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Research Article

THE USE OF HERBARIUM FOR EFFECTIVE PLANT PRESENTATION IN LANDSCAPE ARCHITECTURE EDUCATION

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ABSTRACT. The successful design of landscape architecture works relies on the meticulous incorporation of plant materials, as they serve as vital living components. Nevertheless, it is unfeasible to procure all the necessary components for these items throughout every season of the year. Consequently, herbariums are established by collecting plant samples using diverse techniques. Herbarium specimens have the potential to be great educational tools since they offer a tangible and visual depiction of the wide range of plant species. This article presents the construction stages of the herbarium established at Çanakkale Onsekiz Mart University Department of Landscape Architecture. It also examines the successful utilization of this herbarium in undergraduate education, specifically in courses linked to the subject. This herbarium contains 360 specimens representing 110 taxa of tree species from both Gymnospermae (open-seeded) and Angiospermae (closed-seeded) plant divisions. The utilization of herbarium samples in landscape architecture education facilitated comprehensive plant identification throughout the year, resulting in noticeable enhancements in students' design skills.

Keywords: *plant material course, planting design, dendrology, landscape plants, design plants.*

INTRODUCTION

Landscape architecture is a multidisciplinary profession that seeks to provide inventive solutions by using social, cultural, ecological, and environmental resources in both urban and rural settings. Landscape architecture education encompasses the study of ecological planning, landscape engineering, technical and cultural aspects of landscape areas, cultivation, and presentation of landscape plants, as well as the design of landscape spaces. The research encompasses a wide range of structural and plant materials.

Plant materials in landscape design projects are distinct and significant due to their status as living entities. Plant materials, unlike inanimate substances like stone, concrete, and water, are dynamic design elements that undergo seasonal transformations, resulting in diverse appearances throughout time [1]. To fully understand and identify them, it is important to carefully observe and document the dendrological characteristics, growth patterns, branches, stems, leaves, blooms, and fruits of these plants during the entire year. Consequently, it is possible to develop planting designs that are efficient and functional throughout the entire year.

The decision about the type of trees, bushes, and other landscape features is contingent upon the specific design envisioned by the landscape architect. The landscape architect chooses the green elements, which are living materials, based on their aesthetic aspects and ecological requirements and qualities. Furthermore, the plants' functional attributes

should also be duly considered. The design should prioritize the prominent inclusion of all the constituent aspects of the green structure, encompassing their dimensions, form, hue, and surface quality. It is important to ascertain whether the plants fulfill their intended purpose as elements of massing, enclosure, delimitation, furnishing, or decoration [2]. It will be feasible to create plant compositions that consider several attributes and represent their year-round effects on the area through careful recognition and consideration. Given their extensive range, it is also feasible to employ a diverse array of combinations in designs. Therefore, it is imperative to establish herbariums that contain meticulously dried specimens of plants, which serve as the fundamental basis for landscape architecture designs, representing each season.

An herbarium is a repository where desiccated botanical specimens are preserved. Essentially, they are equipped with field investigations as part of their botanical science education. According to Funk's (2018) definition, a herbarium is a methodical compilation of dehydrated, flattened, and conserved plant specimens that offer comprehensive insights into the classification, environment, and geographic range of the plant [3]. Herbariums are vital resources for individuals engaged in plant science, as they facilitate the identification and categorization of plant species.

Herbariums can be created for various purposes according to people working on different subjects. These are;

- To use in plant identification,
- To prove the existence of a plant,
- Then to carry out studies on plant-related issues,
- To ensure that material is available for times when it is not possible to access the plant [4].

Herbarium plant specimens have diverse applications in numerous sectors, including morphological investigations, regional distribution analysis of plant groups, and educational and training objectives for students [4].

In summary, a herbarium is a collection of dried and pressed plants. Drying and storing plant samples between cartons was first practiced in the 15th century. Plant collection studies have been carried out by scientists, public institutions, private organizations, and individuals for centuries [4]. In Turkey, the first herbarium was established in 1845 at the Military Medical School in Istanbul. However, a fire in 1948 destroyed this herbarium [5,6]. In 1933, the herbarium established at Ankara University Faculty of Science was the oldest herbarium with the largest number of specimens and is still in use in our country [6].

Within extensive herbarium collections, plant specimens are meticulously organized and arranged using specialized cabinets and a systematic classification [7]. To prevent complications in the categorization of herbarium specimens, blooming plants can be systematically arranged based on their respective families. Alphabetical sorting is employed to enhance practicality and facilitate the identification of genera. The species within the categories are arranged in alphabetical order [4].

When collecting specimens for herbarium purposes, the suitability of the color and form of the plant before pressing should be checked; clean (disease- and pest-free) specimens should be selected; and if they are dirty, they should be cleaned and then pressed. During fieldwork, regular notes should be taken by giving the location of the plant, the date the sample was taken, and, if necessary, the sample number. Plant samples taken from the field are collected in bags or metal bags for later pressing [4].

To preserve the original form and pigmentation of plant specimens stored in bags for a brief duration, it is necessary to desiccate them using a compression apparatus known as presses. These presses consist of a grid measuring 45x30 cm, which is made of either wood or metal. Belts are employed to apply pressure and compress these presses. The samples obtained from the field are cleansed and positioned on a press grid, sandwiched between moisture-absorbing sheets. When feasible, a rigid substance like cardboard is inserted between the blotters, along with 2–5 plant samples. Once the press reaches a height of 20–30 cm, the press grid is repositioned on top and secured tightly using mesh belts or ropes. Ultimately, weights are positioned on the samples to ensure effective compression, and if feasible, blotting papers are replaced daily until the samples are completely dried. Typically, the drying process takes around 10-14 days to complete [4].

After the completion of the drying process for the plant samples, the subsequent step involves transforming the recognized plants into herbarium specimens. Currently, the desiccated plant specimens are affixed to white cardboard. Three distinct methodologies can be employed to rectify the specimens. The methods employed include taping, utilizing silicone adhesives, and securing with a needle and thread. The final phase entails affixing labels to the herbarium specimens. The label should include essential details such as the herbarium's name, the plant's species, family, and local name, the location and date of collection, and the collector's identity [8,9]

Landscape architecture is a versatile field that integrates art, science, and environmental management to design outdoor areas that are both useful and visually appealing, while also promoting sustainability. To effectively fulfill the intended functions of plants in landscape architecture projects and create visually pleasing images, it is essential for students to be equipped with the knowledge and skills to accurately identify plant materials during their educational period. Within this framework, one effective method utilized to chart a path for students and facilitate their future self-development and acquisition of information and skills is the utilization of herbariums, which comprise dried plant specimens. Furthermore, with these specimens, there are also illustrations depicting exemplars that encompass all the distinctive features of the plants. When it comes to the landscape plants industry, which is characterized by its extensive diversity and continuous growth, it is crucial to emphasize that education in this field should not be limited to specific time periods, but rather should encompass the entirety of one's professional career.

Planting designs in landscape architecture have important functions in terms of ecological, environmental, social, and human health. For these designs to be sustainable and visually attractive, it is very important to create open green areas that are effective year-round. The appearance of plants changes according to seasons and years. Drying and collecting plants is a way of preserving them for the future. Plants dried and stored under the right conditions can last for a very long time and can be preserved for years. In this context, herbariums are very valuable resources for education. Because they allow students and researchers to study plants in detail for many years in terms of their morphology, anatomy, ecology, and all dendrological features. With these features, herbarium studies can be used in seasons and times when it is not possible to access plants. Based on these requirements, in this article, the importance of herbarium use in landscape architecture education is stated, and it aims to explain how to prepare and use herbarium in detail and to explain with examples how landscape architect candidates can develop in the future.

MATERIAL AND METHOD

The main material of the study consists of tree species from open (Gymnospermae) and closed-seeded (Angiospermae) plant classes and their dried herbarium specimens located in Çanakkale Onsekiz Mart University (ÇOMÜ) Terzioglu Campus. In addition, the auxiliary material of the study is the tables containing drawings and information that provide a detailed presentation of the plants in terms of landscape architecture.

ÇOMÜ campus is on an area of about 3 hectares, just a few hundred meters from the sea. There is a radar hill behind the university and its surrounding is surrounded by forest. Campus visually and its natural areas provide privilege to the campus [10]. The existing plants of the university campus are used for continuous demonstration in landscape architecture education and have a very wide variety.

The methodology of the study consists of the following stages:

1- The curriculum of the ÇOMÜ Landscape Architecture Department was examined in detail, and the use of herbarium specimens was associated with its widespread effect.

2- Literature review.

3- On-site examination and listing of landscape plants (trees) on the campus.

4- Collection of plant samples from the field: A total of 360 specimens of tree species belonging to open and closed-seeded plant classes were collected from ÇOMÜ Terzioglu Campus during field studies. These specimens were separated into files at the time of collection and transported in bags, considering all items and characteristics, to facilitate their identification, pressing without deterioration and healthy storage. Care was taken to ensure that the collected plant specimens had flowers, fruits, shoots, buds, leaves, or cones, if any.

5- Identification of the collected plant samples (temporarily labelled).

6- All plant samples were pressed, dried in accordance with the technique and controlled (Fig. 1).



Fig. 1. *Wood drying press and compressive mesh belts*

7- In order to dry the pressed plant samples in a healthy way, the blotting papers placed between the samples were changed every day (for 15-20 days) to avoid color loss in the drying process.

8- Alphabetical ordering of the identified taxa according to their Latin genus names. Taking photographs of dried plants as herbarium specimens.

9- Making drawings of plants in order to ensure effective use in planting designs. Analyzing tables and determining design features.

10- Dried plant specimens were labeled with scientific name, location, and date of collection and stored with reference numbers in the Department of Plant Material and Cultivation Technique, Department of Landscape Architecture, Faculty of Architecture and Design, ÇOMÜ (Fig. 2). Tables and drawings were sorted and scanned.

11- The prepared herbarium specimens were entered into the data list created in the "Microsoft Office Excel" program in order to be recorded according to a certain system: In the database created in this section, the herbarium specimens obtained from the field studies in "ÇOMÜ Terzioglu Campus" were sorted alphabetically according to their genus names and their families were also indicated. Then, the number of the sample area where each plant was collected, its open- or closed-seeded status, and reference numbers were recorded in this database.

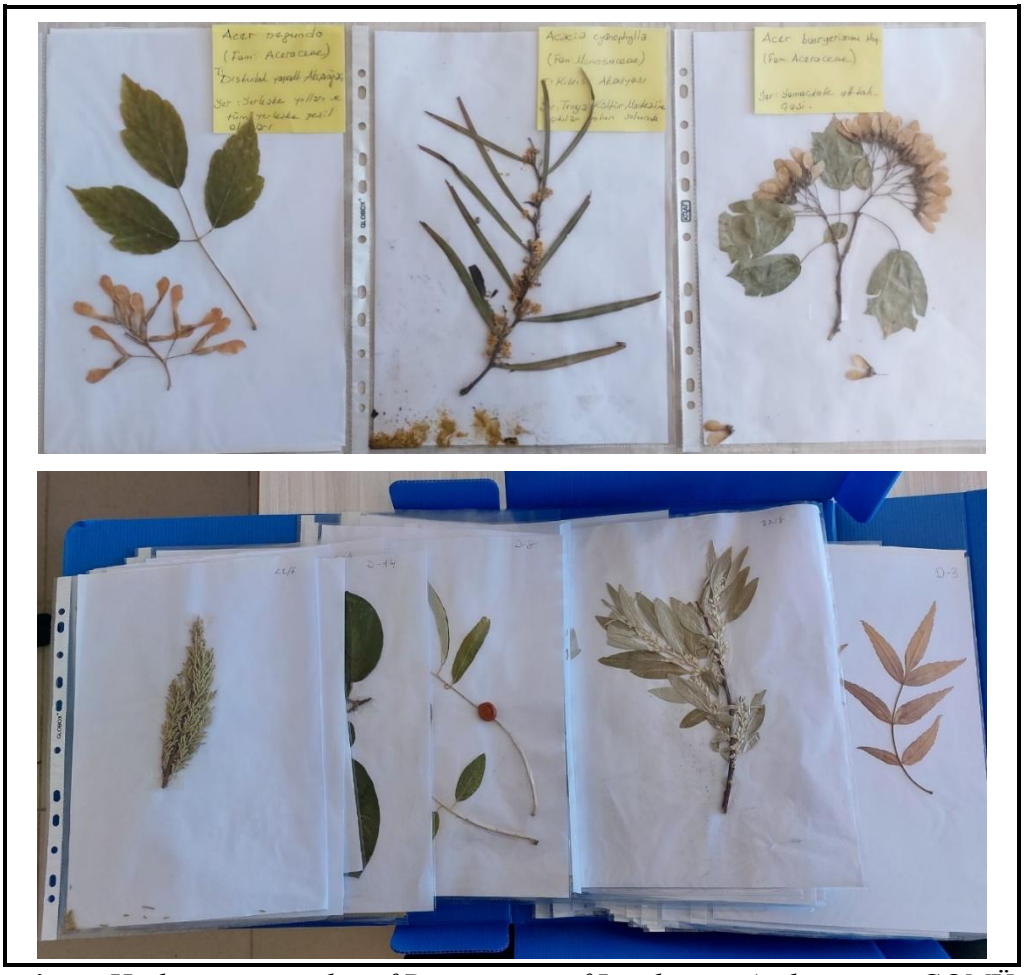


Fig. 2. *Herbarium samples of Department of Landscape Architecture, ÇOMÜ*

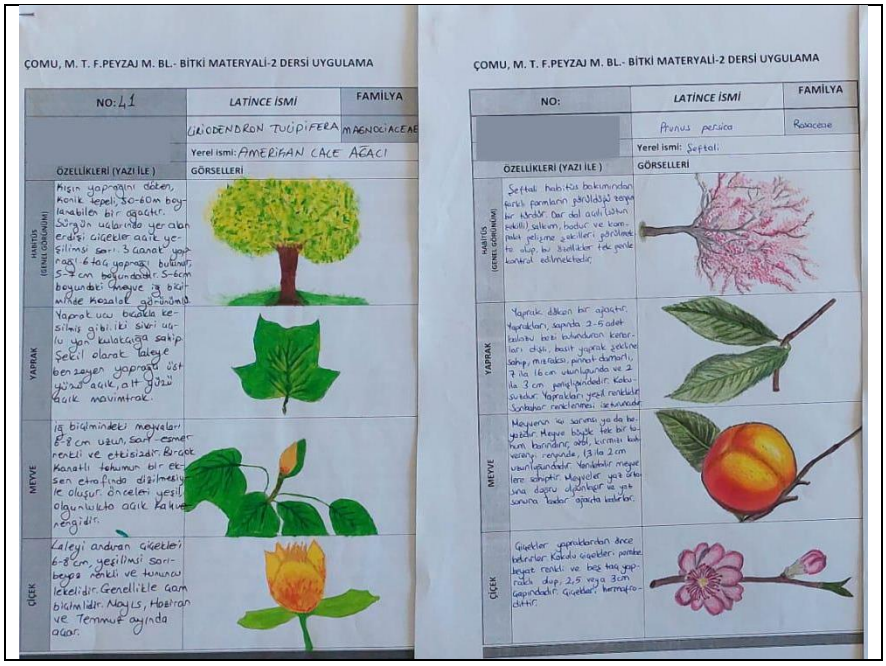
FINDINGS

ÇOMÜ Landscape Architecture herbarium has 360 specimens of 110 taxa collected from Terzioglu Campus. When ÇOMÜ Landscape Architecture undergraduate curriculum was examined, it was found that ten courses were directly related to plant material in the compulsory course group (Table 1). Especially in plant material courses and planting design courses, students use herbarium specimens in a way that they can observe the landscape characteristics of plants in every period and season.

Table 1. *List of courses related to plant material in the Department of Landscape Architecture, ÇOMÜ*

Term	Course Code	Course	Time (T: Theoretical, P: Practical)
Fall	PMM-1011	Plant Material I	2T+2P
Spring	PMM-1016	Plant Material II	2T+2P
Fall	PMM-2011	Plant Material III	2T+2P
Fall	PMM-2033	Planting Design	2T+2P
Fall	PMM-2005	Project I	3T+2P
Spring	PMM-2004	Plant Material IV	2T+2P
Spring	PMM-2010	Project II	3T + 2P
Fall	PMM-3003	Project III	3T + 2P
Spring	PMM-3006	Project IV	3T + 2P
Fall	PMM-4003	Project V	3T + 2P

In the undergraduate education of Landscape Architecture Department, herbarium specimens were utilised for plant identification and drawing of plant specimens during the application hours of Plant Material courses (Fig. 3).



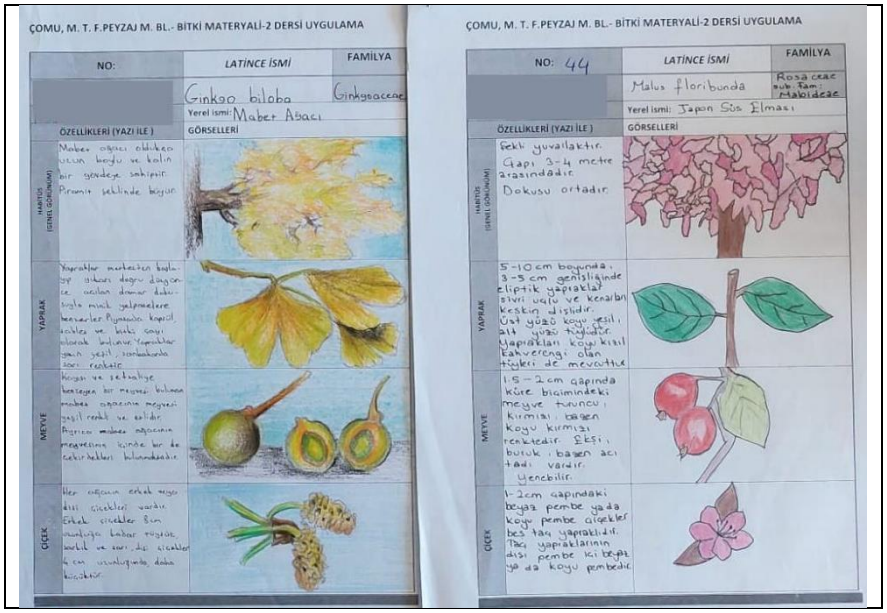
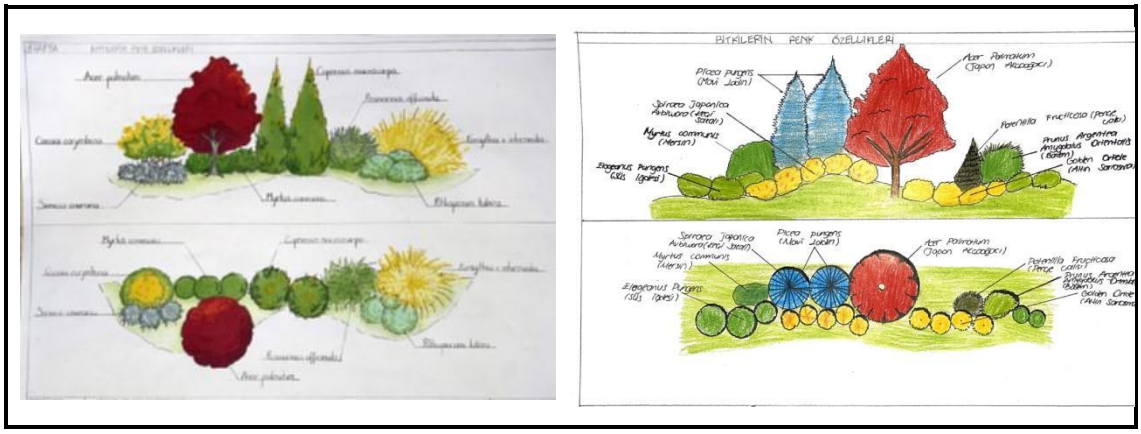


Fig. 3. *Drawing examples of herbarium plants within the scope of Plant Material-II courses*

Incorporating herbarium specimens into the design process in the herbal design course is a dynamic and forward-thinking approach in line with the principles of biodiversity, ecological awareness, and education. In this context, some examples of the designs made in the "ÇOMÜ Landscape Architecture" undergraduate education process in the planting design course where herbarium specimens are used for promotion are given in Fig. 4.



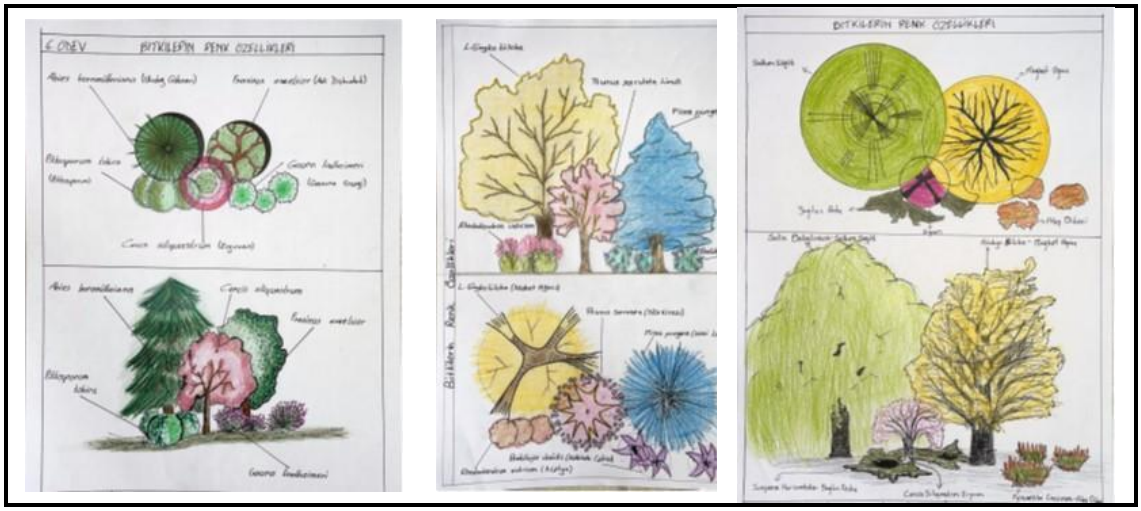


Fig. 4. *Design examples made within the scope of Planting Design courses*

RESULTS

Integrating the use of herbarium into landscape architecture education would efficiently facilitate plant identification and contribute to an integrated and environmentally responsible learning process in various courses. The evolving nature of this field allows students to gain a comprehensive education beyond conventional limits, thanks to the diverse advantages of engaging with herbariums. Landscape architects serve as both stewards of the natural environment and creators of designs, with the primary responsibility of ensuring that the spaces they develop perfectly align with the surrounding ecosystem. It is crucial for them to have a thorough understanding of their plant materials, which form the foundation of their work. The herbarium serves as a significant instrument in achieving this goal.

Herbarium specimens are great educational aids as they offer a tactile and visual picture of plant diversity. Herbarium studies provide landscape architects with practical skills in plant identification and biodiversity conservation, enabling them to make well-informed judgments in their designs. This proficiency guarantees that their designs not only fulfil aesthetic objectives but also enhance ecological well-being and adaptability. Students will enhance their creative abilities by incorporating herbarium specimens into their designs as part of their landscape architecture course.

Simultaneously, the utilization of the herbarium offers research prospects for the department and promotes a sense of accountability in students. Through active engagement in projects aimed at enhancing an understanding of indigenous plant life and ecological systems, students develop a heightened awareness of sustainable behaviors. This comprehensive approach enables students to anticipate and adapt to the evolving demands of our globe.

To summarise, herbariums are a crucial resource for educating a new generation of landscape architects dedicated to promoting ecosystems' long-term viability. Upon commencing their professional journeys, these students' education centered around herbariums will showcase their sagacity in designing environments that are in sync with the natural surroundings. They will also embrace a comprehensive perspective that considers both communities and ecosystems while adopting a sustainable and enduring approach. In the future, individuals will have the ability to independently establish

herbariums to preserve the botanical knowledge they acquire during their education. The herbarium will serve as the crucial connection between education, design, and the sustainable future of landscapes.

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REFERENCES

[1] Öztan, Y. (2004): Yaşadığımız Çevre ve Peyzaj Mimarlığı, Ankara, ISBN: 975-96507-
[2] 3-8.
[3] Pamay, B. (1979): Park-Bahçe ve Peyzaj Mimarisi, İ.Ü. Orman Fakültesi Yayınları, İ.Ü. Yayın No: 2486, O.F. Yayın No: 264, İstanbul.
[4] Funk, V., A. (2018): Collections-based science in the 21st Century. Journal of Systematics and Evolution, 56 (3), 175-193.
[5] Özer, Z., Tursun, N., Önen H., Uygur, F. N. and Erol, D. (1998): Herbaryum Yapma Teknikleri ve Yabancı Ot Teşhis Yöntemleri. Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Yayınları No:22 Kitaplar Serisi No:12, Tokat.
[6] Baytop, A. (2004): Türkiye'de Botanik Tarihi Araştırmaları. Tübitak Yayınları / Akademik Dizi;3, Ankara.
[7] Geven, F., Bingöl, Ü., and Güney, K. (2008): ANK Herbaryum'u Polygonaceae Familyasının Revizyonu ve Veritabanının Hazırlanması. Kastamonu Univ., Journal of Forestry Faculty, 8(1): 67-85.
[8] Müller-Wille, S. (2006): Linnaeus' herbarium cabinet: a piece of furniture and its function. Endeavour, 30(2), 60-64.
[9] Özkul, P., Kaynakçı Elinç, Z., Göktürk, R., S., and Aykurt, C. (2020): Herbaryumlar için Tasarım Önerisi: Akdeniz Üniversitesi Herbaryumu Örneği. International Journal of Engineering, Design and Technology 2(1): 24-30.
[10] Uma, M., M. (2010): Bitki Toplama, Teşhis ve Herbaryum Teknikleri, Yüksek Lisans Tezi, Çukurova Üniversitesi Fen Bilimleri Enstitüsü.
[11] Erduran Nemutlu F. and Karabacak E. (2019): The Importance of Using Design Plants in University Campus: COMU Case. International Journal of Landscape Architecture Research, 3(2): 55-59.