### Examples of Comparative Morphology of Underground Organs between Congeneric Angiosperms — Supplement to "Underground Organs of Herbaceous Angiosperms" (4)

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#### Abstract:

Exomorphological information and illustrations of the underground organs of Lychnis gracillima, Lychnis miqueliana (Caryophyllaceae) and Cardamine flexuosa, Cardamine dentipetala, Cardamine nipponica, Cardamine leucantha (Brassicaceae) are presented in order to show their high taxonomic significance.

The exomorphological information about underground organs of wild herbaceous angiosperms is generally not so much available as in their aerial organs. When we realized that they are of high taxonomic significance, we have started continuing observation and have illustrated them since 1981. As a result, we have recently published a book entitled "Underground Organs of Herbaceous Angiosperms" in 1995. Because the number of plants illustrated is limited there, we have published some supplemental articles. The present paper is a continuation of Supplement (3) published in "Annual Report of Botanic Garden, Faculty of Science, Kanazawa University No. 20 (1997) ", aiming at the morphological comparison of underground organs between some selected congeneric species of Caryophyllaceae and Brassicaceae.

### Lychnis gracillima (ROHRB.) MAKINO (Caryophyllaceae) (Fig. 1)

Distribution: Northern and middle Honshu, Japan. Endemic.

Rhizomatous perennial, growing under montane forests. Rhizomes primary and vertical (SHIMIZU 1989, SHIMIZU & UMEBAYASHI 1995), branching sympodial. Scar or basal part of old aerial stem distinct on rhizome; oldest one 6 years old in this material. Several lateral buds present on the lower part of the hornotinous stem to the upper part of rhizome, but never opposite. One or two buds on the basal part of a stem well developed to winter buds, 2,5-3 cm long, bearing 9-paired opposite scales. Scales of winter bud lanceolate, shallowly connate at base, ciliate on the lower margin, largest at the eighth node, about 17 mm long, the uppermost scales smaller, about 13 mm long, constricted at the middle. Other lateral buds small, usually not developed. Secondary buds present at the axile of one of bud scales of each pair. The upper secondary buds the larger up to eighth node, about 2 mm long. Those at the ninth node smaller, about 1 mm long. Next year's winter bud formed at the axile of eighth and/or seventh node of the winter bud. Axis of the winter bud up to the eighth node transformed to rhizome after the next year.

Two kinds of adventitious root from nodes of lower part of stem and rhizome; one thick contractile roots, 1-2 mm across, the other fine roots. Persistent root hairs present on fine root.

Materials collected at the suburb of Matsumoto, middle Honshu, on November 1<sup>st</sup>, 1987.

# *Lychnis miqueliana* ROHRB. (*Caryophylla-ceae*) (Fig. 2)

Distribution: Honshu, Shikoku and Kyushu, Japan. Endemic.

Rhizomatous perennial, growing under light montane forests. Rhizomes typical, primary and horizontal (SHIMI-



Fig. 1: Lychnis gracillima (ROHRB.)



Fig. 2: Lychnis migueliana (ROHRB.)

ZU 1989, SHIMIZU & UMEBAYASHI 1995), branching sympodial. Only one hornotinous stem formed from the terminal bud of rhizome. Scar or basal part of old stem distinct; oldest one 8 years old in this material. Several lateral buds formed on the basal nodes of stem, but never opposite. Only one lateral bud well developed to winter bud, up to 9 mm long and about 4,5 mm across, bearing 7- paired opposite scales. Scales of winter bud deltoid, shallowly connnate at base, glabrous; largest scale 6 mm long at the sixth node; the uppermost scale smaller, about 4 mm long. Other lateral buds small, dormant. Secondary bud present at the axile of one of bud scales of each pair. The upper secondary buds the larger up to sixth node, about 1 mm long. Scales at seventh node about 0,5 mm long. Next year's winter bud formed at the axile of fifth or sixth pair of bud scales. Axis of the winter bud up to sixth node transformed to rhizome after the next year.

Two kinds of adventitious root from node of lower part of stem and rhizome; contractile roots 2-3 mm across and fine roots much thinner. Persistent root hairs present on fine roots.

Materials collected on Mt. Takabocchi, Shiojiri, middle Honshu, on September 27<sup>th</sup>, 1986.

### Cardamine flexuosa WITH. (Brassicaceae)

#### (Fig. 3)

Distribution: Japan, Korea and China (North-eastern).

Rhizomatous winter annual, commonly growing in paddy fields. Root system mostly primary, partly secondary. Rhizomes secondary and vertical (SHIMIZU 1989, SHIMI-ZU & UMEBAYSHI 1995), very short, 2,5-6(-15) mm long, never branching. Radical leaves forming rosette, wintering, withered in spring and leaving several scars. Lateral buds consisting of a few tiny radical leaves often formed on rhizome, but withered after fruiting.

Taproot well developed and branching. Adventitious roots from axile of radical leaves, short. Persistent root hairs present on lateral roots and adventitious roots.

Materials collected at Kakuma, Kanazawa, Honshu, on May 22<sup>nd</sup>, 1997.

# Cardamine dentipetala MATSUM. (Brassicaceae) (Fig. 4)

Distribution: Northern and middle Honshu, Japan. Endemic.

Rhizomatous perennial, growing on marshy sites or







Fig. 4: Cardamine nipponica FRANCH. et SAV.





Fig. 6: Cardamine leucanta (TAUSCH) O. E. SCHULZ



rocky stream-sides in montane forests. To be called separated geophytic plant (SHIMIZU & UMEBAYSHI 1995), forming a young independent plant from each rhizome by separation of stolon from mother rhizome. Rhizome system compound, consisting of secondary vertical rhizome and stolon (SHIMIZU 1989, SHIMIZU & UMEBAY-SASHI 1995). Stolons, 8-22 mm long, 1-1,6 mm across, produced from the nodes of vertical rhizome after anthesis. Then apical part of stolon above the ground thickened, up to 12-35 mm long, 5-8 mm across, bearing many radical leaves. Radical leaves wintering, withered before anthesis. The part of stem with radical leaves turned to vertical rhizome. Previous year's rhizome dead to produce a new independent plant before anthesis.

Three to five adventitious roots formed at each node of rhizomes. Persistent root hairs present on all roots.

Materials collected at Nara-toge, Gifu, Honshu, on June 15<sup>th</sup>, 1997.

## *Cardamine nipponica* FRANCH. et SAV. (*Brassicaceae*) (Fig. 5)

Distribution: Hokkaido, northern and middle Honshu, Japan. Endemic.

Rhizomatous alpine perennial, growing on open sandy and rocky slopes. Rhizome system compound, consisting of secondary vertical rhizome with compact nodes and stolon with long internodes (SHIMIZU 1989, SHIMI-ZU & UMEBAYSHI 1995). Rhizomes transformed from basal part of previous year's aerial stems, with several radical leaves, a terminal bud and axillary ones. Rhizome branching sympodial when terminal bud is flower, monopodial when terminal bud is leaf. Both of these winter buds about 2 mm long. Winter buds sometimes present also on previous year's rhizomes. Dormant buds on older rhizomes sometimes developed by chance. Stolons elongated from winter buds, when buried under sand or due to other environmental changes. Oldest shoot in this material 10-year old, though not perfect.

Adventitious roots much branching, with persistent root hairs.

Materials collected on Mt. Norikura, middle Honshu, on August 19<sup>th</sup>, 1983.

## *Cardamine leucantha* (TAUSCH) O.E. SCHULZ (*Brassicaceae*) (Fig. 6)

Distribution: Japan, Korea, China (Northern & Northeastern), East Siberia,

Amur, Ussuri, Sakhalin.

Rhizomatous perennial, growing on marshy site or stream-side in montane forests. Rhizome system compound, consisting vertical rhizome and stolon (SHIMIZU 1986, SHIMIZU & UMEBAYASHI 1995). Stolons conspicuous, several per plant, elongated from axillary buds of radical leaves in spring, sometimes more than 80 cm long, 1-2.5 mm across, densely hairy only on basal part; nodes with a deltoid scale leaf, about 2 mm long with an axillary bud. Stolons forming a large network through branching at the level of 1-3 cm deep under the ground surface. Short vertical rhizomes with several radical leaves formed from apex of stolon when appearing above the ground in autumn. Radical leaves wintering and withered before anthesis in spring. Instead, flowering stems raised from the terminal bud of rhizome. Oldest aerial stems and stolons 4 years old in this material.

Adventitious roots with dense persistent root hairs, 2-4 at each node of rhizome and stolon.

Materials collected in Yatsuo-machi, Nei-gun, Toyama, Honshu, Japan, on June 15th, 1997.

- 1. Winter annual, without stolon ..... C. flexuosa
- 1. Perennial, with stolon
- 2. Rhizome and stolon caducous, separated from mother plant after fruiting ...... *C. dentipetala*
- 2. Rhizome and stolon persistent at least over a few years
- 3. Stolon secondary, short, not branching C. nipponica
- 3. Stolon primary, long and slender, sometimes longer than 80 cm .....C. leucantha

### Zusammenfassung

Die äußere Morphologie der unterirdischen Organe folgender Arten wird beschrieben und illustriert, um deren taxonomische Bedeutung hervorzuheben: Lychnis gracillima, Lychnis miqueliana (Caryophyllaceae) und Cardamine flexuosa, Cardamine dentipetala, Cardamine nipponica, Cardamine leucantha (Brassicaceae).

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: Stapfia

Jahr/Year: 1997

Band/Volume: 0050

Autor(en)/Author(s): Shimizu Tatemi, Umbebayashi M.

Artikel/Article: Examples of comparative morphology of underground organs between congeneric Angiosperms 327-337