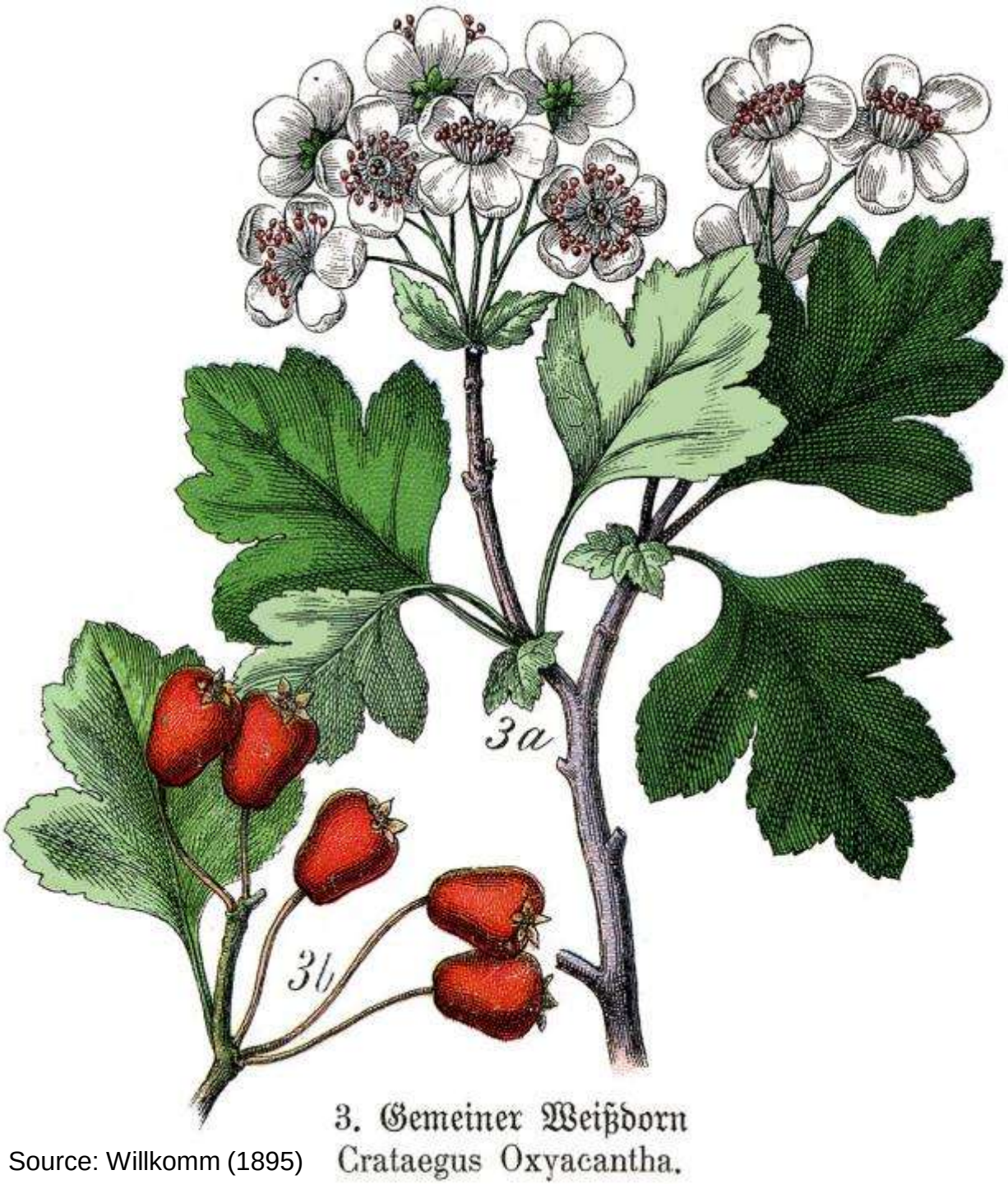


Source: Willkomm (1895)

Wild species and hybrids of *Crataegus* in W-, N- and Middle Europe

- Native species

- Native hybrids

- Naturalized introduced species and hybrids

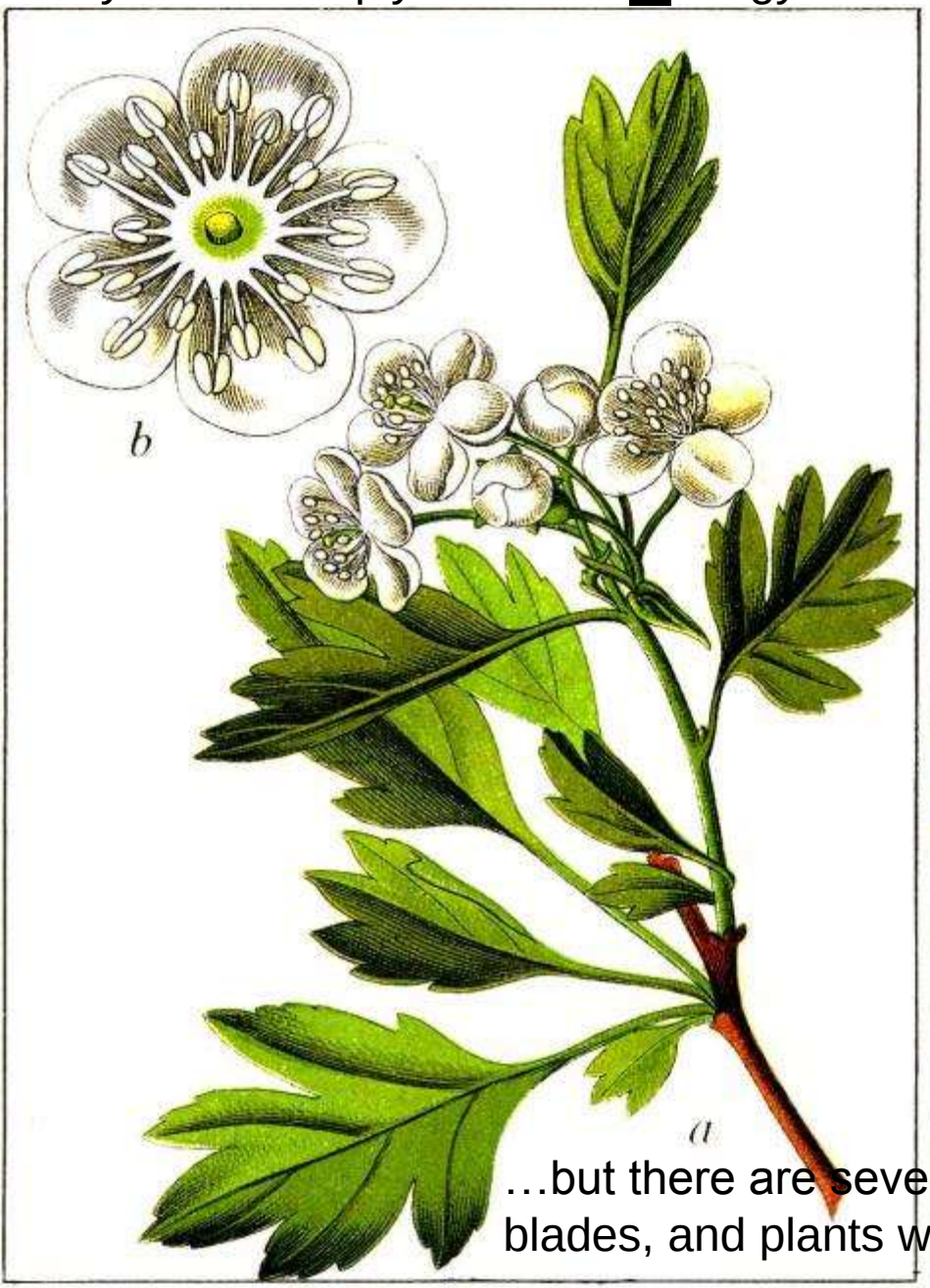
Dr. Peter A. Schmidt

Prof. emeritus (Dresden Univ. of Technology, Tharandt)

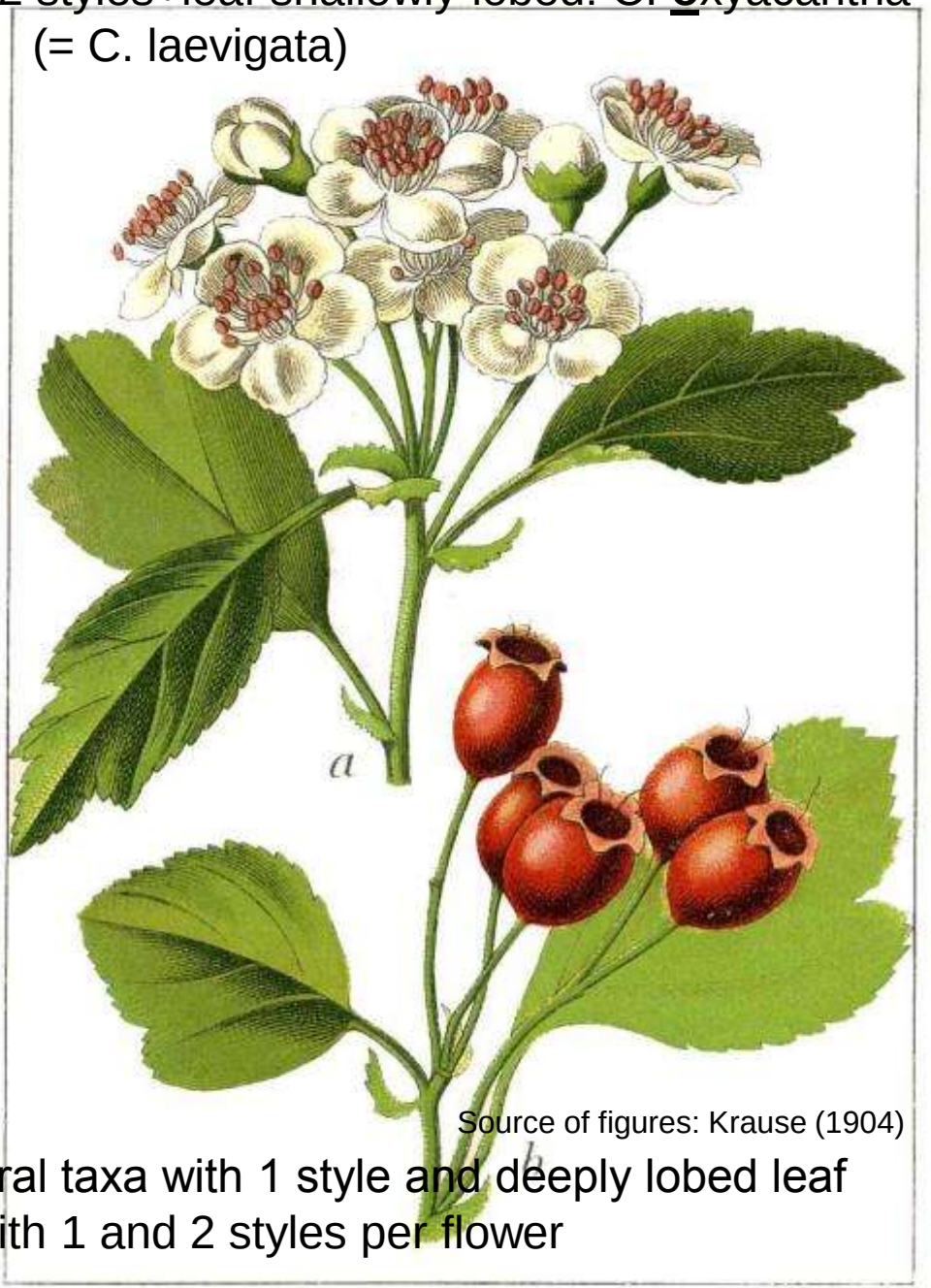
German Dendrology Society

In the past simple scheme: 1 or 2 styles, leaves deeply (**M**) or shallowly (**O**) lobed

1 style+leaf deeply lobed: C. **m**onogyna



2 styles+leaf shallowly lobed: C. **o**xyacantha (= C. laevigata)



Source of figures: Krause (1904)

…but there are several taxa with 1 style and deeply lobed leaf blades, and plants with 1 and 2 styles per flower

Differences about the number and taxonomic ranking of wild Crataegus species (excl. C. germanica = Mespilus g.) and hybrids (nothospecies) in Middle, N- and W-Europe since the 1970th, e. g.

Baltic states **1971** (Cinovskis) **7 species** and **5 hybrids**

Germany **1976** (Doll) **8 species** and **11 hybrids**
(Doll altogether described from Germany **20 species** as new)
however **since 1990th** (Lippert, Schmidt, Christensen, Loos):
3-4 species and **3-5 hybrids**

Czech Republic **1992, 2002** (Holub) **4 species** and **15 hybrids** (incl. brack-crossings, poly- and superhybrids, „introgressants“)

Middle Europe **1994** (Lippert) **3 species** (1 with 2 subsp.) and **3 hybrids**

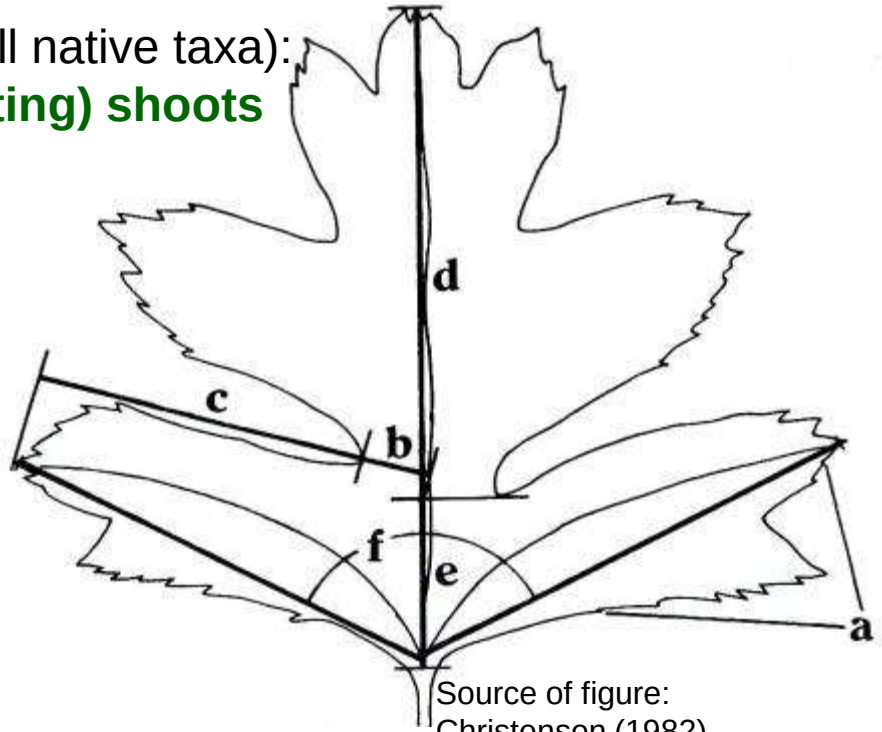
Switzerland **1998** (Hess et al.) **2 species**

Slovakia **1999** (Baranec et al.) **14 species** and **5 hybrids**

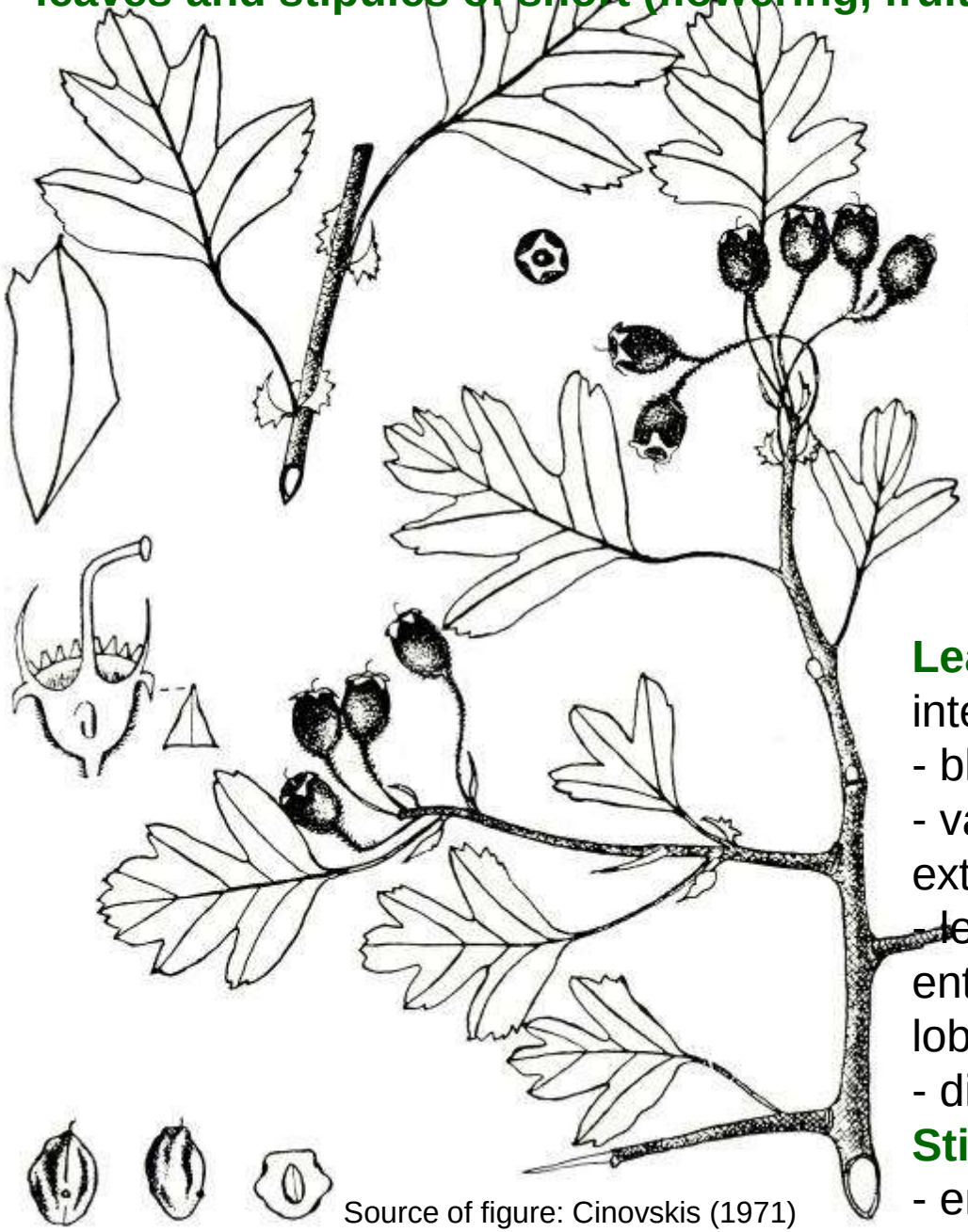
Norway (Mossberg & Sternberg), Austria (Fischer et al.), British Isles (Stace), Belg./Lux. (Lambinon et al.), France (Tison & Foucault), Poland (Wrobel et al.)
2003-2015 : **3 species** (partly 1-2 with 2 subsp. and/or 1 with 2 var.) **and 3 hybrids** (partly 1-2 with 2 nothosubsp. or -var.)

Carpat.-Pannon. Region (Hungary…)
2015 (Kerényi-Nagy) **8 species** and **13 hybrids**

Important for identification in Sect. Crataegus (all native taxa):
- **leaves and stipules of short (flowering, fruiting) shoots**



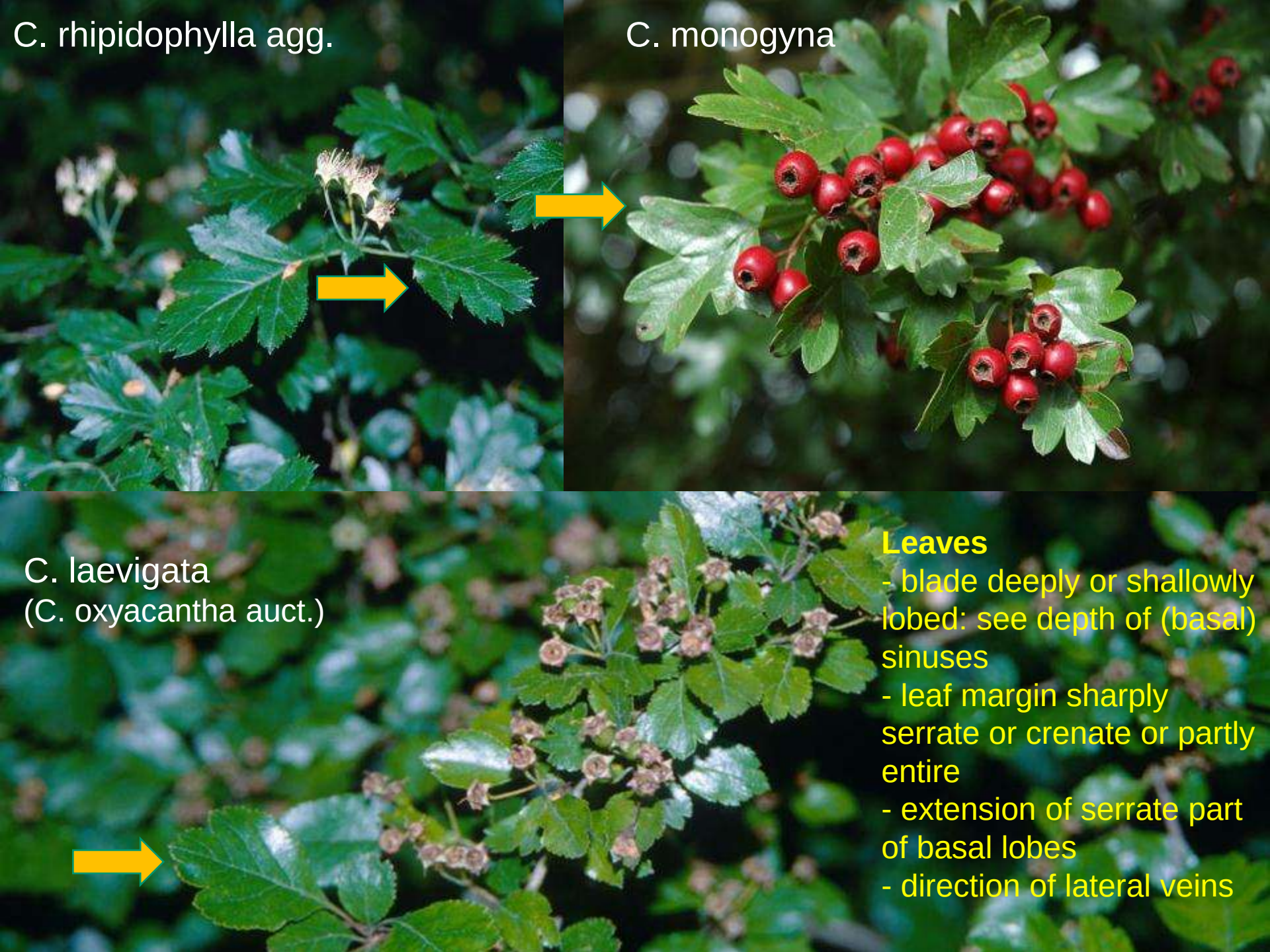
Source of figure: Christensen (1982)

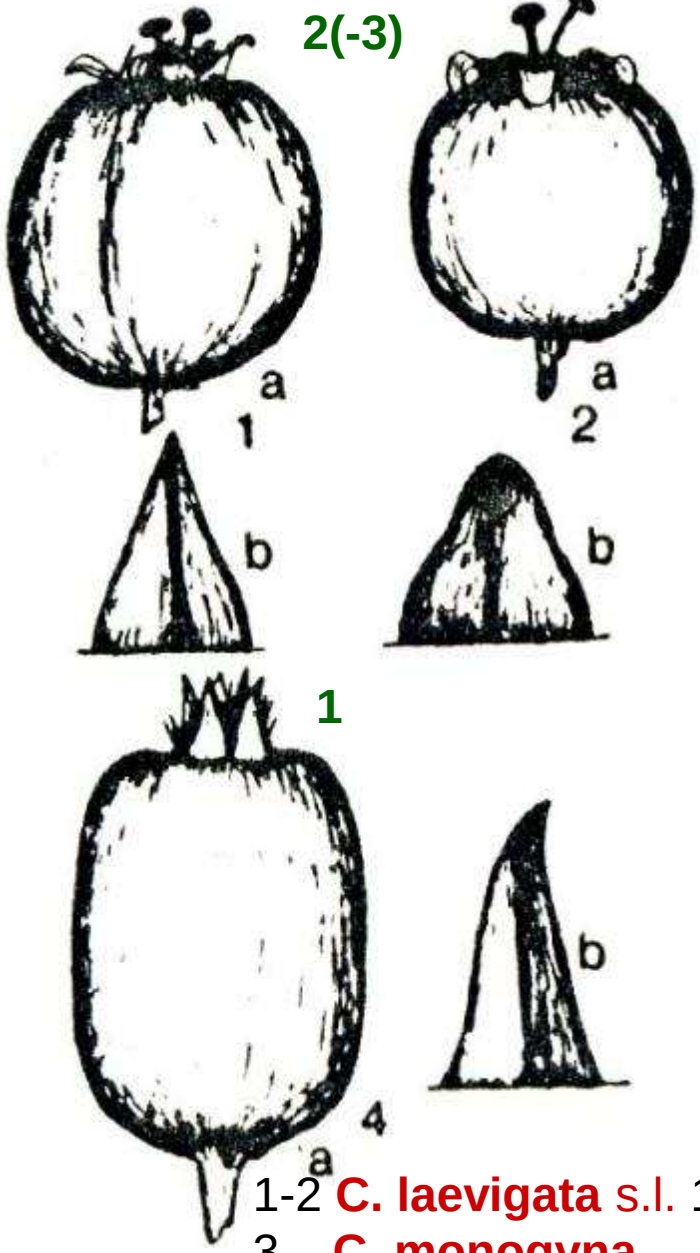


Source of figure: Cinovskis (1971)

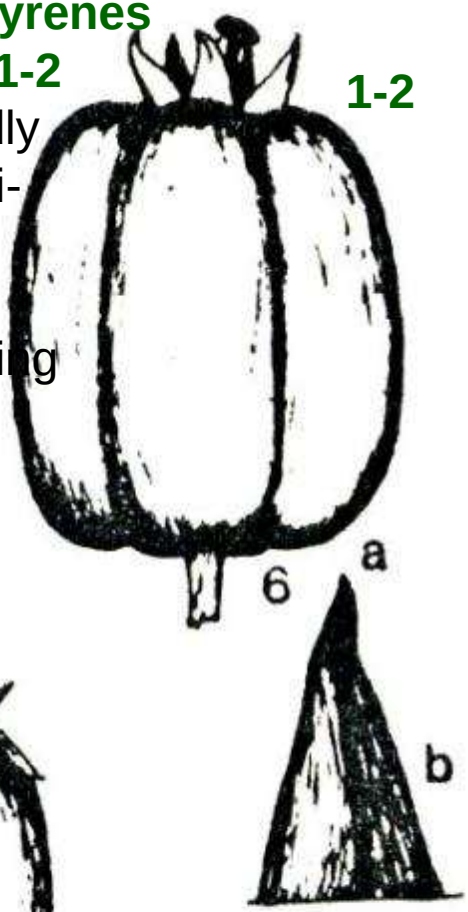
Leaves with 1-3 pairs of lobes, with intercalary veins running to the sinuses
- blade deeply or shallowly lobed
- varying in depth of (basal) sinuses = extension of (basal) lobe to midrib
- leaf margin serrate or crenate or partly entire, extension of serrate part of basal lobes (number of teeth)
- direction of lateral veins

Stipules (mostly) persistant
- entire, denticulate or (glandular-)serrate


C. rhipidophylla agg.
C. monogyna
C. laevigata
(C. oxyacantha auct.)
Leaves
- blade deeply or shallowly lobed: see depth of (basal) sinuses
- leaf margin sharply serrate or crenate or partly entire
- extension of serrate part of basal lobes
- direction of lateral veins



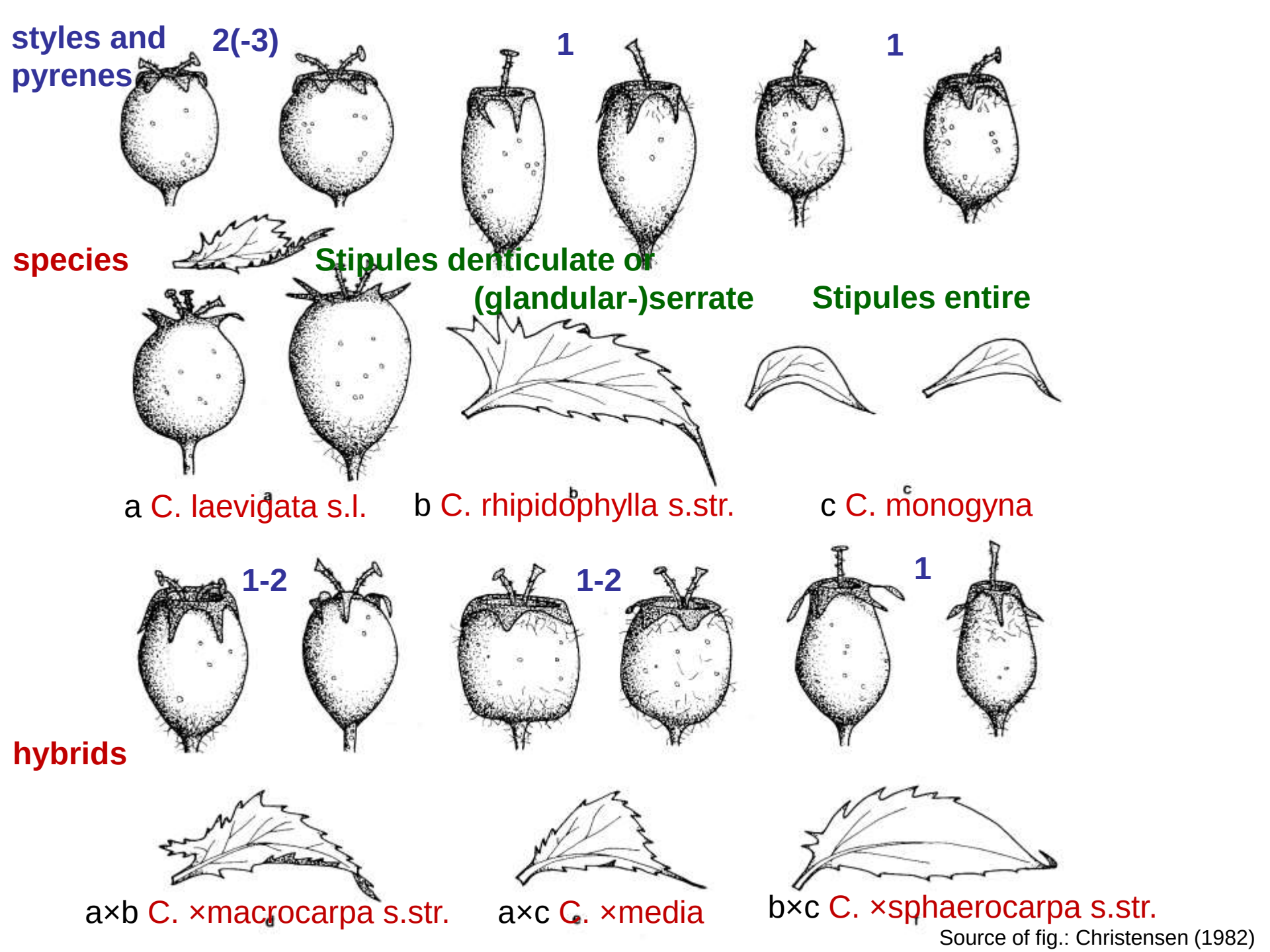
Styles and pyrenes
1 or 2(-3) or 1-2
Sepals broadly or narrowly tri-angular to lanceolate; erect, spreading or reflexed



Fruits red pomes, ± globose to ellipsoid or pyriform, rarely ± angular

1-2 **C. laevigata** s.l. 1 **subsp. palmstruchii** (2×5 or 6?) 2 **subsp. laevigata**
3 **C. monogyna**
4-5 C. rhipidophylla agg. 4 **C. lindmanii** 5 - **C. rhipidophylla** s.str.
6 C. ×macrocarpa agg.: **C. ×calycina** 4×2

Source of fig.: Gostyńska-Jakuszewska (1978)



Source of fig.: Christensen (1982)

Native species groups (agg.) and species

1 C. laevigata (C. oxyacantha auct.) **s.l.**

1.1 **subsp. laevigata**
1.2 **subsp. palmstruchii** (C. palmstruchii auct.) → ? 1.1 × 3 (× 1.1), Type of C. palmstruchii = 1.1

2 C. monogyna (incl. C. alemanniensis, C. subborealis)
2.1 **subsp. monogyna** (incl. subsp. nordica, C. orientobaltica)

3 C. rhipidophylla agg. (C. calycina ss. Fl.Eur., C. curvisepala agg., C. rosiformis agg.)

3.1 C. rhipidophylla (s.str.) = **C. rhipidophylla subsp. or var. rhipidophylla** (C. praemonticola, C. calycina subsp. curvisepala ss. Fl. Eur., C. kyrtostyla ss. Fl. SSSR)

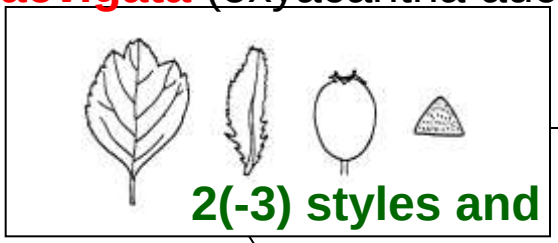
3.1 x 3.2 C. x dunensis

3.2 C. lindmanii (C. calycina subsp. calycina ss. Fl. Eur.) = C. rhipidophylla subsp. lindmanii or var. lindmanii

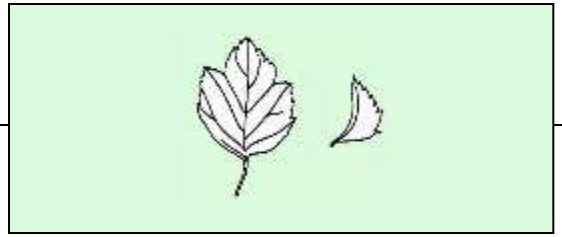
Sepals broadly triangular, spreading or reflexed

laevigata (oxyacantha auct.)

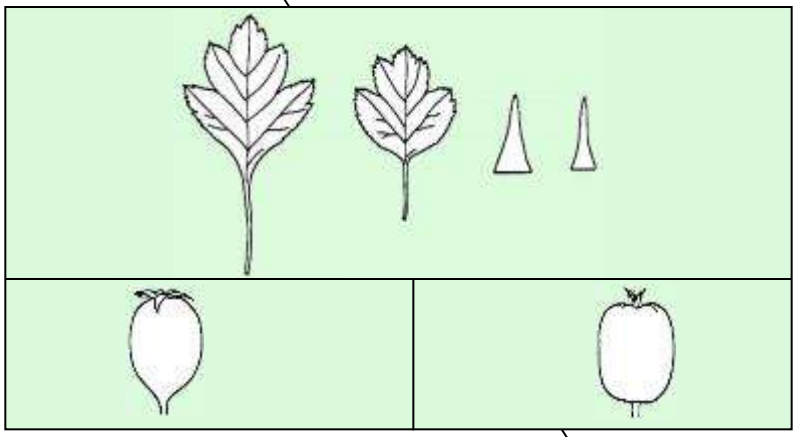
monogyna

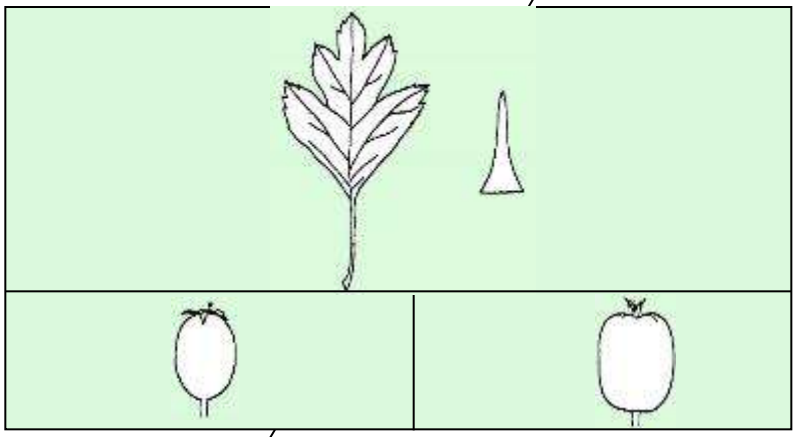


2(-3) styles and pyrenes



1 style and pyrene





rhipidophylla s.str.

lindmanii

Sepals reflexed or spreading

Sepals erect

Sepals narrowly triangular to lanceolata

1 style and pyrene

rhipidophylla agg. (curvisepala agg.)

Crataegus laevigata

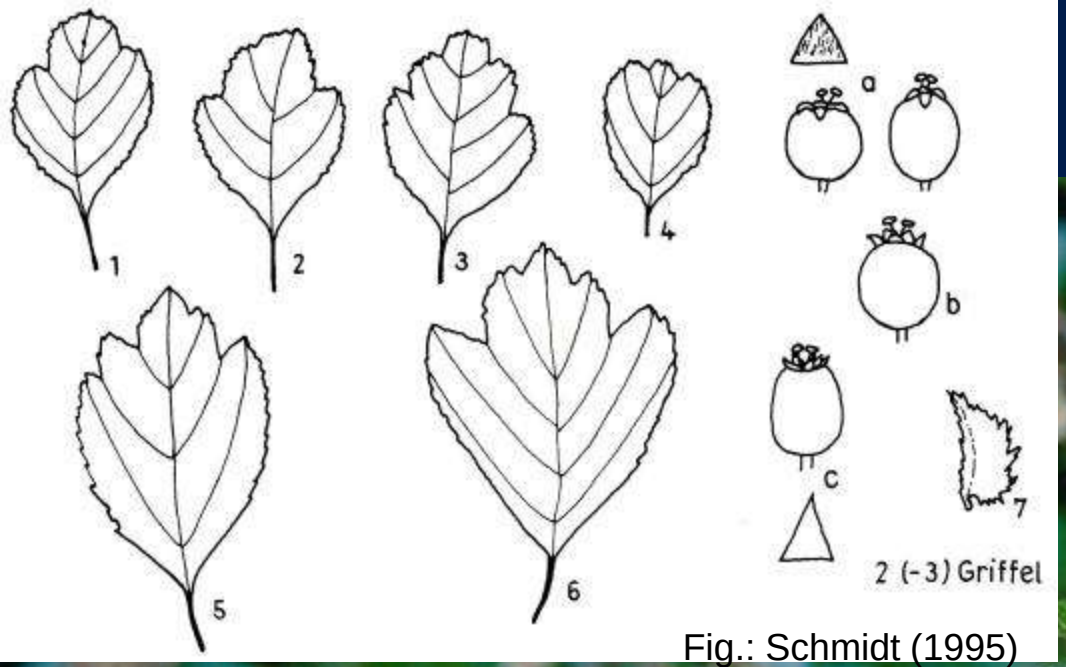


Fig.: Schmidt (1995)

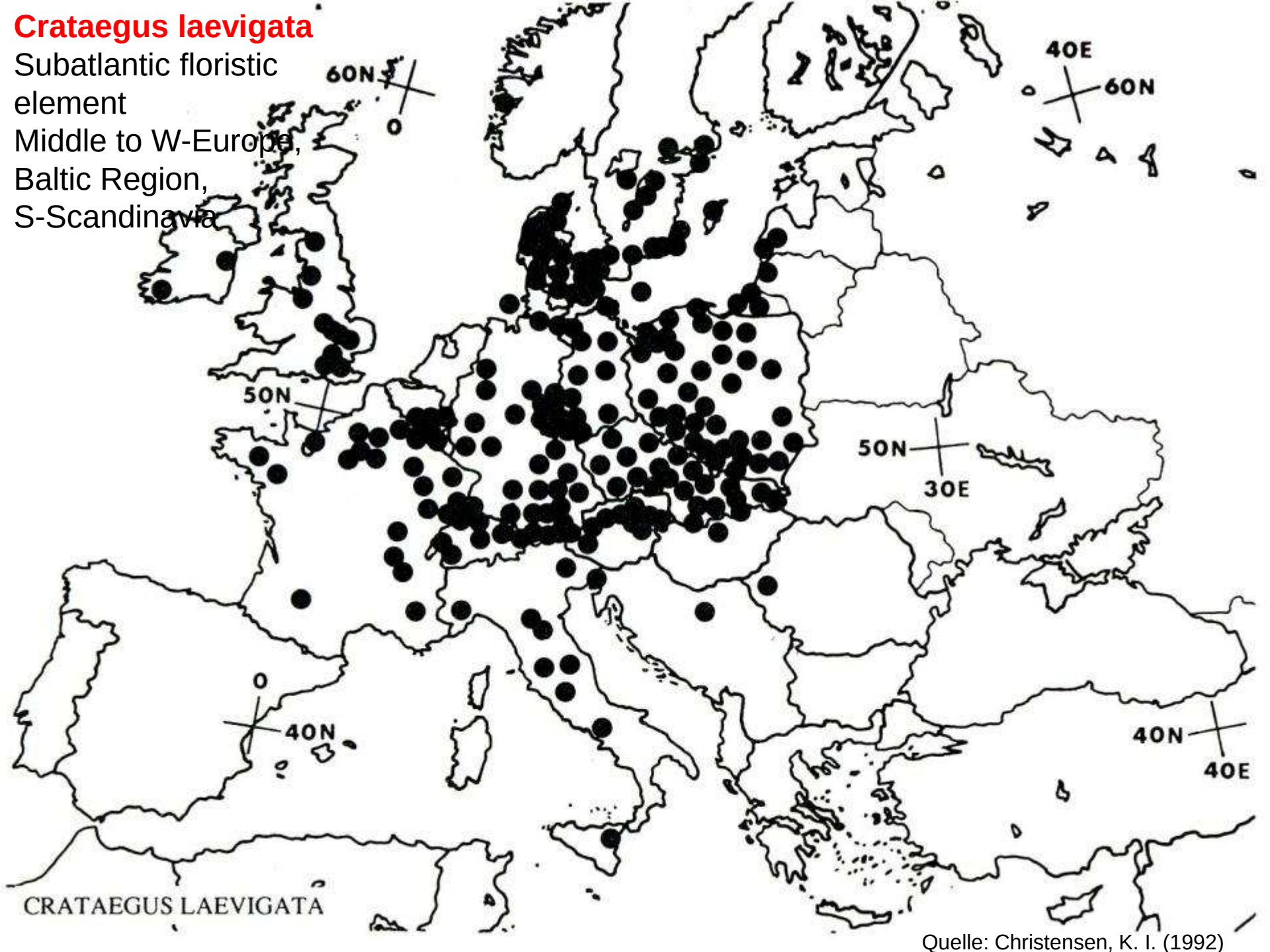
1-4, a and foto: subsp. laevigata = C. laevigata s. str.

5, 6 and c:
subsp. palmstruchii (may be belonging to C. ×macrocarpa or backcrossing C. laevigata × C. ×macrocarpa)

Crataegus laevigata

Subatlantic floristic element

Middle to W-Europe, Baltic Region, S-Scandinavia



Quelle: Christensen, K. I. (1992)

Typical leaves on a lamp shade in Patagonia!

Crataegus monogyna

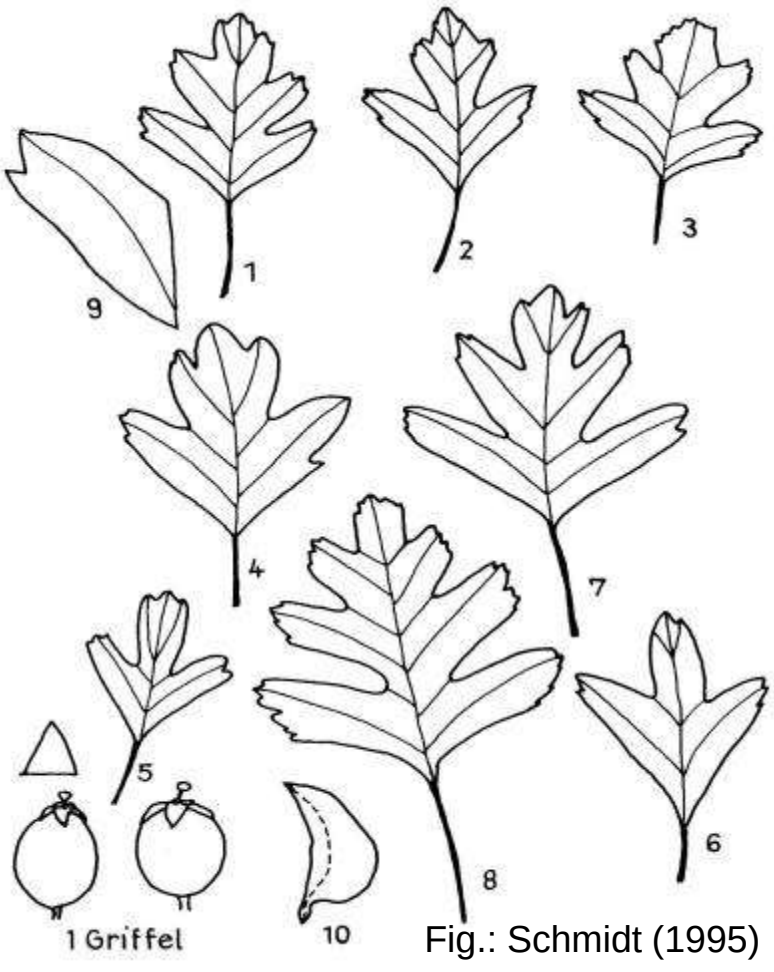
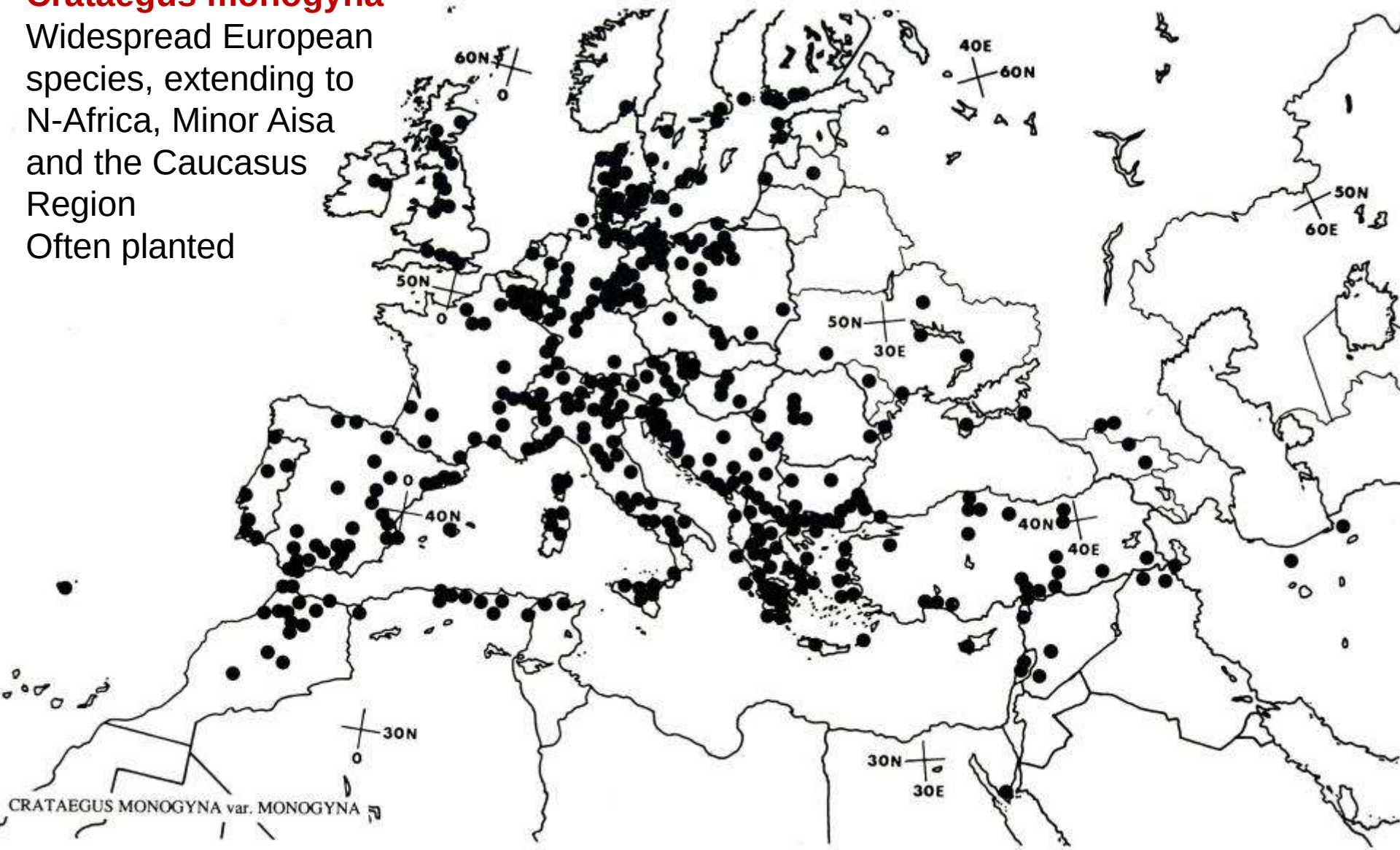


Fig.: Schmidt (1995)

Crataegus monogyna

Widespread European species, extending to N-Africa, Minor Aisa and the Caucasus Region

Often planted



map: Christensen (1992)

Crataegus rhipidophylla

1-8, a-b:
C. rhipidophylla agg.

1-3, a, foto:
subsp./var. rhipidophylla = **C. rhipidophylla s. str.**

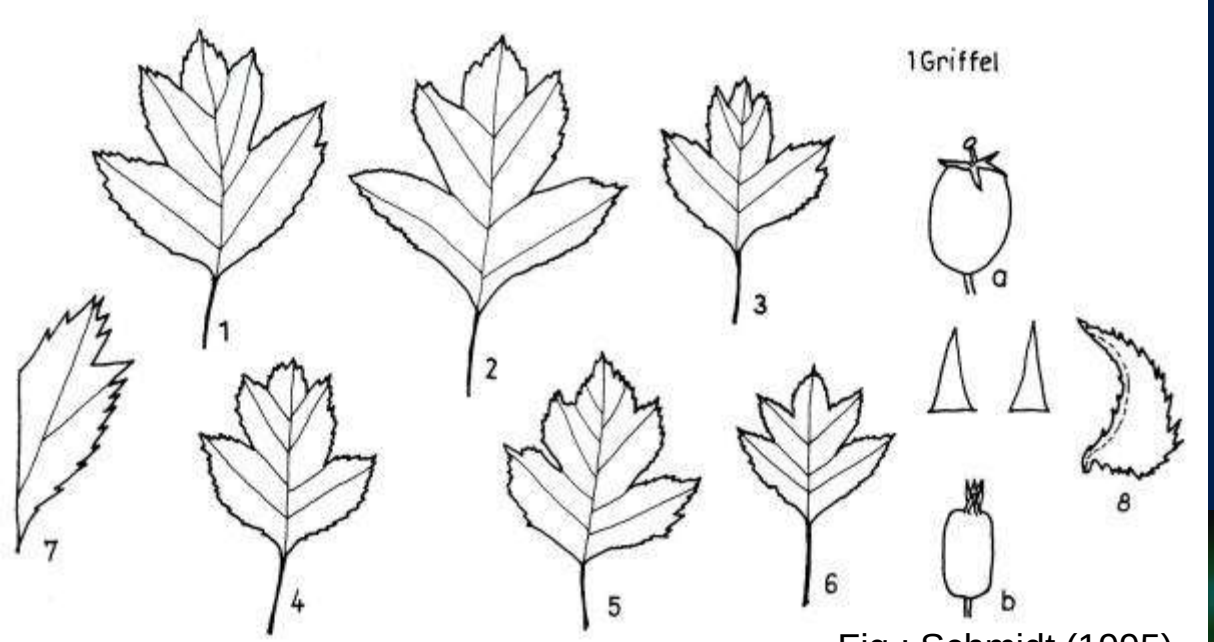
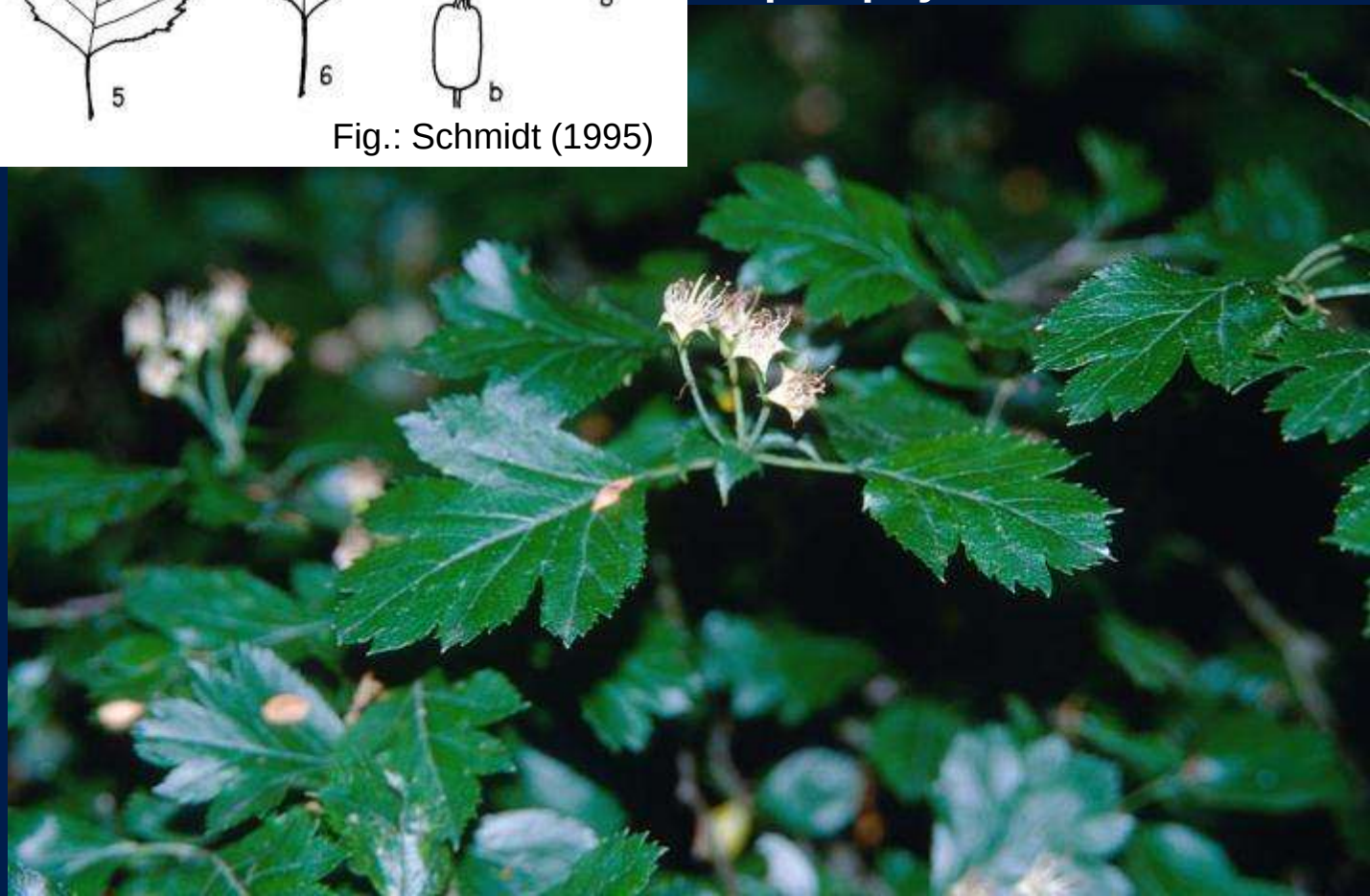
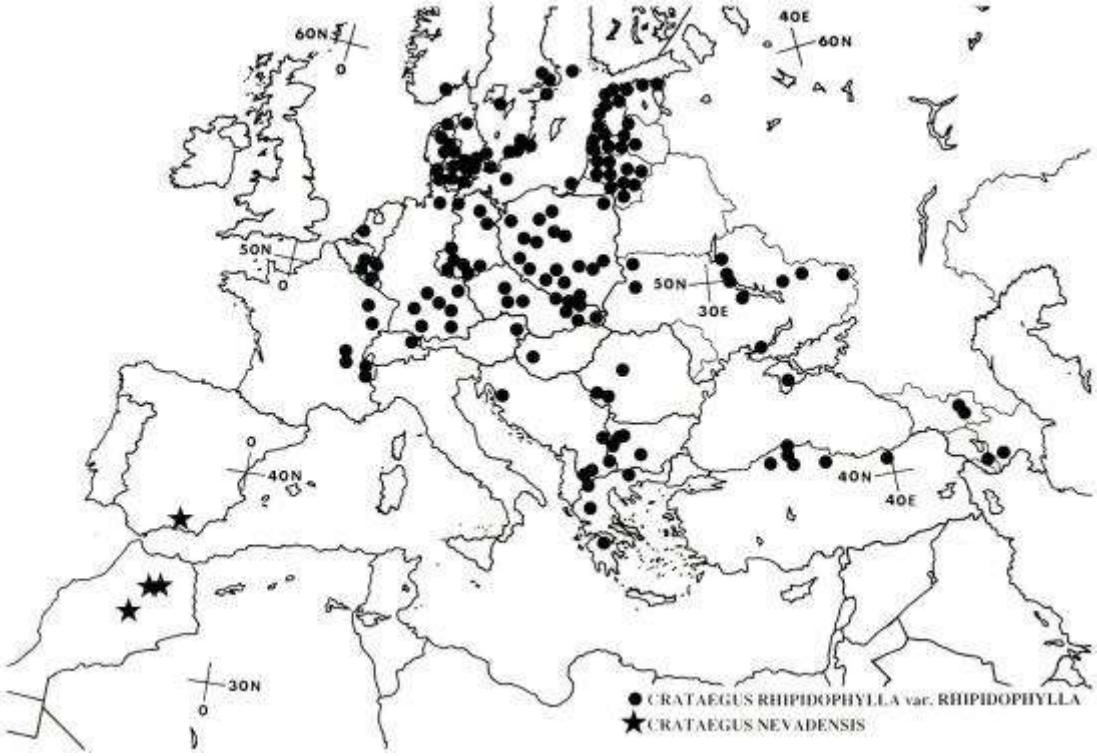


Fig.: Schmidt (1995)

4-6, b:
subsp./var. lindmanii
= **C. lindmanii**





● **C. rhipidophylla** s. str.: subatlantic to subcontinental floristic element, extending from Middle to E- and SE Europe, Minor Asia and the Caucasus Region

C. lindmanii
Subatlantic floristic element, mainly Middle Europa to southern Scandinavia and the Baltic region

maps: Christensen (1992)

Native hybrid complexes (agg.) and nothospecies

1 × 2 C. laevigata × C. monogyna = **C. ×media** (Syn. C. ×intermedia)

1 × 3 C. ×macrocarpa agg. = hybrid complex C. laevigata × C. rhipidophylla agg.

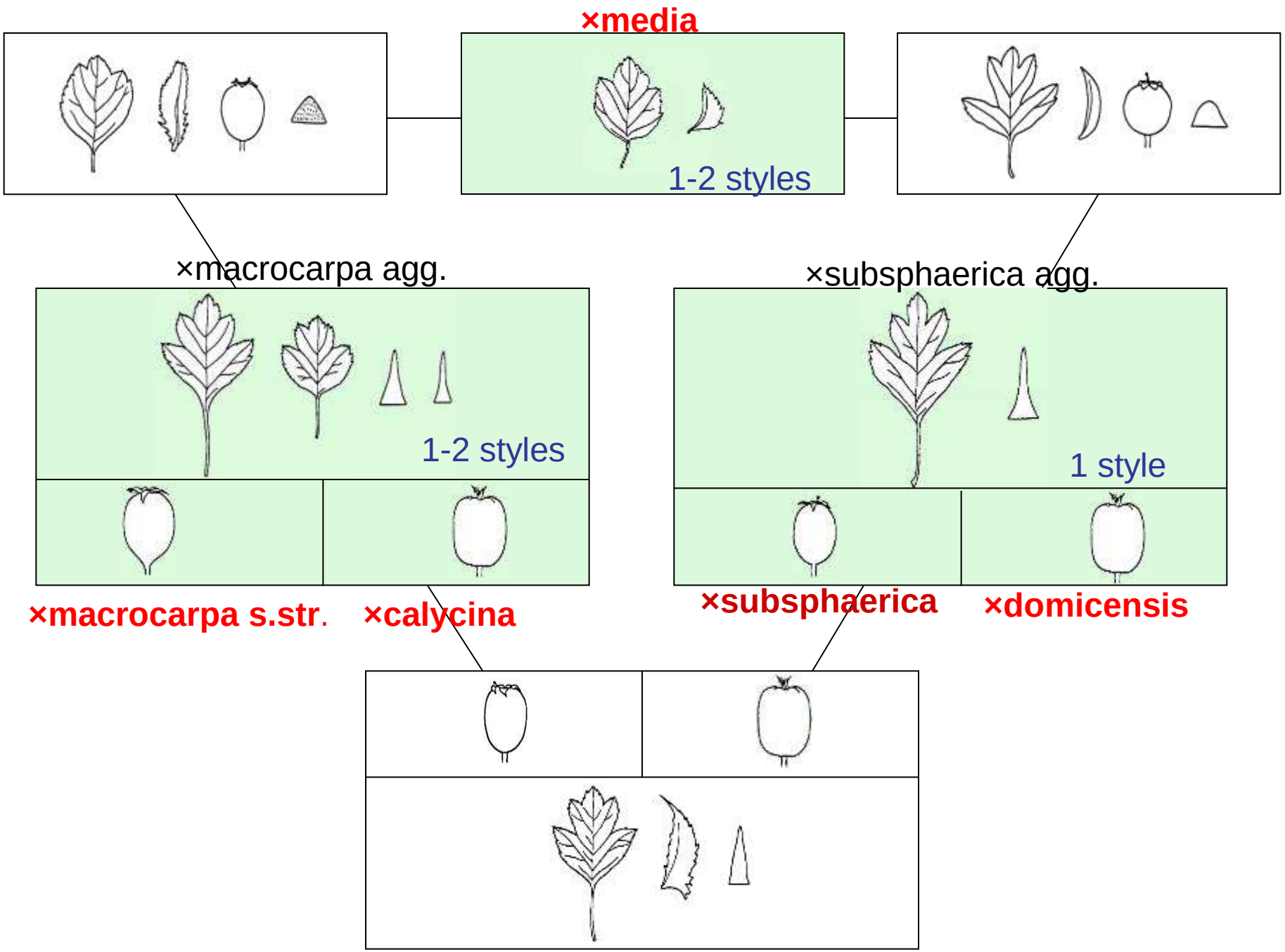
1 × 3.1 C. laevigata × C. rhipidophylla s.str. = **C. ×macrocarpa** s.str.
= C. ×macrocarpa nothosubsp. macrocarpa or nothovar. macrocarpa
(Syn. C. ×schumacheri, C. ×pseudoxyacantha, C. ×uhrovae)

1 × 3.2 C. laevigata × C. lindmanii = **C. ×calycina**
= C. ×macrocarpa nothosubsp. calciphila or nothovar. hadensis

2 × 3 C. ×subsphaerica agg. = hybrid complex C. monogyna × C. rhipidophylla agg.

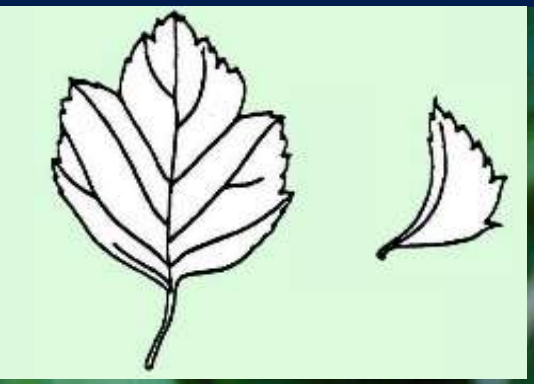
2 × 3.1 C. monogyna × C. rhipidophylla s.str. = **C. ×subsphaerica** s.str.
= C. × subsphaerica nothosubsp. or nothovar. subsphaerica
(Syn. C. ×heterodonta, C. ×raavadensis, C. ×fallacina)

2 × 3.2 C. monogyna × C. lindmanii = **C. ×domicensis**
= C. × subsphaerica nothosubsp. or nothovar. domicensis
(Syn. C. ×plagiosepala)


×media
1-2 styles
×macrocarpa agg.
×subsphaerica agg.
1-2 styles
1 style
×macrocarpa s.str.
×calycina
×subsphaerica
×domicensis

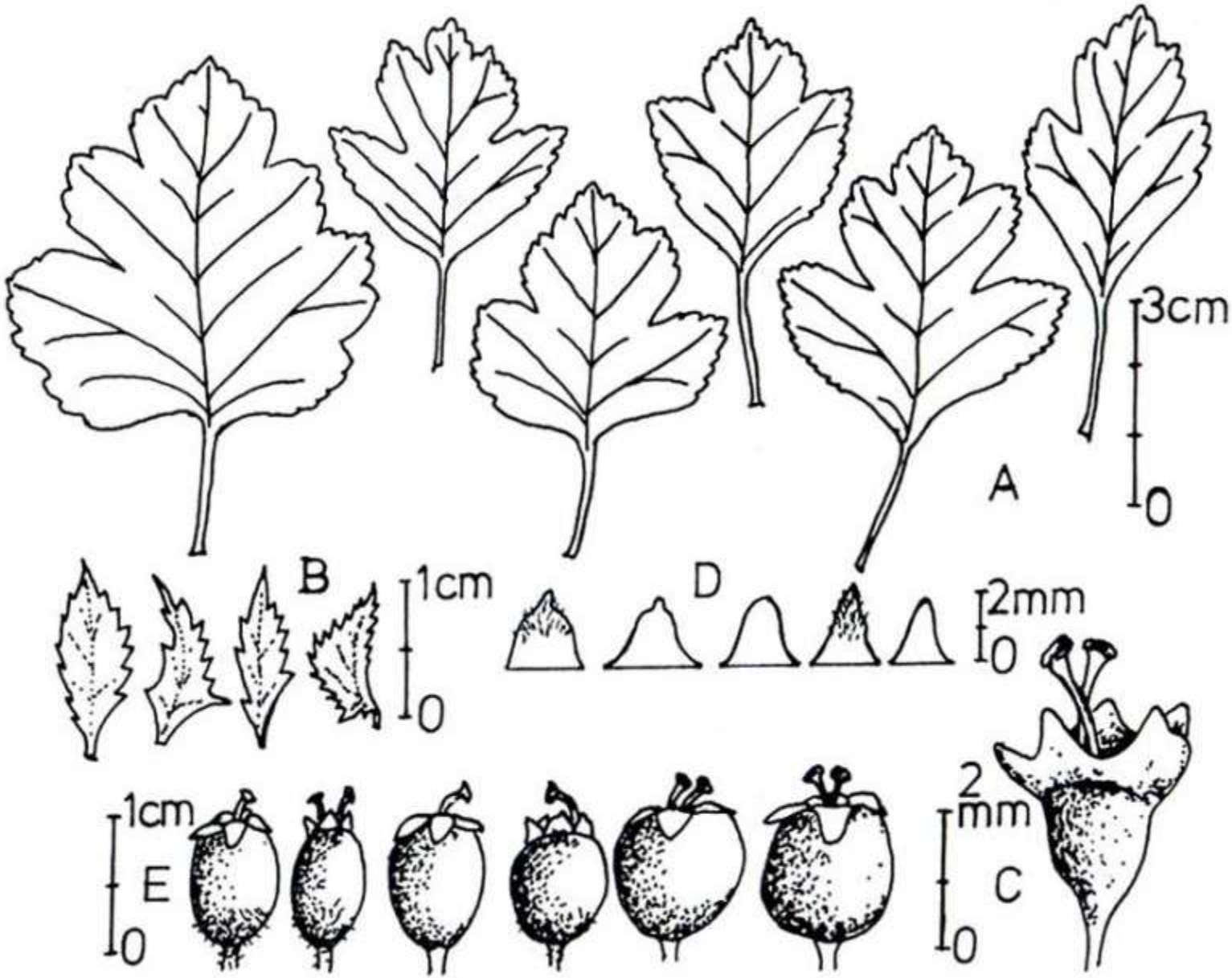
Crataegus × media = C. laevigata × C. monogyna

Flowers with 1 or 2 styles, pomes with 1 or 2 pyrenes, leaves ± intermediary



In the same altitudinal range and at equal sites C. laevigata is flowering 1-2 weeks before C. monogyna. However, in regions where a mosaic of ecological conditions exists, plants of both species may flower at the same time.

C. ×media is also often planted, among others cultivars with pink or red flowers, e.g. the popular ornamental 'Paul's Scarlet' with double red flowers.

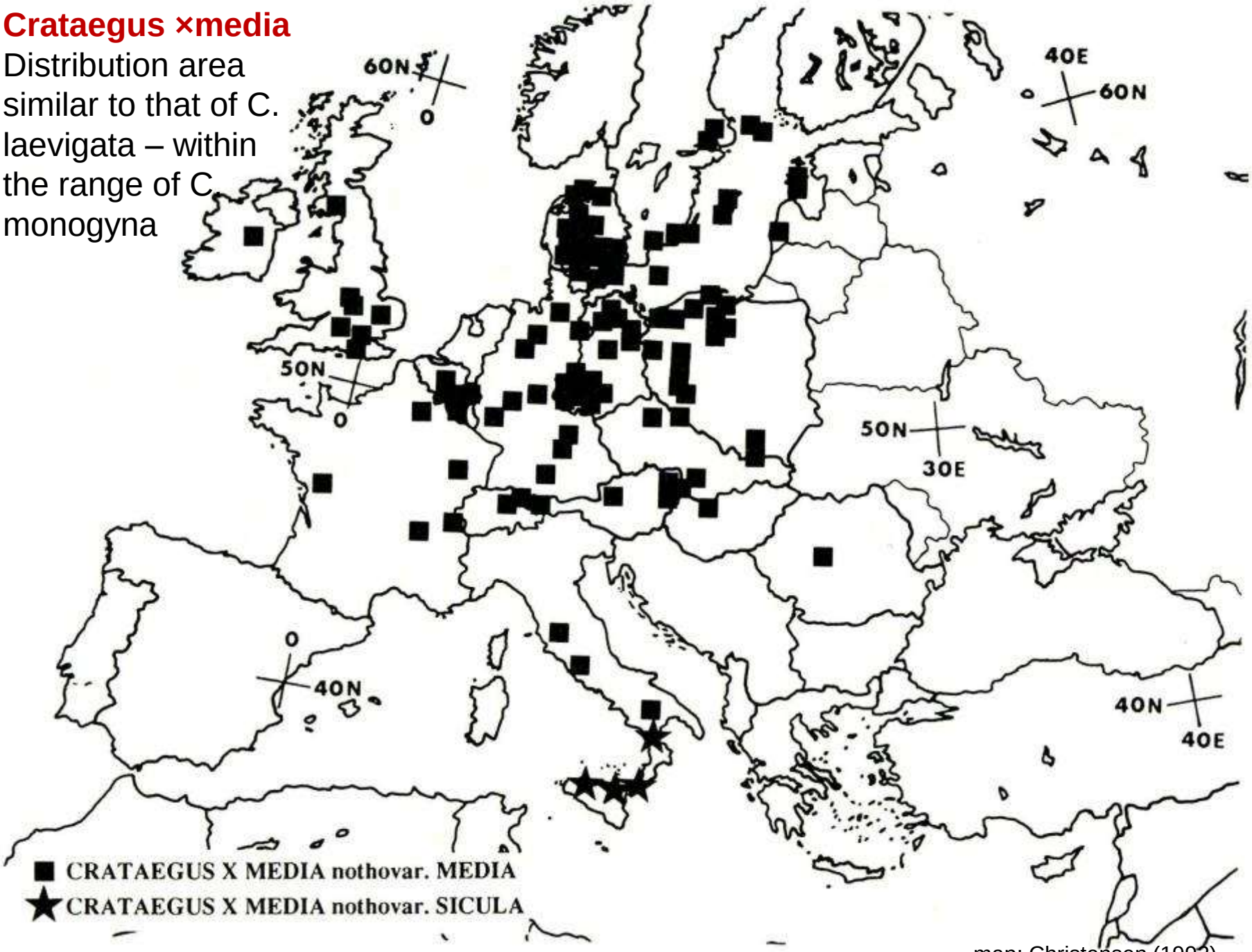


Crataegus ×media

source: Timmermann & Müller (1994)

Crataegus ×media

Distribution area similar to that of C. laevigata – within the range of C. monogyna



map: Christensen (1992)

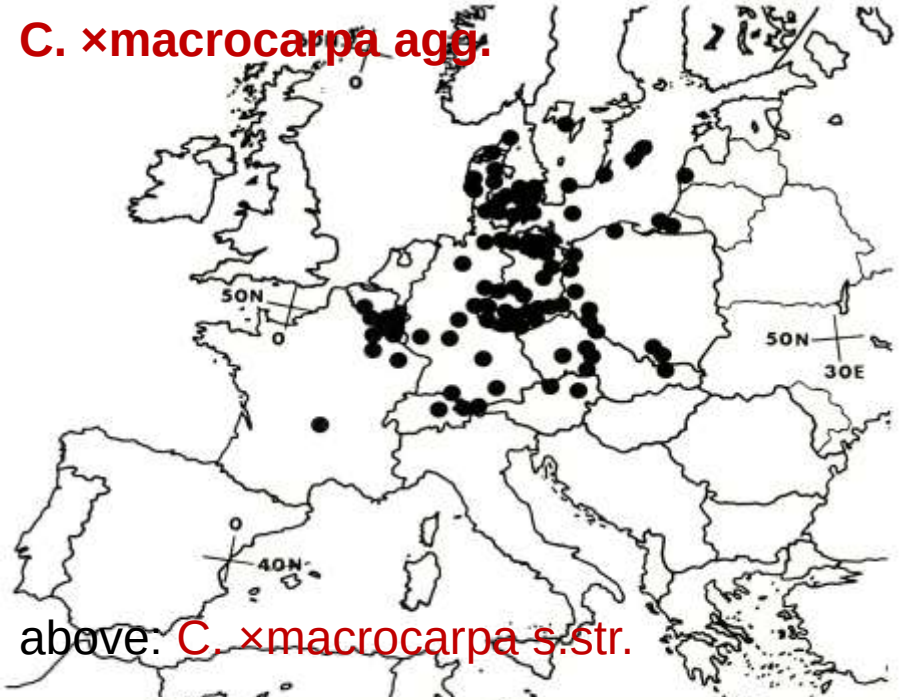
Crataegus ×macrocarpa agg.

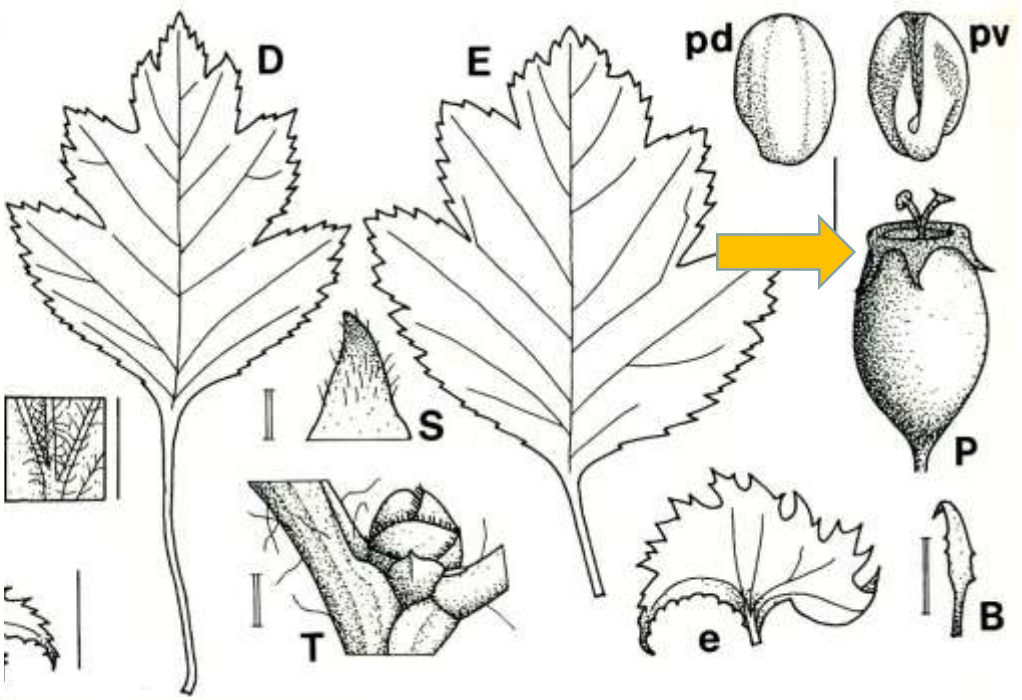
= C. laevigata × C. rhipido-phylla agg.

C. ×macrocarpa s.str. (laevigata × rhipidophylla s.str.)

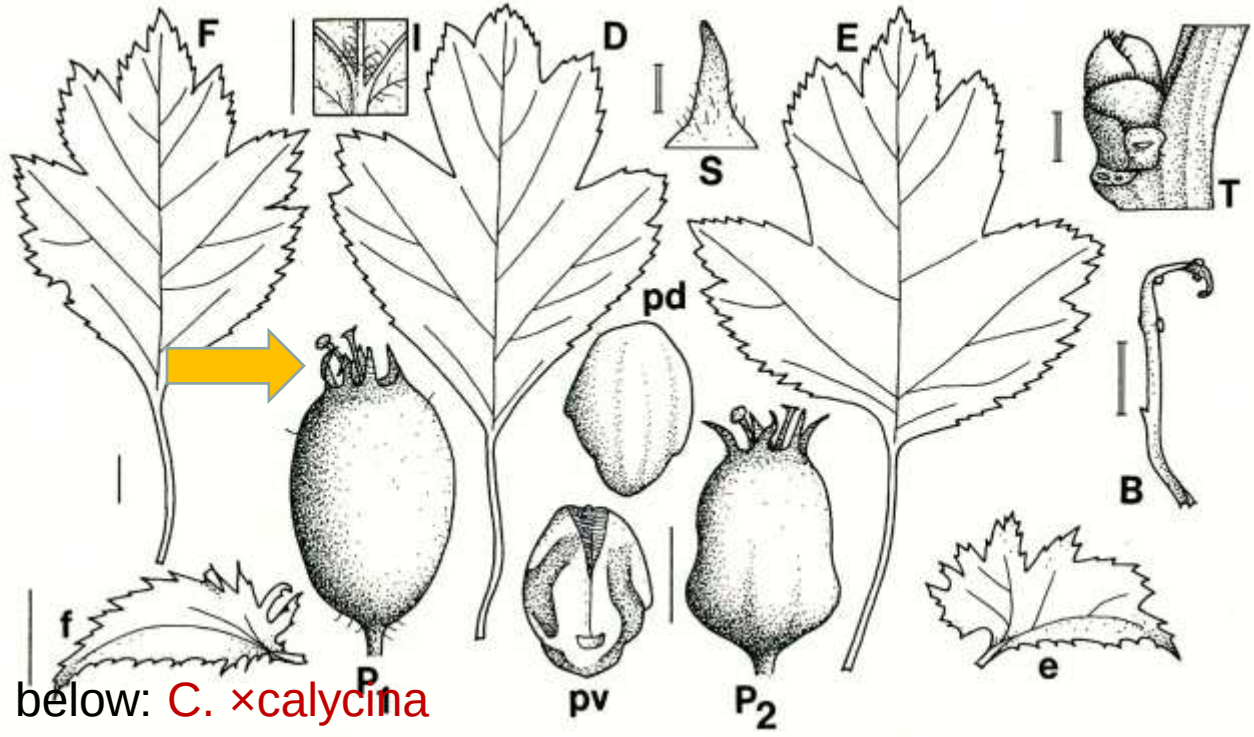
C. ×calycina (laevigata × lindmanii)

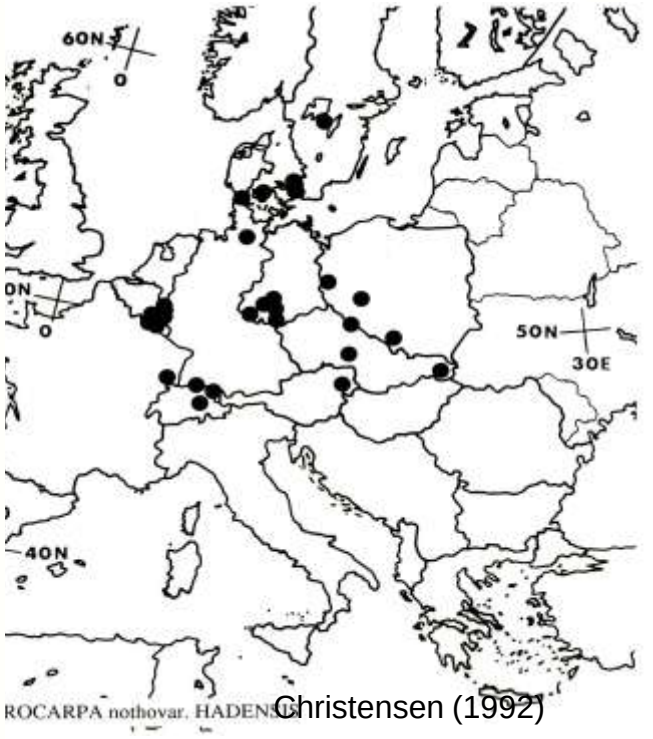
C. ×macrocarpa agg.





above: C. ×macrocarpa s.str.



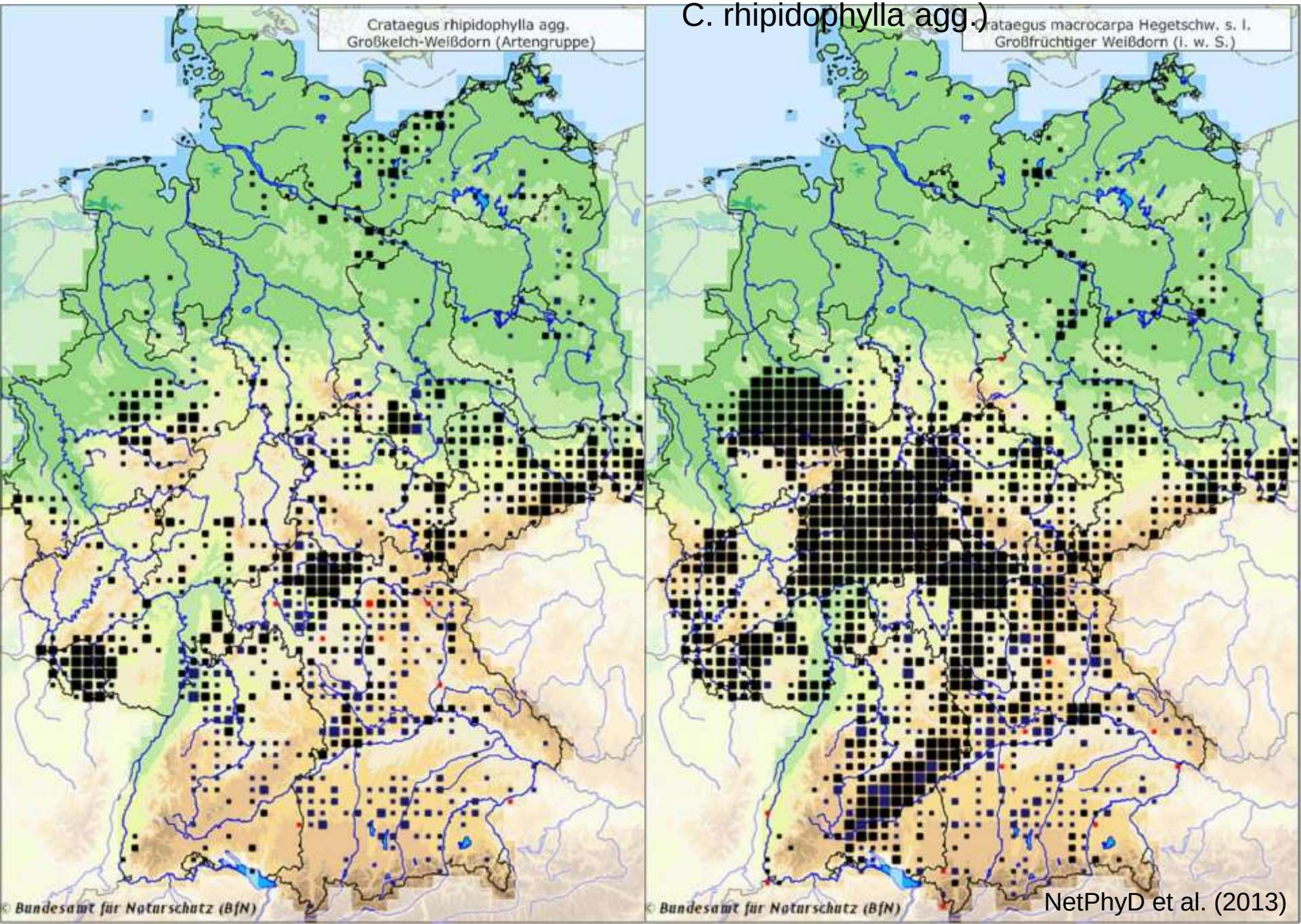


below: C. ×calycina

Christensen (1992)

Distribution of C. rhipidophylla agg. in D

… of C. ×macrocarpa agg. (C. laevigata × C. rhipidophylla agg.)



NetPhyD et al. (2013)

C. ×subsphaerica agg.
= C. monogyna × C. rhipidophylla agg.

Right: variation in leaves

foto: C. ×subsphaerica s.str. = C. monogyna × C. rhipidophylla s.str.

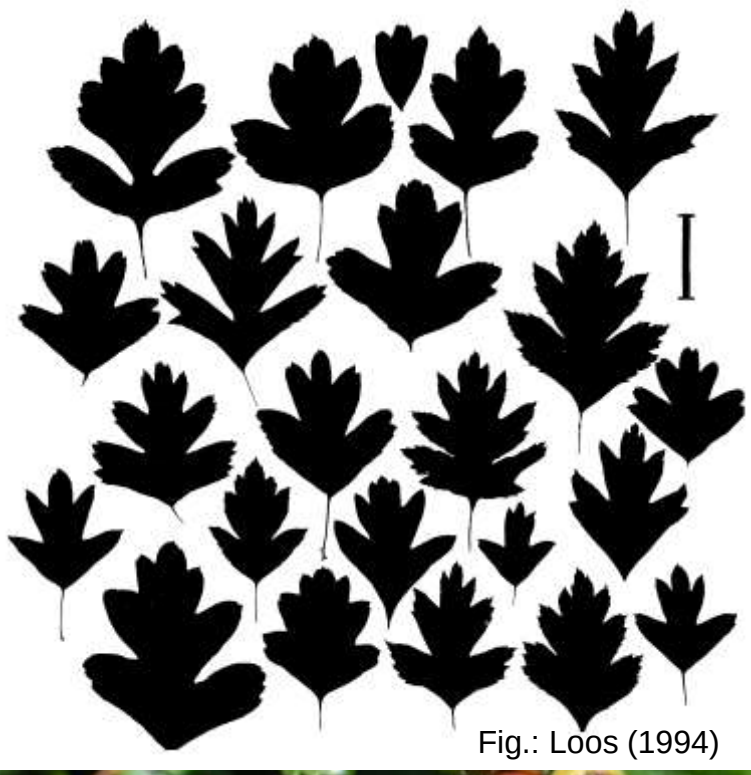
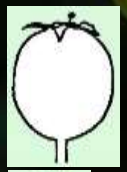


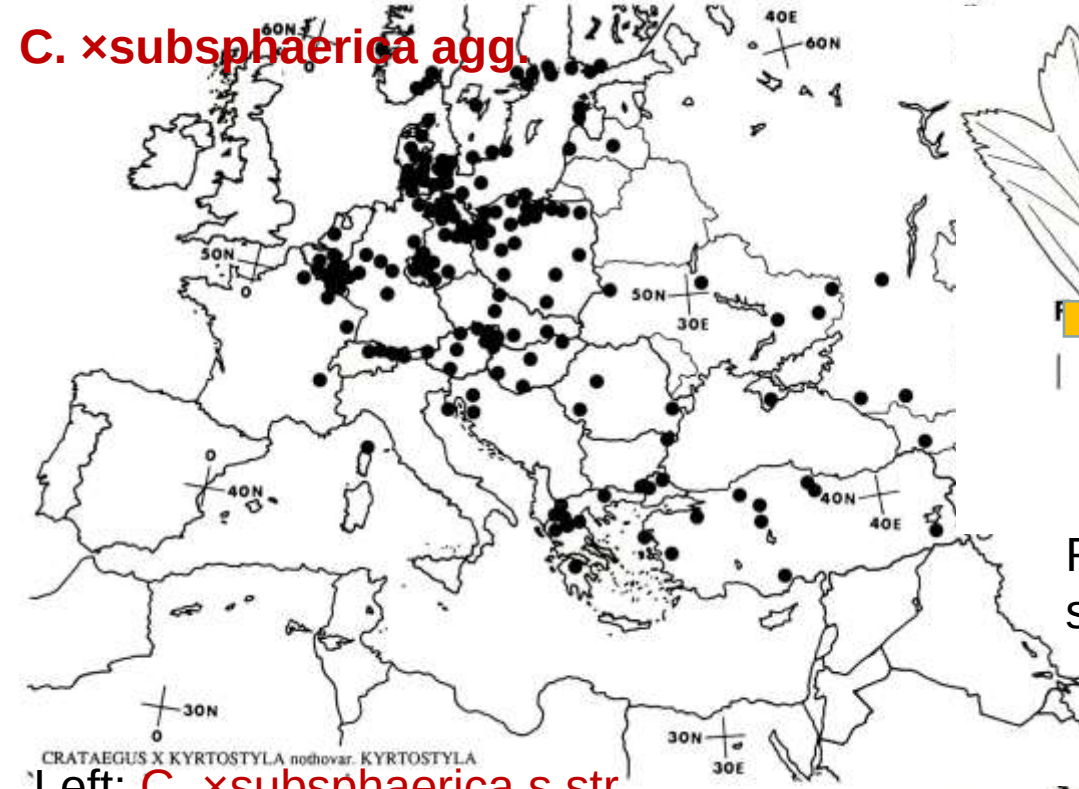
Fig.: Loos (1994)

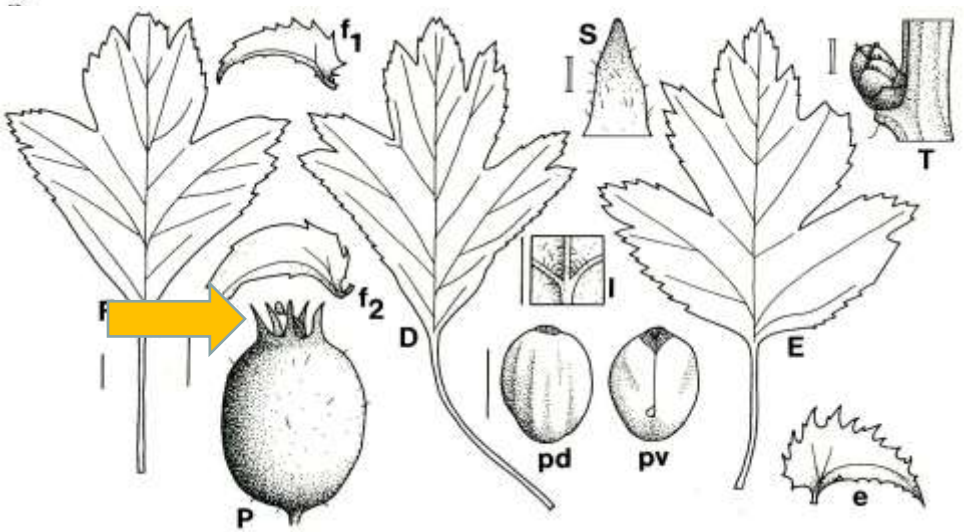


C. ×subsphaerica s.str. (monogyna × rhipidophylla s.str.)

C. ×domicensis (monogyna × lindmanii)

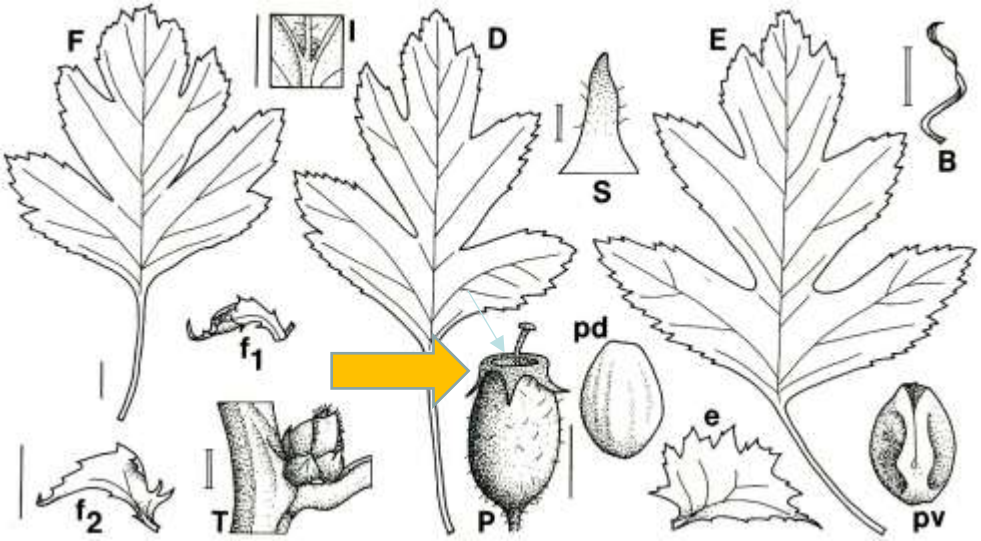
C. ×subsphaerica agg.

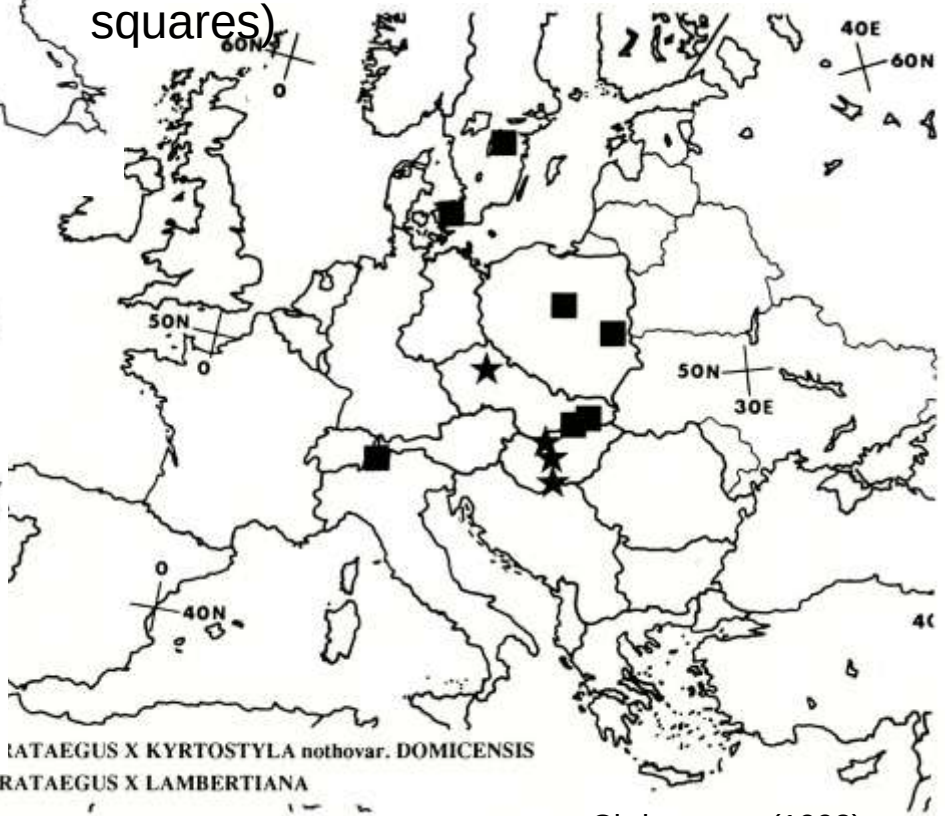




Right: C. ×domicensis (map: black squares)

Left: C. ×subsphaerica s.str.





source: Christensen (1992)

Naturalized non-native species and hybrids, e.g.

1	**C. coccinea** (C. pedicellata)	B, CZ, D, GB
2	**C. coccinioides**	GB
3	**C. crus-galli**	F, GB
4	**C. flabellata**	NOR
5	**C. heterophylla**	GB
4	**C. ×lavallei** (C. ×carrieri)	B, D
5	**C. mollis**	CZ
6	**C. orientalis**	GB
7	**C. ×persimilis** (C. ×prunifolia)	B, CZ, D
8	**C. sanguinea**	D
9	**C. submollis**	D, GB
10	**C. succulenta**	GB


C. crus-galli


C. submollis


C. coccinea

C. orientalis

C. succulenta

C. sanguinea

Some reasons for „The Crataegus Problem“

- the species are inherently variable, e. g. **high variability** of leaves on short and long shoots (heterophylly and heteroplasty)
- **hybridisation** (incl. back-, multiple crossing), introgression, and subsequent polyploidy or even apomixis may occur, e.g. diploid, tri- and tetraploid species and hybrids

C. laevigata, *C. monogyna*, *C. ×media*	2n = **34**
C. ×macrocarpa, C. ×subsphaerica	2n = 34, **51**, 68
C. rhipidophylla, C. lindmanii	2n = 34, 51,**68**

- **human influences** on the popolation dynamics, the distribution pattern, the formation of hybrids, the evolution of species, e.g. spread and hybridisation of isolated populations and species after clearing and opening forests, wood pasture
- planting Crataegus of different origin in hedges since centuries
- **gaps in knowledge** of the reproductive system, **different taxonomic concepts, frequent nomenclatoral changes**…

Thank you for your attention