A new subspecies of *Phoenix theophrasti* Greuter (Phoenix *theophrasti* Greuter subsp. *golkoyana* Boydak) from Turkey

*Phoenix theophrasti* Greuter türünün Türkiye’de tanımlanan yeni bir alttürü (*Phoenix theophrasti* Greuter subsp. *golkoyana* Boydak)

Melih Boydak

Department of Landscape Architecture, Işık University Faculty of Fine Arts, 34398, Istanbul, Turkey

**ABSTRACT**

In the present study, a new subspecies (*Phoenix theophrasti* Greuter subsp. *golkoyana* Boydak) is described in Turkey. The unidentified *Phoenix* taxon native to Bodrum–Gölköy, Aegean Turkey and named as the “Gölköy *Phoenix* population” has been known to Gölköy’s inhabitants for centuries. The Gölköy *Phoenix* population was considered to be representative of *P. theophrasti*. Boydak made the first of a number of trips to Gölköy and immediately noticed some distinct differences between the Gölköy *Phoenix* population, *P. theophrasti* Greuter, and *Phoenix dactylifera* L. in the early summer of 1990. He continued his investigations on this taxon for many years to shed light on the subject. He made two new trips to the three native stands of *P. theophrasti* and the Gölköy *Phoenix* populations in 2015 and 2018. Measurements and observations were made on the morphological characteristics that showed distinct differences among the Gölköy *Phoenix* population, *P. theophrasti*, and *P. dactylifera*. These were related to the length of male stalks and female inflorescences and some fruit and seed characteristics. The results indicate that some distinctive morphological characteristics of the "Gölköy *Phoenix* population" merit its being described as a new subspecies. "*Phoenix theophrasti* Greuter subsp. *golkoyana* Boydak" differs from *P. theophrasti* Greuter with respect to its longer fruiting-female stalk length and longer male stalk length, its fruiting stalks hold fruits marginally higher, and its having seeds with slightly visible striate surface crust structures and deeper-wider grooves.

**Keywords:** A new subspecies, Bodrum–Gölköy, *Phoenix theophrasti*

**INTRODUCTION**

Turkey is one of the most important floral regions in the world, with >11,707 taxa of herbaceous and woody species, of which 3035 are endemic (Güner et al., 2012). The rich vegetation in Turkey is because of its geographic location and topography, leading to different climate and subclimate types (Boydak and Çalışkan, 2014; Çalışkan and Boydak, 2017). Many new taxa were described in recent years.
Phoenix theophrasti Greuter and Phoenix dactylifera L. are in the genus Phoenix L. (Barrow, 1998). The genus Phoenix L. (Phoeniceae: Coryphoideae) belongs to the order Principes (Aracales) and the family Palmea (Arecales) (Uhl and Dransfield, 1987).

P. theophrasti was first described by Greuter in 1967 from the famous grove at Vai in Crete (Greuter, 1967). The species is now known from nine coastal localities on the same island (Barclay, 1974; Turland et al., 1993), where it is possible to find it growing along damp valley floors, streamsides, springs, and coastal rocks and cliffs, in all cases by the seashore and from 0 to 230 m altitude (Figure 1). Greuter (1967) remarked that the “Cretan Date Palm” had been known since Classical antiquity, when it was recorded in the Theophratus’ writings. Many of them thought that it was an escaped cultivar of the Date Palm, P. dactylifera (e.g., Zohary, 1973). On the other hand, Greuter considered the Cretan palm to be a different species. He named it P. theophrasti on behalf of the Greek botanist-philosopher (Greuter, 1967).

The family Palmea was not known to occur naturally in Turkey until the first occurrence of P. theophrasti was recorded in the Datça Peninsula in 1982 (Boydak and Yaka, 1983; Boydak, 1985). The second occurrence was found in Kumluca–Karaöz in Finike Bay (Boydak, 1987). Another unidentified Phoenix taxon native to Bodrum–Gölköy–Aegean Turkey and named as the “Gölköy Phoenix population” was found later (Boydak and Barrow, 1995) (Figure 1).

Several species of the genus Phoenix, some other members of Palmae (P. dactylifera, Phoenix canariensis, Phoenix roebelenii, Trachycarpus fortunei, Chamaerops humilis, Washingtonia robusta, W. filifera, and Syagrus romanzoffiana), and some other palms are being cultivated in the Mediterranean and Aegean areas of Turkey (Esener, 1999; Hazir and Buyukozturk, 2013). P. dactylifera is cultivated for fruits and ornamental purposes, whereas others are generally cultivated for ornamental purposes.

Greuter (1967), quoting from Evreinoff (1956), wrote that fossil research revealed that some members of the genus Phoenix were identified in central Europe Miocene formations, around the Aegean coastal regions, and also found in Pleistocene formations. The characteristics of the fossil form P. dactylifera fossils...
Drude were found to be very similar to the characteristics of the date palm *P. dactylifera* L.

Recent investigations in new early Miocene fossil forest sites (18–20 million years ago) in northwest Turkey–Bolu–Seben (900 m) revealed the first record of silicified palm wood in Turkey (Akkemik et al., 2016). Later, this palm wood and three more unpublished Neogene palm fossil woods (two from Çanakkale–Göççeada and one from Edirne–Keşan–Erikli) were studied by Iamandei et al. (2018). The palm woods were identified as *Pal-moxylon coryphoides* Ambwani & Mehrotra from Göççeada, *Pal-moxylon* cf. *Trachycarpus* from Seben, and *Palmoxylon* cf. *Borasus* from Erikli (Iamandei et al., 2018).

Greuter (1967) and Zohary (1973) accepted that *P. dactylifera* had its origin in the mid-eastern hot deserts. According to Zohary (1973), these assumptions are consistent with Fischer and Beccari (1890). He also stated that this supposition of the date palms' Irano-Arabian origin is very consistent with the fact that the Sumerians are the source of the earliest evidence on date cultivation. However, he admits that this does not eliminate the possibility of an ancestral relationship between the cultivated date palm and *P. theophrasti*.

Nevertheless, the Phoenix taxon indigenous to the coastal plains in southern Iran and Iraq at the locations of Sharqa, Bander Abbas, and Basra was described as a wild form of *P. dactylifera* by Fischer (1881; in Greuter, 1967). It was stated that more research was necessary to determine if this taxon is actually *P. theophrasti* (Zohary, 1973). Barrow (1998) explained that *P. dactylifera* and *P. theophrasti* are difficult to differentiate on the basis of morphological and anatomical data. The author also added that molecular data supported the two species as close sisters; however, the author also accepted *P. theophrasti* as a different species when considering certain morphological features. Comprehensive research based on multiloci fingerprints supported the existing taxonomy, since all individuals from the same species clustered together. Specifically, *P. dactylifera*, *P. theophrasti*, and *Pinus sylvestris* were accepted as comprising the “*P. dactylifera* clade.” The related species *P. atlanta* and *P. canariensis* appeared highly distinct from each other, with few or no alleles being mutual. These results showed that the date palm was preliminarily domesticated from wild populations of *P. dactylifera*, with only secondary and localized genetic contributions from other species (Pintaud et al., 2010).

*P. theophrasti* is distinguished from *P. dactylifera* by its erect fruit clusters and small, inedible fruits (Anon., 1983; Greuter, 1967). Both *P. theophrasti* and the Gölköy Phoenix population have sweet but in general thinner mesocarps. Turland et al. (1993) noted that *P. theophrasti* has smaller, shorter, and sharper leaves.
than \( P. dactylifera \). The observations of the author of the present manuscript also suggest that the leaves of \( P. theophrasti \) are sharper than those of the Gölköy Phoenix population.

The unidentified Phoenix taxon native to Bodrum–Gölköy–Aegean Turkey and named as the “Gölköy Phoenix population” has been known to Gölköy’s inhabitants for centuries (Boydak and Barrow, 1995). Bayraktar and Aslanboga (Professors of Landscape Architecture, Ege University) made a visit to the Gölköy Phoenix population in 1989 and thought it was a member of \( P. theophrasti \). Boydak, the author of the current paper, made the first of a number of trips to Gölköy in the early summer of 1990. He instantly recognized certain obvious differences between the Gölköy Phoenix population, \( P. theophrasti \), and \( P. dactylifera \). Samples were given to the Herbarium of Istanbul University, Faculty of Forestry (October 1990) and sent to the Royal Botanic Garden, Edinburgh (December 1990) and Royal Botanic Gardens, Kew (July 1993). Boydak and Barrow visited the Gölköy population and the two indigenous stands of \( P. theophrasti \) in Datça–Eksera Deresi and Kumluca–Karaöz in Finike Bay in April 1994, and they collected more herbarium materials (Boydak and Barrow, 1995). Boydak continued his investigations on this taxon for many years. He made two more trips to the three native stands of \( P. theophrasti \) and the Gölköy Phoenix population in 2015 and 2018, collected further herbarium materials, and delivered them to the Herbarium of the Faculty of Forestry, Istanbul University-Cerrahpaşa (İSTO).

This new Phoenix population is found growing on swampy ground surrounded by the Gölköy Lake, the boundaries of the rapidly growing village of Gölköy, patches of Pinus brutia together with maquis, and the sea. A number of palms are currently included in the gardens of houses built recently (Boydak and Barrow, 1995). The Gölköy Phoenix population primarily covers an area of 3.9 ha according to the management plans of the Turkish Forest Service completed in 2013 (Anon., 2013). There are mainly four Phoenix groves covering 1.2 ha, 1.2 ha, 1.0 ha, and 0.5 ha inside or alongside the bog and/or bordering the village (Figures 2, 3).

Research based on anatomical data indicated a close relationship between \( P. dactylifera \), \( P. theophrasti \), and the Gölköy Phoenix population (Barrow, 1998). Boydak and Barrow (1995) stated that more sampling is necessary for understanding the precise nature of their relationships; however, they noted that morphological characteristics show several differences between the Gölköy palm and \( P. theophrasti \) and \( P. dactylifera \). They discussed whether the Gölköy palm represents a new species or a subspecies or variety of \( P. theophrasti \) and \( P. dactylifera \). As is explained above, Boydak continued his investigations on this taxon for many years to shed light on the subject.

When one sees the population so close to the village, one cannot help but ask if it is natural and native, rather than being the remnants of cultivated date palm grove. Reasons exist to think that it is natural and native. First, the palm yields small fruits that are slightly sweet but seldom fleshy; thus, it does not appear likely that they were planted as a fruit crop. No local record supports its usage as leaf or leaf-based fiber. Second, the population is robust and regenerating successfully by both seedlings

Figure 3. A view from the Phoenix theophrasti Greuter subspecies golkoyana Boydak populations
and suckers (Boydak and Barrow, 1995). Moreover, four Miocene and Neogene palm fossil wood sites representing different taxa were recently recorded in Anatolia, indicating that natural palm groves existed in the past in Anatolia (Akkemik et al. 2016; Iamandei et al., 2018). In addition, the “Gölköy Phoenix population” has been known to Gölköy’s inhabitants for centuries.

The aim of the present study was to investigate the relationship and differences between P. dactylifera, P. theophrasti, and the Gölköy Phoenix populations by comparing some morphological properties, especially those that exhibit distinct differences.

**MATERIAL AND METHODS**

Measurements and observations were made on the morphological characteristics that showed distinct differences among the Gölköy Phoenix population, P. theophrasti, and P. dactylifera.

**Table 1. Male and female inflorescence lengths of the Gölköy Phoenix population**

| Tree no. | Male inflorescence | Female inflorescence |
|----------|---------------------|-----------------------|
|          | Length (cm)         | Length (cm)           |
| 1        | 85                  | 94                    |
| 2        | 73                  | 107                   |
| 3        | 94                  | 91                    |
| 4        | 120                 | 74                    |
| 5        | 114                 | 94                    |
| 6        | 92                  |                        |
| 7        | 68                  |                        |
| 8        | 70                  |                        |
| 9        | 120                 |                        |
| 10       | 83                  | 147                   |

**Table 2. Results of the measurements of the Phoenix theophrasti populations and the Gölköy Phoenix population in Turkey and other measurements cited in the related literature**

| Species and locality | Male stalk length | Female-fruiting stalk length |
|----------------------|-------------------|------------------------------|
|                       | Avenue (cm)       | Avenue (cm)                  |
| P. theophrasti: Datça–Eksera Deresi | Up to 45 cm | Up to 65 cm |
| P. theophrasti: Datça–Hurmalıbük | Up to 50 cm | Up to 70 cm |
| P. theophrasti: Kumluca–Karaöz | Up to 55 cm | Up to 70 cm* |
| Gölköy Phoenix population | Up to 120 cm | Up to 210 cm |
| P. theophrasti (Barrow, 1998) | Up to 40 cm | Up to 70 cm |
| P. dactylifera (Flora of China, 2019) | Up to 100 cm | Up to 200 cm |

| Fruit and seed dimensions | Thickness (mm) | Length (mm) | Thickness (mm) | Length (mm) |
|---------------------------|----------------|-------------|----------------|-------------|
| P. theophrasti: Datça–Eksera Deresi | 11.0 (10–12) | 17.5 (16–20) | 8.9 (8–10) | 15.3 (14–17) |
| P. theophrasti: Datça–Hurmalıbük | 11.6 (10–13) | 18.2 (16–20) | 9.0 (7–10) | 16.0 (14–18) |
| P. theophrasti: Kumluca–Karaöz | 10.3 (8–12) | 15.1 (13–17) | 8.5 (8–10) | 13.1 (11–15) |
| Gölköy Phoenix population | 11.5 (9–15) | 20.8 (16–27) | 8.0 (4–10) | 16.6 (12–21) |
| P. theophrasti: Crete (Greuter 1967) | (8–10) | (14–16) | (6–7) | (8–13) |
| P. theophrasti (Barrow, 1998) | Oblong | 10×15 mm | (6–7) | (11–13) |
| P. dactylifera (Flora of China, 2019) | Oblong 3 cm | 7 cm | | |
| P. dactylifera (Barrow, 1998) | 2–3 cm | 4–7 cm | 5–8 mm | 20–30 mm |

*110 cm on one tree at the edge of the population in a camping area
These were related to the length of male stalks and female inflorescences and some fruit and seed characteristics.

The length of female inflorescences and male stalks of the *P. theophrasti* populations at Datça–Eksera Deresi, Datça–Hurmalıbük, and Antalya–Kumluca–Karaöz and the *Phoenix* population at Bodrum–Gölköy was measured on 15–20 female and 15–20 male trees using a tape measure. The longest female inflorescences and male stalks on each tree were selected for measurement. Observations were also made of the perpendicularity of the male and

---

Figure 4. Male inflorescences of *Phoenix theophrasti* Greuter subspecies *golkoyana* Boydak (a, up to 120 cm, erect) and *P. theophrasti* Greuter (b, up to 55 cm, erect)

Figure 5. Comparison of male inflorescence lengths of *Phoenix theophrasti* Greuter (a) and *P. theophrasti* Greuter subspecies *golkoyana* Boydak (b)
female flower stalks. The Bodrum–Gölköy Phoenix population was on a topographic plane, and so a water tender-sprinkler and ladder were used to reach the samples. Since the topographies were steeply sloped at the Datça–Eksera Deresi, Datça–Humalbük, and Antalya–Kumluca–Karaöz P. theophrasti populations, a portable ladder and long lever shears were used. Owing to the topography and the tree conditions in these populations, the length of some samples could only be estimated by close observations. However, only the direct measurements were considered.

The dimensions of fruits and seeds were measured in the laboratory by micrometer calipers at samples of hundred seeds for each Phoenix population. Equal numbers of fruits from each sampled tree were separated and compiled as one hundred seeds for each population. In addition, the seed surface structures and the shapes of the grooves of seeds were observed.

**RESULTS AND DISCUSSION**

The results of male and female stalk length measurements at the Gölköy Phoenix population were tabulated (Table 1).

As it is shown in Table 1, the maximum male and female stalk lengths are 120 cm and 210 cm at the Gölköy Phoenix population, respectively.
Gölköy Phoenix population has nearly the same male inflorescence lengths as *P. dactylifera* (up to 100 cm, erect) (Figures 4, 5) (Barrow, 1998; Flora of China, 2019).

The length of female inflorescences of the Gölköy Phoenix population is up to 210 cm (female inflorescences erect or arching slightly), which is approximately three times the female inflorescence lengths of *P. theophrasti* (up to 70 cm, erect), but has about the same female inflorescence lengths with *P. dactylifera* (up to 200 cm, erect, becoming pendulous with fruit maturity) (Figures 6, 7). Although the lengths of female inflorescences of the Gölköy Phoenix population and *P. dactylifera* are similar, female inflorescences of the Gölköy Phoenix populations are erect or arching slightly, whereas those of *P. dactylifera* become pendulous with fruit maturity (Barrow, 1998; Flora of China, 2019).

The Gölköy Phoenix population’s fruiting stalks hold fruits marginally higher than *P. theophrasti*. Specifically, the length of the fruiting area of the Gölköy Phoenix population is in general longer than that of female inflorescences together with the fruiting stalk of *P. theophrasti* (Figure 8).

The fruit size of the Gölköy Phoenix population is substantially smaller than that of *P. dactylifera*, but is slightly larger than the fruit sizes of the *P. theophrasti* populations. Moreover, the ranges of both fruit thickness and lengths of the Gölköy Phoenix populations are greater than the fruits of all the *P. theophrasti* populations (Table 2, Figure 9). The fruit size of the Kumluca–Karaöz population is clearly smaller than that of the other *P. theophrasti* populations. However, fruit characteristics were not used as a criteria for the description of new subspecies (Greuter, 1967; Barrow, 1998; Flora of China, 2019).

The seed thickness of the Gölköy Phoenix population is nearly equal to that of *P. dactylifera*. The seed thickness of the Gölköy Phoenix is slightly thinner than that of *P. theophrasti* with the exception that the seed thickness of the Kumluca–Karaöz population is nearly equal to it. In contrast, the seed length of the Gölköy Phoenix population is slightly longer than that of *P. theophrasti* but shorter than that of *P. dactylifera*. Ranges of both seed thickness and length of the Gölköy Phoenix population are greater than the seeds of all the *P. theophrasti* populations (Table 2, Figure 10) (Barrow, 1998; Flora of China, 2019; Greuter, 1967).

The other distinctive characteristics of the seeds of the Gölköy Phoenix population compared with the *P. theophrasti* and *P. dactylifera* populations are explained below.

The seeds of the Gölköy Phoenix population have slightly visible striate or smooth surfaces and deep-wider grooves, whereas those of *P. theophrasti* have clearly visible striate surfaces and shallow grooves. On the other hand, the seeds of *P. dactylifera* have smooth seed surfaces and deeper and wider grooves than those of both the *P. theophrasti* and Gölköy Phoenix populations. One can easily distinguish the seeds of the Gölköy Phoenix population from those of all the *P. theophrasti* populations and *P. dactylifera* trees (Figure 10). Differences in seed characteristics
are accepted as important criteria in taxonomy. These are the most distinctive seed characteristics of the Gölköy Phoenix populations when compared with the seeds of the *P. theophrasti* Greuter and *P. dactylifera* L. populations; therefore, they are used among the criteria for the description of the new subspecies.

The Gölköy Phoenix population and *P. theophrasti* fruits are slightly sweet, but scarcely fleshy. They are not cultivated for fruit productions; however, *P. dactylifera* has fruits that are sweet and fleshy and has been cultivated for many thousands of years for its fruit.

**Evaluations and description of a new subspecies**

As was described above, *P. theophrasti* was distinguished from *P. dactylifera* by its erect fruit clusters and small inedible fruits (Anon., 1983; Barrow, 1998; Greuter, 1967).

The results of this morphological study strongly indicate that various morphological features of the Gölköy Phoenix population appear similar to and/or different from either *P. theophrasti* or *P. dactylifera*. Therefore, the Gölköy Phoenix population merits being described as a new subspecies.

Since the Gölköy Phoenix population has a 50 km distance from the nearest *P. theophrasti* population (Datça–Eksera Deresi *P. theophrasti* population), a natural buffer zone has existed as barrier to interbreeding with other Phoenix populations. Therefore, the Gölköy Phoenix population can be described as a subspecies of *P. theophrasti* as follows:

*P. theophrasti* Greuter subsp. *golkoyana* Boydak subsp. nov.

Type:

TURKEY C1 Muğla: Bodrum, Gölköy (Göltürkbükü), female, latitude 37.1147° N, longitude 27.3981° E, Plain, 3 m., 27 August 2018, M. Boydak (holotype: ISTO 38308); ibid, (paratypes: (male) ISTO 38309, (female) ISTO 38310); ibid, 01 October 1990, M. Boydak (paratype: ISTO 27384).

*Phoenix theophrasti* Greuter subsp. *golkoyana* Boydak” differs from *P. theophrasti* Greuter with respect to its longer fruiting-female stalk length and longer male stalk length, its fruiting stalks hold fruits marginally higher, and its having seeds with slightly visible striate surface crust structures and deeper-wider grooves.
An identification key is given for these two species:

1. Fruit clusters erect or slightly arching; fruits small and inedible; male inflorescences length up to 120 cm; female inflorescences length up to 210 cm; seed surfaces smooth and striate; seed grooves deep or shallow.

2. Male inflorescences length up to 55 cm; female inflorescences length up to 70 cm, erect; seed surfaces deeply striate; seed grooves very narrow and shallow.

*P. theophrasti* Greuter subsp. *theophrasti*

2. Male inflorescences length up to 120 cm; female inflorescences length up to 210 cm, erect, arching slightly; seed surfaces slightly striate or smooth; seed grooves wide and deep.

*P. theophrasti* Greuter subsp. *golkoyana* Boydak subsp. nov.

1. Fruit clusters erect, becoming pendulous with fruit maturity; fruits larger and edible; female inflorescences length up to 200 cm; male inflorescences length up to 100 cm, erect; seed surfaces smooth; seed grooves wider and deeper.

*P. dactylifera* M. Boydak

---

Figure 10. The seeds of the Gölköy *Phoenix* population have slightly visible striate or smooth surfaces and deep-wider grooves (b), whereas the seeds of *Phoenix theophrasti* have clearly visible striate surfaces and shallow grooves (c, d). On the other hand, *P. dactylifera* has smooth seed surfaces and deeper and wider grooves than the seeds of both the *P. theophrasti* and Gölköy *Phoenix* populations (a). One can easily distinguish the seeds of the Gölköy *Phoenix* population from the seeds of all the *P. theophrasti* populations and *P. dactylifera* trees. These are the most distinctive seed characteristics of the Gölköy *Phoenix* populations when compared with the seeds of the *P. theophrasti* Greuter and *P. dactylifera* L. populations; therefore, they are used among the criteria for the description of the new subspecies.
Conservation of *P. theophrasti* Greuter ssp. *golkoyana* Boydak

The *P. theophrasti* Greuter ssp. *golkoyana* Boydak population primarily covers an area of 3.9 ha according to the management plans of the Turkish Forest Service completed in 2013 (Anon., 2013). There are mainly four *Phoenix* groves covering 1.2 ha, 1.2 ha, 1.0 ha, and 0.5 ha inside or alongside the village and/or bordering the village (Figures 2, 3). In addition, a number of palms are currently included in the gardens of houses built recently. This population is unique and of great importance as a natural palm grove in Turkey; therefore, it is imperative that positive action is taken to ensure its conservation and development.

The name Gölköy, which means "Lake Village," originates in the lake that surrounds the palm grove and the village. A drainage trench surrounding the whole area was constructed to establish a golf area in the early 1990s. The lake is fed by a number of copious springs; thus, the drainage ditch is unlikely to dry out the swamp completely. However, the sinking water-table did have adverse impacts on the local ecosystem which then could affect the conditions of the palm grove (Boydak and Barrow, 1994, 1995).

Therefore, in 1993, Boydak applied to the local and city governors to demand effective protective measures for the Gölköy grove, including bans on both the water drainage scheme and the village’s expansion into the palm population. In addition, based on the authors’ report, and other evidence, in 1994, Birgin prepared another report and suggested breaking the agreement between the local authority and the private company developing the golf area. Later, the golf area and drainage activities were banned. By applying conservation status to the area, the grove is legally in a more protected condition now.

Fire also affected the grove in June 1993, but the grove recovered by a healthy abundance of suckers sprouting at the base and trunk together with healthy seedlings. Many palms flowered in the following years. Currently, they are very healthy and obviously living up to the meaning of the word *Phoenix*, "rising from the fire" (Boydak and Barrow, 1995).

Currently, tourism has become an important source of income for the locals; pressure grows to develop the village with new summer housing and tourist facilities (Boydak and Barrow, 1995).

The combined effect of the fire and expansion and development of the village necessitated that a conservation status be placed upon the grove, which the grove now has. In addition, non-governmental organizations are paying great attention to the grove.

*P. theophrasti* Greuter ssp. *golkoyana* Boydak is among the endangered species; however, Göltekbükü–Gölköy consisting of the *P. theophrasti* Greuter ssp. *golkoyana* Boydak groves and other patches or individuals including those in private estate gardens are under conservation statutes as a natural protected area (Byfield and Özhatay, 2005). In addition, the *P. theophrasti* Greuter populations are under conservation regimes. The population and the palm trees that are currently included in the gardens of houses are also under protection according to the management plans of the Turkish Forest Service completed in 2013 (Anon., 2013).

CONCLUSION

“*Phoenix theophrasti* Greuter ssp. *golkoyana* Boydak” differs from *P. theophrasti* Greuter with respect to its longer fruiting-female stalk length and longer male stalk length, its fruiting stalks hold fruits marginally higher, and its having seeds with slightly visible striate surface crust structures and deeper-wider grooves. This population is unique and of great importance as a natural palm grove in Turkey; therefore, it is imperative that positive action is taken to ensure its conservation and development, together with the three native *P. theophrasti* stands in Turkey. In addition, its range could be expanded by planting in parks, streetsides, and gardens in the Mediterranean and Aegean regions both to expand its population and for ornamental purposes. This population has also great importance as a natural palm grove that contributes to the world’s flora.

Peer-review: Externally peer-reviewed.

Acknowledgements: I am grateful to Prof. Dr. Chadwick D. Oliver for editing the English manuscript. I appreciate Doç. Dr. Servet Çalışkan and Emine Çalışkan for their valuable assistance during the field and laboratory works. I wish to thank Dr. Sasha Barrow, Prof. Dr. Adil Güner for their opinions and guidance regarding the article. I also thank to Assistant Professor Dilek Oral for her helps with the herbarium materials. My thanks to Doç. Dr. Rüya Esen for his valuable assistance in sending seeds for controls. I also appreciate contributions of Dr. Neşat Erkan, Dr. Mehmet Çalışkan, Abdurrahman Çobanoğlu, Hakan Zeybek, Önder Barut, Uğur Orhon, Muthu mercan, Cevdet Altış, Saner Demirtaş, and Necati Saray for their valuable assistance during my field trips to their forest districts. My thanks to Ahmet Demirtaş, Yaşar Canbek, Sedat Taşıoğlu, Ahmet Baş, Cen Akşol, Muhterem Kavcar, Ulıfet Yıldız, and other foresters and forest workers who gave valuable assistance in the field during measuring and collecting materials. I also thank to Şehrülg Erdek and Selçuk Özış for helping the arrangement of the photographs and Mustafa Ulnü for providing audio-visual materials. Gönül Boydak, my wife, contributed at every stage of the study and also joined the field trips.

Conflict of Interest: The author have no conflicts of interest to declare.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

- Akkemik, Ü., Anslan, M., Poole, I., Tosun, S., Köse, N., Karlıoğlu, Kılıç, N., Aydın A., 2016. Silicified woods from two previously undescribed
early Miocene forest sites near Seben, northwest Turkey. Review of Palaeobotany and Palynology 235: 31-50. [CrossRef]

- Anon., 1983. Phoenix theophrasti Greuter. Red data sheet (1983 version). IUCN Threatened Plants Committee, Kew.

- Anon., 2013. Muğla Orman Bölge Müdürlüğü, Milas Orman İşletme Müdürlüğü, Bodrum Orman İşletme Şefliği, Fonksiyonel Orman Amenajman Planı (2013-2032), OGM, Ankara.

- Barclay, C., 1974. A new locality of wild Phoenix in Crete. Ann. Mus. Goulandris 2: 23-29.

- Barrow, S., 1998. A monograph of Phoenix L. (Palmae: Coryphoideae). Kew Bulletin 53: 513-575. [CrossRef]

- Boydak, M., Yaka, M., 1983. Datça Hurması (Phoenix theophrasti) ve Datça Yarımadasında saptanan doğal yayılışı. İ.Ü. Orman Fakültesi Dergisi 33(1): 73-92.

- Boydak, M., 1985. The distribution of Phoenix theophrasti in the Datça Peninsula, Turkey. Biologia 32: 129-135. [CrossRef]

- Boydak, M., 1987. A new occurrence of Phoenix in Turkey: Gölköy-Bodrum. Principes 3(1): 89-95.

- Boydak, M., Barrow, S., 1994. Bodrum-Gölköy'de saptanan yeni bir Phoenix yayılışı. İ.Ü. Orman Fakültesi Dergisi 44(2): 35-45.

- Boydak, M., Barrow, S., 1995. A new locality for Phoenix in Turkey: Gölköy-Bodrum. Principes 39(3): 117-122.

- Boydak, M., Çalışkan, S., 2014. Araçlandırma. CTA Press, Ankara.

- Çalışkan, S., Boydak, M., 2017. Afforestation in Arid and Semiarid ecosystems in Turkey. Turkish Journal of Agriculture and Forestry 41: 317-330. [CrossRef]

- Byfield, A., Özhatay, N., 2005. Gölköy. In: Özhatay, N., Byfield, A., Atay, N. (Eds.), Türkiye’nin 122 önemli bitki alanı, WWF Türkiye, Istanbul, pp. 159-160.

- Esener, R., 1999. Palmiyeler. Palmiye Merkezi Yayınları, Ankara.

- Flora of China, 2019. Available from: http://www.efloras.org/flora-taxon.aspx?flora_id=2&taxon_id=200027092 Phoenix dactylifera Linnaeus, Sp. Pl. 2:1188.1753. (Accessed: 3 May 2019).

- Güner, A., Aslan, S., Ekim, T., Vural, M. ve Babac, M.T., 2012. Türkiye Bitkileri Listesi (Damarlı Bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayınları, Istanbul.

- Greuter, W., 1967. Beiträge zur Flora der Südägäis 8-9. Bauhinia 3: 243-250.

- Hazir, A. and Buyukozturk, H. D., 2013. Phoenix spp. and others ornamental palms in Turkey: The threat from red palms weevil and red palm scale insects. Emirates Journal of Food Agriculture 25(11): 843-853. [CrossRef]

- Iamandei, S., Iamandei, E., Akkemik, Ü., 2018. Neogene Palmoxylon from Turkey. Acta Palaeobotanica Romani 14(1): 31-45.

- Pintaud, J-C. Zehdi, S. Couvreur, T. Barrow, S. Henderson, S. Aberlenc-Bertossi, F. Tregear, J. and Billotte, N., 2010. Species delimitation in the genus Phoenix (Arecaceae) based on SSR markers, with emphasis on the identity of the Date palm (Phoenix dactylifera). In: Seberg, O., Petersen, G., Barfoed, A., Davis, J. (Eds.) Taxonomy of Phoenix Diversity, phylogeny, and evolution in the Monocotyledons. Aarhus University Press, Denmark, pp. 267-286.

- Turland, N. L., Chilton, L., Press, J. R., 1993. Flora of the Cretan area: an annotated checklist and atlas. HMISO, London.

- Uhl, N. W., Dransfield, J. 1987. Genera Palmarum: A classification of palms based on the work of Harold E. Moore, Jr., Allen Press, Kansas.

- Zohary, M., 1973. Geobotanical foundations of the Middle East. Second volume, Gustav Fisher, Verlag-Stuttgart.