



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)**

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2015



كلية التربية
قسم العلوم البيولوجية والجيولوجية

تركيب وأنماط توزيع وحيود مجتمعات أشجار الشوارع في مدينة
القاهرة الكبرى، مصر

رسالة مقدمة
لاستكمال متطلبات الحصول على درجة دكتوراه الفلسفة لإعداد المعلم في
العلوم تخصص علم النبات

من

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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*

Acknowledgment

Praise and gratitude be to **ALLAH** (the one and only), the God of all creatures, for guiding us to the right way.

The author wishes to express her deep thanks and Indebtedness to **Dr. Monier M. Abd El-Ghani**, Professor of Flora & Ecology, Faculty of Science, Cairo University for suggesting the problem, keen supervision, guidance throughout this work and revision of the manuscript.

Sincere gratitude is due to **Dr. Maged M. Abou-El-Enain**, Professor of Plant Taxonomy & Flora, Faculty of Education, Ain Shams University for his keen supervision, help and advice during the work and for his assistance in preparation of the manuscript.

gratitude to **Prof. Dr. Salwa M. Abbas** Professor of Plant Physiology, Faculty of Education, Ain Shams University for helpful advice and encouragement.

Deep thanks are also due to **Dr. Abd-El-Moneim I. Aboel-Atta**, Assistant professor of Plant Taxonomy, Biological and Geological Sciences Department, Faculty of Education, Ain Shams University for his supervision, generous help and advice during the study.

Appreciation to **Dr. Rabea A. T. Shehab**, Assistant professor of Phycology, Biological and Geological Sciences Department, Faculty of Education, Ain Shams University for continuous encouragement and sustaining.

Special thanks to **Mrs. Therese Labib**, consultant of classification & identification of ornamental species, Orman Garden for offering the aid during field work and identification of the taxa found in the different habitats.

The author is also greatly indebted to **Prof. Dr. N. Z. Al-Alfy**

Ex-heads of Biological and Geological Sciences Department, Faculty of Education, Ain Shams University for their cooperation in the practical part and encouragement throughout the work; and the present Head **Prof. Dr. M. Abd-Elaziz** for providing facilities.

Thanks are also due to all staff members of Biological and Geological Sciences Department, Faculty of Education, Ain Shams University whose provide sincere help especially **Prof. Dr. M. Hesham Abd El-Hameed Loutfy and Prof. Dr. M. H. Abd El-Aal** for their kind assistance in the practical work and **Mr. Abd-El-Moneim Gomaa** for his assistance in carrying out the field work.

Finally, all thanks and gratitude to my lovely Mother, my Husband, my Sisters and Brothers that helped me a lot in the completion of this modest work.

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 performed 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