

STUDIES ON THE ARTHROPODS AND MICROORGANISMS OF SOME LIBYAN SOILS

Soil Arthropods and Microorganisms under Some Vegetable Crops

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INTRODUCTION

In this series of investigations, soil arthropods and microorganisms under fruit trees and field crops were studied by the same authors (Kolkaila et al., 1971; Makawi et al. 1971). To complete this series of studies, the present work was aimed to cover the populations of soil arthropods and microorganisms of six different vegetable crops, namely, tomato, artichoke, pea, carrot, radish and lettuce.

Soil samples were obtained from the Agric. Exp. Farm, Ministry of Agric. and Agrarian Reform, Tripoli, where accurate informations concerning the different agricultural treatments could be obtained. Moreover, the studied soil samples under the different vegetables were of harmonious characters to minimize soil factors.

MATERIAL AND METHODS.

Soil samples were obtained from the Agricultural Experiment Farm, Ministry of Agriculture and Agrarian Reform, Tripoli, L. A. R., during January, 1970. All samples were collected within one week. Sampling, extraction of arthropods, microbial counts and analyses of the important physical soil characters were carried out following the same techniques, as mentioned previously (Kolkaila et al, 1971). The main agricultural treatments for the six tested vegetable crops are listed in table 1.

RESULTS AND DISCUSSION

The six soil samples analyzed during this present investigation showed almost the same physical characters (Table II). Soil samples had a higher organic matter content than most of the previously tested soils in Libya (Makawi and Abd-El-Ghafar, 1971). This is clearly evident as a result of the continuous

Table 1

Agricultural treatments applied to the tested vegetable crops.

	Tomato	Artichoke	Pea	Carrot	Lettuce	Raddish
Time of seed Planting	1 Sept	August	30Oct	15Oct	10Oct	15Oct
Irrigation by Spraying	weekly	weekly	weekly	weekly	weekly	weekly
Organic fertilizers (ton/ha)	20	20	10	10	10	10
Chemical fertilizers (kg / ha)						
Calcium super phosphate	—	75	400	200	200	200
Amm. sulphate	200	75	200	200	200	400
Pot. sulphate	200	150	150	200	200	200

TABLE II

Physical property	Tomato	Artichoke	Pea	Carrot	Raddish	Lettuce
Moiaure %	2.4	2.49	3.02	3.68	3.7	3.06
Water holding						
Capacity, vol %	36	36	36	36	36	36
Bulk density	1.38	1.39	1.38	1.38	1.38	1.38
Particle density	2.7	2.73	2.7	2.71	2.72	2.7
Porosity	51.11	50.91	51.11	50.99	50.73	51.11
Organic matter	2.12	2.03	2.51	2.51	2.51	2.508

TABLE III

Counts (in thousands) of microorganisms in 1 gm dry soil cultivated with vegetables.

	Tomato	Artichoke	Pea	Carrot	Raddish	Lettuce
Total count of bacteria	76000	72000	80000	84000	101000	92000
Spore forming bacteria	980	620	830	820	1200	1600
Actinomycetes	760	580	680	940	980	970
Fungi	310	260	260	480	610	630
Cellulose decomposers	42	32	32	33	40	56

application of organic and inorganic fertilizers. Also, the weekly irrigation of the different vegetable crops resulted in an increase in the moisture content. However, moisture contents of tomato and artichoke soils were less than those of the other four tested soils because the soil samples of those two vegetables were taken one day before irrigation.

Tomato and artichoke soils were the richest in the total arthropod counts, followed by carrot, pea and finally raddish and lettuce (table IV). Acarina represented the highest percentages among the tested soils, except in artichoke soil where Collembola dominated. Trombidiform mites were present in all the samples, being highest in tomato and artichoke. Mesostigmata were well represented in the six tested soils although their number did not exceed those of Oribatei except in pea. Oribatid mites were the highest in all the samples except in tomato soil where large numbers of Acaridiae mites were found. Collembola appeared in high numbers in artichoke and tomato soils and in few numbers in pea soil while they were absent in the rest. As to the other arthropod fauna in general and Diptera and Coleoptera in particular, they were found in higher numbers in tomato soils.

It appears that all tested soils contained relatively high microbial counts (table III). However, total counts of bacteria in raddish, lettuce, carrot and pea soils were, as a whole, higher than those of tomato and artichoke soils. Spore forming bacteria were high in lettuce and raddish soils, medium in tomato, pea and carrot soils while they were low in artichoke soil. Fungi and actinomycetes counts showed the same trend. Their numbers were higher in raddish and lettuce soils while in artichoke, pea and tomato the numbers were low. Cellulose decomposing bacteria were high in lettuce, tomato and raddish soils, while artichoke, pea and carrot soils had the same counts.

Table IV : Numbers of soil animal fauna in one Litre soil.

Fauna	Tomato				Artichoke				Carrot				Pea				Raddish				Lettuce			
	Loc A	Loc B	Mean	%	Loc A	Loc B	Mean	%	Loc A	Loc B	Mean	%	Loc A	Loc B	Mean	%	Loc A	Loc B	Mean	%	Loc A	Loc B	Mean	%
Annelida	1	—	0.5	—	—	—	—	—	—	—	—	—	1	—	0.5	—	1	—	0.5	—	—	—	—	—
Acarina :																								
Trombid	79	18	48.5	10.77	36	13	24.5	7.25	24	4	11	20.27	6	3	4.5	10.71	—	4	2	11.43	1	1	1	20.0
Mesostig	51	45	43	9.55	75	29	52	15.39	20	20	20	28.96	14	18	16	38.08	—	14	7	40.0	—	4	2	40.0
Sarcop																								
Oribatei	46	130	88	19.54	36	121	78.5	23.24	53	15	34	49.23	9	15	12	28.56	—	14	7	40.0	—	3	1.5	30.0
Acaridiae	358	—	179	39.73	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	534	193	358.5	80.70	147	163	155	45.88	97	39	68	98.46	29	36	32.5	77.35	—	32	16	91.42	1	8	4.5	90.0
Collembola																								
Arthrop.	85	66	75.5	6.76	13.1	23.1	18.1	53.58	—	—	—	—	6	9	7.5	17.85	—	—	—	—	—	—	—	—
Psocoptera	1	—	0.5	0.11	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.5	2.86	—	—	—	—
Coleoptera																								
Adult																								
Staphyl.	1	—	0.5	0.11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Scarab.	—	8	4	0.89	4	—	2	0.59	—	1	0.5	0.72	1	—	0.5	1.19	1	—	0.5	2.86	—	—	—	—
Larvae																								
Staphyl.	1	4	2.5	0.56	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diptera																								
Adult	—	—	—	—	—	—	—	—	1	—	0.5	0.72	—	—	—	—	—	—	—	—	—	1	0.5	10.0
Larvae	4	3	3.5	0.78	—	—	—	—	—	—	—	—	1	1	1	2.38	1	—	0.5	2.86	—	—	—	—
Hymenoptera	—	—	—	—	—	—	—	—	—	—	—	—	1	—	0.5	1.19	—	—	—	—	—	—	—	—
Total Arthrop	626	274	445	100	160.1	186.1	173.1	100	98	40	69	100	38	46	42	100	2	33	17.5	100	1	9	5	100

The high populations of soil arthropods obtained in tomato and artichoke soils may be attributed to the higher amounts of organic fertilizers added to those two soils (table I). This agrees with the findings of Tischler (1955) and El-kifl (1965). On the other hand, the addition of higher amounts of inorganic fertilizers in the soils of the four other vegetables (pea, carrot, raddish and lettuce) may be the cause of their lower arthropod populations. The variations in the arthropod populations of those latter four vegetable crops may also be a result of the agricultural practices which were more evident in their soils, than they were in soils of tomato and artichoke. Moreover, the early cultivation of both artichoke and tomato and their well developed growth might be the reason of their higher arthropod populations.

The lower counts of total bacteria in artichoke and tomato soils may be due to the lower amounts of soil moisture content as well as to the lower amount of inorganic fertilizers, mainly calcium super phosphate. This agrees with the findings of Alexander (1965) and Holding and Jeffrey (1967) who stated that microbial growth requires the presence of available forms of phosphorus.

It was clear that soils of raddish, lettuce, carrot and pea contained the highest microbial counts, and at the same time harboured the lowest numbers of arthropods. This result may be attributed to the disturbance of soils due to agricultural practices evident in the soils of these four vegetables which affected more the arthropod populations.

SUMMARY

The populations of soil arthropods and microorganisms under six vegetable crops (tomato, artichoke, pea, carrot, raddish and lettuce), cultivated in Tripoli area, were estimated during January, 1970. All soil samples are light sandy.

Tomato and artichoke soils were the richest in their total arthropod counts, followed by carrot, pea, and finally raddish and lettuce. The highest population of arthropods in artichoke and tomato soils may be attributed to their high amounts of organic fertilizers, and their well- developed growth. On the other hand, the addition of higher amounts of inorganic fertilizers in the soils of pea, carrot, raddish and lettuce, besides the evident agricultural practices in the soils of these four vegetables, may have been the cause of their lower arthropod population.

The total counts of bacteria in soils under raddish, lettuce, carrot and pea were higher than those under tomato and artichoke. Counts of spore forming bacteria, fungi and actinomycetes were higher in lettuce and artichoke soils. Cellulose decomposing bacteria were higher in lettuce, tomato and raddish soils. The lower counts of total bacteria in artichoke and tomato soils may be attributed to lower amounts of soil moisture contents and lower inorganic fertilizers.

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