec*
Cynanchum acutum L. subsp. *acutum*	*Cyn acu*	*Polypogon viridis* (Gouan) Breistr.	*Pol vir*
Cynodon dactylon (L.) Pers.	*Cyn dac*	*Portulaca oleracea* L.	*Por ole*
Cyperus alopecuroides Rottb.	*Cyp alo*	*Ranunculus sceleratus* L.	*Ran sce*
Cyperus laevigatus L.	*Cyp lae*	*Rumex dentatus* L.	*Rum den*
Cyperus papyrus L.	*Cyp pap*	*Setaria verticillata* (L.) P. Beauv	*Set ver*
Cyperus rotundus L.	*Cyp rot*	*Solanum nigrum* L.	*Sol nig*
Dactyloctenium aegyptium (L.) Willd.	*Dac aeg*	*Sonchus oleraceus* L.	*Son ole*
Digitaria sanguinalis (L.) Scop.	*Dig san*	*Sorghum* sp	*Sor sp*
Dysphania ambrosioides (L.) Mosyakin & Clemants	*Dys amb*	*Spergularia marina* (L.) Besser	*Spe mar*
Echinochloa colona (L.) Link	*Ech col*	*Stellaria media* (L.) Vill.	*Ste med*
Eichhornia crassipes (C. Mart.) Solms	*Eic cra*	*Tamarix nilotica* (Ehrenb.) Bunge	*Tam nil*
Echinochloa crus-galli (L.) P.Beauv.	*Ech cru*	*Tamarix tetragena* Ehrenb.	*Tam tet*
Eclipta prostrata (L.) L.	*Ecl pro*	*Trifolium resupinatum* L.	*Tri res*
Emex spinosa (L.) Campd.	*Eme spi*		

making stubble wetlands where its root forms deep heavy roots with hollow rhizomes and an active rhizosphere. The oxygen escapes from roots makes oxidized microplaces that eliminate suspended organic solids, phosphorus, lead, and nitrogen from impurities (Abdelsalam *et al*., 2019).

While, *Pluchea dioscoridis* (L.) DC. was recorded in seven sites which agreed with the results reported by Shaltout *et al*. (2010) and Ahmed *et al*. (2018). The distribution and presence of *P. dioscoridis* had been affected by human activity, chiefly due to a destructive manner (limiting canals and drains), resulting in the reduction of aquatic communities (Shaltout and El-Sheikh, 2002).

4. **Evaluation of the effect of uses water from Bahr El-Baqar drain on the available micronutrients and heavy metals content of the investigated soils of the nine sites:**

The data outlined in Table (5) showed that the average of available micro-nutrients and heavy metals content of soils in different sites. Concerning available micro nutrients were above permissible limits for Fe in sites No. 1, 2, 3, 5, 8, and 9; while available Mn and Zn were above permissible limits in all sites except sites 4 and 9 for Mn and sites No. 2 and 4 for Zn. Also, available Cu was a high permissible limit according to Michael *et al.* (2007). While the available Cd was permissible limit in all the studied sites exception site No. 9 was high. Co, Cr, Ni and Pb were low in all sites.

The presence of waste land indicator species: *Arundo donax* L. in sites 4, 6, 7 and 8; *Dysphania ambrosioides* (L.) Mosyakin & Clemants in sites 1, 3, 4, 6 and 7 and *Chenopodium murale* L. in sites 1, 3, 5, 6 and 8; *Convolvulus arvensis* L. in sites 1, 3, 6, 7 and 9; *Mentha longifolia* (L.) L. in sites 3, 4, 5 and 6 and *Plantago major* L. in sites 3, 4 and 5. The absence or presence of particular plant species indicates specific level of pollution Ahmad *et al.* (2019).

Meanwhile, the maximum contents of available micro-nutrients and heavy metals in soil were found in site 1 for Fe; site 8 for Mn and Cu; site 9 for Cd and Co; and site 5 for Ni. On the other hand, the minimum contents were recorded in site 6 for Fe and Cu; site 9 for Mn; sites 2 for Zn, Cd and Ni; site 1 for Co and site 5 for Pb (Table, 5). Fig. (4) showed that the high values of Cr in sites 8, 7 and 9 (2.97 mg kg^{-1}, 1.88 mg kg^{-1} and 1.86

Table 5. Effect of use water from Bahr El-Baqar drain on available micronutrients and heavy metals content of the investigated soils.

Sites No.	Available content mg kg^{-1} Fe	Mn	Zn	Cu	Cd	Co	Cr	Ni	Pb
1	12.56	5.27	3.99	2.31	0.27	0.10	1.03	0.43	0.50
2	9.88	4.47	2.49	1.30	0.14	0.14	0.92	0.23	0.29
3	7.99	5.25	4.79	2.43	0.22	0.16	2.06	0.34	1.14
4	5.52	2.35	2.51	2.30	0.30	0.33	1.42	0.26	0.35
5	9.33	4.11	3.74	2.27	0.26	0.22	0.98	0.62	0.14
6	5.50	3.92	5.26	1.26	0.20	0.16	2.09	0.56	1.24
7	5.79	5.27	3.94	1.40	0.27	0.16	1.88	0.54	1.03
8	7.71	5.78	3.95	3.44	0.21	0.15	2.97	0.43	0.78
9	9.30	2.25	4.20	2.43	0.34	0.64	1.86	0.38	0.30
Minimum	5.50	2.25	2.49	1.26	0.14	0.10	0.92	0.23	0.14
Maximum	12.56	5.78	5.26	3.44	0.34	0.64	2.97	0.62	1.24
Average	8.18	4.30	3.87	2.13	0.24	0.23	1.69	0.42	0.64
Critical Limit	4.0-6.0 [b]	1.2-3.5 [b]	1.0-3.0 [b]	0.3-0.8 [b]	0.31[b]	--	8.0[b]	8.1[b]	13[b]

a: Horneck *et al.* (2011) and b: Michael *et al.* (2007)

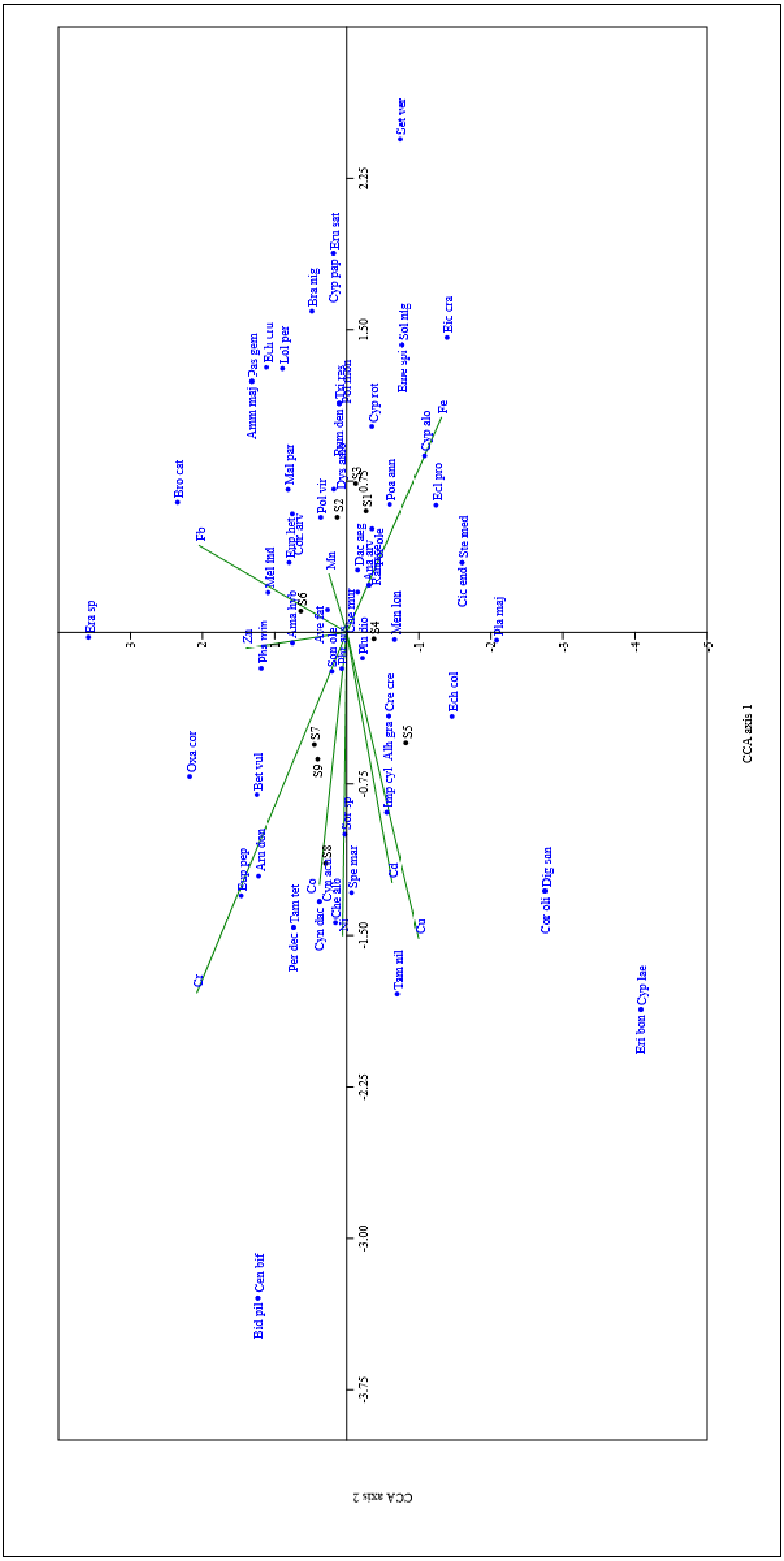

Fig. 4. CCA ordination diagram of distributed species along Bahr El Baqar drain, based on the data obtained from the analyses of the available micronutrients and heavy metals content soil samples. Abbreviations of species are listed in Table (4), S= site.

mg kg^{-1}, respectively) and high value of Co in site 9 (0.64 mg kg^{-1}) are accompanied the presence of *Arundo donax* L. (waste indicator species), this results is agreed with that reported by Ahmad *et al.* (2019). The high values of Zn in site 3 (5.25 mg kg^{-1}) is accompanied the presence of *Dysphania ambrosioides* (L.) Mosyakin & Clemants (waste indicator species). Similar results were reported by Ahmad *et al.* (2019). The high values of Fe in sites 5, 3 and 4 (9.33 mg kg^{-1}, 7.99 mg kg^{-1} & 5.52 mg kg^{-1}, respectively) and high values of Cu in sites 3, 4 and 5 (2.43 mg kg^{-1}, 2.3 mg kg^{-1} and 2.27 mg kg^{-1}, respectively) is accompanied with the presence of waste indicator species among them: *Plantago major* L. and *Mentha longifolia* (L.) L. Our results were supported with that given by Ahmad *et al.* (2019). Moreover, the high values of Fe in sites 1 and 2 (12.56 mg kg^{-1} and 9.88 mg kg^{-1}, respectively) and high values of Mn in sites 1, 2 and 3 (5.27 mg kg^{-1}, 4.47 mg kg^{-1} and 5.25 mg kg^{-1}, respectively) is accompanied with the presence of *Chenopodium murale* L. the waste indicator species. The high values of Mn (3.92 mg kg^{-1}) and Pb (1.24 mg kg^{-1}) in site 6 is accompanied the presence of *Convolvulus arvensis* L. as waste indicator species this is agreed with data outlined by Ahmad *et al.* (2019). In site 1 and 3, the high values of Fe are accompanied the dominance of the hydrophte *Eichhornia crassipes* (C. Mart.) Solms. *Eichhornia crassipes* is a water purifier species, offers dynamic ecosystem services which could accumulate wastes from water and act as bioremediator species (Shaltout and Ahmed, 2012). Abbreviations of the species in Fig. (4) are listed in Table (4).

The higher values of macro, micro nutrients and heavy metals contents at the different studied sites may be attributed to the contribution of agricultural farmer practices such as using chemical fertilizers and irrigating with wastewater, which lead to accumulation of these nutrients and metals during long period for applications of these activities.

CONCLUSION

Finally, this study highlights the negative effect of the drainage (polluted water) used for irrigation on soil and crop-associated weeds.

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أثر تلوث الماء علي توزيع النباتات البرية المصاحبة للمحاصيل حول مصرف بحر البقر

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تم دراسة تسعة مواقع على طول مصرف بحر البقر لدراسة تأثير تلوث مياه الرى المستخدمة على توزيع النباتات البرية المصاحبة للمحاصيل المزروعة بالمنطقة. و قد أسفرت الدراسة عن تعريف ٦٣ نوعا تنتمي إلى ٢٢ عائلة على طول مصرف بحر البقر في التسع مواقع المختارة. كانت العائلات الأكثر شيوعًا هي النجيلية، تليها المركبة، عرف الديك و السعدية. كما تم تمثيل العائلات اللبينية، الأثلية و الخيمية بأقل الأنواع من حيث العدد . كما أظهر تحليل (CCA) أن الصوديوم

والتوصيلية الكهربائية والكلوريد والكبريتات كانت أكثر المتغيرات البيئية فعالية في توزيع الحشائش على طول مصرف بحر البقر في التسعة مواقع قيد الدراسة. أظهرت البيانات أن الأنواع ذات مؤشر الملوحة مثل: *Spergularia marina* ، *Imperata cylindrica* ، *Cressa cretica* ، ظهرت في الملوحة العالية و التوصيلية الكهربائية، في حين تم أيضاً توثيق الأنواع ذات مؤشر الأراضي الملوثة مثل : *Dysphania* ، *Arundo donax Chenopodium murale ambrosioides*. وقد شملت هذه الدراسة تعريف وتصنيف الأنواع النباتية و تحديث الأسماء لكل الأنوع قيد الدراسة على طول مصرف بحر البقر. وقد أوضحت هذه الدراسة التأثير السلبى الذى تسببه المياه الملوثة المستخدمة فى الرى على التربة و النباتات المصاحبة للمحاصيل.