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Taxonomy of North American leafy spurge

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Editor's note – The photographs of herbarium specimens of various *Euphorbia* taxa were included to provide a visual representation of the taxonomic treatment. Photographs were supplied by Dr. Alina Stahevitch, Biosystematics Research Institute, Central Experimental Farm, Ottawa, Ontario K1A 0C6.

I. Introduction

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I. Introduction

The problem of the differentiation between the numerous described taxa in what is variously termed the 'esula-aggregate', the 'virgata-group', and 'leafy spurge' is considerable. Some authorities, for example Bakke (1), have preferred to regard this polymorphic complex as comprising one variable species, *Euphorbia esula* L. Others, for example Prokhanov (11) and Klovov (6), go to the other extreme in recognizing each minor variation as a separate and distinct species. Somewhere in between these two positions come many, myself included, who would endeavor not to obscure the factors of obvious taxonomic significance by excessive lumping, nor, on the other hand, who would fail to recognize the devaluation of the concept of species that comes with excessive splitting, but who nevertheless are somewhat perplexed when it comes to the point of asking, "Where is the line to be drawn between what may generally be considered to be 'good' and 'bad' species in this aggregate?" The answer is usually a conservative one – those 'species' tend to get perpetuated that have graced the pages of the greatest number of appropriate botanical works, whereas those not thus privileged tend to be subsumed or even forgotten.

The following is a synopsis of the members of the aggregate that have generally been recognized at one level or another, together with the hybrids that have been described between them.

agraria M. Bieb (71)

andrachnoides Schrenk (8)

androsaemifolia Willd. (41)
 (*salicetorum* Jord.)
 × *angustata* (Roch.) Soó (66)
 (*salicifolia* × *waldsteinii* (*virgata*))
 (*salicifolia* ‘b’ *angustata* Roch.)
astrachanica C.A. Mey. ex Claus (30)
boissieriana (Woron.) Prokh. (13)
 (*virgata* v. *orientalis* Boiss.)
boissieriana × *esula* (13a)
borodini Sambuk (61)
borszczowii Prokh. (50)
buhsei Boiss. (9)
buschiana Grossh. (4)
chamaesula Boiss. (63)
 × *csatoi* (Simk.) Borza (73)
 (*agraria* × *esula* × *salicifolia*)
cyparissias L. (24)
cyrtophylla Prokh. (32)
discolor Ledeb. (48)
esula L. (34)
filicina Portenschl. (42)
 × *gayeri* Boros & Soó (29)
 (*cyparissias* × *waldsteinii* (*virgata*))
glomerulans Prokh. (67)
gmelini Steud. (47)
gracilis Bess. (52)
 (*esula* v. *cyparissioides* Boiss.)
guntensis Prokh. (33)
 × *gusuleacii* Prod. & Soran (14)
 (*boissieriana* × *salicifolia*)
 × *hankoana* Soó (27)
 (*cyparissias* × *pinifolia*)
hebecarpa Boiss. (23)
iberica Boiss. (68)
imperfoliata Vis. (43)
irgisensis Litw. (7)
jaxartica Prokh. (18)
kaleniczenkii Czern. (57)
karoii Freyn (49)
latifolia C.A. Mey. ex Ledeb. (59)
leptocaula Boiss. (11)

lucida Waldst. & Kit. (69)
lunulata Bunge (64)
maleevi S. Tamam. (5)
mandschurica Maxim. (75)
microcarpa Prokh. (45)
mosana Lej. (40)
nevadensis Boiss. & Reut. (78)
pamirica Prokh. (22)
panicii G. Beck (39)
 × *paradoxa* (Schur) Podp. (36)
 (*esula* × *salicifolia*)
 (*esula* ‘e’ *paradoxa* Schur)
 (*esula* v. *pubescens* Griseb. & Schenk)
 × *peisonis* Rech.f. (28)
 (*cyparissias* × *salicifolia*)
pinifolia DC. (51)
 × *podolica* Błocki (54)
 (*gracilis* × *salicifolia*)
poecilophylla Prokh. (62)
 × *procopianii* Sävul. & Rayss. (72)
 (*agraria* × *salicifolia*)
pseudagraria P. Smirn. (44)
 × *pseudoesula* Schur (25)
 (*cyparissias* × *esula*)
 (*figerti* Dörfl.)
 × *pseudolucida* Schur (70)
 (*lucida* × *waldsteinii* (*virgata*))
 × *pseudovirgata* (Schur) Soó (38)
 (*esula* × *waldsteinii* (*virgata*))
 (*virgata* ‘b’ *pseudovirgata* Schur)
 (*intercedens* Podp. non Pax)
 (*virgata* f. *esulifolia* Thell. ex Hegi)
 (*podperae* Croiz.)
 (× *jucula* Prod.)
salicifolia Host (65)
sanusunitensis Hand.-Mazz. (16)
sareptana Becker (55)
savaryi Kiss. (3)
 × *schurii* Simk. (37)
 (*esula* v. *riparia* Schur × *salicifolia*)
sewerzowii Herd. (74)

sieboldiana Morr. & Decne. (2)
subcordata C.A. Mey (20)
subhastata Vis. & Panc. (77)
subtilis Prokh. (46)
szechuanica Pax & K. Hoffm. (60)
tanaitica Pacz. (56)
tenuifolia Lam. (10)
thyrsoidea Boiss. (76)
tommasiniana Bertol. (17)
 (*virgata* v. *montana* Rchb.)
trapezoidalis Viv. (1)
tristis Bess. (53)
tshuiensis (Prokh.) Serg. (31)
tyraica Klok. & Artemcz. (58)
undulata M. Bieb. (6)
uralensis Fisch. ex Link (21)
 (*virgata* v. *uralensis* (Fisch. ex Link) Boiss.)
 (*virgata* 'a' *angustissima* Schur)
waldsteinii (Soják) A. Radcliffe-Smith (12)
 (*virgata* Waldst. & Kit.)
 (*saratoi* Ardoino)
virgultosa Klok. (15)
 × *wagneri* Soó (35)
 (*esula* × *lucida*)
 × *wimmeriana* Wagner (26)
 (*cyparissias* × *lucida*)
zhiguliensis Prokh. (19)

The great bulk of these are central and east European, with extensions into western Europe on the one hand, and into Temperate Asia on the other. Some of the species hybridize freely among themselves, as can be seen from the above list, the best-documented in this regard being *waldsteinii*, *cyparissias*, *esula*, *salicifolia*, *lucida* and *agraria*, which are also the commoner and more widespread species in the aggregate. These six species – and some of their satellites, which are variously regarded as either varieties or distinct species – are, according to Croizat (2), the chief representatives of the aggregate to be found or to be expected as adventive in North America. Croizat (2) lists the following in this connection:

esula L.
waldsteinii (Soják) A. Radcliffe-Smith (as *virgata* Waldst. & Kit.)
boissieriana (Woron.) Prokh. (as *virgata* v. *orientalis* Boiss.)
tommasiniana Bertol (as *virgata* v. *montana* Rchb.)
 × *pseudovirgata* (Schur) Soó (as *intercedens* Podp.)
uralensis Fisch. ex Link

agraria M. Bieb.
lucida Waldst. & Kit.
cyparissias L.
hebecarpa Boiss. and *salicifolia* Host.

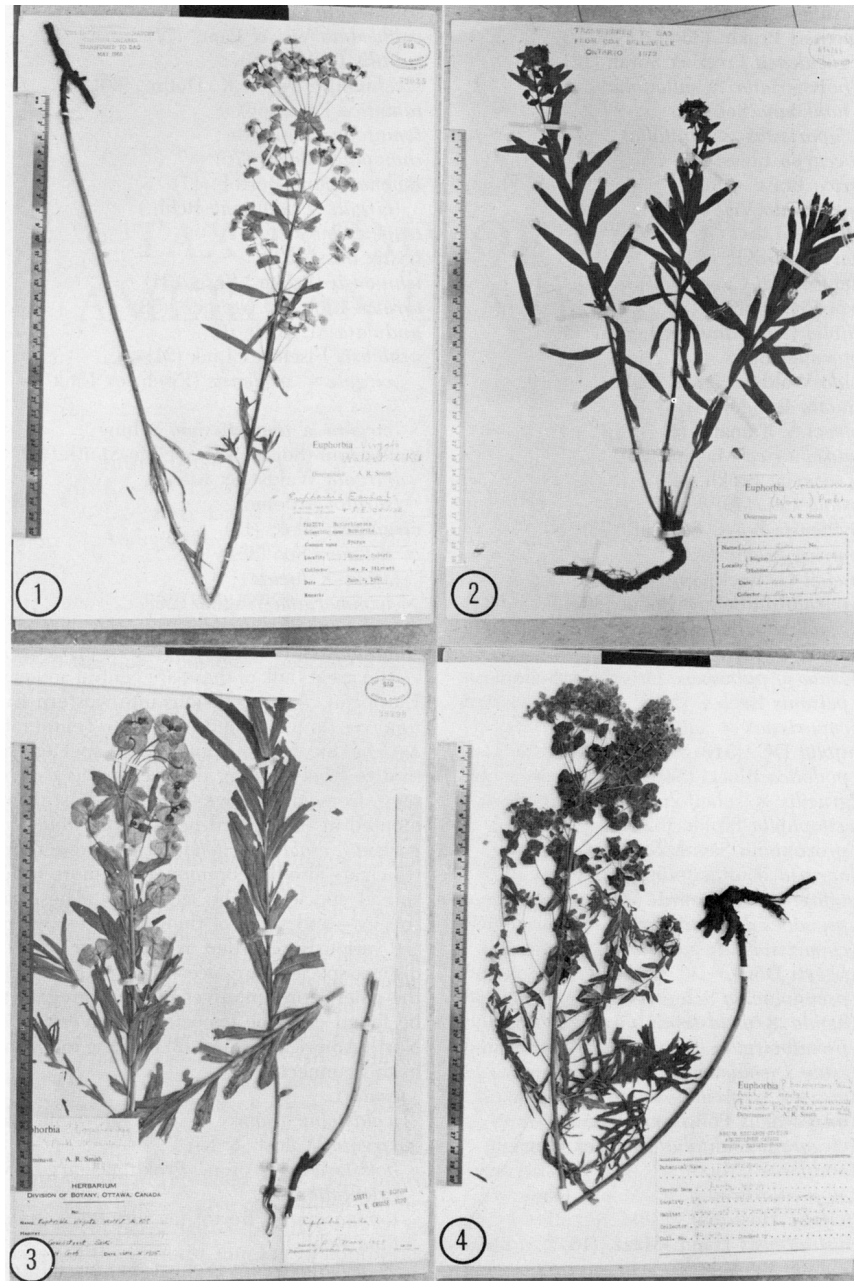


Figure 1. *E. waldsteinii* (Soják) Radcliffe-Smith (*E. virgata* Waldst. & Kit.).

Figure 2. *E. boissieriana* (Woron.) Prokh.

Figure 3. *E. boissieriana* × *esula* hybrid.

Figure 4. *E. boissieriana* × *esula* hybrid.

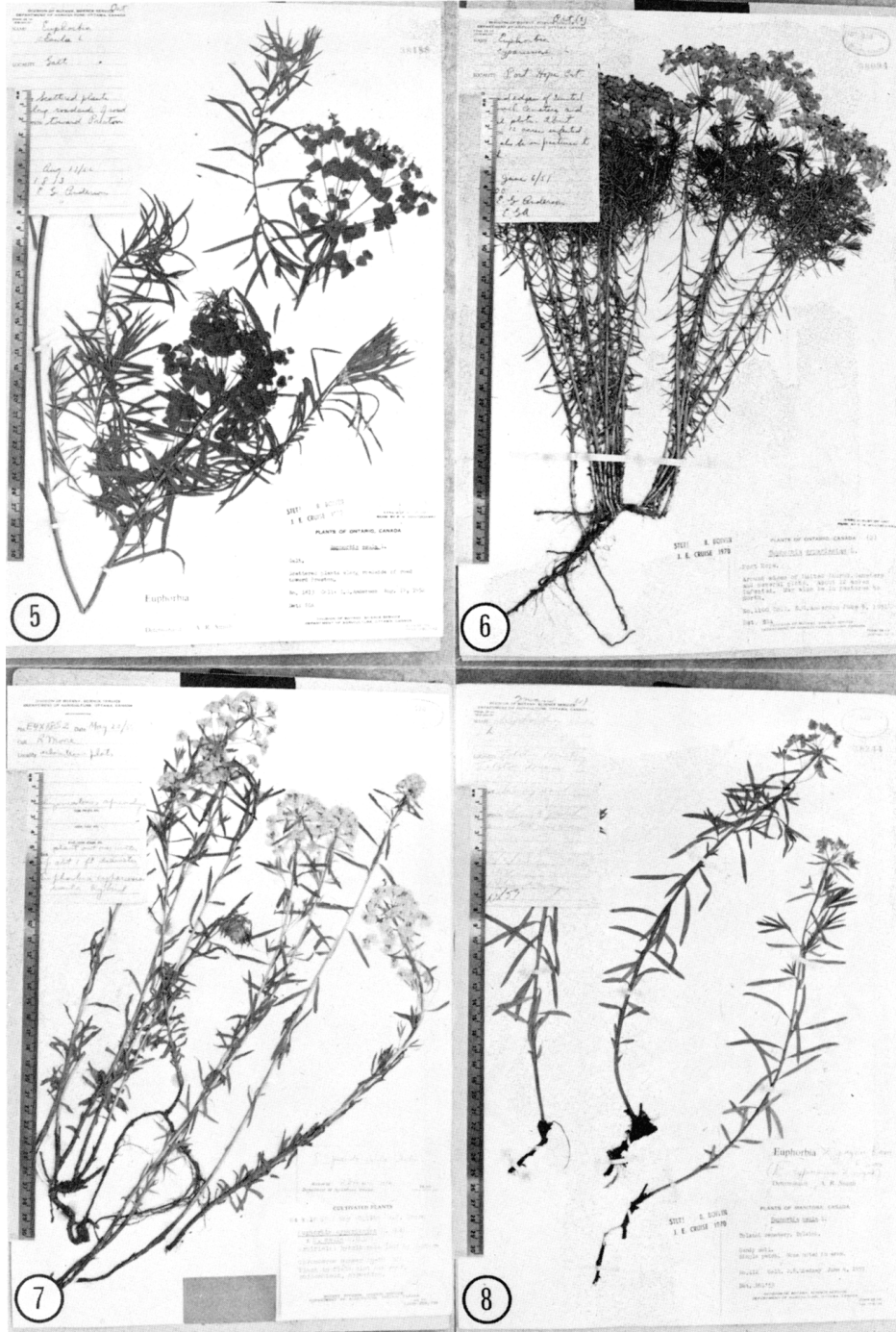


Figure 5. *E. uralensis* Fisch. ex Link

Figure 6. *E. cyparissias* L.

Figure 7. *E. × pseudoesula* Schur.

Figure 8. *E. × gayeri* Boros & Soó.

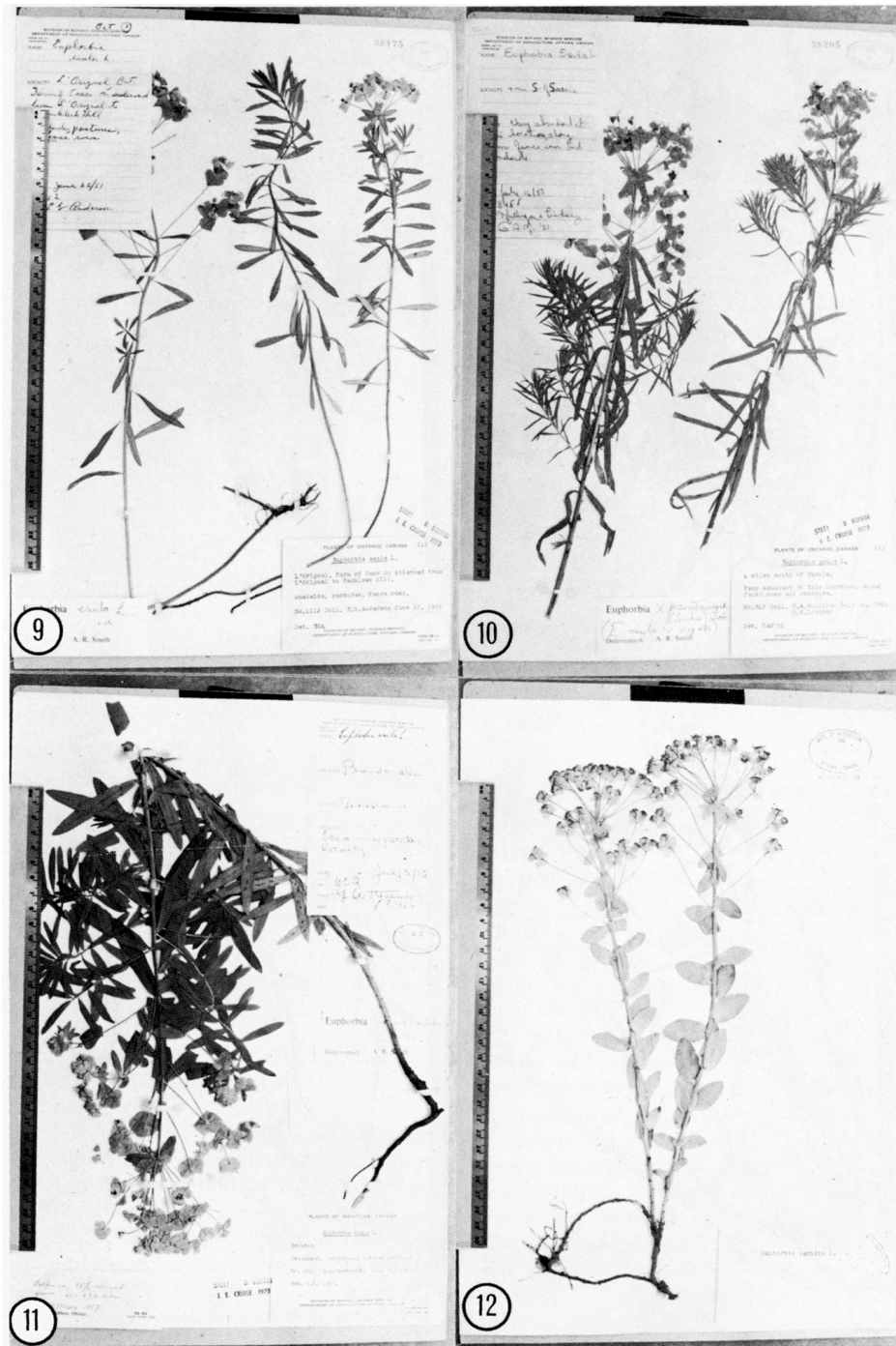


Figure 9. *E. esula* L.

Figure 10. *E. × pseudovirgata* (Schur) Soó.

Figure 11. *E. androsaemifolia* Willd.

Figure 12. *E. agraria* M. Bieb.

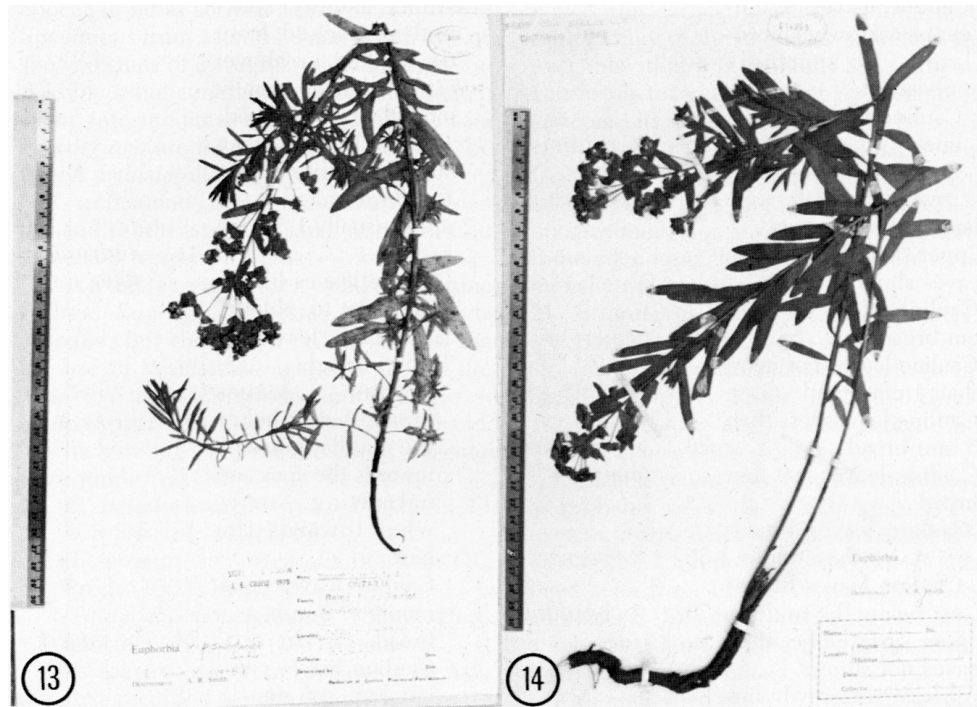


Figure 13. *E. × pseudolucida* Schur.

Figure 14. *E. × pseudolucida* Schur.

In a recent limited sampling of members of this aggregate adventive in North America, Dunn and Radcliffe-Smith (5) recognized five entities:

esula L.

androsaemifolia Willd. (as *esula* L., s.l.)

boissieriana (Woron.) Prokh. (as *virgata* v. *orientalis* Boiss.)

uralensis Fisch. ex Link (as *virgata* v. *uralensis* (Fisch. ex Link) Boiss.) and
 × *pseudovirgata* (Schur) Soó.

Since many of the 78 entities listed above have never been reported as adventive in North America, it would be superfluous to treat them all in this account, and so I have confined the treatment to the provision of a key to, and notes on, the species and hybrids that have either been reported by Croizat (2) or by Dunn and Radcliffe-Smith (5) as adventive, or that might be expected to become so, owing to the possession of similar biological characteristics to those that are.

II. Key to treated taxa

Cauline leaves cordate at the base:

Cauline leaves up to 8 cm broad

71. *agraria*

Cauline leaves not more than 1 cm broad 17. *tommasiniana*

Cauline leaves not cordate at the base:

Plant puberulous or pubescent, at least in part:

Fruit pubescent 23. *hebecarpa*

Fruit glabrous:

Cauline leaves narrowly oblong or oblanceolate-oblong, broadest above the middle 36. × *paradoxa*

Cauline leaves broadest at or below the middle:

Cauline leaves broadly lanceolate, acute, evenly pubescent 65. *salicifolia*

Cauline leaves ± linear or narrowly lanceolate, sparingly pubescent:

Cauline leaves ± linear 28. × *peisonis*

Cauline leaves narrowly lanceolate 66. × *angustata*

Plant quite glabrous:

Upper surface of cauline leaves shiny:

Cauline leaves up to 13 cm broad 69. *lucida*

Cauline leaves not more than 1 cm broad:

Cauline leaves less than 5 mm broad 26. × *wimmeriana*

Cauline leaves 5-9 mm broad:

Cauline leaves broadest above the middle 35. × *wagneri*

Cauline leaves broadest below the middle 70. × *pseudolucida*

Upper surface of cauline leaves not shiny:

All leaves narrowly linear, those of the axillary leafy shoots densely clustered, giving them a pine-like appearance 24. *cyparissias*

Not as above:

Cauline leaves oblanceolate or narrowly oblanceolate-oblong, rounded at the apex, broadest above the middle, cuneate-attenuate at the base:

Cauling leaves not more than 4 mm broad 25. × *pseudoesula*

Cauline leaves usually (3-)5-10 mm broad 34. *esula*

Cauline leaves linear, lanceolate or oblong, broadest at or below the middle, or of ± uniform breadth for most of their length:

Stems usually branched from the base with numerous sterile branches; cauline leaves narrowly linear, usually less than 1.5 mm broad, sharply acute ... 21. *uralensis*

Stems usually sparingly branched from the middle or above; cauline leaves usually more than 2 mm broad:

Cauline leaves oblong to elliptic-oblong, obtuse or rounded at the apex, usually 1.5-2 cm broad 41. *androsaemifolia*

Cauline leaves linear-lanceolate to oblong-lanceolate, less than 1.5 cm broad:

Cauline leaves broadest at or below the middle, tapering towards the apex and narrowing somewhat towards the base:

Cauline leaves commonly c. 2 mm broad 29. × *gayeri*

Cauline leaves commonly c. 4-5 mm broad 38. × *pseudovirgata*

Cauline leaves more than 5 mm broad 13a. *boissieriana* × *esula*

Cauline leaves broadest below the middle, rounded or cuneate-rounded at base:

Cauline leaves linear-lanceolate, usually cuspidate-acuminate 12. *waldsteinii*

Cauline leaves lanceolate to oblong-lanceolate, usually -L obtuse and sometimes mucronulate 13. *boissieriana*

12. *E. waldsteinii* (Soják) Radcliffe-Smith in Kew Bull. (*E. virgata* 36 (2): 216 (1981) Waldst. & Kit., Pl. Rar. Hung. 2: 176, t. 162 (1804), non Desf. (1804)) (*Tithymalus waldsteinii* Soják in Čas. Nár. Muz. Praha 140(3-4): 177 (1972))

North American material of this species has been seen from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Oregon, Montana, Wyoming and Connecticut. It differs from its hybrid with *esula* chiefly in having somewhat broader cauline leaves that are broadest below the middle and ± rounded at the base. Although widespread, it does not appear to be as serious a pest as the hybrid. Specimens from Manitoba and South Dakota showed signs of introgression with *esula*, but possibly some generations back. In Saskatchewan, intermediates between *waldsteinii* and *boissieriana* are found, and in Manitoba, between *waldsteinii* and *uralensis*.

E. waldsteinii (*E. virgata*) is native to central and southeastern Europe, northern Caucasus and western Siberia.

It is to be regretted that a well-known name, such as *Euphorbia virgata*, has had to be changed, but the author (12) is hopeful that the use of Waldstein's name in the epithet will serve as an identifiable link with the old name. Apparently it is not possible to decide in which months of 1804 the two *E. virgatae* were published (16).

13. *E. boissieriana* (Woron.) Prokh. in Fl. U.S.S.R. 14: 445 (1949) (*E. virgata* var. *orientalis* Boiss. in DC. Prodr. 15(2): 160 (1862)) (*Tithymalus boissierianus* Woron., Herb. Fl. Cauc. No. 479 (1931), nomen)

This species, native to southwestern Asia, was first recorded for the American flora by Croizat (2) on the basis of specimens from Connecticut. Dunn & Radcliffe-Smith (5) reported it for Washington and Oregon, and it is now known also from British Columbia and Saskatchewan, with a possible occurrence also in Ontario. It is altogether more robust than *E. waldsteinii* (*E. virgata*), and has broader leaves of a rather different outline.

13a. *E. boissieriana* × *esula*

This hybrid, not reported in Europe as far as is known, has now been recognized amongst material from British Columbia, Saskatchewan, Ontario and Iowa, and it possibly also occurs in Manitoba and North Dakota. It is reminiscent of × *pseudovirgata*, but with generally broader leaves.

**17. *E. tommasiniana*. Bertol., Fl. Ital. 5: 78 (1842)
(*E. virgata* var. *montana* Rchb., Ic. Fl. Germ. Helv. 5:8, t. 147, f. 4792β
(1841))**

Described from Mt. Spaccato in the vicinity of Trieste, *E. tommasiniana* appears to be of rather restricted occurrence in Europe. It is characterized by its narrow cauline leaves that are shallowly cordate and usually somewhat broadened at the base.

Unfortunately, this name had to be used in Flora Europaea (14) at subspecific rank in a sense much wider than that originally intended—including the typical entity of which it was formerly described as a variety – since it was the earliest available epithet at that rank for any of the elements included. However, now that it is generally agreed by most European taxonomists that *waldsteinii* (*virgata*) and its allies should not thus be merged with *esula*, the problem no longer arises. Croizat (2) expected this plant to be found adventive in the United States, but had seen no specimen, nor has the present author. It is included here chiefly on account of its nonmenclatural importance.

**21. *E. uralensis* Fisch. ex Link, Enum. Hort. Berol. 2:14 (1822)
(*E. virgata* var. *uralensis* (Fisch. ex Link) Boiss. in DC. Prodr. 15(2): 160
(1862))
(*E. virgata* ‘a’ *angustissima* Schur, Enum. Pl. Transs.: 598 (1866))**

Croizat (2) cited a specimen from Michigan as probably referable to this species. However, it is now definitely known as an adventive in the United States, specimens having been seen from Idaho, Wyoming, Colorado and Kansas (5), and probably also in Canada, a specimen approaching this species having been seen from Ontario.

Although very close to *E. waldsteinii* (*E. virgata*), *E. uralensis* is nevertheless clearly recognizable on account of its very narrow, elongate and sharply acute cauline leaves it ranges from southern Russia across to western Siberia and central Asia.

23. *E. hebecarpa* Boiss., Diagn. Pl. Or. Nov., Ser. 1, 8: 90 (1846)

This species is very restricted in its distribution in the Middle East, being confined to the extreme north of Iraq and western Iran, and I do not concur with Croizat (2) who equates it with Central European entities which others have shown are hybrids involving *E. salicifolia*; despite his contention that it “may easily appear as a strictly localized adventitious [sic] plant” in the United States, I feel this to be unlikely. On the other hand, *E.*

× *paradoxa* (Schur) Podp. (q.v.), which he cites as a synonym (giving the wrong authority), might well be expected to occur.

24. *E. cyparissias* L., Sp. Pl.: 461 (1753)

Perhaps one of the most readily recognizable members of the aggregate, with its densely leafy axillary shoots conferring almost a coniferous aspect, *E. cyparissias* nevertheless freely hybridizes with many of its close congeners to produce a multiplicity of intergrading entities.

E. cyparissias is more of a problem in Canada than in the United States, and studies on it there were carried out in the 'fifties (7,8,10). It was shown that two races occurred in Canada - a fertile tetraploid and a male-sterile diploid - which were morphologically indistinguishable except for differences in the size of the leaf-epidermal cells. Material from the United States has been seen from New York.

E. cyparissias occurs widely in Europe (from France and Spain eastward to S. European Russia and Turkey-in-Europe; it is introduced into Britain, Scandinavia and N. European Russia), but its native range nowhere extends far outside it (doubtfully into Turkey-in-Asia).

25. *E. × pseudoesula* Schur, Enum. Pl. Transs.: 595 (1866); Domin & Podp., Klíč Úpl. Kvét. Rep. Česk.: 778 (1928).

(*E. cyparissias* × *esula*)

(*E. × figerti* Dörfl., Herb. Norm. nos. 4295 & 4296 (1902))

Moore (7) described the artificial production of this hybrid and showed that *E. × figerti* represented the same cross as *E. × pseudoesula*, *E. cyparissias* and *E. esula* being involved in both cases.

Material has been seen from North America from Saskatchewan, Ontario, Minnesota, and New York, and it possibly also occurs in Massachusetts as well.

In Europe, this hybrid has been reported along waterways in eastern Germany, northern and eastern Austria, Czechoslovakia, Hungary and Rumania.

26. *E. × wimmeriana* Wagner, Bot. Közl. 20: 85 (1923)

(*E. cyparissias* × *lucida*)

Originally described from Hungary, and subsequently reported also in Germany, Poland, eastern Austria, Czechoslovakia and Rumania, this hybrid resembled *E. cyparissias* except that the leaves are somewhat wider and shiny on the upper surface, and there are fewer and shorter rays in the pseudo-pleiochasium. This may be expected to occur in Canada where both parents are found.

28. *E. × peisonis* Rech. f. in Feddes Rep. 22: 186 (1926)

(*E. cyparissias* × *salicifolia*)

Originally described from eastern Austria, and subsequently reported also in Hungary and Rumania, this hybrid resembles *E. cyparissias* except that it is generally taller in stature, and exhibits a varying degree of pubescence, inherited from *E. salicifolia*. It is to be expected where both parents are found.

**29. *E. × gayeri* Boros & Soó, Bot. Közl. 22: 66 (1925)
(*E. cyparissias* × *waldsteinii* (*virgata*))**

Originally described from Hungary, and subsequently reported also from Germany, Switzerland, eastern Austria and Czechoslovakia, and recently also seen from Rumania, this hybrid resembles *E. cyparissias* except that the leaves are not parallel-sided, and taper towards an acuminate apex; the leaves are narrower than in *E. waldsteinii* (*E. virgata*). North American material has been seen from British Columbia, Manitoba, Ontario and New York, and material collected by Wm. Countryman in 1966 from Vermont is possibly referable here.

34. *E. esula* L., Sp. Pl.: 461 (1753) sensu stricto

In the restricted sense, *E. esula* is widely scattered in North America as an adventive, although is not of course as prevalent as indicated by Bakke (1). Material has been seen from Alberta, Saskatchewan, Ontario, Idaho, Wyoming, Colorado, Minnesota, New York and New Jersey, which does not bear out Croizat's prediction that it should only be expected on the Pacific seaboard. In Canada, Moore (7) also reports it for British Columbia, Manitoba, Quebec and Nova Scotia, but some of these records undoubtedly refer to *E. × pseudovirgata* (q.v.). Material of *esula* showing some signs of introgression with *waldsteinii* (*virgata*) has in fact been seen from Manitoba, Ontario and Nova Scotia. The European distribution is substantially the same as that of *E. cyparissias* L. (q.v.). The synonymy is very extensive, and need not be cited in full here. The literature relating to *E. esula* (s.l.) in North America is reviewed by Moore (7).

**35. *E. × wagneri* Soó, Bot. Közl. 22:67 (1925)
(*E. esula* × *lucida*)**

This was originally thought by Schur (13) to be a variant of his *E. × pseudolucida*, but Soó (15) showed that *esula* was one of the parents, and not *waldsteinii* (*virgata*). It has been recorded from Germany, Poland, Austria, Czechoslovakia, Hungary and Rumania. A specimen possibly referable to this hybrid has been seen from British Columbia.

**36. *E. × paradoxa* (Schur) Podp. in Publ. Fac. Sc. Univ. Masaryk, 12: 29 (1922),
and in Domin & Podp., Klíč Úpl. Květ. Rep. Česk.: 778 (1928)
(*E. esula* × *salicifolia*; *E. esula* L. 'e' *paradoxa* Schur, Enum. Pl. Transs.: 596
(1866); *E. esula* L. var. *pubescens* Gris. & Schenk. Iter. Hung. in Wieg.
Arch.: 297(1852))**

Treated by Schur (13) as an infraspecific taxon of *E. esula* of unspecified rank, and tentatively equated by him with Grisebach's var. *pubescens*, it is now generally agreed that Podpěra (9) was correct in assigning hybrid status to this entity, as it is only found where the parents occur together. It has narrower leaves than in *E. salicifolia*, but is pubescent as is that parent, albeit generally less densely so, and presents other features intermediate between the two species. It was erroneously equated with *E. hebecarpa* Boiss. (q.v.) by Croizat (2); in *× paradoxa* the fruits are glabrous or subglabrous, whereas in *E. hebecarpa* they are densely pubescent. *E. × paradoxa* occurs in eastern Austria, southern Czechoslovakia, Hungary and Rumania. It has not yet been recorded from America. It is now considered by some to have horticultural merit, and so might come to be more widespread as a result.

- 38. *E. × pseudovirgata* (Schur) Soó in Veröff. Geobot. Inst. Rübel in Zürich, 6:252 (1930)**
(E. esula × waldsteinii (virgata); E. virgata Waldst. & Kit. 'b' pseudo-virgata Schur, Enum. Pl. Transs.: 598 (1866); E. intercedens Podp. in Publ. Fac. Sc. Univ. Masaryk, 12: 29 (1922), & in Domin & Podp., Klíč Úpl. Kvét. Rep. Česk.: 778 (1928), non Pax; E. virgata Waldst. & Kit. f. esulifolia Thellung ex Hegi, Ill. Fl. Mittel-Eur. 5(1): 175 (1924); E. podperae Croiz., Amer. Mid. Nat. 37: 801 (1947); E. × jucula Prod. in Fl. R.P.R. 2: 673 (1953))

Although Schur (13) implied hybrid origin for this plant by citing in his synonymy, '*E. virgato-esula* Schur' (nom. nud., pro. syn.), Podpěra (9) was the first to indicate this explicitly, but the name he assigned to the hybrid was illegitimate. Soó (15) took up the name by which it was first known, but maintaining Podpěra's evaluation of the taxon as of hybrid origin, and thus it is known today. Dunn and Radcliffe-Smith (5) have shown how widespread this plant is in the United States in relation to other members of the *esula* aggregate, bearing out Croizat's contention that this is the aggressively invasive entity that has become naturalized and has spread so rapidly in the American Midwest, especially causing problems in Montana, the Dakotas, Nebraska, Kansas, Minnesota and Iowa. Material has subsequently been seen from Wyoming, Colorado (where it is spreading particularly in the southwest of the state), Wisconsin and Michigan. It is also in some of the Northeastern states, as for example New Hampshire, Massachusetts, New York and New Jersey, but does not appear to be such a pest there. Material has also been seen from every province in Canada from British Columbia across to Nova Scotia. Back-crossings with *esula* and with *waldsteinii (virgata)* have been noted from some of these provinces and states. In Saskatchewan, populations also occur that veer towards *uralensis*, and that show signs of introgression with *cyparissias*. A very full description of this plant is given by Bakke (1) under the name '*E. esula* L.'. Dunn (4) also referred to this plant as '*E. esula*' but later recognized that a complex of entities was involved in the American populations. Moore (7) disagreed with Croizat and went back to using '*E. esula*' for the bulk of the American populations, but to my mind this is a simplistic view; he then went on to say that variations may arise in America different from those that occur in Europe, but this is not borne out by recent investigations, all of the American material so far examined being found to have its Old World counterparts, with the possible exception of the hybrid between *boissieriana* and *esula*. The European distribution of *× pseudovirgata* is substantially similar to, but rather wider than, that of *× paradoxa*, except that in this case it has recently been seen from Poland, Yugoslavia and Bulgaria as well and has become a common adventive plant in the British Isles also. Unlike *× paradoxa*, it has no horticultural merit whatever.

- 41. *E. androsaemifolia* Willd., Enum. Hort. Berol. Suppl.: 27 (1814)**
(E. salicetorum Jord., Pugill. Pl. Nov.: 138 (1852))

Customarily included in *E. esula*, *E. androsaemifolia* nevertheless differs from that species in having much broader oblong leaves that are of ± uniform breadth for most of their length. It is a west European species, and was reported by Dunn and Radcliffe-Smith (5) - as '*E. esula* s.l.' - as having been introduced into New Jersey. Material has subsequently been seen from Manitoba, Minnesota and New York, and intermediate forms between it and *esula* s. str. have been seen from Saskatchewan and Connecticut.

65. *E. salicifolia* Host, Syn. Pl. Austr.: 267 (1797)

A distinctive member of the *esula* - complex, at once distinguished by its even indumentum and often broadly lanceolate leaves, this species ranges from Germany and Austria to western Russia and the Balkans, and freely hybridizes with many of the other species of the group. Croizat (2) reports introducing it into cultivation at Harvard and reports that “it is an extraordinarily aggressive perennial with all the earmarks of a potentially pestiferous weed”; in doing so, he may have helped to compound the American leafy spurge problem, although the author has no knowledge of the subsequent history of that introduction, if any.

**66. *E. × angustata* (Roch.) Soó, Bot. Közl. 22: 66 (1925)
(*E. salicifolia* × *waldsteinii* (*virgata*); *E. salicifolia* Host ‘b’ *angustata* Roch. Pl. Ban. Rar.: 43, t. 7, fig. 16 (1828))**

Described from Hungary and found also in Rumania, this hybrid resembles a narrow-leaved specimen of *E. salicifolia* and may be expected where both parents are found.

69. *E. lucida* Waldst. & Kit., Pl. Rar. Hung. 1: 54, t. 54 (1801)

The most robust member of the *esula* – complex, with thick stems, especially at the base, and also distinctive on account of its very shiny leaves, which character it imparts to hybrids with other species in the complex. It occurs in marshes and along riverbanks from Germany and Austria eastward to southwestern Russia and south to the Balkan peninsula. Croizat (2) records it as having been introduced into Alberta, Canada.

70. *E. × pseudolucida* Schur, Sieb. Ver. Naturw. Verh. Mitth. 3: 124 (1852), & Enum. Pl. Transs.: 598 (1866); Domin & Podp., Klíč Úpl. Květ. Rep. Česk.: 778 (1928) (*E. lucida* × *waldsteinii* (*virgata*))

Croizat (2) suggested an equation of Schur’s plant with Podpěra’s *E. intercedens*, but it seems clear that they do not represent the same cross. They are regarded as distinct, for example, by Domin & Podpěra, in their “Key to the Higher Plants of Czechoslovakia” (3), as well as by Schur (13) himself. Originally described from Rumania, and subsequently reported from Czechoslovakia and Hungary, this hybrid resembles a narrow-leaved specimen of *E. lucida*. Material referable to this hybrid has been seen from British Columbia, Saskatchewan, Manitoba and Ontario.

71. *E. agraria* M. Bieb., Fl. Taur.-Cauc. 1: 375(1808)

A very distinctive member of the *esula* complex because of its broadly ovate-lanceolate cauline leaves that are cordate and sub-amplexicaul at the base, this is basically a Balkan species, extending eastward to the Crimea. Croizat (2) cited three specimens from New York in the Gray Herbarium, but in 1971 Steve Stevens of the University of Kansas collected it in Jefferson County, Nebraska. It is possible that this species will spread in North America as its congeners have done. This species does not seem to hybridize so readily with the other members of the complex, although a hybrid with *salicifolia* (× *procopianii* Săvul. & Rayss.) and a triple hybrid with × *paradoxa* (Schur) Podp. (× *csatoi* (Simk.) Borza) have been reported from Rumania and Hungary.

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