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Phyllanthaceae Familyası Yeni Cins (*Phyllanthus* L.) Kaydı: Türkiye Damarlı Bitkilerine İstilacı Yabancı bir İlave

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ÖZET

Phyllanthus L. cinsi ve *P. tenellus* Roxb. (Phyllanthaceae) türü, Türkiye florası için yeni kayıt olarak verilmektedir. Bitkinin Türkçe adı sera nohutu olarak önerilmektedir. Türkiye'de seralarda istilacı yabancı bir ot olan bitkinin tanınmasını kolaylaştırmak üzere teknik çizimi ve fotoğrafları sunulmaktadır. Cinsin ve türün detaylı betimleri de verilmektedir. Türün örnekleri, KTÜ Orman Fakültesi araştırma ve uygulama serası ile Orman Genel Müdürlüğü, Of Orman Fidanlığı seralarından toplanmıştır. KD Anadolu, nemli iklimi nedeniyle pek çok yabancı bitki taksonuna ev sahipliği yapmaktadır. Son yıllarda yapılan çalışmalar, bu bölgeden çok sayıda yabancı bitki taksonunun Türkiye florasına kaydedildiğini vurgulamaktadır.

Botanik

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Phyllanthus
Phyllanthaceae

A New Generic Record of Phyllanthaceae (*Phyllanthus* L.): Addition to the Alien Invasive Vascular Flora of Türkiye

ABSTRACT

In this study, the genus Phyllanthus L. and its species P. tenellus Roxb. (Phyllanthaceae) are reported as a new record for the flora of Türkiye. The Turkish name of the species is suggested as sera nohutu (greenhouse chickpea). Technical drawings and photographs are given to facilitate the identification of the plant, which is an invasive weed in greenhouses in Türkiye. A description of the genus and species are also provided in detail. Specimens of the species were collected from research and application the greenhouse of the Faculty of Forestry in Karadeniz Technical University (KTÜ) and Of Forest Nursery Directorate greenhouses. NE Anatolia hosts many alien plant taxa, primarily due to its humid climate. Recent studies highlighted that many alien plant taxa have been recorded in the flora of Türkiye from this region.

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INTRODUCTION

Despite different types of greenhouses, in general, they are special structures which are designed in order to regulate especially the temperature and humidity of the environment inside and they are usually associated with horticulture and the exhibition of both native and exotic plants. Thus, they are centers of the introduction of alien plant species and potentially may become sources of dispersion of some taxa (Galera & Ratyńska, 1999). In Türkiye, the studies on the weed of greenhouses are very limited in that they are generally on determining yield loses in crops (Arslan et al., 2012; Torun, 2022). In addition to causing yield and labor loss, early detection and rapid response of invasive alien species is important in terms of protecting biodiversity. As in the present study, early detection of non-native (alien, introduced, adventive) plant species' intentional or unintentional introduction is the first step of such studies.

The genus *Phyllanthus* L. is not represented in the native vascular flora of Türkiye and is a member of the family Euphorbiaceae, one of the largest families of flowering plants. This family islately divided into three families such as Euphorbiaceae, Phyllanthaceae, and

Picrodendraceae (Chase et al., 2002). Hereafter, *Phyllanthus* is a member of Phyllanthaceae which is pantropical and the second-most species-rich family segregated from Euphorbiaceae (Bouman et al., 2021) with approx. 2000 species (Kullayiswamy et al., 2021) and some 59 genera (Hoffmann et al., 2006; Serdar et al., 2008) worldwide. Phyllanthaceae has already been divided into seven subgenera (*Kirganelis*, *Isocladus*, *Emblica*, *Phyllanthodendron*, *Eriococcus*, *Xylophylla* and *Phyllanthus*) and the subgenus *Phyllanthus* comprise the two sections; *Phyllanthus* and *Urinaria* (Chakrabarty & Balakrishnan, 2018; Kullayiswamy et al., 2021).

Phyllanthaceae is known with 2 native genera in Turkish vascular flora such as *Andrachne* L. and *Flueggea* Willd. (Güner et al., 2012). The present paper underlined that by adding the new genus, *Phyllanthus* L., the number of genera of Phyllanthaceae of Flora of Türkiye reached three. *Phyllanthus* is represented throughout the tropical and subtropical regions of the world (Webster, 1957; Wu et al., 2008; Bouman et al., 2018). The genus, with almost 900 species, is the largest and highly diverse genus in the family Phyllanthaceae (Goaverts et al., 2000). The word *Phyllanthus* comes from two Ancient Greek words "phyllon" and "anthos" (mean leaf and flower respectively) they refer to the appearance of flowers from the edge of the leaves (Pasha et al., 2013). Many of the *Phyllanthus* species share a distinctive vegetative specialization known as "phyllanthoid branching" with leaves on the main stem reduced to scale-like leaves (cataphylls), lack laminate leaves on the main stem (Webster, 1956; Kathriarachchi, 2006; Ralimanana & Cable, 2020).

Phyllanthus tenellus Roxb. is native to Angola, Comoros, Madagascar, Mauritius, Mozambique, Réunion, SW. Arabian Peninsula, Tanzania, Yemen, and Morocco, and regarded as a naturalized plant in more than 30 countries (Figure 1). Due to its rapid flowering and explosively dehiscent fruits, it is able to become invasive out of its natural distribution range in at least 30 countries (POWO, 2024; Khamar et al., 2022). Other than its native lands, this taxon occupies different habitats such as forest margins, forest clearings, and cultivated lands (Coode et al., 1982), 0-2050 m above sea level in Madagascar (Ralimanana & Hoffmann, 2011).

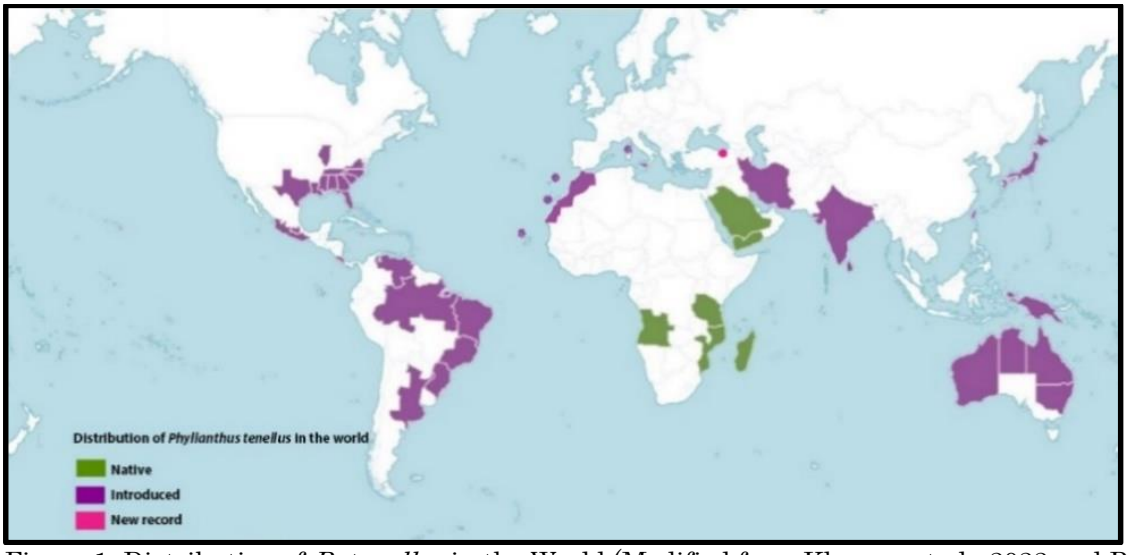

Figure 1. Distribution of *P. tenellus* in the World (Modified from Khamar et al., 2022 and POWO, 2024).
Şekil 1. P. tenellus'un Dünyadaki yayılışı (Khamar et al., 2022 ve POWO, 2024'den uyarlanmıştır).

The new record genus and its species, an invasive greenhouse weed, record reported here which has not been reported yet from Türkiye prior to the present paper.

MATERIAL and METHOD

The studied materials of *P. tenellus* were collected from different propagation greenhouses in Trabzon province located in NE Anatolia. All specimens were stored at KATO Herbarium (in Karadeniz Technical University, Faculty of Forestry) in Trabzon. After careful examination of the collected materials of *Phyllanthus* (KATO: 24451!, 24452! and 24453!), which were collected from A7 (Karadeniz Technical University, Kanuni Campus in Ortahisar District) and A8 (Forest Nursery in Of District) Trabzon province, and checking with proper literature (Webster, 1957, 1970; Ralimanana & Hoffmann 2011; Crisafulli et al., 2011; Zare et al., 2015; Khamar et al., 2022), *P. tenellus* was determined as a new alien greenhouse weed record for the flora of Türkiye.

RESULTS and DISCUSSION

Webster (1956) underline that the main characters used to distinguish the present genus from other 59 genera of the family are the apetalous flowers, absence

of pistillodes and staminodes and the presence of a disc or disc glands in the flowers and branching (phyllanthoid) system. This genus, which is morphologically diverse, shows many differences in terms of flowers, seeds and habit.

Phyllanthus L., Sp. Pl. 2: 981. 1753.

Type: *P. maderaspatensis* L.

The description of the genus below is based on the treatments of Wu et al. (2008), Ralimanana & Hoffmann (2011), and Pasha et al. (2013).

Trees, shrubs, or herbs phyllanthoid branching present or absent; mostly monoecious; glabrous or with simple hairs. Simple leaves petiolate or sessile; alternate, opposite, subopposite or spirally arranged, entire, sometimes revolute, usually symmetric, often reduced and scale-like on main stems; stipules small, deciduous or persistent; venation pinnate. Stipules varied, entire to fimbriate. Inflorescences are usually axillary, on leafy branches; pedicels delicate, bracteols 2 per flower. Flowers pedicellate, glabrous in both sexes; pedicels terete, tepals 5–6. Male flowers: sepals imbricate; filaments entirely free, apetalous; disk glands 3–6, various shapes; stamens 2–6; filaments free or connate; pistillodes absent. Female flowers: sepals as in male or more; disk glands free or connate into an annulus, surrounding ovary; ovary usually 3–loculed; styles 3, short, free or shortly connate, bifid. Fruit is usually a dehiscent, globose capsule, occasionally baccate or drupaceous. Seeds 2 per locule, trigonous; surface smooth, sculptured, or striate.

Recommended Dichotomous Key to Genera of Phyllanthaceae in Türkiye

Adding the genus *Phyllanthus*, the number of genera of *Phyllanthaceae* in Turkish flora reached three and a new key to genera was recommended for the Flora of Türkiye as seen below:

1. Monoecious or dioecious, shrubs or herbs (in Türkiye); flowers apetalous

2. Leafy branches resembling pinnate leaves (phyllanthoid); male flowers without pistillode; stamens 2-6 and shorter than sepal ..... **Phyllanthus**

2. Shoots never resembling pinnate leaves; male flowers with pistillode; stamens 4-7 and clearly longer than sepal ..... **Flueggea**

1. Monoecious, subshrubs or perennial herbs (in Türkiye); flowers with developed petals ..... **Andrachne**

Phyllanthus tenellus Roxb. Flora Indica 2(3):668 (Roxburgh, 1832). Type: India. Calcutta, Wallich 7892 A, Figure 2.

Syn.: *Phyllanthus brisbanicus* F. M. Bailey, *Diasperus tenellus* (Roxb.) Kuntze, *D. corcovadensis* (Müll. Arg.) Kuntze (Crisafulli et al., 2011)

Common names: Mascarene Island leaf flower, Long-stalked *Phyllanthus*, Long stalked leaf flower.

Description: Monoecious, annual herb, up to 50 cm in height. Somewhat woody at base (in Türkiye), glabrous plant. Stem smooth with spirally arranged cataphylls; phyllanthoid branching, branches terete and striate. Cataphylls and cataphyllary stipules triangular, entire, glabrous. Stipules entire, persistent, membranous, triangular, glabrous. Leaves 7 – 15 per branch, elliptic to ovate, acute or obtuse at the tip, 6 – 10 × 3 – 9 mm, petioles terete, glabrous. Cymules axillary on deciduous branchlets; inflorescence with 1-2 male flowers and 1 female flower on proximal parts or 1 female flower on distal parts of plagiotropic branches. Pedicels of staminate flowers up to 1.5 mm; calyx lobes 5, entire, l-veined, whitish, stamens 5 and entirely free, filaments ca. 0.2-0.3 mm long; disc glands 5. Pedicels of pistillate flower (2.5-) 3-8 mm; calyx lobes 5, ovate, acute or obtuse; disk entire; ovary smooth; styles free, spreading. Capsules depressed globose or globose, greenish, glabrous, 1.7-1.9 mm broad, seed pale brown, densely papillose, 0.8-0.9 mm.

Type: India. Botanic Gardens, Calcutta, *Wallich 7892 A ex p.* (holotype K).,

Turkish Name: Sera nohutu (The new scientific Turkish name suggested according to the guide of Menemen et al., (2016)).

Collected localities: A7 Trabzon – Ortahisar District, Kanuni Campus, Research and application greenhouse of Faculty of Forestry in KTÜ, 60 m, 05.06.2024, KATO 24451!; Drawn specimen (figure 2), ibid!, KATO 24452!; A8 Trabzon – Of District, General Directorate of Forestry, Greenhouses of Of Forest Nursery, 6 m. 15.06.2024, KATO 24453!, (Figure 3, 4).

Because of its distribution in greenhouses in Türkiye, pot soil is an important vector for easily dispersing diaspores of the species, and especially the lower altitudes of the Eastern Black Sea region of Türkiye are at risk of easy invasion. Furthermore, this region has extremely appropriate climate condition for the species which easily grows in forest clearings or margins, and cultivated fields (Coode et al., 1982) and the species is eager to moderate temperature.

While the time and vector of introduction into Trabzon province are uncertain, it could have probably been disseminated by pot soil of both many ornamental and fruit (blueberry) plants commonly produced and used in the region. Due to reports of its naturalization in Italy (Crisafulli, 2011), Iran (Zare et al., 2015), Sumatera (Hariri et al., 2020), Morocco (Khamar et al., 2022), with more than 30 other countries (POWO, 2024), the distribution of *P. tenellus* in NE Anatolia is not surprising. While the species is indicated as an invasive taxon both in agricultural areas and nurseries, some records showed that it is able to be introduced in urban areas (Crisafulli, 2011; Hariri et al., 2020).

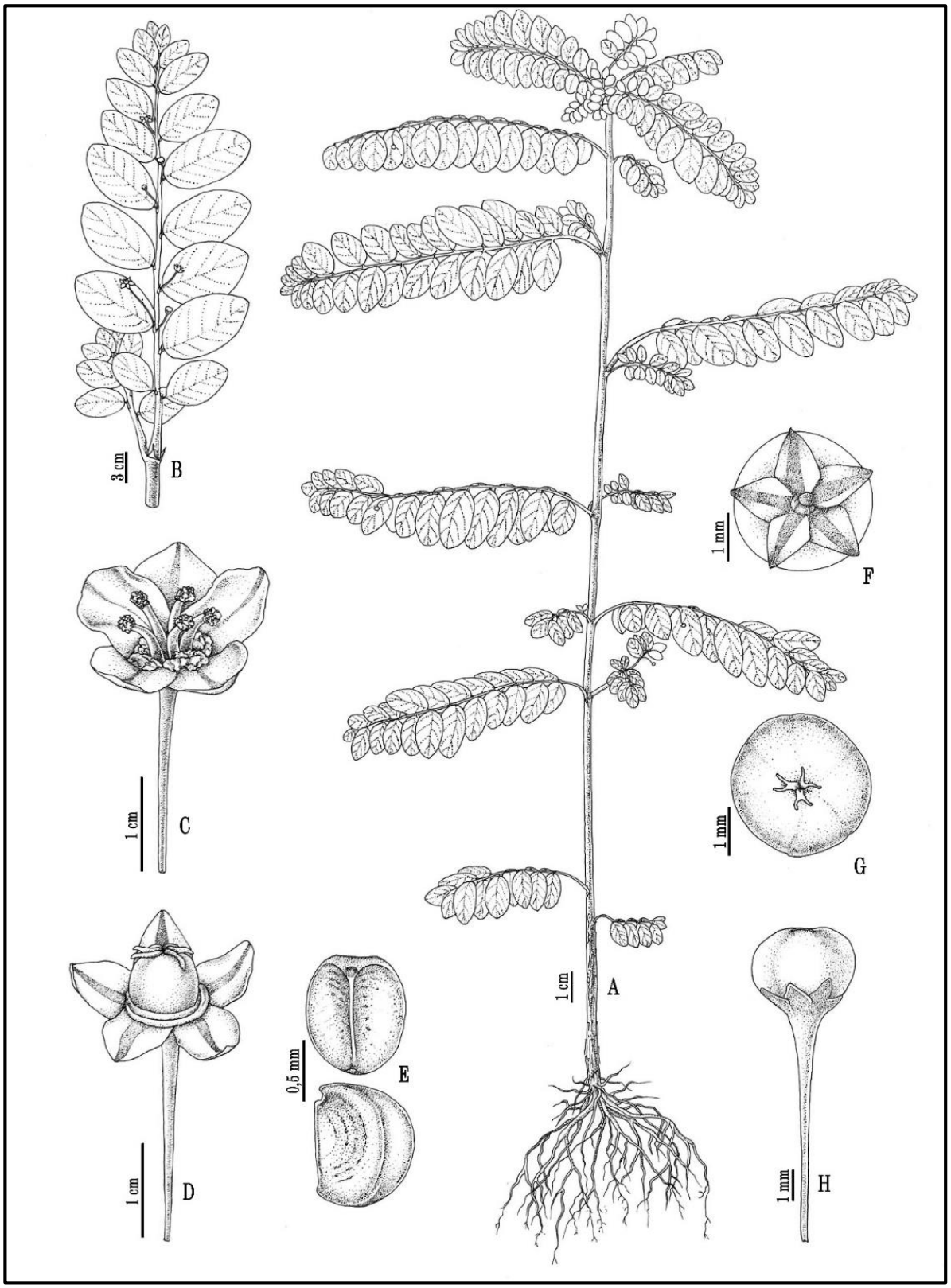

Figure 2. *Phyllanthus tenellus*: A–Habit; B–Branches and leaves with stipule and phyllodium; C– Staminate flower; D– Pistillate flower; E–Seeds (ventral (up) and lateral (down) views); F, G, H–Fruit (back, top and side view, respectively) (Drawing by Melike Çiğdem).

Şekil 2. Phyllanthus tenellus: ***A****–Bitkinin habitusu;* ***B****–Kulakçık ve stipullu dallar;* ***C****– Erkek çiçek;* ***D****– Dişi çiçek;* ***E****–Tohumlar (üstte karın ve altta yan taraf görünümü);* ***F****,* ***G, H****– Meyve görünümleri (sırasıyla; sırt, üst ve yan) (Melike Çiğdem tarafından çizilmiştir).*

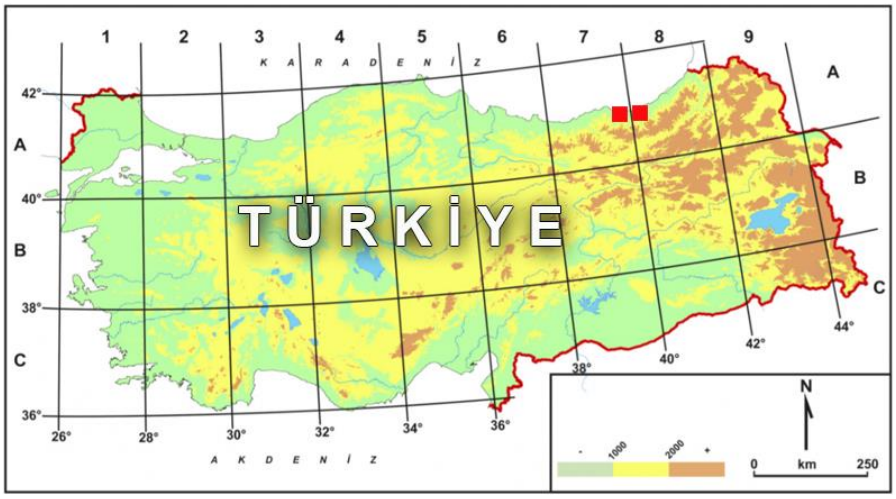

Figure 3. Distribution of *P. tenellus* (■) in Türkiye (Adapted from Güner & Ekim, 2014).
Şekil 3. P. tenellus (■)'un Türkiye'deki yayılışı (Güner ve Ekim, 2014'den uyarlanmıştır).

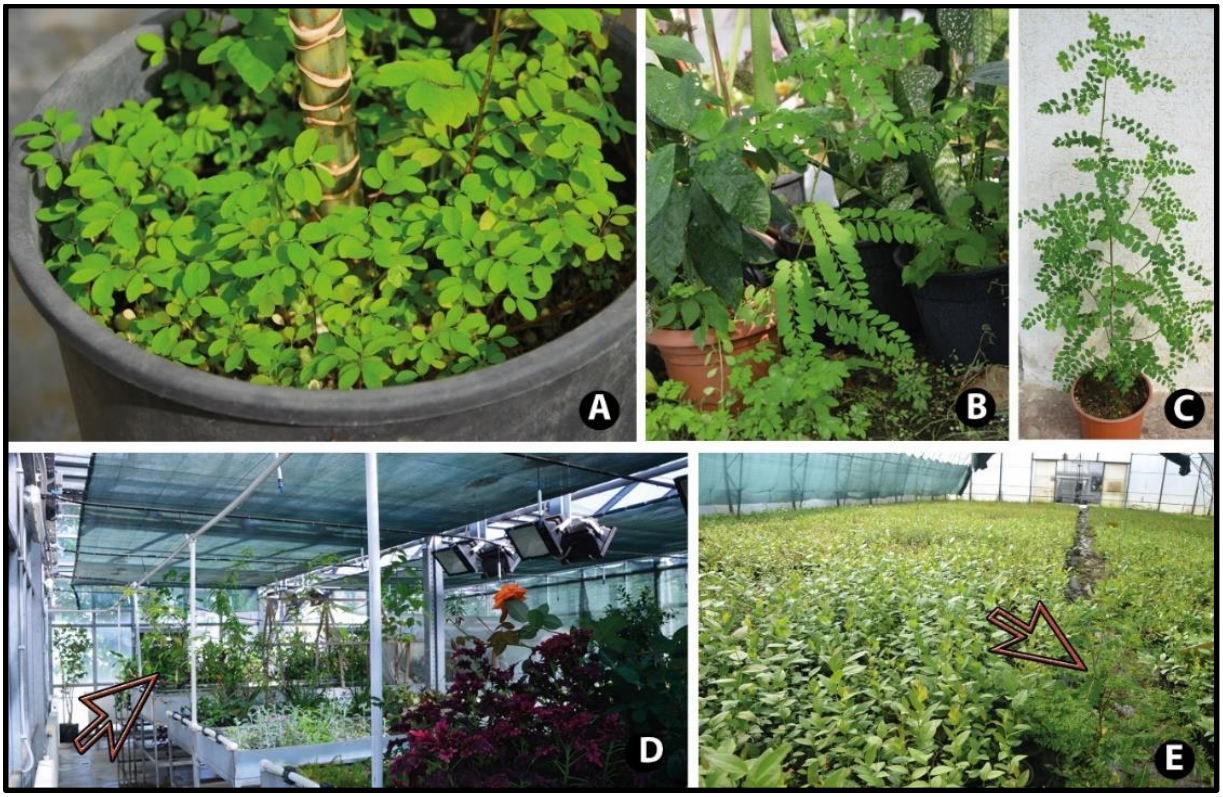

Figure 4. **A**, **B** – Individuals in different pots with different ornamental exotic plants in the greenhouse; **C** – An individual in the pot of a dead blueberry seedling; **D** – In the greenhouse bench in KTÜ; **E** – Together with blueberry seedlings in Of Forest Nursery.

*Şekil 4. **A, B** – Serada farklı egzotik süs bitkileri ile farklı saksılardaki bireyler; **C** – Ölü bir maviyemiş fidesi saksısındaki bir birey; **D** – KTÜ'de sera tezgahlarında; **E** – Of Orman Fidanlığında maviyemiş fidanlarıyla birlikte.*

Unfortunately, in the Eastern Black Sea Region, the weather is rainy throughout the year, which is suitable for this species to be carried out of greenhouses unintentionally and introduced into the natural places. Furthermore, diaspores may be dispersed quickly by the blueberry pots distributed/sold by Of Orman Nursery. For this reason, cleaning *P. tenellus*, already a weed of greenhouses in Türkiye, seedlings pots, and eradicating individuals of the species in greenhouses before seed/fruit maturation will be an important weed control activity before its distribution.

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Conflict of Interest

The author declares that he has no conflict of interest.

REFERENCES

Arslan, Z.F., Aksoy, E. & Uygur, N. (2012). Effect of solarization on weeds in greenhouse tomatoes and tomato yield in East Mediterranean region of Turkey. *Plant Protection Bulletin, 52(4)*, 349–366.

Bouman, R.W., Keßler, P.J.A., Telford, I.R.H., Bruhl, J.J., Strijk, J.S., Saunders, R.M.K. & Van Welzen, P.C. (2021). Molecular phylogenetics of *Phyllanthus* sensu lato (Phyllanthaceae): Towards coherent monophyletic taxa. *Taxon, 70(1)*, 72–98.

Bouman, R.W., Keßler, P.J.A., Telford, I.R.H., Bruhl, J.J. & Van Welzen, P.C. (2018). Subgeneric delimitation of the plant genus *Phyllanthus* L. (Phyllanthaceae). *Blumea, 63*, 167–198.

Chakrabarty, T. & Balakrishnan, N.P. (2018). Indo-Burmese Phyllanthaceae - A taxonomic revision. Bishen Singh Mahendra Pal Sing, Dehradun, India, 194 pp.

Chase, M.W., Zmarzty, S., Lledó, M.D., Wurdack, K.J., Swensen, S.M. & Fay, M.F. (2002). When in doubt, put it in Flacourtiaceae: a molecular phylogenetic analysis based on plastid rbcL DNA sequences. *Kew Bulletin, 57*, 141–181.

Coode, J.E, Radliffe-Smith A. & Scott, A.J. (1982). Euphorbiaceae. In: Flore des Mascareignes, La Réunion, Maurice et Rodrigues. 153–160-ème famille (Lauraceae à Euphorbiaceae). The Sugar Industry Research Institute, Mauritius / L'office de la recherche scientifique et technique outre-mer, Paris / the Royal Botanic Gardens, Kew, 1–32.

Crisafulli, A., Picone, R.M. & Zaccone, S. (2011). *Phyllanthus tenellus* (Phyllanthaceae) a new alien species naturalized to Sicily, first record for Italy. *Flora of Mediterranean 21,* 293–297.

Galera, H. & Ratyńska, H. (1999). Greenhouse weed in the botanical garden of Pas in Warsaw-Powsin. *Acta Societatis Botanicorum Poloniae. 68(3)*, 227–236.

Govaerts, R., Frodin, D. G. & Radcliffe–Smith, A. (2000). World checklist and bibliography of Euphorbiaceae (with Pandaceae). Vols: 1–4. Royal Botanic Gardens, Kew.

Güner, A., Aslan, S., Ekim, T. & Babaç, M.T. (2012). Türkiye Bitkileri Listesi (Damarlı Bitkiler). Nezahat Gökyiğit Botank Bahçesi ve Flora Araştırmaları Derneği Yayını, İstanbul.

Güner, A. & Ekim, T. (Edit.). (2014). Resimli Türkiye Florası, cilt 1. İstanbul: NGBB Yayınları Flora Dizisi 2, Flora Araştırmaları Derneği ve Türkiye İş Bankası Kültür Yayınları.

Hariri, M.R., Irsyam, A.S.D. & Mountara, A. (2020). *Phyllanthus tenellus* Roxb. (Phyllanthaceae): a new record to the flora of Sumatera. *Jurnal Ilmiah Biologi Eksperimen Dan Keanekaragaman Hayati, 7 (2)*, 19–24.

Hoffmann, P., Kathriarachchi, H. & Wurdack, K.J. (2006). A phylogenetic classification of Phyllanthaceae (Malpighiales; Euphorbiaceae sensu lato). *Kew Bulletin, 61,* 37–53.

Kathriarachchi, H., Samuel, R., Hoffmann, P., Mlinarec, J., Wurdack, K.J., Ralimanana, H & Stuessy, T.F. (2006). Phylogenetics of Tribe Phyllantheae (Phyllanthaceae; Euphorbiaceae Sensu Lato) Based on nrITS and Plastid matDNA Sequence Data. *American Journal of Botany*, *93 (4),* 637–655.

Khamar, H., Benkhnigue, O., Douira, A., Zidane, L. & Touhami, A.O. (2022). *Phyllanthus tenellus* Roxb. (Phyllanthaceae), a newly naturalising species in Morocco. *Check List, 18 (2)*, 411–417.

Kullayiswamy, R.K., Devi, S.N. & Karanth, K.P. (2021). *Phyllanthus palakondensis* sp. nov. (Phyllanthaceae) from Eastern Ghats of Andhra Pradesh, India. *Nordic Journal of Botany*, e03319.

Menemen, Y., Aytaç, Z., Kandemir, A. (2016). Türkçe Bilimsel Bitki Adları Yönergesi. *Bağbahçe Bilim Dergisi,* 3: 1-3 (in Turkish).

Pasha, M.K., Chakrabarty, T. & Balakrishnan, N.P. (2013). A taxonomic revision of *Phyllanthus* L. (Euphorbiaceae) in Bangladesh. *Journal of Economics and Taxonomic Botany, 37(2)*, 291–304.

POWO, (2024, July 5). Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet: https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names: 354756–1.

Ralimanana, H. & Hoffmann, P. (2011). Taxonomic revision of *Phyllanthus* (Phyllanthaceae) in Madagascar and the Comoro Islands I: synopsis and subgenera Isocladus, Betsileani, Kirganelia and Tenellanthus. *Kew Bulletin, 66 (3)*, 331–365.

Ralimanana, H. & Cable, S. (2020). Taxonomic revision of *Phyllanthus* (Phyllanthaceae) in Madagascar and the Comoro Islands IV: subgenus Anisonemoides section Pseudogomphidium and incertae sedis. *Kew Bulletin,* 75 (4), id. 64.

Roxburgh, W. (1832). Flora Indica, 1-3. – Calcutta, London.

Serdar, B., Hayden, W.J. & Terzioğlu, S. (2008). Wood anatomy of *Flueggea anatolica* (Phyllanthaceae). *IAWA Journal, 29 (3)*, 303–310.

Torun, H. (2022). Weed Species, Densities and Frequency Determination of the Greenhouse Tomato and Pepper Production Areas in Adana and Mersin Provinces (Sözlü bildiri). 2nd international congress of engineering and natural sciences studies, Ankara, Türkiye, May 07-09 2023, pp. 329–

336.

Webster, G. L. (1956). A monographic study of the West Indian species of *Phyllanthus*. *Journal of the Arnold Arboretum, 37*, 91–122.

Webster, G.L. (1957). A monographic study of the West Indian species of *Phyllanthus*. *Journal of the Arnold Arboretum, 38*, 51–80.

Webster, G.L. (1970). A revision of *Phyllanthus* (Euphorbiaceae) in the continental United States. *Brittonia, 22*, 44–76.

Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.) (2008). Flora of China 11: 180–190. Missouri Botanical Garden Press, St. Louis.

Zare, H., Amini, T. & Zare, M. (2015). *Phyllanthus tenellus* (Euphorbiaceae), a new record and naturalized species in Mandazaran. *The Iranian Journal of Botany, 21 (2)*, 129–132.