JOURNAL OF ENVIRONMENTAL STUDIES AND RESEARCHES

Reprint from

JOURNAL OF
ENVIRONMENTAL STUDIES
AND RESEARCHES

**THE OFFICIAL JOURNAL OF
ENVIRONMENTAL STUDIES AND RESEARCHES
INSTITUTE (ESRI), UNIVERSITY OF SADAT CITY**

AN JOURNAL OF NUTRITION AND FEEDS

Notes to Authors

1- Research papers submitted for publication in the journal of environmental studies and researches (JESR) must be based on original work, not submitted for publication, as a whole or a part, elsewhere.

2- Manuscripts are submitted in duplicate to the chief editor. The first page shows only the title and keywords. A covering page includes the title, authors' names and addresses.

3- Along with manuscripts the contributor has to hand over a statement signed by all authors (in some conditions, the first author) indicating their agreement on the contents and form of the manuscript, this could be arranged on the covering page.

4- The manuscripts must conform to the style and format of JESR, please consult a recent issue. The followings are the main features:

    4-1.   Manuscripts should be typed in double space with lines numbered, in each page starting by 1.

    4-2.   Assign serial numbers to pages in the order; text, references, tables, figures and Arabic summary. There are no fixed sections except summary, introduction, material and methods, results and discussion, references and Arabic summary and English summary in Arabic manuscripts.

    4-3.   Capitalize the letters of the major work in both the article's title and the sections titles, e.g. MATERIAL AND METHODS.

    4-4.   Sub-titles are written in italics (lined in the manuscript) with only the first letter of the first word in capital.

    4-5.   Within the text keep the following formats:

        4.5.1. Any other abbreviations must be defined. Notice that a period (dot) (.) is put after the abbreviation.

        4-5-2. Enumerations Zero to ten are written in letters, e.g. Zero, one two….. etc. Values greater than ten or that followed by abbreviated units are written in Arabic numerals. e.g. 11 persons, 49 years.

        4-5-3. Referring to authors is shown in name for single or double followed by Year, e.g. Garrette 1990, Ahmed and Cline 1989. In case of three or more authors the name of the first author only is mentioned followed by *et al*., 1989.

        4-5-4. Tables, figures and plates are referred to by capital first letter T, F and P.

    4-6.   In the references section, each reference is shown in the following succession; name of author(s), Year, title and editing authority, plus publishing Co. in case of books and symposia. In case of periodicals the volume no. is followed by the number of the first page of the article, if the reference is a book or symposium the book or symposium the pages of the article referred to are shown as pp. 42- 46, or the chapter no. stated. Italicize (lined in the manuscript) the periodical name (e.g. J. Anim. Sci.), in case of books the first letter of each main word of the title is capital.

    4-7.   Tables must be legible self explained and with suitable size. Avoid, as possible, tables which can be included only in horizontal direction or in more than on page (the JESR page size is about 45 lines by about 53 spaces/ line. The table heading is written as: Table heading is written as: Table 2. Means of ….. Capitalize the first letter of the first word in each column heading. Footnotes are referred to by numbers 1, 2 .. if the table is not including numbers or otherwise by letters a, b ,c… The table must be of good quality typing since it is included in the issue by photocopy.

    4-8.   The figures should be executed on transparency or calc paper. Include the legend in the figure area.

    4-9.   Plates either black and white or coloured must show fine resolution.

5- Each article will be refereed by two experts and forwarded to the author to consider the comments of the referees in case of acceptance for publication.

2014	Volume 1	Number 1

CONTENTS

مجلة
الدراسات والبحوث البيئية

مطبوعة من

مجلة
الدراسات والبحوث البيئية

AN INTEGRATED WEB MAPPING SOLUTION TO ASSESS THE EFFECT OF SLR ON THE NORTHERN COAST OF EGYPT – EGSLR

R.I. Refai[1]; W.Talat[2]; M. El Hataab[1] and A. Seleman[3]

[1]*Environmental Studies and Researches Institute (ESRI), University of Sadat City, Monofia, Egypt.*

ABSTRACT

I n its 2007 assessment, the Intergovernmental Panel on Climate Change (IPCC) declared the Nile Delta one of three sites on earth that are most vulnerable to sea level rise. The Panel projected a global average surface temperature will increase by 1 to 3.5C with an associated rise in sea level of 15 to 95cm by 2100. Several recent assessments suggest this figure could be much higher. In one study that considered the impact of a 1m SLR for 84 developing countries, Egypt was ranked the 2nd highest with respect to the coastal population affected, 3rd highest for coastal GDP affected and 5th highest for proportion of urban areas affected. In this study, the methodology to build an integrated web map solution to access the effect of the SLR scenarios (WHAT IF) on the northern coast of EGYPT – EGSLR was presented.

Keywords: EGSLR; Climate Change and MAPPING

INTRODUCTION

The northern Delta coast of Egypt on the Mediterranean extends from Alexandria city in the west to Port Said city in the east, with a total length of about 240 kilometers. The coordinates of the upper left (UL) corner of the study area is (latitude: 31.8, longitude: 29.6) and the lower right (LR) corner is (latitude: 30.8, longitude: 32.6).The region in the Mediterranean coastal zone represents the major industrial, agricultural, and economic resource of the country. The Nile Delta and Mediterranean coast include 30-40% of Egypt's agricultural production, half of Egypt's industrial production. The three main Delta lagoons are Idku, Burullus and Manzala produce over 60% Egypt's fish catch. Approximately 15% of Egypt's GDP is generated in these Low Elevation Coastal Zone (LECZ) areas. This area is at risk from future sea level rise and storm surge. With a large and growing population in coastal zones and a low adaptive capacity, the area is highly vulnerable. In the absence of adaptation, the physical, human and financial impacts of climate change on coastal zones will be significant. Coastal adaptation is therefore likely to be a priority area.

MATERIALS AND METHODS

Global Projected Sea Level Rise:

Projections of SLR have changed over the years as more information has become available (e.g., more advanced climate change models and more accurate data).The 1990 IPCC report a scenario of global warming and consequent global SLR of 18 cm by 2030 and between 21 cm to 71 cm by 2070 (IPCC,1990). In 2001, the IPCC projected that SLR would increase by 9 cm to 88 cm by 2100 over 1990 sea levels (IPCC TAR, 2001). Uncertainties about Greenhouse gas emissions scenarios, temperature sensitivity of the climate system, contribution from the Antarctic, and glacial melt can explain the range of SLR predictions.

Table (1): Projected temperature change and sea level rise (excluding future rapid dynamical changes in ice flow) for the six IPCC emission scenarios

IPCC emission scenario	Temperature rise IPCC-AR4	Sea level rise 2100 IPCC-AR4	Sea level rise 2050 IPCC-TAR
B1	1.8C	0.18 - 0.38 m	0.05 – 0.26 m
A1T	2.4C	0.20 - 0.45 m	0.07 – 0.29 m
B2	2.4C	0.20 – 0.43 m	0.06 – 0.28 m
A1B	2.8C	0.21- 0.48 m	0.06 – 0.28 m
A2	3.4C	0.23 – 0.51 m	0.06 – 0.27 m
A1FI	4.0C	0.26 – 0.59 m	0.06 – 0.3 m

In February 2007(AR4), the IPCC slightly lowered its estimate of SLR to between 18 cm to 59 cm by 2100 over 1990 sea levels because new data and technologies became available about the contribution of thermal expansion of SLR. However, the new range does not incorporate the potential acceleration of melting of Greenland or the West Antarctic Ice Sheet. The estimates include only the steric component of the sea level rise due to the heating of the ocean waters and their consequent expansion. The numbers given by IPCC should therefore be considered as a lower limit of the expected sea level rise. The 2007 IPCC report advises that if ice discharge from these processes were to increase in proportion to global average surface temperature change, it would add 0.1-0.2 m to the upper limit of sea level rise by 2100. The IPCC also acknowledged that "larger values could not be excluded" as shown in Table (1).

The Methodology of the Development of an Interactive Web Enabled SLR Scenarios (EGSLR)

The most important factors are being included in the designing and implementing of the EGSLR as a web GIS application are functional module, graphic user interface, downloading time, system performance and the technology related. The system must be portable and extendable to accommodate future changes in hardware, software and networking. Keeping in view these factors, EGSLR developed based on two components: the server side and the web client side, which runs in the browser.The framework of the technical development process of the EGSLR is focusing on:

1. Spatial and attribute database collection, analysis and design
2. Data conversion and importing
3. Development environment and tools
4. EGSLR Database Model
5. EGSLR architecture
6. EGSLR main features
7. EGSLR main components
8. EGSLR main functions

EGSLR Database Model:

The database is the most important part of any web application. In the case of GIS web-based applications, it becomes more important because of the storage requirements of the spatial data. Once the spatial data are stored in a database; they can be used, analyzed and displayed in the form of maps by the web-based application. The EGSLR data are divided logically into two categories: spatial data and attribute (tabular) data as shown in figure (1). The EGSLR database model designed to be stored physically different although the relationships between the two categories of data are preserved regardless of whether the division is physically or logical (hybrid database model).This means that two separate database were used in the systems; one for spatial data and one for attribute data. The Shuttle Radar Topography Mission (SRTM) data are used as a source of the elevation data in the EGSLR scenarios application. Two tiles (srtm_43_06 and srtm_42_06) which cover the coastal area from Port Said to Alexandria City are used. In order to use the data in the EGSLR

scenariosapplication over the web, The SRTM data must be converted fromraster format to vector layers format.
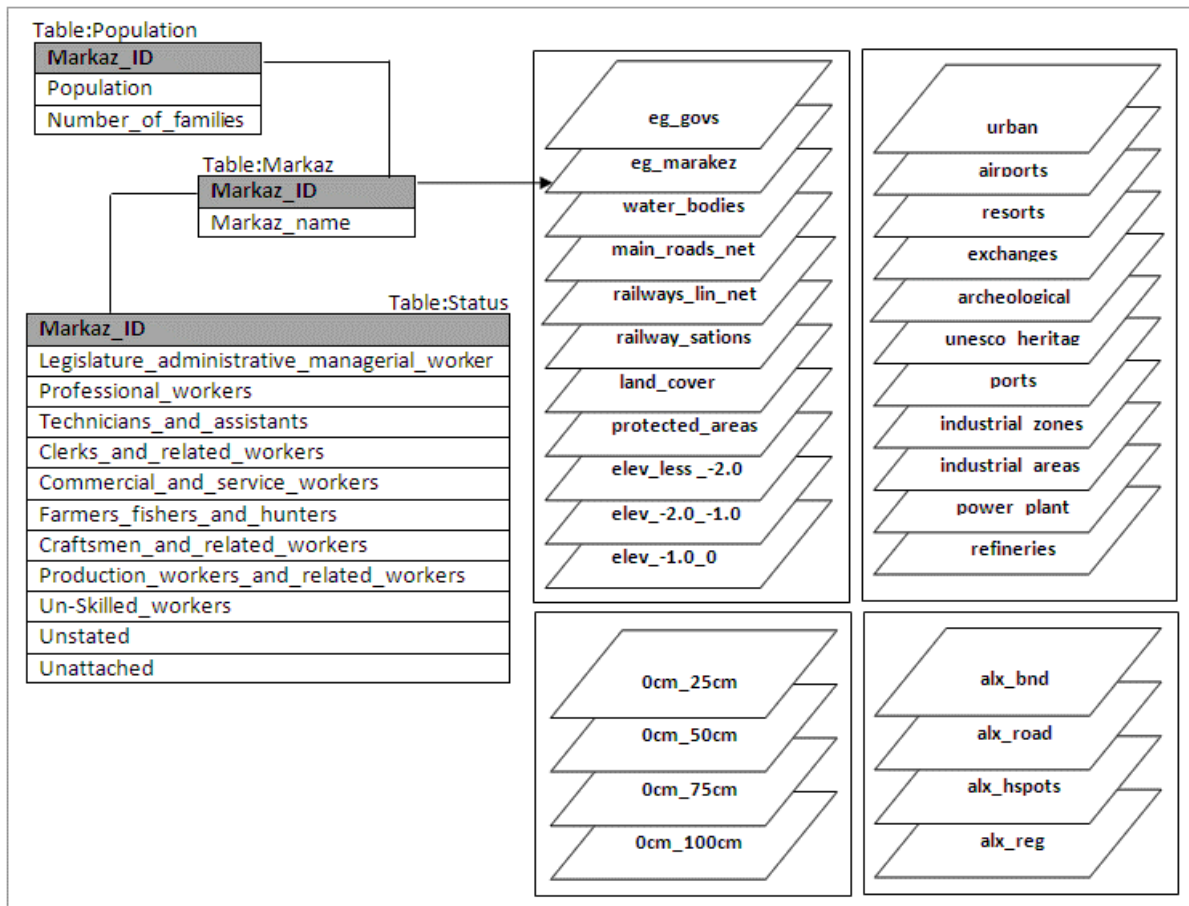
EGSLR *Architecture*

EGSLR is a server side application (thin client architecture) where users can send a request to a server (i.e. an address), and the server processes the request and sends the results back as an image embedded in an HTML page via standard HTTP (HyperText Transfer Protocol). The response is a standard web page that a generic browser can view.in server-side web GIS applications, all the complex and proprietary software, in addition to the spatial and tabular data remain on the server. This architecture has several advantages because the application and data are centralized on a server.

EGSLR *Main Components*

EGSLR is divided into a set of functional units (modules).Each module represents a set of related tasks or functions. Modules are independent of one another but they communicate with each other. EGSLR is developed and deployed using standard web development tools, and is comprised of two elements; the web site framework and the functional tools. The framework presents the EGSLR supporting information via a graphical user interface to the user. The second element is the functional tools that enable access to GIS functions such as SLR scenarios, mapping and query functions.The main modules are:

1. Display Functions - Map tools
2. Cartographic Presentation
3. Utilities
4. Mash up Module
5. Layer Manager Module
6. Sea Level Rise Scenarios Module: This module contains four levels to study:

       a.   Scenario 1: sea level rise from 0 cm to 25 cm.
       b.   Scenario 2: sea level rise from 0 cm to 50 cm.
       c.   Scenario 3: sea level rise from 0 cm to 75 cm.
       d.   Scenario 4: sea level rise from 0 cm to 100 cm.
7.   Population Distribution Module
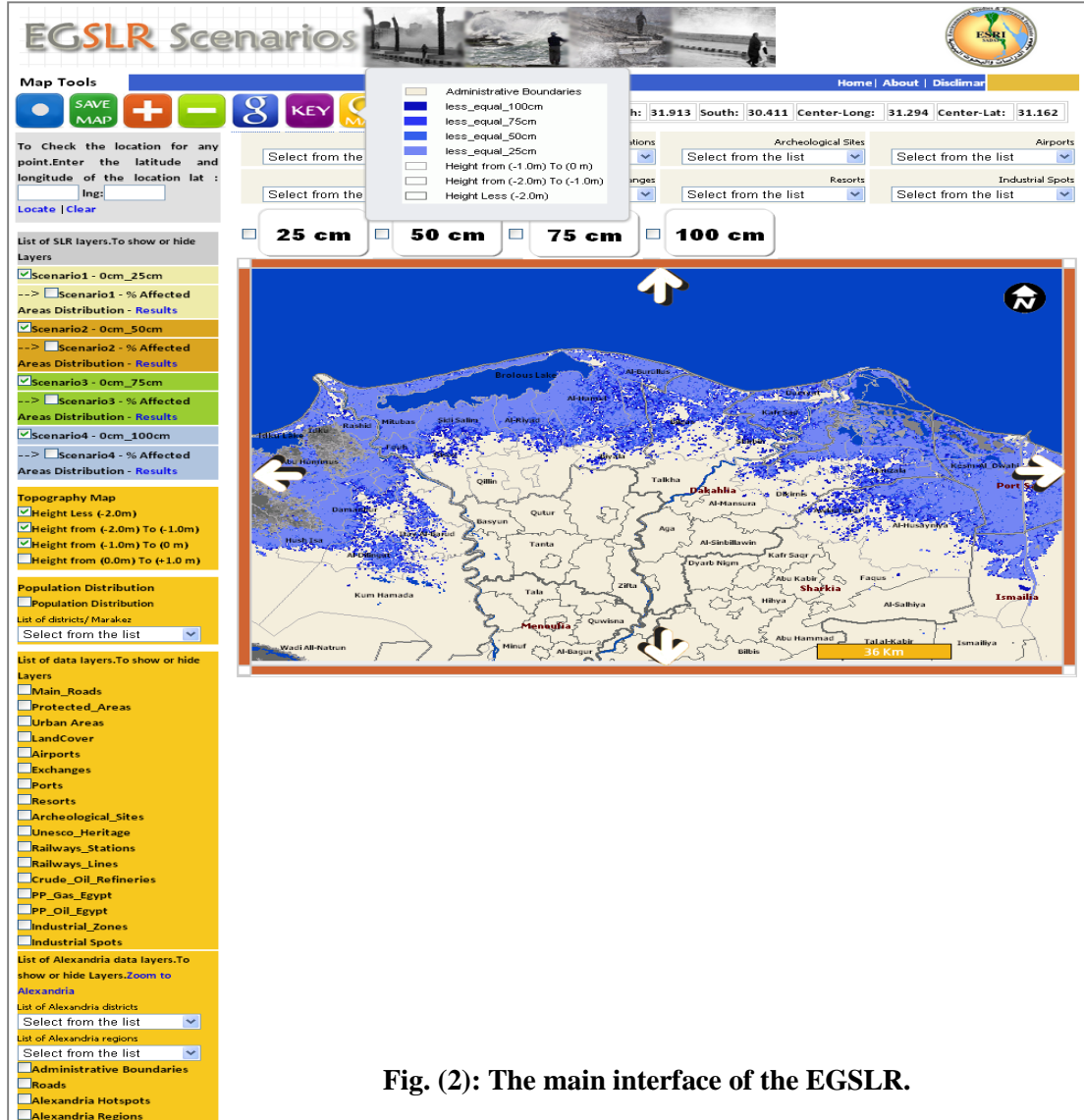
Fig. (2): The main interface of the EGSLR.

For each scenario, the user can:

1. Select any SLR scenario to overlay it on the base mapas shown in figure (3).The user can overlay more than one scenario at the same time. For each scenario, the user can check the affected districts. The affected districts are classified into five categories based on the percentage of area affected of each district divided by the total area of the districtas shown in figure (4).

2. Select any Markaz/district in the study area and locate it geographically on the base map. For any selected Markaz, the application provides:

    • The number of population and the number of families.

    • The affected area of the selected markaz divided by total markaz area for each scenario.

    • Pie chart shows the distribution of labor force in the selected district. The labor force is classified to eleven category

4

3. Select any hotspot point. The hotspots data include: urban areas, railway stations, archeological sites, airports, industrial zones, exchanges, resorts and industrial spots. For any selected hotspot the application shows its location on the map and which SLR scenario(s) may affect it.

4. Locate any GPS point by inputting its latitude and longitude in decimal degree format to check if it is affected by any SLR scenario or not. to check if it is affected by any SLR scenario or not.
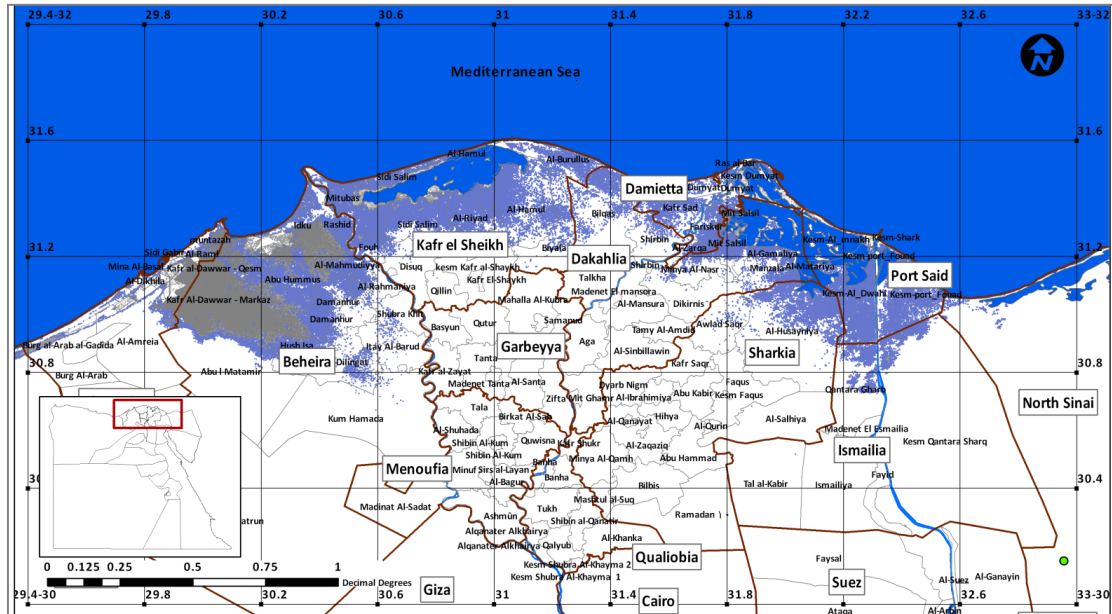
Fig. (3): Scenario (2) the expected impact of a 50cm SLR.
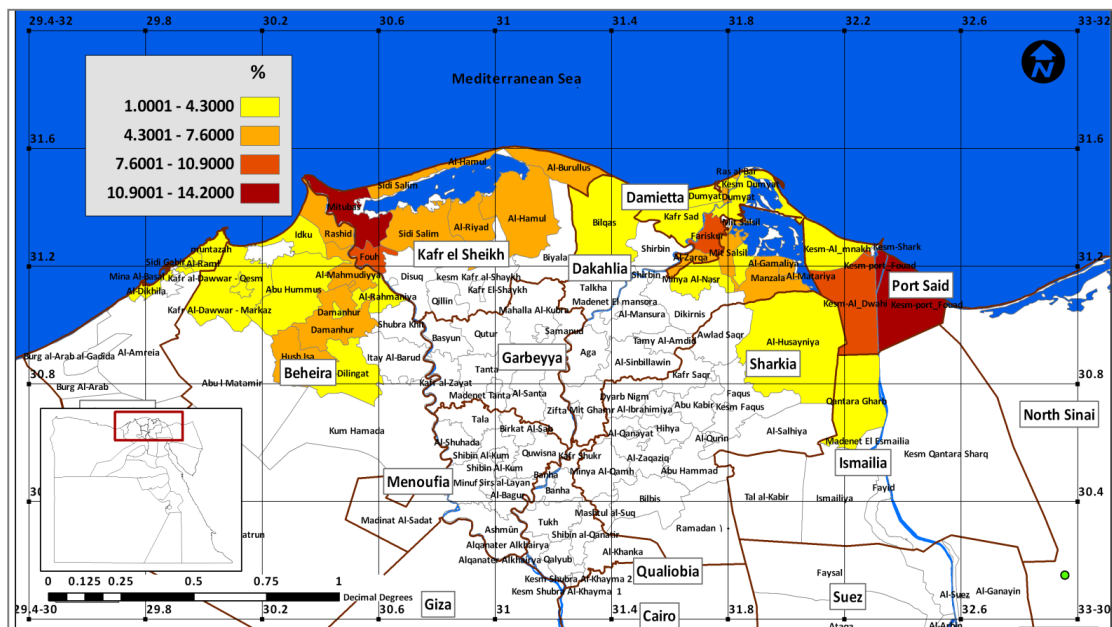
Fig. (4): Map shows the classification of impacted districts by scenario (1) – 25cm.

CONCLUSIONS

1. The most affected areas are part of Alexandria, Behira, Dakahlia, Damietta, Ismalia, KafrAlshikh, Port Said and Sharkia governorates.

2. The most vulnerable governorates are KafrAlshikh, Behira and Port Said which present about 70 to 75% of total affected area by each scenario.
3. The highest vulnerable governorate is Kafr El-Shikh and the highest impacted district (Markaz) is Fouh.
4. Total area affected by 25, 50, 75 and 100 cm SLR is 582, 1058, 1579 and 2200.3 km² respectively.
5. The effects of sea level rise need to be seen in the context of other socioeconomic drivers.
6. Geographic Information System (GIS) is capable of creating, analyzing, and displaying sea level rise scenarios enabling local officials and decision makers to address the native effects of elevated sea levels by allowing them to identify affected communities that are at risk, access the situation, and develop mitigation strategies.

REFERENCES

Dasgupta, S.; B. Laplante; C. Meinsner; D. Wheeler and J. Yan (2009). The impacts of sea level rise on developing countries: a comparative analysis. Climate Change, 93: 379-388.

Frihy, O.E. (2003). The Nile Delta-Alexandria Coast: vulnerability to sea-level rise, consequences and adaptation. Mitigation and Adaptation Strategies for Global Change, 8: 115-138.

El-Raey, M. (1997). Vulnerability assessment of the coastal zone of the Nile delta, Egypt, to the impacts of sea level rise. Ocean and Coastal Management, 37: 29-40.

Liu, JK. (1998). Developing Geographic Information System Applications in Analysis of Responses to Lake Erie Shoreline Changes. M.S. thesis, Graduate School of The Ohio State University.120Pp.

El-Raey, M.; O.E Frihy; S.M. Nasr and Kh. Dewidar (1999). Vulnerability Assessment of Sea Level Rise Over Port Said Governorate, Egypt. Environmental Monitoring and Assessment, 56: 113-128.

Gebert, N.; J. Kloos and J. Birkmann (2012). Emerging Risks: Sea Level Rise and Potentially Forced and Planned Relocation - Case Study from Greater Alexandria, Egypt, Institute for Environment and Human Security, United Nations University, Final Report of CLICO project.

Dasgupta, S.; B. Laplante; C. Meinsner; D. Wheeler and J. Yan (2009). The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis. Climate Change, 93: 379-388.

Lu, X. (2005). An investigation on service-oriented architecture for constructing distributed Web GIS application. IEEE International Conference on Services Computing, 1: 191-197.

IPCC Climate Change (1990). The IPCC Scientific Assessment Report, Cambridge University Press, Cambridge, UK.410Pp.

IPCC Climate Change (2001). The Physical Science Basis, Working Group 1 Contribution to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).881Pp.

IPCC Climate Change (2007a): The Physical Science Basis, Working Group 1 Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Technical Summary, Chapter(10).987Pp.

GROUNDWATER EXPLORATION BY USING 1-D RESISTIVITY TECHNIQUE AT ABU ZENIMA AREA, SOUTHWESTERN PART OF SINAI, EGYPT

A.G. Abd El-Hameed[1]; H.M. El-Shayeb[2] and H.Y. Khalid[3]

[1]Survey of Natural Resources Department, Environmental Studies and Research Institute, University of El-Sadat City, Menofiya, Egypt

[2]Geology Department, Faculty of Science, Menofiya University, Egypt.

[3]Geological Operations Manager, Petro Services GmbH.

ABSTRACT

Sinai Peninsula is considered one of the attracted regions where, the government set a national plan for its sustainable development. The aim of this work is focused in defining the groundwater occurrences along WadiTayiba, WadiThal, WadiIseila, Wadi Abu- Ideimat, WadiRewikna, Wadi El-Garf and WadiRewis El- Ghanam at Abu Zenima area. Twenty six Vertical Electrical Soundings (VES) were measured in the study area by using AB/2 ranging from 1.5-1000 m, on two areas A and B. The results of quantitative interpretation of resistivity data at area A indicated that the subsurface section of the study area consists of five geoelectrical units , the first geoelectrical unit is characterized by very high resistivity values and is composed of coarse sand and gravels, .The second geoelectrical unit is represented by sand and gravels which exhibits resistivity values ranging from 300-550 Ohm.m and represents the Quaternary aquifer in the study area.The third geoelectrical unit is represented by resistivity values ranging from 13-108 Ohm.m. corresponding to Rudies-Nukul Formation of Lower Miocene The fourth geoelectrical unit reflects low resistivity values ranging from 5-12 Ohm.m .The fifth geoelectrical unit is beneath of resistivity values ranging from 18-19.5 Ohm.m corresponding to Thebes Formation. The results of quantitative interpretation of resistivity data at area B indicate that the subsurface of this area consists of four geoelectric units. The first geoelectrical unit is coarse sand and gravels that belong to the surface layer; it composed of sand and gravels of the Quaternary deposits. The second geoelectrical unit is composed of sand and gravels that belongs to the Quaternary deposits. The third geoelectrical unit is correlated with sandstone that belongs to Paleozoic rocks. The fourth geoelectrical layer is correlated with the basement rocks.

Keywords: Resistivity; Groundwater and Faults

INTRODUCTION

Sinai Peninsula covers an area of about 61000 km[2.] It is triangular in shape with its apex formed by the junction of the Gulf of Aqaba and the Gulf of Suez, and its base by the Mediterranean coastline. The southern part of the Sinai consists of an intricate complex of very rugged mountains formed by igneous and metamorphic rocks.

The middle and northern parts of the peninsula comprise a massively developed limestone plateau on lapping the basement rocks. The prevailing drainage system is formed to the north by the Wadi El-Arish with its many effluents. The eastern and the western edges are dissected by deep gorges draining into the Gulf of Aqaba and Gulf of Suez respectively. In the northern part, the regional dip slope is broken up into many large hills followed northwards by a belt of low lands, with high sand dunes along the Mediterranean coast. The plains or low lands along the east and the west coast of the Gulf of Suez are part of its structural and depositional province. El-Qaa plain and El-Tur plain along the central and southeastern coast are separated by an East-West trending subsurface high. Its presence is expressed by a regional southwest dip of the formations in El-Tur

plain and by a northwest dip of the strata in El-Qaa plain. The area of study "Abu Zenima" is located between Lat. 29º 00`-29º 15`N and Long. 33º 00`-33º 40`E.

Many authors worked on the area such as Ghorab (1961) who introduced formational names and described the stratigraphy of the Cretaceous rocks at west central Sinai. Geophysica (1963) gave an investigation on water and soils resources using geophysical methods and made groundwater potentialities in central Sinai. Youssef and Abdel-Malik (1969) studied the geologic succession of the Tayiba-Feiran area, west central Sinai, and classified it into eleven lithostratigraphic units. Abdallah and Abu-Khadra (1977) studied the geomorphology of Sinai Peninsula and its associated rocks and discussed some geomorphological and hydrogeological aspects on it. Garfunkel and Bartov (1977) reported that, the faulting took place on Paleozoic rocks and increased in intensity and aerial extension progressively reached its Climax in Oligo-Miocene period. Hammad (1980 and 1985) studied the hydrogeological aspects in southwestern Sinai and made planning for water resources in it. Issawi *et al.* (1981) studied the stratigraphy of west central Sinai, and they classified the Cretaceous-Lower Eocene rocks from bottom to top. Barakat *et al.* (1986) studied the sandstone section of Malha Formation and classified it into different rock units and assigned it to Permo-Triassic to Early Cretaceous. Abdeen (1988) studied the structure of the area from HammamFaraun to El-Tur, and described the folds and faults and their direction and extension. Okiel (1995) studied the Hydrology of the area between WadiSidri and WadiGharndal and concluded that, the Carboniferous sandstone is the main aquifer in this area. El-Kelani et al. (1999 and 2003) studied the lithostratigraphic of Paleozoic and Mesozoic in southwestern Sinai, and gave the description about their lithology and made lithostratigraphic sections. JICA (1999) classified the geomorphology of south Sinai Peninsula into eight categories by LANDSAT image analysis aerial photograph interpretation and field survey. El-Shayeb (2001) studied the area of WadiSudr at west Sinai area and made geophysical studies to help in groundwater potentiality and concluded that, there are three main aquifers (Quaternary aquifer, Upper Cretaceous aquifer and Lower Cretaceous aquifer). Youssef *et al*. (2004) studied the groundwater occurrences along Wadi Gharandal and its tributaries. These studies revealed that the subsurface succession consists of 11 geoelectrical units, some of these units are considered as water bearing formations. Also, the subsurface faults play an important role in the groundwater occurrences along Wadi Gharandal. Sultan *et al.* (2009) studied the groundwater occurrences along Al qantara East, North Western Sinai, Egypt. Al A bassy (2010) studied the area east of Suez Canal and made geophysical hydrogeological studies to help in groundwater potentiality

MATERIAL AND METHODS

1.1. Geology of the study area
Geomorphology:

    Generally Sinai Peninsula can be divided into two main parts: The southern part (dominated by Precambrian igneous and metamorphic rocks) and the northern part (dominated by Paleozoic to Cenozoic sedimentary rocks). Hammad (1980) divided Sinai into seven geomorphological units. These are; southern elevated mountainous district, central plateaux district (El-Tih and El-Egma), hilly district, north and northwest coastal plain district, marshy and sabkhas district, alluvial coastal plains district and lakes. The investigated area is part of the central plateau's district and the alluvial coastal plains district.

Stratigraphy:

The area of study is covered   by exposed rock units varying from Lower Cretaceous to Quaternary, where most of these rock units are considered as water bearing formations. *Quaternary Deposits* are unevenly distributed in WadiIseila and WadiThal as dark patches. They cover the floor of wadis from Abu-Zenima town up to the downstream area of WadiNukhul and occupy the downstream portions of the wadis (Fig.2).

Structure:

According to Shata (1956); Youssef & Abdel-Malik (1969) and Garfunkel and Bartov (1977), the major structures of the investigated area are dominated by normal and step faults. Generally, the downthrow of the faults ranges between few centimeters to several hundreds of meters. These faults may be related to the synthetic type comprises all faults which are parallel to the Red Sea Graben, and the antithetic type that include the faults which are parallel to the Gulf of Suez and Gulf of Aqaba (Fig.2).

2-Methodology:

2.1. Geoelectric data acquisition:

Geoelectrical survey described in the work is representing by DC resistivty sounding. A total of 27 of Vertical Electrical Sounding (VES) stations were carried out in the study area as a grid pattern. 14 of these sounding stations were measured at the area "A" is located in the Western part of studied area and the others (12 VESes) were measured at the area "B" which located in the Eastern part of studied area. Some of these sounding stations were measured near hand dug wells to estimate the geophysical parameter available for verifying the geoelectrical interpretation. The distribution of the sounding stations and the trend of geoelectrical profiles are shown in (Fig. 3, 4).

The Schlumberger configuration is used in this work with electrode spacing from AB/2=1.5m to AB/2=1000m, The "SYSCAL R1"resistivity meter made in France was used for measuring the apparent resistivity of high accuracy. The topographic survey was carried out with the purpose of determine the location (latitudes and longitudes) of the sounding stations on topographic map by using the GPS apparatus and concluding the ground elevations. VESes locations were chosen according to the following:

a) The VESes stations must be far away from water channels as can as possible and should be arranged in a grid form.
b) The VESes stations must be far away from any source of electricity such as electrical cables and high potential lines to avoid external electrical field.
c) The tilting of land surface at VESes locations must be less than 30º to be conformable with the iterative method of interpretation (Zohdy, 1989).

2.2. Geoelectric Data Interpretation:

2.2.1. Quantitative interpretation of VES stations:

The quantitative interpretation was proceeded using the computer program "RESIST" (Van Der Velpen, 1988) & IPI2WIN Program (2010) for non- automatic iteration method in which the measured field data are compared with data calculated from an assumed model. The initial models were constructed depending on the available data from drilled wells in the investigated area and the geologic map (G.S.E., 1994). The interpreted values of the true resistivity and thickness of the subsurface layers are recorded in Table (1). The quantitative interpretations provide the geoelectrical parameters, i.e., the true resistivities and the corresponding thicknesses of the encountered geoelectrical layer at each sounding station. The interpreted resistivities and thicknesses of the soundings were compared with the available geological and hydrogeological data that come from the drilled wells and the geologic map to assign these resistivities to geoelectrical layers. These geoelectrical layers were grouped as geoelectrical units to be equivalent to the geological formations. The lateral and vertical distribution of the geoelectrical succession, subsurface geologic structures and groundwater occurrence were clarified through the construction of 6 geoelectrical cross sections along the studied area (Fig 2&3).

Table (1): True resistivity and true thickness obtained from the interpretation of the resistivity curves.

VES #	True resistivity (Ohm.m)					True thickness (m)			
Area (A)									
	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	h_1	h_2	h_3	h_4
1	437	350	13	9	29	1.2	18	135	149
2	650	325	13	7	31	6.4	8.6	195	290
3	670	447	17	7	15	0.8	5	8	35
4	1000	225	15	10	25	1.4	2.6	10	140
5	825	330	15	5	19.5	0.9	4.5	104	
6	375	300	108	12		1	8.5	55	.....
7	730	580	15	5	16.5	1.2	4.7	18.8	64.6
8	550	220	11	5	19	1.1	7.4	67.8	160
9	1900	190	15	10	26	1	4.2	15	120
10	1100	550	13	5	18	1	1	96	130
11	394	315	27	11		1.7	16.2	59.4	.....
12	1300	650	16	7	24	1	3.2	16.5	103
13	580	116	17	6	16.3	1	5	12	33
14	500	180	15	5	19	1.3	3.3	17	110

VES #	True resistivity (Ohm.m)				True thickness (m)		
Area (B)							
	$\rho1$	$\rho\,2$	$\rho\,3$	$\rho\,4$	h1	h2	h3
15	318	188	...	8900	5	15.3	.....
16	134	58.5	160	5550	4.5	25	160
17	443	64	....	4415	0.5	4.5	.....
18	510	107	93.6	2734	2.55	8.45	30
19	850	136	94	3155	3.5	22.5	95
20	456	84	31.5	8000	4.2	15.8	150
21	667	102	....	1460	0.5	8.5	.....
22	280	76	31	5326	2.2	12	68
23	2009	759	.....	3106	0.4	5	.....
24	183	37.3	......	3579	0.5	9.5	.....
25	235	125	38	8900	0.6	4.4	60
26	350	195	43	4126	0.7	28.3	25

2.2.2. Geoelectrical Cross-sections:
2.2.2.1 Geoelectric cross-sections of area A
2.2.2.1.1.1 Geoelectric.Cross-section A1-A`1:

The geoelectrical cross-section (A1-A1`) passes a cross the sites of VESes 10, 5, 11 and 6, It shows four geoelectrical units beneath VES 5, 11 and 6 and five geoelectrical units under the VES-10. (Fig.5). The first geoelectrical unit occurred at all VESes with nearly homogeneous thickness ranging from 1.5-2m. It is characterized by very high resistivity values and is composed of coarse sand and gravels, this unit represented by Wadi deposits. The second geoelectrical unit appeared at all VESes with thickness ranging from 4.5-15m, its resistivity values ranging from 300-550 Ohm.m.The third geoelectrical unit is represented under all VESes but with different thickness between VES-5 and VES-10 due to the presence of interpreted fault between them. This unit has resistivity values ranging from 13-108 Ohm.m.The fourth geoelectrical unit occurs under all VESes with large thickness and low resistivity values ranging from 5-12 Ohm.m.The fifth geoelectrical unit is beneath under VESes-10 and 5 with extending vertically to undetermined depth and the resistivity values ranging from 18-19.5 Ohm.m.

2.2.2.1.1. 1 Geoelectric Cross-section A2-A2`:

The geoelectric cross-section A2-A2` passes across the sites of VESes 10, 1, 2, and 12, it shows five geoelectrical units beneath all area under study (Fig.6). The first unit represented by alluvial deposits of high resistivity and few meters of thickness. The second unit represented by sand and gravel with change of resistivity values from 325-650 Ohm.m and change of thickness under the VESes. The third unit is characterized by low resistivity which ranging from 13-16 Ohm.m and change of thickness with present interpreted fault.

The fourth unit represented under all VESes and characterized by very low resistivity values ranging from 5-9 Ohm.m. The fifth unit shows resistivity from 18-25 Ohm.m and extended under the area and represented of Thebes formation.

2.2.2.1.1. 2 Geoelectric Cross-section A3-A3`:

The geoelectrical cross section (A3-A3`) involves VESes number 7, 13 and 4. *(Fig.7)* it is characterized by the presence of five geoelectrical units. The first unit represented by alluvial deposits of high resistivity and thickness of about few meters. The second geoelectrical unit exhibits resistivity ranging from 116-580 Ohm.m with change of thickness. The third geoelectrical unit may be very few change of resistivity where the resistivity ranging from 15-17 Ohm.m and have about 20m thickness. The fourth geoelectrical unit change in thickness may be indicated on interpreted fault under VES-13 and have resistivity values ranging from 5-10 Ohm.m. The fifth geoelectrical unit has resistivity values ranging from 16-25 Ohm.m with change in thickness affected by the interpreted fault under VESes. The geoelectrical cross sections at the area A reveal a five geoelectrical units, which include: The 1st (surface) geoelectrical unit has been detected at all stations with changing of thickness and characterized by a wide range of resistivity values which reflects lithological heterogeneities. This unit is mainly alluvial deposits of Quaternary age. The 2nd geoelectrical unit has change of thickness and resistivity values, it mainly consists of sand and gravels represented Quaternary aquifer of the studied area. The 3rd geoelectrical unit: mainly consists of sandstone and clay stone represented by Rudies - Nukhul Formation of early (lower) Miocene age. The 4th geoelectrical unit: mainly consists of clay stone, sandy marl and sandstone which represented late (upper) - Middle Eocene age. The 5th geoelectrical unit: mainly consists of limestone of Thebes Formation which represented by Early (lower) Eocene age.

2.2.2.2 Geoelectric cross-sections of area B

2.2.2.2.1 . Geoelectric.Cross-section B1-B1`:

The geoelectric cross-section B1-B1` *(Fig. 8)* is constructed depending on the interpretation of VESes 16, 19 and 22 from NE to SW direction; it is characterized by four geoelectrical units. The first geoelectric unit is beneath all VESes with thickness ranging from 0.5-5m and characterized of high resistivity values ranges from 134-850 Ohm.m. The second geoelectric unit is recorded under all VESes with resistivity values ranging from 58.8-136 Ohm.m and has thickness ranges from 5-25m. The third geoelectric unit is recorded under all VESes with large thickness about 170m under VES-16 and resistivity value between 31-160 Ohm.m. The fourth geoelectric unit is recorded under all VESes with high resistivity values ranging from 3155-5550 Ohm.m and extended with undetermined depth.

2.2.2.2.2 . Geoelectric.Cross-section B2-B2`:

The geoelectric cross-section B2-B2` passes through VESes 15, 18 and 21 from NW to SE direction (*Fig 9*). It is characterized by four geoelectric units. The first geoelectric unit is surface layer; it has resistivity values ranging from 318-667 Ohm.m with thickness ranging from 0.5-5m. The second geoelectric unit has resistivity values ranging from 102-180 Ohm.m with thickness ranging from 8-15 m. The third geoelectric unit recorded under VES-18 but missing under VESes 21 and 15 which form a lens under VES 18 it has resistivity value 93 Ohm.m with thickness about

8.5 m. The fourth geoelectric unit has high resistivity values ranging from 1460-8900 Ohm.m and extended with undetermined depth and represented by igneous rocks.

2.2.2.2.3 . Geoelectric.Cross-section B3-B3`:

The geoelectric cross-section B3-B3` passes through VESes 22, 21, 24 and 23 from NE to SW direction (Fig. 10) and it is characterized by four geoelectrical units. The first geoelectrical unit with thickness about 0.5m and resistivity values ranging from 183-2009 Ohm.m. The second geoelectrical unit has thickness ranging from 4-10m and has resistivity values ranging from 37-750 Ohm.m. The third geoelectrical unit is recorded under VES-22 and missed under VESes 21, 23 and 24 effected by interpreted fault and has about 70m thickness. The fourth geoelectrical unit has resistivity values ranging from 1460-5326 Ohm.m and extended with undetermined depth. The geoelectrical cross sections at the area B from the electrical surveying with correlation with borehole No.2 reveal that: The first geoelectrical unit is coarse sand and gravels that belong to the surface layer; it composed of sand and gravels of the Quaternary deposits. The second geoelectrical unit is composed of sand and gravels that belongs to the Quaternary deposits. The third geoelectrical unit is correlated with sandstone that belongs to Paleozoic rocks. The fourth geoelectrical layer is correlated with the basement rocks.

2.2.3. Iso-resistivity maps:

The Iso-resistivity contour maps may give a primary outline of the fault zones, which are characterized by anomalies of considerable aerial extension along a given direction and have a maximum horizontal gradient. In the present work, we have two areas (A and B).

2.2.3.1. Iso-resistivity maps: of area A:

At this area, 4-four Iso-resistivity maps are constructed to cover the most of the succession penetrated by the electric current. First geoelectric unit shows resistivity values are ranging from 300-1800 Ohm.m, the maximum resistivity represented in the Central part and Southwest corners while minimum resistivity at Southeast corners. This can be attributed to lithological heterogeneities (Fig. 11). Second geoelectric unit shows resistivity values are ranging from 50-600 Ohm.m, the maximum resistivity represented in the East part of the studied area and decreases to West direction, but we can recognize a clear difference than the previous map due to general decrease in resistivity values w`ith depth. (Fig.12). The third and the fourth geoelectric units, shows low resistivity values ranging between 10-100 Ohm.m at the most West area while the low values occur at the Northwest corner of the studied area (Figs. 13&14).

From Iso-resistivity maps, we can recognize the values are decreasing with depth, essentially at the Western part of the studied area

2.2.3.2. Iso-resistivity maps: of area B:

Four Iso-resistivity contour maps are constructed to indicate the variation of the resistivity values for different layers that to differentiate the lithology of these units.   First geoelectrical unit shows resistivity value ranged from 50-1800 Ohm.m. This can be attributed to lithology heterogeneities. At general trend it is clear that, the higher resistivity values are obtained at west part of the study area and the lower resistivity values are represented at the East part (Fig. 15). This indicates that the electrical current at the encountered depth may be introduced the Quaternary aquifer, which consists mainly of sand and gravels and contains water as encountered from the subsurface. Second and third geoelectrical units resistivity's are decrease with depth at all area, the values of resistivity ranging between 50-100 Ohm.m with second unit but more decrease at third unit and give resistivity value from 20-170 Ohm.m (Figs. 16 and 17) the maximum value of resistivity at west direction but decrease at Northeast direction and give low resistivity at north part with third unit. Fourth geoelectrical unit shows very high resistivity values with increasing the depth. The resistivity values increasing in all directions and ranging from 1000-8000 Ohm.m which

indicate that the electrical current at the encountered depth may be intruded to the basement rocks (Fig. 18).

2.3. Groundwater Occurrence:

In the area, there are two aquifers for groundwater in the studied area: The Quaternary aquifer (Limited groundwater) and Paleozoic (The Carboniferous aquifer).

2.3.1. Groundwater Possibilities at Area (A):

From the results of geological and geophysical exploration for groundwater possibilities at area (A) and from the interpretation of the proposed hydrogeological cross-sections developed from the geological and geoelectrical data the following can be suggested:

1. Poor groundwater possibilities can occur along the directions of every geoelectrical section and are taken at the area due to the presence of many faults, which reduce the thickness of permeable layer and presence of thick impermeable layers.
2. Limited groundwater possibilities within the Quaternary gravels mainly recharge from the infiltrated rainfall.

2.3.2. Groundwater Possibilities at Area (B):

From geoelectrical studies on Wadi El-Garf and the hydrogeological cross sections, the following can be concluded:

1. The first water- bearing layer is equivalent to the second geoelectrical layer. It is recharged from the very little amount of infiltrated rain water at the aquifer belonging to the Quaternary.
2. The second water-bearing layer is equivalent to the third geoelectrical layer, which belongs to Paleozoic rock aquifer.
3. The basement rocks acts as barrier preventing groundwater to escape deeper.

CONCLUSION

Poor groundwater possibilities in area **(A)** are due to the presence of many faults, which reduced the thickness of layers but limited groundwater possibilities within the Quaternary gravels. In area **(B)** groundwater possibilities are within the Quaternary gravels. There is a water-bearing zone equivalent to the Paleozoic aquifer, where the basement rocks make an impermeable layer for groundwater, accordingly; we are recommend drilling for water wells to the top of the confined aquifers under VESes 16, 19 & 22.

FUTURE RESEARCHES

Whereas the Basementrocks in the studied area are highly affects the aquifers thickness and its availability, we recommend applying future investigation using Gravity method to map the basement correctly.

REFERENCES

Abdallah, A.M. and A. Adindani (1963). Stratigraphy of the Upper Paleozoic rocks, western side of Gulf of Suez. Egypt. Geol. Surv. Paper 25, 18p.

Abdallah, A.M. and A.M. Abu-Khadra (1977). Remarks on the geomorphology of Sinai Peninsula and its associated rock, Egypt. Proc., Egypt. Proceedings, Sixth Colloquium on the Geology of Aegen Region, No. 6 (Athens), pp. 509-516.

Abdeen, M.M. (1988). Structural analysis and tectonic of a segment of HammamFaraun area, Sinai peninsula. M. sc. Thesis, Ain Shams University, Egypt.

Al Abassy, K.A.A. (2010). Geophysical and Hydrogeological studies in the Area East of Suez Canal, Egypt MSc., Al-Azhar Uni., Cairo, Egypt, 183P.

Barakat, M.G.; M. Darwish and A.N. El-Barkoky (1986). Lithostratigraphy of the Post Carboniferous Pre Cenomanianclastics in west *central Sinai and Gulf of Suez. Egypt: 8th E.G.P.C.*

Dobrin, M.B. (1976): Introduction to geophysical prospecting MC Grow Hill, New York, Toronto, London.

Dobrin, M.B. and C.H. Savit (1988). Introduction to geophysical Prospecting. 4th edition, MC Grow-Hill, New York.

El-Kelani, A.; I.A. El-Hag; B. Husseni and S. Mohamed (1999). Type and stratotype sections of the Paleozoic in Sinai, Special Publication, No.77.

El-Kelani, A.; I.A. El-Hag; B. Husseni and S. Mohamed (2003). Type and stratotype sections of the Mesozoic in Sinai, Special Publication, No.79.

El-Shayeb, H.M. (2001). Geophysical contribution to the groundwater potentiality at WadiSudr, Sinai, Egypt. Proc. 6th Conf. Geology of Sinai for Development, Ismailia, pp. 97-107.

Garfunkel, Z. and Y. Bartov (1977). The tectonics of the Suez rift. Geol. Survey Israel, Bull, No.71, 44p.

Geophysica Co. (1963). Investigation on water and soil resources in the north and central part of Sinai peninsula. Geofizika, Zagrab, Yougoslavia, 182 p.

Ghorab, M.A. (1961). Abnormal stratigraphic features in RasGhariboil field: 3rd Arab Petroleum Congress, Cairo, 10p.

Hammad, F.A. (1980). Geomorphological and hydrogeological aspects of Sinai Peninsula. Annals of Geological Survey of Egypt, X:807-817.

Hammad, F.A. (1985). Quantitative geomorphology and groundwater possiblibtities in the vicinities of WadiNassib, Abu Zenima, Sinai: Desert Institute Bull. A.R.E., 35(2):331-351.

IPI2WIN Program: ver.31 2C; 17.10.08 (1990-2008). Copytight@1990-2010, Bobachev A. A., Programs set for VES data interpretation, Dep. Of geophysics, geological faculty, Moscow State University, Russia, 119899.

Issawi, B. and U. Jux (1982). Contributions to the stratigraphy of the Paleozoic rocks in Egypt. Geol. Surv. Egypt. pp. 28-64.

Issawi, B.; M. El-Hinnawi; L. El-Khawaga; S. Labiband and N. Anany (1981). Contribution to the geology of WadiFerian area, Sinai. Egypt. Geol. Surv. Internal Report, 48p.

Jakosky, J.J. (1961). Exploration geophysics Triya new beach Calif. Techs 1, 5 and 6.

JICA. (1999): South Sinai groundwater resources study in the Arab Republic of Egypt.

Keller, G.V. and F.A. Frischknecht (1966). Electrical method in geophysical prospecting, Pergman, London, 517p.

Okeil, S.A. (1995). Geology of Groundwater Supply in the area between WadiGharandal and WadiSidri, southwest Sinai, A.R.E. M.Sc. Thesis, Ain Shams University, Region No. 6 (Athens), pp. 509-516.

Shata, A. (1956). Structural development of the Sinai Peninsula, Egypt, Bull. Inst., Desert de Egypt, Tom, VI(2):117- 156.

Sultan, S.A.; H.M. Mekhemer and F.A. M.Santos (2009). Groundwater exploration and evaluation by using geophysical interpretation (case study: Al qantara East, North Western Sinai, Egypt)., Arabian Journal of Geoscience, 2(3):199-211.

Van Der Velpen, B.P.A. (1988). "RESIST", version1.0, a package for the processing of the resistivity sounding data: M.Sc. Research Project, ITC, Deft, the Netherlands.

Youssef, A.M.A.; T.A. Abdellatief; S. Mousa and A.M.M. Al Tamamy (2004). Geoelectrical survey to delineate the extension of the water bearing formations in wadi gharandal, southwest Sinai, Egypt. EGS Journal, 2(1): 75-84.

Youssef, M.I. and W. Abdel-Malik (1969). Stratigraphy, structure and sedimentary history of the Tertiary rocks of Tayiba- Feiran area, west central Sinai, Egypt. Six Arab Sc. Cong., Demscaaus, pp. 661-673.

Zohdy, A.A. (1989). A new method for the automatic interpretation of Schlumberger and Wenner sounding curves. Geophysics, 54 (2): 245-253.

Figure Captions :
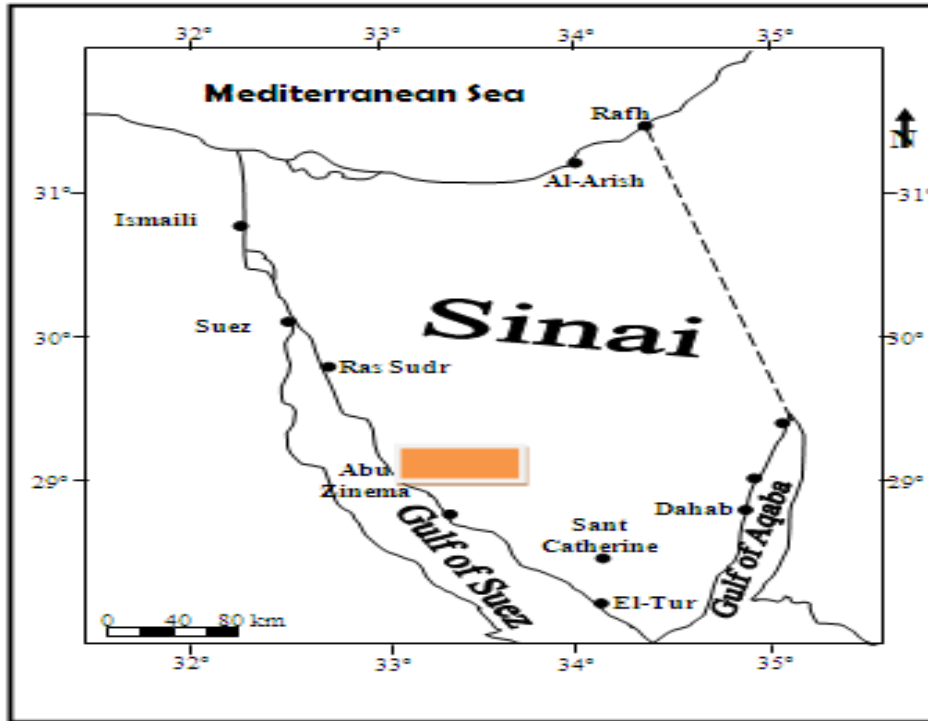
Fig. (1): Location map of the study area.
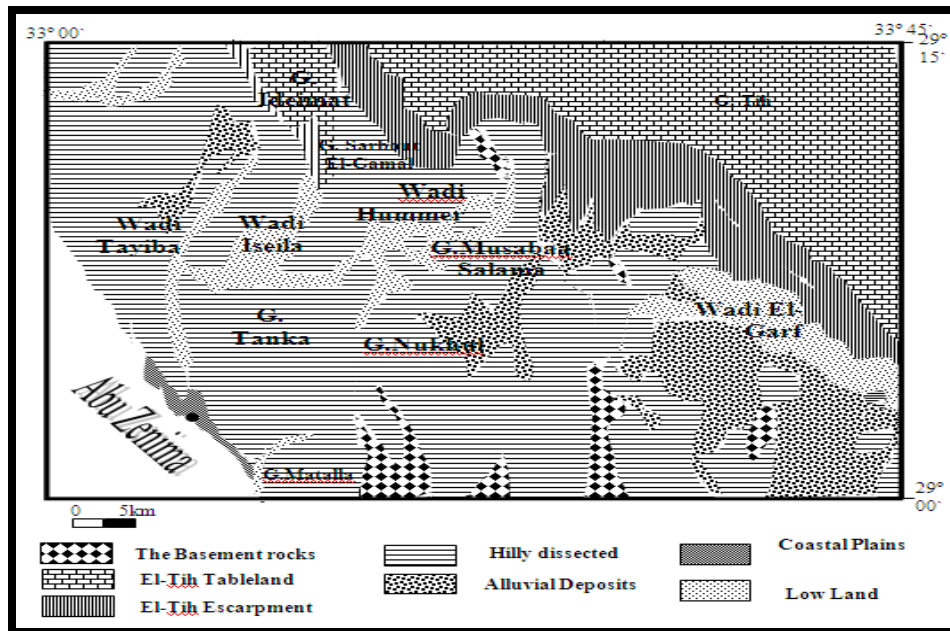
Fig. (2): Geological map of the study area (Modified after Okiel, 1995).
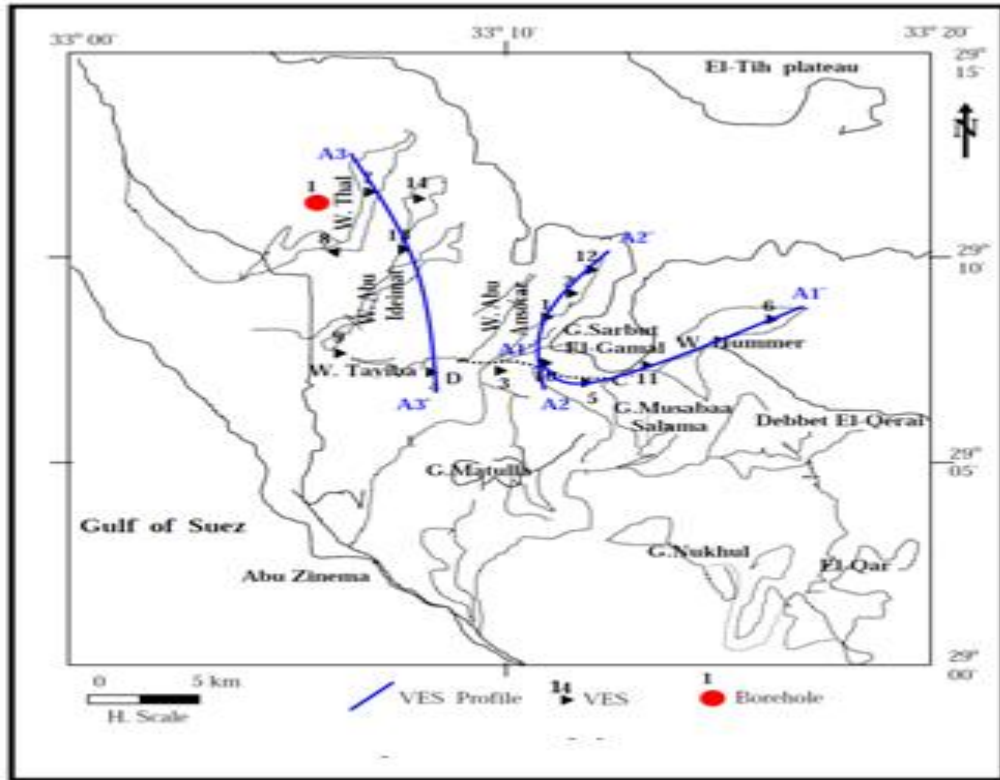
Fig. (3): Location map of the VES station and geoelectric cross-sections of area A.
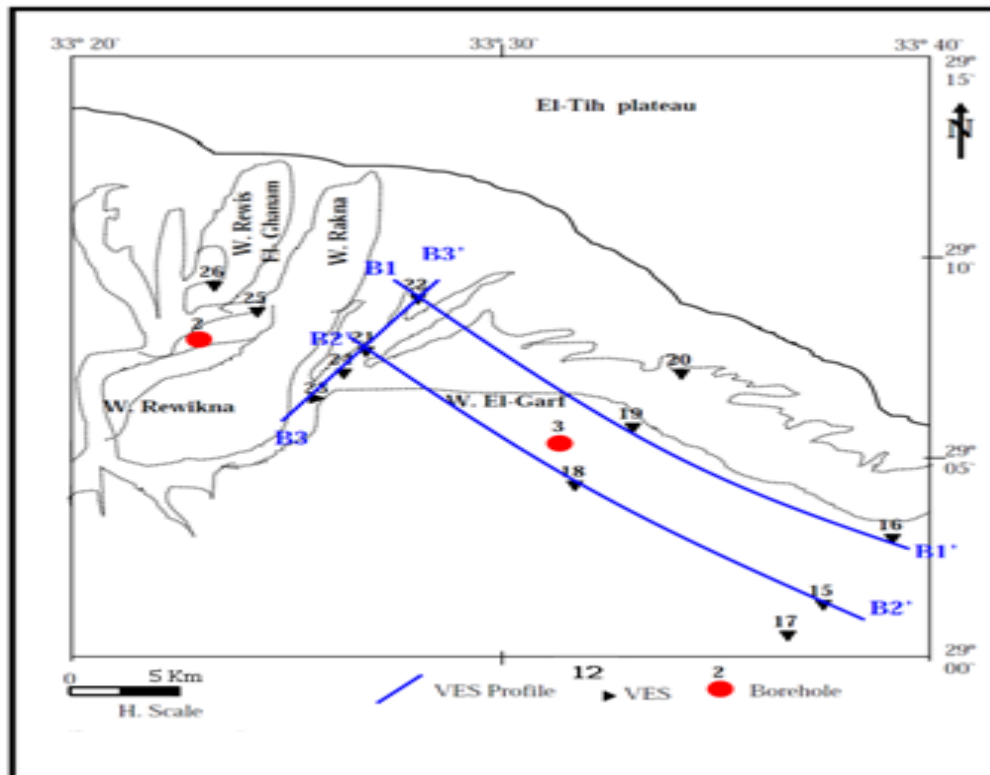
Fig. (4): Location map of the VES station and geoelectric cross-sections of area B.
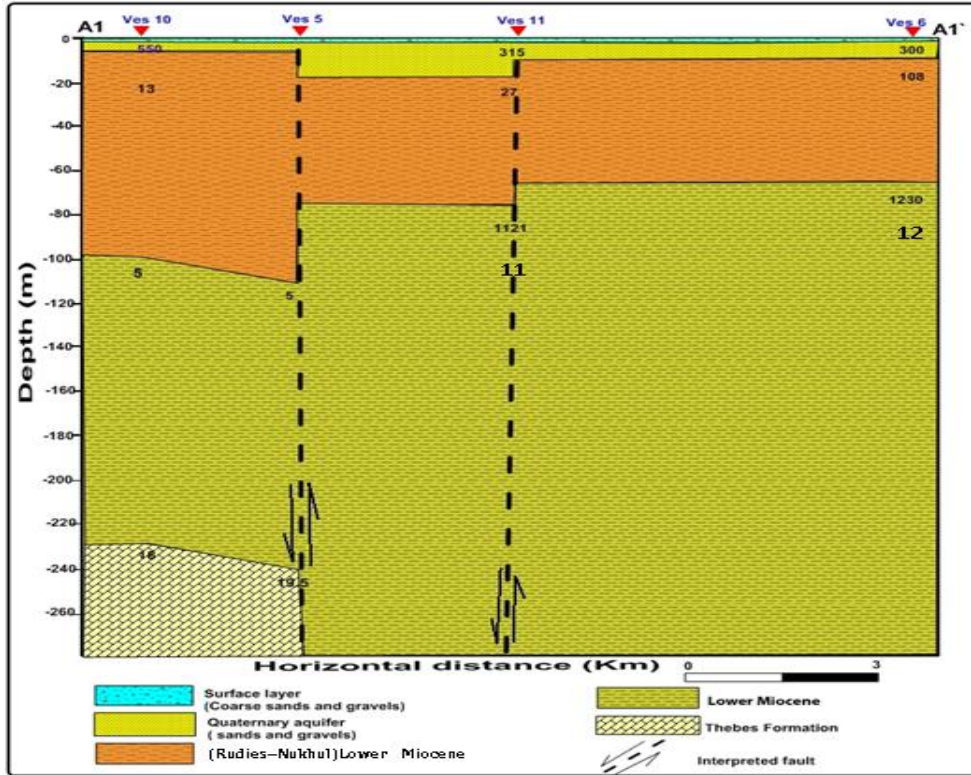
Fig. (5): Geoelectric cross-section A1-A1`.
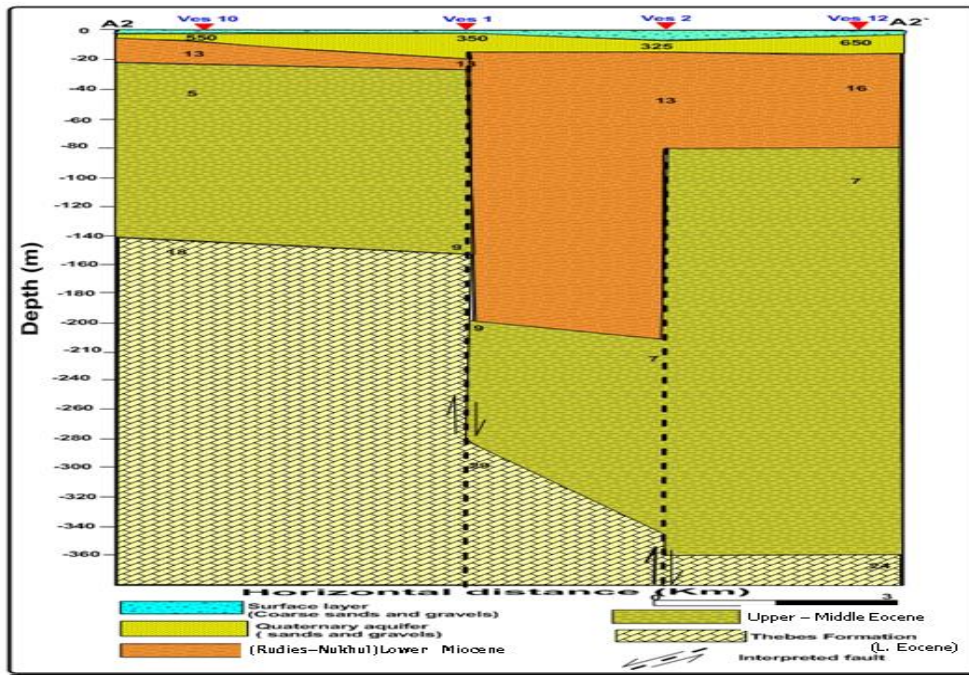
Fig. (6): Geoelectric cross-section A2-A2`.
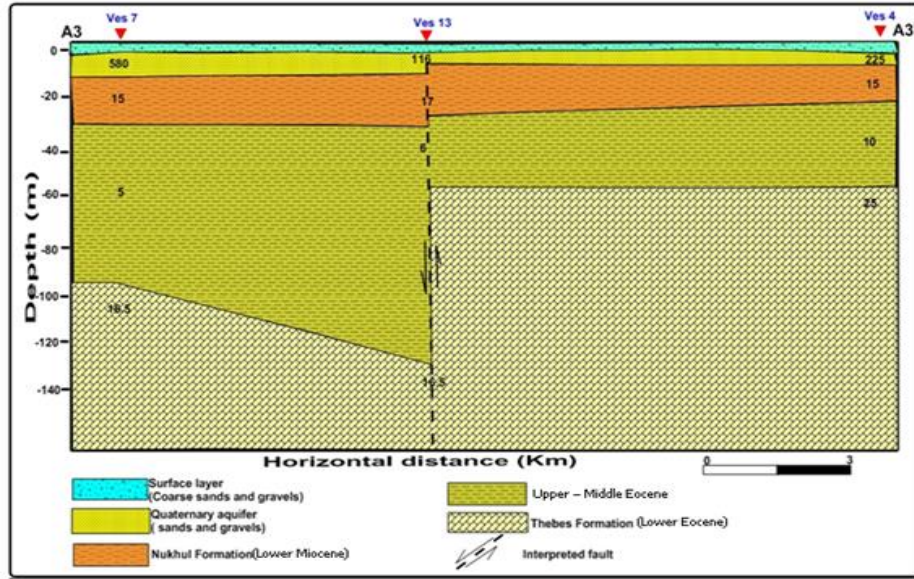
Fig. (7): Geoelectric cross-section A3-A3`.
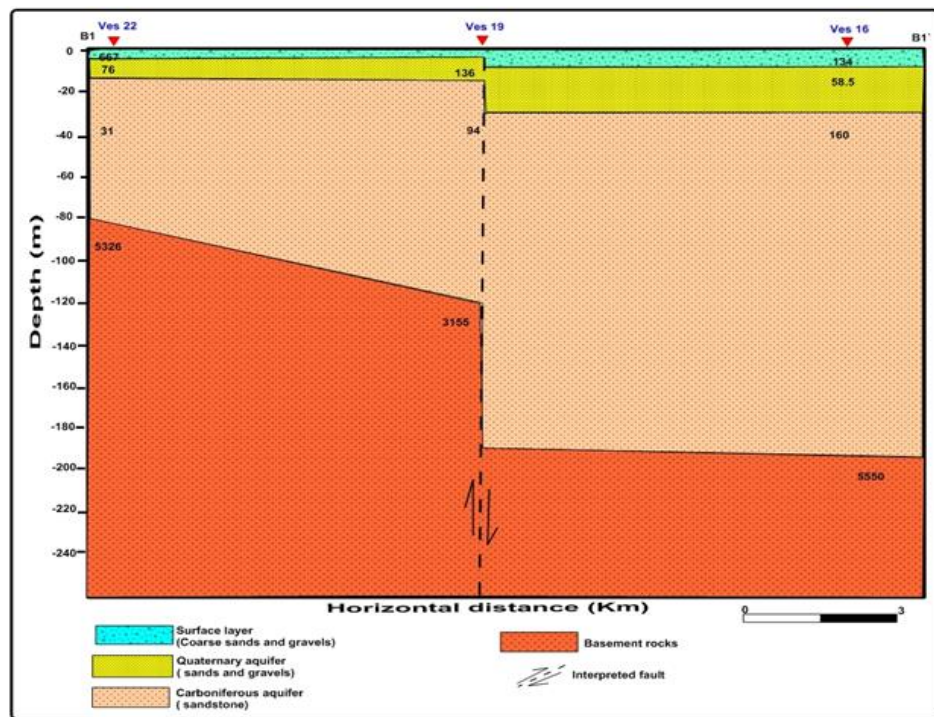
Fig. (8): Geoelectric cross-section B1-B1`.
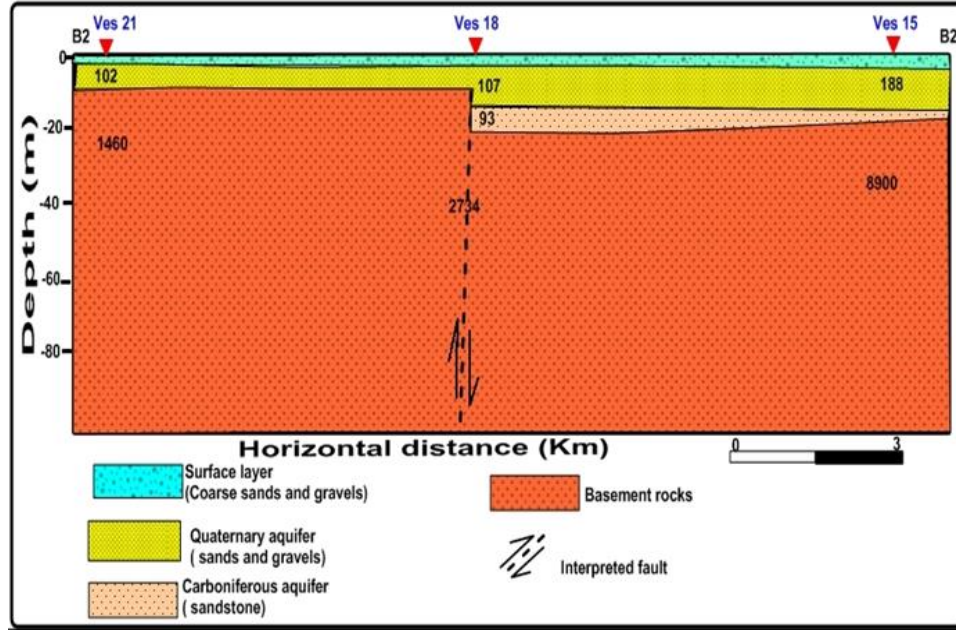
Fig. (9): Geoelectric cross-section B2-B2`.
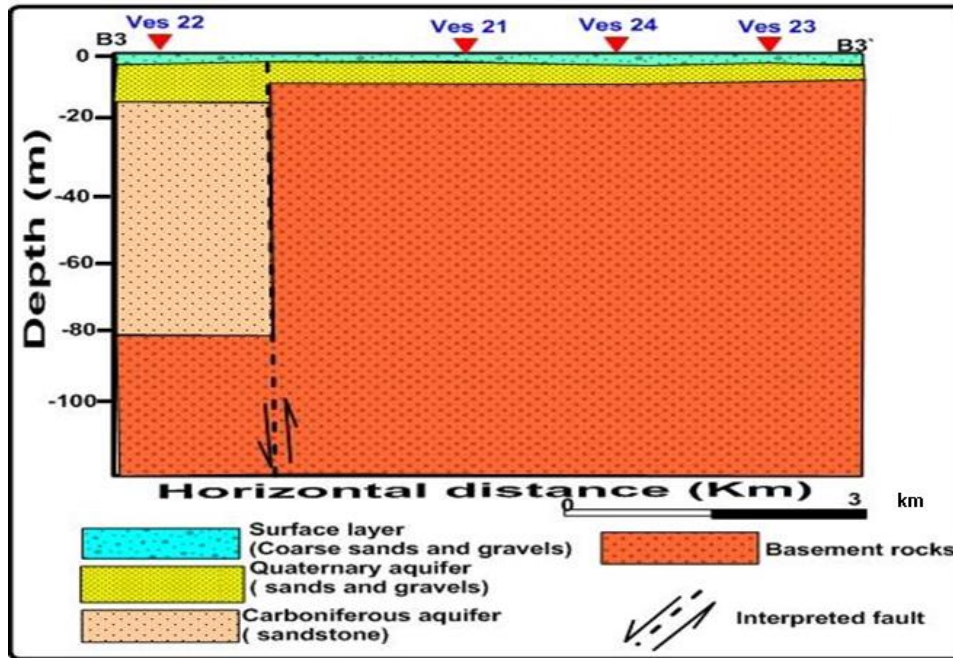
Fig. (10): Geoelectric cross-section B3-B3`.
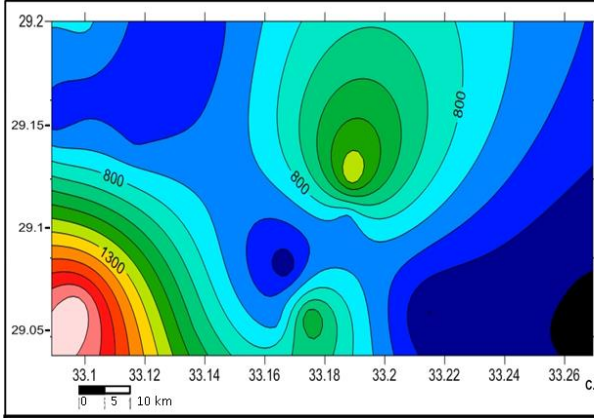
Fig. (11): Iso-resistivity map of the first geoelectric unit for area A
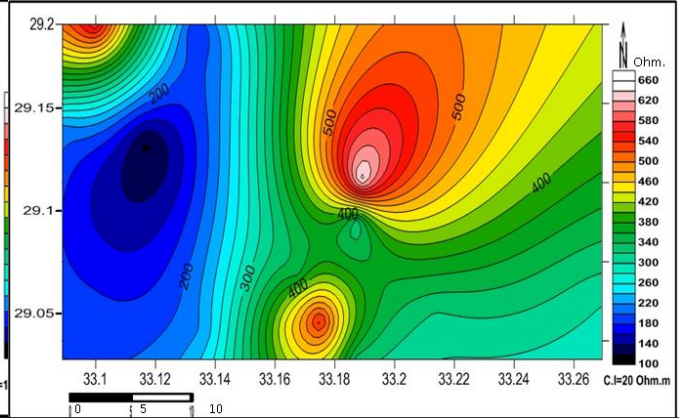
Fig. (12): Iso-resistivity map of the second geoelectric unit for area A
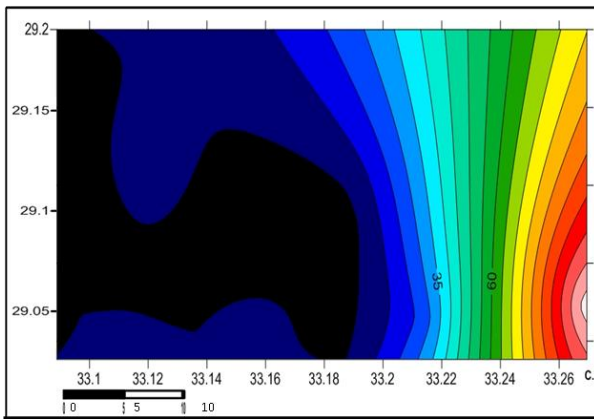
Fig. (13): Iso-resistivity map of the third geoelectric unit for area A
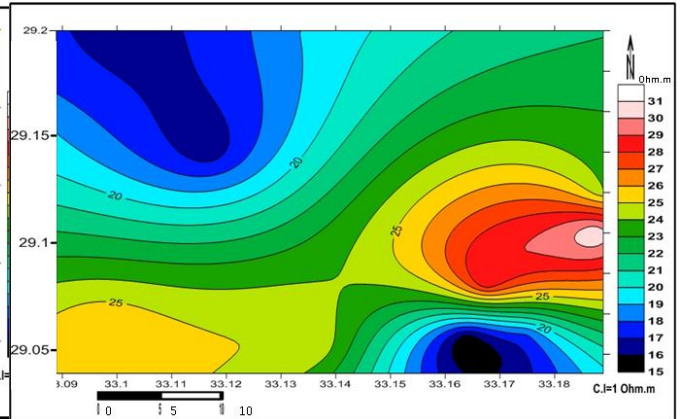
Fig. (14): Iso-resistivity map of the fourth geoelectric unit for area A
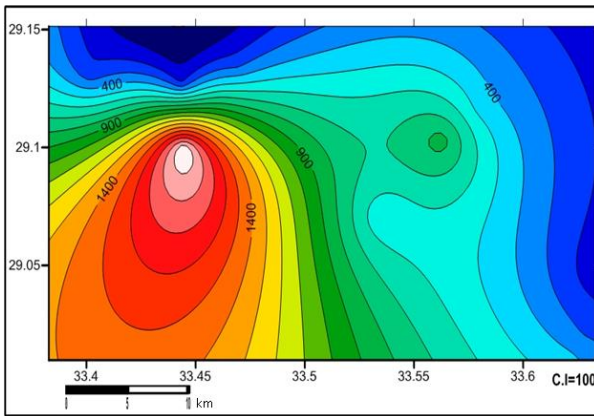
Fig. (15): Iso-resistivity map of the first geoelectric unit for area B
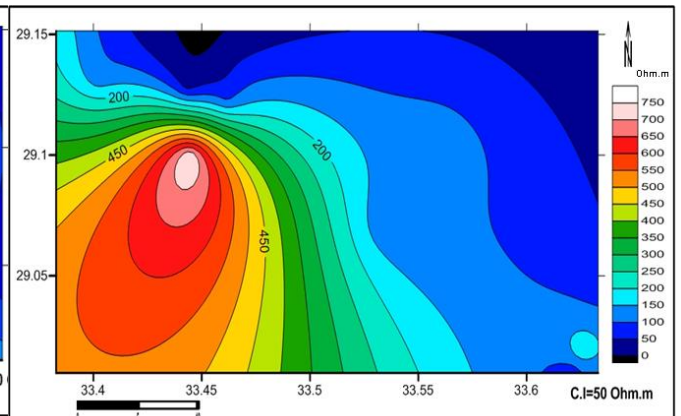
Fig. (16): Iso-resistivity map of the second geoelectric unit for area B
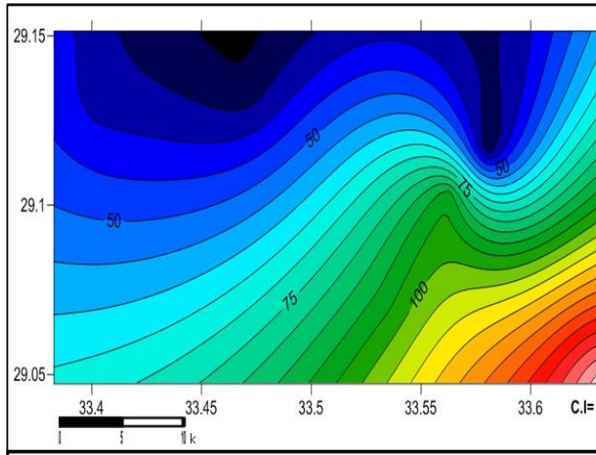
Fig. (17): Iso-resistivity map of the third geoelectric unit for area B
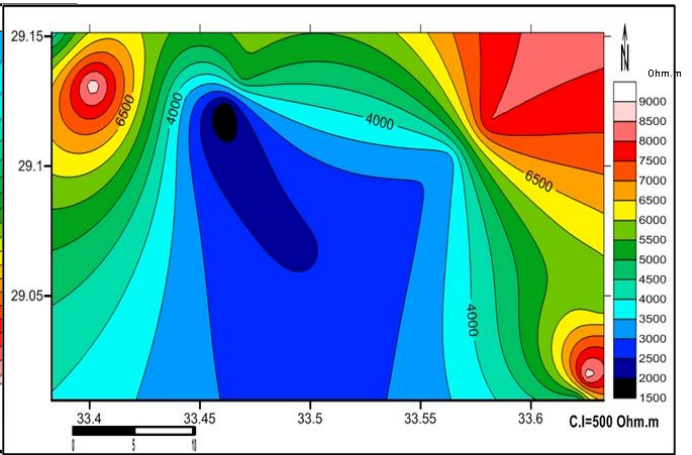
Fig. (18): Iso-resistivity map of the fourth geoelectric unit for area B

EFFECTIVENESS OF A PROGRAM IN ENGLISH LANGUAGE ON ENVIRONMENTAL AWARENESS DEVELOPMENT

M.H. Ali[1]; A.Salama[2] and H.E.Khatab[1]

[1]*Environmental studies and reasarch institute (ESRI), Sadat City University (SCU), Monofiya, Egypt.*

[2]*Faculty of education , Minofyia University, Egypt.*

ABSTRACT

Research work is directed to improve the environmental awareness through developing a program in English for prep-stage curricula. There has been a great deal of research work in the last few decades, devoted to environmental awareness that is achieved by environmental education. There should be an urgent need for using new strategies and methods for teaching environmental science to overcome environmental illitracy. The research is done through five steps. Results indicated the difference in the opinions of experts towards the environmental problems as well as their responses to environmental solutions and participation. There is obvious difference in students' scores in pre and post tests in the direction of the pre one. It was found out that teaching of the educational unit improved students' environmental awareness.

Keywords: effectiveness; english language and environmental

INTRODUCTION

The study has shown the importance of promoting environmental education into school curricula as it serves as the bottom line of environmental protection commitments. The fundamental issue of promoting environmental education involves improving attitudes towards the environment, clarifying the sense of value and modifying certain behaviors. "Live your life as if you might die tomorrow, but look after the Earth as if you might live forever" (Buchan, 1992). The environmental crisis that is facing the world today includes an extremely great number of problems. The continuous ignorance of these problems will result in the destruction of the earth, as humans know it now. The slogan "Think globally and act locally" as well as "think locally and act globally" applies even more today than it has in the past (Bacchus, 1996). A number of environmental trends are developing, according to Brown (1992) in The State of the World. He says; the protective ozone shield in heavily populated latitudes of the northern hemisphere is thinning twice as fast as scientists thought just a few years ago. A minimum of 140 plant and animal species are condemned to extension each day. For this reason, the author has examined the English curricula for the prep-stage, but she has noticed that environmental education is poorly included in them. Therefore, the researcher has encouraged preparing a questionnaire for environmental and educational specialists about the most important environmental issues.

Statement of the problem:

The protection and preservation of our environment from various types of contaminations has become one of the most important issues in our contemporary world. The problem in this research is represented in: The insufficient concern with teaching environmental issues in school curricula that not only create environmentally literate citizenry but also, prepare students for responsible action and leadership in dealing with environmental problems now and in the future. For this reason, the author has examined the English curricula for the prep-stage, but she has noticed that environmental education is poorly included in them. Therefore, the author has encouraged preparing a questionnaire for environmental and educational specialists about the most important environmental issues. So, this research has the following purposes:

1) To explore major issues of environmental education during its beginning stages.
2) To examine environmental awareness and behavior of the pre-stage students
3) To develop an educational environmental program in the prep-stage English curricula.

MATERIAL AND METHODS

Participants:

Study sample consisted of two groups; each group was forty-one students.

Research questions:

The research question examined by the study is: How effective is the educational program on the development of knowledgeable achievement and environmental awareness and skills among prep-stage students?

Description of the Program:

The author developed an educational program depending on her survey of the English curricula of the prep stages; experience in teaching and the responses of experts and students. This unit titled "keeping the environment clean". It was divided into five lessons. Pretests related to the environmental awareness level; developed to establish student's knowledge level and skills. Before teaching the unit, these pretests were answered by participants. Afterwards, the same educational unit covering environmental information and issues applied to experimental group only. The posttests were administrated to the two groups.

Hypotheses:

This research was also developed to provide the necessary data to test the following four null hypotheses.

The first hypothesis:

There are no statistically significant differences between the mean scores of control group students and the experimental group students in the pre application for educational achievement test (EAT) skills test and environmental awareness measure (EAM).

The second hypothesis:

There are no statistically significant differences between the mean scores of control group students and the experimental group students in the post tests educational achievement test (EAT), skills test and environmental awareness measure (EAM) in favor of students of the experimental group.

The third hypothesis:

There are no statistically significant differences between the mean scores of students in the experimental group on pre and post applications of the educational achievement test (EAT), skills test and environmental awareness measure (EAM)**.**

The fourth hypothesis:

There are no statistically significant differences between the mean scores of control group students on the pre and post applications of the educational achievement test (EAT), skills test and environmental awareness measure (EAM).

RESULTS AND DISCUSSION

The results showed that each mean scores of each test is closed in its self. Three tests are educational achievement; environmental awareness measure and skills test in comparisons between pre-tests of control and experimental groups as shown in Fig 1. That means; there are no statistically significant differences between the two groups in pre and posttests. These results ensured the first hypothesis. Overall, students' educational achievement improved significantly the environmental awareness and their skills attitude towards the environmental as shown in Fig 2. Therefore, the null second hypothesis (H_o) is refused and accepted the alternative theory (H1). In discuusion of third hypothesis, we found considerable and influential differences between scores of control and experimental groups in three posttests in compared with pretests as shown in Fig 3. We can accept the alternative theory (H1). There are significant differences in post application in three tests applied in case of the forth hypoehess. This difference is due to the effectiveness of the application of the educational unit. And then validates the fourth hypothesis as shown in Fig 4.

According to the results of this study, the research question was answered. Briefly; students begin not only to collect the garbage, but they also categorize it (paper, glass, cans,...,). They turn off the electricity and water when not in use. Students advise farmers to reduce or eliminate the use of chemicals in farms and fight the insects biological not chemically. They stop people who burn the garbage so that they can prevent air pollution.
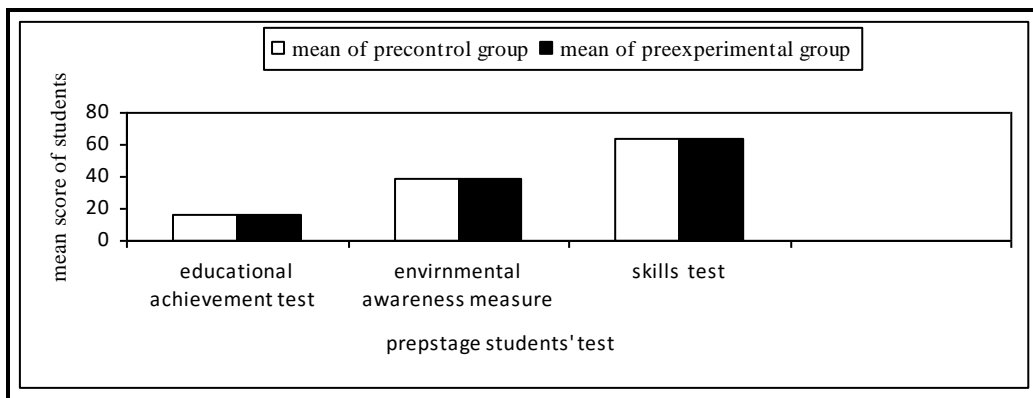
Fig. (1): Relationship between mean of students' score in pretests.
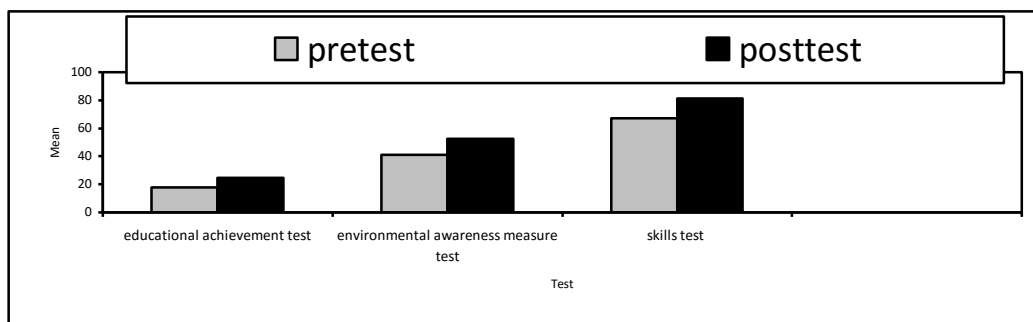
Fig. (2): Relationship between mean of students' score in posttests of educational achievement, environmental awareness measure and skills test.
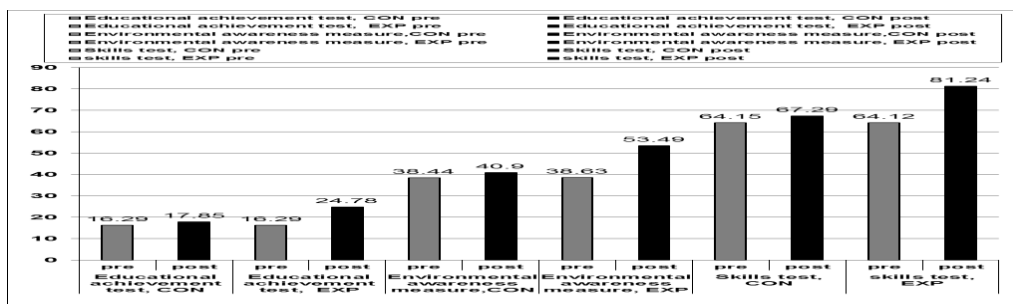
Fig. (3): Relationships between mean of students' score in pretests and posttests of educational achievement, environmental awareness measure and skills test.
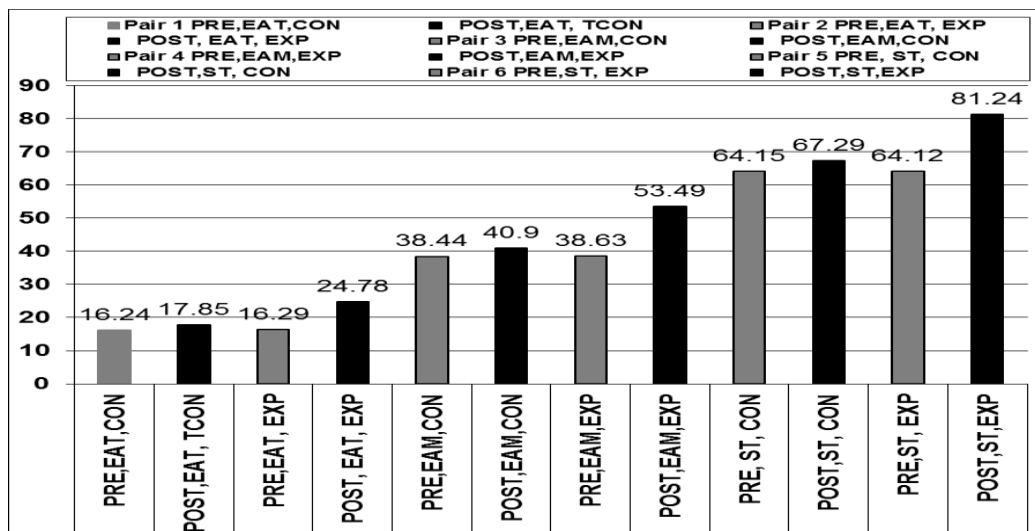
Fig. (4): Relationships between mean of students' score in pretests and posttests of educational achievement, environmental awareness measure and skills test.

CONCULUSION

Based on the major findings of the study, the following recommendations can be made for alternative policies in environmental education:

1. An urgent need for using new strategies and methods for teaching environmental science to overcome environmental illitracy.
2. A great concern with involving environmental issues in schools curricula both as an independent course and as curricula infused into other courses.

REFERANCES

Ashworth, w. (1991). The encyclopedia of environmental studies: Facts of file. New York.

Atwa, A. (2002). (The government role in maximizing the input of NGOs in the planning and management of the environment in Egypt). Paper presented the Symposium for NGOs and the environmental problems in Egypt. Cairo, Egypt: Cairo University, Egypt.

Brown, L. (1991). The New World Order. In L.Brown (ed) State of the World 1991. New York:W.W.Norton&Co.

Buchan, G.D. (1992). Propagating environmental science and ethics: A vocational school as a university,/ high school link. Journal of Environmental Education, 23(2): 10-15.

Bacchus, M.K. (1996). The role of teacher education in development in south countires. The Alberta Journal of Educational Research, XL(II)(2): 77-86.

www.globalwarming.orgwww.epa.gov/ozone/strathome.html www.nsta.orghttp://www.johanssesburgsummit.org/html/documents/statements/26 desai_opening_speech.pdf.

EFFECT OF IRRIGATION PERIODS ON BARLEY GRASS FODDER PRODUCTION USING HYDROPONICS SYSTEM

A.A. Abdalla[1]; E.A. El-Absawy[2]; M.M. Asfour[1] and M.A. Hashesh[2]

[1]*Environmental Studies and Research Institute, Sadat City University.*

[2]*Genetic Engineering and Biotechnology Research Institute, Sadat City. University.*

ABSTRACT

A laboratory experiments were conducted during 2011 and 2012 at the growth room of the Plant Production Laboratory, Environmental Studies and Research Institute, Sadat City University, using complete randomized design with four replications in order to evaluate yield, water use efficiency (WUE) and quality of barley fodder irrigated with three irrigation periods: (2, 3 and 4 min / 4h), under hydroponics system. Barley grains (Giza 124) of a commercial grade with good viability (80-85%) were sterilized with 20% sodium hypochlorite solution to control fungal growth. Seeds were sown in stacked trays in a temperature controlled room. Plants were harvested 7 days after sowing. Fresh fodder and dry fodder weight, the germination percentages and the amount of water used were recorded. Representative fresh green fodder samples from each treatment were oven-dried at 70ºC for 48 hrs and analyzed. Crude protein and crude fiber were determined. Results indicated that germination percent and yield of barley increased as the increasing of irrigation periods increased; however, the increase in WUE was increased with the decreasing of irrigation periods. Proximate chemical analyses indicated that there was significant effect of treated sewage on moisture, crude protein, crude fiber and fat of the barley fodder.

Keywords: Irrigation; barley; grass fodder and hydroponics system

INTRODUCTION

The Egyptian Agriculture is one of the oldest agriculture civilizations in the world. Egypt occupies a total area of about 100 million hectares, out of this area, is about 3.1 million hectares as cultivated area covering three different production zones:

1. The old irrigated lands with an area of 2.3 millions hectares lying in the Nile Valley and Delta and most is fertile soils. 2. The newly reclaimed lands (0.8 million hectares included sandy and calcareous soils, the soil is poor in organic matter and macro-and micronutrients). 3. The rain fed area is about 0.1 million hectares of sandy soil located in the Northwest Coast and North Sinai (Abd El Hadi, 2004)

Egypt is almost entirely dependent upon a single water resource, the Nile, and uses 100% of its water allocation of 55.5 billion m^3, allocated under the terms of the 1959 Nile water agreement *(Radwan, 1998).* Agriculture presently accounts for an estimated 86% of water use in Egypt *(CAPMAS, 2008).* In the face of growing demand for - and dwindling supplies of - water, evidence based water allocation policies will be needed to help make the most productive use of water.

Where water resources are limited the availability for agricultural production is constrained and consequently the need to increase water productivity - the ratio of the net benefits from crop, forestry, fishery, livestock, and mixed agricultural systems to the amount of water required to produce these benefits *(CA, 2007)* - becomes essential in order to increases the availability of water for other human productive and non-productive uses.

Hydroponics technique can be used to produce fodder in very short periods (7-10 days) and it has been proven to be efficient both financially and environmentally *(*Rotar, 2004*).* It is estimated that with this technique, the costs of agricultural inputs are at least 10 times lower than under field conditions (Mooney, 2005). High water use efficiency is, however, a major

advantage of this technique which saves about 95-97% of used water in comparison to conventional agriculture with small piece of land (Al Hashmi, 2006).

The present study aimed to investigates yield and WUE of the hydroponically produced barley sprouts using three irrigation periods (2, 3 and 4 min / 4h).

MATERIALS AND METHODS

The research has been carried out during 2011and 2012 at the growth room of the Plant Production Laboratory, Environmental Studies and Research Institute, Sadat City University.

The hydroponics system:

The hydroponics system is composed of two cabinets (units) with metal frame and four shelves each with a length of 200 cm, a width of 50 cm, and a height of 240 cm. Each unit of the system could carry 28 planting trays with capacity to produce approximately 80-100 kg green fodder per growth cycle (7 days). The number of units of the hydroponics system can be increased and planting date scheduled for daily production of green fodder to meet the daily demand of animals in the farm. Polystyrene trays with a length of 40 cm, a width of 20 cm and a depth of 8 cm were used for growing grains (100g/tray) to produce green fodder. The units of hydroponics system have been arranged in the growth room close to window to utilize natural illumination. An air conditioning unit was used to control temperature inside the growth room which was maintained at 24±2ºC. The relative humidity in the growth room ranged between 65 ±5 percent.

Plant material:

Barley (Giza 124) grains were subjected to a germination test to check for their viability before being used. The results showed that the germination percentage was 95%.

Treatment of seeds and planting:

Grains of barley were cleaned from debris and other foreign materials. Then the cleaned seeds were surface sterilized by soaking for 30 minutes in a 20% sodium hypochlorite solution (Clorox bleach) to prevent the formation of mould. Planting trays and the growing cabinet also were cleaned and disinfected. The seeds were washed well from residues of bleach and re-soaked in tap water overnight (about 12 hours) before sowing.

Irrigation treatments:

Trays were irrigated daily with three Irrigation periods: (2, 3 and 4 min / 4h). Some physical and chemical properties of water used for irrigation in this study are presented in Table (1a).

Table (1a): Some physical and chemical properties of water used for irrigation in this study.

SAR	EC ds/m	PH	SO_4	CL	$CaCo_3$	K	Na	Mg	Ca
					Meq/L				
3.3	2.17	7.10	7.5	12.3	1.9	0.22	8.4	8.5	4.5

Water use efficiency:
Water use efficiency (WUE) was computed according to:
WUE= kg. Green fodder produced/ L water used.

Nutrient solution:

(M.S) were applied at rate of 0.5 g/litter of water, Murashige and Skoog (1962) Table (1b).

Table (1b): Composition of basal medium of Murashige and Skoog (1962).

Constituent	Concentration
Marco-nutrients: (mg/L)	
NH_4NO_3	1650
KNO_3	1900
$CaCl_2.2H_2O$	440
$MgSO_4.7H_2O$	370
KH_2PO_4	170
Micro- nutrients: (mg/L)	
$MnSO_4.4H_2O$	22.30
$ZnSO_4.4H_2O$	8.60
H_3BO_3	8.20
KI	0.83
$NaMoO_4.2H_2O$	0.25
$CuSO_4.5H_2O$	0.025
$CoCl_2.6H_2O$	0.025
Iron: (mg/L)	
Na_2EDAT	37.25
$FeSO_4.7H2O$	27.25
Vitamin: (mg/L)	
Nicotinic acid	0.5
Pyridoxine-HCL	0.5
Thiamine-HCL	0.1
Myo -inositol	100.0
Amino: (mg/L)	
Glycine	2.0
Sucrose (g/L)	30.0

Fodder yield:

At the end of experiment (7 days after seeding), the produced green fodder was ready for harvest, and green plants with their root mats in the trays (Figure 1) were harvested and the following data were recorded: Herb fresh yield (kg/m^2), Root   fresh yield (kg/m^2), herb dry yield (kg/m^2), root dry yield (kg/m^2), moisture content of herb (%) and root, protein content in herb(%) and root, WUE (kg/L), ratio of produced fodder/ planted seed weight , fat content in herb and root (%), and fiber content in herb and root (%).

Fig. (1): Green fodder was ready for harvest   Fig. (2)

Experimental design and statistical analysis:

The completely randomized design (CRD) was used with four replicates. Data were statistically analyzed using analysis of variance (ANOVA) according to the statistical package MSTAT-C (Michigan State Univ., East Lansing, MI, USA). Probabilities of significance among treatments and LSD (a 0.05) were used to compare means among treatments.

RESULTS AND DISCUSSION

Herb, root fresh weight and dry weight of plant were significantly increased with increasing irrigation treatment up to the highest rate of water Table (2). Application of water at the period of 4 min. /4h. recorded the highest values of herb, root fresh weight and dry weight of barely (21.936, 4.364, 2.343 and 0.433 kg/m^2, respectively), while the lowest values were obtained with the lowest irrigation time 2 min./4h (21.136, 3.822 , 1.999 and 0.411 kg/m^2) for herb, root fresh weight and herb, root dry weight, respectively.

The favorable effect of water quantity on plant growth through the important functions of water in plant metabolism, cell division, and differentiation and enlargement of cells and that might be due to its favorable effect on all fresh weight of different plant organs. Similar results were obtained by Al-Ajmi *et al*. (2009) and Fazaeli *et al*. (2011).

Table (2): Effect of irrigation period on herb, root fresh weight and dry weight of barley (combined data).

Irrigation treatments	Herb fresh yield (kg/m^2)	Root fresh yield (kg/m^2)	Herb dry yield (kg/m^2)	Root dry yield (kg/m^2)
2 min./4h.	21.136	3.822	1.999	0.411
3 min./4h.	21.506	4.097	2.207	0.414
4 min./4h.	21.936	4.364	2.343	0.433
LSD at 0.05 level	0.04	0.04	0.05	0.002

Moisture content in herb significantly increased with irrigation treatment 2 min./4h and recorded 90.21 % , while 4 min./4ha irrigation gave the lowest value of moisture content (89.04%) as shown in (Table 3). On the contrary, the maximum moisture content in root (88.01 %) was obtained with 4 min. /4h irrigation, while the minimum value (87.45 %) was obtained with 2 min./ 4ha irrigation. These findings are in agreement with those indicated by Morgen *et al*. (1992) and Mona El-Deeba *et al*. (2009).

While the Protein % in herb significantly increased with increasing irrigation treatment up to 4 min./4h and recorded 26.178 % , while 2 min./4ha irrigation gave the lowest value of protein content (25.533%) as in (Table 3).

On the contrary, protein % in root significantly increased with decreasing irrigation treatments up to the lowest rate (15.964 %), while irrigation treatments up to the highest rate 4 min. / 4h gave the lowest protein content in root (15.433 %). These results are in harmony with those obtained by Mona El-Deeba *et al.* (2009).

Table (3): Effect of irrigation period on herb, root moisture content and protein content of barley (combined data).

Irrigation treatments	Moisture content of herb (%)	Moisture content of roots (%)	Protein content in herb	Protein content in roots
2 min./4h.	90.217	87.450	25.533	15.964
3 min./4h.	89.536	87.733	25.639	15.728
4 min./4h.	89.025	88.011	26.178	15.433
LSD at 0.05 level	0.22	0.30	0.103	0.09

Water use efficiency by barely was significantly decreased with increasing irrigation treatment up to the highest rate of water. (Table 4)

Application of water at the period of 2 min./4h. recorded the highest value of herb WUE (1.968 kg/L), while the lowest values were obtained with the highest irrigation period 4 min./4h (1.812 kg/L). Irrigation at 3 min/4h recorded intermediate value (1.863 kg/L). Morgen *et al.* (1992) and Mona El-Deeba *et al.* (2009).

While the ratio of produced fodder planted seed weight of barely was significantly increased with increasing irrigation treatments up to the highest rate (4 min/4h.) and gave the highest value (5.817) as shown (Table 4).

While the lowest value (5.433) was obtained with irrigation treatment at 2 min/4h. On, the other side, irrigation treatment at 3 min/4h. gave intermediate value between them (5.650). These findings are in agreement with those reported by Al-Hashimi (2008) and Al-Karaki (2008).

Table (4): Effect of irrigation period on water use efficiency and the ratio of produced fodder planted seed weight of barely.

Irrigation treatments	WUE (kg/L)	Ratio of produced fodder/ planted seed weight
2 min./4h.	1.968	5.433
3 min./4h.	1.863	5.650
4 min./4h.	1.812	5.817
LSD at 0.05 level	0.03	0.096

Irrigation treatments of barely under hydroponics system had significantly increased fat content in herb and root. (Table 5). Fat content% in herb was significantly decreased with increasing irrigation treatment up to the highest rate of water. Application of water at the time of 2 min./4h. recorded the highest value in herb (5.106%). while the lowest value was obtained with the highest irrigation time 4 min./4h (5.058%) without significant differences between irrigation time 3 min./4h. As for root fat content, the highest value was obtained by irrigation treatments 3 min./4h. (6.017%) without significant differences between irrigation time 4 min./4h, while the lowest value was obtained by irrigation treatments 2 min./4h. (5.983%). Al-Karaki (2011) recorded similar results .Fiber content in herb was significantly increased with decreasing irrigation treatment up to the lowest irrigation rate (Table 5). Application of water at the time of 2 min./4h. recorded the highest value of herb fiber content (15.786%), while the lowest values were obtained with the highest irrigation time 4 min./4h (15.122%) . Irrigation 3 min/4h recorded intermediate value (15.550%).

Root fiber content significantly increased by increasing irrigation treatments up to the highest rate 4 min./4h (15.883%), while the decreasing of irrigation water quantity decreased root fiber content (15.283%).

Table (5): Effect of irrigation period on Herb, root fat content and fiber content of barley

Irrigation treatments	Fat content in herb	Fat content in roots	Fiber content in herb	Fiber content in roots
2 min./4h.	5.106	5.983	15.786	15.283
3 min./4h.	5.075	6.017	15.550	15.594
4 min./4h.	5.058	6.000	15.122	15.883
LSD at 0.05 level	0.023	0.019	0.14	0.033

CONCLUSIONS

Hydroponics system is a potential technique for barley fodder production with less water consumption where water is the main limiting factor for agricultural production. The current study shows the superiority of 4min irrigated fodder barley over that irrigated with 2min in several aspects related to production and quality of the produced barley crop. This indicated that 4min is a good period of nutrients needed for plant growth to promote high yields.

REFERENCES

Abd El Hadi, A.H. (2004). Country Report on Egyptian Agri, IPI regional workshop on Potassium and Fertigation development in West Asia and North Africa ; Rabat, Morocco, 24-28 November, 2004.

Al Ajmi, A.; A. Salih; I. Kadhim and Y. Othman (2009). Yield and water use efficiency of barley fodder produced under hydroponic system in GCC countries using tertiary treated sewage effluents. J. Phytol., 1(5):342–348.

Al Hashmi, M. (2006). Green forage production in Arabian Gulf countries: current situation and alternative techniques. A scientific report submitted in partial fulfillment of requirement for high diploma in desert and soilless agriculture. Desert and arid zones programme. Arabian Gulf University. Bahrain. 39 p.

Al-Hashmi, M.M. (2008). Hydroponic green fodder production in the Arabian Gulf Region. MSc. Thesis, Faculty of Graduate Studies, Arabian Gulf University, Bahrain. Emir. J. Food Agric., 23(1): 80-94.

Al-Karaki, G.N. (2008). Application of hydroponics culture in production of green fodder. Training workshop, Arabian Gulf University. Bahrain 21-23 April, 2008.

Al-Karaki, G.N. (2011) Utilization of treated sewage wastewater for green forage production in a hydroponics system Emir. J. Food Agric., 2011. 23(1): 80-94.

C.A.W.M.A (2007) (Comprehensive Assessment of Water Management in Agriculture). Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture. London: Earthscan, and Colombo: International Water Management Institute.

CAPMAS (2008). Central Agency for Public Mobilization and Statistics. Statistical Year Book, 2008.

El-Deeba. Mona; N.M. El-Awady; M.M. Hegazi; A. Fathy and J. Mooney (2005). Growing cattle feed hydroponically. Meat and livestock Australia. 30 p.

Fazaeli, H.; H.A. Golmohammad; A.A.N. Shoayee; N. Montajebi and S.h. Mosharraf (2011). Performance of feedlot calves fed hydroponics fodder barley. J. Agr. Sci. Tech., 13: 367-375.

Mooney, J. (2005). Growing cattle feed hydroponically. Meat and livestock Australia. 30 p.

Morgan, J.; R.R. Hunter and R. O'Haire (1992). Limiting factors in hydroponic barley grass production. In the proceeding of the 8th International congress on soil less culture, pp: 241-261.

Murashige,T. and F.A. Skoog (1962). Arevised medium for rapid growth and bioassays with tobacco tissue cultures physiol. Plant, 15: 473-497.

Radwan, L. (1998).Water management in the Egyptian delta: problems of wastage and inefficiency. The Geographical Journal, 164: 112-119,

Rotar, P. (2004). Hydroponic techniques sprout healthy, inexpensive Fodder. Accessed through [http://www.isar.org/pubs/ST/hydroponics47.html].

تأثير فترات الرى على انتاج علف الشعير الاخضر استخدام نظام الزراعة المائية

عادل عبد الهادى عبدالله[1] ، السيد العبساوى[2] ، منذر محمد محمد عصفور[1] و محمد النهدى حشيش[2]

[1]معهد الدراسات والبحوث البيئية – جامعة مدينة السادات – مصر.

[2]معهد الهندسة الوراثية والتكنولوجيا الحيوية – – جامعة مدينة السادات – مصر.

تعتبر الزراعة المائية هى حجر الأساس الذى إرتكزت عليه الزراعات اللاأرضية وتعرف على أنها تكنولوجيا إنماء النباتات فى المحاليل المغذيه مع استخدام أو عدم استخدام بيئه خاملة كعامل تثبيت ميكانيكى

ولها عدة مزايا و أهداف من الأهمية بمكان أن توضع فى الاعتبار عند صانعى قرار السياسات الزراعية على مستوى الأفراد و المجتمعات اهمها ارتفاع انتاجية المحصول (الانتاج على مدار العام) وجودته وسرعة نضجة(الحصاد بعد 7 ايام من الزراعة) كما العائد الاقتصادى يكون مرتفعاً.

- تم هذا البحث بمعهد الدراسات و البحوث البيئية جامعة مدينة السادات خلال الاعوام   2011و 2012 لدراسة تاثير فترات الرى (2 ، 3 و 4 دقيقة كل 4 ساعة) على محصول العلف الاخضر للشعير صنف جيزة 124 و خصائصة الطبيعية و الكميائية و كفاءة استخدام المياه و ذلك باستخدام وحدة زراعة مائية تم انشائها و تطويرها لتتناسب متطلبات الدراسة .

- وقد تم دراسة الخصائص التالية:

الوزن الرطب للمجموع الخضرى(كجم/م^2), الوزن الرطب للمجموع الجذرى (كجم/م^2), الوزن الجاف للمجموع الخضرى (كجم/م^2), الوزن الجاف للمجموع الجذرى (كجم/م^2), محتوى الرطوبة فى المجموع الخضرى(%),محتوى الرطوبة فى المجموع الجذرى(%),معدل انتاج المادة الجافة للعلف المنتج الى وزن البذور المزروعة , محتوى الدهون للمجموع الخضرى (%), محتوى الدهون للمجموع الجذرى%), محتوى الالياف للمجموع الخضرى (%) محتوى الالياف للمجموع الجذرى   (%),محتوى البروتين للمجموع الخضرى (%),محتوى البروتين للمجموع الجذرى (%)ودراسة كفاءة استخدام المياه (كجم/لتر).

وكانت افضل النتائج لمعظم الصفات عند ثبات درجة الحرارة عند ± 2 24^0 ورطوبة تتراوح بين 65 % ± 5. عند فترة الرى 4 دقائق كل 4 ساعات.

MORPHOLOGICAL FEATURES OF GLANDULAR AND NON-GLANDULAR TRICHOMES IN SOME SPECIES OF FAMILY LAMIACEAE

F.M. Ghonam**; Z.A. Turki* and M. F. Azazi**

*Botany department, faculty of Science, Menoufiya University, Monoufiya, Egypt

**Surveying of Natural Resources in Environmental Systems Department Environmental Studies & Research Institute, University of Sadat city

ABSTRACT

The trichomes on leaves of *Lavandula hybrid*, *Mentha aquatic*, *Mentha citrate*, *Mentha longifolia*, *Mentha spicata*, *Ocimum basillicum*, *Origanum majorana*, *Rosmarinus officinalis*, *Salvia elegans*, *S. farinaceae*, *S. splendeus*, *Thymus capitatus*, and *T. vulgaris* are examined by light microscope. Four types of non-glandular trichomes and four types of glandular trichomes were distinguished. Non glandular trichomes appeared valuable data in taxonomy of Lamiaceae. Four distinct glandular trichomes found: short-stalked capitates, long-stalked capitates, small peltate and large peltate. The peltate trichomes are the most abundant type.

Keywords: Trichome, Glandular, Non glandular, Lamiaceae

INTRODUCTION

Lamiaceae as a flowering family contains large number of medicinal aromatic plants. Many species belonging to the family being highly aromatic due to the presence of external glandular structures that produce volatile oil. Within the micro morphological studies, an important taxonomic significance is attributed to the epidermis, in particular to trichomes. Trichomes are defined as unicellular or multicellular appendages, which originate from epidermal cells only (Cantino, 1992), and can develop on all parts of the plant: vegetative and reproductive. Trichomes on plants, extremely variables in their structure and function, could have taxonomical importance in certain plant groups. The type and distribution of trichomes was one of the features differentiating the various subfamilies (Cantino, 1990 and Harley *et al*., 2004). The micro morphological study of the species belonging to different genera can evidence new similarities or differences among the various taxa (Endress *et al*., 2000).

The present work presents the observations on the trichomes oftherteen taxa belonging to the family Lamiaceae viz. *Lavandula hybrid*, *Mentha aquatic*, *M. citrate*, *M. longifolia*, *M. spicata*, *Ocimum basillicum*, *Origanum majorana*, *Rosmarinus officinalis*, *Salvia elegans*, *S. farinaceae*, *S. splendeus*, *Thymus capitatus*, and *T. vulgaris*.

MATERIALS AND METHODS

Plant material:

The present study was mainly based on fresh materials collected from their natural habitats in Egypt in addition to specimens obtained from spring flower gallery. The aerial parts of the examined plants were collected during the flowering – fruiting period (April–July, 2012).

Anatomical investigations:

Samples for anatomy of stem as well as leaves were chosen from both dry and fresh material. All assessments were made on all plants at similar developmental stages (fruiting stages) and in comparable positions of each plant. Stem samples were taken from 4th internodes from the apex about 2-3 cm. Fresh materials were fixed in F.A.A. (5:5:90), while dried herbarium specimens of stem and leaves were first softened by either normal or warm water, after fixation stem and leaves specimens were transformed in ethyl alcohol series, then embedded in paraffin wax. The specimens were sectioned at 10-15 µm; sections were dehydrated in alcohol-xylol series. Sections were stained in safranin and light green according (Sass, 1961). The transverse sections of stem and leaves were examined by using light microscope. The trichomes types of the investigated taxa, followed the terminology after Payne (1978) and Giuliani & Maleci Bini (2008).

RESULTS AND DISCUSSION

Anatomical characters:

Different types of non-glandular and glandular trichomes were found on all examined leaves of the different taxa (Table1 and Figs 1-10).

Types of non-glandular trichomes:

  A - Unicellular (arrect or bent)
  B - Multicellular (arrect)
       B1- Multicellular (arrect), with smooth surface wall
       B2- Multicellular (arrect), with cuticular papillae
  C - Multicellular (aduncate)
       C1- Multicellular (aduncate), with smooth surface wall
       C2- Multicellular (aduncate), with cuticular papillae
  D - Dendroid (dendriform) hair

   Type A – Unicellular arrect or bent trichomes (Fig.1). These are living trichomes having a vacuolated protoplasm with numerous plastids.

   Type B – Multicellular trichomes. They are uniseriate, unbranched, composed of 2-4 cells. Stiffly erect, directed upward from an inclined base. Similar to unicellular trichomes, composed of living cells containing numerous plastids. This type distinguished into two subtypes:

   B1-The wall surface is smooth without cuticular papillae (Fig. 2).
   B2-The wall surface is covered with cuticular micropapillae (Fig. 3).

   Type C - Multicellular trichomes. They are uniseriate, unbranched, composed of 2-4 cells. Trichomes twisted or bent at different levels. Similarly to type B trichomes, they are composed of living cells containing numerous plastids. This type distinguished into two subtypes:

   C1-The wall surface is smooth without cuticular papillae (Fig. 4).
   C2-The wall surface is covered with cuticular micropapillae (Fig. 5).

   Type D- Dendroid hair. Multicellular trichomes, branched to a tree in form; having a stem like part arising immediately from the broadened base and dividing to produce diverging branches which may be repeatedly forked in their turn (Fig. 6). They are composed of living cells containing numerous plastids.

Types of glandular trichomes:

   Four types of glandular trichomes are investigated in the studied taxa. These types are represented in the following:

   A- Small peltate (cup-shaped)
   B - Large peltate (cup-shaped)
   C- Short capitate (brevicollate)
   D- Long capitate (asciiform)

Type A- Peltate trichomes: They are made up of one basal cell, a short unicellular stalk and up to 10 secretory cells covered with a cuticle, beneath which a large subcuticular space is formed (Fig. 7). The secretorycells contain chloroplasts.

Type B - similar to type A, but with 10-14 secretary cells (Fig. 8)

Type C- Short capitates trichomes: They are made up of one basal cell, the stalk formed ofone or two cells and two secretory cellswithin the head which is covered with a cuticlelayer (Fig.9).

Type D- Long capitates trichomes: They are multicellular (2-3 cells) uniseriate stalk and unicellular glandular head covered with a cuticle (Fig. 10). In this trichome type there are different shapes of the cells composing the head: spherical or significantly elongated, some ofthem narrowed in the lower or middle part.

A characteristic feature of these trichomes was the occurrence of a strongly vacuolated cytoplasm only in the lower, most elongatedcell of the stalk. But the cells lying nearest the head had a dense cytoplasm, with typical secretory cells.

Table (1): Different types of glandular and non-glandular trichomes

No.	Taxa	Glandular trichome	Non- glandular trichome
1	*Lavendula hybrid*	C	D
2	*Mentha aquatica*	A,D	A,C1
3	*Mentha citrata*	A	C1
4	*Mentha longifolia*	B	C1
5	*Mentha spicata*	A,D	C2
6	*Ocimum basillicium*	A,C	B1
7	*Origanum majorana*	B	C1
8	*Rosmarinus officinalis*	D	B1
9	*Salvia elegans*	A	A,B1
10	*Salvia farinaceae*	A,C	B2
11	*Salvia splendeus*	B	C1
12	*Thymus capitatus*	B	B1
13	*Thymus vulgaris*	A	A

Types of non-glandular trichomes: A- Unicellular (arrect or bent),B1- Multicellular (arrect), with smooth surface wall,B2- Multicellular (arrect), with cuticular papillae ,C1- Multicellular (aduncate), with smooth surface wall, C2- Multicellular (aduncate), with cuticular papillae, D - Dendroid (dendriform) hair.

Types of glandular trichomes: A- Small peltate (cup-shaped), B - Large peltate (cup-shaped), C- Short capitate (brevicollate), D- Long capitate (asciiform).

Types of non-glandular trichomes
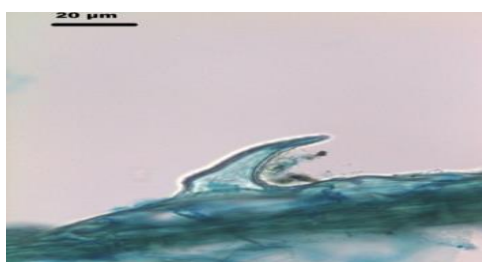
Fig. (1): Unicellular trichome of *Thymus capitatus*
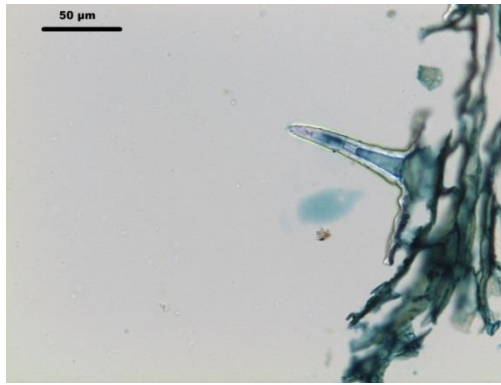
Fig. (2): Arrect non-glandular trichomes of *Salvia elegans*
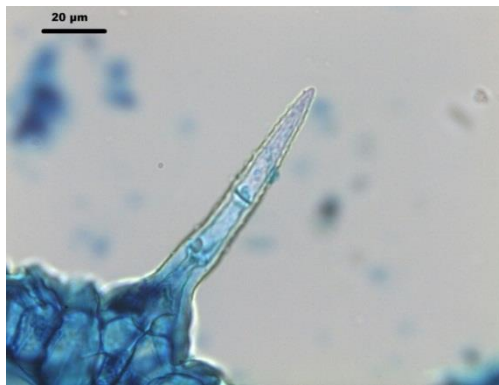
Fig. (3): Arrect rough non-glandular trichomes of *Salvia farinacea*
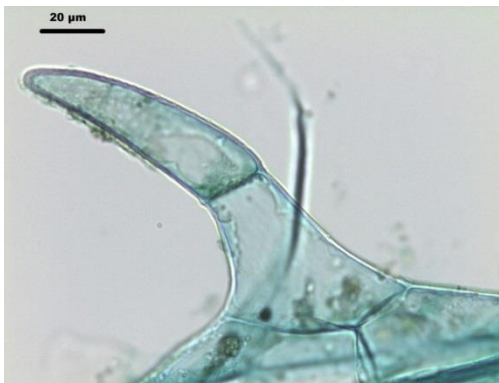
Fig. (4): Bent non-glandular trichomes of *Mentha citratea*

Fig. (5): Bent rough non-glandular trichomes of *Mentha spicata*
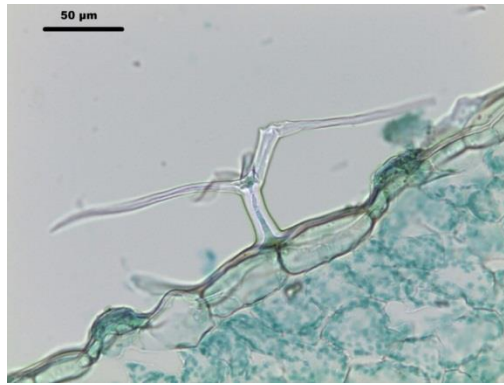
Fig. (6): Dendroid (dendriform) hair of *Lavendula stricta*

Types of glandular trichomes:
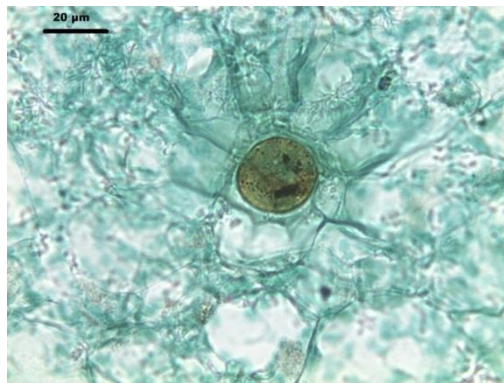
Fig. (7): Small peltate trichomes of *Mentha citrata*
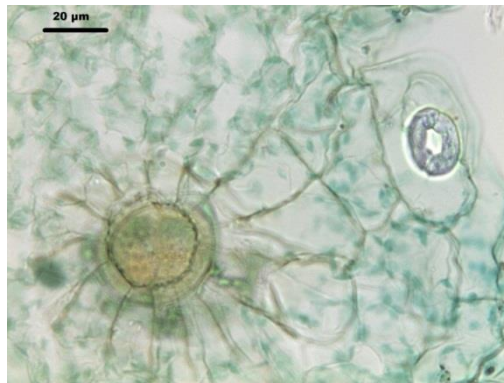
Fig. (8): large peltate trichomes of *Salvia splendens*

Fig. (9): Short capitates trichomes of *Lavendula hybrid*
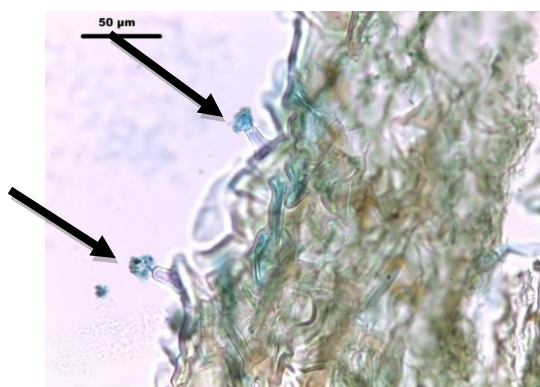
Fig. (10): Long capitates trichomes of *Rosmarinus officinalis*

The aerial surfaces of almost all of the aromatic plants belonging to the family Lamiaceae examined are covered with trichomes, including non-glandular trichomes and glandular or secretory trichomes (Werker*et al.*, 1985; Werker, 1993). In the present study, four types of non-glandular trichomes (A, B, C and D) are distinguished. Type Arepresented in three of the studied species viz: *Mentha aquatica*, *Salvia elegans* and *Thymus capitatus*.Type B1 represented in four species: *Ocimum basillicum, Rosmarinus officinalis, Salvia elegans* and *Thymus capitatus*. Type B2 observed only in *Salvia farinaceae*. Type C1 represented in five species *Mentha aquatic, M. citrate, M. longifolia, Origanum majorana* and *Salvia splendens*. Both Type C2 and Type D are represented in only one species from studied taxa: *Mentha spicata* and *Lavendula hybrid* respectively.

Every species of the three studied *Salvia* species have different type of non-glandular trichomes as *Salvia elegans* have type A and B1, *Salvia farinaceae* have type B2 and *Salvia splendens* have type C1. *Mentha citrate, M. longifolia* and *M. spicata* have the same type of trichomes C1 and only the species *M. spicata* have the type C2 .The two studied species *Thymus capitatus* and *T. vulgaris* have two different types of non-glandular trichomes, viz. *T. capitatus* has type B1 and *T. vulgaris* has type A.

Within the family Lamiaceae, different species can have different types, distribution, morphology, and density of glandular trichomes, which could be of important taxonomic value (El-Gazzar and Watson, 1970), such as having both peltate and capitates trichomes, or with only either peltate or capitates trichomes, or, more rarely, having neither (Huang *et al*., 2008).The present study showed that trichomes have great taxonomic value in the studied taxa at the level of species, but this is not detectable with the four studied species of *Mentha* species, where two species of *Mentha* have the same

type of glandular trichomes small peltate (A) and long capitates (D) .*Mentha citrate* has only type (A) small peltate and *Mentha longifolia* has the type (B) long peltate.

Every species of the three studied species of *Salvia* have type of glandular trichomes differ from the others as *Salvia elegans* have small peltate trichomes (A), *S. farinaceae* have small peltate trichomes (A) and short capitate (C) and *S. splendens* have large peltate type (B). *Thymus capitatus* have large peltate trichomes (B) while *T. vulgaris* have small peltate trichomes (A).

The glandular trichomes are known to be the primary sites of secondary metabolite biosynthesis, secretion and storage, and generally consist of either simple subcutaneous glands or of trichomes (Weiss, 1997). In present study, four distinct glandular trichomes, i.e. short-stalked capitates, long-stalked capitates, small peltate and large peltate glandular trichomes were found.

Two types of capitates trichomes are found based on their morphological features, namely short capitate (C) and long capitates trichomes (D). The differences between these trichomes are in the stalk length, the neck cell and the shape of the glandular head. The result is consistent with the findings of Werker*et al*. (1985) who noted that capitates trichomes are very variable in stalk length, glandular head shape and secretions, and can be classified into various types. The short-stalked capitates trichomes (C) are represented in three of the studied taxa: *Lavendula hybrid, Ocimum basillicum* and *Salvia farinaceae*. The short-capitate trichomes are the commonest type of capitates trichome found in Lamiaceae and these types have globoid to obovoid uni- or bicellular glandular heads (Ascensao *et al*., 1999). The long-stalked capitates trichomes (D) found in three of the studied species *Mentha aquatic, M. spicata* and *Rosmarinus officinalis*. According to Ascensao *et al*. (1999), capitates trichomes may differ in terms of their morphological characteristics, reflecting the different secretory processes, and would probably have distinctive functions.

Peltate trichomes are very frequently found in the studied taxa, as small peltate (A) found in seven species *Mentha aquatica, M. citrate, M. spicata, Ocimum basillicum, Salvia elegans, S. farinaceae* and *Thymus vulgaris*. Large peltate trichomes (B) found in four species *M. longifolia*, *Origanum majorana, Salvia splendens* and *Thymus capitatus*. In many of the species of the Lamiaceae, the broad head of the peltate trichomes usually consisted of four to twelve cells (Werker*et al*., 1993; Serrato-valenti *et al*., 1997; Bisio *et al*., 1999; Corsi and Bottega, 1999; Turner *et al*., 2000; Huang *et al*., 2008; Bagherpour *et al.,* 2010; Kahraman *et al*., 2010). Previous studies on Lamiaceae did not report peltate broad head with more than 12 cells. In the present study large peltate trichomes head consisted of 10-14 cells. The peltate trichomes produce most of the essential oils, i.e. terpenes (Clark *et al*., 1997)

REFERENCES

Ascensao, L.; L. Mota and M.D. Castro (1999). Glandular trichomes on the leaves and flowers of *Plectranthus ornatus*: morphology, distribution and histochemistry. Ann. Bot-London, 84: 437-447.

Bagherpour, S.; A. Kahraman; M. Doğan; F. Celep; B. Başer and S. Pehlivan (2010). The anatomical and micro morphological characteristics of *Salvia vermifolia* (Sect. *Aethiopis* Bentham, Lamiaceae) from central Anatolia, Turkey. Cent. Eur. J. Biol., 5(6): 872-879.

Bisio, A.; A. Corallo; P. Gastaldo; G. Romussi; G. Ciarallo; N. Fontana; N. De Tommasi and P. Profumo (1999). Glandular hairs and secreted material in *Salvia blepharophylla* Brandegee ex Epling grown in Italy. Ann Bot-London, 83: 441-452.

Cantino, P.D. (1990). The phylogenetic significance of stomata and trichomes in the *Labiatae* and *Verbenaceae*, J Arnold Arbor., 71: 323–370.

Clark, L.J.; J.G.C. Hamilton; J.V. Chapman; M.J.C. Rhodes and D.L. Hallahan (1997). Analysis of monoterpenoids in glandular trichomes of catmint *Nepeta racemosa*. Plant J., 11(6): 1387-1393.

Corsi, G. and S. Bottega (1999). Glandular hairs of *Salvia officinalis*: New data on morphology, localization and histochemistry in relation to function. Ann Bot-London 84: 657-664.

El-Gazzar, A. and I.A. Watson (1970). Taxonomic study of Labiatae and related genera. New Phytol., 69: 451-486.

Endress, P.K.; P. Baas and M. Gregory (2000). Systematic plant morphology and anatomy: 50 Years of progress, Taxon., 49: 401–434.

Giulian, C. and L. Malcibini (2008). Insight into the structure and chemistry of glandular trichomes of Labiatae, with emphasis on subfamily Lamioideae, Plant Syst., 276: 199-208.

Harley, R.M.; S. Atkins; A.L. Budantsev; P.D. Cantino; B.J. Conn; R. Grayer; M.M. Harley; R. De Kok; T. Krestovskaya; R. Morales; A.J. Paton; O. Ryding and T. Upson (2004). *Labiatae*. In: Kadereit, J. W., (ed) The families and genera of vascular plants, Lamiales, vol 7.Springer, Berlin, pp: 167–282.

Huang, S.S.; B.K. Kirchoff and J.P. Liao (2008). The capitate and peltate glandular trichomes of *Lavandula pinnata* L. (Lamiaceae): Histochemistry, ultrastructure, and secretion. J Torrey Bot. Soc., 135: 155-167.

Kahraman, A.; F. Celep and M. Dogan (2010). Anatomy, trichome morphology and palynology of *Salvia chrysophylla* Stapf (Lamiaceae). S. Afr. J Bot., 76: 187-195.

Payne, W.W. (1978). A glossary of plant hair terminology. Brittonia, 30(2): 239-255.

Sass, J.E. (1961) Botanical microtechnique. The Iowa state University Press, Ames.

Serrato-Valenti, G.; A. Bisio; L. Cornara and G. Ciarallo (1997). Structural and histochemical investigation of the glandular trichomes of *Salvia aurea* L. leaves, and chemical analysis of the essential oil. Ann Bot-London, 79: 329-336.

Turner, G.W.; J. Gershenzon and R. Croteau (2000). Development of peltate glandular trichomes of peppermint. Plant Physiol., 124:665-680.

Weiss, E.A. (1997). Essential Oil Crops. CAB International. New York.

Werker, E.; U. Ravid and E. Putievsky (1985). Structure of glandular hairs and identification of main components of their secreted material in some species of the Labiatae. Israel J Bot., 34: 31-45.

Werker, E. (1993). Function of essential oil-secreting glandular hairs in aromatic plants of the Lamiaceae - a Review. Flavour Frag J., 8: 249-255.

Werker, E.; E. Putievsky; U. Ravid; N. Duda and I. Katzir (1993). Glandular hairs and essential oil in developing leaves of *Ocimum basilicum*L. (Lamiaceae). Ann Bot-London, 71: 43-50.

Werker, E. (2000): Trichome diversity and development. In: Hallahan, D.L. and Gray, J.C. (eds), Advances in Botanical Research. Academic Press, London, 31: 1-35.

EFFECT OF GINGER ON HAMSTERS INFECTED BY *GIARDIA LAMBLIA*

Amal, I.A. Ammar[1]; Soheir, S.M. Mahmoud[1] and N.N. El Hefnawy[2]

[1]Parasitology Department, Theodor Bilharz Research Institute, Giza, Egypt.

[2] Institute for Environmental Studies and Research, University of Sadat City, Monofiya, Egypt.

ABSTRACT

The present work was carried out to evaluate the effect of ginger extract, a natural product extracted from roots of *Zingiber officinal*, in addition to Ginger Drug against *Giardia lamblia* in infected hamsters. Seventy laboratory-bred hamsters were used in the current experimental study. Hamsters were divided into 7 groups, normal control, infected control, infected treated with metronidazole, infected treated with ginger drug and, ginger plant extract Combined treatment of metronidazole with either Ginger drug or ginger plant in a half dose each were also given to a group of infected animals.

After oral infection with *G. lamblia* cysts, treatment was given 3 weeks post infection after stool examination.The drugs were given for 7 days in a single oral dose, followed by scarification of all hamsters 2 weeks after the end of treatment. The highest percentages of reduction in the number of Giardia cysts and trophozoites were in the group receiving combined therapy followed by metronidazole treated group then the ginger drug and lastly the ginger plant treated group.

Histopathological examination revealed complete healing of intestinal mucosa after the combined treatment, while partial healing of the lining epithelium of the intestine was noticed after metronidazole and either ginger drug or ginger plant treatment.

INTRODUCTION

Giardia lamblia is a flagellated unicellular enteric protozoan pathogenic to digestive system of humans causing giardiasis (Thompson *et al.,* 2000). The clinical presentation of giardiasis range from an asymptomatic cyst excreting state to diarrhea which can be acute, chronic or intermittent (Rickard *et al.,* 1999) Also, Giardia infection have been associated with growth failure due to nutrient malabsorption (Berkman *et al*., 2002) .

Giardia infection is mostly associated with developing countries, where compromised hygiene infrastructure might lead to increased transmission and endemic establishment of such diseases (Savioli, 2006). In industrialized countries, Giardia causes outbreaks of diarrheal diseases in day-care centres and water-associated outbreaks (Robertson *et al*., 2010).

There are some agents to treat giardiasis such as metronidazole, tinidazole, furazolidone, paramomycin and nitazoxanide (Davila *et al.*, 2002). However, many problems are associated with the currently used chemotherapeutic agents including treatment failure, unpleasant side effects, activity against normal intestinal flora, possible carcinogenicity and Parasite resistance (Petri, 2003).

In order to improve the current chemotherapy of Giardia infection, potential antigiardial agents have been screened, including natural plant extract products (Hawrelak, 2003).

MATERIAL AND METHODS

Experimental animals:

The present study was conducted on seventy laboratory bred male Syrian hamsters (*Mesocricetus auratus*) with a weight range of 100-110 gm. The animals were provided by Schistosome biological supply program (SBSP) in Theodor Bilharz Research Institute (TBRI).

Throughout the study, the animals were kept on a standard diet containing 24% protein, 4% fat and about 4-5% fiber and water ad-libidum in the biological unit of TBRI under a temperature of 24 C.

Ethics:

Anesthetic procedures complied with the ethical guidelines approved by the Ethical Committee of the Federal Legislation and National Institutes of Health Guidelines in USA were approved by the Medical Ethical Committee of Theodor Bilharz Research Institute (TBRI) in Egypt.

Drug administration:

1- Metronidazole (Flagyl) was given orally in a suspension form in a dose for 7 mg/hamster/day for seven consecutive days (Mahmoud and Shalaby, 2006).
2-Ginger in a dose of 200 mg/hamster/day and dimethylsulphoxide 1% (DMSO) were dissolved in 99% distilled water. The suspension was orally given for 7 consecutive days. The doses were calculated by extrapolation of human therapeutic doses to animal doses according to the table of Paget and Barnes (1964).
3- Ginger plant extract was given orally in a dose of 200 mg /hamster/day.

Preparation of *Zingiber officinale* extract:

Plant collection:

Rhizome of Z.officinale were purchashed from the local market, the Rhizome were cut, washed with distilled water.

Extraction:

The fresh catted roots of Z*ingiber officinale* (30 gm) soaked in 75% (1L*3) methanol for 4 weeks. The methanol solution was evaporated under vacuum using rotatory evaporator (Bushi) to give 300ml of crude methanol extract; the latter was dissolved in DMSO.

Experimental design:

All animals included in the present study were divided into 7 groups according to the drug they received.
Group A: Control group; comprising 10 healthy hamsters which were not infected and received no treatment.
Group B: Infected control group: comprising 10 hamsters which were infected with *Giardia lamblia* cysts and received no treatment.
Group C: comprising 10 infected hamsters receiving Metronidazole.
Group D: comprising 10 infected hamsters received full dose of ginger drug.
Group E: comprising 10 infected hamsters receiving full dose of ginger plant extract.
Group F: comprising 10 infected hamsters received a combination of metronidazole in reduced dose of 3.5mg/hamster/day and ginger drug in a reduced dose of 100 mg/ hamster /day for 7 consecutive days' oral doses
Group G: comprising 10 infected hamsters received a combination of metronidazole in a reduced dose of 3.5 mg/hamster/day and ginger plant extract in reduced dose of 100 mg/ hamster /day for 7 consecutive days oral doses.

Infection of animals:

Hamsters included in groups B, C, D, E, F and G were orally infected with *Giardia lamblia* cysts using esophageal tube. Extraction of Giardia from stool: *Giardia lamblia* cysts used for infection of hamsters included in the present study were obtained from diarrheic patients attending the outpatient clinic of TBRI. The stool samples of infected patients were collected in sterile clean stool cups taking care that the specimens were not contaminated with water or urine. After collection of stool samples, they were repeatedly sieved and washed using normal saline to obtain the cysts to concentrate the cysts. Each hamster was infected with *Giardia lamblia* cysts in a dose of 10000 ±1 cysts.

The infecting dose was calculated by taking the average of 3 counts, each of them done in 1 ml of stool sediment. Three weeks after infection of hamsters, stool samples were collected and subjected to parasitological examination to detect *Giardia lamblia* cysts and to ensure that hamsters have been infected. Hamsters included in group B, C, D, E, F and G were given the corresponding drug for 7 consecutive days, and three weeks post infection.

Two weeks after administration of drugs, stool specimens were collected from infected hamsters and subjected to parasitological examination to count the number of *Giardia lamblia* cysts per each gram of stool, then animal sacrifice was undertaken.

Collection of stool samples:

Fecal samples of hamsters were collected in clean, wide mouthed containers with tight-fitting covers. The sample should not be contaminated with water or urine for subsequent microscopic examination.

Parasitological examination of stool samples:

All stool samples were subjected to:
a) Direct examination: done according to Baroody (1946) Wet films were examined directly by light microscopy using saline and iodine for detection of parasites.
b) Merthiolate-iodine-formaldehyde-concentration method (MIFC): done according to Blagg *et al*. (1955).

Animal scarification:

Scarification of animals was done 2 weeks after administration of drugs and was performed by intraperitoneal anesthesia. The upper part of small intestine was removed and subjected to histopathological examination, also, the duodenal contents were subjected to parasitological examination in order to count the number of *Giardia lamblia* trophozoite in 5 successive fields /animal.

Histopathological examination:

After scarification of hamsters, their small bowels were removed. Three segments of one cm length each were excised at a distance 5, 15 and 25 cm from the gastro duodenal junction. The excised segments were submitted to histopathological examination as follows:

The excised segment was opened longitudinally, oriented on a filter paper and fixed in 4% formaldehyde. After fixation; the tissues were processed for paraffin embedding. Histopathological sections of 4 mm thickness were stained with haematoxylin-eosin. They were examined microscopically under low power (X200) and high power (X400) to detect histopathological changes that occurred due to Giardiasis and to assess the degree of healing of intestinal mucosa after drug administration.

Statistical analysis:

-Data were coded and entered using the statistical packages SPSS version 12.
-Data were summarized using mean and standard deviation for quantitative variables and qualitative variables.
-Comparisons between groups were done using chi square test for qualitative variables and analysis of variants (ANOVA) and multiple comparison post Hoc test for quantitative variables.

-P values lower than 0.05 were considered as statistically significant.

RESULTS AND DISCUSSION

a- **Results of stool examination (cyst count):**

The number of *Giardia lamblia* cysts per each gram of stool of hamsters two weeks after administration of drugs was 12134±1573 cysts/gm in group B (infected hamsters receiving no treatment), 985±214 cysts/gm in group C (infected hamsters treated with metronidazole), 5426±521 cysts/gm in group D (infected hamsters treated with ginger drug) and 569±145 cysts/gm in group E (infected hamsters treated with metronidazole and ginger drug in a half dose each).

The number of *Giardia lamblia* cysts showed a percentage of reduction of 91.88% in group C, 55.28% in group D ,95.31% in group E , 39.49% in group F and 86.12%in group G when compared to the number of *Giardia* cysts in stool of group B (control infected group). These data are shown in table (1). The difference in the number of *Giardia* cysts between groups C , D, E,F,G and group B was statistically significant (P value <0.001).

Table (1): The number of *Giardia* cysts and the percentage of reduction in the stool of infected hamsters two weeks after administration of drugs.

Animal groups	No. of *Giardia* cysts/gm stool 2 weeks after treatment (Mean ± SD)	Percentage of reduction in number of *Giardia* cysts
Group B (Infected untreated)	12134 ± 1573	
Group C (Infected treated with metronidazole)	985 + 214	91.88%***
Group D (Infected treated with ginger drug)	5426 + 521	55.28%**
Group E (Infected treated with ginger drug and metronidazole)	569 ± 145	95.31%***
Group F(Infected treated with ginger plant)	7342 + 862	39.49%*
Group G(Infected treated with ginger plant and metronidazole)	1684 ± 279	86.12%***

*** *High significant difference between treated and untreated group P> 0.001.*
** *Moderate significant difference between treated and untreated group P> 0.01.*
* *Low significant difference between treated and untreated group P> 0.05.*

b- **Examination of the contents of small intestine of hamsters (trophozoite count):**

The number of *Giardia lamblia* trophozoites/H.P. F. in the contents of the small intestine 2 weeks after administration of drugs was 195 ± 94.92 cysts/gm in group B (infected hamsters receiving no treatment), 25.24 ± 8.72 cysts/gm in group C (infected hamsters treated with metronidazole), 104.15± 28 cysts/gm in group D (infected hamsters treated with ginger drug) and 10.53± 3.42 cysts/gm in group E (infected hamsters treated with metronidazole and ginger drug in a half dose each).

The number of *Giardia lamblia* trophozoites showed a percentage of reduction of 87.06% in group C, 46.6% in group D and 94.6% in group E, 37.77% in group F and88.5% in group G as shown in table (2). The difference in the number of *Giardia* trophozoites/H. P. F. between groups C, D, E ,F ,G and group B was statistically significant (P value <0.001).

Table (2): The number of *Giardia* trophozoites and percentage of reduction in the contents of the small intestine of infected hamsters two weeks after administration of drugs.

Animal groups	No. of Giardia trophozoites/H.P.F. in contents of small intestine (Mean ± SD)	Percentage of reduction in Giardia trophozoites in small intestine contents
Group B (Infected untreated)	195 + 94.92	
Group C (Infected treated with metronidazole)	25.24 + 8.72	87.06%***
Group D (Infected treated with ginger drug)	104.15 + 28	46.6%**
Group E (Infected treated with ginger drug and metronidazole)	10.53 ± 3.42	94.6%***
Group F(Infected treated with ginger plant)	121.34 + 35	37.77%*
Group G(Infected treated with ginger plant and metronidazole)	22.42 ± 4.25	88.5%***

*** *Highly significant difference between treated and untreated group P> 0.001.*
** *Moderate significant difference between treated and untreated group P> 0.01.*
* *Low significant difference between treated and untreated group P > 0.05.*

1. Histopathological results of group A (normal control group):

Histopathological examination of sections of small intestine of hamsters in this group showed normal villous architecture with average length and width of villi. Goblet cells were moderate in number with a healthy well defined brush border as demonstrated in Figure (1).
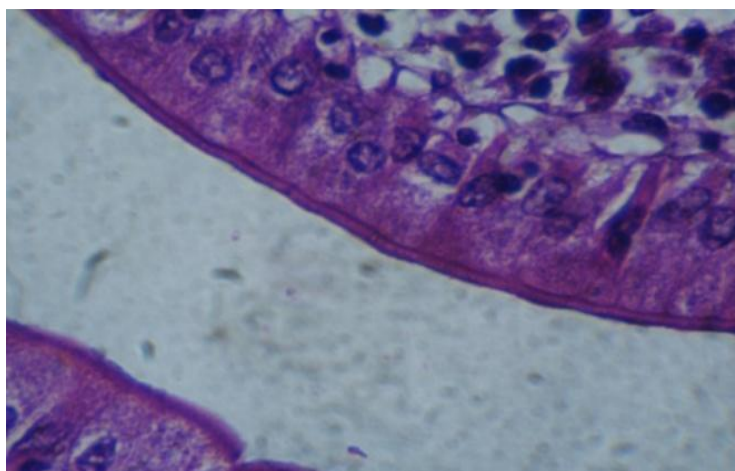
Fig. (1): Section of small intestine in group A (normal control group) showing normal villous architecture with normal brush border (H & E stain x1000).

2- Histopathological results of group B (infected control group):

Histopathological examination of sections of small intestines of hamsters in group B (infected with no treatment) revealed profound histopathological changes in the morphology of the intestinal mucosa as a result of infection with *Giardia lamblia.* These changes included shortened broad villi, decreased ratio of villous height to crypt length, goblet cell depletion, mucosal ulceration and infiltration of lamina propria with inflammatory cells mainly lymphocytes and esinophils. Also, *Giardia lamblia* trophozoites were detected in the intestinal lumen and between the villi as demonstrated in figure (2).
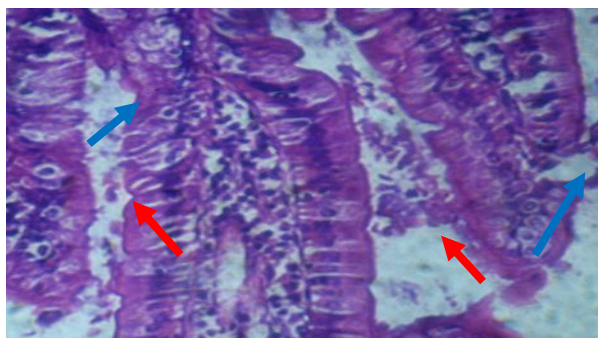
Fig. (2): Section of small intestine in group B (infected control group) showing *Giardia lamblia* trophozoite in the intestinal lumen (red arrows) and shortened broad villi with showing ulceration of the lining intestinal epithelium (blue arrow) (H & E stain x 400).

3. Histopathological results of group C (infected treated with metronidazole):

Histopathological examination of sections of small intestine of infected hamsters in this group treated with metronidazole showed improvement in the histopathological changes following *Giardia* infection. Evidences of improvement included partial healing of the intestinal mucosa with focal flattening of surface enterocytes. Mild depletion of goblet cells, mild decrease in the ratio between villous height to crypt length, focal infiltration with inflammatory cells in the lamina propria and partial mucosal ulceration were detected. A small number of *Giardia lamblia* trophozoites were still detected in the lumen as shown in Figure (3).
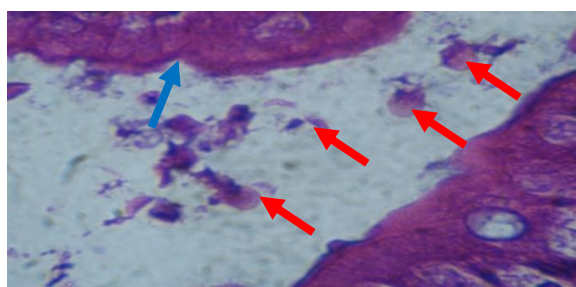
Fig. (3): Partial healing of the lining epithelium with mild flattening of villi of the intestine of hamsters after metronidazole treatment (H & E stain x 1000).

4. Histopathological results of group D (infected treated with ginger drug):

Histopathological examination of sections of small intestine of infected hamsters included in this group treated with ginger drug showed improvement in the histopathological changes following *Giardia* infection. Evidences of improvement included partial healing of the intestinal mucosa and mild shortening and thickening of villi. Partial mucosal ulceration, mild depletion of goblet cells, mild decrease in the ratio between villous height to crypt length and focal infiltration with inflammatory cells in the lamina propria was detected. A small number of *Giardia lamblia* trophozoites were detected in the lumen as shown in Figure (4).
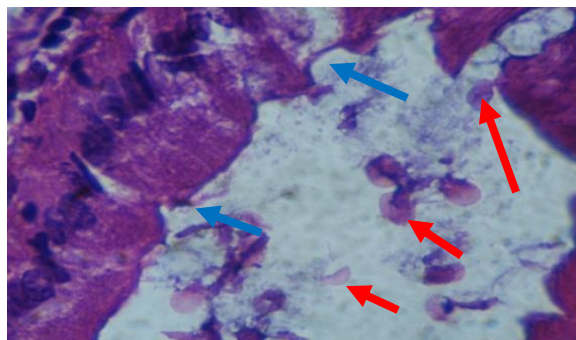
Figure (4): Partial healing of the intestinal villi of hamsters in group D after ginger drug treatment with some ulcerated areas (blue arrow) could be detected (H &E stain x1000).

5. Histopathological results of group E (infected treated with metronidazole and ginger drug in reduced dose):

Histopathological examination of sections of small intestine of hamsters given combined therapy (group E) revealed a significant improvement of the histopathological changes in the form of complete healing of intestinal mucosa, preserved brush border, absence of mucosal ulceration, normal villous architecture, very mild depletion of goblet cells, patchy inflammatory cellular infiltration of lamina propria, ratio between villous height to crypt length more or less preserved and no *Giardia lamblia* trophozoites could be detected as shown in figure (5).
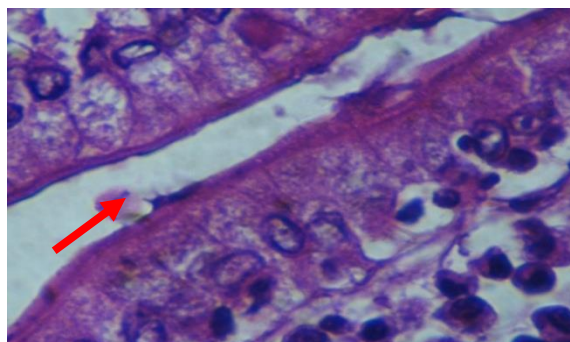
Fig. (5): Partial healing of the lining epithelium with mild flattening of villi of the intestine of hamsters after ginger drug and metronidazole treatment (H & E stain x 1000).

6. Histopathological results of group F (infected treated with ginger plant):

Histopathological examination of sections of small intestine of infected hamsters included in this group treated with ginger plant extract showed improvement in the histopathological changes following *Giardia* infection. Evidences of improvement included partial healing of the intestinal mucosa and mild shortening and thickening of villi. Partial mucosal ulceration, mild depletion of goblet cells, mild decrease in the ratio between villous height to crypt length and focal infiltration with inflammatory cells in the lamina propria was detected. A small number of *Giardia lamblia* trophozoite were detected in the lumen as shown in figure (6).
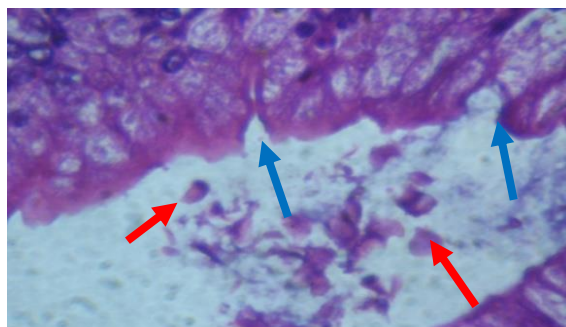
Fig. (6): Partial healing of the intestinal villi of hamsters in group after ginger plant treatment with some ulcerated areas (blue arrow) could be detected) H & E stain x1000).

7. Histopathological results of group G (infected treated with metronidazole and ginger plant):

Histopathological examination of sections of small intestine of hamsters in metronidazole and ginger plant treated group (group G) revealed a significant improvement of the histopathological changes in the form of complete healing of intestinal mucosa, preserved brush border, absence of mucosal ulceration, normal villous architecture, very mild depletion of goblet cells, patchy inflammatory cellular infiltration of lamina propria, ratio between villous height to crypt length more or less preserved and no *Giardia lamblia* trophozoites could be detected as shown in figure (7).
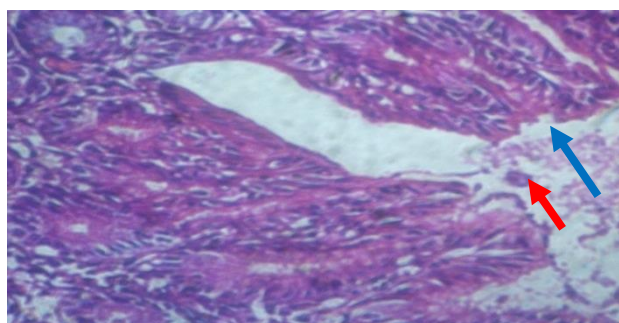
Fig. (7): Partial healing of the lining epithelium with mild flattening of villi of the intestine of hamsters after ginger plant and metronidazole treatment (H & E stain x 400).

Giardia lamblia infection is a common protozoan causing diarrheal diseases Worldwide (Adam, 2001). Giardia is unicellular parasite that resides in small intestinal lumen, attaches to the epithelium and overlying mucus and causes mild or mucosal inflammation.

Usually, most infections are controlled by an effective immune response, but some individuals develop chronic disease, as it is unclear what immune mechanisms are responsible for effective control of infections as reported by Faubert (2000) and Eckmann (2003).

In this work the marketed drug ginger was given to hamsters experimentally infected with *Giardia lamblia* cysts. The use of ginger drug revealed or significant reduction in the number of Giardia cysts 2 weeks post treatment (55,28%) metronidozole in its full dose revealed a very high significant reduction cysts count in stool (91,88%) when the dose of metronidozole is reduced to the half in the combination therapy regimens (metronidazole + ginger) the reduction in cysts count reached (95,31%).

The use of ginger plant extract similarly reduced cyst number but far less significant (39, 49%).The combination therapy (metronidozole + ginger plant extract) also revealed a significant reduction in cyst count in stool (86, 12%) but still less than (metronidozole + ginger drug). The same comment in this work applies to trophozoite count in small intestine where the percentage reduction (94.6%) reached after using combination regimen (ginger and honey) also

yielded higher percentage reduction in parasite burden then each compound individually (Al-masoudy, 2011).

The combination of lauric acid and metronidozole the treatment of *Giardia lamblia*, revealed high percentage of reduction in cyst count in stool and vegetative forms in the small intestine (Aly *et al.,* 2012). Addition of *Ailanthus altissimo* to metronidozole, the drug most currently used for treatment of giardiasis, revealed the highest percent reduction (Shalaby *et al*., 2008). More trials using different natural compound at different doses with different time intervals are highly indicative to give the highest efficacy to the available used drugs especially in endemic areas, (Mahmoud and Shalaby, 2006).

As regards the histopathological changes, *Giardia lamblia* trophozoites were detected in the intestinal lumen and in between the villi in group B. These findings were in accordance with (Randhawa *et al*, 1994) who revealed variable histopathologic changes ranging from partial to complete villous atrophy and inflammatory infiltrate attributed to Giardia infection. Similar histopathological findings were reported by Eckmanne and Gillin (2001).

In the current study, histopathological examination of the infected group treated with metronidozole revealed an improvement in the form of partial healing of the intestinal mucosa, mild shortening and thickening of villi with focal flattening of surface enterocytes and mild depletion of goblet cells. The ratio between villous heights to crypt length was mildly decreased and there was focal infiltration of inflammatory cells in the lamina propria and partial mucosal ulceration. Few *Giardia lamblia* trophozoites were detected in the lumen. In agreement with the present results regarding the histopathological changes following metronidozole treatment, Amer *et al*. (2007) and Fahmy *et al*. (2008) reported partial healing of intestinal villi after metronidozole treatment.

Histopathological examination of the infected group treated with ginger revealed an improvement in the form of partial healing of the intestinal mucosa, mild shortening and thickening of villi. Partial mucosal ulceration, mild depletion of goblet cells, mild decrease in the ratio between villous heights to
Crypt length and focal inflammatory cells in the lamina propria were detected.

A small number of *Giardia lamblia* trophozoite was detected in the lumen. Also, combined treatment with metronidozole and ginger was evaluated on the basis of histopathological changes. Examination of sections of small intestine revealed marked improvement of the histopathological changes in the form of complete healing of intestinal mucosa, preserved Bruch border, absence of mucosal ulceration, normal villous architecture, and mild depletion of goblet cells and patchy inflammatory cellular infiltration of lamina propria.

In the present work, the combined administration of metronidozole and ginger reported good evidences of cure when compared to the results obtained following administration of the two separately. This can be explained by a potential synergistic effect as each of the two drugs has a different mechanism of action. In the present study, histopathological examination of the infected control group revealed profound effect on the structure of the intestinal mucosa in comparison with the non-infected control group. This effect was in the form of villous shortening and atrophy, decrease in the ratio of villous height to crypt length, goblet cell depletion, mucosal ulceration and infiltration of lamina propria with inflammatory cells mainly lymphocytes and esinophils with diffuse loss of brush border micro villous surface area.

The ratio between villous heights to crypt length was more or less preserved and no *Giardia lamblia* trophozoites could be detected. It has been shown that ginger (and some of its constituents) is effective against cytokines synthesized and secreted at sites of inflammation (Grzanna *et al.,* 2005). Cytokines are small proteins secreted at sites of inflammation by lymphocytes, macrophages, fibroblasts and other cells, and act as chemical messengers between cells involved in immune and inflammatory responses. Ginger was found to modulate some biochemical pathways activated in chronic inflammation (Grazanna *et al.,* 2005).

CONCLUSION

It could be concluded that ginger offers an alternative therapy to be used in place of, or concurrently with conventional anti-protozoals used for treatment of giardiasis. The combination of ginger and metronidozole for the treatment of *Giardia lamblia* revealed high percentage of reduction in cyst count in stool and vegetative forms in the small intestine. Additionally, the combined treatment with metronidazole and ginger displayed marked improvement of the histopathological changes of the small intestine caused by *Giardia lamblia* infection. In addition the best cure rates were obtained following combined treatment of metronidazole together with ginger drug or ginger plant extract.

REFERENCES

Adam, R.D. (2001). Biology of *Giardia lamblia*. Clin.Microbiol.Rev., 14: 447-475.

Al-masoudi, H.K. (2011). Antigiardial activity of *Zingiber officinale* in combination with honey *in vivo*. Journal of Babylon University, 1-2 pp: 450-461.

Aly, M.M.; M.A. Shalaby; S.S. Attia; S.H. El Sayed; A. Helmy; O. Hammam; S.S. Mahmoud and S.I. Hassan (2012). Evaluation of the therapeutic effect of medium chain saturated fatty acid (lauric acid) against *giardia lamblia* in infected hamsters. Meeting at a glance of the 3rd annual conference of the EPU. Ain Shams Guest House, 10-11 October 2012.

Amer, N.M.; S.S. Mahmoud; A. Helmy and O. Hammam (2007). The role of probiotics in controlling *Giardia intestinalis* in experimental animals. The new Egyptian Journal of Medicine, 37: 13-23.

Baroody, B.J. (1946). Stool analysis by the direct smear method. J. Lab. Clin. Med., 31:815.

Berkman, D.S.; A.G. Lescano; R.H. Gilman; S.L. Lopez and M.M. Black (2002). Effects of stunting, diarrheal disease and parasitic infection during infancy on cognition in late childhood: A follow-up study. Lancet, 16:564-571.

Blagg, W.; N.S. Mansour and G.L. Khalaf (1955). A new concentration technique for the demonstration of protozoa and helminthic eggs in feces. Am. J. Trop. Med. Hyg., 4: 23.

Dávila-Gutierrez, C. E.; C. Vásquez; B. Trujillo-Hernandez and M. Huerta (2002). Nitazoxanide compared with quinfamide and mebendazole in the treatment of helminthic infections and intestinal protozoa in children. Am. J. Trop. Med. Hyg., 66: 251–254.

Eckmann, L. (2003). Mucosal defenses against *Giardia*. Parasite Immnnol., 25: 259-270.

Eckmann, L. and F.D. Gillin (2001). Microbes and microbial toxins: Paradigms for microbial-mucosal interactions 1. Pathophysiological aspects of enteric infections with the lumen-dwelling protozoan pathogen *G. lamblia*. Am. J. Physiol. Gastrointest. Liver physiol., 280(1):G1-G6.

Fahmy, Z.H.; A.H. Mohamed and M.M. Nosseir (2008). Ultrastructural and histopathological changes in *Giardia lamblia*-infected hamsters following administration of two natural compounds and/or metronidazole. Egypt. J. Med. Sci., 38: 53-61.

Faubert, G.M. (2000). Immune response to *Giardia duodenalis*. Clin. Microbiol. Rev., 13:35-54.

Grzanna, R.; L. Lindmark; C.G. Frondoza (2005). Ginger-an herbal Medicinal product with broad anti-inflammatory actions. J. Med. Food, 8: 125-132.

Hawrelak, J.A. (2003). Giardiasis: pathophysiology and management, Altern. Med. Rev., 8:129–142.

Mahmoud, S.S. and M.A. Shalaby (2006). The effect of some natural compounds against *Giardia lamblia* in infected hamsters. Egypt. J. Med. Sci., 27: 615-633.

Paget, G.E. and J.M. Barnes (1964). Evaluation of results: Qualitative application in different species. In: Evaluation of drug activities. Pharmacometrics, Eds. Laurence, D. R. and Backarach, A. L. Academic press, London and New York, 1: 160-167.

Petri, W.A. (2003). Therapy of intestinal protozoa. Trends Parasitol., 19:523–526.

Randhawa, V.S.; V.A. Sharme; M. Vena and V.J. Jagdish (1994). Human giardiasis. A morphometric study of duodenal biopsy specimens in relation to trophozoite count in duodenal aspirate. Arch. Pathol. Lab. Med., 118:891.

Rickard, L.S.; C. Siefker; C.R. Boyle and E.J. Gentz (1999). The prevalence of *Cryptosporidium* and *Giardia* spp. in faecal samples from free-ranging white deer (*Odocoileus virginianus*) in the Southeastern United States. J. Vet. Diagn. Invest., 11:65-72.

Robertson, L.J.; K. Hanevik; A.A. Escobedo; K. Mørch and N. Langeland (2010). Giardiasis – why do the symptoms sometimes never stop? Trends Parasitol., 26(2): 75-82.

Savioli, L. (2006). Giardia and Cryptosporidium join the "Neglected Diseases Initiative", Trends Parasitol., 22: 203–208.

Shalaby, M.A; N.G. Nessim and A.A. Saeed (2008). Giardicidal effect of anatural compound (*Ailanthus altissima*) Given alone or in combination with metronidazole with impact on nitric oxide levels and ultrastructural changes in experimentally infected animals.Egypt.J.Med.Sci., 39(1): 7-14.

Thompson, R.C.A.; R.M. Hopkins and W.L. Homan (2000). Nomenclature and genetic grouping of *Giardia* infecting mammals. Parasitol. Today, 16: 210-213.

تأثير نبات الزنجبيل على الهامستر المعداه بالجيارديا لامبليا

امال اسماعيل عبد العزيز عمار[1]، سهير سيد محمد محمود[1] و نبيل نصر الحفناوي[2]

[1]قسم الطفيليات بمعد تيودوربلهارس، الجيزة- مصر.

[2]قسم التنمية المتواصلة للبيئة وادارة مشروعاتها – معهد الدراسات والبحوث البيئية - جامعة مدينة السادات – منوفية – مصر

أهمية البحث الحد من الآثار السلبية التي يسببها هذا المرض ويوجد 2.5 مليون شخص يموتون سنويا بسبب الإسهال الناتج عن هذا المرض.

وقد أجريت هذة الدراسة على70 فأرا من فئران الجرذ الذهبي (الهامستر) حيث تراوحت اوزانهم من 100 الى110 جرام ثم قسمت الفئران الى 7 مجموعات و هم :مجموعة ضابطة ، مجموعة ضابطة معداة بالجيارديا و لم تأخذعلاج, اما فأرا المتبقيون تم عدواهم عن طريق الفم ب10000 حويصلة من الجيارديا لامبليا لكل فأر منهم.

وقد قسموا الى خمسة مجموعات و هم:1- مجموعة معداة مجموعة اخذت الميترونيدازول جرعة كاملة2- مجموعة اخذت دواء الزنجبيل جرعة كاملة, 3- مجموعة اخذت مستخلص الزبجبيل جرعة كاملة 4-مجموعة اخذت الدوائين معا بنصف الجرعة(الميترونيدازول و مستخلص الزبجبيل). تم اعطاء الأدوية للفئران لمدة 7 ايام متتالية و بعدها باسبوعين تم عمل تحليل براز للفئران وذلك لعد حويصلات الجيارديا لكل جرام براز ثم تمت الضحية بالفئران بعد ذالك.

وجــــد ان هناك انخفاض ذى دلالة احصائية واضحة فى عدد حويصلات التى تم عـدها فى كل جرام براز بين المجموعات المعالجة مقارنة بالمجموعات الضابطة حيث وجد ان أعلى نسبة انخفاض فى عدد حويصلات كانت فى المجموعة التى اعطيت دواء الميترونيدازول و دواء الزنجبيل (95,31%) ثم المجموعة التى أعطيت دواء الميترونيدازول بمفردة(91,88%) و اخيرا المجموعة التى أعطيت دواء الزنجبيل(55,28%). وأيضا تمت دراسة تأثير الأنظمة الدوائية المختلفة على الطور الخضرى (التروفوزويت) لطفيل الجيارديا فى الجزء العلوي من الأمعـــاء الدقيقة للفئــــران التى تمت التضحية بها حيث وجد ان اتحاد كلا مــــن الدوائين معا (دواء الزنجبيل + الميترونيدازول) أعطى نسبة شفاء واضحة وانخفاض فى عـــدد الطور الخضرى بنسبة (94,6%) أما على الجانب الأخر عند اعطاء الفلاجيل ودواء الزنجبيل بفردهما لوحظ أن معدلات الأنخفاض كانت (87,06%) و (46,6%) على التوالى.

وجد ان هناك انخفاض ذى دلالة احصائية واضحة فى عدد حويصلات التى تم عدها فى كل جرام براز بين المجموعات المعالجة مقارنة بالمجموعات الضابطة حيث وجد ان أعلى نسبة انخفاض فى عدد حويصلات كانت فى المجموعة التى اعطيت من دواء الميترونيدازول (91,88%)ثم المجموعة التى أعطيت مستخلص الزنجبيل+ الميترونيدازول (86,12%) و اخيرا المجموعة التى أعطيت مستخلص الزنجبيل(39,49%). وأيضا تمت دراسة تأثير الأنظمة الدوائية المختلفة على الطور الخضرى (التروفوزويت) لطفيل الجيارديا فى الجزء العلوي من الامعاء الدقيقة للفئران التى تمت التضحية بها حيث وجد ان اتحاد كلا من الدوائين معا (مستخلص الزنجبيل + الميترونيدازول)معا أعطى نسبة شفاء واضحة وانخفاض فى عدد الطور الخضرى بنسبة(88,5%) .و اخيرا المجموعة التى احذت مستخلص الزنجبيل (37,77%).

اوضحت الاختبارات الباثولوجية اكتمال الشفاء فى الغشاء المخاطى الجزء العلوى للأمعاء الدقيقة بعد اقران الدوائين معا ،بينما لوحظ وجود شفاء جزئى للغشاء المخاطى الجزء العلوى للأمعاء الدقيقة بعد اعطاء دواء الميترونيدازول او دواء الزنجبيل او مستخلص الزنجبيل بمفردهما.

وخلصت الدراسة إلي :

تعتبر الأعشاب الطبية مصدر غني ورئيسى في استخلاص الكيمياء النباتية ذات التاثير التوافقي   لإحتوائها علي مواد كيميائية متعددة وقد زاد الاحتياج للعلاج بالأعشاب الطبيعية لتجنب الآثار الجانبية الغير مستحبة في العلاج الكيميائي، ولذالك نحن في حاجة الي تقيم واستخلاص مواد فعالة في علاج الجيارداما مثل الزنجبيل وقد وجد في هذا البحث عند استخدام نصف الجرعة من دواء الميترونيدازول مع نصف الجرعة من دواء الزنجبيل أعطيت نتائج جيدة من الشفاء عند المقارنة بإعطاء كل دواء بمفرده.

EFFECT OF OZONE FUMIGATION IN AFLATOXINS CONTENT OF STORED WHEAT GRAINS

A.A. Abdalla; S.I. Shahin; M.F. Omarah and R.H. Mohamed

[1]*Environmental Studies and Research Institute, University of Sadat City, Monofia, Egypt.*

[2]*Regional Center for Food and Feed, Agricultural Research Center, Giza, Egypt.*

ABSTRACT

One of the most important factors determined wheat grain quality is aflatoxins contamination during the storage period. Thiess the purpose of this study was to evaluate the effect of ozone gas exposure on the aflatoxins reduction of wheat grains during storage. So, one experiment was conducted with four wheat varieties Sids 12, Misr 1, Sakha 93 as certified local varieties from Agricultural Research Center and Russian imported wheat and two exposure doses (o and 400mg)/ h of ozone gas by using ozone generator model XT-800, Ozone gas purifier generator with three subsamples from each.

The obtained data showed that aflatoxins B1, B2, G1, and G2 were detected in untreated wheat grain samples with the ratio of 17, 2, 76 and 5%, respectively. While, the ratio were 14, 2, 79 and 5% in the ozonated treatment by 400 mg/ h. AFG1was the main aflatoxin (76–79%) from the total aflatoxins content, meanwhile, other AFs gave the lowest values (21-24). Also, total AFs was increased after 90 days compared with 30 days from the storage. After 30 days from storage, Russian variety had the lowest AFs content and on the contrary, the variety of Misr 1 gave the lowest quantity of AFs after 90 days from storage. In general, the aflatoxin reduction were decreased by increasing the stored period.

Keywords: Aflatoxins; ozone and wheat grains.

INTRODUCTION

Wheat (T*riticum a estivum*) is one of most important agricultural crops in Egypt. Egyptian wheat production reaches about 8.8 million tons and the total consumption about 18.6 million tons, so about 9.8 million tons were imported in 2012 (Economic Affairs Sector, 2012).

On the other hand, the use of ozone in agricultural sector is more recent. Santos *et al.* (2007) reported that the ozone gas (O_3) can be used as a new alternative modified atmosphere to control and to eliminate pests in grains. However, the efficacy of aqueous ozone in killing food borne pathogenic bacteria (Restaino *et al.*, 1995; Zhao and Cranston, 1995) has been demonstrated. Meier (2011) reported that ozonation treatment has significantly decreased the biological toxicity of certain mycotoxins in contaminated feeds and food grains ensuring safety throughout the food supply chain. Five ppm ozone inhibited surface growth, sporulation, and mycotoxin production by cultures of *Aspergillus flavus* Link: Fr, (Mason *et al.*, 1997). Meanwhile, the growth of *Aspergillus flavaus* was completely inhibited and consequently the total aflatoxin content was decreased when wheat grains was directly treated with ozone gas for 5 and 6 hours, (Abd El Fadel *et al.,* 2011).

So, the aim of this experiment was to study the effect of ozone gas exposure on infected wheat grains with *Aspergillus flavus* on aflatoxin content in the storage period during 90 days.

MATERIAL AND METHODS

One laboratory experiment was performed during 2012 in order to determine the effect of ozone gas on aflatoxin reduction of wheat grains during the storage period. This experiment included eight treatments representing the combinations of two ozone gas exposures (untreated and 400 mg/h) for one hour and four infected wheat grains varieties by *Aspergillus flavus* with three subsamples from each. It was carried in the Regional Center for Food and Feed (RCFF), Agricultural Research Center (ARC), Giza, Egypt.

-Wheat grain samples (*Triticum aestivum*) were obtained as follows as Sakha 93, Sids12, and Misr1 as local variety, Field Crops Research Institute (FCRI) and Russian variety (mixed varieties imported from Russian).

-The ozone gas was produced from air using ozone generator model XT- 800, Ozone gas purilifier generator.

-Toxyigenic strain of *Aspergillus flavus* (NRRL 3518) was the producer of aflatoxin from Regional Center for Food and Feed (RCFF), (ARC), Egypt, according to AACC (2002).

Inoculation of spore suspension and production of aflatoxin in wheat grains:

Sterile wheat samples grains with moisture content 14 % were artificially infected with spores count of *Aspergillus flavus* strain (NRRL 3518) which used in a test for the ability of producing aflatoxin in wheat grains. Number of spores/ml was counted in the collected spore suspension using a Spencer haemocytometer to about 106spores/ml. Spore suspension was inoculated to test grains and give a final density of approximately 3000:3500 spore/g of wheat grains as described by Eisa *et al.* (1996).

Determination of t otal aflatoxin and standard aflatoxin:

Standard aflatoxin were obtained from Sigma Chemical Co.,USA. Diluting solution, Methanol, Trifluoroacetic acid, Lactic acid, Sodium chloride, Boric acid, Potassium Iodide, Sodium thiosulphate and Chloromphnicl were purchased from Sigma Chemical Co., USA. Solid AFB1, AFB2, AFG1 and AFG2 (Sigma, St. Louis, Mo.) were analysis by high performance liquid chromatography (HPLC) in RCFF, (AACC, 2000).

RESULTS AND DISCUSSION

According to this study, the aflatoxins B1, B2, G1, and G2 were detected in untreated wheat grain samples with the ratio of 17, 2, 76 and 5%, respectively. While, the ratio were 14, 2, 79 and 5% in the ozonated treatment by 400 mg/ h for above mentioned AFs, respectively (Fig. 1). The main aflatoxin appeared was G1, AFG1 recorded the highest ratio with values ranging from 76 – 79% for the total aflatoxins. Meanwhile, all other AFB1, AFB2 and AFG2 recorded the values varied from 21- 24% for the total aflatoxins and the lowest was B2 (2%).

Results in Table (1), indicated a low percentage in aflatoxines content FB2, AFG1 and AFG2 in wheat grain samples. Data also showed that the ozonation treatment (400 mg/ h) has only significant effect on the content of AFG1 and AFG2 after 30 days from storage. But after 90 days from storage, the use of ozone gas by the dose of 400 mg/ h significant effect on the content of AFB2 and AFG1. Similar results were obtained by El-Desouky *et al.* (2012) who recorded that the amount of AFB1 was decreased with over a longer storage period. Meanwhile, ozone gas is known to possess sporicidal activity (Khadre, *et al.*, 2001) and thereby at higher concentrations could be used to reduce the initial load of contaminants on product (*i.e.* treatment of raw materials) and to disinfect storage and processing areas (Najafi *et al.*, 2009 and Korzun and Sauer, 2008).
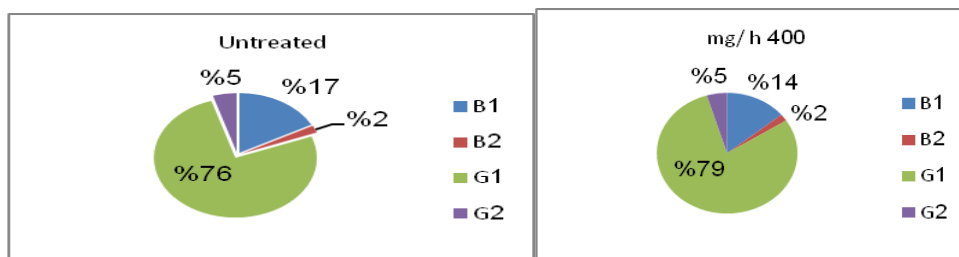
Fig. (1): The percentage of wheat grain aflatoxins content.

With respect to the varieties, Misr 1gave the lowest values (17.2, 3.6, 102.6, 8.3 and 131.7 ppb) for AFs (B1, B2, G1, G2 and total), respectively after 30 days from storage. While, the variety of Russian recorded the lowest AFs content after 90 days by the average of 20.3, 2.0, 119.7, 9.6 and 151.6 for AFB1, AFB2, AFG1, AFG2 and total AFs, respectively. Although the aflatoxin reduction were decreased by increasing the stored period, Fig. (2). The period of storage resulted in aflatoxin reduction from 56 to 49.6% and the reduction of AFB1 in the storage was reported at variable ranges from 64.1 to 33.6, depending on stored period. Graham (1997) reported that ozone gas has advantages over traditional fumigants: Ozone decomposes rapidly (half-life 20–50 min) to molecular oxygen; it leaves no residue; it can be generated on site and it requires no storage and subsequent disposal of chemical containers.

Thus, fumigation with ozone gas can be a good method for achieving sanitation and decreasing initial microbial load in food storage facilities and aid in curbing spoilage on a long term. However, it is clear from this work that ozone gas exposure time higher than 5 min would be required to achieve complete spore kills. These results were in agreement with other studies (Zorlugenc *et al.*, 2008; Antony and Singleton, 2009; Gabler *et al.*, 2010, and Alencar *et al.*, 2012).

Table (1): Effect of ozone exposure gas flow rate mg/h and wheat varieties on aflatoxins content of wheat grains.

Exposure rate flow mg/h	Aflatoxins content ppb ± SD				
	After 30 days from treatment				
	B1	B2	G1	G2	Total
Untreated	41.8 ± 16.1	4.8 ± 0.7	184.9 ± 40.8	11.6 ± 2.3	243.0 ± 56.2
400.0	15.0 ± 22.5	2.0 ± 2.1	85.0 ± 58.1	5.0 ± 2.2	107.1 ± 84.1
	Wheat varieties				
Sids 12	60.3 ± 6.3	5.6 ± 0.2	210.1 ± 29.3	11.1 ± 3.0	287.1 ± 38.9
Misr 1	17.2 ± 13.2	3.6 ± 1.4	102.6 ± 22.9	8.3 ± 2.1	131.7 ± 39.6
Sakha 93	23.1 ± 22.2	2.4 ±2.1	112.2 ± 82.7	5.8 ± 2.7	144.1 ± 109.6
Russian	13.2 ± 11.8	2.0 ± 2.0	114.2 ± 64.8	7.9 ± 5.3	137.3 ± 83.9
	After 90 days from treatments				
Untreated	60.8 ± 27.6	4.4 ± 0.7	273.8 ± 62.2	11.2 ± 3.4	350.2 ± 84.5
400.0	40.4 ± 35.1	1.9 ± 1.2	129.6 ± 74.6	4.6 ± 3.4	176.4 ± 108.7
	Wheat varieties				
Sids 12	100.6 ± 3.3	4.4 ± o.6	295.5 ± 38.6	4.6 ± 1.8	405.1 ± 44.3
Misr 1	29.3 ± 18.2	3.1± 0.9	186.0 ± 97.8	12.1 ± 2.0	230.4 ± 118.9
Sakha 93	52.1 ± 10.8	3.2 ± 2.0	205.6 ± 101.1	5.2 ± 4.4	266.1 ± 118.3
Russian	20.3 ± 8.3	2.0 ± 1.5	119.7 ± 51.0	9.6 ± 4.9	151.6 ± 66.0
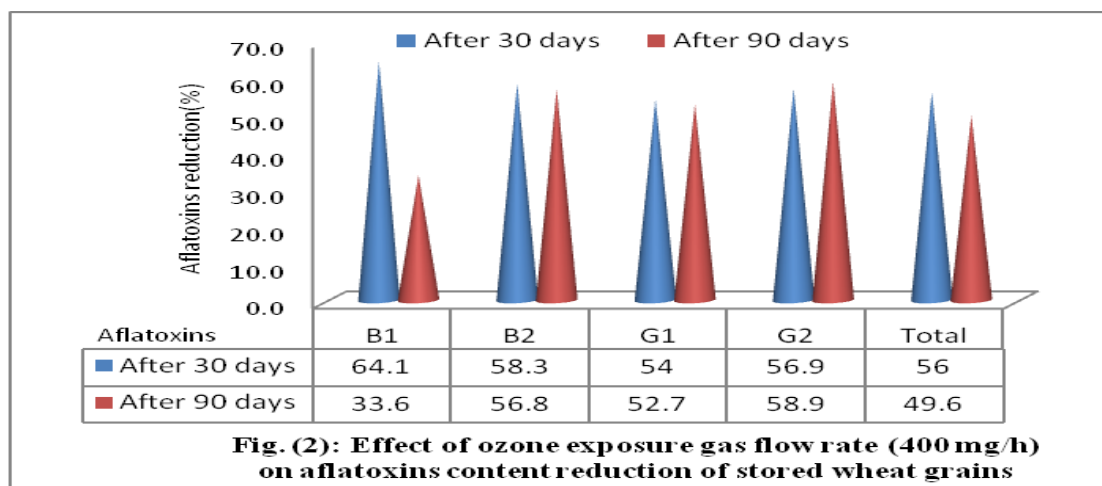
Fig. (2): Effect of ozone exposure gas flow rate (400 mg/h) on aflatoxins content reduction of stored wheat grains

REFERENCES

AACC (2000). Aproved Method of the American Association of Cereal Chemists Tenth Edition, Merch.

Abd El Fadel, M.G.; S.S. Gad; A.A. El-Shibiny; M.F. Emara and T.T. El-Sisy (2011). Effect of handling, milling process and storage on the quality of wheat and flour in Egypt. Ph.D. Food Sci. Faculty of Environmental Agric. Sci. (Arish). Suez Canal Univ., Egypt.

Alencar, E.R.; L.R. Faroni; N.F. Soares; W.A. Silva and M.C. Carvalho (2012). Efficacy of ozone as a fungicidal and detoxifying agent of aflato- xins in peanuts, J. Sci. Food Agric., 2012, 92(4), 899-905.

Antony, B.S. and I. Singleton (2009). Effect of ozone on spore germination, spore production and biomass production in two *Aspergillus* species. Antonie Van Leeuwenhoek. 2009 Nov; 96(4):413-22.

Economic Affairs Sector (2013). Winter crops. Bulletin of the Agri. Statistic, Part (1) 2011 / 2012. Ministry of Agriculture and Land Reclamation. Egypt.

Eisa, N.A.; S.K. Abdel-Reheem; A.E. Badr and M.F. Abol-Ela (1996). Pathological studies on deterioration of yellow corn during storage and its control. I- Associated fungi, percentage of infection and its control. Al-Azhar J. Agric. Res. 24: 65-81.

El-Desouky, T.A.; A.M. Sharoba; A.I. El-Desouky; H.A. El-Mansy and K. Naguib1 (2012). Evaluation of ozone gas as an anti-aflatoxin B1 in wheat grains during storage. J. of Agro alimentary processes and technologies.18 (1): 13-19.

Gabler, F.M.; J.L. Smilanick; M.F. Mansour and H. Karaca (2010). Influence of fumigation with high concentrations of ozone gas on post harvest gray mold and fungicide residues on table grapes. Postharvest Biol. Technol., 55: 85–90.

Khadre, M.A.; A.E. Yousef and J.G. Kim (2001). Microbiological aspects of ozone applications infood: a review, Journal of Food Science, 66: 1242-1252.

Korzun, W.; J. Hall and R. Sauer (2008).The effect of ozone on common environmental fungi. Clin. Lab. Sci. 2008, 21:107–111.

Maier, D.E.; C.A. Campabadal; C.P. Woloshuk and L. Mason (2011). Continuous ozonation treatment systems as other alternative more efficient grain protection technologies. 10th International Working Conference on Stored Product Protection, Pp. 346- 351. Julius-Kühn-Archiv, 425.

Mason, L.J.; C.P. Woloshuk and D.E. Maier (1997). Efficacy of ozone to control insects, molds and mycotoxins. In: Donahaye, Navarro, Varnava (Eds): Proceedings of the International Conference on Controlled Atmos- phere and Fumigation in Stored Products, 665-670. Cyprus Printed Ltd., Nicosia.

Najafi, M. and H. Khodaparast (2009). Efficacy of ozone to reduce microbial populations in date fruits. Food control, 20: 27–30.

Restaino, L.; E.W. Frampton; J.B. Hemphill and R. Palnikar (1995). Efficacy of ozonated water against various food related microorganisms. Applied and Environmental Microbiology, 61: 3471-3475.

Santos, J. E.; M.A. Martins; L.R. Faroni; M. P. Andrade and M.C. Carvalho (2007). Ozonization process: saturation time, decomposition kinetics and quality of maize grains (Zea mays L.). IOA Conference and Exhibition Valencia, Spain.

Zorlugenc, B.; F. Kırog; L. Zorlugenç; S. Ztekin and B. Evliya (2008). The influence of gaseous ozone and ozonated water on microbial flora and degradation of aflatoxin B1 in dried figs. Food and ChemicalToxicology, 46: 3593–3597.

Zhao, J. and P.M., Cranston (1995). Microbial decontamination of black pepper by ozone and the effect of the treatment on volatile oil constituents of the spice. Journal of the Science of Food and Agriculture, 68: 11-18.

تأثير التبخير بغاز الأوزون في محتوى الأفلاتوكسين بحبوب القمح المخزنة.

عادل عبد الهادى عبد الله*، صبرى ابراهيم منصور شاهين*، محمد فهمى زكى عمارة** و رباب هاشم محمد**

*معهد الدراسات والبحوث البيئية ـ جامعة مدينة السادات ـ المنوفية ـ مصر.

**المركز الإقليمي للأغذية والاعلاف, مركز البحوث الزراعية ـ الجيزة ـ مصر.

يعتبر التلوث بالأفلاتوكسينات واحد من أهم العوامل المحددة لجودة حبوب القمح خلال فترة التخزين. الغرض من هذه الدراسة تقييم تأثير تعرض حبوب القمح لغاز الأوزون للحد من الأفلاتوكسينات أثناء التخزين. لذلك ، تم إجراء تجربة واحدة تشتمل على أربعة أصناف من القمح وهى سدس 12، مصر 1 ، سخا 93 من الأصناف المحلية المعتمدة من مركز البحوث الزراعية وصنف قمح روسي مستورد مع معاملتى التعرض لغاز الأوزون (صفر, 400 مجم/ ساعة) باستخدام جهاز اطلاق غاز الأوزون موديل XT - 800، بواقع ثلاثة لعينات لكل معاملة .

أظهرت البيانات التي تم الحصول عليها الكشف عن تواجد الأفلاتوكسينات ب1، ب2، ج 1، ج2 في عينات حبوب القمح غير المعالجة بنسبة 17 ، 2، 76 و 5 ٪ على التوالي. في حين ، كانت النسبة 14 ، 2، 79 ، و 5٪ في المعامل بالأوزون بمعدل 400 مجم / ساعة. يعتبر أفلاتوكسين ج2 هو الأفلاتوكسين الرئيسي بنسبة (76-79 ٪) من إجمالي محتوى الأفلاتوكسين ، وفي الوقت نفسه ، أعطت باقى الأفلاتوكسينات الأخرى أقل القيم (21-24) . أيضا ، تم الكشف عن زيادة محتوى الأفلاتوكسينات بعد 90 يوما من التخزين عنه بعد 30 يوما من التخزين سجل الصنف الروسى أدنى قيمة و على العكس من ذلك سجل الصنف مصر 1 أقل قيمة من محتوى الأفلاتوكسينات بعد 90 يوما من التخزين. بشكل عام ، انخفضت نسبة الحد من الأفلاتوكسينات بزيادة فترة التخزين .

PERFORMANCE EVALUATION OF DISSOLVED AIR FLOTATION UNITS IN SLOUGHTER HOUSE SEWAGE TREATMENT UNIT

M.A. El-Howeity; E.E. Mosa and R.M. Elwakeel

Environmental Studies& Research Institute (ESRI), Sadat City University, Egypt.

ABSTRACT

Poultry processing generates relatively large quantities of wastewater containing blood, flesh, soluble protein and waste material which is high in biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and fat, oil and grease (FOG). The DAF efficiency depends on the removal percentage and this percentage can give an indicator for some mechanical equipments. COD and BOD Chemical analysis of wastewater samples collected from influent and effluent wastewater El-Watania slaughterhouse revealed that removing of BOD.The efficiency fluctuated between the high and low positive values. The highest positive efficient value percent was recorded in wastewater samples collected in March (18.46 mg/l).COD content in El-Wtania wastewater in the influent of DAF unit ranged between3197 mg/l in June to 4674 in November with average of 3665 mg/l at the five samples that collected for selected months.

Keywords: Ar flotation; sloughter house and sewage

INTRODUCTION

The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed without danger to human health or unacceptable damage to the natural environment. Poultry processing generates relatively large quantities of wastewater containing blood, flesh, soluble protein and waste material which is high in biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and fat, oil and grease (FOG) (Environment Agency, 2009).The principal advantage of DAF over gravity settling is its ability to remove very small or light particles (including grease) more completely and in a shorter time (Metcalf and Eddy, 1991). In DAF, the entire influent, some fraction of the influent, or some fraction of the recycled DAF effluent is saturated with air at a pressure of 40 to 50 pounds per square inch (psi), and then introduced into the flotation tank (Martin and Martin, 1991). The method of operation might cause operating costs to differ slightly, but process performance is essentially equal among the three modes of operation (USEPA, 1974, 1975). From 15 to 120 percent of the influent flow may be recycled in larger units (Metcalf and Eddy, 1991). A skimmer mechanism continually removes the floating solids, and a bottom sludge collector removes any solids that settle. Although unit shape is not important, a more even distribution of air bubbles allows for a shallower flotation tank. Optimum depth settings are between 4 and 9 feet (1.2 to 2.7 meters) (Martin and Martin, 1991).

MATERIALS AND METHODS

The samples were taken of Al-Watania wastewater treatment during five months (March, April, May, June and November 2014) and for three places influent DAF unit, effluent DAF unit and plant final effluent and all samples were tested by Al-Watania laboratories.The Temperature, pH values were analyzed in the field. Biochemical oxygen demand,Chemical oxygen demand and Total suspended solidswere analyzedaccording to Standard Methods for Water and Wastewater 21 edd.

RESULTS AND DISCUSSION

1-Biochemical oxygen demand (BOD) in influent wastewater DAF unit:

Biochemical oxygen demand (BOD) of wastewateris an expression for the amount of oxygen consumed by the decomposition of organic matter in a biochemical process. BOD content in wastewater in the influent of DAF unit ranged between 1579 mg/l in June to 2555 in Novemberwith average of 2037 mg/l at the five samples that collected for selected months (Fig. 1).
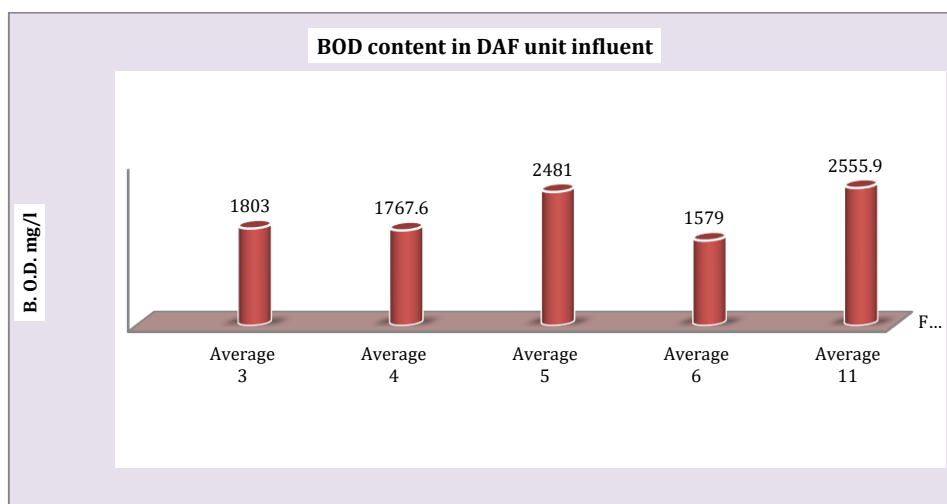
Fig. (1): BOD content in industrial wastewater before influent DAF unit.

2-Biochemical oxygen demand (BOD) in effluent wastewater DAF unit:

BOD content in the effluent wastewater of the DAF unit ranged between1470 mg/l in March to 2685 in Maywith average of 1940 mg/l at the five samples that collected for different months Fig. (2).
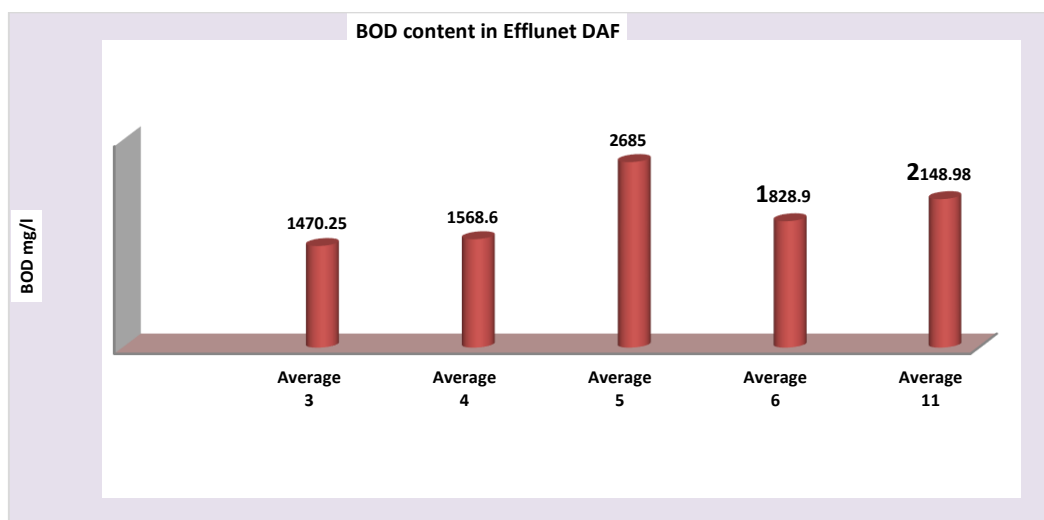
Fig. (2): BOD content in industrial wastewatereffluent DAF unit.

3-BOD Removal percent after DAF units:

Chemical analysis of wastewater samples collected from influent and effluent wastewater El-Wataniya slaughterhouse revealed that removing of BOD calculated on basis of the difference between the values before and after the DAF unit / divided by (100). The efficiency fluctuated between the high and low positive values but in some cases decreased to minimum value to record negative values which mean that the DAF unit affect negatively on wastewater treatment (Fig.1.3). The highest positive efficient value percent was recorded in wastewater samples collected in March (18.46 mg/l). The lowest negative efficient value percent was recorded in wastewater samples collected in June (15.90 mg/l).

4- Chemical oxygen demand (COD) in influent wastewater DAF unit:

Chemical oxygen demand (COD) of wastewater is an expression for the amount of oxygen consumed by the decomposition of organic matter in a chemical process through some reagent like dichromate and sulfuric acid. COD content in El-Wtaniya wastewater in the influent of DAF unit ranged between3197 mg/l in June to 4674 in November with average of 3665 mg/l at the five samples that collected for selected months (Fig. 3).

COD content in DAF influent (mg/l)

3305   3214.6   3933   3197   4674

C.O.D. mg/l

Average 3   Average 4   Average 5   Average 6   Average 11
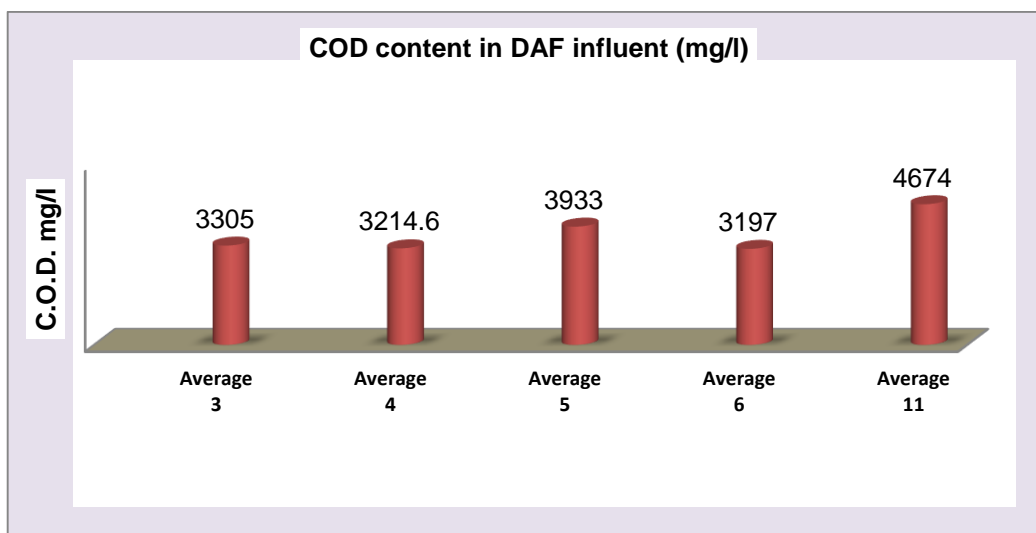
Fig. (3): COD content in industrial wastewaterinfluent DAF unit

5-Chemical oxygen demand (COD) in effluent wastewater DAF unit:

COD content in El-Wtaniya wastewater in the effluent of DAF unit ranged between 2635 mg/l in March to 3925 in November with average of 3414 mg/l at the five samples that collected for selected months (Fig. 4)

COD content in DAF unit effleunt (mg/l)

2635   2852.4   3887   3775   3925

C.O.D. mg/l

Average 3   Average 4   Average 5   Average 6   Average 11
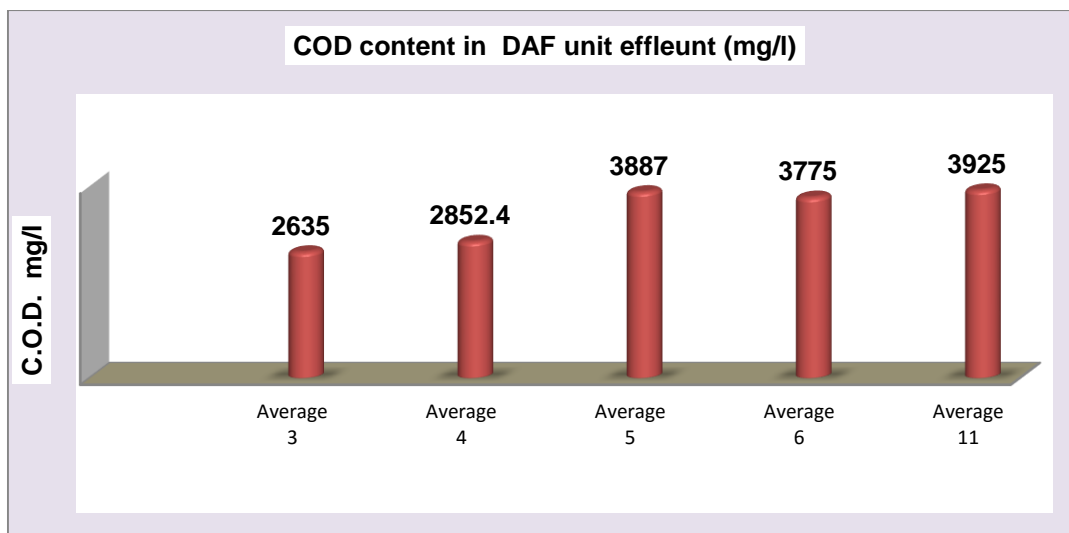
Fig. (4): Chemical oxygen demand (COD) in effluent wastewater DAF unit.

6-COD Removal percent after DAF units in wastewater treatment plant:

Chemical analysis of wastewater samples collected from influent and effluent wastewater El-Wataniya slaughterhouse revealed that; The highest positive efficient value percent was recorded in wastewater samples collected in March (20.27%). The lowest negative efficient value percent was recorded in wastewater samples collected in June (-18.70%).

7- (TSS) influent wastewater DAF unit:

TSS content in the influent wastewater of the DAF unit ranged between 1197.2 mg/l in April to 1885 in Novemberwith average of 1499 mg/l at the five samples that collected for selected months (Fig. 5).

Content of TSS in DAF unit inffleunt (mg/l)

1407.5   1197.2   1714   1292   1885

TSS mg/l

Average 3   Average 4   Average 5   Average 6   Average 11
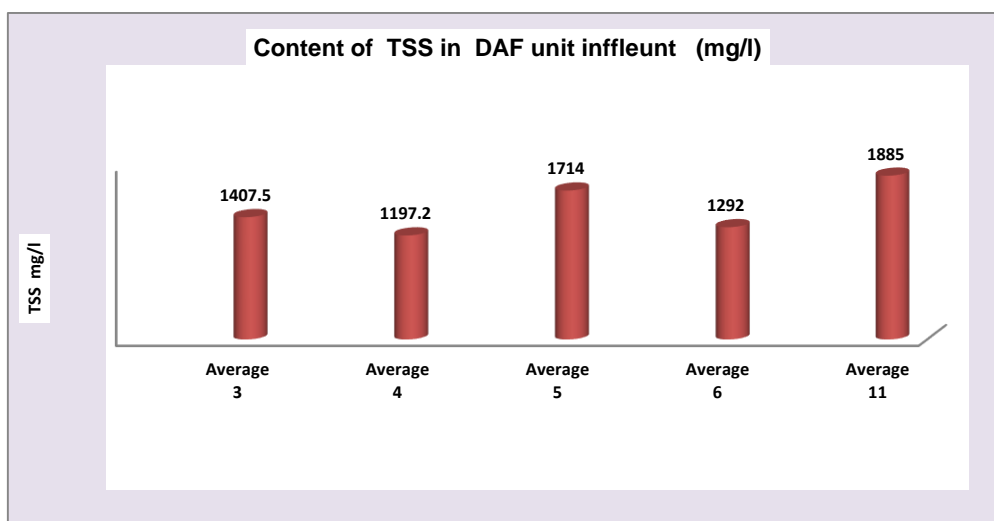
Fig. (5): TSS content in industrial wastewater in DAF unit influent.

8-(TSS) influent wastewater DAF unit:

TSS content in the effluent wastewater of the DAF unit ranged between 931.8 mg/l in April to 1564 in Novemberwith average of 1499 mg/l at the five samples that collected for selected months (Fig. 6).


Content of TSS in DAF unit effleunt (mg/l)

| | | 1460 | 1564 | |
| 1195 | 931.8 | | | 1483 |

TSS mg/l

Average 3 · Average 4 · Average 5 · Average 6 · Average 11
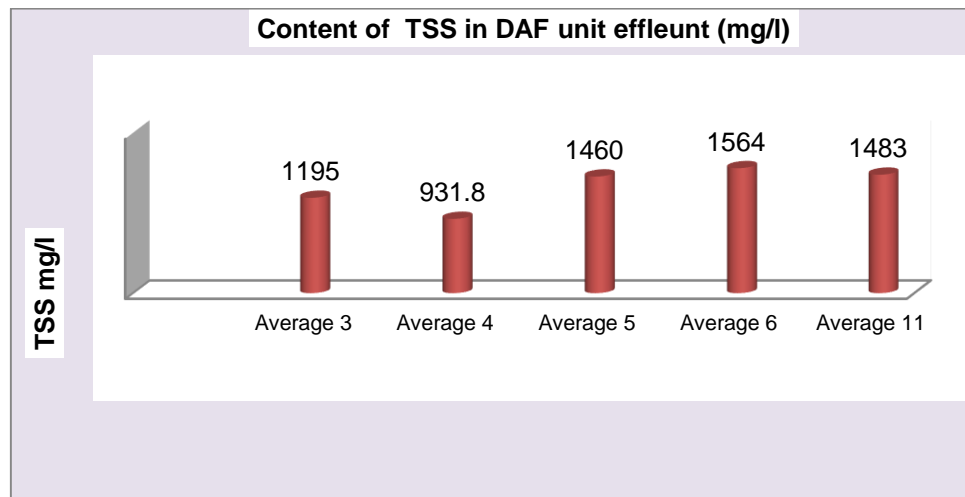
Fig. (6): TSS content in industrial wastewater in DAF unit effluent.

9-TSS Removal % in DAF uniteffluent:

Chemical analysis of wastewater samples collected from influent and effluent wastewater El-Wataniya slaughterhouse revealed that;The highest value for TSS removal was recorded in November (26.63 %). Whereas the lowest value was recorded in May (14.80 %).When the removing % recorded minus value at June (-21.10 %).the mean average of TSS removal in the five months was recorded 12.8 %. The efficiency of DAF unit on TSS basis can be calculated with removal % values.

CONCLUSION

From the case study illustrated the importance of mechanical equipment in the acceleration of treatment works. The DAF efficiency depends on the removal percentage and this percentage can give an indicator for some mechanical equipment in wastewater treatment systems.

Recommendations
1- Need to focus on running the blood separation prior to indirect the wastewater into the primary treatment to reduce the organically load value on the following treatment stages.
2- The DAF unit indispensable in the process of separating fat, grease and oil in wastewater resulting from the poultry processing treatment plants.
3- The DAF efficiency depends on the removal percentage and this percentage can give an indicator for some mechanical equipment in wastewater treatment systems.
4- Using new sweeping water fully to reduce water consumption rates.
5- Need to pay attention to the necessary maintenance of the DAF units in wastewater poultry treatment.

REFERENCES

EPA (Environment protection agency). (2009). Treating and processing poultry (EPR6.11) march,2009.

Martin, E.J. and E.T. Martin (1991). Technologies for Small Water and Wastewater Systems. VanNostrand Reinhold, New York, New York. (DCN 00259).

Metcalf and Eddy, Inc. (1991). Wastewater Engineering—Treatment, Disposal, and Reuse. 3rded.McGraw-Hill Publishing Company, New York,(DCN 00213).

USEPA (U.S. Environmental Protection Agency) (1974). February. Development Document for Effluent Limitation Guidelines and New Source Performance Standards for the Red Meat Processing Segment of the Meat Product.

USEPA (U.S. Environmental Protection Agency) (1975). April. Development Document for Effluent Limitation Guidelines and New Source Performance Standards for the Poultry Segment of the Meat Product and Rendering Processing Point Source Category.

EFFECT OF TYPE, DISTANCE BETWEEN EMITTERS AND NITROGEN FERTILIZER ON YIELD AND ITS COMPONENT OF BREAD WHEAT IN NEWLY RECLAIMED LANDS

A.A. Abdalla and M.R.M. Khalaf

Environmental Studies and Research Institute, University of Sadat City, Monofiya, Egypt.

ABSTRACT

Two experiments were carried out during the two successive seasons of 2009/2010 and 2010/2011 at the farm of Environmental Studies and Research Institute in Sadat City, under drip irrigation method. The split-split in randomize complete block design was used with three replications to study the effect of type of emitters (Long path GR) and Pressure compensating (Turbo emitters) which were allocated in the main plot, the distance between the emitters (50 and 25 cm, D1 and D2) which were randomly distributed in the sub plots and the nitrogen levels (60, 80 and 100 Kg/feddan) which were occupied the sub-sub plots on the bread wheat cultivar Sakha 94. The results indicated that using long path (GR) emitters significantly increased crop growth rate at the two periods of 45:75 and 75:105 days after sowing. Also it significantly increased plant height, number spike/m^2 number of grains/spike, 1000-kernels weight, grain yield/feddan, harvest index. The distance between the emitters (25 cm) produced the highest values of all studied characters. The nitrogen level of 100 Kg N/feddan, also, significantly increased all studied traits. The interaction effect among the experimental treatments significantly affected the studied traits. Water use efficiency was increased with long path emitters and 25 cm distance between the emitters. The interaction effects of the experimental treatments were discussed.

Keyword: fertilizer; bread wheat and reclaimed lands

INTRODUCTION

Maximizing irrigation water use efficiency is a common concept used by irrigation project managers. In recent years, however, growing competition for scarce water resources has led to applying modified techniques for maximizing water use efficiency and improving crop yields, particularly in arid and semi-arid regions as in Egypt. Subsurface drip irrigation system has successfully been used to irrigate wide range of crop patterns, but on the other hand, no studies had been conducted under intensive field crops (Grabow *et al.,* 2004). Overall efficiency of the trickle system, however, was on the average about 28 % and 45 % more than those of the sprinkler and furrow systems, respectively (Dawood and Hamad, 1985). Wheat is one of the key crops in Egypt with a cultivation area of about 1.3 million hectares (Ministry of Agriculture and Land Reclamation, 2014). With increasing human demand for food more efforts had been done to expand wheat cultivation area in new reclaimed and irrigated sandy soils based on new technologies as using bio-fertilizers and developed new varieties (Girgis, 2006). Few technically, economically and environmentally feasible studies had been focused on the application possibility of the alternative drip irrigation systems (surface and subsurface drip); an evaluation and performance consideration exists under intensive field crop conditions, which had been carried out by Suarez-Rey *et al.* (2000). Egypt is one of the countries that facing great challenges due to its limited water resources, and food shortage, especially, in wheat production which is considered as a strategic crop while the population increases greatly. The first challenge is represented mainly by the fixed share of the Nile water and its aridity as a general characteristic. Formulation of Egypt's water resources policy for the 21st century requires a major shift from the classical paradigm used in water resource planning and management to a

new innovative. Therefore, increasing demand for water has created a whole new set of problems confronting irrigated agriculture. For many years, the emphasis of sustainable irrigated agriculture has been improving the effectiveness of water management, water conservation and salinity. The second challenge is wheat production which is the most important staple crop produced in Egypt. Abd El-Rahman (1996) emphasized that crops grown under subsurface trickle irrigation system might obtain yield more than those grown under surface one. The aim of this work is to study the possibility of enhancing water use efficiency of bread wheat cultivar Sakha 94 under two kinds of emitters (GR and Turbo), two distances between the emitters (25cm and 50cm) and three fertilization rates (60, 80 and 100 kg N/faddan) in sandy soils under at the farm of the Environmental studies and research Institute, Sadat City, Minufiya University, Egypt.

Materials and Methods

The present investigation was carried out during the two successive growing seasons of 2009/2010 and 2010/2011 at the farm of Minufiya University, Sadat City, under drip irrigation system.

A field experiment was carried out during the two successive seasons of 2009/2010 and 2010/2011. The experimental layout was split-split plot in randomized complete blocks design with three replications by randomly allocating two types of emitters (Long path (GR), and Pressure compensating (Turbo) E2) in main plots, two distance between emitters D1 (25 cm) and D2 (50 cm) in the sub plots and three nitrogen levels (N1= 60, N2= 80 and N3= 100 Kg/faddan) in the sub-sub plots. The area of the experimental plot was 3 X 3.5 m (10.5 m^2 = 1/400 Fadden) .The bread wheat cultivar Sakha 94 was used. The experiment was sown at 15th November 2009 and 16th November 2010, the harvest was done at 8 May 2010 and 10 May 2011, respectively.

Nitrogen fertilizer, in the rate of 100 Kg N/faddan, was added as a form of ammonium nitrate (33.5%N). And applied into four doses, 20% of the total amount was added at sowing, 40% was added at the first irrigation (25 days after sowing), 30% was added at the second irrigation (55days after sowing) and the rest of 10% was added 75 days after sowing.

Other agronomic practices were applied as the recommendations of the region.

Surface soil samples (0-30 cm depth) from the experimental sites were taken before planting in the two seasons and prepared for physical and chemical analysis according to Piper (1950). The physical and chemical properties of the experimental soils are in Tables 1 and 2.

Plant samples of one m^2 were randomly taken from each experimental plot after 45, 75 and 105 days after sowing to determine Crop Growth Rate (CGR) to the two periods of 45:75 (CGR1) and 75:105 (CGR2) days after sowing.

The data of Crop Growth Rata (CGR) in the two periods 45:75 (CGR1) and 75:105 (CGR2) days after sowing. Plant height (PH cm), number of spike/m^2 (NS), number of kernels/spike (KS), 1000-kernels weight (KW g), harvest index (HI %), Grain yield/faddan (GY) and Water Use Efficiency (WUE) were collected in the two seasons.

Table (1): Mechanical analysis, of the experimental sites, in the two seasons.

Season	Organic materials %	CaCo$_3$ %	Particle fraction			Soil texture
			Clay %	Silt %	Sand %	
2009/2010	0.29	5.50	7.80	19.35	72.85	Sandy loam
2010/2011	0.35	5.61	7.70	19.13	73.17	Sandy loam

Table (2): Water Chemical analysis, of the two experimental sites, in the two seasons.

Season	pH	EC	Soluble cations (meq/L)				Soluble Anions (meq/L)			
			Ca$^+$	Mg$^+$	Na$^+$	K$^+$	Co$_3$	HCo$_3$	Cl$^-$	So$_4$
2009/2010	7.13	1.78	4.56	2.60	3.07	0.36	---	6.60	12.83	1.16
2010/2011	7.20	1.73	4.60	6.63	3.10	0.47	---	6.68	12.80	1.22

RESULTS AND DISCUSSION

Effect of the types of emitters:

The data in Table (3) revealed that type of emitter had a significant effect on crop growth rate at the periods of 45:75 and 75:105 days after sowing in the two seasons. GR emitter significantly increased CGR1 of wheat plants to 18.56 and 19.17 g/day/m^2, and CGR2 to 12.08 and 16.49 g/day/m^2, in both respective seasons.

The data revealed that type of emitter had a significant effect on wheat traits in the two seasons. GR emitter significantly increased plant height of wheat plants to 85.7 and 87.47 cm, number of spike/m^2 at harvest to 405.39 and 392.04 spikes, number of kernels/spike to 55.88 and 59.13 kernels, harvest index to 61 and 60% and grain yield/faddan to 2760.2 and 2606.6 kg, in the first and second season, respectively, compared to Turbo emitters.

On the other hand, Turbo emitter significantly increased 1000-kernels weight to 29.79 g in the first season, while GR emitter significantly increased it to 34.21 g in the second one.

These results revealed the role of emission uniformity of drip irrigation systems and emitters manufactured by injection molding possessed higher EU values with relatively low reduction rate compared with extruded emitters. Consequently, injected-type emitters gave a higher crop yield than extruded types. These results are in agreement with those observed by El-Yazal *et al.* (2002), Kadale *et al.* (2007) and Kassem and El-Suker (2009).

Table (3): Effect of the type of emitters on wheat traits, in 2009/2010 and 2010/2011 seasons.

Emitter	CGR1	CGR2	PH (cm)	NS	KS	KW	GY	HI%
				2009/2010				
GR	18.56	12.08	85.07	405.39	55.88	29.79	2760.2	61
Turbo	15.39	11.20	82.62	391.17	52.70	29.00	2596.5	59
LSD 0.05	0.85	0.13	1.70	2.47	0.99	0.03	2.4	1.00
				2010/2011				
GR	19.17	16.49	87.47	329.04	59.13	34.21	2606.6	60
Turbo	16.17	14.46	81.79	384.71	56.22	30.05	2473.2	57
LSD 0.05	0.31	0.42	1.44	1.16	0.91	0.18	2.9	3.00

Effect of distance between emitters:

Data in Table (4) showed the effect of distance between emitters in both seasons. Whereas 25 cm distance between emitters recorded the highest values of CGR1 and CGR2 at the two studied periods at the two seasons. The values were 19.98 and 20.69 g/day/m^2 for CGR1 and they were 12.57 and 16.83 g/day/m^2 for CGR2, in the two respective seasons.

Table (4): Effect of distance between the emitters (D) on wheat traits, in 2009/2010 and 2010/2011 seasons.

D	CGR1	CGR2	PH (cm)	NS	KS	KW	GY	HI%
				2009/2010				
D1	13.98	10.71	81.54	386.74	51.88	29.26	2474.29	0.58
D2	19.98	19.98	86.15	409/82	56.70	29.52	2882.38	0.61
LSD 0.05	1.88	0.18	1.7	1/51	1.88	0.21	2.09	0.01
				2010/2011				
D1	14.65	14.12	79.71	384.71	55.31	26.62	2372.80	0.57
D2	20.69	16.83	89.54	392.04	60.04	27.11	2706.94	0.61
LSD 0.05	2.98	0.06	1.44	0.51	2.98	0.05	3.02	0.07

Also, the 25 cm between emitters recorded the significantly highest plant height (86.15 and 89.54 cm), number of spike/m^2 (409.82 and 392.04 spikes), number of kernels/spike (56.70 and 60.04 kernels), 1000-kernels weight (29.52 and 27.11 g), grain yield/faddan (2882.38 and 2706.94 kg) and harvest index (61 and 61%), in the two respective seasons.

These increases might be due to the increasing in the wet surface area with increasing the number of drippers and causing higher evaporation, or due to the increase in plant growth and

transpiration in addition to the higher evaporation from the wet top layer rather than from the dry soil surface.

These results are in harmony with the findings of Seidhom (2001), Gaber (2000), Maqsood *et al.* (2002), Nasser and El-Gizawy (2005) and Abd El-Rahman (2009).

Effect of Nitrogen levels:

Table (5) showed that nitrogen levels had a significant effect on crop growth rate during the periods of 45:75 and 75:105 days after sowing in both seasons. Application of 100 kg N/faddan resulted in the highest values of CGR1 (18.08 and 18.38 g/day/m^2) and CGR2 (16.89 and 16.05 g/day/m^2) in both seasons, respectively.

Data, also, showed that 100 kg N/faddan significantly increased plant height to 86.15 and 84.32 cm, number of spikes/m^2 to 402.07 and 391.13 spikes, number of kernels/spike to 55.56 and 58.69 kernels, 1000-kernels weight to 30.17 and 28.25 g, grain yield/faddan to 2833.80 and 2732.84 kg/fed and harvest index to 63 and 60%, in both respective seasons.

These increases may be due to the fact that nitrogen fertilizer is attributing and has an important role in increasing division and cells elongation as well as activating metabolic and photosynthesis processes and translocation from source to sink.

These results are in accordance with those reported by Hassanin (2002), Maqsood *et al.* (2002), Nasser and El-gizawy (2005) and Farboodi *et al.* (2012).

Table (5): Effect of nitrogen fertilizer level (N) on wheat traits, in 2009/2010 and 2010/2011 seasons.

N level	CGR1	CGR2	PH (cm)	NS	KS	KW	GY	HI%
				2009/2010				
N1	15.77	11.42	82.92	395.25	52.89	29.10	2511.10	58
N2	17.08	13.61	84.07	397.49	54.42	28.91	2690.10	60
N3	18.08	16.89	84.51	402.07	55.56	30.17	2833.80	63
LSD 0.05	0.08	0.06	0.05	0.43	0.20	1.10	0.28	5
				2010/2011				
N1	16.56	14.83	81.79	385.87	56.60	24.94	2301.00	55
N2	18.06	15.53	82.79	388.10	57.74	27.40	2585.77	59
N3	18.38	16.05	84.32	391.13	58.69	28.25	2732.84	60
LSD 0.05	0.01	0.60	1.04	0.49	1.75	0.31	0.24	3

The interaction effect between type of emitter and distance between the emitters:

Results in indicated that GR emitter and 25 cm distance between the emitters significantly increased CGR1 to 21.62 and 22.25 g/day/m^2, CGR2 to 13.08 and 18.29 g/day/m^2, plant height to 87.39 and 92.22 cm, number of spike/m^2 to 419.53 and 400.08 spikes, number of kernels/spike to 58.87 and 61.53 kernels, 1000-kernels weight to 30.96 and 27.42 g, grain yield/faddan to 2918.30 and 2774.24 Kg and harvest index to 62 and 61%, in the two seasons respectively, (Tables 6 and 7).

Table (6): Effect of the interaction between type of emitter and distance between the emitters on CGR, PH and NS, in 2009/2010 and 2010/2011 seasons.

D	CGR1		CGR2		PH		NS	
	GR	Turbo	GR	Turbo	GR	Turbo	GR	Turbo
				2009/2010				
D1	15.51	12.45	11.08	10.34	82.75	80.33	391.25	382.23
D2	21.62	18.35	13.08	12.06	87.39	84.90	419.53	400.11
LSD 0.05	0.78		0.31		0.98		2.14	
				2010/2011				
D1	16.08	13.21	14.07	14.07	82.72	76.71	383.99	379.72
D2	22.25	19.13	18.29	15.34	92.22	86.87	400.08	391.25
LSD 0.05	0.36		0.74		2.21		0.72	

These results may be due to the amount of water available to plants by GR emitters and the narrow distance of 25 cm, in addition to the higher evaporation from the wet rather than dry soil surface and to the higher transpiration from plants as well as the amount of water needed for plant growth development and building plant tissues.

Table (7): Effect of the interaction between type of emitter and distance between the emitters on KS, KW, GY and HI, in 2009/2010 and 2010/2011 seasons.

D	KS		KW		GY		HI%	
	GR	Turbo	GR	Turbo	GR	Turbo	GR	Turbo
				2009/2010				
D1	52.9	50.86	29.92	28.61	2602.08	2346.50	59	56
D2	58.87	54.54	30.96	28.61	2853.30	2846.47	62	61
LSD 0.05	0.66		2.74		2.46		0.01	
				2010/2011				
D1	56.73	53.89	26.49	26.81	2438.93	2306.68	58	56
D2	61.53	58.55	27.42	26.74	2774.24	2639.65	61	59
LSD 0.05	0.22		0.22		2.44		0.08	

The interaction effect between nitrogen levels and type emitter:

Results revealed that GR emitter plus 100 kg N/faddan gave the significantly highest CGR1 (20.95 and 20.14 g/day/m^2), CGR2 (12.50 and 17.38 g/day/m^2), plant height (85.67 and 89.97 cm), number of spikes/m^2 (415.04 and 398.99 spikes), 1000-kernel weight (36.55 and 28.14 g), grain yield/faddan (2874.36 and 2760.51 Kg) and harvest index (62 and 61%) in the first and second season, respectively. While number of kernels/spike significantly increased up to 57.30 kernels using GR emitter under 100 Kg N/faddan in the first season, and up to 59.90 kernels by using Turbo emitter under 100 Kg N/faddan in the second season (Tables 8 and 9). These results are in accordance with those reported by AbdEl-Rahman (1996).

Table (8): Effect of the interaction between type of emitter and nitrogen fertilizer level on CGR, PH and NS, in 2009/2010 and 2010/2011 seasons.

N level	CGR1		CGR2		PH		NS	
	GR	Turbo	GR	Turbo	GR	Turbo	GR	Turbo
				2009/2010				
N1	17.09	14.45	11.76	11.09	84.20	81.65	406.05	584.46
N2	18.65	15.52	11.99	11.23	85.34	82.85	408.35	386.64
N3	20.95	16.21	12.50	11.29	85.67	83.35	415.04	389.11
LSD 0.05	0.01		0.04		2.20		2.02	
				2010/2011				
N1	17.91	15.21	15.53	14.13	85.13	80.45	392.64	379.10
N2	19.45	16.67	16.56	14.51	87.31	81.33	395.36	380.85
N3	20.14	16.62	17.38	14.73	89.97	83.58	398.99	383.29
LSD 0.05	0.03		0.04		1.09		0.01	

Table (9): Effect of the interaction between type of emitter and nitrogen fertilizer level on KS, KW, GY and HI, in 2009/2010 and 2010/2011 seasons.

N level	KS		KW		GY		HI%	
	GR	Turbo	GR	Turbo	GR	Turbo	GR	Turbo
				2009/2010				
N1	54.42	51.37	32.72	28.14	2599.00	2423.20	59	57
N2	55.93	52.91	33.78	29.05	2807.20	2573.00	61	59
N3	57.30	53.82	36.55	30.60	2874.36	2793.25	62	61
LSD 0.05	0.05		0.53		1.69		4	
				2010/2011				
N1	54.93	58.37	25.30	24.58	2405.60	2196.40	58	53
N2	65.36	59.12	27.62	27.18	2653.65	2517.90	60	58
N3	57.47	59.90	28.41	28.09	2760.51	2705.18	61	60
LSD 0.05	0.92		0.45		1.44		1	

The interaction effect between the distance between emitters and nitrogen levels:

The interaction effect between the distance between emitters and nitrogen levels had a significant effect on wheat studied traits in the two seasons (Tables 10 and 11).

The interaction significantly increased CGR1 to 21.12 and 21.76 g/day/faddan, CGR2 to 13.11 and 22.40 g/day/faddan, plant height to 86.72 and 91, 99 cm, number of spikes/m^2 to 415.04 and 398, 99 spikes, number of kernels/spike to 58.35 and 61.12 kernels, grain yield/faddan to 3019.45 and 2908.58 Kg and harvest index to 63 and 60%, in the two respective seasons.

Table (10): Effect of the interaction between the distance between emitter and nitrogen fertilizer level on CGR, PH and NS, in 2009/2010 and 2010/2011 seasons.

N level	CGR1		CGR2		PH		NS	
	D1	D2	D1	D2	D1	D2	D1	D2
				2009/2010				
N1	12.80	18.75	10.34	11.60	80.52	85.32	384.46	406.05
N2	14.09	20.08	10.65	12.50	81.80	86.39	386.64	408.35
N3	15.04	21.12	10.91	13.11	82.30	86.72	389.11	415.04
LSD 0.05	0.68		0.03		0.10		0.02	
				2010/2011				
N1	13.86	19.25	15.74	18.64	77.97	87.61	379.10	392.64
N2	15.07	21.05	14.51	20.84	79.61	89.03	380.85	359.36
N3	15.00	21.76	14.73	22.40	81.56	91.99	383.29	398.99
LSD 0.05	0.01		0.75		1.08		0.69	

Table (11): Effect of the interaction between the distance between emitter and nitrogen fertilizer level on KS, KW, GY and HI, in 2009/2010 and 2010/2011 seasons.

N level	KS		KW		GY		HI%	
	D1	D2	D1	D2	D1	D2	D1	D2
				2009/2010				
N1	50.77	55.02	24.58	28.14	2312.50	2709.70	56	60
N2	52.10	56.74	27.18	29.05	2462.20	2918.00	62	62
N3	52.77	58.35	28.09	30.60	2648.16	3019.45	62	63
LSD 0.05	0.12		0.23		1.68		2	
				2010/2011				
N1	54.14	59.05	25.30	28.76	2132.75	2469.25	53	58
N2	55.45	59.95	27.62	29.74	2428.55	2743.00	58	59
N3	56.25	61.12	28.41	30.07	2557.11	2908.58	59	60
LSD 0.05	3.89		0.01		1.43		1	

The interaction effect between type of emitter, distance between the emitters and nitrogen levels:

The second order interaction between the experimental treatments significantly affected all wheat studied traits. The highest values of CGR1 (22.97 and 23.34 g/day/faddan), CGR2 (13.34 and 19.69 g/day/faddan), plant height (88.24 and 95.64 cm), number of spikes/m^2 (426.94 and 403.15 spikes), number of kernels/spike (61.20 and 62.90 kernels), grain yield/faddan (3042.10 and 2932.83 Kg) and harvest index (63 and 63%) were achieved by using GR emitters with 25 cm distances between the emitters under 100 Kg N/faddan in both seasons, respectively. On the other hand, using Turbo emitters with 50 cm in-between under 60 Kg N/faddan resulted in the lowest values of mentioned traits in the two seasons (Tables 12 and 13).

Table (12): Effect of the interaction between type of emitter, distance between the emitters and nitrogen levels on CGR, PH and NS, in 2009/2010 and 2010/2011 seasons.

Emitter	N Kg/f	CGR1		CGR2		PH		NK	
		Distance between emitters							
		D1	D2	D1	D2	D1	D2	D1	D2
		2009/2010							
GR	60	14.07	20.12	10.64	12.88	82.45	85.95	387.93	414.66
	80	15.52	21.78	10.95	13.03	82.70	87.99	390.99	416.98
	100	16.94	22.97	11.66	13.34	83.10	88.24	394.83	426.94
Turbo	60	11.53	17.38	10.30	11.89	78.60	84.70	380.99	397.44
	80	12.67	18.38	10.35	12.11	80.90	84.80	382.30	399.73
	100	13.15	19.28	10.38	12.20	81.50	85.20	383.40	403.15
LSD 0.05		0.97		0.3		3.02		2.85	
		2010/2011							
GR	60	14.99	20.83	14.39	16.68	81.14	89.12	382.98	397.36
	80	16.31	22.59	14.61	18.52	82.71	91.91	383.39	399.73
	100	16.95	23.34	15.07	19.69	84.30	95.64	385.62	403.15
Turbo	60	12.74	17.68	13.15	15.11	74.80	86.10	375.22	387.93
	80	13.83	19.52	13.57	15.45	76.52	86.15	378.32	390.99
	100	13.06	20.18	13.96	15.51	78.82	88.35	380.96	394.83
LSD 0.05		0.37		1.05		2.80		0.99	

Table (13): Effect of the interaction between type of emitter, distance between the emitters and nitrogen levels on KS, KW, GY and HI in 2009/2010 and 2010/2011 seasons.

Emitter	N Kg/f	KS		KW		GY		HI%	
		Distance between emitters							
		D1	D2	D1	D2	D1	D2	D1	D2
		2009/2010							
GR	60	52.20	56.64	28.93	27.72	2457.10	2740.90	58	61
	80	53.10	58.76	30.32	28.76	2642.50	2971.90	60	62
	100	53.40	61.20	30.52	27.78	2706.63	3042.10	61	63
Turbo	60	49.35	53.40	27.35	32.42	167.90	2678.50	55	60
	80	51.10	54.72	27.79	28.76	2281.90	2864.10	56	62
	100	52.14	55.50	27.69	31.71	2589.70	2996.80	59	63
LSD 0.05		4.41		0.05		2.38		1	
		2010/2011							
GR	60	56.34	60.40	24.14	25.83	2202.10	1609.10	56	60
	80	56.95	61.30	27.39	27.09	2526.50	2780.80	59	61
	100	56.90	62.90	27.94	27.50	2588.20	2932.83	60	63
Turbo	60	51.95	57.71	25.02	24.78	2063.40	2329.40	50	57
	80	54.13	58.60	26.97	28.16	2330.60	2705.20	57	60
	100	55.60	59.35	28.24	29.32	2526.03	2884.34	59	62
LSD 0.05		5.51		0.63		2.5		1	

Water use efficiency (WUE):

Data in Table 14 represent the average water use efficiency of bread wheat under the experimental treatments in Kg grains per one m^3 of irrigation water.

It could be noticed that the mean water use efficiency was 1.16 and 1.47 Kg/m^3, with the distances between emitters of 50 and 25 cm, respectively. And it was 1.28 and 1.21 Kg/m^3, when GR and Turbo emitters wear used, respectively. Nitrogen fertilizer levels dramatically increased WUE with increase in nitrogen application. WUE increased from 1.10 with 60 Kg N/faddan to 1.21 with 80 Kg N/faddan and/or to 1.31 Kg/m^3 with 100 Kg N/faddan were applied.

However, the highest value of WUE of 1.43 Kg/m^3 was a Kg/m^3 accrued when GR emitter was used with 25 cm distance between emitters under 100 Kg N/faddan.

These increases in WUE may be due to the decrease in actual evapo-transpiration at low applied water quantities which could correspond with high grain yield.

Similar results were reported by Seidhom (2001) and El-Yazal *et al.* (2002).

Table (14): WUE as affected by type of emitters, distance between emitters and nitrogen fertilizer level in 2009/2010 and 2010/2011 seasons.

N	GR			Turbo			N Mean	D Mean	
	D1	D2	Mean	D1	D2	Mean		D1	D2
N1	1.12	1.28	1.20	1.01	1.19	1.10	1.10	1.06	1.23
N2	1.24	1.38	1.31	1.10	1.33	1.21	1.21	1.17	1.65
N3	1.27	1.43	1.35	1.22	1.41	1.31	1.31	2.31	2.41
Mean	1.21	1.63	1.28	1.11	1.31	1.21	1.21	1.16	1.47

RERERANCES

Abd El-Rahman, G. (2009). Water Use Efficiency of wheat under drip irrigation systems at Al-Maghara area, North Sinai, Egypt. American-Eurasian J. Agric. & Environ. Sci., 5 (5): 664-670.

Dawood, S.A. and S.N. Hamad (1985). A comparison of on-farm irrigation systems performance. In Proceedings of the Third International Drip/Trickle Irrigation Congress. California, 18-21 November 1985.

Farboodi, M.; A.S. Nejad; S. Shahrokhi and A. Faramarzi (2012). Effect of nitrogen levels and cultivation arrangements on yield and yield components of wheat. Journal of Food, Agriculture Environment, 10: 1 part 2, 608-611. 22 ref.

Girgis, M.G.Z. (2006). Response of wheat to inoculation with phosphate and potassium mobilizers and organic amendment. Annals Agric. Sci., Ain Shams Univ., Cairo, 51(1): 85-100.

Grabow, G.L.; R.L. Huffman; R.O. Evans; K. Edmisten and D. Jordan (2004). Subsurface drip irrigation research on commodity crops in North Carolina. Tech. Report, N. C. University, USA.

Gaber, A.M. (2000). Water consumptive use, water use efficiency and production of some wheat varieties. Egyptian Journal of Soil Science, 40(4): 545- 556.

Hassanin, M.S. (2002). Effect of variety and nitrogen levels on growth, yield and yield components of wheat *(Triticum aestivumL.)* in newly cultivated land. Egyptian Journal of Agronomy. 2001, publ. 2002. 23: 111-131. 38 ref, ISSN1110-0486.

Kadale, A.S.; N.M. Shah and M. Mallik (2007) Determination of permissible lateral pressure variation for various types of emitters - a case study Karnataka Journal of Agricultural Sciences, 20(2): 444-445. 2 ref.

Kassem M.A. and A. AL-Suker (2009). Effect of fertigation methods on productivity and nitrogen use efficiency for wheat and barley crops. Misr J. Ag. Eng., 26(2): 866-885.

Maqsood, M.; A. Ali; Z. Aslam; M. Saeed and S. Aslam (2002). Effect of irrigation and nitrogen levels on grain yield and quality of wheat. Int. J. Agric. Biol., 4: 164-165.

Nasser Kh. B. and El-Gizawy (2005). Yield and nitrogen use efficiency as influenced by rates and sources of nitrogen fertilizers of some wheat varieties. The 11th Conference of Aagronomy, Agron. Dept., Fac. Agric., Assiut Univ., November, 15-16, 2005.

Piper, C.S. (1950). Soil and plant analysis. Interscience Publisher, Inc., New York.

Seidhom, S.H. (2001). Water use efficiency and water economy of some crops as affected by soil heat at Sinai. Ph.D. Thesis, Fac. Agric., Zagazig Univ., Egypt.

Suarez-Rey, E.; C.Y. Choi; P.M. Waller and D.M. Kopec (2000). Comparison of subsurface drip irrigation and sprinkler irrigation for Bermuda grass turf in Arizona. Trans. ASAE, 43(3): 631-640.

تأثير نوع النقاطات والمسافة بينها والتسميد النيتروجيني علي المحصول ومكوناته لقمح الخبز في الأراضي حديثة الاستصلاح

عادل عبدالهادى عبدالله و محمد رمضان محمد خلاف

معهد الدراسات والبحوث البيئية، جامعة مدينة السادات – مصر.

تم إجراء التجربة بمزرعة جامعة المنوفية بمدينة السادات خلال موسمي الزراعة 2010/2009 و 2011/2010 لدراسة تأثير نوعين من النقاطات هما النقاط "تربو" و النقاط "جي ار" ومسافتان بين النقاطات (25 و 50 سم)، وثلاث معدلات من التسميد النيتروجيني (60، 80 و 100 كجم نيتروجين لفدان) علي نمو ومحصول قمح الخبز، في منطقة السادات بهدف الترشيد في استخدام مياه الري، والوصول الى أعلى كفاءة لأستخدام المياه والتوصل للتوليفة المثلي من العوامل لتحقيق أفضل إنتاج. نفذت التجربة في تصميم قطاعات كاملة العشوائية بنظام القطع المنشقة مرتين في ثلاث مكررات، خصصت القطع الرئيسية لنوع النقاطات، بينما خصصت القطع الشقية الأولي للمسافات بين النقاطات، وكان نظام الري المتبع هو الري بالتنقيط السطحي وتم دراسة صفات النمو والمحصول ومكوناته، ومعدل النمو للمحصول فى الفترة من 45 إلى 75 ومن 75 إلى 105 يوم، وكفاءة الاستفادة من مياه الري. وأظهرت النتائج وجود فروق معنوية بين تأثير النقاطات علي جميع الصفات المدروسة، حيث أدي استخدام النقاط جي ار إلي زيادة معنوية في طول السنبلة، معامل الحصاد، الوزن الجاف للنبات، معدل نمو المحصول عند جميع مراحل النمو، محصول الحبوب للفدان وكفاءة الاستفادة من مياه الري بالنسبة لمحصول الحبوب كما كان هناك تأثيرا معنويا للمسافة بين النقاطات، حيث أن المسافة 25 سم بين النقاطات سجلت أعلي القيم لجميع الصفات المدروسة، وكانت أفضل القيم عند أستخدام النقاط جي ار والمسافة 25 سم، بينما زادت كفاءة استخدام مياه الري بنسبة 18% عند استخدام النقاط تربو والمسافة بين النقاطات 25 سم.

EFFECT OF ENVIRONMENTAL CONDATION ON AFLATOXINE CONTAMINATION INPORTED YELLOW CORN GRAINS

W.M. Darwisch[1]; M.F.Z. Omara[2] and M.A. A.Saleh [2]

[1] Institute for Environmental Studies and Research, University of Sadat City, Monofiya, Egypt.

[2] Regional Center for Food and Feed, Agricultural Research Center, Giza, Egypt.

INTRODUCTION

Corn is widely cultivated throughout the world, and a greater weight of corn is produced each year than any other grain. The United States produces 40% of the world's harvest; other top producing countries include China,Brazil, Mexico, Indonesia, India, France and Argentina. Worldwide production was 817 million tones in 2009 more than rice (678 million tons) or wheat (682 million tons). (Food and Agriculture Organization of the United Nations, 2012). , In 2012, over 159 million hectares (390 million acres) of corn were planted worldwide, with a yield of over 5 tons/hectare (80 bu/acre). Production can be significantly higher in certain regions of the world; 2009 forecasts for production in Iowa were 11614 kg/ha (185 bu/acre) (International Grains Council, 2013).

Aflatoxin contamination has been reported for grains as corn, soya, wheat, rice, and cotton seed, and nuts such as peanuts, almonds, Brazil nuts, hazelnuts, walnuts, cashew nuts, pecans, and pistachio nuts (Gürses, 2006).

Kumar *et al*. (2000) reported that Aflatoxins develop in corn in the field and during storage thus making the grains unwholesome for consumption. The predisposing factors of infection include improper drying, high relative humidity and temperature, farmers' production practices-intercropping with aflatoxin infected grains- early and delayed harvesting and poorly constructed storage structures. Corn predisposed to some of these factors has a high 3 probability of fungal infection (Aspergillus sp) which may, presumably enhance the development of aflatoxins. It is therefore assumed that, since climatic conditions, especially rainfall, temperature and relative humidity as well as storage structures vary in the country, the infection of corn by fungi (Aspergillus sp) and the subsequent development of aflatoxin may also vary. Figure1.1. shows a corn cob infested by fungi in the field.

Dorner and Cole (2002) reported that Atoxigenic strains, like aflatoxin-producing fungi, become associated with corps in the field during crop production. These fungi remain with the harvested corps after harvest and in storage. Since crop contamination with aflatoxins may occur in the field, in storage or anytime until the crop is consumed, if conditions are conducive for fungal growth, e.g., high humidity and high temperature, then crop infection and contamination will continue as well. Like their aflatoxin- producing relatives, atoxigenic strains also move into storage with the crop and provide residual protection in transport, storage, and processing until consumption.

Moisture is not a grading factor in commercial grain. However, a loss of quality in stored corn hinges largely on the amount of moisture present in the grain. Moisture is an important factor most discount schedules. Moisture is recorded on the grain certificate to the nearest tenth of a percent (USDA) Official Grain Standards of the United States Federal Grain Inspection Handbook (2009).The presence and growth of Aspergillus on pre-harvested crops can be reduced through agricultural practices such as proper irrigation and pest management. Pre-harvest interventions include choosing crops with resistance to a biotic stresses (like drought, temperature and moisture content) and reducing crop stresses in general, developing host resistance through plant breeding, and choosing varieties that are genetically more resistant to fungal growth and aflatoxins production, diseases and pests. However, these processes may not be economically feasible in

many high-risk regions. The use of staple crops resistant to fungal colonization or genetically modified crops that inhibit fungal invasions (transgenic crops), joined to the elimination of inoculum sources (such as infected debris from the previous harvest) may prevent infection of the crop. Years before, the use of fungicides, pesticides and in secticides were a good way for controlling infections, but nowadays, the use of biocontrol agents is the most appropriated in order to avoid consumers chemical intoxications. For example, biopesticides consisting of a non aflatoxigenic strain of Aspergillus may competitively exclude toxic strains from infecting crops, but the allergenic and human health aspects of the toxigenic strain need still to be evaluated. Aflatoxins M1 and M2 (whose names are derived from milk aflatoxins, and then related to meat aflatoxins too), are thermo-resistant hydroxylated metabolites produced by lactating animals consuming aflatoxin contaminated feeds. The ingested AFB1 and AFB2 are metabolized by livestock into AFM1 and AFM2 respectively, with estimated conversion ratio of 1–3% between AFB1 and AFM1 (Herzallah, 2009).

MATERIALS AND METHODS

Yellow Corn Samples had been collected from Ukrainian, Argentina, Bulgarian, Romanian, American, Hungarian, Serbian, Brazilian and Egyptian stored corn in silos and warehouses in ports of Alexandria, Damietta, and Dekhila . Samples had been divided, graded and kept in cloth bags and stored for three months period at ambient environmental condition.

Experimental Design:

Eight samples had been used as experimental groups (Ukrainian, Argentina, Bulgarian, Romanian, American, Hungarian, Serbian and Brazilian), while Egyptian Yellow Corn sample had been used as control group. 25 kg of each type of corn (Egyptian, Brazilian, American, ….etc.) had been collected. 3 samples of each type of corn had been prepared for grading test (3 samples x 4 periods of times 0, 30, 60 and 90 days).

Total weight required for grading tests = 1050 gm*12= 12600

Residual weight = 25000-12600= 12400 kg

The residual weight had been used for aflatoxin and microbial tests 12400/3*12 = 344.4 gm.

The total weight used for tests = 25 Kg X 9 types of corn = 225 kg.

Weather conditions:

The study had been conducted in the period from 1st August to the 30th November, 2012. This period is divided into thee sub-intervals (0-30 days), (30-60 days) and (60-90 days) as shown in Table (1).

- Springfield device Model# 91551-W had been used for measuring both temperature and humidity

Table (1): Mean of the temperature and relative humidity through the previously mentioned period.

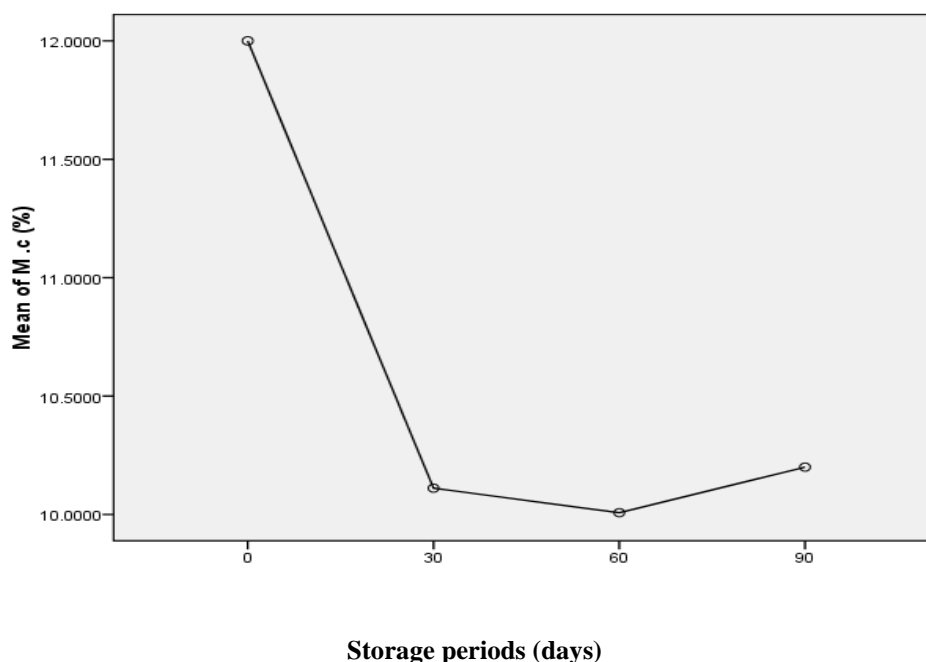| Period	0-30 days	30-60 days	60-90 days
Average temperature	34	30	29
Average Humidity	58.5	57.5	58

Determination of moisture content:

Moisture content was determined by using Jag 2100 device as shown in Fig. (1).

**Fig. (1): GAC 2100 device for moisture content determination.**

RESULTS AND DISCUSSION

Storage periods (days)

Fig. (1): Mean of moisture content (%) with storage periods (days).

It is clear from the abave fig. that the moisture content sharply decreases from 0 time to 30 days and then slightly decrease from 30 days to 60 days , then slightly increases in the period from 60 days to 90 days. This can be explained as follows, at zero time, the imported corn usually has moisture content doesn't exceed 15%, while in the period from zero time to 30 days , the moisture content decreases dramatically due to the storage in the summer (August), but then it decreases slightly due to relative decrease in temperature in the month of September. In the period from 60

days to 90 days, the moisture content starts to increase due drop in temperature in the month of October and due to increase in air moisture due to raining in this period.
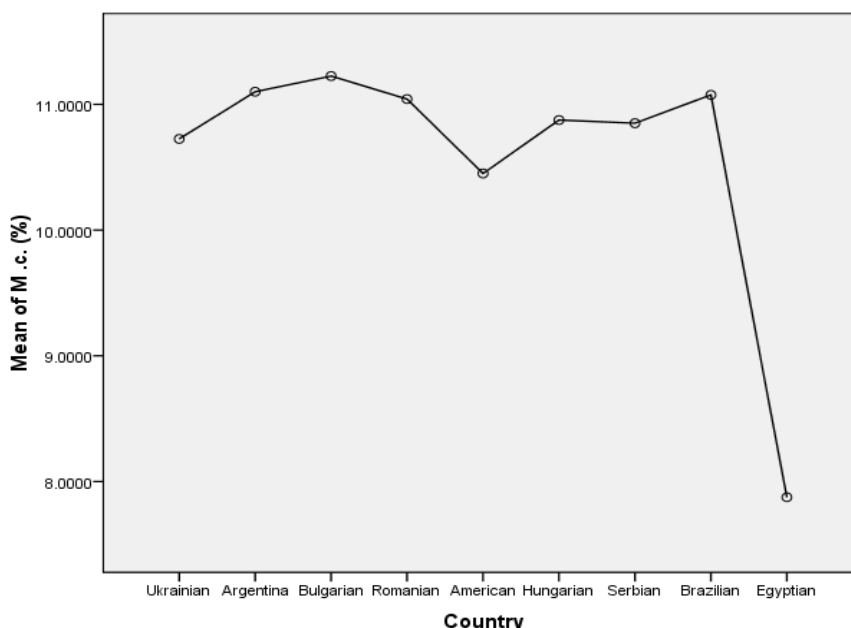
Fig. (2): The relation between the mean of the moisture content (%) and the countries.

The above figure shows that Egyptian corn has the lowest moisture content while the maximum moisture content refers to Argentinean corn and Brazilian corn respectively. This means that Egyptian corn has great advantage of lowest moisture content but unfortunately, the production is low.
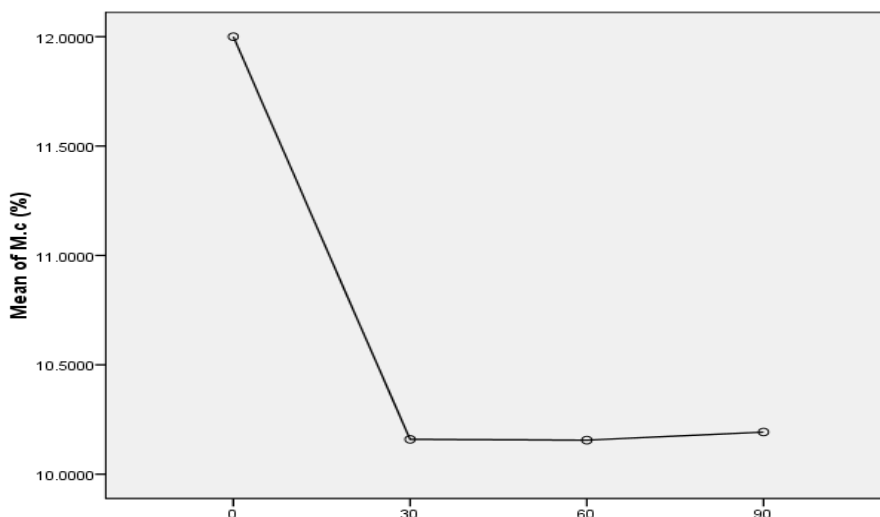
Fig. (3): Relation between M.C. (%) and storage periods in (days).

The above figure shows that the mean of the moisture content (%) is at its highest value at zero time and decrease after 30 days and remains constant in the period from 30 to 60 days while it slightly increases in the period from 60 to 90 days. At zero time the moisture content is in its highest value because the imported corn grains passed the test that determine the moisture content

of the grain. Then the grain moisture content decreases due to environmental conditions during the storage period from zero time to 30 days and remains approximately constant in the period from 30 to 90.

REFERENCES

Dorner, J.W. and R.J. Cole (2002) Effect of application of nontoxigenic strains of *Aspergillus flavus* and *A. parasiticus* on subsequent aflatoxin contamination of peanuts in storage. Journal of Stored Products Research, 38: 329-339.

Gürses, M. (2006). Mycoflora and Aflatoxin Content of Hazelnuts, Walnuts, Peanuts, Almonds and Roasted Chickpeas(LEBLEBI) Sold in Turke. International Journal of Food Properties, 9 (3): 395-399.

Herzallah, SM. (2009). Determination of aflatoxins in eggs, milk, meat and meat products using HPLC fluorescent and UV detectors. Food Chemistry, 114(3):1141-1146.

International Grains Council (international organization) (2013), "International Grains Council Market Report 28 November 2013", Iowa corn crop poised to set record, Cedar Rapids Gazette. 12 August 2009.Iowa, USA. 4p.

Kumar, P. Lava; S. Vera Reddy and F. Waliyar (2000). Management of aflatoxins in corn; J. of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Andrah, Pradesh, India.

United States Department of Agriculture, Federal Grain Inspection Service*. The Official Grain Standards of the United States Federal Grain Inspection Handbook,. (2009) M.G. Evans, R.L Nielsen, and C.B. Southard Agronomy Department, Purdue University.