

SYNOPSIS ON GENUS *ACHILLEA* L. (ASTERACEAE DUMORT.) IN THE FLORA OF DNIESTER-PRUT RIVER REGION

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Abstract: The article brings the list of one of the difficult in species diagnosing genus of Asteraceae Dumort. family – yarrow (*Achillea* L.), which embodies 13 species in the Dniester-Prut region. The dichotomic key for genus *Achillea*, as well as brief ecological habitat characters and original pictures for each species are given.

Key words: flora, Asteraceae, *Achillea*, distribution, biology, ecology.

CONSPECTUL GENULUI *ACHILLEA* L. (ASTERACEAE DUMORT.) ÎN FLORA INTERFLUVIULUI NISTRU-PRUT

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Rezumat: Articolul prezintă conspectul unuia dintre cele mai dificile genuri din familia Asteraceae Dumort. – coada șoricelului (*Achillea* L.), care cuprinde 13 specii din flora interfluviului Nistru-Prut. Sunt prezentate cheia dicotomică pentru genul *Achillea*, precum și caracterele ecologice și staționale, imagini originale pentru fiecare specie. Sunt indicate particularitățile corologice în regiune pentru 3 specii rare.

Cuvinte cheie: flora, Asteraceae, *Achillea*, corologie, biologie, ecologie.

INTRODUCTION

The genus *Achillea* L. includes species of perennial herbaceous and undershrub plants, distributed throughout almost the entire Holarctic, but especially are numerous in the countries of the Eastern Mediterranean and Southwest Asia.

The nomenclature description of the genus was first given by C. Linné [9]. Since that time, the number of known *Achillea* species has continuously increased with each new work on the flora or systematics of plants, and the structure of the genus has become more complicated and refined. There is currently no single point of view on the system of the genus *Achillea*; systematics disagree in assessing the volume of a genus, its sectional division, and the establishment of phylogenetic relationships in sections, some of which are possibly heterogeneous, and some are phylogenetically independent [19].

The main difficulty in classifying species of the genus *Achillea* is the high polymorphism of many species and their weak distinction according to most diagnostic characters. In addition, most *Achillea* are capable of hybridization. The development of the correct system and the refinement of the *Achillea* nomenclature are necessary for an accurate assessment of the place this genus occupies in the modern flora of Northern

Eurasia. This is necessary when solving problems aimed at preserving the biodiversity of our region. The genus *Achillea*, widespread in Europe and beyond, is represented by many taxa that are found in almost all steppe biotopes. At such a scale of its spread, *Achillea* affects the sphere of agriculture, since it inhabits meadows and pastures, but a rich spectrum of chemical bioactive substances contained in plants of this genus is a promising material for the pharmaceutical industry [15].

MATERIALS AND METHODS

During our investigation concerning genus *Achillea* L. for the flora of Dniester-Prut region we performed all necessary research on field and laboratory examination. Firstly, we reviewed all published information on the presence of species in the territory, and consulted specimen materials in different scientific herbaria (Herbarium of the National Botanical Garden (Institute) of Republic of Moldova and Herbarium of the State University of Moldova).

When processing the data on the genus representatives, a morpho-geographical method was used, which allows to consider the morphological variability of plants taking into account the geographical and ecological conditions of growth.

The taxonomy of *Achillea* species followed by the recent taxonomical literature [21]. The names of taxon authors are accepted in the standard form «The International Plant Names Index» (<http://ipni.org>).

RESULTS AND DISCUSSIONS

Achillea L. is one of the most difficult genera, diagnosewise in the Asteraceae family, which comprises about 150 species, widespread in Europe, North Africa, West and Central Asia and North America [20]. Of these, 52 species are given for the territory of Europe [11], including 17 species for the flora of Eastern Europe, as well as their numerous hybrids [20]. In the flora of Dniester-Prut river region it embodies 13 species.

Genus *ACHILLEA* L.

Linnaeus, 1753, Sp. Pl.: 896; id. 1754, Gen. Pl., ed. 5: 382

Perennial herbs, usually rhizomatous. Leaves entire to 3-pinnatisect, alternate. Synflorescences cymose, flat-topped panicles. Capitula usually small, pedunculate, radiate. Involucres oblong, ovoid, or hemispheric. Phyllaries (involucral bracts) in 2 or 3 rows, the outer somewhat shorter than the inner, with a scarious margin. Receptacle flat to convex, conical; scales present. Marginal florets in 1 row, female, fertile, ligulate, the ligules more or less 3-dentate, patent or rarely short and wide. Disk florets hermaphrodite, 5-lobed, white, yellow or pink; corolla tubular. Achenes compressed, oblong or obovate; pappus absent [11].

L e c t o t y p u s: *A. millefolium* L.

Key to species of *Achillea*

1a. Marginal floret ligules yellow. Leaves pinnatisected, elongate-elliptic, linear or

- linear-lanceolate 2.
- 1b.** Marginal floret ligules white, pink or lilac marginal flowers. Leaves mono-, bi- or tri-pinnatisected, broad-lanceolate or elliptical 3.
- 2a.** Rachis with uneven segments, the primary large and intermediate ones (teeth) in the upper part – smaller 1. *A. coarctata*.
- 2b.** Rachis with equal segments 2. *A. leptophylla*.
- 3a.** Herbaceous plants with woody base. All stems equal, long. Leaves pinnatisected. Inflorescence flat to convex 13. *A. ochroleuca*.
- 3b.** Herbaceous plants. Stems unequal, the sterile ones short, arranged in the basal rosette. Leaves 2- or 3-pinnatisected. Inflorescence convex to conical 4.
- 4a.** Leaf segments unequal: the primary ones large and intermediate smaller (sometimes in the form of teeth) 5.
- 4b.** Leaf segments equal 7.
- 5a.** Leaf rachis 0.4-0.6 mm wide 6.
- 5b.** Leaf rachis 2-5 mm wide 3. *A. distans*.
- 6a.** Marginal floret ligules white. Plant densely covered with long appressed hairs. Leaf segments linear, spaced by 2-6 mm on the leaf rachis 11. *A. nobilis*.
- 6b.** Marginal floret ligules yellow. Plant scarce covered with short hairs. Leaf segments lanceolate, spaced by 3-9 mm on the leaf rachis 12. *A. neilreichii*.
- 7a.** Median stem leaves pinnatisected, with a rachis 1-4 mm wide 8.
- 7b.** Median stem leaves bi- or tri-pinnatisected, with a rachis 0.3-1.3 mm wide 9.
- 8a.** Plant densely covered with short hairs. Leaves pinnatisected. Marginal floret ligules pink or lilac, rarely white. Coastal species 4. *A. euxina*.
- 8b.** Plant scarce covered with long soft hairs. Leaves pennate-sected, only the lower ones 2- or 3- pinnatisected. Marginal floret ligules white, rarely pink 5. *A. inundata*.
- 9a.** Phyllaries without brown margin 10.
- 9b.** Phyllaries with brown margin 12.
- 10a.** Leaf segments with terminal lobes linear-lanceolate, lanceolate or broad-lanceolate, at the tip with short prickle 0.6-1.2 mm long 6. *A. pannonica*.
- 10b.** Leaf segments with filiform terminal lobes, narrow-linear or lanceolate, at tip with longer prickle 11.
- 11a.** Leaf segments with filiform or narrow-linear terminal lobes, 0.3-2 mm long and 0.1-0.2 mm wide. Involucre 2.8-3.3 mm long and 1-1.6 mm wide. Marginal floret ligules 0.8-1.2 mm long and 1-1.6 mm wide. Achenes elongate-obovoid, 1-1.3 mm long and 0.3 mm wide 10. *A. setacea*.
- 11b.** Leaf segments with lanceolate terminal lobes, 0.3-1.5 mm long and 0.2-0.4 mm wide. Involucre 3.5-4.5 mm long and 1.7-2.5 mm wide. Marginal floret ligules 1.2-1.8 mm long and 1.3-2.3 mm wide. Achenes elongate-conical, 1.3-2.3 mm long and 0.6-0.7 mm wide 9. *A. stepposa*.
- 12a.** Leaf segments with triangular-lanceolate terminal lobes. Phyllaries with membranous, pale-brown, poorly evident margin 7. *A. collina*.
- 12b.** Leaf segments with lanceolate or linear terminal lobes. Phyllaries with membranous, pale-brown, well-evident margin 8. *A. millefolium*.

Section 1. *Micranthae* Klokov et Krytzka, 1984, Тысячелистники: 171. – *Achillea* L. sect. *Filipendulinae* (DC.) Afan. 1961, Фл. СССР, 26: 90, р. р. – Lamina of cauline lives, usually without intermediate segments. Involucres of 2.5-5 mm long and 1.5-3 mm wide. Receptacle convex. Phyllaries distinctly separated from the bracts. Marginal floret ligules yellow. Achenes of 1.1-1.4 mm long.

Т у р у s: *A. micrantha* Willd.

1. *A. coarctata* Poir. 1810, in Lam. Encycl. Méth. Bot., Suppl. 1: 94; Афанасьев, 1961, Фл. СССР, 26: 91; Richards. 1976, Fl. Europ. 4: 165; Гейдеман, 1986, Опред. высш. раст. МССР, изд. 3: 543; Цвелев, 1994, Фл. евр. части СССР, 7: 121; Зиман, 1999, Опред. высш. раст. Укр., изд. 2: 335; Васильева и Коваленко, 2003, Консп. флори Півден. Бессарабії: 42; Negru, 2007, Determ. pl. fl. R. Moldova: 248; Ciocârlan, 2009, Fl. ilustr. a României: 796. – *A. compacta* Willd. 1804, Sp. Pl. 3: 2206, non Lam. 1783. – *A. glomerata* M.Bieb. 1819, Fl. Taur.-Cauc. 3: 585. – *A. tomentosa* auct. non L.: Станков, 1949, в Станков и Талиев, Опред. раст. европ. части СССР: 625. (Figure 1).

Plants 25-40 (70) cm tall, densely pubescent tomentose. Rhizome vertical, long, many-headed with numerous roots. Stems solitary or several, erect, round, simple or branched. Basal and the lower cauline leaves petiolate, 6-20 x 1-3 cm, linear, those median linear or linear-lanceolate of 2-6 (9) x 0.4-1.2 cm, sessile, pinnatisected; segments numerous, elongate, faintly sectioned into linear lobes, entire or 2-3-toothed; rachis usually with intermediate teeth. Capitula many on a dense-pubescent peduncle, gathered in dense and strongly convex corymbose inflorescences, often semi-globular, 4-7 cm in diameter. Involucres obconic, 3-4 x 2.5-3.5 mm in diameter, with membranous phyllaries, the outer ones narrow-triangular, the other elongate, obtuse, convex, sometimes brown at the tip. Marginal floret ligules yellow, reniform, at tip rounded-3-toothed, often poorly developed or lacking. Achenes cuneate-elongate, about 1 mm long $2n = 18$ [2].

It is a hemicryptophytic plant. The plants bloom in May-July and fructify in June-August. Propagate by seeds.

The plants usually grow in small groups or sometimes it occurs solitary in meadows and edges of arid forests with *Quercus pubescens*, steppe slopes, loess hills, Black Sea coastal area. A xerophilous plant, specific for steppe habitats. The species is growing in

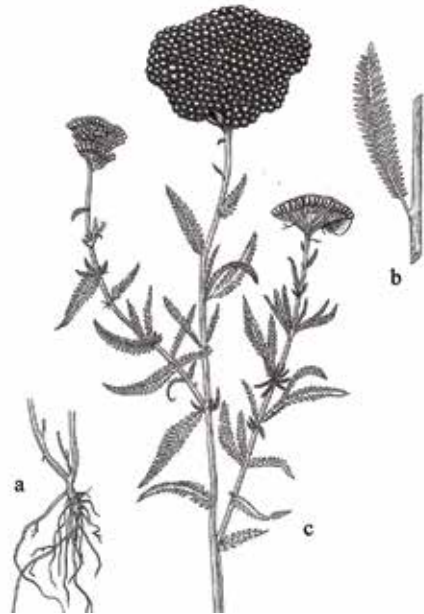


Figure 1. *Achillea coarctata* Poir.
(a – rhizome, b – stem leaf, c – the upper part of the stem with inflorescences)

the central and southern zone of Besarabia [14, 16]. The area of distribution covers the territory of Central Europe (south-east) and East (south-west), Balkan Peninsula, Asia Minor [11, 19, 20].

In the region, the species is rare. In the Republic of Moldova is protected by the state [8]. In Romania, as a vulnerable species (category VU) is included in the Red Book [3].

Achillea coarctata is an aromatic and medicinal plant. It has astringent properties and acts as a mild laxative. The plant is a source of essential oil, possesses cytotoxic and antimicrobial effects [7]. New highly bioactive substances with antiinflammatory activity were isolated from *A. coarctata* [5, 12].

2. *A. leptophylla* M.Bieb. 1808, Fl. Taur.-Cauc. 2: 335; Афанасьев, 1961, Фл. СССР, 26: 94, p. p.; Richards. 1976, Fl. Europ. 4: 164, p. p.; Цвелев, 1994, Фл. евр. части СССР, 7: 122; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Ciocârlan, 2009, Fl. ilustr. a României: 796. (Figure 2).



Figure 2. *Achillea leptophylla* M. Bieb. (a – rhizome, b – stem leaf, c – the upper part of the stem with inflorescences, d – apical leaf segment)

Plant 12-40 cm tall, grayish-green, soft-tomentose, very rarely almost glabrous. Rhizome thin, short, vertical, strongly branched, many-headed. Stems solitary or numerous, round, branched from the base, rarely simple. Leaves linear-lanceolate or linear-elongate, the median ones elongate-linear, 2-4 cm long, pinnatisect; segments of upper leaves usually entire, denticulate or linear, segments of other leaves 3-4 mm long, sectioned or divided into 3-5 lobes, elongate, elongate-spathulate or short-linear, obtuse or very short aculeolate, 2-3 x 0.4-0.7 mm. Rachis narrow, entire. Lower leaves petiolate, with more distal segments and 3-4 pairs of larger segments. Numerous capitula, gathered in compound corymbose, lax, few-flowered inflorescences, 1-2(3) cm in diameter. Involucre ovoidal or nearly

semi-round, dense-hairy, 3-4 mm long and 2.5-3.5 mm in diameter, with green phyllaries, the outer ones acuminate-ovate, the inner ones elongate, with the white-membranous margin. Marginal floret ligules bright yellow, rounded-reniform, at tip rounded-3-toothed. Achenes elongate-obovoidal, brown, 1.3-1.5 x 0.4 mm. $2n = 18$ [20].

It is a hemicryptophytic plant. The plants bloom in May-July and fructify in June-August. Propagate by seeds.

The plants usually grow in limestone slopes with steppe vegetation. A xerophilous plant, typical for petrophytic habitats. The species is growing in the south-east of Besarabia, in the vicinity of Tighina town. At present on the territory almost extinct

species. The area of distribution covers the territory of Central (Romania: Dobrogea) and Eastern Europe (Moldova, south-eastern part of Ukraine) [20].

In Romania, as a critically endangered species (category CR) is included in the Red Book [3].

It is a fodder, food, technique, tinctorial, medicinal and aromatic plant. The aerial part of the plant has a hemostatic effect very useful in metrorrhagia. It is also used in the treatment of respiratory disorders, especially in respiratory infections [17].

Section 2. *Achillea*. – Leaf lamina elongate to linear, without, or rarely, with intermediate segments. Involucres 2.7-5 mm long and 2-3 mm wide. Receptacle convex. Phyllaries distinctly separated from the bracts. Marginal floret ligules white or pink, rarely yellowish-white. Achenes 1.3-2.2 mm long.

T y p u s: The genus lectotype.

3. *A. distans* Waldst. et Kit. ex Willd. 1803, Sp. Pl., 3, 3: 2207; Афанасьев, 1961, Флора СССР, 26: 87; Richards. 1976, Fl. Europ. 4: 162; p. max. p.; Цвелев, 1994, Фл. евр. части СССР, 7: 124; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Ciocârlan, 2009, Fl. ilustr. a României: 797, p. p. – *A. asplenifolia* auct. non Vent.: Кондратюк, 1962, Флора УРСР, 11: 248. (Figure 3).

Plant completely covered with long white thin hairs. Rhizome woody, long, creeping, branched, many-headed, with thin stolons. Stem solitary or a few, erect, simple, fine-bristled, hairy, 30-80 cm tall and 3-5 mm thick. Basal and lower stem leaves petiolate, up to 35-45 cm long, with the leaf bipinnate- or tri-pinnatisected, elongate-lanceolate or lanceolate; middle and upper leaves sessile, auriculate at the base, 3-12 x 1-3 cm, with bipinnate lamina sectioned, linear-lanceolate. Leaf segments of 2 types: large main and small intermediate (the latter sometimes have the appearance of teeth). Main segments linear- or elongate-lanceolate, 5-15 x 3-5 mm, pinnatisected or incised on 2-3 x 0.4-2.5 mm lobes, lanceolate or triangular-lanceolate. Rachis wide-winged, 2-5 mm and conspicuously toothed. Numerous capitula, gathered in compound corymbose, dense, inflorescences, 5-12 cm in diameter. Elongated involucre, 4-5 x 2.5-3 mm, with outer phyllaries ovate or triangular-ovate, greenish, inner ones elongate-lanceolated. Marginal floret ligules white, semi-elliptical, 2-3.7 x 2-3.4 mm, at the tip slightly rounded-3-toothed. Achenes elongate-cuneated, 1.5-2 x 0.5-0.7 mm. $2n = 54$ [2].



Figure 3. *Achillea distans* Waldst. et Kit. ex Willd. (a – habitus)

It is a hemicryptophytic plant. The plants bloom in June-September and fructify in July-October. Propagate by seeds and vegetatively by underground stolons.

The plants usually grow in groups or sometimes it occurs solitary in glades and edges of forests, glades, meadows, stepped hills, limestone slopes, along the roads, sometimes as part of ruderalized vegetation. A xeromesophilous plant, typical for vegetation of dry meadows. The species is growing throughout the whole territory of Bessarabia [23]. The area of distribution covers the territory of south-eastern part of Central and south-western part of Eastern Europe [20].

Achillea distans is a medicinal and aromatic plant. The plant extracts showed antibacterial activity suggesting a potential source of polyphenolic compounds with bioactive properties for cosmetic and medicinal applications [1].

4. *A. euxina* Клоков, 1954, Бот. Мат. (Ленинград), 16: 359; Кондратюк, 1962, Флора УРСР, 11: 250; Цвелев, 1994, Фл. евр. части СССР, 7: 124; Зиман, 1999, Опред. высш. раст. Укр., изд. 2: 335; Васильева и Коваленко, 2003, Консп. флори Півден. Бессарабії: 42. – *A. asplenifolia* auct. non Vent.: Кондратюк, 1962, Флора УРСР, 11: 250; Ciocârlan, 2009, Fl. ilustr. a României: 798.

Plant of 25-85 (110) cm tall, with creeping, branched, many-headed rhizome. Stem solitary or a few (up to 10), erect or ascending at base, white-gray, short-tomentose, simple with short axillary shoots. Leaves linear-elongate, narrow elongate-elliptic, pubescent, covered with punctate-foveolated glands, pinnatisected. Basal and lower stem leaves petiolate, 7-30 x 0.6-1.6 cm wide, with petiole 2-10 cm long; median and upper leaves sessile, auriculated at base, 3-8 x 0.6-1.5 cm wide; leaf rachis of 2-5 mm wide. Segments of basal and lower leaves 4-9 x 3-7 mm, those of median leaves 2-6 x 2-4 mm. Numerous capitula, gathered in compound corymbose, lax inflorescences, 5-15 cm in diameter. Ovoid involucre, 3.5-5 x 2-3 mm, with elongate-elliptical phyllaries of 2.5-3.5 x 1-1.4 mm. Marginal floret ligules white, almost round, 1.2-2 x 1.2-2 mm, white or pink. Achenes wide-cuneated, 1.5-2 x 0.5-0.7 mm. $2n = 36$ [20].

It is a hemicryptophytic plant. The plants bloom in June-September and fructify in July-October. Propagate by seeds and vegetatively.

The plants grow on sea sand dunes. In the Dniester-Prut region can be met sporadically only in the southern part of the region on the territory of Ukraine in the littoral zone [14, 16]. A typically psammophilous species of sea shores. The area of distribution covers the territory of the south-eastern part of Central and southern part of Eastern Europe, Crimea (Kerch peninsula) [20].

5. *A. inundata* Kondr. 1962, Фл. УРСР, 11: 553; Richards. 1976, Fl. Europ. 4: 163; Клоков и Крицкая, 1984, Тысячелистники: 232; Цвелев, 1994, Фл. евр. части СССР, 7: 124; Зиман, 1999, Опред. высш. раст. Укр., изд. 2: 335; Ciocârlan, 2009, Fl. ilustr. a României: 799. – *A. millefolium* auct. non L.: Афанасьев, 1961, Флора СССР, 26: 78, р. р. (Figure 4).

Plant 30-120 cm tall with long, creeping, many-headed rhizome. Stem solitary or a few, erect or ascending, simple or branch at the top, 3-5 mm thick, dispersed covered with soft hairs. Basal and lower stem leaves petiolated, up to 45 cm long with the petiole,

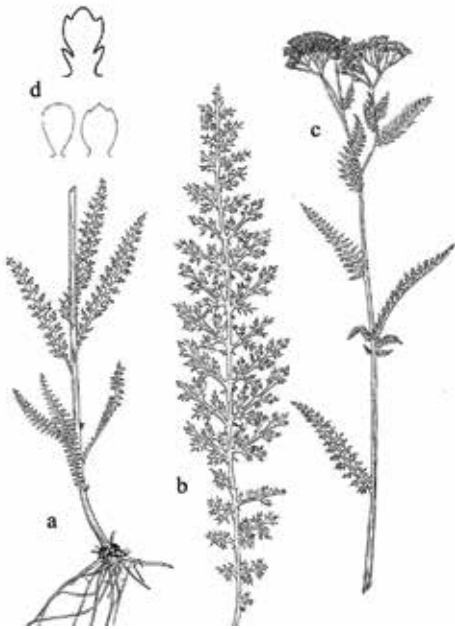


Figure 4. *Achillea inundata* Kondr.
(a – stem base and the rhizome, b – stem leaf,
c – the upper part of the stem with inflores-
cences, d – leaf segments)

A typically xeromesophilous species, typical for vegetation of dry meadows. In the Dniester-Prut region rare throughout the territory of Bessarabia, except for southern regions [22]. Common area of species covers Central (Romania) and Eastern Europe, Crimea (mountains), Middle Asia (north), West Siberia (south); introduced in Eastern Siberia (near Norilsk town) [20].

6. *A. pannonica* Scheele, 1845, *Linnaea*, 18: 471; Афанасьев, 1961, *Фл. СССР*, 26: 82; Richards, 1976, *Fl. Europ.* 4: 163; Клоков и Крицкая, 1984, *Тысячелистники*: 234; Гейдеман, 1986, *Опред. высш. раст. МССР*, изд. 3: 543; Цвелев, 1994, *Фл. евр. части СССР*, 7: 124; Зиман, 1999, *Опред. высш. раст. Укр.*, изд. 2: 335; Васильева и Коваленко, 2003, *Консп. флори Півден. Бессарабії*: 43; Negru, 2007, *Determ. pl. fl. R. Moldova*: 248; Ciocârlan, 2009, *Fl. ilustr. a României*: 798. – *A. millefolium* L. subsp. *pannonica* (Scheele) Hayek, 1929, in *Hegi, Ill. Fl. Mitteleur.* 6, 2: 571. (Figure 5).

Plant 20-90 cm tall, densely covered with long, white hairs. Creeping rhizome thin, branched. Stem solitary or a few, in the lower part villous, erect or ascending, simple. Leaves often gray, linear or linear-lanceolate, bipinnatisect; Median and upper leaves 8 x 1 cm, with bipennate-sected lamina sectioned into linear-lanceolate, lanceolate or broad-lanceolate lobes, 0.5-0.6 mm wide; lower segments larger, semi-amplexicaul; lower leaves long-petiolate, up to 12 x 1.5-2 cm. Leaf rachis 0.5-1.2 mm wide. Numerous capitula, gathered in dense corymbose inflorescences. Involucre elongate, 4.5-5.5 x

with the leaf tripinnatisect, with segments ovate or elongate, 0.5-4.5 cm long, with terminal segments triangular or lanceolate; leaf blade 1-1.2 mm wide, entire or with small teeth. Median and upper leaves sessile, elongate, rarely nearly elliptical, 2.5-8 x 0.6-2 cm, with bipinnatisect lamina sectioned on broad-obovate or elongate-obovate segments, entire or toothed, 3-13 x 0.3-0.8 mm; lobes terminated rounded-triangular; rachis 1-4 mm wide, entire. Numerous capitula, gathered in dense inflorescences, 8-10 mm wide. Involucre elliptic-ovate, 4-6 mm long, with broad phyllaries, slightly pubescent. Marginal floret ligules white or pink, rounded-elliptical or almost rounded, 1.4-2.1 x 0.7 mm. $2n = 54$ [20].

It is a hemicryptophytic plant. The plants bloom in July-September and fructify in August-October. Propagate by seeds and vegetatively.

The plants grow on meadows, glades and forest edges, shrubs, light forests, stepped hills, limestone rocky slopes, vines.

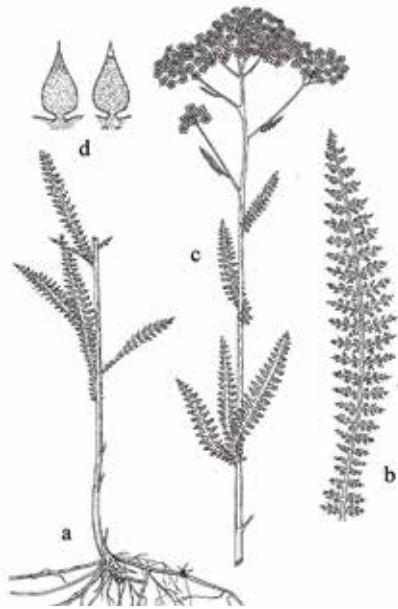


Figure 5. *Achillea pannonica* Scheele (a – stem base and the rhizome, b – stem leaf, c – the upper part of the stem with inflorescences, d – apical leaf segment)

(Balkan Peninsula) [20].

It is an aromatic and medicinal plant with antioxidant [12] and antibacterial [1] activities.

7. *A. collina* J.Becker ex Rchb. 1832, Fl. Germ. Excurs. 3: 850; Richards. 1976, Fl. Europ. 4: 163; Клоков и Крицкая, 1984, Тысячелистники: 227; Русейкина, 1984, Изв. АН МолдССР, сер. биол. хим. наук, 3: 65; Гейдеман, 1986, Определ. высш. раст. МССР, изд. 3: 543; Цвелев, 1994, Фл. европ. части СССР, 7: 125; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Negru, 2007, Determ. pl. fl. R. Moldova: 248; Ciocârlan, 2009, Fl. ilustr. a României: 798. (Figure 6).

Plant 25-60 cm tall, dispersed covered with short, thin, curly hairs. Creeping rhizome many-headed. Stems erect or ascending, simple or branched. Leaves tripinnatisected,

2.5-3 mm, with hairy, greenish-yellowish phyllaries of 2.5-3.5 x 1 mm, usually broad-membranous, outer-elongate-ovated, outer lanceolate-elongated. Marginal floret ligules white or yellow-white, broad-oval, almost rounded, 1.2-1.6 x 1.3-1.8 mm, at the tip truncated, rounded-3-toothed. Achenes elongated, 1.8-2.2 x 0.5 mm. $2n = 72$ [20].

It is a hemicryptophytic plant. The plants bloom in May-August and fructify in June-September. Propagate by seeds.

The plants grow on glades and edges of arid light forests, shrubs, stepped hills, limestone rocky slopes, pastures. A typically steppe mesoxerophilous species. In the Dniester-Prut region can be found throughout the territory. Common area of species covers Central and Eastern Europe, Crimea (mountains), Mediterranean region

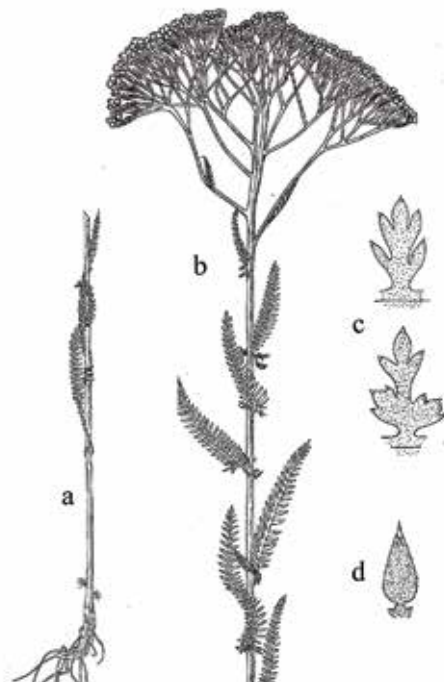


Figure 6. *Achillea collina* J.Becker ex Rchb. (a – stem base and the rhizome, b – the upper part of the stem with inflorescences, c – leaf segments, d – apical leaf segment)

punctate-foveolate, gray-green; basal and lower stem leaves petiolate, 6-20 x 0.7-2 cm, linear or narrow-lanceolate, median and upper leaves sessile, linear, 1.5-7 x 0.2-1 cm. Segments triangular, ovate or narrow-ovate, 2.2-5 x 1.5-4 mm, convoluted. Terminal lobes triangular-lanceolate or lanceolate. Leaf rachis, 0.5-1 mm wide. Numerous capitula gathered in dense corymbose inflorescences, 2-8 cm in diameter. Involucre cylindrical or ovoid-cylindrical of 3.3-4.2 x 1.5-2 mm, with elongate-ovated phyllaries of 1.4-3.2 x 0.7-1.2 mm, with pale-brown membranous margin. Marginal floret ligules white or pale-pink, broad-oval, almost rounded, 1.2-2.2 x 1.3-2.2 mm, at the tip rounded or insignificantly 3-toothed. Achenes elongate-cuneate, 1.3-1.7 x 0.5-0.8 mm. $2n = 36$ [20].

It is a hemicryptophytic plant. Plants bloom in June-September and fructify in July-October. Propagate by seeds and vegetatively.

The plants grow on steppe and calcareous slopes, shrubs, forest glades, dry meadows. A xerophilous species typical for dry meadows vegetation. In the Dniester-Prut region can be found throughout the territory. Outside the country is spread in the Central and Eastern Europe, Mediterranean region, Asia Minor [20].

The extracts of the plant have antioxidant and cytoprotective properties [4, 12].

8. *A. millefolium* L. 1753, Sp. Pl.: 899; Афанасьев, 1961, Фл. СССР, 26: 78; Гейдеман, 1975, Определ. высш. раст. МССР, изд. 2: 491; Richards, 1976, Fl. Europ. 4: 162; Цвелев, 1994, Фл. евр. части СССР, 7: 125; Васильева и Коваленко, 2003, Консп. флоры Півден. Бессарабії: 42; Negru, 2007, Determ. pl. fl. R. Moldova: 248; Ciocârlan, 2009, Fl. ilustr. a României: 798, p. p. – *A. submillefolium* Klokov et Krytzka, 1984, Тысячелистники: 220; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 336. (Figure 7).

Plants 40-100 cm tall, with long rhizomes. Stems erect, unbranched or branched in upper part, often with short sterile branches at leaf axils above middle, striate, usually white villous. Leaves sessile; leaf blade lanceolate, oblong-lanceolate, or sublinear, 5-20 x 1-2.5 cm, (2- or) 3-pinnatisect, abaxially densely villous, adaxially densely depressed glandular punctuate; ultimate segments lanceolate to linear, 0.5-1.5 x 0.3-0.5 mm, apex cartilaginous-mucronulate. Synflorescence a terminal flat-topped panicle 2-6 cm in diameter. Capitula many. Involucres oblong or subovoid, ca. 4 x 3 mm; phyllaries in 3 rows, elliptic or oblong, 1.5-3 x 1-1.3 mm, scarious margin yellow or pale brown; midvein convex. Marginal floret ligules white, pink, or violet-red, suborbicular, 1.5-

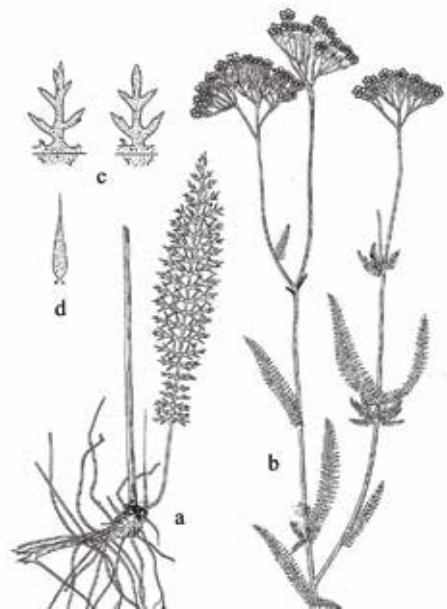


Figure 7. *Achillea millefolium* L.
(a – stem base and the rhizome, b – the upper part of the stem with inflorescences, c – leaf segments, d – apical leaf segment)

3 × 2-2.5 mm, apex 2- or 3-denticulate. Achenes greenish, oblong, ca. 2 mm, with white lateral ribs. 2n=36 [20].

It is a hemicryptophytic plant. Plants bloom in June-October and fructify in July-October. Propagate by seeds.

The plants grow on steppe and calcareous slopes, meadows, glades and forest edges, pastures, along roads, near localities. A xeromesophilous plant, typical for steppe meadows. In the Dniester-Prut region can be sporadically found throughout the territory. Outside the country is spread in the Eastern Europe [19, 20].

The medicinal properties of the plant are worldwide recognized and it is included in the national *Pharmacopoeias* of several European countries. The aerial part has a hemostatic, choleric, anthelmintic, antidepressant, restorative, immunomodulatory, anti-mycotic, galactagogue, antioxidant, antibacterial [17], digestive, anti-inflammatory, vasodilatory, wound healing, diaphoretic, antiseptic, tonic, antispasmodic, antimicrobial, hypotensive, aromatic, anesthetic effect [10, 13]. It is used in the treatment of anorexia, diarrhea, flatulence, hemorrhoids, biliary dyskinesia, gastrointestinal and hepatobiliary colic, hyperacid gastritis, enterocolitis, gastric ulcer [13]. The plant grows in the collection of medicinal plants of National Botanical Garden.

9. *A. stepposa* Klokov et Krytzka, 1984, Тысячелистники: 240; Цвелев, 1994, Фл. евр. части СССР, 7: 126; Зиман, 1999, Опред. высш. раст. Укр., изд. 2: 335. – *A. setacea* auct. non Waldst. et Kit.: Афанасьев, 1961, Фл. СССР, 26: 83, p. p.; Richards. 1967, Fl. Europ. 4: 163, p. p. (Figure 8).

Plant 20-70 cm tall, covered with long, curly hairs. Rhizome is creeping, branched, many-headed. Stem solitary or a few (up to 10), erect or ascending. Leaves linear, lanceolate, lanceolated, elongated, tripennatisected; lower and stem leaves 5-35 × 0.7-2.5 cm, with petiole 0.7-15 cm long; middle and upper leaves sessile, auriculated at base, 2-10 × 0.4-2.2 cm. Numerous primary segments, spaced 1.2-5 mm apart, triangular or wide-triangular, 2-15 × 2-7.5 (10) mm, pennated in 3-9 secondary segments, which, in turn, are sectioned or divided into 2-9 lobes or teeth, rarely second order segments are entire; terminal lobes lanceolate, 0.3-1.5 × 0.2-0.4 mm, at the tip with long prickle of 0.4-0.6 mm. Leaf rachis of 0.5-1.3 mm wide. Capitula many, gathered in dense corymbose inflorescences. Involucre elongated, 3.5-4.5 × 1.7-2.5 mm, with yellow-green or brown



Figure 8. *Achillea stepposa* Klokov et Krytzka (a – stem base and the rhizome, b – the upper part of the stem with inflorescences, c – leaf segment)

margined phyllaries, 2.5-3.5 x 0.6-1.2 mm, outer triangular- or elongate-ovated, inner ones elongated. Marginal floret ligules white or yellowish-white, semi-elliptical or almost rounded, 1.2-1.8 x 1.3-2.3 mm, at the tip rounded-3-toothed. Achenes elongate-cuneated, 1.3-2.3 x 0.6-0.7 mm. $2n = 36$ [20].

It is a hemicryptophytic plant. The plants bloom in June-August and fructify in July-September. Propagate by seeds and vegetatively.

The plants grow on glades and edges of arid forests with *Quercus pubescens*, *dry meadows*, *steppe hills*, *limestone and loess slopes*. A typically steppe mesoxerophilous species of arid habitats. In the Dniester-Prut region the species is rare. It can be met only in the central and southern parts of the region on the territory of the Republic of Moldova [18]. Common area of species covers the Eastern Europe (excluding northern districts), Crimea, Middle Asia (north), Western Siberia (south) [20].

10. *A. setacea* Waldst. et Kit. 1802, Pl. Rar. Hung. 1: 82, tab. 80; Афанасьев, 1961, Фл. СССР, 26: 83, р. р.; Richards. 1976, Fl. Europ. 4: 163, р. р.; Клоков и Крицкая, 1984, Тысячелистники: 235; Гейдеман, 1986, Определ. высш. раст. МССР, изд. 3: 543; Цвелев, 1994, Фл. евр. части СССР, 7: 126; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Васильева и Коваленко, 2003, Консп. флори Півден. Бессарабії: 43; Negru, 2007, Determ. pl. fl. R. Moldova: 248; Ciocârlan, 2009, Fl. ilustr. a României: 798. – *A. millefolium* L. subsp. *setacea* (Waldst. et Kit.) Weiss, 1902, in Koch, Syn. Fl. Germ., ed. 3, 2: 1404. (Figure 9).

Plant 20-70 cm tall, densely covered with long, thin hairs. Rhizome thin, branched, creeping. Stem erect or ascending, covered with white hairs, simple or branched, usually with sterile shortened branches in the axils of the upper leaves. Basal and lower stem leaves petiolate, linear, 5-25 x 0.8-2 cm, the other sessile, linear or narrow-lanceolate, 1.5-5 x 0.4-1.3 cm. Rachis leaf 0.3-0.9 mm wide. Primary segments numerous, 0.6-4 mm spaced, wide-triangular, triangular or elongate, 1.7-7 x 1.2-7 mm, pennatisected on secondary segments divided into 3-9 filiform or narrow-linear terminal lobes, with mucronulate cartilaginous tip 0.5 mm long.

Inflorescence terminal, lax, corymbose; numerous capitula assembled into compound cymes, lax, 2-9 cm in diameter. Involucre elongated-cylindrical, 2.8-3.3 x 1-1.6 mm wide. Phyllaries pubescent, the outer ones elongate-ovated, the other elongated, with

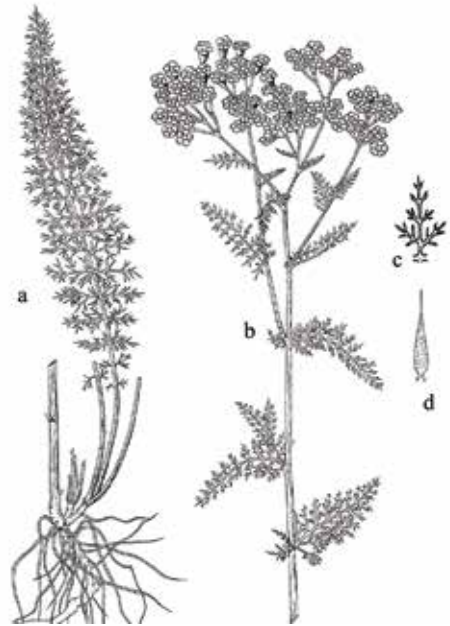


Figure 9. *Achillea setacea* Waldst. et Kit. (a – stem base and the rhizome, b – the upper part of the stem with inflorescences, c – leaf segments, d – apical leaf segment)

the scarious pale-brown or brown margin. Marginal floret ligules white or yellowish-white, oval or almost round, 0.8-1.2 x 1-1.6 mm. Achenes elongate-obovoid, 1-1.3 x 0.3 mm. $2n = 18, 36$ [2, 20].

It is a hemicryptophytic plant. The plants bloom in May-July and fructify in June-August. Propagate by seeds and vegetatively.

The plants grow on steppe hills, limestone slopes, glades and edges of arid forests, dry meadows. A typically steppe mesoxerophilous species of arid habitats. In the Dniester-Prut region can be found throughout the territory. Common area of species covers Atlantic, Central and Eastern Europe (south), Crimea, Mediterranean region, Asia Minor [20].

It is an aromatic, medicinal and ornamental plant. The plant has antibacterial, restorative, antimycotic effect. It is used in mouth and eye diseases, parontosis, stomatitis, conjunctivitis. The infusion is also used in diseases of the respiratory system, especially in lung disorders [7, 17].

Section 3. *Nobilia* Klokov et Krytzka, 1984, Тысячелистники: 174. – Leaf lamina elongate or lanceolate-ovate, with segments or intermediate teeth. Involucre 2-3-3 mm long and 1.5-2.5 mm wide. Receptacle convex. Phyllaries distinctly separated from the bracts. Marginal floret ligules white or yellowish-white. Achenes 0.8-1.1 mm long.

Т у р у s: *A. nobilis* L.

11. *A. nobilis* L. 1753, Sp. Pl: 899; Афанасьев, 1961, Фл. СССР, 26: 76; Richards. 1976, Fl. Europ. 4: 164; Гейдеман, 1986, Определ. высш. раст. МССР, изд. 3: 543; Цвелев, 1994, Фл. евр. части СССР, 7: 127; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Васильева и Коваленко, 2003, Консп. флори Півден. Бессарабії: 42; Negru, 2007, Determ. pl. fl. R. Moldova: 248.

Plant 20-70 cm tall, gray-green, dense and woolly tapered, sometimes almost glabrous, with pivoting root and short underground shoots. Stem solitary or 3-6, erect or slightly ascending, simple or branched. Basal and the lower stem leaves petiolate (petiole 1-4 cm long), broadly-ovate, ovate or elongate elliptic, 3-10 x 1.5-2.5 cm, tripennatisected, the other ovate or elongate-elliptic, 1.5-4 x 0.5-2.5 cm, bi-, rarely tripennatisected, sessile. Primary segments spaced by 2-6 mm on the leaf rachis, especially towards

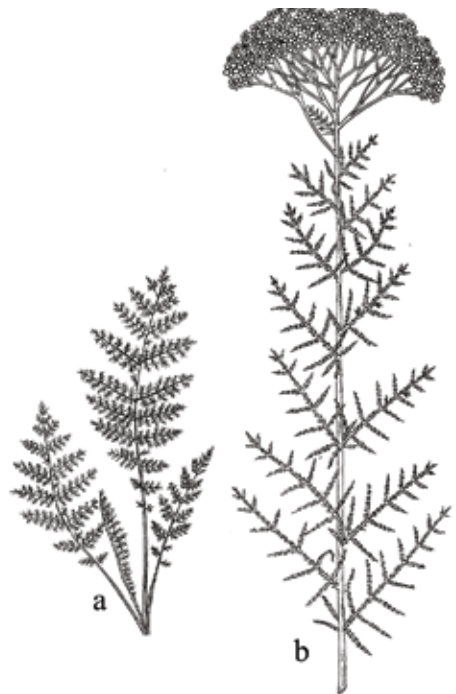


Figure 10. *Achillea nobilis* L.
(a – basal leaves, b – the upper part of the stem with inflorescences)

the base of the leaf, elongated or linear, 10-15 mm long; secondary segments lanceolate or linear, pennatisected, with linear-lanceolate lobes, 1-2 mm long. Leaf rachis 0.5-0.6 mm wide, from middle to tip with intermediate lanceolate, triangular or linear segments, 0.5-2 mm wide. Capitula many, gathered in dense corymbose inflorescences. Involucre ovoid, 2-3 (3.5) x 1.5-2 mm. Phyllaries elongate, with narrow scarios whitish margin. Paleola lanceolate, white, membranaceous. Marginal floret ligules white or yellowish, rounded-round or semi-round, 1-1.6 mm wide, with a truncated tip, uneven 3-toothed. Achenes obovoid, 1 x 0.3-0.5 mm (Figure 10). $2n = 18$ [2].

It is a hemicryptophytic plant. The plants bloom in June-August and fructify in July-September. Propagate by seeds.

The plants grow on steppe and limestone slopes, glades and ridges of arid forests, bushes, dry meadows. A typically mesoxerophilous specific for meadow steppe.

In the Dniester-Prut region can be found throughout the territory. Common area of species covers Atlantic, Central and Eastern Europe (east and west, introduced to other areas), Crimea, Mediterranean region (north-west), Asia Minor and Middle East, Caucasus, Western Siberia [20].

The plant is an aromatic, medicinal, spicy and ornamental plant. Grows in the collection of medicinal plant of National Botanical Garden. The plant has galactagogue, restorative, antibacterial, antimycotic, and antitumor effects. It is used in diseases of the reproductive and cardiovascular system [17]. In folk medicine the infusion is used in tooth diseases. Pharmacological studies revealed the antispasmodic and antioxidant activities of plant extracts [12].

12. *A. neilreichii* A.Kerner, 1871, Österr. Bot. Zeitschr. 21: 141; Афанасьев, 1961, Фл. СССР, 26: 77; Клоков и Крицкая, 1984, Тысячелистники: 217; Гейдеман, 1986, Опред. высш. раст. МССР, изд. 3: 543; Цвелев, 1994, Фл. евр. части СССР, 7: 127; Зиман, 1999, Опред. высш. раст. Укр., изд. 2: 335; Negru, 2007, Determ. pl. fl. R. Moldova: 248. – *A. nobilis* L. subsp. *neilreichii* (A.Kerner) Velen. 1891, Fl. Bulg.: 263; Richards. 1976, Fl. Europ. 4: 164; Ciocârlan, 2009, Fl. ilustr. a României: 797. (Figure 11).

Plant 30-80 cm tall, gray-green, dense villous, with shortened, many-headed rhizome. Stem solitary or a few, erect or slightly ascending, simple or branched at top, leafy. Leaves sessile (only the basal and



Figure 11. *Achillea neilreichii* Kerner (a – basal leaves, b – the upper part of the stem with inflorescences)

inferior petiolate, broad-ovate or ovate), bi- or tripennatisected, punctate-foveolate, 2-5 x 1-2 cm; primary segments spaced by 3-9 mm, especially towards base, ovate-lanceolate or lanceolate, 15 (20) mm long, pennatisected lobes linear, elongate or lanceolate, 0.5-1.5 mm long. Leaf rachis 0.4-0.6 mm wide, completely or from mid to tip with lanceolate or linear intermediate (secondary) segments, entire or pennatisected. Inflorescence terminal, corymbose, dense, 3-7 cm in diameter. Capitula numerous. Involucre ovoid, 2-3 x 1.5-1.8 mm. Phyllaries elongate-ovate, usually whitish, with membranous brownish, rarely white margin. Marginal floret ligules pale-yellow, semi-elliptical or rounded-reniform, 0.6-1.3 x 0.7-1.6 mm, with a truncated, uneven 3-toothed or nearly entire tip. Achenes cuneate-elongate, 1-1.2 mm long. $2n = 45$ [20].

It is a hemicryptophytic plant. The plants bloom in June-September and fructify in July-October. Propagate by seeds.

The plants grow on glade and forest edges, shrubs, steppe hills, limestone slopes. A typically steppe mesoxerophilous species.

In the Dniester-Prut region can be found throughout the territory. The common area covers the Central and south-western part of Eastern Europe, Crimea, Mediterranean region (Balkan Peninsula) [20].

The infusion of *Achillea neilreichii* was tested for antioxidant activity, being a potential source of natural antioxidants for treatment and prevention of related diseases caused by oxidative stress [12].

Section 4. *Ochroleucae* Klokov et Krytzka, 1984, Тысячелистники: 174. – Plant with sterile elongate shoots, evenly covered with spaced leaves. Leaf blade linear, pennate-sected. Involucre 3-3,5 mm long and wide. Receptacle convex. Phyllaries distinctly separated from the bracts. Marginal floret ligules pale-yellow or yellow-white. Achenes 0.9-1.2 mm long.

Т у р у s: *A. ochroleuca* Ehrh.

13. *A. ochroleuca* Ehrh. 1792, Beitr. Naturk. 7: 166, non Willd. 1804; Афанасьев, 1961, Фл. СССР, 26: 93; Richards. 1976, Fl. Europ. 4: 164; Гейдеман, 1986, Определ. высш. раст. МССР, изд. 3: 541; Цвелев, 1994, Фл. евр. части СССР, 7: 127; Зиман, 1999, Определ. высш. раст. Укр., изд. 2: 335; Васильева и Коваленко, 2003, Консп. флори Півден. Бессарабії: 42; Ciocârlan, 2009, Fl. ilustr. a României: 797. – *A. pectinata* Willd. 1804, Sp. Pl. 3, 3: 2197, non Lam. 173. – *A. kitaibeliana* Soó, 1941, Acta Geobot. Hung. 4: 193; Кондратюк, 1962, Флора УРСР, 11: 263. (Figure 12).

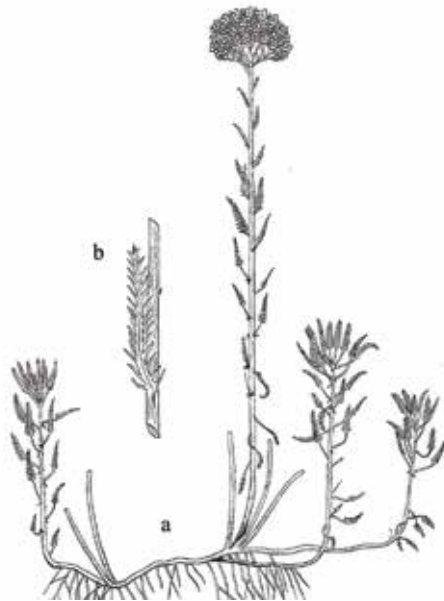


Figure 12. *Achillea ochroleuca* Ehrh.
(a – habitus, b – stem leaf)

Plant up to 50 cm tall, soft-tomentose. Rhizome thick, woody, many-headed. Stems 5-30 (vegetative and generative), from the base woody and ascending, simple, sometimes slightly branched, often with leafy branches in the axes of the stem leaves. Generative stems 10-50 cm tall, with spaced leaves, the lower leaves petiolated, the other sessile. Vegetative stems 5-25 cm high, densely leafy, with petiole leaves. Leaves pubescent or almost glabrous, punctate-foveolate, linear, pennatisected, 1-4 x 2-4.5 mm; rachis of 1.5-2 mm wide; segments arranged as teeth, linear or sub-linear, 1-4 x 0.4-0.5 mm wide, entire or sometimes 1- or 3-toothed. Median stem leaves sessile, at base with longer segments. Lower leaves and those of sterile shoots, often long-petiolate, with segments arranged at the base of the rachis and at sides towards the tip of the leaf. Numerous capitula gathered in dense corymbose inflorescences. Involucre wide-ovoidal or ovoidal, 3-4 x 2.5-3.5 mm, with membranous phyllaries, outer triangular-ovate, inner ones elongate, obtuse, with white-membranous margin, sometimes pale-brown at the tip. Marginal floret ligules pale-yellow, elongate-round, twice shorter than involucre, 3-toothed at tip. Achenes ovoid, 1-1.5 x 0.3-0.6 mm. $2n = 18$ [20].

It is a hemicryptophytic plant. The plants bloom in May-August and fructify in June-September. Propagate by seeds or vegetatively.

The plants grow on steppe and limestone slopes. A typically steppe xerophilous species.

In the Dniester-Prut region can be met only in the southern and south-eastern part of the Republic of Moldova (Anenii Noi, Cimislia, Comrat, Taraclia, Vulcanesti, Cahul and Slobozia districts) and on the territory of Ukraine [6, 14, 16]. The species is located at the northern limit of its common area. Common area of species covers the Balkan Peninsula, south-eastern regions of Central and south-western zone of Eastern Europe [20].

The species is included in the Red Book of the Republic of Moldova as a critically endangered (category CR) [6]. Territorially protected in the Natural Reservation "Bugeac", in the representative sectors with steppe vegetation "Andriasevca Noua" and "Ciumbai", Ramsar site "Lower Dniester". It grows in *ex situ* conditions, in the collection of medicinal plants of National Botanical Garden of the Republic of Moldova.

CONCLUSION

For the territory of the Dniester-Prut region, 13 species of the genus *Achillea* L. were identified: *A. coarctata* Poir., *A. collina* J.Becker ex Rchb., *A. distans* Waldst. et Kit. ex Willd., *A. euxina* Klokov, *A. inundata* Kondr., *A. leptophylla* M.Bieb., *A. neilreichii* A.Kerner, *A. nobilis* L., *A. ochroleuca* Ehrh., *A. pannonica* Scheele, *A. setacea* Waldst. et Kit., *A. stepposa* Klokov et Krytzka and *A. millefolium* L.

One species (*A. euxina* Klokov) are found only in the southern zone of the region (on the territory of Ukraine). One species (*A. leptophylla* M.Bieb.) may have disappeared from the Dniester-Prut region.

We propose to include in the list of species protected by law in the Republic of Moldova the following 3 species of *Achillea* genus – *A. inundata* Kondr., *A. ochroleuca* Ehrh. and *A. stepposa* Klokov et Krytzka.

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