Faculty of science

Ecological studies on water canal plants in El-Fayoum province, Egypt

By

Mai Sayed Fouad Abdel Aziz

A thesis submitted in the Partial Fulfillment

Of

The requirements for the degree of

(Doctor of Philosophy of Science)

In

(Ecology)

Botany Department

Faculty of Science

Fayoum University

2014

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Mai Sayed Fouad Abdel Aziz

(B. Sc. in Botany / Chemistry, 2000)

(M. Sc. Ecology, 2008)

Supervisors:

1- Prof. Dr. Refaat Mohamed Ali

Prof. of Plant Physiology- Botany Department
Faculty of Science - Fayoum University
Signature:

2- Dr. Emad Ali Al Sherif

Assistant professor of plant ecology-Botany Department
Faculty of Science – Beni Suef University
Signature:

SUMMARY AND CONCLUSIONS

The goal of this study was firstly to assess the water quality of different water resources in Fayoum and to determine how the water quality affected vegetation distribution and secondly to test three hydrophytes removal abilities to Cd combined with Pb and Ni. Three important tasks were required to accomplish this goal: sampling, analyses then finally statistical process and evaluation of the results.

PART (I):

Fayoum is a circular depression in Western Desert, some of 90 Kilometers to south west of Cairo. It lies between longitudes 30° 23\ and 31° 5\ E, and latitudes 29° 5\ and 29° 35\ N. It is surrounded by desert from three sides (north, west, and south). It has a very specific nature as a depression with a closed drainage system and the altitude of about 60 m below the sea (Nawar and Salah, 2004). The climate in Fayoum is arid and characterized by hot dry summers and mild winters. Rainfall is limited and ranges from 10 to 20 mm per year. Evapotranspiration is about 1952 mm per year (Khattab *et al*., 2003).

The present study covered all the aquatic habitats in the study area including freshwater canals, agricultural drains, and mixed water canals.

Selected stands were chosen to cover all the variations in the environmental factors of the study area. These stands were analyzed seasonally during the period between 2009 and 2012.

Each stand was vegetationally analyzed. Importance value (I.V.) was used as input data to build up the classification dendrograms. In this study, 51 species with various life forms and different floristic categories were recorded belonging to 29 families representing the recent status of the aquatic and nonaquatic macrophytes in canals and drainages. The number of species varied from canal or drainage to another and from slope or water edge to open water.

Water analysis showed an increase in most cations and EC in drainages and in mixing water.

Soil texture analysis showed that the majority of soils were of clay type followed by Sandy clay type and small proportions were of sandy loamy texture.

Mixing had no clear effect on vegetation, except in case of Bahr Wahby in winter and Bahr El Bashawat and Bahr El Nazla- Etsa in summer. In summer, the indicator species of Bahr El Bashawat and Bahr El Nazla- Etsa group was *Cynodon dactylon*, while in winter was *Imperata cylindrica* for Bahr Wahby group.

The human impact may explain the vegetation absence in streams passing some villages which has imperiled aquatic plant at a variety of scales. Generally, Habitat loss due to hydrological alterations is the largest threat to aquatic plant biodiversity.

PART (II):

This part discussed the employment of three different hydrophytes namely; *Ceratophyllum demersum*, *Myriophyllum spicatum* and *Najas marina* in the trapping of some metal pollutants from synthetic media and the investigation of physiological alterations of the studied species in response to their abilities to accumulate Cd combined with Pb and Ni.

C. demersum, M. spicatum and *N. marina* are hyperaccumulator species. *Ceratophyllum demersum* was the most sensitive species to HMs accumulation meanwhile, *Myriophyllum spicatum* was the best hyperaccumulator species followed by *Najas marina*.

The obtained results were summarized as follow:

(1)Bioconcentration factor of *Ceratophyllum demersum* took the order of Cd >Ni >Pb , for *Myriophyllum spicatum* took the order of Cd ≥ Ni >Pb and for *Najas marina* was Ni> Cd >Pb which means that Cd and Ni were highly competitive while Pb was the least absorbed heavy metal.

(2) The exposure to Cd, Pb and Ni resulted in a decrease in photosynthetic pigments content especially chlotophyll a and b in all investigated species. Carotenoids on the other hand were stimulated in case of *Myriophyllum spicatum* and *Najas marina* at low and moderate concentrations of Cd.

(3) Flavonoids were stimulated obviously in *M. spicatum* compared with the two other species, which means that it was involved in the defense mechanism.

(4) Other antioxidants like TAST, glutathione and phytochelatins were involved in defense mechanism in all species but to certain limits then at higher concentrations of Cd, they will be reduced.

(5) Malondialdehyde as a product of lipid peroxidation exhibited a linear relation with increasing Cd in all plants which resulted in membrane damage especially in *C. demerum*.

(6) Antioxidant enzymes (superoxide dismutase and peroxidase) showed a positive correlation with Cd in all plant species. They were stimulated at low and moderate concentrations of Cd but they were inhibited at higher concentrations with the experimental period.

Finally we can conclude that *M. spicatum* can accumulate Cd with high levels even in combination with high levels of Pb and Ni because its adaptability was deteriorated at Cd concentration above 30 ppm combined with Pb and Ni of 50 ppm. *Najas marina* can absorb high concentrations of Cd but in combination with lower concentrations of Pb and Ni because it is able to tolerate high Cd Concentration (100 ppm) combined with lower concentrations of Pb(30 ppm) and Ni (10 ppm).. *C. demersum* also can accumulate Cd with slightly low concentrations in the presence of also low levels of Pb and Ni because its deterioration was almost clear above 0.75 ppm Cd combined with 5 ppm of Pb and Ni.