

林木種子の識別

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Identification of forest Tree Seeds

Part 5 Prunus

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Introduction

These experiments aim to discriminate the seeds which belong to the genus *Prunus*. In order to carry out these experiments, 19 kinds of *Prunus* have been used as materials and they have been tested by means of the morphological observation, the statistical analysis of measured data on their length and width and their colour reactions to the reagents. I wish to express my thanks to Dr. Tae Hyun Chung and Prof. Tchang Bok Lee for the constant guidance in the course of these experiments. Thanks are also due to Father Luhmann Frederick for revision of English sentences.

Materials

Listed in the following table are the scientific names of the materials, and they were collected in these areas: Cheong-ryang-ri and Ui-dong, Seoul City; Kwang-neung, Kyong-ki Province; Cheong-joo, Choong-pook Province; Poo-yeoh, Choong-nam Province and Kwang-joo, Cheon-nam Province.

SP.	Number of mother tree
<i>Prunus Ansu</i> Komarov	3
<i>P. mandshurica</i> Koehne var. <i>glabra</i> Nakai	2
<i>P. Mume</i> Sieb. & Zucc.	2
<i>P. salicina</i> Lindl. var. <i>typica</i> Nakai	2
<i>P. persica</i> Botsch	4
<i>P. glandulosa</i> Thunb.	1
<i>P. Nakaii</i> Leveille var. <i>typica</i> Nakai.	1

<i>P. tomentosa</i> Thunb.	1
<i>P. padus</i> L. var. <i>seoulensis</i> Nakai.	2
<i>P. serotina</i> Ehrh.	1
<i>P. Leveilleana</i> Koehne var. <i>pendula</i> Nakai.	1
<i>P. Leveilleana</i> Koehne var. <i>pilosa</i> Nakai.	2
<i>P. Leveilleana</i> Koehne var. <i>tomentella</i> Nakai.	2
<i>P. Leveilleana</i> Koehne var. <i>Sontagiae</i> Nakai.	1
<i>P. Leveilleana</i> Koehne var. <i>typica</i> Nakai.	3
<i>P. verecunda</i> Koehne var. <i>typica</i> Nakai.	3
<i>P. takesimensis</i> Nakai.	1
<i>P. Yedoensis</i> Matsumura.	1
<i>P. itosakura</i> Sieb. var. <i>ascendens</i> Makino.	1
Total	19
	34

Methods

The methods used in these experiments are (1) the morphological observations of the stones and seeds, (2) Maule reactions of the stone shells, (3) hydrochloric acid tests for the methanol extracts and (4) for water extracts of the stones, and (5) the statistic analysis of measured data on the stones. And the first three methods have been fully described in my thesis; (Paek: Korean Forestry Journal No. 2, 1962), and in this paper I want to give a brief outline about the latter two methods. (4) (5).

1. Hydrochloric acid test for the water extracts of stones:

1) Preparation of the extracts: Adding 30cc of water to 2g of the fragments and filtering extracts after about 10 hours under the ordinary temperature.

2) Hydrochloric acid test: Adding 5 drops of hydrochloric acid to 5cc of the extracts of the materials and observing the change of colours while heating the above mentioned mixed solution.

2. Statistical analysis of measured data on the stones:

Analyzing the measured data on the stones statistically and discriminating their significant differences.

Reagents

The reagents used in these experiments have been described in the above-mentioned thesis.

Results

1. Morphological characters and chemical reactions of stones and seeds.

P. Ansu Komarov

Stones: generally ovate or ovoid, yellowish orange or tawny, compressed or slightly compressed, 15.25--24.40mm long, 11.70--22.25mm wide: apex acute, obtuse or cuspidate; base orbiculae or emarginate; surface reticulate, a few small hollows; a few sunken striations at the lower part of the stone. **Seeds:** generally conical ovate, compressed, tawny; apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maëule reaction of stones dark red; colour reaction of the hydrochloric acid for the methanol extracts of the stones white or orange.

P. mandshurica Koehne var. glabra Nakai

Stones: generally ovoid, brown or light brown, comparatively compressed, 14.30--20.40mm long, 11.75--18.40mm wide; apex obtuse, orbicular or cuspidate; base orbicular or emarginate: surface, a few small hollows; a few sunken striations at the lower part of the stone. **Seeds:** generally conical ovate or ovoid, compressed, tawny or brown; apex obtuse or acute; base orbicular; surface comparatively scarous, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Mæule reaction of the stones dark red; colour reaction of the hydrochloric acid for the methanol extracts of the stones light pink.

P. Mume Sieb. & Zucc.

Stones: generally fusiform, white, light reddish brown or pale brown, comparatively compressed, 12.40--

18.50mm long, 8.80--14.50 mm wide; apex cuspidate; base orbicular or obtuse; surface rough, numerous small hollows; a few sunken striations at the lower part of the stone. **Seeds:** generally ovate, comparatively compressed, brown; apex acute; base orbicular; surface more or less scabrous, veined: chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maëule reaction of the stones dark red; colour; colour reaction of the hydrochloric acid for the methanol extracts of the stones straw colour, rather colourless.

P. salicina Lindl. var. typica Nakai

Stones: generally conical ovate, yellowish orange or tawny, compressed, 16.25--21.25mm long, 11.40--14.05mm wide; apex long sharp pointed; base broad; surface reticulate, a few small hollows, a few sunken striations at the lower part of the stone. **Seeds:** generally elliptical ovate, compressed, tawny: apex cuspidate; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reaction:** Maëule reaction of the stones red, colour reaction of the hydrochloric acid for the methanol extracts of the stones white, turbid.

P. persica Botsch

Stones: generally ovate, ovoid or ovate-fusiform, brown, comparatively compressed, 20.30--40.45mm long, 15.45--26.70mm wide; apex obtuse, acute, acuminate or long sharp pointed; base obtuse, orbicular or emarginate: surface remarkably rugose with many sunken flutes; a few sunken striations at the lower part of the stone. **Seeds:** generally elliptical, compressed, brownish orange; apex cuspidate; base orbicular; surface scabrous, veined; chalaza basilar, similar colour to that seed coat. **Chemical reactions:** Maëule reaction of the stones tawny, brown or reddish brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless, straw colour or reddish orange.

P. glandulosa Thunb.

Stones: generally globose-ovoid, light brown, comparatively compressed, 7.40--8.25mm long, 6.30--6.80mm wide; apex cuspidate; base obliquely orbicular; surface rugose; a few sunken striations at the lower part of the stone. **Seeds:** generally ovate, light brown;

apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, light purple, different colour from that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones straw colour.

P. Nakaii Leveille var. *typica* Nakai

Stones: generally ovate, light brown, comparatively compressed, 8.55–9.55mm long, 6.20–6.60mm wide; apex acute; base obliquely orbicular; surface rugose; a few sunken striations at the lower part of the stone. **Seeds:** generally elongated ovate, brown; apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless.

P. tomentos Thunb.

Stones: generally nearly globose-ovate, white or light pink, comparatively compressed, 7.52–8.25mm long, 5.45–6.60mm wide; apex cuspidate; base orbicular; surface comparatively smooth; a few sunken striations at the lower part of the stone. **Seeds:** generally ovate, white, white; apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, light purple, different colour from that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless.

P. padus L. var. *seoulensis* Nakai.

Stones: generally nearly globose or globose-ovate, white or light brown, 4.75–7.00mm long, 4.30–6.00 mm wide; apex obtuse or orbicular; base orbicular; surface remarkably rugose with many crooked, raised striations. **Seeds:** generally ovoid, light yellowish brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, dark brown, different colour from that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless.

P. serotina Ehrh.

Stones: generally fusiform or elliptical ovoid, light brown, comparatively compressed, 6.20–6.80mm long,

5.30–6.20mm wide; apex orbicular; base orbicular; surface comparatively smooth, a few crooked, raised striations at the lower part of the stone. **Seeds:** generally ovoid, brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, dark brown, different colour from that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless.

P. Leveilleana Koehne var. *pendula* Nakai.

Stones: generally ovoid, white or brown, comparatively compressed, 5.15–6.55mm long, 4.15–5.45 mm wide; apex acute, one frail projection; base obtuse or orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, 5.15–6.55 mm long, 4.15–5.45 mm wide; apex acute, one frail projection; base obtuse or orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally; ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones white.

P. Leveilleana Koehne var. *pilosa* Nakai

Stones: generally elongated ovate, ovoid or elliptical, white or brown, comparatively compressed, 5.40–6.75 mm long, 4.25–5.55mm wide; apex obtuse or orbicular, one frail projection; base obtuse or orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovoid, ovate or elliptical ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones white.

P. Leveilleana Koehne var. *tomentella* Nakai.

Stones: generally ovoid, white or brown, comparatively compressed, 5.45–6.30 mm long, 4.00–5.40

mm wide; apex obtuse or orbicular, one frail projection; base obtuse; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovoid or ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones tawny, brown or reddish brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones white.

P. Leveilleans Koehne var. *Sontagiae* Nakai

Stones: generally oblong-ovate, white or brown, comparatively compressed, 5.55–6.70mm long, 4.65–5.45mm wide; apex obtuse or orbicular, one frail projection; base obtuse; surface more or less rugose with a few crooked striations. **Seeds:** generally ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones reddish brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones white.

P. Leveilleane Koehne var. *typica* Nakai.

Stones: generally ovate or elliptical ovate, white or brown, comparatively compressed, 5.40–7.45 mm long, 4.50–6.40 mm wide; apex obtuse or orbicular; one frail projection; base obtuse; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovate, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones brown or reddish brown; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones white.

P. verecunda Koehne var. *typica* Nakai.

Stones: generally ovoid, white or light brown, comparatively compressed, 4.75–6.00mm long, 3.80–5.30 mm wide; apex orbicular, one frail projection; base obtuse or orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally

ovate or ovoid, pale brown; apex acute; base orbicular; surface comparatively smooth, veined; chalaza basilar, circular, similar colour to that of the seed coat.

Chemical reactions: Maeule reaction of the stones tawny; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless; colour reaction of the hydrochloric acid for the water extracts of the stones light pink.

P. takesimensis Nakai

Stones: generally nearly globose-ovate or comparatively compressed globose, white or light yellowish brown, 7.70–9.15 mm long, 6.75–8.25 mm wide; apex orbicular; base orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovoid, pale brown; apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones yellow.

P. yedoensis Matsumura

Stones: generally ovoid, white or light brown, comparatively compressed, 6.30–7.35 mm long, 5.40–6.50 mm wide; apex orbicular; base obtuse or orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovoid, pale brown; apex acute; base orbicular; surface comparatively scabrous, veined; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones colourless.

P. itosakura Sieb. var. *ascendens* Makino.

Stones: generally obliquely globose-ovate or comparatively compressed obliquely ovate, white or pale brown, 5.25–6.00 mm long, 4.50–5.00 mm wide; apex orbicular; base obliquely orbicular; surface more or less rugose with a few crooked, raised striations. **Seeds:** generally ovoid, pale brown; apex acute; base orbicular, surface comparatively smooth; chalaza basilar, circular, similar colour to that of the seed coat. **Chemical reactions:** Maeule reaction of the stones red; colour reaction of the hydrochloric acid for the methanol extracts of the stones pink.

2. Statistic analysis of measured data on stones.

1) Length and width of stones.

sp.	Number measured	Length		Width	
		Mean	Standard error of the mean	Mean	Standard error of the mean
P. Ansu (1)	100	19.02	0.079	15.40	0.080
P. mandshricavar. glabra	100	16.41	0.088	14.04	0.105
P. persica (1)	100	36.78	0.149	24.50	0.118
" (2)	100	25.12	0.156	19.85	0.138
" (3)	100	27.10	0.127	20.14	0.088
P. padus var. seoulensis (1)	100	5.32	0.026	4.77	0.021
" (2)	100	6.56	0.022	5.49	0.021
P. Leveilleana var. pendula	100	5.77	0.026	4.64	0.024
P. Leveilleana var. pilosa (1)	100	6.18	0.023	4.67	0.015
" (2)	100	6.20	0.023	4.88	0.015
P. Leveilleana var. tomentella (2)	100	5.47	0.023	4.75	0.029
P. Leveilleana var. Sontagiae	100	6.13	0.023	5.07	0.016
P. Leveilleana var. typica (1)	100	6.38	0.026	5.00	0.016
" (2)	100	6.10	0.018	4.78	0.010
" (3)	100	6.68	0.030	5.74	0.024
P. verecunda var. typica	100	5.69	0.018	4.88	0.013
P. yedoensis	100	6.87	0.021	5.89	0.017

2) Analysis of variance

a) Length

Cause of variation	Degree of freedom	Sum of square	Variance	F
Total	1699	150768.6418	88.7356	
Individuals	16	149944.2877	9371.5180	19133.36**
Error	1683	824.3541	0.4898	

Significant difference

Variance for error.....0.4898

Least significant differences between individual means

$D. = Q(0.05). \overline{sd} = \sqrt{0.4898/100} \times 4.93 \approx 0.35$

b) Width

Cause of variation	Degree of freedom	Sum of square	Variance	F
Total	1699	74904.9806	44.0876	
Individuals	16	73784.5296	4611.5331	6927.34**
Error	1683	1120.4510	0.6657	

Significant difference

Variance for error.....0.6657

Least significant differences between individual means

$D. = Q(0.05). \overline{sd} = \sqrt{0.6657/100} \times 4.93 \approx 0.40$

Discussion and conclusions

1. The morphological characters of the stones and seeds.

One frail projection is visible on the apex of some stones (varieties of *P. Leveilleana* & *F. verecunda*). In some cases, there are **sunken striations** on the lower part of the stone (Subgn. *Amygdalus*, *Prunophora*, *Armeniaca* & *Microcerasus*) and sometimes **raised striations** (Subgn. *Padus* & *Cerasus*). Surface of the stone is rugose (*P. padus* var. *seoulensis*, Sect. *Spiraeopsis* & Subgn. *Amygdalus*), reticulate or porous (Subgn. *Prunophora* & *Armeniaca*) and sometimes smooth (*P. serotina* & Sect. *Amygdalocerasus*). **Apex of the stone** is long, sharp pointed (some of *P. persica*, Subgenus *Prunophora*) and in some cases orbicular, obtuse, acute, acuminate or cuspidate (some of *P. persica*, Subgn. *Microcerasus*, *Armeniaca*, *Padus* and *Cerasus*). **The chalaza of the seed** is different colour from that of the seed coat (Subgn. *Padus*) and in some cases similar colour to that of the seed coat (Subgn. *Cerasus*).

2. Statistic analysis of measured data on the stones.

According to the results of the statistic analysis of measured data, the following subgenera can be divided into two groups: Group I. Subgn. *Amygdalus*, *Prunophora* and *Armeniaca*. Group II.

From these series of the experiments, it may be concluded as follows:

1. Sunken striations on the lower part of the stone.....	2
1. Raised striations on the lower part of the stone	9
2. Length of the stone 12.40~40.45mm.....	3
2. Length of the stone 7.25~9.55mm Subgn. <i>Microcerasus</i>	7
3. Surface of the stone remarkably rugose...Subgn. <i>Amygdalus</i>	<i>P. persica</i>
3. Surface of the stone reticulate or porous.....	4
4. Apex of the stone long, sharp pointed...Subgn. <i>Prunophora</i>	<i>P. salicina</i> var. <i>typica</i>
4. Apex of the stone acute, obtuse, cuspidate or orbicular...Subgn. <i>Armeniaca</i>	5
5. Numerous small hollows on the surface of the stone.....	<i>P. Mume</i>
5. A few small hollows on the surface of the stone	6
6. Reaction of the methanol extracts of the stone with hydrochloric acid white or orange.....	<i>P. Ansu</i>
6. Reaction of the methanol extracts of the stone with hydrochloric acid light pink... <i>P. mandshurica</i> var. <i>glabra</i>	
7. Surface of the stone rugose... Sect. <i>Spiraeopsis</i>	8
7. Surface of the stone smooth...Sect. <i>Amygdalocerasus</i>	<i>P. tomentosa</i>
8. Stones rather globose-ovate; apex orbicular.....	<i>P. glandulosa</i>
8. Stones rather compressed ovate; apex acute	<i>P. Nakaii</i> var. <i>typica</i>

Subgn. *Padus* and *Cerasus*. It is generally of little value for the discrimination of the subgenus *Cerasus* and *Padus*.

3. Chemical reactions of the stones.

Maevle reaction of the stone shells is red (Subgn. *Armeniaca*, *Prunophora*, *Padus*, *Microcerasus* and some species of Subgn. *Cerasus*) and brown (Subgn. *Amygdalus* and most of Subgn. *Cerasus*). **Colour reaction of the hydrochloric acid for the methanol extracts of the stones** is colourless (*P. Nakaii* var. *typica*, *P. tomentosa*, *P. verecunda* var. *typica*, *P. yedensis*, varieties of *P. Leveilleana*, Subgn. *Padus* & some of *P. persica*), white (*P. salicina* var. *typica* & some of *P. Ansu*), orange (some of *P. Ansu*), reddish orange (some of *P. persica*) straw colour (*P. glandulosa*, *P. Mume* & some of *P. persica*), light pink (*P. mandshurica* var. *glabra*), pink (*P. itosakura* var. *ascendens*) and yellowish green (*P. takesimensis*). **Colour reaction of the hydrochloric acid for the water extracts of the stones** is white, turbid (varieties of *P. Leveilleana*) and light pink (*P. verecunda* var. *typica*). Maevle reactions of the stone shells and colour of the methanol extracts of the stones of *P. persica*, and reactions of hydrochloric acid of the methanol extracts of the stones of *P. persica* and *P. Ansu* vary in colours. It seems that they indicate the characteristics of the races.

9. Colour of the chalaza of the seed different from that of the seed coat.....Subgn. *Padus*.....10
9. Colour of the chalaza of the seed similar to that of the seed coat...Subgn. *Cerasus* Sect. *Pseudocerasus*...11
10. Surface of the stone remarkably rugose*P. padus* var. *seoulensis*
10. surface of the stone rather smooth*P. serotina*
11. Reaction of the methanol extracts of the stone with hydrochloric acid red.....Subsect. *Microcalymma*.....
.....*P. itosakura* var. *ascendens*
11. Reaction of the methanol extracts of the stone with hydrochloric acid yellowish green or colourless.....
.....Subsect. *Sargentiella*12
12. Reaction of the methanol extracts of the stone with hydrochloric acid yellowish green.....*P. takesimensis*
12. Reaction of the methanol extracts of the stone with hydrochloric acid colourless.....13
13. Maeule reaction of the stone red*P. yedoensis*
13. Maeule reaction of the stone tawny, brown or reddish brown.....14
14. Reaction of the water extracts of the stone with hydrochloric acid lighy pink... *P. verecunda* var. *typica*
14. Reaction of the water extracts of the stone with hydrochloric acid white*P. Leveilleana* var. *pendula*, *P. Leveilleana* var. *pilosa*, *P. Leveilleana* var. *tomentella*, *P. Leveilleana* var. *Sontagiae*, *P. Leveilleana* var. *typica*

Summary

These experiments aim to discriminate the seeds which belong to the genus *Prunus*. In order to carry out these experiments, 19 kinds of *Prunus* have been used as materials and they have been tested by means of the morphological observation, the statistic analysis of measured data of their length and width and their colour reactions of the hydrochloric acid for the methanol extracts and their water extracts, and their Maeule reactions. From the abovementioned experiments, I have found out the possibilities of the indentificaton of the genus *Prunus*.

摘 要

19 種의 *Prunus* 種子의 識別據點을 把握하고져 外部 및 內部的 形態, 길이와 넓이의 測定値에 對한 統計的 處理, 種子粉末의 methanol 浸出液 및 水浸液에 對한 鹽酸反應과 Maeule 反應에 對하여 實驗한 結果 上記方法에 依하여 그 識別이 可能함을 알게 되었다.

References

1. 李台現(1958): 實驗設計 及 統計分析法 p.13~52.
2. Masao konoshima (1954): Laboratory Manual of Botany p.62-231.
3. 右田仲彦(1950): 木材化學(基礎編)p.110~115.
4. 三好東本一(1933): 本邦產主要針葉樹の化學的性質に依る識別, 帝室林野局林業試驗場報告 2 卷 2 號.
5. 朴弘來, 白雲鵬, 趙載英(1962): 統計的方法 p.123~134.
6. 杉浦庸一(1923): モイレ反應に就きて 日本林學會誌 18 號.
7. 上田博之, 外(1960): 植物化學實驗書 日本植物化學研究會.
8. Takenoshin Nakai(1916): Flora Sylvatica Koreana Pars V.
9. 禹麟根(1959): 植物成分學 p.5~8, 105~163.