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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Morphological and molecular identification and determination of host status of *Cuscuta campestris* Yunck. in Thrace Region of Türkiye

Türkiye'nin Trakya bölgesinde *Cuscuta campestris* Yunck.'in morfolojik ve moleküler tanımlaması ve konukçu dizininin belirlenmesi

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ABSTRACT

Field dodder (*Cuscuta campestris* Yunck.) is a weed species that parasitizes many cultivated plants and has been reported in 40 provinces in Türkiye. Despite being found on so many plants, cases of parasitism in the Poaceae family are limited worldwide and there is no evidence in Türkiye. In this study, weed parasitism was observed in monocot plants of the Poaceae family such as *Setaria viridis, Sorghum halepense, Alopecurus myosuroides, Avena fatua, Avena sterilis, Eleusine indica, Echinochloa crus-galli, Bromus tectorum, Hordeum murinum, Elymus repens, Lolium perenne, Secale cereale* and *Triticum aestivum* growing in Thrace Region in Northwestern part of Türkiye. According to morphological identification parameters, the parasitic weed was identified as *C. campestris. C. campestris* was observed to cause high damage to *Echinochloa crus-galli* and *Sorghum halepense* weed species. A molecular study was conducted to identify the weed on a molecular basis and analyze its molecular phylogeny. For this purpose, DNA was extracted, amplified with specific primers, sequenced and subjected to GenBank sequence comparison using BLAST. In BLAST, the local population showed higher similarity (99.13%) with other *C. campestris* accessions (KJ400050 and EU883527) and clustered in the closest class with the same species in the Maximum Likelihood tree generated using Mega 7 software.

ÖZET

Tarla küskütü (*Cuscuta campestris* Yunck.) birçok kültür bitkisinde parazit olan bir yabancı ot türüdür ve Türkiye'de 40 ilde rapor edilmiştir. Bu kadar çok bitkide bulunmasına rağmen Poaceae familyasında parazitizm vakaları dünya çapında sınırlı olup, Türkiye'de de herhangi bir kanıt bulunmamaktadır. Türkiye'nin kuzeybatısındaki Trakya bölgesinde yetişen *Setaria viridis, Sorghum halepense, Alopecurus myosuroides, Avena fatua, Avena sterilis, Eleusine indica, Echinochloa crus-galli, Bromus tectorum, Hordeum murinum, Elymus repens, Lolium perenne, Secale cereale* ve *Triticum aestivum* dahil olmak üzere Poaceae familyasındaki monokotiledon bitkilerinde küskütün parazit olduğu gözlemlenmiştir. Morfolojik tanımlama parametrelerine göre parazitik olan yabancı ot *C. campestris* olarak tanımlanmıştır. *C. campestris*'in *Echinochloa crus-galli* ve *Sorghum halepense* yabancı ot türlerinde yüksek oranda zarar meydana getirdiği gözlenmiştir. Yabancı otun moleküler bazda tanımlanması ve moleküler filogenisinin analiz edilmesi amacıyla moleküler çalışma yürütülmüştür. Bu amaçla küskütü DNA'sı ekstrakte edilmiş, spesifik primerlerle amplifiye edilmiş, sekanslans yapılmış ve BLAST kullanılarak GenBank sekans karşılaştırmasına tabi tutulmuştur. Blastn'da yerel popülasyon, diğer *C. campestris* aksesyonları (KJ400050 ve EU883527) ile daha yüksek benzerlik (%99.13) göstermiş ve Mega 7 yazılımı kullanılarak oluşturulan Maksimum Likelihood ağacında aynı türlerle en yakın sınıfta kümelenmiştir.

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INTRODUCTION

Angiosperms (flowering plants) are seed-producing plants that make up 90% of the world's plant kingdom. The number of known and described flowering plants is 295.383, divided into two groups: monocots, with 7.273 species, and dicots, with 210.008 species (Christenhusz & Byng, 2016). Among angiosperms, parasitic plants are one of the most damaging, with 4.200 species from 18 families and 274 genera. The largest number of species is found in *Cuscuta*, a genus of plants with little or no chlorophyll, which is insufficient for photosynthesis. They, therefore, require invasion of host plants to survive. The genus comprises 170 species infesting up to 200 plants (Kadıoğlu, 1992; Holm et al., 1997; Garcia et al., 2014). Dicotyledonous plants are the primary hosts due to the development of vascular bundles for haustoria attachment. Monocotyledonous plants are rarely parasitized due to a variety of anatomical constraints, such as the lack of vascular bundles or the incompatibility of the signals required for haustoria attachment (Dawson et al., 1994).

Dodder (*Cuscuta* spp) is reported to be a problem in vegetables, causing severe damage (Holm et al., 1997). Yield losses in alfalfa, sugar beet, sesame, lentil, chickpea, broad bean, tomato, alfalfa and chilli can be as high as 100% (Nemli & Öngen, 1982; Parker & Riches, 1993; Mishra et al., 2005, Üstüner, 2024). In nurseries, parasitic weeds retard the growth of young plants. In addition to causing significant yield losses in many crop species, these parasitic weeds are also important as vectors of diseases such as viruses to host plants. For example, *C. campestris* which has been reported to infect 100 plants can transmit grapevine leafroll virus 7 to healthy grapevines. Host plants play an important role in the survival and reproduction of dodder, which can initiate a new round of damage after the growing season (Jones, 2018). Once attached, the parasite can continue to grow, reaching up to 8 cm in length. The flowers set fruit upon maturity and produce seed capsules (Dawson et al., 1984). Germinated seedlings have a short life cycle and require immediate penetration to survive. A single host plant is sufficient for dodder parasitism and survival. Weeds in infested areas are good alternative hosts. Dodder can produce 3000 to 25.000 seeds by attaching itself to plants. For up to 20 years, the seeds can remain viable in the soil. Seeds remaining in the soil can initiate new invasions in the following growing season (Dawson et al., 1984). The prevalence of dodder, which has dozens of hosts, is reported to be low in monocotyledons due to the low levels of enzymes that degrade plant tissue during parasitism on the parasitic plant (Haidar et al., 1997).

Identifying dodder species and their hosts is essential for developing and effectively implementing appropriate control strategies. To this end, ongoing taxonomic studies are being carried out in several provinces. During one of the studies in Thrace, *Cuscuta* spp. was observed for the first time in monocots such as *Setaria viridis* (L.) P. Beauv., *Sorghum halepense* (L.) Pers. and there were differences in the severity of parasitism between host plants. Based on preliminary observations, it was concluded that this species could be *Cuscuta campestris* Yunck. During the literature review, no data were found on the parasitism of *C. campestris* on monocotyledonous plants in Türkiye. However, various researchers around the world have reported parasitism of wild herbs and cultivated plants such as *Aegilops* sp., *Avena sterilis* L., *Arundo donax* L., *Bromus* sp. and *Echinochloa-crus galli* (Qasem, 2008; Baráth, 2021). To confirm whether or not the parasite was *C. campestris* in monocotyledons, plant samples were collected from infested areas in Thrace for morphological identification and molecular studies. Thrace is located between the Black Sea and the Marmara Sea in the north-western part of Türkiye, bordering Greece and Bulgaria. The region includes the provinces of Edirne, Kırklareli, Tekirdağ and the European parts of the provinces of Istanbul and Çanakkale. The irrigable and non-irrigable agricultural area of the region is 1.385.000 ha (Anonymous, 2023a). Wheat is among the economically most important plants grown in the region, and the amount of total production constitutes 0.3% of world production. Sunflowers and grapevine are the other most common plants in the region (Anonymous, 2023b). The host monocotyledonous plants were also sampled and identified to species level and their parasitism status was recorded. In addition, a literature review was conducted to map the recent host composition of dodder in Türkiye, the species of which were determined after further studies.

MATERIALS AND METHODS

Cuscuta survey, sampling, and morphological identification

At first*, Cuscuta* spp. was observed on some monocotyledon plants in two wheat and sunflower fields and in a vineyard in Tekirdağ province located in Thrace, Türkiye (Figure 1).

Figure 1. Study area map in Türkiye

Şekil 1. Türkiye'de çalışma alanı haritası

The study area in the region included orchards, vineyards, wheat, sunflower fields and pastures. Annual rainfall was about 600 mm and the average temperature was 31 °C at the time of the survey. The sampled sites were randomly selected (Anonymous, 2023b). Altogether 1.135 different plantations (274 vineyards, 970 orchards, 111 others) were visited (Table 1). TURKSTAT production area statistics (TUIK, 2014) were used to determine the number of samples. The field survey was conducted according to the partial sampling method of Bora and Karaca (1970), and at least 1% of the surveyed area was sampled. The majority of the surveyed agricultural areas were not irrigated. Plant species infested by parasitic dodder were recorded in the infested fields. Plants parasitised by *Cuscuta* were selected and collected for morphological identification. Samples of *Cuscuta* were also collected for morphological and molecular identification of the species. Herbaria were prepared from each host plant for the morphological identification of monocotyledonous species. Samples were pressed into the herbarium board at room temperature and allowed to dry completely to prepare the herbarium. After drying, the specimens were glued to cardboard, labelled and covered with a transparent polyethylene sheet for protection against external damage.

The host plant and *Cuscuta* species were identified using published identification keys, including Yuncker, 1932 and Davis, 1982. Species were identified morphologically by examining plant parts with a binocular stereomicroscope; styles, sepals and petals were photographed with a microscope camera. A Nikon Coolpix P900 digital camera was used to photograph host plants.

Dodder prevalence was determined from dodder presence on the same host in different infestations. The severity of the dodder infestation was classified as low, medium and high according to Qasem 2008, as follows;

- Low: A single stem or undeveloped dodder surrounding 1-30% of the plant.
- Moderate: 31-60% of the plant is surrounded and attached by a dodder.
- High: 61-100% of the plant was densely surrounded by dodder, producing few flowers.

Table 1. The list of visited provinces and the number of surveyed areas in Thrace
Çizelge 1. Trakya'da gidilen ilçelerin ve sürvey yapılan alanların sayısı

Cultivated plants	Number of fields/orchards visited	Total survey area (da)
	Tekirdağ	
Cherry orchard	106	≈1.250
Walnut orchard	96	≈2.436
Almond orchard	88	≈ 440
Olive orchard	107	≈2.239
Apple orchard	30	≈365
Pear orchard	86	≈680
Policulture	239	≈1.100
Vineyard	274	≈2100
Other	111	≈2500
Total	1.135	≈13.110

Molecular characterisation of Cuscuta spp.

For the identification of *Cuscuta* spp. at the molecular level, dodder DNA was extracted from a p collected from a vineyard in the Süleymanpaşa district of Tekirdağ. DNA was extracted for molecular analysis using the CTAB procedure (Lefort & Douglas, 1999). Briefly, freshly ground plant material (100 mg plant material) was transferred to 1.5 ml polypropylene tubes in liquid nitrogen, and 1 ml DNA extraction buffer [50 mM Tris-HCl pH 8.0, 20 mM EDTA pH 8.0, 0.7 M NaCl, 0.4 M LiCl, 1% w/v CTAB (hexadecyltrimethylammonium bromide), 1% w/v PVP 40, 2% w/v SDS] and 10 µl β-mercaptoethanol (1% final concentration) were added. After vortexing for 5 seconds, the mixture was incubated for 15 minutes at 65°C in a water bath. After incubation, 0.5 ml chloroform/iso-amyl alcohol (24:1) was added to the tube and centrifuged at 14.000 rpm for 1-5 minutes. As much of the aqueous phase as possible was transferred to a new 1.5 ml tube, centrifuged at 14,.000 rpm for 1 minute, 0.8 ml supernatant was transferred to a new tube, and 0.8 ml isopropanol (optionally cold) was added to the aqueous solution. A white DNA precipitate appeared after gentle mixing of the tube. The tube was then centrifuged at 14.000 rpm for 1 minute, and the supernatant was collected. The DNA pellet was washed with 1 ml of 70 % ethanol and centrifuged at 17.000 g for 1 minute. The supernatant was discarded, and the pellet dried for 10 minutes. DNA pellets were suspended in 50-100µl 10mM Tris-HCl pH 8.0, 1mM EDTA.

DNA concentration in extracted samples (A260/280 A260/230) was measured and amplified with forward and reverse primers N-nc26S1 and 1449rev (5'-ACCCATGTGCAAGTGCCGTT-3'). All PCR reactions were performed to a final volume of 20 µl in a 0.2 ml tube. The tube contained 10 µl 2X PCR Ready Mix (Sigma Aldrich), 1 µl reverse primer, 1 µl forward primer, 2 µl template DNA and 6 µl ddH2O. For PCR reactions in which purified DNA was used as a template, 30 ng of DNA was used per reaction. Amplification products were separated on a 1.5% agarose gel stained with ethidium bromide. The gel was run at 80 V for 50 minutes and visualised under a UV transilluminator. The PCR product was sequenced on an ABI sequencer. A phylogenetic analysis was performed to assess the closeness of the identified *Cuscuta* to other published *Cuscuta* species. For this purpose, the sequence data of the local *Cuscuta* were subjected to a sequence comparison in GenBank using BLAST. Clustal W alignment. Maximum likelihood (bootstrap 1000 replicates) trees were constructed using Mega 7 software, in which 19 different *Cuscuta* sequences from NCBI were compared. Pairwise distances were calculated using Mega 7 software.

RESULTS AND DISCUSSION

This study revealed the presence of *Cuscuta* spp. on monocotyledonous plants in Türkiye, with the dodder on these plants identified as *Cuscuta campestris* Yunck. Different degrees of infection on hosts, including weeds like

Alopecurus myosuroides Hudson, *Avena sterilis* L., *A. fatua* L., *Bromus tectorum* L., *Eleusine indica* (L.) Gaertner, *Echinochloa crus-galli* (L.) P. Beauv, *Elymus repens* (L.) P. Beauv., *Hordeum murinum* L., *Lolium perenne* L. and *Setaria viridis* L. were observed. In addition, wheat (*Triticum aestivum* L.) and rye (*Secale cereale* L.) crops were also affected by the parasite, highlighting the wide host range.

The collected *C. campestris* plant had a distinctive appearance, mainly leafless, with yellow or orange stems [0.48 ± 0.07 (0.36-0.6 mm wide/20 measurements)] and branches. The length of the stem was up to 5 mm.

Twenty randomly selected *C. campestris* plants were described and measured as follows; The parasitic plant had white flowers with a bell-shaped corolla [2.15±0.15 (2.1-2.21 mm long)], five in number, and a calyx with ovate overlapping lobes [1.8±0.11 (1.63-1.93 mm long)], filaments [0.45±0.06 (0.36-0.49 mm long)], filiform styles [1±0.17 (0. 72-1.3 mm long)], 5 sepals, elongated stamens, elliptic anthers [0.44±0.07 (0.32-0.51 mm long)], campanulate corolla tube [0.72±0.03 (0.67-0.73 mm long)], capitate stigma, capsule-like fruit and inflorescence with 4-12 stalked flowers (Figure 2). The petals were triangular with a pointed tip. The stamens were shorter than the corolla lobes, and the anthers were shorter than the filaments. Sepals were 5 in number and had backwards curled tips. Average seed dimensions were 1.2±0.15 (0.9-1.2) mm in length and 0.79±0.27 (1.11-1.6) mm in width. The flowers were yellowish and had 4 to 5 lobes. The average dimensions of the fruits were 2.20±0.42 (1.86-2.43) mm long, and 2.7±0.6 (2.8-3.32) mm wide. The fruit contained 2-4 seeds [3.05±0.73]. The ovary was spherical. The seeds were oval in shape, irregular in size and brown in colour. Seed length was 1.2+0.15 (0.9-1.2) mm and width was 0.79±0.27 (1.11-1.6) mm. Brown seeds were observed on most mature host plants, especially *Echinochloa crus-galli* (L.) P.Beauv.

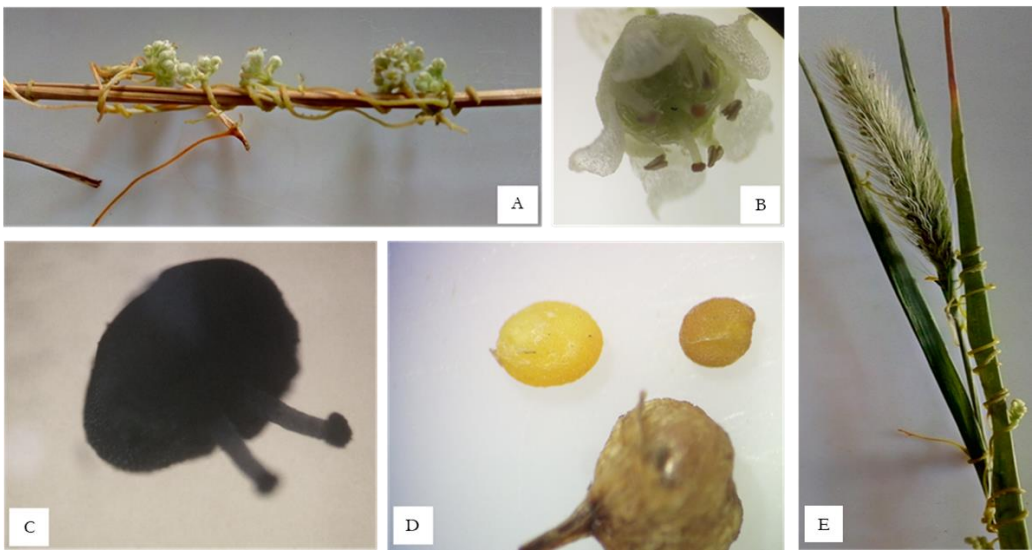

Figure 2. *Cuscuta campestris* Yunck. (A) Attachment to host stem. (B) Flower. (C) Styles. (D) Capsule and seeds. (E) A plant moderately parasitized by dodder

Şekil 2. Cuscuta campestris Yunck. (A) Konukçu bitki gövdesine tutunma. (B) Çiçek. (C) Styles. (D) Kapsül ve tohum. (E) Orta derecede parazitlenmiş bitki

A low to moderate degree of attachment to host was observed. Field dodder haustorium was observed on leaf, stem and spikelet (Table 2, Figure 3-4). Partial wilting and yellow to light green color changes were observed on the leaves of plants such as *Avena sterilis* L.. *Alopecurus myosuroides* Hudson and *Sorghum halepense* (L.) Pers. showed extensive *Cuscuta* attachment.

Table 2. The intensity of attachment of *Cuscuta* on monocotyledon plants (Low: 1-30%, Moderate: 31-60%, High 61-100%)

Çizelge 2. Cuscuta'nın monokotiledon bitkilere tutunma yoğunluğu (Düşük: 1-30%, Orta: 31-60%, Yüksek 61-100%)

Host Plants	Intensity of Attachment	Attached Plant Part	Number of Detected Fields
Alopecurus myosuroides Hudson	Moderate	Leaf and stem	17
Avena sterilis L.	Low	Stem	14
Avena fatua L.	Low	Stem	17
Bromus tectorum L.	Moderate	Spikelet and stem	22
Eleusine indica (L.) Gaertner	Moderate	Leaf, stem, spikelet	17
Echinocloa crus-galli (L.) P.Beauv.	Moderate	Leaf, stem, spikelet	9
Elymus repens (L.) Gould	Moderate	Spikelet and stem	9
Hordeum murinum L.	Moderate	Leaf, stem, spikelet	5
Lolium perenne L.	Low	Stem	9
Secale cereale L.	Moderate	Stem	3
Sorghum halepense (L.) Pers.	Moderate	Leaf and stem	11
Setaria viridis L.	Moderate	Leaf, stem, spikelet	3
Triticum aestivum L.	Moderate	Stem	5

Figure 3. Attachment of *Cuscuta campestris* Yunck. on (A) *Secale cereale* L. (B) *Lolium perenne* L. (C) *Avena fatua* L. (D) *Triticum aestivum* L. (E) *Alopecurus myosuroides* Hudson (F) *Sorghum halepense* (L.) Pers. (G) *Eleusine indica* (L.) Gaertner (H) *Avena sterilis* L. (I) *Hordeum murinum* L.

Şekil 3. Cuscuta campestris Yunck.'un tutunması (A) Secale cereale L. (B) Lolium perenne L. (C) Avena fatua L. (D) Triticum aestivum L. (E) Alopecurus myosuroides Hudson (F) Sorghum halepense (L.) Pers. (G) Eleusine indica (L.) Gaertner (H) Avena sterilis L. (I) Hordeum murinum L.

Figure 4. Attachment of *Cuscuta campestris* on different plant parts

Şekil 4. Cuscuta campestris'in farklı bitki kısımlarında tutunması

Molecular characterisation of Cuscuta campestris Yunck.

The PCR amplification sequence contained 599 bases. The sequence data of *Cuscuta campestris* collected in this study was deposited in NCBI GenBank with accession number MW251503. The similarity was compared with Blast records, and local sequence showed higher similarity with other *C. campestris* sequences. Compared with *C. campestris* KJ400050 local population showed 99.13% identity (571/576 nucleotide) and 95% coverage, and with *C. campestris* EU883527 99.13% identity (567/576 nucleotide). The number of gaps in these sequences was 1.

In comparison with other Cuscuta species the closest matches were with *Cuscuta pentagona* KJ400152 (98.26%; 565/575 nucleotide; 1 gap), *C. gymnocarpa* KJ400101 (98.26%; 565/575 nucleotide; 1 gap), *C. harperi* KJ400102 (98.09%; 565/576 nucleotide; 1 gap), *C. australis* KJ400043 (98.09 %; 558/569 nucleotide; 1 gap), *C. obtusiflora* KJ400140 (97.91%; 562/574 nucleotide; 1 gap), *C. stenolepis* KJ400101 (97.72%; 556/569 nucleotide; 1 gap), *C. plattensis* KJ400154 (97.59%; 552/566 nucleotide; 1 gap), *C. xanthochortos* var. *carinata* KJ400192 (96.70%; 557/576 nucleotide; 1 gap), *C. corniculata* KJ40006 (96.70%; 556/575 nucleotide; 1 gap).

In the Maximum likelihood tree, sequences were divided into two main clades. Clade I contained 11 sequences. Clade II contained eight accessions including accession from Türkiye (MW251503). MW251503 clustered in closest subclade with other *C. campestris* species (EU883527; KJ400050) and *C. pentagona* (KJ400152) (Figure 5).

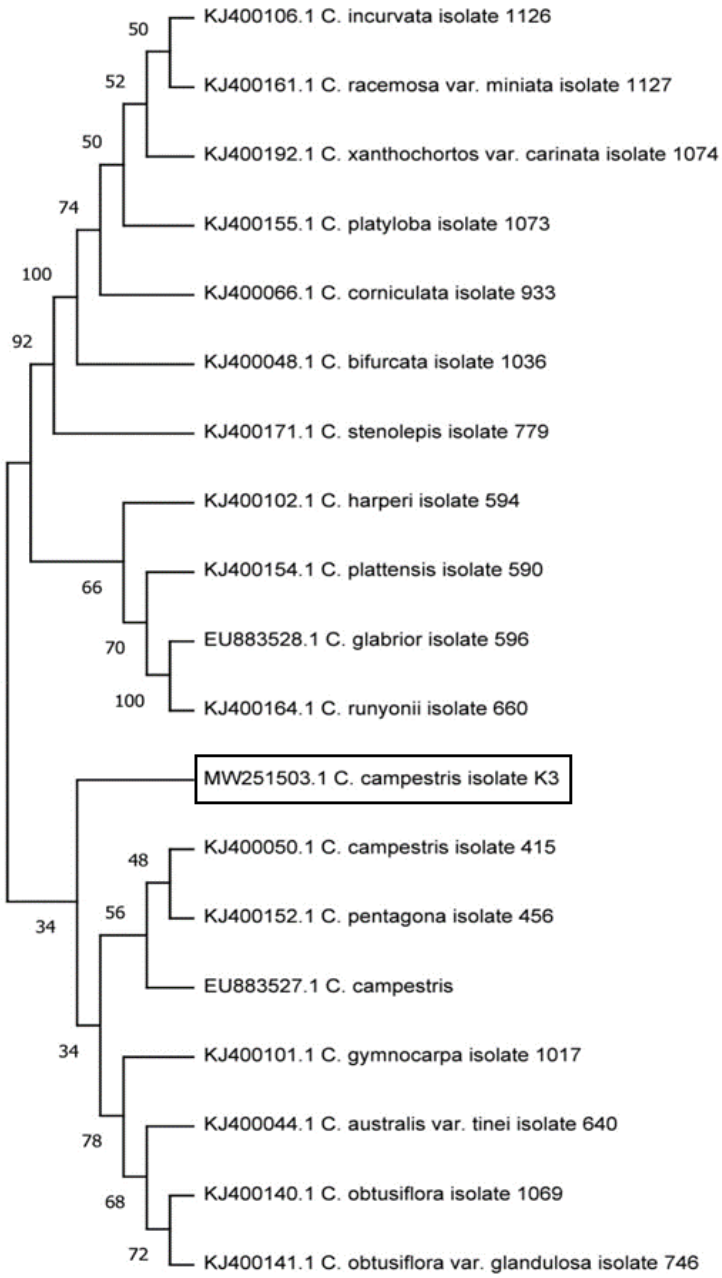

Figure 5. Maximum likelihood tree generated by comparing sequences from Genbank, NCBI

Şekil 5. Genbank, NCBI'den alınan dizilerin karşılaştırılmasıyla oluşturulan Maximum likelihood ağacı

So far, *C. campestris* has been detected in 50 cultivated plants and weeds in Turkey, but none of them were monocots (Kaya et al., 2018). Together with the 13 monocotyledonous plants detected in this study in Thrace, the number of haustorium-attached hosts of *C. campestris* rised to 63. Of these, 45 were weeds and the remaining were annual or perennial plants. The full names of the host species and their families are listed in Table 2. The distribution map of the species is shown in Figure 6. The parasitic weed has been reported in 40 out of the 81 provinces.

Table 2. Updated host plant range of *Cuscuta campestris* in Türkiye

Çizelge 2. Cuscuta campestris'in Türkiye'de güncellenmiş konukçu dizini

Common Name	Host Plant	Family	Reference
Black grass	*Alopecurus myosuroides* Hudson		
Winter wild oat	*Avena sterilis* L.		
Wild oat	*Avena fatua* L.		
Downy brome	*Bromus tectorum* L.		
Goosegrass	*Eleusine indica* (L.) Gaertner		
Barnyyard grass	*Echinochloa crus-galli* (L.) P.Beauv.		
Couch grass	*Elymus repens* (L.) Gould	Poaceae	This study
Foxtail barley	*Hordeum murinum* L.		
Perennial ryegrass	*Lolium perenne* L.		
Rye	*Secale cereale* L.		
Johnson grass	*Sorghum halepense* (L.) Pers.		
Green foxtail	*Setaria viridis* L.		
Wheat	*Triticum aestivum* L.		
Pigweed	*Amaranthus retroflexus* L.	Amaranthaceae	
Lambsquarters	*Chenopodium album* L.		
Wild carrot	*Daucus carota* L.	Apiceae	
Absinth wormwood	*Artemisia absinthium* L.		
Common coclebur	*Xanthium strumarium* L.		
Field sow thistle	*Sonchus arvensis* L.		
Common cichory	*Cichorium intybus* L.	Asteraceae	
Common dandelion	*Taraxacum officinale* (L.) Weber ex F.H.Wigg.		Şin et al., 2020
Canadian horseweed	*Conyza canadensis* (L.) Cronquist		
Pricky lettuce	*Lactuca serriola* L.		
Wild raddish	*Raphanus raphanistrum* L.	Brassicaceae	
Bindweed	*Convolvulus arvensis* L.	Convolvulaceae	
Squirting cucumber	*Ecbalium elaterium* (L.) A.Rich.	Cucurbitaceae	
Black horehound	*Ballota nigra* L.	Lamiaceae	
Common mallow	*Malva sylvestris* L.	Malvaceae	
Ribwort plantain	*Plantago lanceolata* L.	Plantaginaceae	
Prostrate knotweed	*Polygonum aviculare* L.	Polygonaceae	
Curly dock	*Rumex crispus* L.		
Common purslane	*Portulaca oleracea* L.	Portulacaceae	
Stickwilly	*Galium aparine* L.	Rubiaceae	
Black nightshade	*Solanum nigrum* L.	Solanaceae	
Puncture vine	*Tribulus terrestris* L.	Zygophyllaceae	
Oregano	*Origanum onites* L.	Lamiaceae	Sokat, 2019
Sea holy	*Eryngium* sp.	Apiaceae	
Rush skeletonweed	*Chondrilla juncea* L.	Asteraceae	
Bathurst burr	*Xanthium spinosum* L.		Zare & Dönmez, 2020
Barberyy	*Berberis* sp.	Berberidaceae	
Common vetch	*Vicia sativa* L.		
Camelthorn	*Alhagi maurorum* Medik.		
Restharrow	*Ononis spinosa* L.		

Table 2 (continued). Updated host plant range of *Cuscuta campestris* in Türkiye

Çizelge 2 (devamı). Cuscuta campestris'in Türkiye'de güncellenmiş konukçu dizini

Common Name	Scientific Name	Family	Reference
Flax	*Linum usitatissimum* L.	Linaceae	Zare & Dönmez, 2020
Citrus	*Citrus* sp.	Rutaceae	
Mullein	*Verbascum* sp.	Scrophulariaceae	
Snapdragon	*Antirrhinum majus* L.	Solanaceae	
Sunflower	*Helianthus annuus* L.	Asteraceae	Özkil et al., 2019
Sugar beet	*Beta vulgaris* L.	Amaranthaceae	Üstüner, 2024 Nemli et al., 2015,
Onion	*Allium cepa* L.	Alliaceae	
Anise	*Pimpinella anisum* L.	Apiaceae	
Caraway	*Carum carvi L.*		
Melon	*Cucumis melo* L.	Cucurbitaceae	
Alfa alfa	*Medicago sativa* L.	Fabaceae	
Chickpea	*Cicer arietinum* L.		
Clover	*Trifolium* spp.		
Faba bean	*Vicia faba* L.		
Pepper	*Capsicum annuum* L.	Solanaceae	
Eggplant	*Solanum melongena L.*		
Potato	*Solanum tuberosum* L.		
Tobacco	*Nicotiana tabacum* L.		
Tomato	*Solanum lycopersicum* L.		
Grapevine	*Vitis vinifera* L.	Vitaceae	

Figure 6. Distribution map of *Cuscuta campestris* Yunck. in Türkiye (Türkmen, 1998; Söker et al., 2012; Ciğer et al., 2013; Arıtuluk et al., 2014; Satıl et al., 2017; Mumcu & Korkmaz, 2018; Kaya et al., 2018; Sokat, 2019; Sırrı et al., 2020)

Şekil 6. Cuscuta campestris Yunck.'un Türkiye'de yaygınlık haritası (Türkmen, 1998; Söker et al., 2012; Ciğer et al., 2013; Arıtuluk et al., 2014; Satıl et al., 2017; Mumcu & Korkmaz, 2018; Kaya et al., 2018; Sokat, 2019; Sırrı et al., 2020)

Species of Cuscuta are generally reported to be unable to infect monocotyledone plants. This is probably due to anatomical factors such as vascular bundle arrangement or the inability to produce signals that play an important role in vascular connection (Dawson et al., 1999). Broad bean (*Vicia faba* L.), Asparagus (*Asparagus officinalis* L.) and onion (*Allium cepa* L.) weeds can be parasitized by dodder and the parasitism can result in severe damage especially in onions (Kaya & Üremiş, 2019; Dechasa & Dechasa, 2021; Üstüner, 2024). However, in this study conducted in Thrace, 11 monocotyledone weed species and two cultivated plants were found to be moderately to slightly parasitized by the field dodder, *Cuscuta campestris*. All plants belonged to Poaceae family. For instance, 1-2 flower clusters were observed on *Bromus tectorum* L. and *Sorghum halepense* (L.) Pers. The number of fields where dodder have been detected varies between 3 and 17, and parasitized monocotyledonous plants were generally found in vineyard areas. Similar instances of parasitism on monocotyledons, including both weeds and crops such as *Aegilops* sp., *Avena sterilis* L., *Arundo donax* L., *Bromus* sp., *Echinochloa crus-galli*, *Cynodon dactylon* (L.) Pers, *Lolium temulentum* L., *Triticum durum* Desf., *Setaria glauca*, and *Sorghum halepense* (L.) Pers., have been reported by various researchers (Qasem, 2008; Baráth, 2021). A study in Nigeria also reported a low level of infection in weeds of the Poaceae family. These observations highlight the limited occurrences of *C. campestris* parasitism on monocots worldwide. In this case, reduced efficiency of *C. campestris* enzymes involved in breaking down host monocotyledonous tissues during parasite entry has been suggested as a contributing factor to this phenomenon (Nwokocha & Aigbokhan, 2013).

Dodder not only damages cultivated plants but can also indirectly harm other organisms, animals and human beings Some of the plants that found in this study parasitic in Thrace were consumed as food. Plants like wheat, rye, and weeds such as *Hordeum murinum* L. and *Echinochloa crus-galli* (L.) P.Beauv are utilized as animal feed. Dodder parasitism in these consumable plants underscores the importance of controlling the parasite, particularly in pastures where livestock graze. If as much as 50% of these plants are parasitized by dodder, the fodder made from them can become toxic to cattle and horses. Affected animals typically exhibit symptoms such as abdominal pain, diarrhea, and potential weight loss (Abutarbush, 2013). Thus, effective management strategies for dodder are crucial to safeguard the health of livestock. To determine the most effective control method, accurate identification of the dodder species is essential.

In this study conducted in Thrace, the validity of *Cuscuta campestris* as a species is supported by both morphological and molecular data, particularly through the molecular characterization of the 26S region. Comparisons with GenBank data have highlighted the proximity of the local *C. campestris* to other known species. Notably, the sequence from the study showed a 99% nucleotide similarity with a *C. campestris* record from New Mexico Additionally, the local sequence exhibited close nucleotide similarity with sequences from 16 species, including *C. pentagona* and *C. australis*. These findings underscore the genetic relationships and confirm the taxonomic placement of *C. campestris* in the studied region (Anonymous, 2024).

The 26S rDNA region serves as a pivotal component in this study for comparing similarity with other *Cuscuta* species. This DNA region is favoured for molecular characterization and phylogenetic studies due to its ability to provide ample phylogenetic information, its universal presence across plants, and its ease of amplification and sequencing. These qualities make it a versatile tool in taxonomy and evolutionary studies. Numerous weed species have already been molecularly characterized using the 26S region. In this study, the 26S region of plants was specifically utilized to identify *Cuscuta* spp. within the Convolvulaceae family (Neyland, 2001).

In Türkiye, the identification of *C. campestris* has traditionally relied on morphological characteristics. However, morphological features can sometimes be ambiguous, leading to potential misidentifications. Moreover, this method requires trained personnel in identification process. In contrast, molecular identification offers a rapid and reliable alternative. It enables accurate species identification, even by individuals lacking specialized training. Additionally, molecular techniques allow DNA isolation and analysis at any stage of plant development, enhancing their practical utility (Baldwin, 1995).

In this article, information is given about the results of the study in which the presence of dodder in monocotyledonous plants was examined and *C. campestris* was detected in monocot weeds and some cultivated plants. The parasitic weed has been found to have a wide range of host plants in Türkiye and the situation was previously unknown in monocotyledons. The research is essential to support the literature and update the registered host list, especially from monocotyledon plants in the country.

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STATEMENT OF CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHORS' CONTRIBUTIONS

The authors conducted the study, prepared the manuscript and approved it.

STATEMENT OF ETHICS CONSENT

Since the article does not contain any studies with human or animal subjects, its approval by the ethics committee was not required.

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