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Research article/Araştırma makalesi

Cicer floribundum var. *amanicola* (Fabaceae), a new variety from south Anatolia, Turkey

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Abstract

A new variety, *Cicer floribundum* Fenzl. var. *amanicola* M.Öztürk & A.Duran is described from southern Turkey. The variety grows clearing of *Pinus nigra* forest (C6 Osmaniye province). *C. floribundum* var. *amanicola*, an endemic confined to south of Anatolia, is related with *C. floribundum* var. *floribundum*. Diagnostic morphological characters from *C. floribundum* var. *floribundum* are discussed and arranged in a key. Notes are also presented on its ecology and conservation status. In addition, pollen characteristics and seed coat surface features are examined with SEM. The geographical distributions of taxa are given in a map.

Key words: *Cicer*, Leguminosae, palynology, morphology, Turkey

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Cicer floribundum var. *amanicola* (Fabaceae), Güney Anadolu'dan yeni bir varyete

Özet

Türkiye'nin güneyinden *Cicer floribundum* Fenzl. var. *amanicola* M.Öztürk & A.Duran olarak yeni bir varyete tanımlandı. Bu yeni takson, *Pinus nigra* orman açıklıklarında yetişir (C6 Osmaniye). *C. floribundum* var. *amanicola*, endemik olup *C. floribundum* var. *floribundum* taksonundan ayrılır. *C. floribundum* var. *amanicola* ile var. *floribundum* taksonlarının tayin anahtarı düzenlendi ve ayırıcı karakterlerinin karşılaştırmaları yapıldı. Ayrıca ekolojisi verildi ve tehlike katergorisi önerildi. Bunlara ilave olarak polen karakterleri ve tohum yüzey özellikleri elektron mikroskobu (SEM) ile çalışıldı. Taksonların coğrafik dağılımları harita üzerinde gösterildi.

Anahtar kelimeler: *Cicer*, Leguminosae, palinoloji, morfoloji, Türkiye

1. Introduction

The genus *Cicer* L. comprises 45 species which has 9 annuals and 35 perennials (van der Maesen et al., 2007, Dönmez, 2011). Coles et al. (1998) were reported that the diversity centre of the *Cicer* genus is south-western Asia. Also, endemic species found in Morocco and the Canary Islands (van der Maesen,1987; Davies et al., 2007).

Cicer species represented with 10 species in Flora of Turkey (Davis, 1970; Davis et al., 1988). The genus *Cicer* taxa are distributed especially in Southern, South Eastern, Eastern, Mediterranean and Aegean part of Turkey. In addition to these taxa *C. heterophyllum* Contandr., Pamukç. & Quezel and *Cicer uludereensis* Dönmez were introduced to scientific world for the first time (Contandriopoulos et al., 1972; Dönmez, 2011). In this paper, we add a further variety, raising the total number of *Cicer* taxa known from Turkey to 13. *Cicer echinospermum* P.H.Davis, *C. floribundum*, *C. isauricum* P.H.Davis, *C. heterophyllum*, *Cicer uludereensis* and *C. reticulatum* Ladiz. are endemics for Turkey (Davis, 1970; Davis et al., 1988; Contandriopoulos et al., 1972; Dönmez, 2011).

Cicer, the only genus in tribe of *Cicereae*, its greatest diversity in West and Central Asia with an extension to the Mediterranean region (the Middle East, East Europe, and an isolated area in North Africa), but its origin and

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geographical relationships are poorly understood. (Javadi et al., 2007). Chickpea (*Cicer arietinum* L.) is one of the pulse crops domesticated in the Old World ca. 7000 years ago. Most probably, it has originated in an area of south-eastern Turkey and Syria.

The latest system was preferred in generic classification as proposed by in the revision of *Cicer*. According to the life forms, morphology and geographic criteria, the genus *Cicer* divided into six sections. These sections are *Cicer* L., *Chamaecicer* Popov, *Annua* (Maesen) Seferova, *Polycicer* Popov, *Vicioides* Jaub. & Spach. and *Stenophylllum* A.G. Guerra & G.P. Lewis (Davies et al., 2007). *Cicer floribundum* var. *amanicola* is placed in section *Polycicer.*

2. Materials and methods

During a field trip between 2007-2010 vegetation periods, we collected some specimens belonging to the genus *Cicer* in southern part of Anatolia, in the Osmaniye province. After careful examination, it was concluded that they constituted a new variety, belonging to *Cicer floribundum.* By studying the specific descriptions of *Cicer* in Davis (1975), Davis et al. (1988) and Güner et al. (2000), Özhatay et al. (1999), Özhatay and Kültür (2006), Özhatay et al. (2009, 2011) were compared the new variety with specimens in the herbaria E, G, W, IZ, EGE, GAZI, HUB, K, KNYA, AEF, ISFE, ISTO, ISEF and ANK. We found that our specimen was new to science. In the description below, each numerical value is the average of ten measurements from different specimens. Our specimens of *C. floribundum* var. *amanicola* were examined and compared with specimens of the related taxon *C. floribundum* var. *floribundum* in Turkey. The investigated representative specimens of *C. floribundum* var. *amanicola* and var. *floribundum* from different localities are cited in the Appendix 1. Selçuk University, Herbarium of the Faculty of Education was abbreviated as MR. The authors of plant names were checked with Brummitt and Powell (1992).

Palynological investigations are conducted with both light microscope and scanning electron microscope. For light microscope studies, the pollen slides were prepared using the Wodehouse technique (Wodehouse, 1935). Measurements were based on 20 or more pollen grains per specimen. The pollen grains are also directly placed on prepared stubs and coated with gold for SEM studies. Photographs are taken with Zeiss LS-10 after coated with poleron SC7620 sputter coater in SEM studies. Pollen shape classification follows in literature (Erdtman, 1966, 1969). The seeds are examined and photographed under SEM like the pollen (Clarke and Kupicha, 1976; Chatuverdi et al., 1995; Javadi and Yamaguchi, 2004).

3. Results

Cicer floribundum Fenzl. var. ***amanicola*** M.Öztürk & A.Duran **var. nov.** (Figure 1).

Affinis *C. floribundo* var. *floribundo*, sed pedunculis 5-15 cm longis, cum nodis 5-12 (nec 2-5 cm longis, cum nodis 1-4), aristis absentibus vel 2-3 mm longis (nec 15-20 mm), calycibus dentatis 7-8 mm longis (nec 10-15 mm) differt.

Tip: Turkey, Osmaniye: between Osmaniye and Yarpuz, 10. km, 835 m, 16.06.2010, 37°04'840"N, 36°21'965"E, *M.Özt* 1578 & *A.Duran* (holotype: KNYA, isotypes: GAZI, ANK, HUB, MR).

Stem erect, (13-)15-35(-60) cm tall, generally solitary, mostly branching from at the flowering parts and rarely from at the base. **Leaves** 5-11 × 2-5.5 cm in outline, imparipinnate with 4-8 pairs of leaflets; lower leaves imparipinnate ending with leaflet, leaves of flowering parts ending mostly in a simple or rarely 2-3 forked tendrils or cirrhose leaflet; **leaflets** 6-19(-25) x 4-7 mm, ±concolorous, apex of leaflets on at the base of rachis acute or cirrhose and degree increasing gradually at the end of the rachis, sometimes becoming tendrillous; leaflets of flowering part with tendrils. **Stipules** 2-6 x 1-5 mm at middle leaves, with 4-6 unequal ±triangular teeth. **Inflorescence** axillary raceme, most of the flowers falling before matured. **Peduncle** (4-)5-12 cm, bearing 5-12 nodes with bracts on each peduncle, 5-14 flowered (incl. immature flowers), each node 1-3 flowered, last node mostly ending in bract-like scale or linear-spathulate **awn** up to 2-3 mm; **bracts** 2-3 mm, with 8-9 teeth, teeth number reduced up to 3 in the upper flowering part, densely brownish stalked glandular hairs below and sparsely glandular hairs above. **Pedicel** 5-10 mm, patent or slightly deflexed recurved. Peduncles and pedicel densely multicelular glandular pubescent and sparsely eglandular hairs. **Calyx** tube 4-5 mm, irregular teeth 7-8 mm, triangular. **Standard** obovate 13-25 x 6-8 mm, claw 5-7 x 4-5 mm; **wings** 13-15 x 4-5 mm, claw 3 mm; **keels** 10-12 x 4-5 mm. **Ovary** 4-6 x 1-2 mm. **Fruit** 18-25(-27) × 6-8 mm. **Seeds** 4-6 diam.

Figure 1. Natural photos of *Cicer floribundum* var. *amanicola* and var. *floribundum*. var. *amanicola*: A- flowering part, C- calyx, E- middle leaves. var. *floribundum*: B- flowering part, D- calyx, F- middle leaves.

3.1. *Seed coat surface and pollen morphology*

The pollen of *Cicer floribundum* var. *floribundum* has radial symmetry, isopolar, 10% 3-parasynkolporat, 90% 3-zonokolporat. Polar axis (P) 28-35 µm, equatorial axis (E) 21-27 µm. P/E ratio is 1.31 µm. The shape of pollen grain is prolate. The shape of Amb is inter semi-angular, radius 23.5 µm. Exine tectate, 1.4 -2.1 µm, ectexine thicker than endexine. Ornamentation on mesocolpium reticulate, polar axis perforat. Lumina amorf, radius 0.5- 1.2 µm, muri width 0.15-0.30 µm. The orientation of the colpus margin is perforated. Intine 0.5-0.7 µm. Colpus long, upper part acute and forked, Clg 25-30 µm, Clt 7-11 µm, sometimes extending to the polar parts and connected. The aperture membrane

ornamentation is granulate. Pores lolongate, Plt 6-11 µm, Plg 4-7 µm, ornamentation granulate. Seeds 4-6 x 5-7 mm, shape globular, color greenish-brownish, ornamentation granulate-papillate (Figures 2-3).

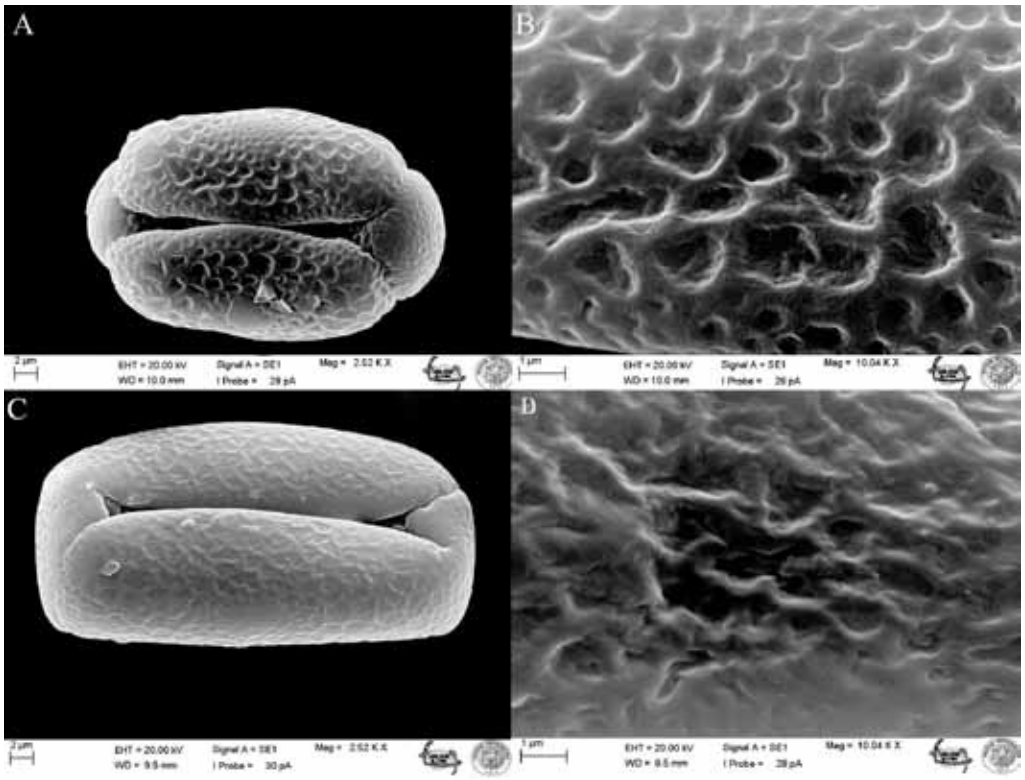

Figure 2. SEM photos of pollen grains *Cicer floribundum* var. *amanicola*: A-general shape, B- ornamentation (*M.Özt* 1493 & *A.Duran*). *Cicer floribundum* var. *floribundum*: C-general shape, D- ornamentation (*M.Özt* 1589 & *A.Duran*).

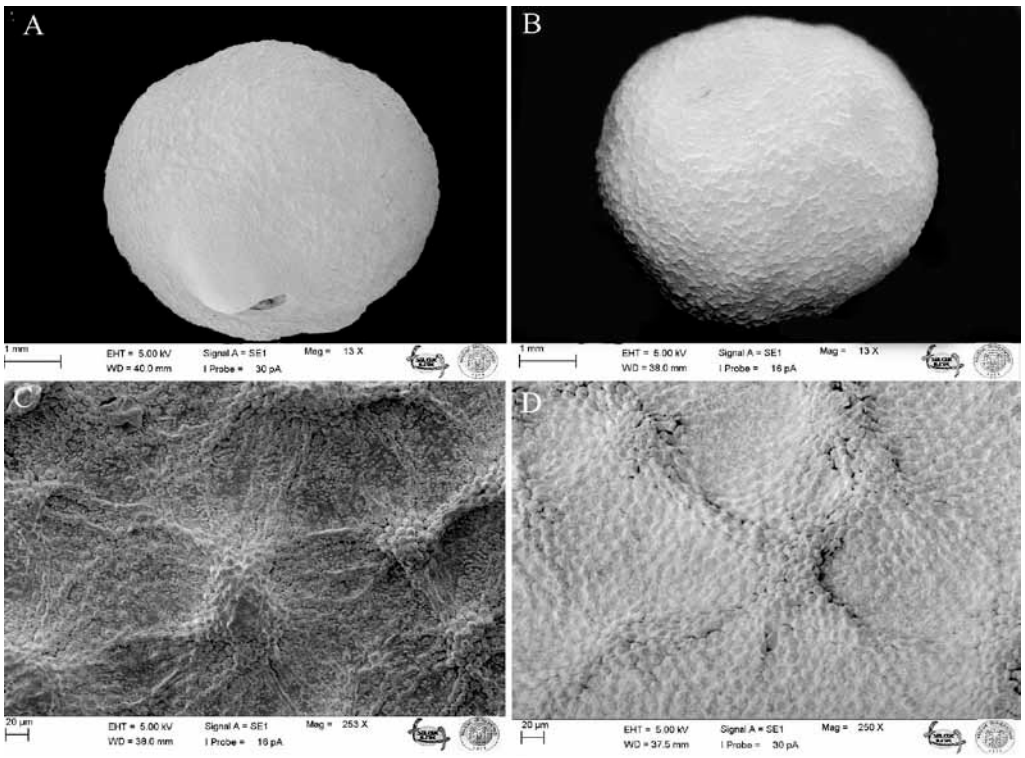

Figure 3. SEM photos of seed coat surface of *Cicer floribundum* var. *amanicola* and var. *floribundum*. Var. *amanicola*: A and B- general shapes, C- ornamentation (*M.Özt* 1493 & *A.Duran, S. Tutaş*). Var. *floribundum*: D- ornamentation (*M.Özt* 1590 & *A.Duran*).

The pollen of *Cicer floribundum* var. *amanicola* has radial symmetry, isopolar, 50% 3-parasynkolporat, 40% 3-zonokolporat and 10% 3-synkolporat. Polar axis (P) 22-28 µm, equatorial axis (E) 23-30 µm. P/E ratio is 0.9 µm. The shape of pollen grain is oblate-spheroidal. The shape of Amb is inter semi-angular, radius 23.5 µm. Exine tectate, 1.4-2.1 µm, ectexine thicker than endexine. Ornamentation on mesocolpium reticulate, polar axis perforate. Lumina amorf, radius 0.3-2 µm, muri width 0.15-0.35 µm. The orientation of colpus margin perforate. Intine 0.5-0.7 µm. Colpus long, upper part acute and forked, Clg 20-26 µm, Clt 8-11 µm, sometimes extending to the polar parts and connected. The aperture membrane ornamentation is granulate. Pores lolongate, Plt 8-11 µm, Plg 4-7 µm, ornamentation granulate. Seeds 4-6 x 5-7 mm, shape globular, color greenish-brownish, ornamentation granulate-papillate (Figures 2-3).

3.2. *Distribution and ecology*

Cicer floribundum var. *amanicola* is an endemic species and restricted to the Amanos Mountains (Osmaniye province), south Anatolia and East Mediterranean element (Figure 4). The vernacular name of this new variety is "Osmaniye Nohudu". It grows in mixed forest, shady slopes and in clearings of forest with *Glycyrrhiza flavescens* Boiss. subsp. *flavescens*, *Chamaetcytisus hirsutus* (L.) Link, *Vicia cracca* L., *Ononis spinosa* L. subsp. *leiosperma* (Boiss.) Širj., *Dorycnium graecum* (L.) Ser., *Lathyrus sulphurea* Boiss. & Bal., *Cercis siliquastrum* L. subsp. *hebecarpa* (Bornm.) Yalt. var. *hebecarpa* Bornm., *Trifolium nigriscens* Viv. subsp. *petrisavii* (Clem.) Holmboe, *Centaurea amanicola* Hub.-Mor., *C. cheriolopha* Fenzl (Wagenitz), *C. lycophifolia* Boiss. & Kotschy, *Quercus cerris* L. var. *cerris*, *Q. infectoria* Oliver, *Styrax officinalis* L., *Salvia multicaulis* Vahl., *Rhus coriaria* L., *Fraxinus ornus* L. *Laserpitium glaucum* Post., *Clinopodium vulgare* L. and *Pinus nigra* Arn.

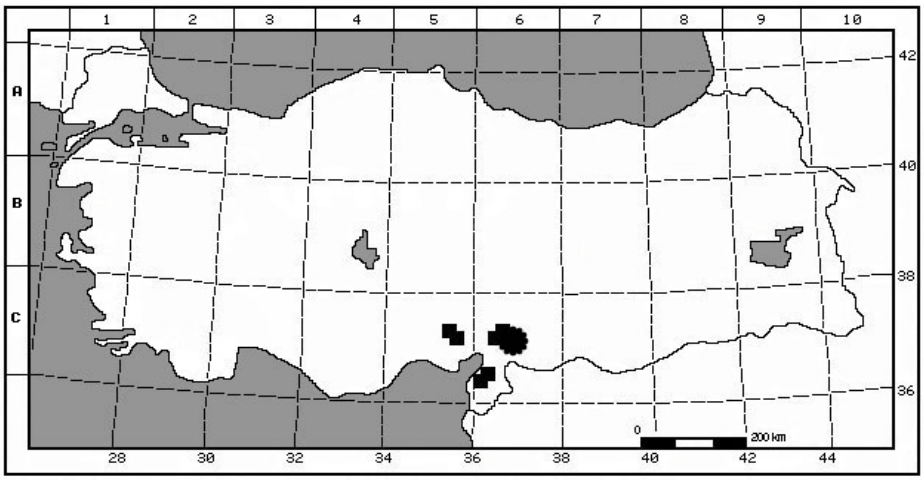

Figure 4. The distribution map of *Cicer floribundum* var. *amanicola* (˜)and *Cicer floribundum* var. *floribundum* (p) in Turkey.

3.3. *Suggested conservation status*

Cicer floribundum var. *amanicola* appears to exist in only the present locality, and its estimated area of occupancy is less than 5 km^2 with a population of over than 120 mature individuals. Area of occupancy reduced estimated to be more than 70% because of the road construction work which began in 2011.Because of its localized distribution and small population size, the new species should be considered as Critically Endangered (CR) and *Cicer floribundum* appears to exist in only the three localities and its estimated area of occupancy is bigger than 5 km^2 with a population of over than 120 mature individuals. Because of its localized distribution and small population size, the new species should be considered as Endangered (EN) according to IUCN Red List criteria (IUCN, 2008) according to IUCN Red List criteria (IUCN, 2008).

The Amanous (Amanos) mountain range is a botanically interesting area, occupying an intersection of Mediterranean phytogeographical region and the Anatolian Diagonal. The concept of the Diagonal was first proposed by P.H.Davis, who defined it as an oblique belt running from the north east south to the Anti-Taurus; it then divided into two, with one branch to the Amanous (Amanos) Mountain, the other to the Cilician Taurus (Davis, 1971). Thirty three percent of the total species growing in Turkey are found along the diagonal, while 5% are more or less restricted to it (Ekim & Güner, 1986). One explains for the present richness is neoendemism and distribution patterns of the plants related to the Diagonal (Ekim and Güner, 1986, Duran et al., 2005, Duran et al., 2010).

The eastern (Cilician) Taurus is made up of a series of broken or partly continuous parallel arch-like folds starting from north of Silifke (Mersin province) and running in a north-east trend (Zohary, 1973). According to Zohary (1973), because of climatological peculiarities (e.g. sizeable rain fall, some occurring during summer months, and high

atmospheric humidity in some parts of this mountain system), and probably also because of its floristic past, the Amanous system occupies a special place in the flora of the East Mediterranean province.
At recent times several taxa were introduced to the scientific world originating from Osmaniye and its surroundings. These taxa are the followings *Scorzonera yıldırımlii* A.Duran & Hamzaoğlu (Duran and Hamzaoğlu, 2004), *Prangos turcica* A.Duran, M.Sağıroğlu & H.Duman (Duran et al., 2005), *Origanum* x *adanense* Baser & Duman (Duman et. al, 1998), *Silene doganii* A.Duran & Y.Menemen (Duran and Menemen, 2003), *Hesperis hamzaoglui* A.Duran (Duran, 2008).

Key to related *Cicer* species in Turkey

1. Peduncle 2-5 cm, bearing 1-4 nodes with bracts on each peduncle, 1-4 flowered; awn 15-20 mm …… ……..……..……..var. **floribundum**
1. Peduncle (4-)5-12 cm, bearing 5-12 nodes with bracts on each peduncle, 5-14 flowered; awn absent or 2-3 mm ....var. **amanicola**

C. floribundum var. *amanicola* has some distinctive features in its morphologic characteristics when it has compared with *C. floribundum* var. *floribundum*. It mainly differs from var. *floribundum* because it has long peduncle 5-12 cm (not 2-5 cm), 5-12 nodes on each peduncle (not 1-4), flowers 5-14 (not 1-4), awn generally absent or rarely 2-3 mm long (not 15-20 mm), calyx tube 4-5 mm and teeth 7-8 mm (not tube 2-3 mm and teeth 10-15 mm).
C. floribundum var. *amanicola* has some distinctive features in its micromophologic characteristics too. Polar axis and P/E proportion of pollen grains smaller than *C. floribundum* var. *floribundum.* Pollen shape is oblate-speroidal, not prolate like in *C. floribundum* var. *floribundum.* Diagnostic characters of *C. floribundum* var. *amanicola* and *C. floribundum* var. *floribundum* are given in Table 1.

Table 1. Comparison of diagnostic characters of *Cicer floribundum* and *C. floribundum* var. *amanicola*

Characters	**Cicer floribundum** var. **floribundum**	**Cicer floribundum** var. **amanicola**
Leaflets	20-25 x 7-8 mm, bicoloured	6-19(-25) x 4-7 mm, ±concolorous
Stipules	10-13 x 7-9 mm at middle leaves, 6-10(-12) teeth	2-6 x 1-5 mm at middle leaves, 4-6 teeth
Peduncle	2-5 cm long, bearing 1-4 nodes with bract on each peduncle, up to 4 flowers, ending in a linear-spathulate awn	(4-)5-12 cm long, bearing 5-12 nodes with bract on each peduncle, up to 14 flowers, the last node mostly ending in bract-like scale or linear-spathulate awn
Awn	15-20 mm	mostly not or rarely 2-3 mm
Pedicel	5-7 mm, densely reddish to brownish multicelular glandular pubescent and sparsely eglandular hairs	5-10 mm, densely glandular and a few eglandular simple hairs
Calyx	tube 2-3 mm, teeth 10-15 mm, linear-lanceolate	tube 4-5 mm, teeth 7-8 mm, triangular

The seed coat surfaces of *Cicer floribundum* var. *floribundum* and var. *amanicola* were studied. On SEM images, it can be seen that both varieties seed ornamentation is characterized by granulate-papillate. Their seed shapes are globular. Seed and pollen characters were given in Table 2.

Table 2. Seed and pollen characters of *Cicer floribundum* var. *floribundum* and *C. floribundum* var. *amanicola*

Characters \ Taxa	**C. floribundum** var. **floribundum**	**C. floribundum** var. **amanicola**
Pollen type	10% 3-parasynkolporat, 90% 3-zonokolporat	50% 3-parasynkolporat, 40% 3-zonokolporat and 10% 3-synkolporat
Polar axis (P)	28-35 µm	22-28 µm
Equatorial axis (E)	21-27 µm	23-30 µm
P/E ratio, shape	1.31 µm, prolate	0.9 µm, oblate-spheroidal
Exine thickness	1.4 -2.1 µm	1.4-2.1 µm
Ornamentation equatorial area	reticulate	perforate
Ornamentation polar area	reticulate	perforate
Lumina radius	0.5- 1.2 µm	0.3-2 µm
Muri width	0.15-0.30 µm	0.15-0.35 µm
Clg	25-30 µm	20-26 µm
Clt	7-11 µm	8-11 µm
Plg	4-7 µm	4-7 µm
Plt	6-11 µm	8-11 µm
Seed length and width	4-6 x 5-7 mm	4-6 x 5-7 mm
Outline	globular	globular
Color	greenish-brownish	greenish-brownish
Ornamentation	granulate-papillate	granulate-papillate

According to the results, *Cicer floribundum* var. *amanicola* has some distinctive characteristics in terms of peduncle, pedicel, awn, bracts and calyx features in spite of the fact that the new variety is not similar to var. *floribundum*.

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Appendix 1. Additional specimens examined

Cicer floribundum var. **amanicola** (Paratypes); — Turkey, C6 Osmaniye: between Osmaniye-Yarpuz, 15. km, 26.06.1975, JM 260675 0501 (IZ); Adana: Osmaniye, Karataş village, 780 m, 11.06.1987, AK 110687 0206 (IZ); Osmaniye: Amonous (Amanos Mountain), *Quercus coccifera*-Gebüsch 1 km, under Yarpuz, 870 m, 02.06.1959, *P.H.Davis* 16.184-*1969* (G, foto!); Osmaniye: 1 km below Yarpuz, 870 m, *Hub.-Mor. 16184* (ANK); Osmaniye: Yarpuz, *Pinus-Quercus* forest, *van der Maesen* 2060 (ANK); Osmaniye: Yarpuz road, 10. km, 835 m, 18.6.2007, *P. brutia* ve *Quercus* mixed forest, 37°04'840"N, 36°21'965"E, *M.Özt* 1268 & *A.Duran, B.Doğan* (MR); ibid., 28.6.2009, *M.Özt* 1493 (MR)*;* ibid., 1.07.2010, *M.Özt* 1588 & *A.Duran, S.Tutaş* (MR). — **Cicer floribundum** var. **floribundum:** Turkey, C5 Adana: Karsantı, Şemadan region, enviroments of Şemadan beli, *Quercus* forest, 30.05.1973, *E.Yurdakul* 1602 (ANK); Adana: Karaisalı, Karsantı, 21.06.1970, *A.Pamukçuoğlu s.n.* (HUB); Adana: Pos, 1400-1500 m, fôret de *P. nigra*, Qz-Gt s.n. (MARSSJ); C6 Adana: Karsantı, Ardıçlı dölek, c. 1400 m, 15.7.1972, *E.Yurdakul* 53 (G, foto!); Adana: Aladağ, c. 10 km from Kökez village, 1070 m, 18.06.2010, *P. brutia* forest clearings, 36°S 697'574"E, 41°61'598"N, *M.Özt* 1581 & *A.Duran* (MR); Adana: In Monte Tauro, 1836, *T.Kotschy* 614-I, no: 167 (W, foto!); Osmaniye: Yarpuz road, 15. km, 936 m, 1.07.2010, *P. brutia* and *Quercus* mixed forest, 37°S 26'90590"E, 41°057'49"N, *M.Özt* 1589 & *A.Duran, S.Tutaş* (MR), ibid., 1.07.2010, *M.Özt* 1590 & *A.Duran, S.Tutaş* (MR); **Hatay:** Dörtyol, near Topaktaş (yayla) village, *Akman* 225 (ANK); Hatay: Dörtyol, *Fagus orientalis* forest, Amonos Mountain, ca. 1350 m., 16.06.1966, *Y.Akman* 225 (G, foto!); Tarbas Mt., Cilicia, *Siehe* 233 (GE, JE, K foto!).

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