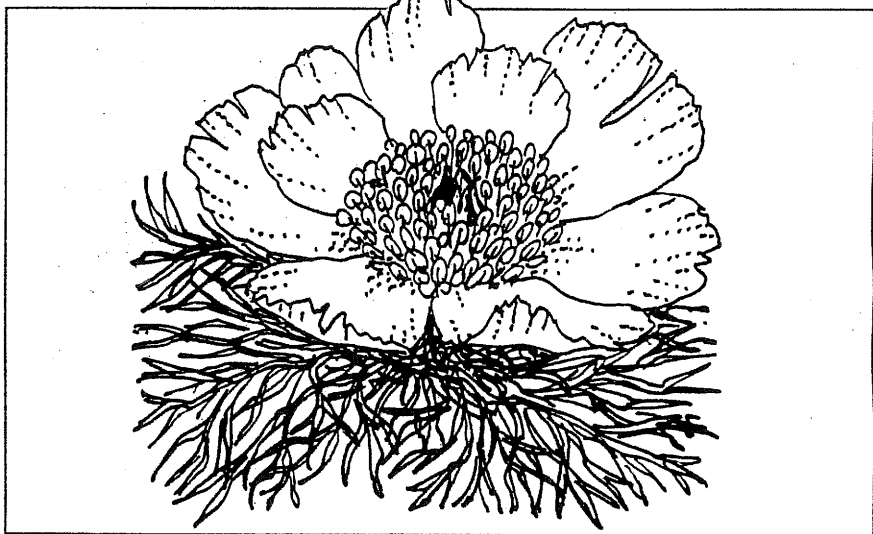


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Josef J. Halda:

Notes on the observations upon the structure of the *Paeonia* seeds, fruit and roots

A new system of the genus *Pediocactus* Britton & Rose

Synopsis of the genus *Hoodia* Sweet ex Decne

New System of the genus *Ariocarpus* Scheidweiler

New descriptions

Notes on the observations upon the structure of the *Paeonia* seeds, fruit and roots.

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Halda, J. J.: Notes on the observations upon the structure of the *Paeonia* seeds, fruit and roots. Acta Mus. Richnov. 5(1):1-10 (1998). ISBN 80-86076-08-3.

Seeds, fruit and roots of *Paeonia* L. are revised; a new subgenus *Albiflora*, sections *Emodi* and *Tenuifoliae* are stated; section *Flavonia* is renewed; a sample of seeds, fruit and roots of each subgenus is illustrated; Key of subgenera, sections, subsections and species is made.

1. Seeds.

27 taxa of seeds were observed under a binocular microscope. Five groups of shape are described:

1) **cylindric** [from large ones of *P. lutea* (18x10mm) to small cylindric ones of *P. tenuifolia* (7-8x2-3mm)]. 2) **quadrangular-cylindric** [*P. suffruticosa* subsp. *rockii* (15x10mm)], 3) **regularly ovate** [*P. emodi* (10x9mm)], 4) **irregularly ovate** [*P. lactiflora* (8-10x6-7mm)] and 5) almost **globular** [*P. mlkosewitschi* or *P. wittmanniana* (6-7 mm across)]. All observed seeds were from wild collections.

List of observed seeds:

[Note: There is a correlation between the number of seeds in the follicle and the size and shape of seeds - a great number of seeds are mostly much smaller and irregular. For example when *P. suffruticosa*-follicles are very full, almost all seeds are nearly regularly quadrangular, but when there are only a few seeds, they are regularly cylindric. The same *P. lutea*, *P. delavayi*, *P. potanini*, *P. brownii*, *P. lactiflora*, *P. veitchii* and *P. anomala*].

Name	size	number of seeds	number of samples	shape
<i>P. lutea</i>	18x10	142	6	cylindric
<i>P. delavayi</i>	17x16	106	4	cylindric
<i>P. potanini</i>	15x11	88	12	cylindric
<i>P. suffr. ssp. rockii</i>	15x10	130	3	cyl.-quadrang.
<i>P. suffr. ssp. spontanea</i>	14x11	95	2	cyl.-quadrang.
<i>P. decomposita</i>	14x12	62	3	cylindric
<i>P. brownii ssp. calif.</i>	15x7x5	40	2	narrowly ovoid
<i>P. brownii ssp. brownii</i>	13x8x5	77	3	ovoid
<i>P. lactiflora</i>	8-10x6-7	340	18	compr.-ovoid
<i>P. emodi</i>	10x9	80	4	broadly ovoid
<i>P. mascula + subsps.</i>	10x7	310	26	cylindric
<i>P. daurica</i>	9x7	460	37	cylindric
<i>P. coriacea</i>	9x7	50	6	cylindric
<i>P. broteri</i>	9x7	50	4	cylindric
<i>P. officinalis</i>	9x6	150	18	cylindric
<i>P. peregrina</i>	9x6	150	12	cylindric
<i>P. parnassica</i>	9x6	88	3	cylindric
<i>P. clusii</i>	9x7	50	2	cylindric
<i>P. rhodia</i>	9x6	50	2	cylindric
<i>P. anomala</i>	8-10x5-6	450	36	ovoid
<i>P. veitchii</i>	7-9x5-6	200	14	cylindric
<i>P. obovata</i>	7-8x6-7	200	9	cylindric
<i>P. mairei</i>	7x6	150	5	cylindric
<i>P. tenuifolia</i>	7-8x2-3	300	22	narrowly cylindrical
<i>P. mlkosewitschi</i>	6-7	350	8	nearly orbicular
<i>P. wittmanniana</i>	6	320	14	nearly orbicular
<i>P. corsica</i>	6x5	150	4	nearly orbicular

Note: Seeds of *P. brownii* and *P. lactiflora* are very similar (shape, colour and size).

2. Fruit.

Four main groups of follicles are described.

1) **slim erect semi-open follicles** ["**Suffruticosa-type**" - *P. suffruticosa*, *P. decomposita*, *P. lactiflora*]. 2) **thick erect semiopen follicles with thick walls** ["**Delavayi-type**" - *P. delavayi*, *P. lutea*, *P. potanini*], 3) **thick erect half-open follicles with thin walls** ["**Brownii-type**" - *P.*

brownii], which are always pendent and 4) **widely open follicles** of most herbaceous species ["**Mascula-type**"].

3. Roots.

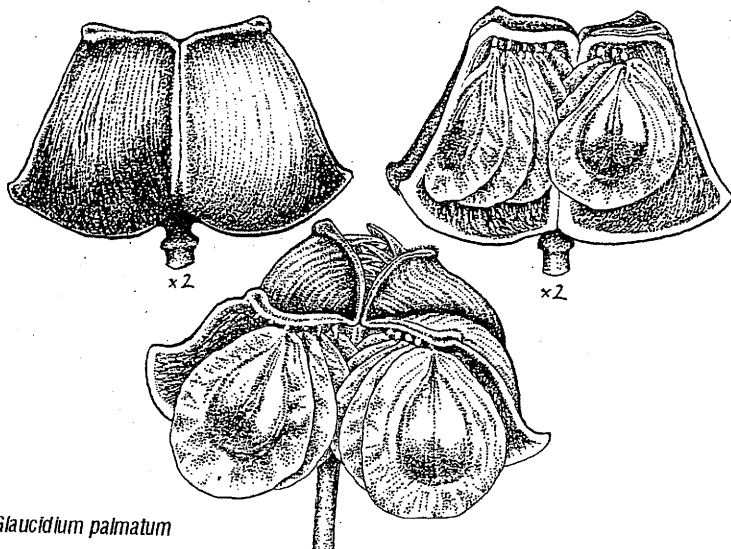
Seven main root-types are described.

1) **vertical primary (main) root with many or several secondary roots** ["**Suffruticosa-type**" - all "**woody**" peonies]. 2) more or less **regularly fasciculate main roots** with a "head-like" top ["**Lactiflora-type**" - *P. lactiflora*], with many secondary roots. 3) **irregularly fasciculate main roots** ["**Brownii-type**" - *P. brownii*] with many secondary roots.

4) **tapering or carrot-like main root** ["**Mascula-type**" - *P. mascula*-group]. 5) **fusiform or "digitate"-form** - from the rootstock on a string-like attachments grow corm-like swollen roots, tapering into thin roots. ["**Officinalis-type**" - subsect. *Paeonia*]. 6) **fusiform with a thick irregular main root with swollen corm-like roots** on string-like attachments ["**Anomala-type**" - subsect. *Anomala* and *Obovata*].

7) **fusiform with a thin rootstock and many subglobular swollen bulblets** (as a short "coral-chain") ["**Tenuifolia-type**" - *P. tenuifolia*].

After a reevaluation of all those characters were done some changes; sect. *Albiflora*, [which does not fit in subgenus *Paeonia*] was changed to the subgenus -rank, because together with *P. brownii* they create a special group with similar seeds, follicles and roots. Seeds of *P. emodi* are much closer to *P. lactiflora* than to the others herbaceous species. Seeds and roots of *P. tenuifolia* are exceptional and need a special status. Yellow Caucasian *P. mlkosewitschii* and *P.*



Fruit and seeds of *Glaucidium palmatum*

wittmanniana with fleshy lobate staminodial disc and small globose seeds are presented as section *Favonia*. Species of the "*Macula*-group" are presented as sect. *Paeonia* subsect *Masculae* - their main roots are tapering or carrot-like and leaf-segments mostly integrous.

subgenus *Albiflora*(Salm-Dyck) J. J. Halda **stat. nov.**

[bas: *Paeonia*sect. *Albiflora*Salm-Dyck, Hort. Dyck. 366 (1834); *Paeonia*sect *Albiflora*Salm-Dyck ex Uspensk. in Bjull. Mosk. O-va Ispyt. Prir. otd. biol. 92(3):83 (1987)].

Roots fasciculate, tapering, more or less vertical; leaves chartaceous, margin cartilaginous, scabrid, irregularly dentate-serrate in two rows; stem with several flowers; carpels 3-5, erect, slim; seeds pale brown, irregularly cylindrical, often compressed in regular rows.

Type species: *P. lactiflora* Pall.

sect. *Emodi* J. J. Halda **sect. nov.**

Flos solitarius vel 2-4, pendulus; petala alba; semina ovoideo-globosa, brunneo-nigra.

Flower solitary or more, pendent; petals white; seeds large, ovate-globose, dull brownish-black.

Type species: *P. emodi* Wall. ex Royle.

sect. *Tenuifoliae* (Stern) J. J. Halda **stat. nov.**

[bas: *Paeonia* sect. *Paeon* subsect. *Dissectifoliae* group *Tenuifolia* Stern, *Paeonia* 110 (1946), nom. nud.; *Paeonia* ser. *Fissae* Komarov in Fl. SSSR 7:31 (1937), nom. inval.; *Paeonia* sect. *Paeonia* ser. *Tenuifolia* Stern ex Uspensk. in Bjull. Mosk. O-va Ispyt. Prir. Otd. Biol. 92(3):84 (1987); *Paeonia* subg. *Paeonia* sect. *Paelearcticae* subsect. *Tenuifoliae* (Stern ex Uspensk.) J. J. Halda in Acta Mus. Richnov. 4(2):27 (1997)].

Roots with short chains of coraliform globose or shortly cylindrical bulblets; leaf-segments pinnatisect; flower single, erect; petals red; carpels 3 (rarely 1-2), densely coarse-tomentose; seeds shiny pale brown, narrowly cylindrical.

Type species: *P. tenuifolia* L.

sect. *Flavonia* Kem.-Nath. in Trudy Tbil. Bot. Inst. 21:18 (1961).

[*Paeonia* sect. *Paelearcticae* Huthemend. Uspensk. subsect. *Flavonia* (Kem.-Nath.) Uspensk. in Bjull. Mosk. O-va Ispyt. Prir. Otd. Biol. 92(3):83 (1987)].

Flowers single, yellow or creamy; staminodial disc fleshy, lobate, at the base of carpel; seeds globose, shiny black.

Type species: *P. wittmanniana* Hartwiss.

sect. *Paeonia* subsect. *Masculae* (F. C. Stern ex Uspensk.) J. J. Halda **stat. nov.**

[bas: *Paeonia* sect. *Paelearcticae* ser. *Masculae* F. C. Stern ex Uspensk. in Bjul. Mosk. O-va Ispyt. Prir. Otd. Biol. 92(3):83 (1987); *Paeonia* sect. *Paelearcticae* group *Macula* F. C. Stern, *Paeonia* 67 (1946), nom. nud.; *Paeonia* ser. *Masculae* Kem.-Nath. in Tr. Tbil. Bot. Inst. 21: 28 (1961), nom. nud.; *Paeonia* sect. *Paelearcticae* groups *Coriaceae* & *Russii* Stern, *Paeonia* 88 (1946), nom. nud.; *Paeonia* ser. *Corallinae* Komarov in Fl. SSSR 7:28 (1937), nom. nud.; *Paeonia* sect. *Corallinae* Salm-Dyck, Hort. Dyck. 365, 366 (1834)].

Roots tapering of carrot-like; leaf-segments more or less integrous.

Type species: *P. mascula* Mill.

Key to the subgenera:

- 1a Roots succulent, not woody; stems herbaceous, deciduous. 2
- 1b Roots woody; stems woody, persistent. subg. *Moutan*
- 2a Leaves thin or coriaceous, margin entire, smooth. 3
- 2b Leaves chartaceous, margin scabrid, cartilaginous with rows of irregular serrate teeth. [single species: *P. lactiflora* Pall]. subg. *Albiflora*
- 3a Staminal disc reaches more than 1/3 of gynoecium; petals coriaceous, slightly larger than sepals [single species: *P. brownii* Douglas ex Hooker]. subg. *Onaepia*
- 3b Staminal disc small or poorly developed; petals thin, much larger than sepals. subg. *Paeonia*

Key to the subgenus *Moutan*:

- 1a Staminal disc as a thin leathery sheath, covering whole carpels in full bloom; lower leaves bipinnate [sect. *Moutan*]. 2
- 1b Staminal disc as conspicuous fleshy lobes around the base of carpels, reaching up to 1/3 of carpels; lower leaves biternate, deeply lobed or toothed. [sect. *Delavayanae*]. 3
- 2a Carpels completely enveloped by staminal disc. *P. suffruticosa*
- 2b Carpels enveloped only up to 1/2- 2/3. *P. decomposita*
- 3a Calyx of 5 leathery greenish sepals with a conspicuous involucre of 8-12 green bracts; flowers red. *P. delavayi*
- 3b Calyx without an involucre; bracts and sepals 5-7, the outer 1-4 more or less foliaceous, the innermost rounded and sepaloid. 4
- 4a Segments and lobes of leaves 17-30mm wide; flowers up 90mm across yellow or yellow with reddish blotch at base. *P. lutea*
- 4b Segments and lobes of leaves 5-10mm wide, upper segments wider; flowers smaller, red, white or yellow. *P. potanini*

Key to the subgenus *Paeonia*:

- 1a Flowers yellow or creamy; staminal disc fleshy, lobate; seeds globose, shiny-black. *Flavonia*

- 1b Flowers not yellow or creamy; staminodial disc imperceptible; seeds ovate or cylindrical. 2
- 2a Flowers pendent, white; seeds ovate-globose, dull brownish-black [single species: *P. emodi* Wall. ex Royle]. sect. *Emodi*
- 2b Flowers more or less erect; carpels 3 (2) or more; seeds cylindrical or ovate. 3
- 3a Roots tapering, fusiform to subglobose; segments of lower leaves less than 40, each segment more than 5mm wide.sect. *Paeonia*
- 3b Roots with coralliform-globose or shortly cylindrical bulblets; segments of lower leaves more than 40, each segment less than 5mm wide [single species: *P. tenuifolia* L.].
..... sect. *Tenuifoliae*

sect. *Flavonia*

- 1a Staminodial disc fleshy, lobate, ca 4mm; diploid. *P. mlkosewitschi*
- 1b Staminodial disc tiny, ca 1mm; tetraploid. *P. wittmanniana*

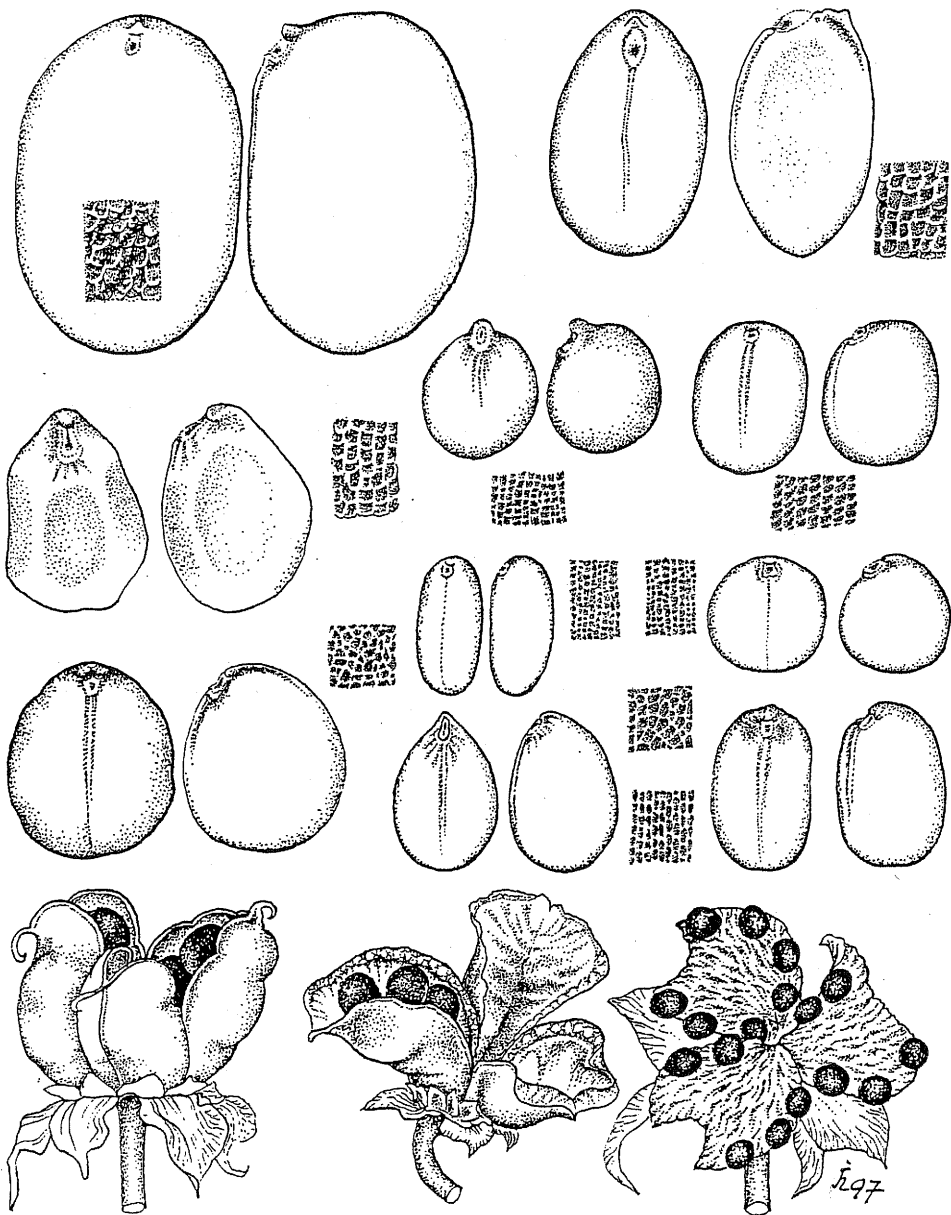
sect. *Paeonia*

- 1a Roots fusiform or subglobose. 2
- 1b Roots tapering, more or less carrot-like [subsect. *Masculae*]. 10
- 2a Carpels narrowly conical, attenuated to the relatively large curved stigma; lower leaves biternate [subsect. *Obovatae*]. 9
- 2b Carpels not narrowed, not attenuated. 3
- 3a Leaf-segments dentate [subsect. *Paeonia*]. 4
- 3b Leaf-segments laciniate, leaflets lanceolate [subsect. *Anomalae*]. 8
- 4a Flowers white. 5
- 4b Flowers red or violet. 6
- 5a Lower leaves with 40-80 leaflets and lobes, the leaflets usually 3-5-fid to 1/2 or 2/3 into oblong-lanceolate lobes. *P. clusii*
- 5b Lower leaves with 9-29 leaflets and segments, mostly ovate to oblong-elliptic or lanceolate. *P. rhodia*
- 6a Flowers red. 7
- 6b Flowers dark violet. *P. parnassica*
- 7a Flowers half-open; leaf-segments broadly triangular, spreading, the leaflet appearing serrate at the apex. *P. peregrina*
- 7b Flowers widely open; leaflets very narrowly elliptical to lanceolate *P. officinalis*
- 8a Flower single. *P. anomala*
- 8b Flowers 2-6. *P. veitchii*

- 9a Leaflets unequal, terminal usually obovate, laterals broadly oval or oblong, all shortly acuminate at the apex, cuneate or widely cuneate at the base. *P. obovata*
- 9b Lateral leaflets sometimes bifurcate; leaflets elliptic or obovate-elliptic, cuneate or long-cuneate at the base, long-acuminate to caudate at the apex. *P. mairei*
- 10a Most leaflets divided, the lower leaves with 17-30 narrowly elliptical segments. *P. broteroi*
- 10b Most leaflets undivided, the lower leaves with 9-16 elliptical, ovate or orbicular segments. 11
- 11a Leaflets orbicular; margins undulate. *P. daurica*
- 11b Leaflets generally narrower; margins not undulate. 12
- 12a Follicles 5-8, ca 6cm, glabrous, purple. *P. corsica*
- 12b Follicles less than 5, less than 6cm, glabrous or pubescent, never purple, sometimes reddish. 13
- 13a Follicles (3.5-) 4.5cm, glabrous, with apex attenuate into stigma *P. coriacea*
- 13b Follicles 2.5-4cm, usually pubescent, with obtuse or rounded apex and sessile stigma. 14
- 14a Leaves glabrous beneath; leaflets 2-4cm wide, narrowly elliptical. *P. broteroi*
- 14b Leaves usually pubescent beneath; leaflets 5-10cm wide, elliptical. *P. mascula*

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Fruit of: *P. lutea*

1	2
3	5 6
4	7 8
	9 10

1. *P. lutea*
2. *P. brownii*
3. *P. lactiflora*

P. brownii

4. *P. emodi*
5. *P. mlokosewitschii*
6. *P. obovata*

P. emodi subsp. *sterniana*

7. *P. tenuifolia*
8. *P. corsica*
9. *P. anomala*
10. *P. veitchii*

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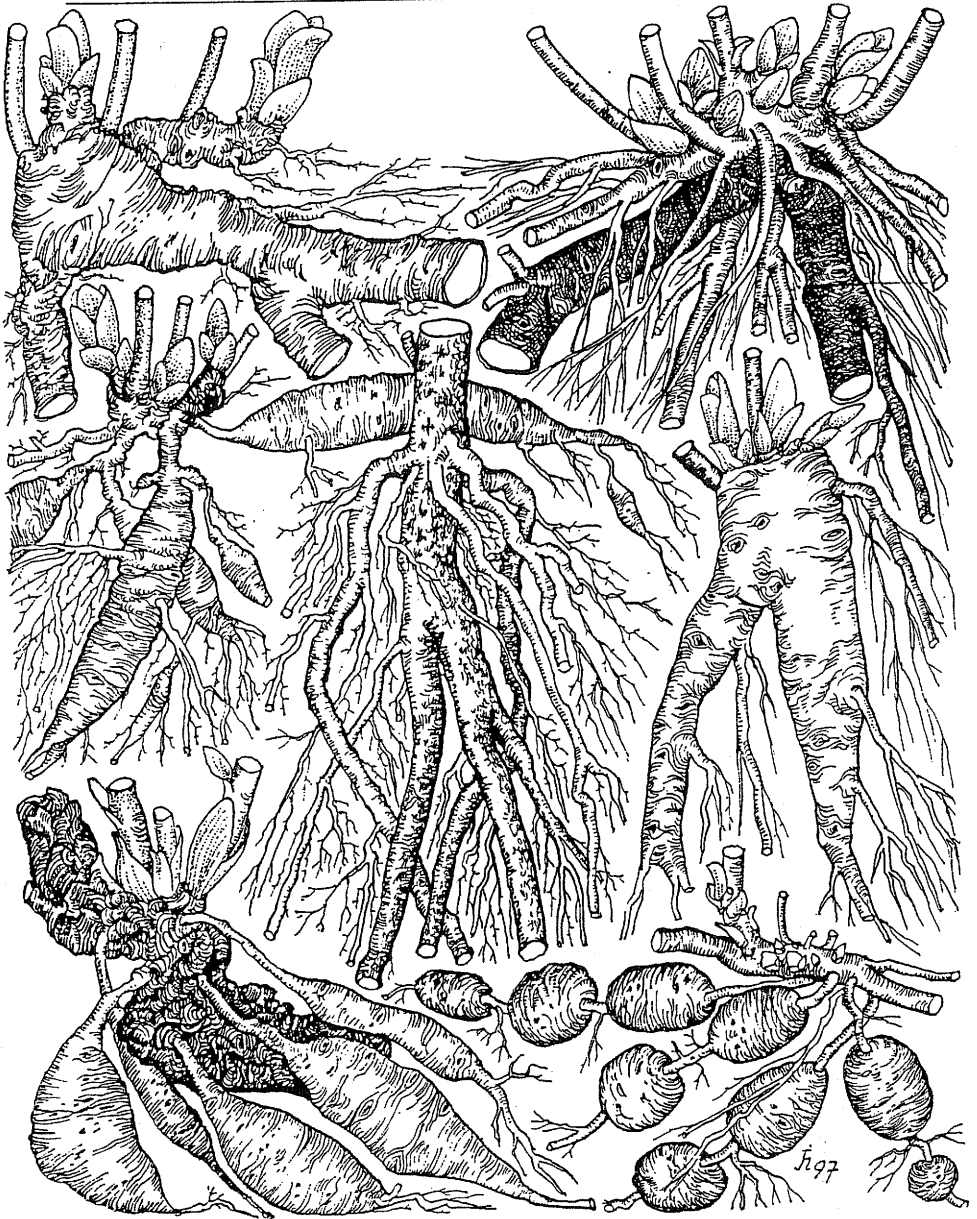


1	2
3	4 5
6	7 8

1. *P. suffruticosa*
2. *P. delavayi*
3. *P. brownii*

4. *P. emodi*
5. *P. officinalis*

6. *P. lactiflora*
7. *P. mlkosewitschi*
8. *P. vaitabii*

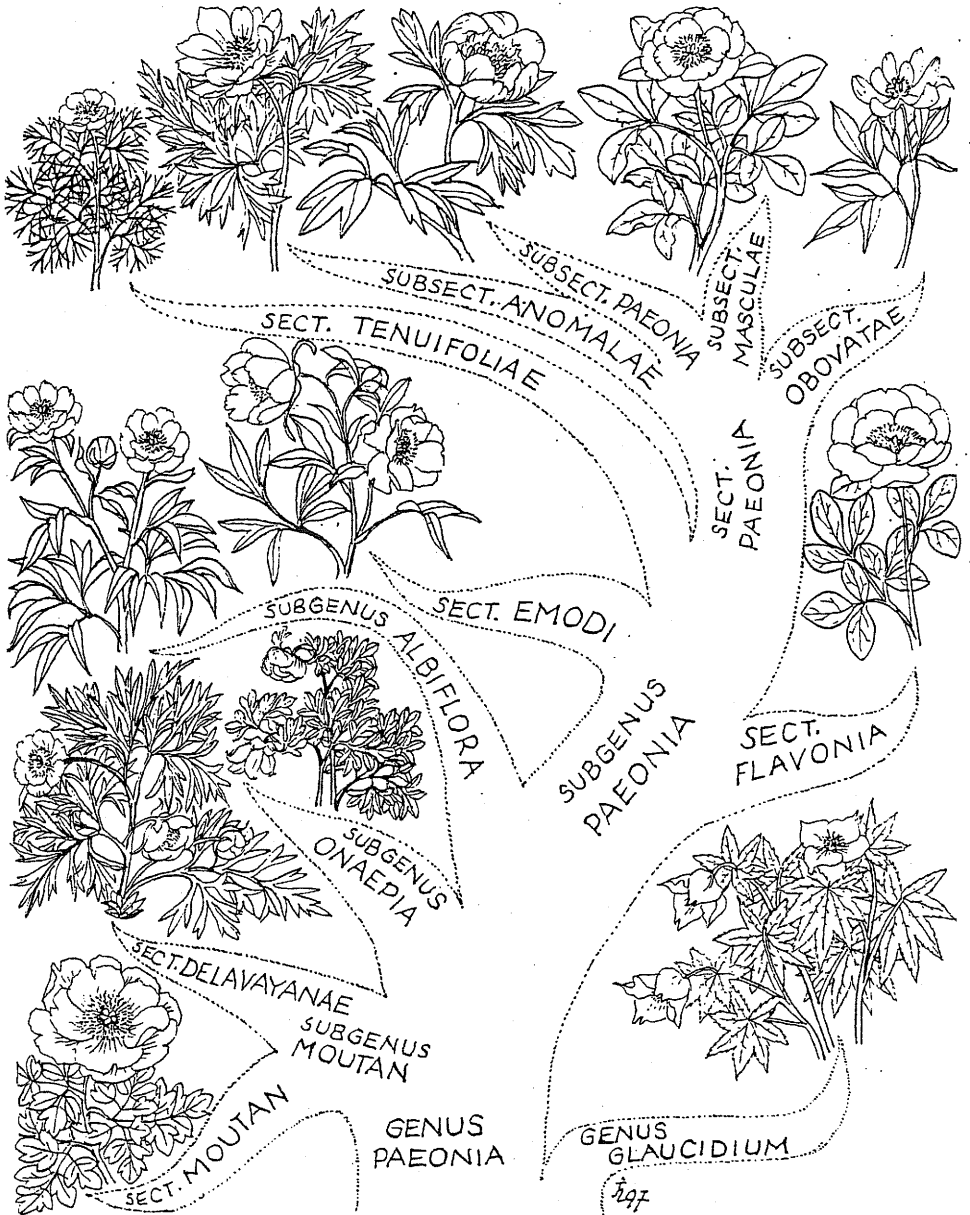


1	2
3	4 5
6	7

1. *P. brownii*
2. *P. lactiflora*

3. *P. officinalis*
4. *P. suffruticosa*
5. *P. mascula*

6. *P. anomala*
7. *P. tenuifolia*



The phylogenetic sketch of the genera *Paeonia* & *Glaucidium*