

## Taxonomy of the Genus *Prunus* L. (*Rosaceae*) in Turkey

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**Abstract:** The taxonomy of the genus *Prunus* L. in Turkey is studied in detail. According to morphological characters, descriptions of the species have been evaluated and completed. *P. kurdica* Fenzl ex Fritsch, *P. cocomilia* Ten. var. *puberula* (Schneider) Browicz and *P. divaricata* Ledeb. subsp. *ursina* (Kotschy) Browicz are reduced to synonyms. A new key for the identification of the species has been prepared. Illustrations and distribution maps of particular species in Turkey were added to other information. Furthermore, data concerning habitat, altitude, flowering and fruiting time, distribution, chromosome numbers and taxonomic discussion for some species are given. Three new synonyms are proposed here. Palynological and anatomical results of many samples are discussed.

**Key Words:** *Prunus*, *Rosaceae*, Revision, Flora of Turkey.

### Türkiye’de Yetişen *Prunus* (*Rosaceae*) Cinsinin Taksonomisi

**Özet:** Bu revizyon çalışmasında Türkiye’de yetişen *Prunus* cinsinin taksonomisi ayrıntılı olarak incelenmiştir. Türlerin betimleri morfolojik karakterlere göre yeniden düzenlenerek, gerekli düzeltme ve genişletmeler yapılmıştır. *P. kurdica* Fenzl ex Fritsch, *P. cocomilia* Ten. var. *puberula* (Schneider) Browicz ve *P. divaricata* Ledeb. subsp. *ursina* (Kotschy) Browicz sinonim edilmiştir. Türlerin teşhisi için yeniden anahtar yapılmıştır. Türlerin çizimleri yapılmış ve Türkiye’deki dağılım haritaları hazırlanmıştır. Taksonların habitat, yükseklik, çiçeklenme ve olgun meyveye ulaşma zamanı, yeryüzü dağılışı ve kromozom sayıları verilmiş, taksonomik tartışmaları yapılmıştır. Bu çalışma kapsamında üç takson sinonim edilmiştir. Bir çok örnek için yapılan anatomik ve palinolojik çalışma sonuçları da tartışılmıştır.

**Anahtar Sözcükler:** *Prunus*, *Rosaceae*, Revizyon, Türkiye Florası.

### Introduction

Species of the genus *Prunus* L. are distributed in the northern hemisphere. Most of the species occur in semi-arid climates. Cultivated species of the genus are found under varying ecological conditions. The taxonomy of the genus is complicated because of the polymorphism and wide ecological tolerance of the species, as well as the presence of numerous cultivars.

Most genera of *Rosaceae* family are of economic importance(1). There are many taxonomic works on these well-known plants from pre-Linnaean times. Since the publication of Linnaeus’s *Species Plantarum*(2), the interest of systematists in this family has been ongoing. The genus *Prunus* is referred to the tribe *Pruneae* of the family. In spite of many taxonomic works on this family, there is no consensus as to its division. Dahlgren has placed some genera in separate families(3). Some authors(4, 5, 6, 7) divide the family into subfamilies, while others(8, 9) have divided it into tribes. Many authors(7, 10, 11) treat the genus *Prunus* broadly.

Among specialists there is still no agreement as to the morphological range of the genus *Prunus*. We prefer to adopt a narrow concept of the genus, as was done by Browicz(13) in the Flora of Turkey.

In spite of many comprehensive works on higher taxonomic levels of the family, there are few detailed works on the genus or the species complex. Many floras have been prepared since the second half of the 20<sup>th</sup> century for Asian and European countries(14). Afterwards, new revisions have been prepared. Ghora and co-workers’ revision on the Indian *Rosaceae* family is a good example of these new revisions(15). After Boissier’s work(16), an important revision of the genus *Prunus* was prepared by Browicz in Davis’s Flora of Turkey(13). There are no taxonomic works on the genus *Prunus* in Turkey published after Browicz(13). However, this revision by Browicz is very general because of insufficient herbarium materials and lack of field observations. Also, some taxonomic judgements about the genus *Prunus* given by him and previous authors seem to be ambiguous. In addition, there have been no

palynological, anatomical, biochemical or cytological works on the specimens belonging to *Prunus* species growing in Turkey. Therefore, our aim is to improve the taxonomy of the Turkish *Prunus* species.

In this revision, detailed descriptions of the species of *Prunus*, illustrations of some taxa and distribution maps according to Davis's (17) grid system were prepared. Keys are given to identification of the species in the flowering and fruiting stages of development. Type specimens or microfilms of most species and many original materials were examined. Published literature, herbarium samples, field observations, and anatomical and palynological information obtained from the work in our laboratory were used.

In addition to the study of the anatomy and palynology of the samples, the morphological species concept (18, 19, 20) has been applied.

## Material and Methods

In this study, morphological works are based on the herbarium specimens collected by the first author and other botanists. The specimens were studied in detail through direct observations and under a stereomicroscope according to habit, indumentum, leaf shape, flower and fruit characters. In order to examine type specimens and other herbarium samples AEF, ANK, EGE, GAZI, HUB, ISTE, ISTF, ISTO, K, E and Hb. Yıldırımli herbaria were visited. A herbarium acronym according to Holmgren et al. (21) followed by an exclamation mark indicates a type specimen seen. Taxon names were written according to the International Code of Botanical Nomenclature (22). Habitats, habit and other features of plant individuals were observed and their photographs were taken in the field. Large numbers of the specimens were used to compose the species descriptions. The descriptions of the taxa, based on mature and well-developed plants, have been supplemented or corrected according to type specimens, original descriptions, herbarium samples and field observations. In this paper the terminology concerning the morphology of plants follows Stearn (23), Lawrence (24) and Radford et al. (25). In the case of some species, the structures of their populations have been analysed. For this purpose, many samples collected from different localities were studied in detail anatomically and palynologically.

Various parts from the same plants were used for both anatomical and palynological works. Branches and leaves collected for anatomical studies were placed into

75% alcohol. Flower buds picked for palynological examination, and herbarium materials deposited in HUB for morphological works taken from the same plants. The anatomical structure of leaves and wood was studied by the paraffine method described by Foster (26), Purvis (27) and Dönmez (28). The slides were stained with safranin and fast green together. These slides were examined by James Swift light microscope and sections were photographed.

Pollen slides were prepared according to the Woodhouse (29) method for light microscopy. Pollen morphologies of the species were studied by both light and scanning electron microscopy. Pollen ornamentation, pollen size and shape, aperture, and exine and intine features were observed and measured.

For chromosome counts, many seeds were germinated. After root tips were cut, the seedlings were planted into pots and then transported to a garden. Observations on the development of young plants have provided some information on the nature of the indumentum.

For the accuracy of species names, author and other citations, Index Kewensis (30) was considered. Descriptions of the genus *Prunus*, identification keys of the taxa, selected localities of the plant samples, discussions and other information are given below. Abbreviations used in the text are as follows: Fl, flowering time; mf, mature fruiting time; H, habitat; A, altitude; Cn: chromosome number; DstT, distribution in Turkey; DstW, distribution in world; Prg: phytogeographic region, AAD: Ali A. Dönmez.

### PRUNUS L., Sp. Pl. 473 (1753).

Type species: *Prunus x domestica* L., Sp. Pl. 475 (1753).

Trees and shrubs; thorny or unarmed. Leaf and stipules deciduous, convolute in buds. Flowers solitary, in pairs or in clusters, hysteranthous, rarely synanthous. Sepals 5, petals 5(-7), stamens 20-30(-40) in 2 rows. Fruit fleshy and juicy; pruinose. Stone ovate, slightly compressed, surface smooth or ornamented. Seed compressed, ovate to elliptic.

1-Plant thorny; fruit at most

12(-15) x 10 mm

1- *spinosa*

1-Plant unarmed or weakly thorny;

fruit at least 15 x 12 mm

2-Sepals reflexed; fruit pendant,

pedicels longer than fruit

3- *divaricata*

2-Sepals erect or patent; fruit pendant or erect, pedicels usually shorter than fruit

3-Leaves 2-4 cm, crenate; plant weakly thorny; fruit sour **2- cocomilia**

3-Leaves longer than 4 cm, serrate, crenate; unarmed; fruit sweet **4- x domestica**

1- *Prunus spinosa* L., Sp. Pl. 475 (1753). (Figures 1, 2).

Typus: Described from Europe (Clifford Herbarium, microfilm !).

= *Prunus spinosa* L. var. *dasyphylla* Schur, Enum. Pl. Transs. 178 (1866).

= *Prunus kurdica* Fenzl ex Frisch, Sitz.-Ber. Akad. Wiss. Wien 101:628, t. 1 (1892). syn. nova.

= *Prunus spinosa* L. subsp. *dasyphylla* (Schur) Domin, Bull. Intern. Ac. Tchèque Sci. 54, 27:15 (1944).

Iconographia: Hegi, G., 1923, III. Fl. Mittel-Eur. 4 (10): t. 1102; Poyarkova, A. I., 1941, Fl. URSS, 10, t. 32(31); Pignatti, S., 1982, Fl. d'Italia, 1:616(32); Roger, P., 1983, Trees in Br. Eur. and N. Amer., 176(33); Chrtek, J., 1992, Kvetena-3 Cheske Rep., 4, t. 98(34).

Thorny shrub, 1-2(-3) m, buds and young shoots hairy, rarely glabrous. Buds 1-2 x 1-1.5 mm, in 2-3 groups. Stipules 3-5 x 0.5-1.5 mm; deciduous, lanceolate, margin glandular. Leaves pubescent; petiole 5-10(-20) mm, lamina (10-)20-30 x 8-15(-25) mm, on young shoots up to 90 x 40 mm; obovate to elliptic; margin serrate, crenate, glandular, a pair of large glands present at base of lamina. Flowers 10-15 mm in diameter, single or in pairs, flowering before leaves, rarely together. Pedicel 10-15 mm, on fruit up to 25 mm. Hypanthium 1.5-3.5 x 1.2-4 mm; cupular, hairy inside and outside. Sepals 2-3 x 1.5-2 mm; oblong-elliptic, apex obtuse, hairy, rarely glabrous. Petals 3-4.5 x 2-4 mm; white, orbicular, obovate to elliptic. Stamen 15-18, in one row on the hypanthium. Ovary glabrous, globose to ovate. Fruit 5-8 x 5-6 mm, erect or patent, globose to ovate, glaucous, sour. Stone 6-10 x 5-9 mm; surface smooth or verrucose, slightly compressed, keeled on the ventral side. Seed 5-7 x 3-5 mm; ovate, slightly compressed, longitudinally striated, apex acute.

*Fl*: March to May (September); *Mf*: June to September; *H*: Orchard edge, steppe, rocky places, mixed forest; *A*: s. l.-1800 m; *Cn*: 2n=32, (35); 2n=32 (36); 2n=32, (34); *DstT*: throughout Turkey; *DstW*: North America, Europe, Caucasia. *Prg*: cosmopolitan.

**A1** Edirne: Uzunköprü, 23 vi 1968, *A. Baytop* 14.139! Tekirdağ: Malkara to Keşan, 200 m, *Davis* 39276!-*Coode*. Kırklareli: between Saray and Vize, 11 vi 1968, *A. Baytop* 13.174! **A2** İzmit: around İzmit, 1 m, 30 iii 1957, *Davis* 26247!-*Hedge*. İstanbul: Tuzla 30 vii 1966, *A. and T. Baytop* 6762! **A3** Adapazarı: Sakarya, Dokuzcuk, 8 viii 1974, *F. Tekin!* Bolu: Akçakoca, 2-50 m, 28 viii 1995, *Ş. Yıldırım!* 18992! Kütahya: 66. km to Eskişehir road, 1020 m, 9 iv 1994, *AAD* 4056 **A4** Zonguldak: Zonguldak to Çaycuma, 450 m, 17 vi 1962, *Davis* 37655!-*Coode and Yaltırık*. Ankara: Bağlum village, 1100 m, 12 viii 1994, *AAD* 4166; Çubuk, Karagöl, 18 vii 1973, *S. Erik* 258!; Çankırı: Korgun, Kozdere fountain to Dikenli village, 1100 m, 25 v 1996, *AAD* 5287-*Ş. Yıldırım!*. Kırıkkale: Koçubaba, Gölçukuru district, 1300 m, 20 v 1994, *AAD* 4090. **A5** Kastamonu: between Korgun and Ilgaz, 900 m, 19 vii 1993, *AAD* 3580. Amasya: W of Ortaklar village, 800 m, 22 vii 1993, *AAD* 3737. Sinop: 50 m, 25 vii 1962, *Davis* 38104!-*Coode and Yaltırık*. Çorum: Çorum, 900 m, 23 iv 1969, *Tobey* 2494! Samsun: Ladik, Karadağ, 1150 m, 14 vi 1965, *C. Tobey* 1138! **A6** Tokat: Reşadiye, Çambolu village, Çaylılar district, 25 viii 1974, *S. Şahin!* **A7** Gümüşhane: around Şiran, 1350 m, 7 ix 1993, *AAD* 3988-*A. Güner*. **A9** Ardahan: Posof, between Gümüşkavak and Eminbey village, 1700 m, 24 viii 1995, *AAD* 5004. **B1** Balıkesir: Yeşilhisar village, Savaştepe, 5 vii 1980, *G. and H. Çakırlar*, *ISTE* 45.258! Çanakkale: around of Başpınar, 80-150 m, limestone, 8 ix 1995, *AAD* 5058. İzmir: Kemalpaşa, Nif mountain, 750 m, 8 vii 1965, *C. Argat*, No: 7522! **B2** Manisa: Soma, around Hamzalıhoca village, 150 m, 8 ix 1995, *AAD* 5063. Uşak: around Çevreköy, 1000 m, 3 viii 1995, *AAD* 4790. **B3** Bilecik: between Bilecik and Bozhüyük, 750 m, 2 v 1993, *Z. Aytaç* 5761! Kütahya: 6-8 km N of İnönü, 900 m, 23 iv 1966, *Davis* 42111c! Isparta: Şarkikaraağaç, Kızıldağ National Park, Çatakbaşı, 1150 m, 16 x 1994, *B. Mutlu* 1133! Afyon: around train station, 1000 m, 1 viii 1993, *AAD* 3885. Eskişehir: Mihalıççık, between Dinek and Sorkun, 950 m, 1 v 1993, *AAD* 3155. **B4** Ankara: Beytepe campus, 950 m, 18 iv 1994, *AAD* 4081. **B5** Yozgat: Çayıralan, 2 km Çayıralan to Elçiköy, 25 viii 1994, *AAD* 4206. Aksaray: Kızılkaya village, Kutlukaya district, 1150 m, 24 viii 1994. *F. Ertuğ* 170! Kayseri: Özvatan, Kermeli village, Alibey valley, 1350 m, 26 viii 1994, *AAD* 4219-*Z. Aytaç*. **B6** Sivas: Sivas to Tatlıcak, 1350 m, *Tobey* 1689! **B8** Erzurum: Hınıs, Çatak village, 1640 m, 4 viii 1996, *AAD* 5427. Muş: Ad pagum Angag versus Murat flumen, 1300 m, 1 ix 1859, *Kotschy* 534! (type sample of *Prunus kurdica* Fenzl ex Frisch); Murat valley, Muş to Varto, 1430 m, 8 vi 1966, *Davis* 46130!; Mercimekkale,



Figure 1. *Prunus spinosa*. a: flowering branch (AAD 3155); b: fruiting branch (AAD 3580), c: leaf, d: bud, e: flower, f: fruit, g: stone.

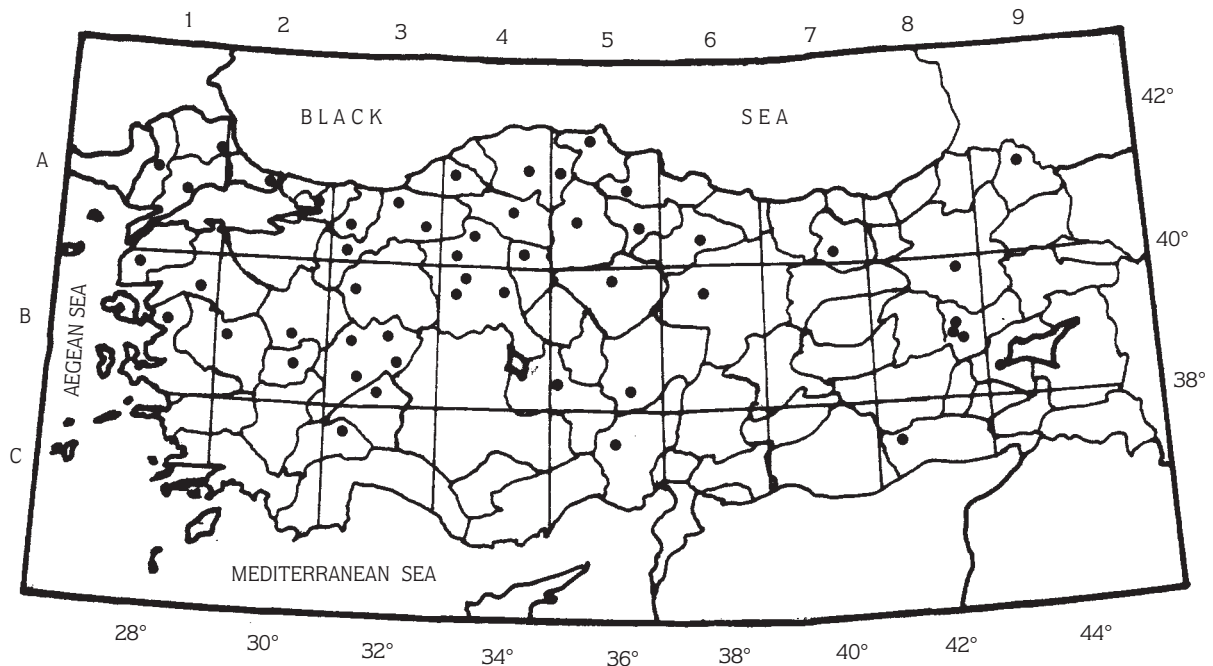


Figure 2. Distribution of *P. spinosa* (●) in Turkey.

around Tepeköy, 1450 m, 4 viii 1996, AAD 5433, AAD 5436, AAD 5438, AAD 5441, AAD 5442, AAD 5445 and AAD 5449. **B9** Bitlis: Tatvan, above Sez village, 1600-1700 m, 30 viii 1972, *H. Peşmen* 3318! **C2** Burdur: between Gölhisar and Dirmil, 5 km to Dirmil, 1000-1100 m, 23 viii 1993, AAD 3953. **C5** Adana: Dorak, 100 m, 31 ix 1913, *Ed. W. Siehe* 1913:319! **C8** Urfa: Siverek, 800 m, 6 viii 1998, AAD 5795-E. O. Dönmez.

The species is widely distributed in the northern hemisphere and has many intraspecific variants. The species was divided into varieties by some authors (10, 31, 37) and into subspecies by Chrtek (34). Other authors do not divide this species to lower categories (e.g. Webb) (38).

Herbarium samples collected by the first author and other systematists and field observation on this species showed that the species exhibits wider variation than was thought before. But when we deal with local plant groups, we notice that there are no distinctive morphological features differentiating them from other local groups. Many characters are common in different populations, and there are no considerable morphological differences between small groups. Furthermore, their pollen morphology and anatomical structures show no important taxonomic differences.

The occurrence of thorns is an important character of this species, but the thorns are weaker in deep soils and humid areas. The indumentum is generally present on young branches and leaves. However, especially on young shoots, it is weaker and sometimes absent. In late summer or autumn, mature plants lose their indumentum, especially when they live in exposed places. When plants live in damp and nutrient-rich soils, their leaves become larger but leaf shape remains constant. Leaves of sterile shoots are more robust and this may lead to misidentification.

*P. kurdica* is an extreme form of *P. spinosa*. It grows on river banks and nutrient rich soils in the Murat valley, which is the *locus classicus* of *P. kurdica*. Previous authors analysed only its young braches. We observed that the shrubs have weak thorns. However there are no distinctive differences in its indumentum and leaves. On the other hand, there are *P. spinosa* populations fifty meters away from *P. kurdica* plants. These two groups of shrubs are so similar to each other that they should not be regarded as two different taxa. The shrubs called *P. kurdica* represent different plants but not different taxa. However, some authors (31, 13) have concluded that *P. kurdica* is a nothospecies, whose parents would be *P. x domestica* and *P. divaricata*. However, there is no morphological or anatomical evidence for the hybrid origin of *P. kurdica*.

This revision is based on the plant material collected in Turkey only. Although literature and floras including the species *P. spinosa* in some other countries were taken

into account, unfortunately, it was not possible to examine plant materials from these countries.



Figure 3. *Prunus cocomilia*. a: flowering branch (AAD4358), b: fruiting branch (AAD 3928), c: fruit, d: stone, e: seed.

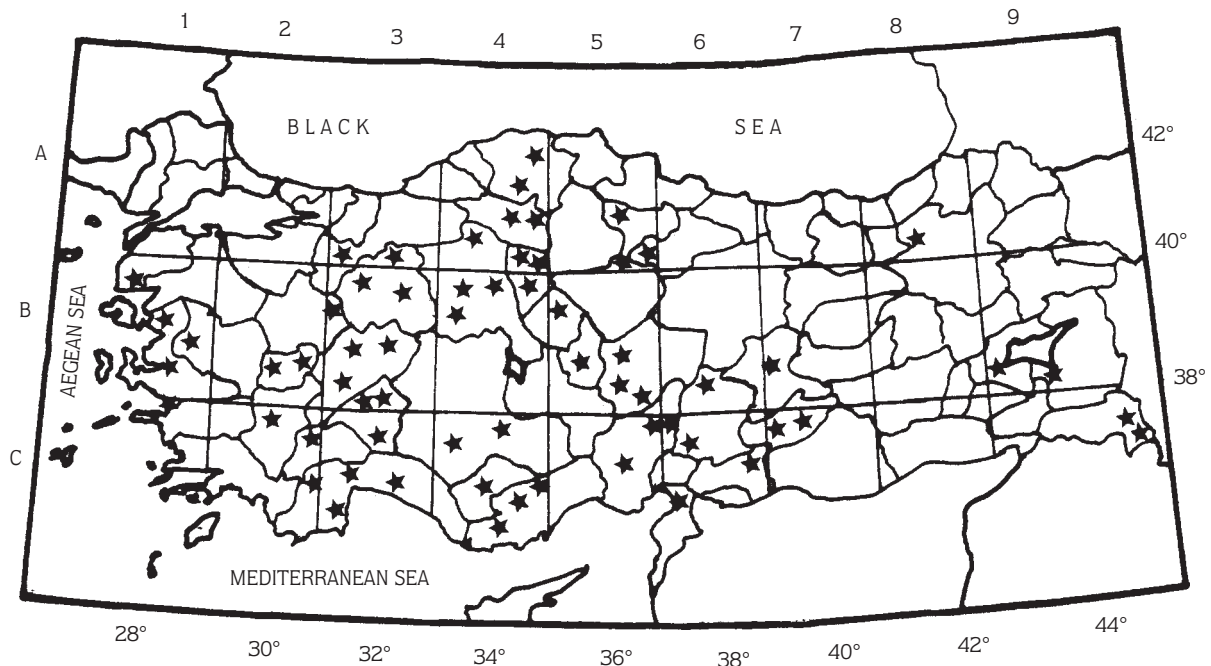


Figure 4. Distribution of *Prunus cocomilia* (★) in Turkey.

2- *P. cocomilia* Ten., Prodr. Fl. Nap. 1:68 (1811). (Figures 3, 4).

Typus: Described from S. Italy.

= *Prunus pseudoarmeniaca* Heldr. & Sart., Boiss., Diagn. ser. 2(5):96 (1859).

= *Prunus pseudoarmeniaca* Heldr. & Sart., var. *puberula* Schneider. Ill. Handb. Laubh. 1:634 (1906).

= *Prunus monticola* C. Koch, var. *pubescens* Nab., Publ. Fac. Sci. Univ. Masaryk Brno. 35:107 (1923).

= *Prunus cocomilia* Ten. var. *puberula* (Schneider) Browicz, Fl. Turkey 4:13, 1972. *syn. nova*.

= *Prunus divaricata* Ledeb. subsp. *ursina* (Kotschy) Browicz, in Fl. Turkey, 4:11(1972), *syn. nova*.

Iconographia: Pignatti, S., 1982, Fl. d'Italia, 1: 616.

Tree or shrub, 1.5-5 m; weakly thorny or unarmed, shoots pilose, pubescent or glabrous. Buds 2-3 x 1-2 mm; ovate to elliptic, pubescent or glabrous, leaf axillary buds single, elliptic to oblong. Stipules 2-4 mm; deciduous, margin glandular, incised at the base. Petiole 10-15 mm. Lamina (10-)20-30 x (5-)15-25 mm; obovate, elliptic, hairy or glabrous, apex obtuse, acute, rarely slightly caudate, margin crenate to bicrenate, serrate, biserrate, glandular, a pair of large glands present at the base of the

lamina. Flowering hysteranthous, rarely synanthous, flowers 20-30 mm diameter; 1-2 flowers in each bud, rarely in cyme. Pedicel (1-)3-10(-15) mm. Hypanthium 2-4 x 3-4 mm, cup-shaped. Sepals 1-2 x 1.5-2 mm; ovate-elliptic, patent or erect. Petals 2-6 x 3-6 mm; orbicular, obovate, usually white, rarely pinkish. Stamens (28-)30-35(-38), inserted from hypanthium. Fruit 10-20 x 8-20(-25) mm, globose to ovate, erect or patent, yellow, orange or dark violet, glaucous, rounded depressed smooth or acute, sour. Stone slightly compressed, surface smooth or slightly pitted, winged on the ventral side. Seed ovate, elliptic, slightly compressed, longitudinally striated.

*Fl*: January to May; *Mf*: August to October; *H*: Deciduous mixed forest, steppe, field edge, garden, limestone; *A*: 300-1700 m; *DstT*: throughout Turkey, Inner Aegean, Central Antolia, W of SE Anatolia; *DstW*: Italy, Greece, Turkey, Lebanon, Palestine, *Prg*: Irano-Turanian.

**A3** Kütahya: Tavşanlı to Emet, 800 m, 3 vi 1962, Davis 365711-Cooder. Eskişehir: Hekimdağ pass, 1200 m, 10 iv 1994, AAD 4077. **A4** Ankara: Kızılcahamam, Soğuksu National Park, 1040 m, 2 v 1994, AAD 4088. Kırıkkale: Koçubaba, 1350 m, 10 v 1995, AAD 4486. Çankırı: N of Yapraklı, 1450 m, *Quercus-Pinus* forest, 26

ix 1992, AAD 2989b. Kastamonu: between Korgun and Ilgaz, 900 m, 19 vii 1993, AAD 3572. A5 Amasya: W of Ortaklar village, 800 m, 22 vii 1994, AAD 3739. Tokat: Zile, Akçağaçlı village, 900 m, 24 vii 1993, AAD 3788. Yozgat: National Park, 1380 m, 24 vii 1993, AAD 3816. A8 Erzurum: Kop Dağı, between Aşkale and Bayburt, 2000-2450 m, *Rechinger* 32892! B1 Çanakkale: Ayvacık, Çatı village, 700 m, 8 ix 1995, AAD 5061. İzmir: Kuşadası, Samsundağ, Taşdelen district, 8 v 1965, *Kayacık* and *Yaltrık* No:3348! Manisa: Sipil mountain, above Manisa, 700-800 m, *J. Bornmueller* 1906:9459! B2 Uşak: between Çevreköy and Uşak, 950 m, 3 viii 1995, AAD 4776, AAD 4785. B3 Isparta: Şarkikaraağaç, Kızıldağ National Park, 1250 m, 23 vii 1994, *B. Mutlul* Afyon: around train station, 1000 m, 1 viii 1993, AAD 3887. Eskişehir: Mihalıççık, between Sorkun and Mihalıççık, 1320 m, 1 v 1993, AAD 3151. B4 Ankara: Beynam village, 900 m, 24 iv 1995, AAD 4448. Kırıkkale: Delice, Barak village, 900-1070 m, 17 viii 1993, AAD 3928. B5 Niğde: Altunhisar, Hasan mountain, Karakapı village, 1900 m, 18 viii 1996, AAD 5471. Kayseri: Yahyalı, Yeşilköy, 800 m, 20 viii 1996, AAD 5499. Kırşehir: Çiçek mountain, Kavurma village, 1300-1450 m, 9 v 1995, *H. Polat* 1024! B6 Kahramanmaraş: Göksun, Kandil mountain, Kınıkkoz, 2200 m, 25 x 1980, *B. Yıldız* 2380! B7 Elazığ: Keban, Ağım, Altınayva village, 1300 m, 10 v 1996, AAD 5258. B9 Bitlis: Tatvan, Nemrut mountain, above Sıcakgöl, 2500 m, 5 vii 1972, *H. Peşmen* 3012! Van: E of Pelli mountain pass, 38. km Gevaş to Tatvan, 2240 m, 7 vi 1966, *Davis* 46078! C1 İzmir: Kuşadası, Samsundağ, Taşdelen district, 9 v 1965, *Kayacık* 3348! C2 Burdur: between Gölhisar and Dirmil, 1100 m, 23 vii 1993, AAD 3953. Denizli: Bozkurt, Çambaşı village, 1300 m, 8 viii 1993, AAD 3904. Antalya: Kumluca, Tahtalı mountain, above Altınyaka village, 800 m, 26 viii 1993, AAD 3971. C3 Isparta: Sütçüler, between Çandır and Kızıllı, 700 m, 29 viii 1993, AAD 3984. C4 Karaman: Ermenek, Bucakkışla, Bayır village, 1050 m, 20 viii 1994, AAD 4201. Konya: around Sille dam, 1300 m, 5 viii 1995, AAD 4831. İçel: between Anamur and Kazancı, 850 m, 8 viii 1994, AAD 4181-*M. Vural*. C5 Adana: Pozantı, Çamardı village, 1100 m, 18 v 1993, AAD 3175. C6 Adana: Fevzipaşa, c. 150 m, 12 iv 1934, *K. Balls* 768! Hatay: İskenderun, Karagöz village, 350 m, 31 iii 1995, AAD 4431. Kahramanmaraş: between Andırın and Geben, 1130 m, 21 v 1993, AAD 3206-*M. Koyuncu et al.* Gaziantep: between Dülükbaba and Karabuç village, 1200 m, 27 vi 1995, AAD 4702. C7 Adıyaman: Gölbaşı, 1100 m, 29 vii 1995, AAD 4751;

around Sincik, 1380 m, 23 iii 1996, AAD 5126. C9 Hakkari: Yüksekova to Şemdinli, 1850 m, 15 vi 1966, *Davis* 45063! C10 Hakkari: Şemdinli to Yüksekova 8. km, 1700 m, 10 vi 1966, *Davis* 44967!

This species, occurring naturally in Turkey, has been divided into two varieties: *P. cocomilia* Ten var. *cocomilia* and *P. cocomilia* Ten var. *puberula* (Schneider) Browicz, in Flora of Turkey, by Browicz (13). This species grows in mixed deciduous scrub, especially in oak scrub. There are no thornless plants in the field belonging to this species. However, the thorns are not as abundant as in *P. spinosa*, and the thorns of *P. cocomilia* are mainly on two- or three-year-old branches. Some herbarium samples cut from one- or two-year-old branches can be misleading. The indumentum is mainly pilose but some plants are glabrous. There is no sufficient reason for dividing *P. cocomilia* into the variety *P. cocomilia* Ten var. *puberula* (Schneider) Browicz.

*P. divaricata* Ledeb. subsp. *ursina* (Kotschy) Browicz does not belong to *P. divaricata*, but to *P. cocomilia*. Its habit, leaf shape, indumentum, fruit shape and pedicel characters fit *P. cocomilia* and not *P. divaricata*. There is a problem concerning the type studied. The herbarium sheet includes two fruits in the envelope, but these fruits differ from each other. One of them (ovate) belongs to *P. divaricata*, whereas the other one (globose) belongs to *P. cocomilia*. Undoubtedly, these two fruits were not collected from the same plant. However, the plants on the herbarium sheet belong to *P. cocomilia*. These two fruits can lead to a mistake. Both the pollen ornamentation and wood structure of the this two species are very similar, suggesting that there are no important taxonomic differences between them.

*P. divaricata* subsp. *ursina* is transferred to *P. cocomilia* by the authors of this study. As there are no differences between *P. divaricata* subsp. *ursina* and *P. cocomilia*, subsp. *ursina* is reduced to a synonym of the latter species. As explained above, *P. cocomilia* var. *puberula* is also reduced to a synonym of typical *P. cocomilia*.

3- *P. x domestica* L. Sp. Pl. 475 (1753). (Figures 5, 6).

Typus: Described from S Europe.

Iconographia: Hegi, G., 1923, III. Fl. Mittel-Eur. 4 (10) (2): t. 1275; Pignatti, S., 1982, Fl. d'Italia, 1: 616(32); Chrtek, J., 1992, Kvetena-3 Cheske Rep., 3, t. 99(34).





Figure 5. *Prunus x domestica*. a: flowering branch (AAD 4060), b: fruiting branch (AAD 3714), c: leaf of young shoot, d: fruit, e: stone, f: seed.

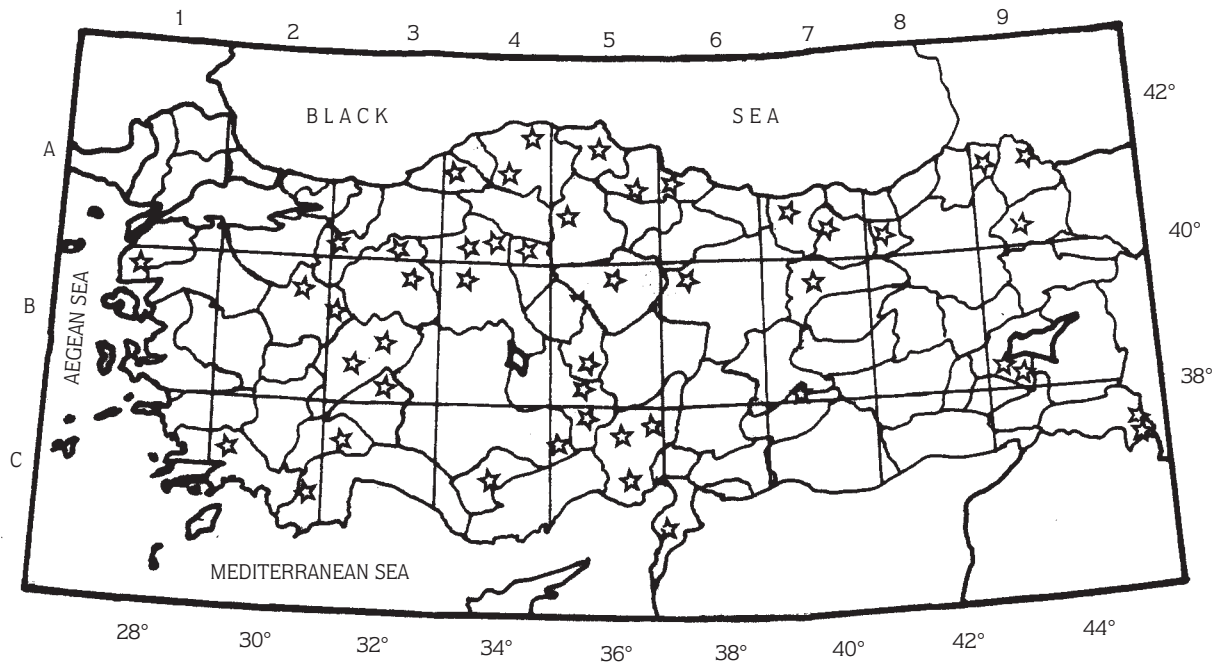


Figure 6. Distribution of *Prunus x domestica* (☆) in Turkey.

Trees, up to 12 m; unarmed, rarely weakly thorny, shoots and buds glabrous or hairy. Buds 2-3 x 1-2 mm; ovate to elliptic. Stipule deciduous, subulate, margin incised, glandular. Leaves glabrous or pilose. Petiole 10-20 mm. Lamina (30-)40-60(-80) x (20-)30-40 mm, on young shoots up to 100 x 60 mm, serrate, crenate, apex acute or cuspidate. Flowering before the leaves, rarely together; flowers in 15-25 mm diameter. Pedicel 5-10(-15) mm, up to 30 mm in fruit. Hypanthium 2-2.5 x 3-3.5 mm; cup-shaped, glabrous or hairy. Sepals 5, 2-3 x 1.5-2 mm; oblong to elliptic, apex obtuse or acute. Petals 5(-7), 6-8 x 6-7 mm; white, orbicular, elliptic or obovate. Fruit 20-40(-50) x 15-30(-40) mm; globose, ovate, glaucous. Stone (10-)15-30 x (8-)10-20 mm; ovate to elliptic, compressed laterally, surface pitted, verrucose or reticulate, winged on the ventral side. Seeds 8-10 x 5-8 mm; compressed laterally, longitudinally striate, obovate to elliptic.

*Fl*: February to April; *Mf*: May to July; *H*: Garden; *A*: s.l.-1900 m; *Cn*: 2n=48 (36); 2n=48 (34); *DstT*: through Turkey; *DstW*: North America, Europe, Caucasia, Australia. *Prg*: cosmopolitan.

**A3** Kütahya: Tavşanlı to Emet, 800 m, 3 vi 1962, *Davis* 36571!-*Coode*. **A4** Zonguldak: Keltepe, Sorgun pasture, above of Yenice, 1300 m, 4 viii 1962, *Davis* 38979! Ankara: Bağlum village, 1100 m, 12 viii 1994,

*AAD* 4161. Kırıkkale: Koçubaba, 1200 m, 10 viii 1994, *AAD* 4142. **A5** Kastamonu: Tosya to Kastamonu, 750 m, 20 vii 1993, *AAD* 3613. Amasya: Ortaklar village, 800, 22 vii 1993, *AAD* 3739. Sinop: Erfelek, Lala village, 110 m, 21 vii 1993, *AAD* 3691. Samsun: Vezirköprü, 400 m, 22 vii 1993, *AAD* 3712. **A6** Samsun: Mağmur mountain, 300 m, 12 iii 1966, *Tobey* 1537! **A7** Giresun: Dereli, Yavuzkema, 1480 m, 6 ix 1993, *AAD* 3987-A. *Güner*. Gümüşhane: around Şiran, 1350 m, 7 ix 1993, *AAD* 3989-A. *Güner*. **A8** Bayburt: N of Maden village, 2300-2850 m, 12 ix 1993, *AAD* 4002-A. *Güner*. **A9** Artvin: around the city, 200 m, 3 vi 1993, *AAD* 3251-J. *A. Metzger*. Kars: Kümbet valley, 1300 m, 16. 11. 1997, *Ş. Yıldırım* 20766! Ardahan: Eminbey village, 1300, 24 viii 1995, *AAD* 5007. **B1** Çanakkale: İter Trojanum 1883, 3 iv 1883, *P. Sintenis*! **B2** Kütahya: between Tavşanlı and Emet, 800 m, *Davis* 36571! **B3** Kütahya: 6-8 km SW of İnönü, 900 m, 23 iv 1966, *Davis* 42111c! Afyon: Başmakçı, Söğüt mountain, Akpınar village, 850 m, 5 viii 1993, *AAD* 3901. Eskişehir: between Mihaliççık and Sorkun, 1320 m, 1 v 1993, *AAD* 3153. Isparta: Şarkikaraağaç, Kızıldağ National Park, 1150 m, 16 x 1994, *B. Mutlu* 1172! **B4** Ankara: Dikmen, 950 m, 8 iv 1994, *AAD* 4035. **B5** Niğde: Gümüşler, 1400 m, 19 viii 1996, *AAD* 5485. Yozgat: 15 km Sorgun to Çekerek, 1200 m, *Coode and Jones* 27 v 1965, No. 1756! **B6**

Sivas: between Sivas and Tatlıcak, 1350 m, 29 iv 1966, *Tobey* 1689! **B7** Erzincan: Kemah, Muratboynu village, 910 m, 5 iv 1996, *AAD* 5181. **B9** Bitlis: Tatvan, Reşadiye village, 1800 m, 8 ix 1996, *AAD* 5660. **C2** Muğla: between Fethiye and Dirmil, Asar district, 1450 m, 23 viii 1993, *AAD* 3957. Antalya: around Elmalı, 1200 m, 24 viii 1993, *AAD* 3962. **C3** Isparta: Sütçüler, between Çandar and Kızıllı village, 700 m, 29 viii 1993, *AAD* 3981. **C4** Ermenek: 1. km Bayır to Karaman, 1300 m, 20 viii 1994, *AAD* 4203-*M. Vural*. Niğde: Ulukışla, towards Pozantı 20 km, 1200 m, 24 vi 1993, *AAD* 3508-*Z. Aytaç*. **C5** Adana: Gülek, 1280 m, 24 vi 1993, *AAD* 3510. **C6** Antakya: Samandağı, Leylekli village, 500 m, 27 vi 1993, *AAD* 3522. **C7** Adıyaman: Kahta, Ulupınar village, 500 m, 28 vi 1988, Ş. *Yıldırım* 10846! **C10** Hakkari: Nehil stream, 25 km Yüksekova to Hakkari, 1790 m, 2 vi 1966, *Davis* 45845!

The species and its many cultivars are extensively cultivated in Turkey. The seeds of this species germinate easily, and so many plants escaped from cultivation can be found. Identification of these fertile plants, whether natural or cultivated, is difficult. Further observations, particularly on habitat and the taste of fruit, are necessary for accurate identification.

4- *P. divaricata* Ledeb., *Ind. Sem. Horti Dorp.* 6 (1824).

Shrub or small tree, 2-4 m; weakly thorny, young shoots and buds glabrous. Buds single or rarely 2-3 in the leaf axil; outer bud scales leathery, inner scarious and longer than outer. Stipules 4-8 mm; subulate, deciduous, margine incised, glandular. Petiole 8-15 mm; hairy or glabrous. Lamina 30-60 x 20-40 mm; ovate, apex acute, cuspidate, margine finely serrate, biserrate glandular, glabrous or pilose, a pair of glands present at the base. Flowers single or in pairs, flowering synanthous, rarely hysteranthous; in flowers 15-25 mm diameter. Pedicels 10-15(-20) mm, up to 25(-35) mm in fruit, glabrous, rarely pilose. Hypanthium 2-4 x 2,5-4 mm; cup-shaped, glabrous, rarely hairy. Sepals 2-4 x 1.5-3 mm; oblong, elliptic, reflexed on well developed flowers. Petals 6-9 x 4-6 mm; white, obovate or orbicular. Stamens 30, in one row on the hypanthium margine. Fruit 10-15 x 8-12 mm; globose or ovate, pendent, yellow, red or pink. Stone 8-12 x 6-8 mm; elliptic, ovate, compressed laterally, surface smooth or striate, wing small. Seed 6-8 x 4-6 mm; ovate, laterally compressed, longitudinally striated.

*Fl*: March to May; *Mf*: August to October; *H*: Deciduous forest, steppe, rocky places, garden edge; *A*: s.

l.-2450 m; *Cn*:  $2n=32$  (34);  $2n=16$ , 24, 32, 48 (36); *DstT*: throughout Turkey; *DstW*: North America, Europe, Caucasia, Central Asia, Australia. *Prg*: Euro-Siberian.

1- Leaves and fruit green; petals white var. *divaricata*

1- Leaves and fruit pink; petals pink var. *pissardi*  
var. *divaricata* (Figures 7, 8).

Type: [Caucasus] Tscherkessische Pflaume-fructus, Parrot - Cult. in Hb. Dorpatens (LE).

≡ *Prunus cerasifera* Ehr. subsp. *divaricata* (Ledeb.) Schneider, 1906, *Ill. Handb. Laub.* 1:632.

Iconographia: Vassilczenko, 1959, in *Not. Syst. (Leningrad)* 19:227; Hegi, G., 1923, *Ill. Fl. Mittel-Eur.* 4 (10) (2): t. 1269; Poyarkova, A. I., 1941, *Fl. URSS*, 10, t.32(31); Pignatti, S. 1982, *Fl., d'Italia*, 1:616(32); Roger, P., 1983, *Trees in Br. Eur. and N. Amer.*, 171(33); Chrtek, J., 1992, *Kvetena-3 Cheske Rep.*, 4, t. 99(34).

**A1** Kırklareli: Melyadağ, 850 m, 12 vi 1968, *A. Baytop* 13.270! **A2** Bursa: Keşiş mountain (Uludağ), 1700 m, *Bornm.* 1899:4771. **A3** Eskişehir: Sündiken mountain, c. 1200 m, 26 vi 1974, *T. Ekim* 786! **A4** Çankırı: Eldivan, Doruk to Karadere, 1300-1800 m, 21 viii 1985, Ş. *Yıldırım* 8782! **A5** Kastamonu: Tosya, Gavurdağ, *Sint.* 1892:3974. **A6** Sivas: Suşehri, 900 m, 6 iv 1996, *AAD* 5189. **A7** Sivas: Yıldızeli, Yusuföğlan village, 1450 m, 30 vii 1996, *AAD* 5313. Giresun: Şebinkarahisar, Asarcık village, 1900 m, 6 ix 1993, *AAD* 3224. Trabzon: in city, 50 m, 30 iii 1960, *Stainton* 8114! Bayburt: Gümüşhane road, Vavukdağı pass, 1750 m, 13 ix 1993, *AAD* 4004. Gümüşhane: Torul, 1100 m, 30 v 1993, *AAD* 3224-*J. A. Metzger*. **A8** Trabzon: Köprübaşı, Büyükdoğanlı village, 620 m, 11 ix 1993, *AAD* 4000-*A. Güner*. Erzurum: Uzundere, Lesindere district, 900 m, 4 iv 1996, *AAD* 5168. Rize: Çamlıhemşin, Kale village, 1920 m, 19 ix 1993, *AAD* 4021-*A. Güner*. Artvin: Şavşat, Adamkayası district, 1450 m, 23 iv 1983, *A. Güner* 4783!-*M. Vural*. **A9** Artvin: around the city, 200 m, 3 vi 1993, *AAD* 3250-*J. A. Metzger*. Kars: Kümbet stream, 1300 m, 16. 11. 1997, Ş. *Yıldırım* 20767! Ardahan: Posof, between Gümüşkavak and Eminbey village, 1700 m, 24 viii 1995, *AAD* 5003. **B1** Manisa: Sipil mountain, *Aucher* 1490. **B2** Kütahya: Simav, Kiçir to Akdağ, peak of Akdağ, 2000 m, *Coode and Jones* 2747! **B3** Isparta: Şarkikaraağaç, Kızıldağ National Park, 1100-1250 m, 24 vii 1994, *B. Mutlu* 1263! Konya: Akşehir, Sultan mountain, Hanoğlu stream, 1950 m, 28 ix 1976, *G. Dökmec*! Afyon: Sultan



Figure 7. *Prunus divaricata* var. *divaricata*. a: flowering branch (AAD 4459), b: fruiting branch (AAD 5005), c: flower, d: fruit, e: stone, f: seed.

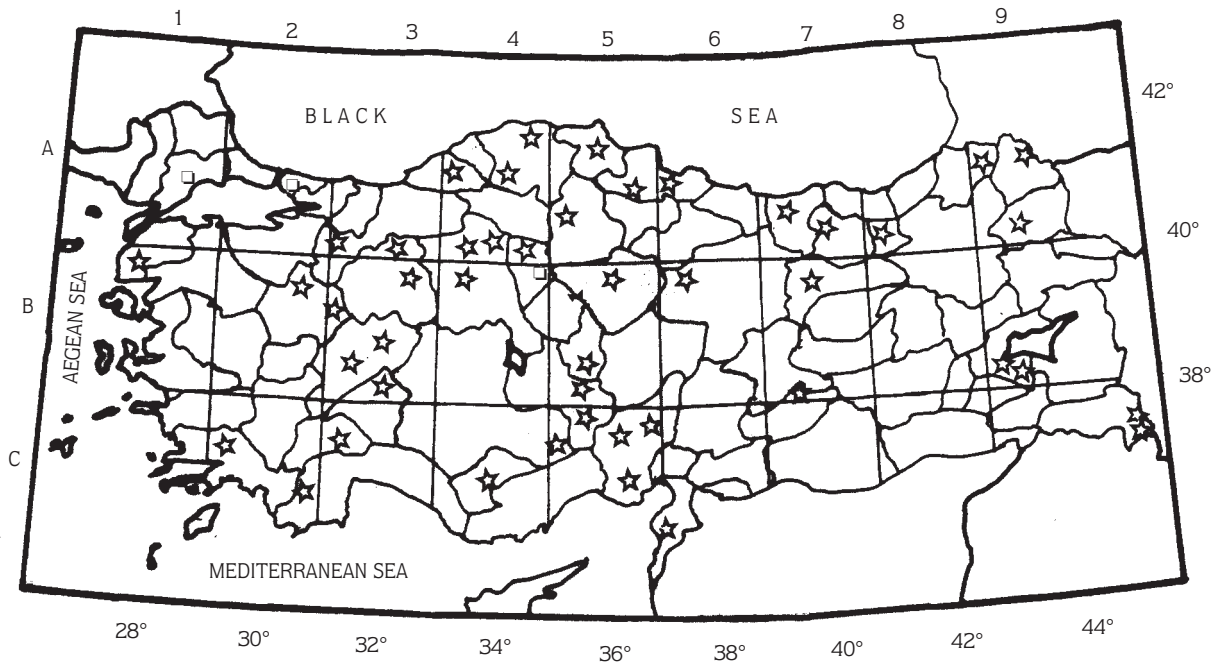


Figure 8. Distribution of *Prunus divaricata* var. *divaricata* (☆) and *Prunus divaricata* var. *pissardi* (□) in Turkey.

mountain, Derecine village, 1200 m, *G. Dökmeçl* B5 Kırşehir: Çiçek mountain, Alahacılı village, 1150 m, 9 v 1995, *H. Polat* 1009! Yozgat: Akdağ, Büyüktoraman, Taşocağı district, 1800 m, 25 viii 1994, *AAD* 4215-Z. *Aytaç*. B6 Kayseri: Pınarbaşı, 1500 m, 21 v 1993, *AAD* 3207-M. *Koyuncu*. Sivas: Yıldızdağ-Sarıyar, 1900 m, 14 viii 1967, *Tobey* 2377! B7 Erzincan: Kemah, Muratboynlu village, Çatakderesi, 910 m, 5 iv 1996, *AAD* 5175. Elazığ: in city, Esentepe, 1200 m, 14 v 1995, *Ö. Yıldız!* B8 Muş: Inter Noreg et Angag pagum, 1300 m, 1 ix 1859, *Kotschy* 535! B9 Bitlis: Tatvan, Nemrut mountain, above Sapur village, 2000 m, 20 viii 1973, *H. Peşmen* 3238! Van: E of Pelli Pass, 38. km Gevaş to Tatvan, 2240 m, 7 v 1966, *Davis* 46078! C1 Aydın: Kuşadası, Dilek peninsula, National Park, c. 500 m, 25 iii 1991, *H. Sümbül* 3739! C2 Aydın: Karacasu, Babadağ, 1100 m, *Davis* 41543! Denizli: Babadağ, towards Efenkli and Başalan pasture, 800-1100 m, 22 iv 1997, *Ş. Yıldırımli* 20148! C4 İçel: Anamur, Abanoz pasture, 1650 m, 18 viii 1994, *AAD* 4183. C5 Burdur: around Çavdar, 950 m, 31 x 1992, *AAD* 3095. Adana: Feke, Gürümze village, 1000 m, 21 v 1993, *AAD* 3196. Niğde: Ulukışla, Çiftahan, Horozköy, 1200-1350 m, 30 vii 1984, *Ş. Yıldırımli* 7110! C6 Antakya: İskenderun, Karagöz village, 350 m, 31 iii 1995, *AAD* 4432. Kahramanmaraş: Süleymanlı, Berit mountain, Sarıgöl, 2000-2400 m, 11 vi 1978, *B. Yıldız* 2051! Kilis: Ali Osman mountain, 900 m,

4 iv 1996, *Ş. Yıldırımli* 19347! Gaziantep: Araban, Sarıkaya village, 1100 m, 20 iii 1996, *AAD* 5074. C8 Mardin: mountains around Mardin, *Hauskn.* C9 Hakkari: Cilo mountain, 2450 m, 10 viii 1054, *Davis* 24227! C10 Hakkari: 5. km Şemdinli to Yüksekova, 1550 m, *Davis* 45022!

*P. divaricata* shows variations in its fruit colour and shape. But these characters have no taxonomic value because there are many intermediate forms. The species has been divided by Kovalev (39) into eleven ecotypes according to their morphological characters and ecological preference. In practice, however, these ecotypes are not distinguishable from one another. As shown earlier, *P. divaricata* subsp. *ursina* appears to be a synonym of *P. cocomilia*.

There are different treatments on the *P. divaricata* and other names of this species. Recently, the names *P. cerasifera* Ehrend. and *P. divaricata* (Ledeb.) Schneider are proposed for the cultivated forms and wild forms of the species respectively by Browicz (40). He noted the two subspecies as *P. cerasifera* subsp. *cerasifera* and *P. cerasifera* subsp. *divaricata* (Ledeb.) Schneider in the same paragraph. There is no more explanation on the taxonomic categories and related populations, cultivated or natural. There is uncertainty over the cultivated plums, one of which belongs to *P. x domestica* or *P. divaricata*

and another uncertainty on the wild or cultivated forms of the *P. divaricata*, especially in the man made habitats.

In this revision *P. divaricata* subsp. *divaricata* includes natural or possibly cultivated form of the species while *P. divaricata* subsp. *pissardi* includes cultivated forms, pink flowered and purple coloured leafy forms.

The subspecies *divaricata* occurs throughout Turkey, but it thrives best in the northern parts. Other relatively dry parts of Turkey do not have suitable conditions for this plant. The thorny character is more prominent in populations occurring in arid places.

var. *pissardi* Koeh. in Dendr. 307, 1893.

Typus: [Iran] Touris of Teheran, Pissard s.n. (cultivated in France at Chatenayles-Sceaux).

= *P. pissardi* Carr. in Rev. Hortic. (1881) 190.

= *P. cerasifera* var. *atropurpurea* Dipp., Laubh. III. 633. 1893.

A1 Tekirdağ: Malkara, in city, 250 m, 21. 12. 1998, AAD 6263. A2 İstanbul: Küçükyalı, 50 m, 15 viii 1998, AAD 6256b. B4 Ankara: Beytepe campus, 950 m, 7 vii 1996, AAD 5297.

This plant is extensively cultivated in Turkey for its showy leaves and flowers. The plant was introduced to France by Pissard(41) and described in Revue Horticole. The taxon was given only as "*P. pissardi* Carr. in Rev. Hortic. (1881)" in Index Kewensis(30). Many systematists do not consider this cultivated plant, but this taxa is an element of the flora. A work on its taxonomic history seems to be necessary.

## Results and Discussion

In this work the genus *Prunus* is revised and four species belonging to the genus are recognized. Previous descriptions of the genus and species are examined. Some descriptions are supplemented and corrected in the light of the new materials and observations of plants in their natural habitats. Type specimens and other materials examined and cited in the Flora of Turkey by Browicz are reexamined carefully. The localities given in Flora of Turkey were visited at least two times for collection of flowering and fruiting materials. Consequently, some changes made in the previous descriptions are based on abundant plant materials and literature.

An identification key was also prepared for the species. The key includes characters of both of flowering and fruiting specimens. This is very important for woody species of angiosperms. Because plants are usually

collected either in flowers or fruits, if the key does not comprise both characters, correct identification of the material is often impossible. The identification keys to the genus *Prunus* given in Flora of Turkey are not practical in this respect.

Anatomical works on the genus *Prunus* were carried out on many wood and leaf samples taken from taxonomically difficult taxa. The samples were collected from different plants of some species for understanding the anatomical structures of different populations. In anatomical features, *Prunus* species are similar to each other. Our anatomical results are in agreement with those obtained by Schweingruber (42), Zhangs (43) and Metcalfe and Chalk (44). The aim of our anatomical studies was to determine anatomical differences between the *Prunus* species. Unfortunately, we were unable to find taxonomically important anatomical differences. Similarly, palynological studies have been carried out on many plants to understand the pollen morphological features of different taxa and the intrapopulational variation of some species. Our results show that there are no very remarkable differences between the taxa with respect to their pollen morphology.

All the *Prunus* species seeds have similar germination capacity. There are no differences in seedling emergence between plants of the same species collected from different altitudes and habitats. It has been observed that dormancy was broken within twenty days at 4°C, after which the seeds germinated.

For mapping the exact distribution of the taxa in Turkey, all available localities are shown on the maps. Many new localities have been included, and hence the maps of distribution presented here are much more reliable.

It seems that Turkish *Prunus* species are not restricted in their occurrence to phytogeographical regions in Turkey. However, it can be said that some species grow better in some areas than in other places. Although *P. x domestica* grows well throughout Turkey, other *Prunus* species have certain ecological preferences. *P. spinosa* does not occur in the Mediterranean region or in the drier parts of E and SE Anatolia. As well as in NE Anatolia, which is characterized by a wet climate, this species grows well in humid places in Central Anatolia, the Aegean region, the western Black Sea and Thrace. *P. cocomilia*, on the other hand, grows throughout Turkey, but thrives best in the Irano-Turanian region. The species grows also in the Mediterranean region in Turkey, Greece and Italy. There is not yet any note on the phytogeographical region to which it belongs. In our

opinion, the species could be treated as an element of the Irano-Turanian region. We also assume that *P. divaricata* is an element of the Euro-Siberian region. Some of its localities are one located in other parts of Turkey, but the species is rather rare there and does not form rich populations.

All of the results obtained from anatomical, palynological and morphological works are used for the identification of the populations. Descriptions of the species are based on these comprehensive data. In this article, only the results of morphological studies are given. The results of anatomical and palynological studies related to the biology of the genus *Prunus* will be presented in another paper.

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