FACULTY OF EDUCATION
BIOLOGICAL & GEOLOGICAL
SCIENCES DEPARTMENT

COMPOSITION, DISTRIBUTION PATTERNS AND DIVERGENCE OF THE STREET TREE COMMUNITIES IN THE GREATER CAIRO CITY, EGYPT

A THESIS

SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF Ph. D. IN PREPARATION OF SCIENCE'S TEACHER (BOTANY)

BY

ETHAR ASAAD SAYED AHMED HUSSEIN

Master in Preparation of Science's Teacher (Botany-2011)
Special Diploma in Preparation of Science's Teacher (Botany-2007)
General Diploma in Preparation of Science's Teacher (Botany-2006)
B.Sc. & Ed. (2005)

SUPERVISED BY

Dr. Monier M. Abd El-Ghani
Professor of Flora & Ecology
Faculty of Science
Cairo University

Dr. Maged M. Abou-El-Enain
Professor of Taxonomy & Flora
Faculty of Education
Ain Shams University

Dr. Salwa M. Abbas
Professor of Plant Physiology
Faculty of Education
Ain Shams University

Dr. Abd-El-Moneim I. Aboel-Atta
Assistant Prof. of Taxonomy & Flora
Faculty of Education
Ain Shams University

Dr. Rabea A. T. Shehab
Assistant Prof. of Phycology
Faculty of Education
Ain Shams University

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إيثار أسعد سيد أحمد حسين

ماجستير في إعداد معلم العلوم (نبات - ٢٠١١)
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بكالوريوس علوم وتربية (٢٠٠٥)

إشراف

أ.د/ منير محمد عبد الغني
أستاذ البيئة النباتية والفلورة
كلية العلوم- جامعة القاهرة

أ.د/ ماجد محمود أبو العنين
أستاذ التصنيف والفلورة
كلية التربية- جامعة عين شمس

أ.د/ سلوى محمد عباس
أستاذ فسيولوجيا النبات
كلية التربية- جامعة عين شمس

د/ عبد المنعم إبراهيم إبراهيم أبو العطا
أستاذ التصنيف والفلورة المساعد
كلية التربية- جامعة عين شمس

د/ ربيع عبد التواب شهاب
مدرس علم الطحالب
كلية التربية- جامعة عين شمس

٢٠١٥

FACULTY OF EDUCATION
BIOLOGICAL & GEOLOGICAL
SCIENCES DEPARTMENT

Approval Sheet

Student Name: ***Ethar Asaad Sayed Ahmed Hussein***

Title: Composition, Distribution Patterns and Divergence of the Street Tree Communities in the Greater Cairo City, Egypt

Degree: Ph. D.

Supervisors	**Approved**
Prof. Dr. Monier M. Abd El-Ghani	***( )***
Prof. Dr. Maged Mahmoud Abou-El-Enain	***( )***
Prof. Dr. Salwa M. Abbas	***( )***
Dr. Abd-El-Moneim Ibrahim Aboel-Atta	***( )***
Dr. Rabea A. T. Shehab	***( )***

DECLARATION

This thesis has not been previously submitted for any degree at this or any other University.

Ethar Asaad Sayed Ahmed

To
My Parents and my Family

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The author

Abstract

Species diversity of the tree flora of 38 districts in the Greater Cairo city was studied with reference to landscape differentiation of species make-up. Three main habitats including 14 sites with 263 sample plots were considered (35 urban parks, 76 road islands and 152 street verges). The multivariate statistical analyses were performed by using the program package MVSP for Windows, v. 3.1. The produced data were subjected to a UPEGMA-clustering based on squared Euclidean distance and the obtained groups were represented in a dendrogram. Principal Coordinates Analysis (PCoA) is preformed using the product-moment correlation as a coefficient. In total, 378 of vascular plant species belonging to 264 genera and 79 families were recorded in urban areas of the Greater Cairo city. The most species-rich (44.7%) families were Fabaceae (36 spp.), Asparagaceae, Poaceae (21 spp.), Moraceae (19 spp.), Asteraceae (17 spp.), Euphorbiaceae and Malvaceae (15 spp.), Arecaceae (14 spp.), Lamiaceae (11 spp.), whereas the remaining families (70) constituted together 193 species. *Ficus* (18 spp.) was the highest among the species-rich genera, followed by *Euphorbia* (11 spp.), *Asparagus*, *Brachychiton*, *Callistemon*, *Citrus* and *Pinus* (4 spp. each). 257 genera contained only 1-3 species e.g. *Cereus*, *Koelreuteria*, *Strelitzia*, *Terminalia*, *Carica* and *Toona*. Growth form spectra revealed that, the recorded trees (139 spp.) belonged to 32 families; shrubs (79 spp.) to 30 families, herbs and others (160 spp.) to 48 families. A complete refined checklist of the recorded species in the Greater Cairo City was prepared and detailed species compositions, classification and their distribution patterns in each of the street verges, road islands and urban park were presented. Taxonomic diversity and growth forms in each habitat were estimated and graphically compared. Interactions between human disturbance, habitat condition and tree composition were discussed and recommendations regarding conservation ecology were suggested.

Key Words:

Urban biodiversity, street trees, urban trees, metropolitan flora, Egypt, growth forms, green spaces.

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Introduction and Aim of the Work

Urban ecology is a subfield of ecology which deals with the interaction of plants, animals, and humans with each other and with their environment in urban or urbanized settings. Analysis of urban settings in context of ecosystem ecology is ultimately helping us to design healthier, better managed communities. It involves the study of the effects of urban development patterns on ecological conditions. Emphasis may be placed on planning communities via design and building materials in order to promote a healthy and biodiversity urban ecosystem (Funch, 2008).

Urban landscapes are generally dominated by human infrastructure: building (residential and industrial); transport links (roads, pavements, railways, canals); and open land required for parking vehicles and disposal of waste. There also, sometimes substantial, areas of green space: gardens, parks, playing fields, golf courses, road verges and grounds of public institutions comprise nearly half of the land area (Baines, 1995).

Flora and vegetation of cities are different not only from semi-natural vegetation but also from human-made habitats

outside cities (Kowarik, 1988). Numerous studies are devoted to man made habitats in open landscapes (Prach *et al*., 1997; Sykora *et al*., 2002). Cities have their own spatial organization and distinctive patterns of species behavior, population dynamics and the formations of communities, each of which is specific to the urban environment (Sukopp, 2002). The unique character of urban habitats is well demonstrated after World War II; as reported by Salisbury (1943), who described plant species that colonized the ruins in London.

Biological diversity or biodiversity is introduced as a major objective in world-wide conservation strategies at the conference in Rio de Janeiro in 1992. Recent research in this field revealed that not only natural and semi-natural landscapes can be highly diverse in flora and habitats, but that urban and industrial areas also display a wide variety of habitats and communities. Urban- industrial ecosystems differ from non-urban ones in a number of ways. Most of the factors which affect ecosystems in cities (climate, soil, water conditions, human impact, etc.) are comparable to the site conditions in non-urban areas; the combination of these factors creates unique urban-industrial ecosystems. Consequently, the city has to be regarded as a new type of

environment with species compositions and habitats peculiar to urban-industrial areas (Maurer, 2002). Moreover, land use patterns and historical changes could affect floristic diversity in cities (Zerbe *et al.*, 2003). The extensive introduction and invasion of alien species in urban areas, and heterogeneity of urban habitats (natural, disturbed and managed), could raise species richness above the surrounding natural or semi-natural habitats (Kowarik, 1990; Turner *et al.*, 2005).

The flora of many urban habitats has been recognized as considerably rich in species. Cities represent an accumulation of species diversity in intensively managed landscapes (Haeupler, 1974; Kühn *et al*., 2004). This is due to a high heterogeneity of the urban environment which provides plants with habitats suitable for all kinds of strategies (Gilbert, 1989). It is also significantly enriched by invasions of alien species. This makes their flora prone to the loss of native specific, spread of aliens and thus biotic homogenization (Mackinneys & Lockwood, 1999).

The physical, ecological and geographical factors influence the species which may be found. Soil quality determines plant growth, being involved in nutrient