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Research article/Araştırma makalesi

A new alien species record for the flora of Turkey: *Bidens bipinnata* (Asteraceae)

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Abstract

In the present study, some morphological properties of *Bidens bipinnata* L., which recorded as a new record for the flora of Turkey, were examined. Additionally, identification key for the species which belongs to *Bidens* L. genus in Flora of Turkey was rearranged.

Key words: *Bidens bipinnata*, Asteraceae, new record, N. Anatolia, Turkey

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Türkiye florası için yeni yabancı tür kaydı: *Bidens bipinnata* (Asteraceae)

Özet

Bu çalışmada, Türkiye florası için yeni kayıt olan *Bidens bipinnata* L.' (su keneviri) nın, bazı morfolojik özellikleri verilmiştir. Ayrıca, Türkiye Florası'ndaki *Bidens* L. cinsine dahil türlerin tayin anahtarı, yeniden düzenlenmiştir.

Anahtar kelimeler: *Bidens bipinnata*, Asteraceae, yeni kayıt, K. Anadolu, Türkiye

1. Introduction

Alien species are species that are not indigenous in a given geographical unit regardless of their origin **(**Weber, 1997). In addition to natural factors, increasing anthropogenic activities (migrations, agricultural activities, commercial and touristic travels, etc.) ensure recolonization of many plant species in new habitats and inhabitation. Thus non-indigenous plant species have become components of the flora of most regions of the world within the last 500 yr as a result of the tremendous species exchange between continents and vegetation transformation by man (Weber, 1997). Since 1988, also a lot of new records and new alien taxa have been published as contribution to Turkey's flora (Özhatay et al., 1994; Özhatay et al., 1999; Özhatay and Kültür, 2006; Coşkunçelebi et al., 2007; Yıldırım and Gemici, 2010; Doğan and Duran, 2010).

Genus of *Bidens* L., which belongs to Helianthinae, Heliantheae and Asteraceae upper taxa (Davis, 1975), distributes in many regions of the world with 280 species (Mitich, 1994). Range of *Bidens bipinnata* L. (Syn.: *Kerneria bipinnata* (L.) Godr. and Gren.) which is called "su keneviri" in Turkish is wide, from Rhode Island to Florida and westward to Kansas and Mexico; while rare in South America; scattered across central Europe, Asia, eastern Africa and northeast coast of Australia. It probably is native only to the eastern U.S. and eastern Asia, and introduced elsewhere (Sherff, 1937; Mitich, 1994).

2. Materials and methods

Specimens of *B. bipinnata* were collected from open places on roadsides and hazelnut plantation in Terme (Samsun/Turkey) in October 2009 and September 2010 (Figure 1). Photographs of plant specimens and plant parts were taken at herbarium and natural habitats. Morphological characters were measured by a milimetric ruler under a stereo binocular microscope (Olympus SZ60). Our measurements and their comparisons with other published studies (Tutin,

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1976; Dakshini and Prithipalsingh, 1984; Tadesse, 1993; Bosch, 2004; Sîrbu and Oprea, 2008) have been given in Table 1. Identification of plant samples was done with the aid of the Flora Europaeae (Tutin, 1976) and specimens have been kept in Herbarium of Ondokuz Mayıs University (OMUB).

Collected Specimens: A6 Samsun: Terme-Gölyazı Natural Protected Area, on roadsides, 3.X.2009, 5m, *Mumcu* 8737 (OMUB); A6 Samsun: Terme-Sakarlı village, on road sides and hazelnut plantation, 11.IX.2010, 5m, *Korkmaz* 8741 (OMUB).

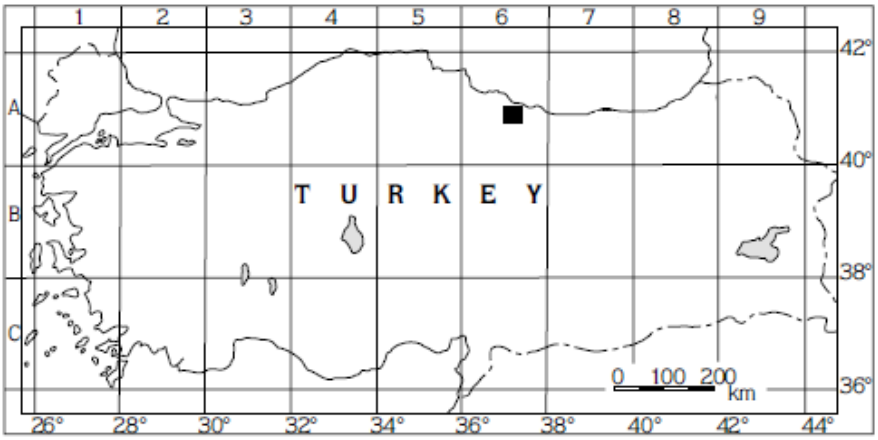

Figure 1. Distribution of *Bidens bipinnata* in Turkey

3. Results

Based on observations and measurements implemented on *Bidens bipinnata* L.**,** that represent a new record for the flora of Turkey specimens, which were collected from different localities, description of species is as follows (Figure 2; Table 1):

Annual herbs. Roots thin, numerous and shallowly. Stem erect, up to 250 cm tall, quadrangular, almost glabrous. Base of stem up to 10-11 mm diameter, middle of stem up to 9 mm diameter. Leaves opposite in lower parts, alternate in upper parts, usually glabrous, sparsely pubescent especially on veins. Petiol 3-5 cm, slightly winged. Lamina ovate, decreasing towards inflorescence; lower ones 7-22 × 5-11 cm, upper ones 5-9.5 × 4-8 cm. 2- (-3)-pinnat, with up to 3 pairs of pinna, the lower ones lobed almost to the midrib, lobes rhombic to broadly lanceolate, entire or coarsely toothed.

Inflorescence arranged in a cyme. Capitulum heterogamous, radiat, solitary, ±erect, 8-12 × 3-4 mm, sparsely pubescent at base. Peduncles elongating in fruit, 3-5 cm on flowering period, 4-8 cm on fruiting period. Involucral bracts 2-seriate; outer 4-7, herbaceous, lanceolate, 4-5 mm, inner ones 7-8, membranous margined, linear-lanceolate, 5 mm. Receptacle paleaceaous, palea shorter than achenes, linear-lanceolate, scarious, with brownish longitudinal lines. Ray flowers steril, 2-3, conspicuous, lamina spatulate, entire or bifid, yellow, whitish towards base, 5-6 × 2-2.5 mm. Disc flowers hermaphrodite, 16-22, corolla yellowish, corolla tube with 5 toothed, whitish towards base; inner ones longer than outer, 8 mm (inner), 6 mm (outer). Stigma bifurcate clearly exerted from corolla tube. Achenes radially oriented on mature capitulum, tetragonal, blackish-brown, papillose, dimorphic; inner ones 12-15 × 1 mm, outer ones 10-12 × 1 mm. Pappus unequel (2-4 mm) with 4 retrorsely barbed arista.

Genus of *Bidens* L. is represented by 4 taxa in Turkey's flora: *B. cernua* L. var. *cernua*, *B. tripartita* L. (Kupicha, 1975), *B. cernua* L. var. *radiata* DC. (Güner, 2000), which are indigenous taxa, and *B. frondosa* L. which is alien for Turkey and native for North America (Coşkunçelebi et al., 2007). There is an identification key to distinguish for only two species of *Bidens* in the Flora of Turkey (Kupicha, 1975). By this study, the number of *Bidens* taxa has reached 5 in Turkey's flora. So we rearranged the identification key to distinguish species and infraspesific taxa of *Bidens* in flora of Turkey, based on literature (Kupicha, 1975; Tutin, 1976; Dakshini and Prithipalsingh, 1984; Tadesse, 1993; Güner, 2000; Bosch, 2004; Coşkunçelebi et al., 2007; Sîrbu and Oprea, 2008) and observations on herbarium samples, as follows:

1. Leaves simple-serrate; achenes bearing 4 aristae……*B. cernua* L.
a. Capitula discoid……var. *cernua*
b. Capitula radiate…….var. *radiata* DC.
1. Leaves lobed or pinnate; achenes bearing 2 or 4 aristae
2. At least lower leaves 3-5 lobed……..*B. tripartita* L.
2. All leaves pinnate
3. Leaves 1-pinnate; achenes compressed, bearing 2 aristae…….*B. frondosa* L.
3. Leaves 2-3 pinnate; achenes 4-angled, bearing 4 aristae……..*B. bipinnata* L.

Table 1. Main differences between our measurements and the measurements on *Bidens bipinnata* specimens from previously published studies

Morphological characters	**Other investigations done**					
	Present study	Tutin, 1976	Dakshini and Prithipalsingh, 1984	Tadesse, 1993	Bosch, 2004	Sîrbu and Oprea, 2008
Length of stem	up to 250cm	10-100cm	-	20-150 (250)cm	150 (200)cm	50-120cm
Indumentum of stem	almost glabrous	almost glabrous	-	glabrous or minutely setose-hispid	-	usually glabrous, rarely minutely setose-hispid
Size of leaves	7-22 × 5-11cm	-	2.2-13×0.3-2.3 cm	up to 20cm length	11-20cm length	7-15 × 5-9cm
Indumentum of leaves	usually glabrous, sparsely pubescent on veins	-	-	usually pubescent in lower parts	-	glabrous, rarely pilose along the veins and on the border of the lobes
Petiol length	2-5cm	-	1-5cm	1-6cm	-	2-5cm
Flowering capitulum	8-12 × 3-4mm	5-10mm diameter	3.5-9 × 2-9mm	4-7×4-6mm	4-7mm diameter	6-8 × 4-6mm
Peduncle length of flowering capitulum	3-5cm	-	-	up to 10cm	-	2-10cm
Peduncle length of fruiting capitulum	4-8cm	-	-	-	-	-
Number of outer involucral bracts	4-7	-	-	7-10	7-10	7-10
Length of outer involucral bracts	4-5mm	-	2-8mm	3-5 × 0.5mm	3-5mm	-
Number of inner involucral bracts	7-8	-	-	7-8	-	-
Length of inner involucral bracts	5mm	-	4.5-9mm	3-6 ×1mm	-	-
Number of ray florets	2-3	-	-	3-5	3-5	0-4
Size of ray florets	5-6 × 2-2.5mm	-	2.2-5.2×1.2-3 mm	c. 5 × 1.5mm	5-6mm length	2-3mm length
Number of disk florets	16-22	-	-	-	-	20-25
Length of disk florets	8mm (inner), 6mm (outer)	-	2-4.5mm	c. 4mm	4-5mm	3-4mm
Size of inner achenes	12-15 × 1mm	10-18mm length	10-20mm length	7-18 × 1mm	4-13mm length	12-18 × 1mm
Size of outer achenes	10-12 × 1mm	8-10mm length	-	-	-	-
Number of arista	4	2-3	(2) 3-4	(2,3) 4	2 (-4)	3-4
Length of arista	2-4mm	2-4mm	2-4mm	2-4mm	2-4mm	2-4mm

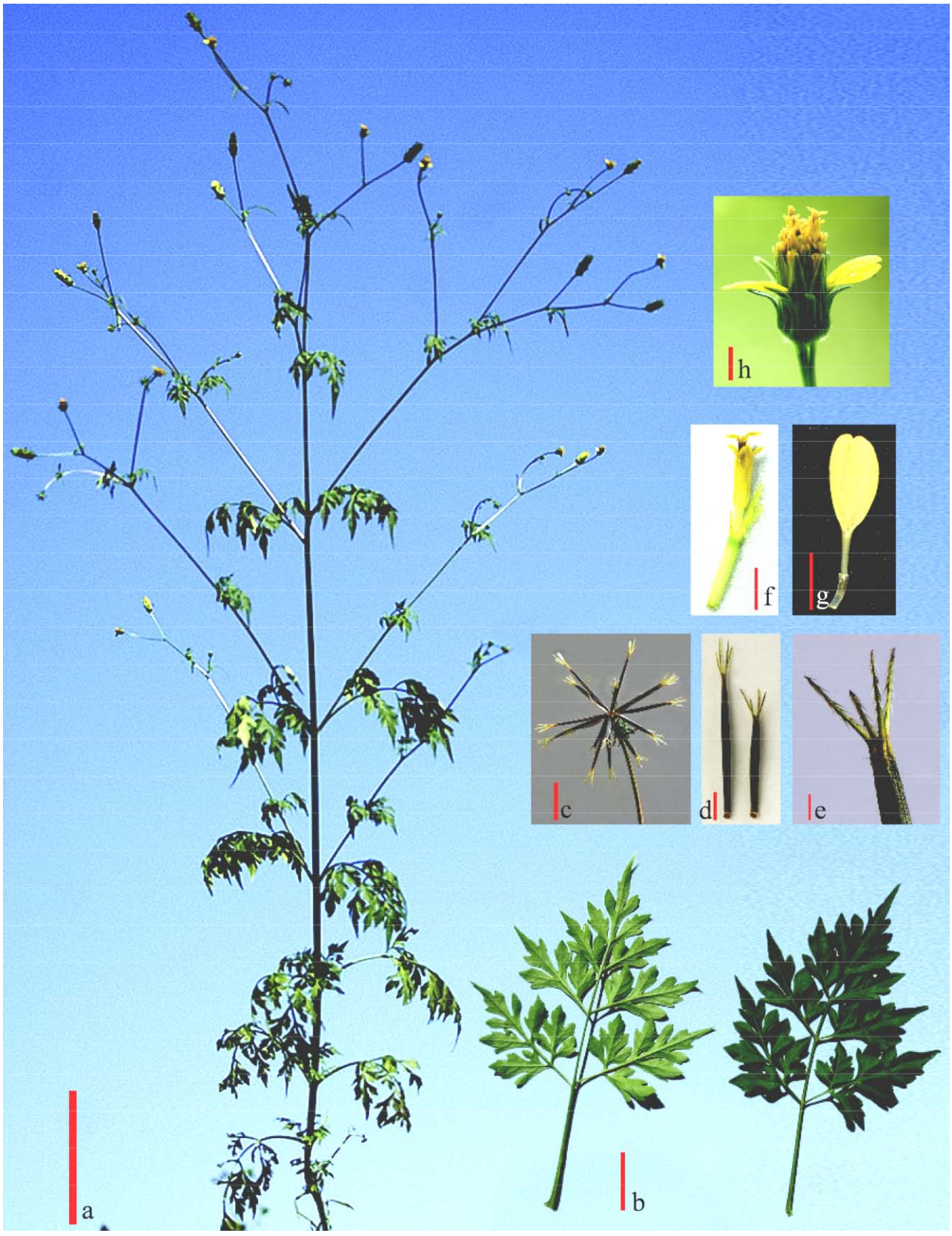

Figure 2. *Bidens bipinnata.* a- general habitus (natural); b-leaf; c-fruiting capitulum; d-outer and inner achene; e-arista of achene; f-disc flower; g-ray flower; h-flowering capitulum (Scale bars; a:10 cm; b: 3cm; c: 1 cm; d: 3 mm; e: 1 mm; f: 2 mm; g: 2 mm; h: 3 mm)

4. Discussion

B. bipinnata is native of South and North America and was naturalised in south and south-central Europe (Hegi, 1954; Tutin, 1976) and distributed throughout many countries of the world (Bosch, 2004). This phenomenal spread and colonization is due partly to their effective pollination mechanisms and their distinctive dispersal adaptations which allow seed distribution by humans, animals, wind, and water (Holm et al., 1977). The distribution of this species occurs zoochorous because its achenes which have retrorsely barbed arista adhere by means of the bristles (Figure 2e) to the fur of passing animals or clothes of humans (Bosch, 2004). We considered that; owing to such chorological characters of *B. bipinnata*, there are differences among measured morphological characters except for arista length (Table 1). Achenes of *B. bipinnata* probably was located from Balkans to Turkey by humans and this species distributed across fields, hazelnut plantations and roadsides of Middle Black Sea Region as a result of convenient climate and their ecological demands. A remarkable number of alien species have easily naturalised in NE Anatolia due to the high rainfall throughout the year (Terzioğlu and Anşin, 2001). Thus many new aliens have been reported previously from the Black Sea region of Turkey (Coşkunçelebi et al., 2007).

Bidens bipinnata individuals occurre sparsely in their habitats. Flowers bloom soon after the onset of first autumn rains and continue over October and fruits ripen synchronously. The outer achenes germinate later than the inner ones (Venable and Lawlor, 1980). Although this species is a new record for Turkey, we think that this species may be spread over ecologically favourable habitats and naturalised in Northern Anatolia due to its invasive character. It prefers open, sunny and warm places, with light, moist, and moderate-fertile soils. It especially grows in disturbed habitats: waste places, cultivated fields, areas along railroads and roadsides, riverbanks, and so on (Hegi, 1954; Correll and Johnston, 1970; Tutin, 1976; Huxley, 1992; Sîrbu and Oprea, 2008).

The following species were represented in the same habitat together with *B. bipinnata*: *Fraxinus angustifolia* Vahl subsp. *oxycarpa* (Bieb. ex Willd.) Franco and Rocha, *Alnus glutinosa* L. subsp. *barbata* (C.A.Meyer) Yalt., *Rubus sanctus* Schreber, *Urtica dioica* L., *Lythrum salicaria* L., *Oplismenus undulatifolius* (Ard.) P. Beauv., *Bidens tripartita* L., *Echinochloa oryzoides* (Ard.) Fritsch, *E. crus-galli* (L.) P. Beauv., *Amaranthus deflexus* L., *Plantago major* L., *Mentha longifolia* (L.) Huds., *Artemisia vulgaris* L., *Sambucus ebulus* L., *Phytolacca americana* L., *Senecio vernalis* Waldst. and Kit., *Conyza canadensis* (L.) Cronq., *Setaria glauca* (L.) P. Beauv., *Digitaria sanguinalis* (L.) Scop., *Solanum dulcamara* L., *Glechoma hederacea* L., *Chenopodium album* L., *Tamus communis* L. subsp. *communis*, *Prunella vulgaris* L., *Potentilla reptans* L., and *Holcus lanatus* L.

The key point is that alien plants are species moved directly or indirectly by people well beyond the original geographic range in which they evolved. In the process of translocation, alien plants are often freed from their pathogens and herbivores, which are left behind in the country of origin (Crawley, 1977). Thus, alien species are able to colonize to places where they have been transported.

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