A STUDY OF SOME BROAD-LEAVED EVERGREENS FOR NORTHEASTERN KANSAS

by

MAX BYRON MILLER

B. S., Kansas State College
of Agriculture and Applied Science, 1946

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Horticulture

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1950

TABLE OF CONTENTS

INTRODUCTION

Broad-leaved evergreens are of considerable value in landscape work. They have attractive persistent foliage, a wide variety in form and texture and some have attractive fruit. Another desirable point is the shade-loving characteristic of some types. Because no extensive study of this group of plants has been made in Kansas it seems pertinent that such a study be made.

Broad-leaved evergreens are not uncommon in central and eastern Kansas landscapes at present but the number used is quite limited. Those most widely used and now obtainable from Kansas nurseries include the following: Mahonia aquifolium, Euonymus kiautschovicus, Euonymus fortunei var. Purpleleaf, Pyracantha coccinea lalandi, Hedera helix var. Baltic, Vinca minor var. Bowles, and very rarely Buxus sempervirens or Buxus sempervirens var. Truedwarf. It would be desirable if this list could be increased. This may be done by introducing new species and varieties for testing under Kansas conditions. One of the major objectives of this study was to establish a permanent collection of this type of plants on the campus of Kansas State College for continued study of their growth characteristics in northeastern Kansas. Although none of the newly introduced types can be soundly recommended after being grown for such a short time as was

encompassed by this study, they will prove their relative value after a prolonged trial period.

Another objective was to make a taxonomic description of the plants concerned based on vegetative characters.

This study was also to determine if the plants concerned were evergreen under the conditions of northeastern Kansas. Some plants that are classified as evergreens in one section of the United States may not be evergreen in another section.

The plants used in this study were those that do not require a strongly acid soil. Members of the Ericaceae family were not included because most of the soils in northeastern Kansas are not acid enough for ericaceous plants and would therefore have to be treated in order to grow them.

METHODS AND MATERIALS

As experience has shown that shade or partial shade is beneficial for most of the broad-leaved evergreens, a Pine grove on the campus of Kansas State College, Manhattan, Kansas, was chosen as the site for the plantings to be studied. Those plants that required more sun than others were planted on the west side of the Collection. Those that are more shade tolerant were planted near the east side where the shade is more dense. The planting plan of the Collection is given in Plate XXVII.

The Collection is located in the northwest corner of the Pine grove. The grove extends about 60 feet beyond the south end of the Broad-leaved Evergreen Collection and about 300 feet beyond the east end. The grove consists mostly of Pinus sylvestris, Pinus ponderosa, and Pinus nigra. The majority of these trees are from 45 to 48 years old. The soil is Wabash silt loam. The surface soil tests a pH 6.1 while the sub-soil at a depth of 3 feet tests a pH 6.8.

The plants in the Collection were not given artificial winter mulch or other protection. Wire mesh was placed around most of the specimens to reduce rabbit damage. Commercial fertilizer in the form of ammoniated phosphate was applied to each planting bed in the spring of 1948. A top dressing of animal manure was applied in the fall of 1948. Other than this the only cultural practices followed were to keep down the weeds and irrigate during dry periods of the summer and fall.

Climatological data at Manhattan, Kansas for the years 1947, 1948 and 1949 are given in Table 2.

The data on range of adaptation of plants given by Rehder (9) were used extensively in choosing plants for trial. Some specimens were purchased from commercial nurseries while others were obtained from arboretums or botanical gardens. Information given by Wyman (10) on plant materials of the major arboretums of the United States was very helpful in obtaining some of the more uncommon specimens. Manning (7) was

consulted in buying specimens from commercial sources.

No attempt was made to specialize the Collection in one or a few genera. This study included 12 families, 21 genera, and 63 species and varieties. As many genera were included as seemed practical. It was hoped that this wide selection would prove valuable in making future selections of species and varieties for the Collection. For example none of the species or varieties of the genus Cotoneaster proved evergreen here, while nearly all of the species and varieties of the genus Buxus proved evergreen. This would indicate that the collection of the genus Buxus should be increased. Table 1 illustrates the evergreen characteristics of the specimens during the time grown.

Two specimens of each species or variety were planted. For the sake of brevity the data given on the plants observed are usually an average of the growth characteristics of both plants.

The photographs used to illustrate some of the specimens give both the above and under side view of the leaves. Fruit or flower characteristics were photographed where possible. The scale of the photographs is one-half life size. All of the photographs were taken during October, 1949.

The nomenclature used throughout the thesis is that accepted by the American Joint Committee on Horticultural Nomenclature and published in Standardized Plant Names, Kelsey (5).

VEGETATIVE KEYS WITH FIELD NOTES AND DESCRIPTIONS OF PLANTS

Abelia - Abelia

Abelia grandiflora, Glossy Abelia. This species is not evergreen at Manhattan, Kansas. It is a shrub of an upright habit of growth with arching branches that may grow to a height of about 6½', Rehder (9). The leaves are ovate with a cuneate to rounded base and acute to acuminate tip. They measure from 10/16" to 1 11/16" long and 5/16" to 1 1/16" wide. The leaf margin is sinuate. The leaves are a dark lustrous green above and lighter green below. The midrib is bearded near the base but the leaf is otherwise glabrous. The branchlets are usually reddish-brown when young and chocolate-brown when matured. This shrub bears attractive bell-shaped flowers from the middle of June until a killing frost in the fall. The flowers are white with slight pink markings in the throat.

The specimens planted in the Broad-leaved Evergreen Collection were propagated from specimens in the campus nursery of the College. The plants were approximately 7" high at planting in May, 1947. They reached a height of about 3½' by October, 1949. Both plants were frozen to within 5" of the ground during the winter of 1947-1948. The foliage remained evergreen until January or shortly after, depending on the

season. The leaves take on a purplish color after several severe frosts.

There is a record of this plant having been planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1942. By October, 1949, one specimen was alive. It measured about 2' high.

According to Knerr (6), it had been growing in the Trial Nursery of Kansas State College at Manhattan 4 years at the time of that writing (1934). Knerr (6) states that it never grew more than 2' in height.

A flowering branchlet of this species is illustrated in Plate I, Fig. 1.

Berberis - Barberry

A. Leaves glabrous above and below.

B. Leaves elliptic to almost linear, indistinct venation on under side of leaves . . . . . B. julianae.

C. Leaves oblong to elliptic or lanceolate, venation on underside of leaves more distinct . . . . . .B. sargentiana.

AA. Leaves glaucous or glaucescent below.

B. Leaves lanceolate to narrow-lanceolate, with 1 to 2 small setose teeth on each side; branchlets glabrous, Rehder (9)B. triacanthophora.

C. Leaves narrow-ovate to elliptic; branchlets slightly verruculose . . . . . B. verruculosa.

Berberis julianae, Wintergreen Barberry. This species is not always evergreen at Manhattan, Kansas. It is an upright shrub that may grow to a height of about 6½', Rehder (9). The leaves are elliptic to almost linear with a spiney serrate margin. They are from 10/16" to 2 2/16" long and 3/16" to 7/16" wide. They are dark green and glossy above and lighter green below. The leaf blade is quite stiff and tipped with a spine. The underside of the leaf usually has indistinct venation. The branchlets are slightly angular and yellowish when young turning to gray-brown the second year. The branchlets bear very stiff three-parted spines.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son, Painesville, Ohio. They were planted in June, 1947. The height of the specimens at planting averaged 32". One specimen died by the fall of 1947. The above ground parts of the other specimen were killed to the ground during the winter of 1947-1948. New growth started from the roots in the spring of 1948, but all parts were dead by mid-summer of 1948.

The specimens observed did not grow enough to permit a thorough check on their true identity. A specimen growing in the deciduous Shrub Collection on the campus of the College closely resembles this species although it is labeled Berberis sargentiana. It is illustrated in Fig. 2 of Plate I. The

description given above is of the specimen growing in the deciduous Shrub Collection.

According to Quinlan (8), Berberis julianae has been growing in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas, since 1946. It has proved to be quite hardy during the period observed. The specimen in the deciduous Shrub Collection measured 1½' high by October, 1949.

Berberis sargentiana, Sargent Barberry. This species is usually evergreen at Manhattan, Kansas. It has an upright growth habit and may grow to a height of about 6½', Rehder (9). The leaves are oblong to elliptic or lanceolate. They are from 10/16" to 3" long and 4/16" to 13/16" wide. The leaf margin is serrate and very spiny. The leaf blade is stiff and tipped with a spine. The underside of the leaf has noticeable venation. The base of the leaf is cuneate. The color is a dark glossy green above and lighter beneath. The branchlets are light reddish-brown when young and gray the second year. They are round in cross section. The branchlets bear very stiff three-parted spines.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. The plants were labeled Berberis julianae but it was obvious that they were Berberis sargentiana and are now labeled as such in the Collection. The specimens averaged 1½' at planting in June, 1947. One plant died during the summer of 1947 and was not replaced until May, 1949. The replacement

was propagated from the specimen that lived. The original plant measured 1' 8" in October, 1949. The foliage suffered severe injury during the 1947-1948 winter. Slight winter injury of the foliage was observed during the 1948-1949 winter.

According to Quinlan (8), Berberis sargentiana has been growing on the campus of Kansas State College since 1940. It has proved to be hardy, especially in shaded areas.

This species is illustrated in Plate II, Fig. 1.

Berberis triacanthophora, Threespine Barberry. The specimens planted for this species did not grow enough to permit a thorough check on their true identity. They were purchased from Henry Kohankie and Son of Painesville, Ohio, and were planted in the Broad-leaved Evergreen Collection in June, 1947. The height at planting was about 2'. One specimen died during the summer of 1947. An attempt was made to propagate the species by cuttings from the one living specimen but the cuttings did not live. The remaining specimen froze to the ground during the 1947-1948 winter. New growth came up from the roots during the summer of 1948 and this new growth measured about 4" high by the fall of 1948. The specimen died during the winter of 1948-1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Berberis verruculosa, Warty Barberry. This species is not altogether evergreen at Manhattan, Kansas. It may grow

to a height of 5', Rehder (9). The leaves are narrow-ovate to elliptic. They measure from 7/16" to 1 12/16" long and 3/16" to 10/16" wide. They are lustrous dark green above and the underside is covered with blue bloom. The foliage takes on a slight purplish color during the winter. The leaf margin is revolute and spiny. According to Rehder (9), the branchlets of this species are densely verruculose but the branchlets of the specimens in the Broad-leaved Evergreen Collection are only slightly verruculose. The branchlets are circular in cross section. They bear stiff three-parted spines.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. The height of the specimens at planting in June, 1947 averaged 5½". By October, 1949 the specimens averaged 10" high. The above ground parts of this species are not entirely hardy here. From 1/3 to 2/3 of the length of the above ground parts were killed during the winter of 1947-1948. The branchlets and foliage near the ground that were protected by snow escaped winter injury.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate II, Fig. 2.

Buxus - Box

A. Leaves obovate to narrow-obovate; branchlets usually glabrous . . . . . B. microphylla.

B. Leaves obovate to round-obovate; petiole glabrous, Rehder (9) . . . B. m. japonica.

C. Leaves obovate to almost elliptic; petiole and midrib above pubescent B. m. koreana.

AA. Leaves elliptic to lance-oblong; branchlets usually slightly pubescent, Rehder(9) B. sempervirens.

B. Leaves ovate to broad-ovate, glabrous above and below; petiole pubescent . . . . . B. s. var. Handsworth.

C. Leaves ovate or sometimes obovate, 6/16" to 15/16" long and 3/16" to 7/16" wide . . . . . B. s. var. Truedwarf.

D. Leaves ovate or sometimes obovate, 6/16" to 13/16" long and 3/16" to 6/16" wide . . . . . B. s. var. Weller.

Buxus microphylla, Littleleaf Box. This species is evergreen at Manhattan, Kansas. It may reach a height of 3½' but it sometimes follows a prostrate habit of growth, Rehder (9). The leaves are usually obovate to narrow-obovate. They are from 5/16" to 13/16" long and 2/16" to 6/16" wide. The base of the leaf is cuneate and rounded or sometimes slightly notched at the tip. They are light green above and a light

yellow-green below. During the winter the foliage takes on a distinct bronze color. Both leaves and branchlets are glabrous. The branchlets are angular in cross section. The plant bears flowers in terminal clusters. They are insignificant yellowish-green in color and fragrant, having a scent somewhat like wild plums.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 11" high at planting in June, 1947. They averaged about 1½' in height with a spread of almost 2' in October, 1949. Slight winter injury was noted on the tips of a few of the branchlets in the spring of 1948. No winter injury occurred during the winter of 1948-1949. The specimens bloomed quite profusely in early April of 1948 and 1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate III, Fig. 1. The branchlet to the left in the picture has an empty seed pod. The center branchlet shows fall flower bud formation.

Buxus microphylla japonica, Japanese Littleleaf Box. It was difficult to buy specimens of this variety from commercial sources. Twenty-five cuttings were received from the Missouri Botanical Garden in January, 1949. The cuttings grew successfully and two specimens were planted in the Broad-leaved Evergreen Collection in May, 1949. They were in a good growing

condition by October, 1949.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

Buxus microphylla koreana, Korean Littleleaf Box. This variety is evergreen at Manhattan, Kansas. It has a more upright habit of growth than the type and may grow to a height of about 2', Rehder (9). The leaves are obovate to almost elliptic. They are from 4/16" to 11/16" long and 3/16" to 5/16" wide. The tip of the leaf is usually notched. The base of the leaf is cuneate. The color of the leaves is a light green above and light yellowish-green below. During the winter the foliage takes on a bronze color but the bronzing is not as distinct as with the type. The petiole and midrib of the upper surface of the leaves are pubescent. The branchlets are also pubescent. They are angular in cross section.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. The specimens averaged 10" high when planted in June, 1947. By October, 1949 they averaged about 14" high with a spread of 1½'. The specimens bloomed profusely in early April, 1949. The foliage did not show any winter injury during the winters of 1947-1948 or 1948-1949.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate III, Fig. 2. The branchlet in the left of the photograph has a dried seed pod.

The branchlet to the right shows fall flower bud formation.

Buxus sempervirens, Common Box. It was difficult to buy specimens of this species from commercial sources. Twenty-five cuttings were obtained from the Missouri Botanical Garden in January, 1949. These cuttings grew successfully and two specimens were planted in the Broad-leaved Evergreen Collection in May, 1949. They were in a good growing condition by October, 1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Buxus sempervirens var. Handsworth, Handsworth Common Box. This variety is not altogether evergreen at Manhattan, Kansas. The habit of growth of this shrub is quite upright, Rehder (9). The leaves are ovate to broad-ovate or oval. They are usually notched at the tip and broad-cuneate at the base. They measure from 7/16" to 1 3/16" long and 4/16" to 10/16" wide. The foliage is a glossy dark green above and a lighter green below. The leaves are glabrous above and below except the petioles which are puberulous. The branchlets are angular and puberulous.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. The plants averaged 1' high at planting in June, 1947. Winter injury occurred during the winters of 1947-1948 and 1948-1949. The dead parts were pruned off and the plants averaged only about 10" high by October, 1949.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate IV, Fig. 3.

Buxus sempervirens var. Truedwarf, Truedwarf Common Box. This variety is evergreen at Manhattan, Kansas. It may grow to a height of 3 1/3', Rehder (9). The leaves are ovate or sometimes obovate. They measure from 6/16" to 15/16" long and 3/16" to 7/16" wide. The tip of the leaf is sometimes slightly notched and the base is cuneate. The leaves are dark glossy green above and lighter green below. They are glabrous above and below. The branchlets are angular and sparsely puberulous.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 11" high when planted in June, 1947. They averaged about 13" high by October, 1949. Both specimens remained in excellent condition through the winters of 1947-1948 and 1948-1949. The foliage did not discolor in any way or show any winter injury during the time the plants were grown.

Four specimens of this variety were planted on the campus of Kansas State College, Manhattan, Kansas in 1930, Quinlan (8). All of the specimens died from an unknown cause during the summer of 1934.

This variety is illustrated in Plate IV, Fig. 1.

Buxus sempervirens var. Weller. This variety is ever-

green at Manhattan. The specimens of this variety were purchased from the Weller Nurseries Co. of Holland, Michigan. It is not listed by Rehder (9) or Kelsey (5). No description of a Buxus by this name was available. It is sold under the name of Buxus welleri; however, it is undoubtedly a selection of B. sempervirens. The leaves are ovate or sometimes obovate. They are from 6/16" to 13/16" long and 3/16" to 6/16" wide. The tip of the leaves is sometimes notched and the base is cuneate. The leaves are glabrous above and below. The foliage is dark glossy green above and lighter green below. The branchlets are angular and sparsely puberulous. No difference was found between this variety and Buxus sempervirens var. Truedwarf except the slightly larger leaves of the latter.

A pressed specimen of the Buxus from the Weller Nurseries Co. was sent to Mr. George T. Moore, Director of the Missouri Botanical Garden, St. Louis, Missouri. A portion of his letter concerning this Buxus is quoted below.

> Buxus welleri is not a recognized species. So far as we know, it is simply the Buxus sent out by Weller. I believe it is one of the numerous varieties of Buxus sempervirens and may be the one known as Truedwarf. Weller is located in a protected part of Michigan where Buxus is more apt to be hardy than in other Michigan localities.

The specimens planted in the Broad-leaved Evergreen Collection averaged 5" high at planting in June, 1947. One specimen died by the fall of 1947 and was replaced by a cutting from the living specimen in May, 1948. The cutting measured

3" high at planting and 7½" high by October, 1949. By October, 1949 the original specimen was 11" high with a spread of 11". No winter injury or foliage discoloration of any kind was noted during the time the plants were grown.

There is no record of this variety having been grown before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate IV, Fig. 2.

Cotoneaster - Cotoneaster

A. Leaves orbicular, suborbicular or broad-oval.

B. Leaves orbicular or suborbicular, glabrous above and below when young; semi-erect growth habit . . . . . C. apiculata.

C. Leaves suborbicular to broad-elliptic, glabrous above, sparingly strigose-pubescent below; prostrate growth habit, Rehder (9) . . . . . C. horizontalis.

D. Leaves orbicular to suborbicular or broad-oval, glabrous above, very slightly puberulous below; prostrate growth habit . . . . . C. h. perpusilla.

E. Quite similar to the preceding variety but more vigorous; leaves somewhat larger, Rehder (9) . . . . . C. h. wilsoni.

F. Leaves broad-obovate to almost orbicular; more upright habit of growth than C. horizontalis and its varieties . . . . C. rotundifolia.

AA. Leaves ovate to obovate or elliptic.

B. Leaves elliptic to ovate, pubescent above when young, glabrous later and tomentose beneath, 13/16" to 1 3/16" long, Rehder (9) . . . C. francheti.

C. Leaves quite small, about 3/16" to 5/16" long, obovate to obovate-oblong, glaucous and densely grayish pubescent below, Rehder (9) . . . . . C. microphylla.

D. Leaves elliptic to ovate-elliptic, glabrous above, tomentose below, 1 2/16" to 2 4/16" long . . . . . C. salicifolia.

Cotoneaster apiculata, Cranberry Cotoneaster. This species is not evergreen at Manhattan, Kansas. It has a semi-erect habit of growth. The longer branches arch and often take root where they touch the ground. The leaves are orbicular or suborbicular. They are from 8/16" to 14/16" long and 6/16" to 14/16" wide. They are usually glabrous above and below when mature but slightly puberulous when young. The leaf margin is fringed with hair. The midrib below is light puberulous when the leaves are young. The tip of the leaf is apiculate while the base is blunt or very broad-cuneate. The color of the leaves is a dark semi-glossy green above and

lighter green below. They have a crinkled appearance. The branchlets are circular in outline. They are pubescent when young. According to Rehder (9) the fruit is red.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 8½" high at planting in November, 1947. By October, 1948 they averaged 11" high and the spread averaged 2'. By October, 1949 they averaged 18" high with a spread of about 4'. All of the foliage usually dropped before January of each year. The specimens bloomed in early May of 1948 and 1949. No fruit was observed on the specimens during the period grown.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate V, Fig. 1.

Cotoneaster francheti, Franchet Cotoneaster. The specimens planted for this species did not grow enough to permit a thorough check on their true identity. The specimens planted were purchased from Henry Kohankie and Son of Painesville, Ohio and averaged 9" high when planted in the Broad-leaved Evergreen Collection in June, 1947. The above ground parts of both plants were dead by April, 1948. One specimen came up from the crown in the spring of 1948. Both plants were dead by June, 1948.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Cotoneaster horizontalis, Rock Cotoneaster. The specimens planted for this species did not grow enough to permit a thorough check on their true identity. The specimens planted were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 8" high when planted in the Broad-leaved Evergreen Collection in June, 1947. The above ground parts of both specimens were killed during the 1947-1948 winter. New growth came up from the crown of one specimen in April, 1948. Both plants were dead by June, 1948.

According to Quinlan (8), this species has been planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1929 and 1930. All of these specimens are dead. Another planting was made in the deciduous Shrub Collection of Kansas State College in 1946. It has not proved very satisfactory here.

Cotoneaster horizontalis perpusilla, Ground Cotoneaster. This variety is not evergreen at Manhattan, Kansas. Most of the foliage drops before January of each year. It is of a more prostrate habit of growth than the type according to Rehder (9). The leaves are orbicular to suborbicular or broad-oval. They measure from 6/16" to 10/16" long and 5/16" to 9/16" wide. The leaves are a semi-glossy dark green above and lighter green below. The tip of the leaf is rounded or sometimes notched and sometimes mucronate. The base of the leaf is broad-cuneate to blunt. The leaves are glabrous above and very

slightly puberulous below. The branchlets are quite pubescent when young. The fruit is bright red.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 6" high when planted in June, 1947. By October, 1949 the plants had reached an average height of 7" and a spread of about 2'. They bloomed in May, 1949 and set a small quantity of fruit.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate V, Fig. 2.

Cotoneaster horizontalis wilsoni, Wilson Cotoneaster. The specimens planted for this variety did not grow enough to permit a thorough check on their true identity. The specimens planted were purchased from Henry Kohankie and Son of Painesville, Ohio. They were planted in the Broad-leaved Evergreen Collection in June, 1947 and died by the fall of 1947.

According to Quinlan (8), this variety was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1946. It has proved hardy during the period grown but it is not evergreen. The specimen in the deciduous Shrub Collection measured about 4' high by October, 1949.

Cotoneaster microphylla, Rockspray Cotoneaster. The specimens planted for this species did not grow enough to permit a thorough check on their true identity. The specimens planted were purchased from Kallay Bros. Co. of Painesville,

Ohio. They were planted in the Broad-leaved Evergreen Collection in November, 1947. The above ground parts were dead by April, 1948 and all parts were dead by June, 1948.

There is no record of this species having been planted before at Kansas State College, Manhattan, Kansas.

Cotoneaster rotundifolia, Redbox Cotoneaster. This species is not evergreen at Manhattan, Kansas. It may grow to a height of about 13', Rehder (9). The growth habit is upright with arching branches. The leaves are broad-obovate to almost orbicular. They are from 4/16" to 12/16" long and 4/16" to 11/16" wide. The tip of the leaf is rounded and usually mucronate or sometimes notched. The base is usually broad-cuneate. The leaves are dark green above and lighter green below. They are glabrous above while the underside has widely spaced rather stiff hairs. The young branchlets are tomentose. The fruit is bright red.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' high when planted in November, 1947. They were in a poor condition when received from the nursery. One specimen died during the winter of 1947-1948. It was replaced in May, 1949 by a cutting propagated from the living specimen. The original specimen measured about 1' in height with a spread of 2' 3" by October, 1949. It bloomed in May of 1948 and 1949. There was a sparse set of fruit in the fall of both 1948 and 1949. The plant lost all of its

foliage by mid-winter of each year.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate VI, Fig. 1.

Cotoneaster salicifolia, Willowleaf Cotoneaster. This species is not evergreen at Manhattan, Kansas. It has an upright habit of growth with graceful arching branches. It may grow to a height of 16', Rehder (9). The leaves are elliptic to ovate-elliptic. They are from 1 2/16" to 2 4/16" long and 6/16" to 14/16" wide. The tip of the leaf is acute or acuminate and the base is cuneate. The leaves are dark lustrous green above and lighter green below. The upper surface has a leathery texture and is glabrous. The under surface is tomentose. The branchlets are tomentose, especially when young.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 4½' high when planted in November, 1947. The above ground parts of one specimen died by the spring of 1948. New growth came up from the crown in the late spring of 1948 but the complete plant was dead by the fall of 1948. It was replaced in May, 1949 by a cutting propagated from the living specimen. The original specimen measured 5' high with a spread of 4' by October, 1949. The plant was completely defoliated by mid-winter of each year.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate VI, Fig. 2.

Daphne - Daphne

Daphne cneorum, Rose Daphne. The specimens of this species did not grow enough to permit a thorough check on their true identity. The specimens were donated by the Wayside Gardens Company of Mentor, Ohio. They were planted in the Broad-leaved Evergreen Collection in November, 1947. Because of the late date of planting a mulch of pine needles was placed around each specimen. Both plants were dead by the spring of 1948.

According to Quinlan (8), this species was planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1930. The specimens died by 1933. This plant has been tried several times in the perennial gardens on the campus of the College with little success.

Daphne, Somerset. This plant is not listed by Rehder (9) or Kelsey (5). No description was available. It is a patented plant (U. S. Plant Patent 315). The specimens planted for this species were donated by the Wayside Gardens Company of Mentor, Ohio. They were planted in the Broad-leaved Evergreen Collection in November, 1947. Because of the late date of planting a mulch of pine needles was placed around each plant. Both specimens were dead by the spring of 1948.

There is no record of this plant having been tried before at Kansas State College, Manhattan, Kansas.

Euonymus - Euonymus

A. Usually creeping shrub or climbing if given support (except with H); leaves glossy to dull above; branchlets usually minutely warty, Chadwick (1) . . . . . E. fortunei.

B. Leaves 5/16" to 12/16" long, ovate or sometimes elliptic, marked white along veins, minutely warty; branchlets minutely warty . . . . . E. f. var. Baby.

C. Leaves 3/16" to 9/16" long, elliptic to ovate, lightly marked white along veins, minutely warty; branchlets minutely warty . . . . . E. f. var. Kew.

D. Leaves 14/16" to 1 13/16" long, elliptic to elliptic ovate, smooth above and below, lustrous; branchlets minutely warty . . . . . E. f. var. Glossy.

E. Leaves 12/16" to 2 6/16" long, ovate to ovate-elliptic, smooth above and below, distinct purplish color during winter; branchlets minutely warty . . . . . E. f. var. Purpleleaf.

F. Leaves 6/16" to 1 3/16" long, ovate to broad-elliptic to elliptic, veins obsolete, Rehder (9) . . . . . E. f. radicans.

G. Leaves 7/16" to 1 4/16" long, ovate to ovate-elliptic, variegated white and blue-green . . . . . E. f. var. Silveredge.

H. Leaves 9/16" to 1 6/16" long, ovate to broad-ovate, glabrous above and below; branchlets glabrous; upright growth habit . . . . . E. f. var. Upright.

I. Leaves 12/16" to 1 12/16" long, broad-elliptic to almost orbicular, glabrous above and below; branchlets minutely warty . . . . . E. f. vegetus.

AA. Upright shrubs but sometimes spreading in the case of B.

B. Leaves 1 5/16" to 3 12/16" long, obovate to broad-elliptic, glabrous above and below, glossy; usually upright growth habit . . . . . E. kiautschovicus.

C. Leaves 7/16" to 15/16" long, oblong to lance-oblong, glabrous above and below . . . . . E. japonicus var. Boxleaf.

Euonymus fortunei var. Baby, Baby Wintercreeper Euonymus. This creeping shrub is evergreen at Manhattan, Kansas. Hottes (4) lists the varieties Baby and Kew as one and the same

thing, but Rehder (9) and Chadwick (1) make a distinction between the two. The variety Kew generally has smaller leaves than Baby, Rehder (9). The leaves of Euonymus f. var. Baby are ovate or sometimes elliptic. They are from 5/16" to 12/16" long and 3/16" to 7/16" wide. They are dark green above and lighter green below. They are marked white along the veins. The margin of the leaves is crenate-serrate. Both the base and tip of the leaves are bluntly rounded. The branchlets and upper surface of the leaves are minutely warty. The under surface of the leaves is smooth. The foliage takes on a slight purplish color during the winter.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They had an average spread of 4" at planting in June, 1947. By October, 1949 they had an average spread of 5½". Although they have grown quite slow, the foliage has remained in a fair condition throughout each season. Both specimens were slightly damaged by rabbits during the fall of 1947.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate VIII, Fig. 1.

Euonymus fortunei var. Kew, Kew Wintercreeper Euonymus. This creeping shrub is evergreen at Manhattan, Kansas. As stated in the discussion of Euonymus f. var. Baby, Rehder (9) states that the variety Kew generally has smaller leaves than

Baby. The leaves of Euonymus f. var. Kew are from 3/16" to 9/16" long and 2/16" to 6/16" wide. They are elliptic to ovate. They are dark green above and lighter green below. The veins in the leaves are marked white but not quite so distinct as with Euonymus f. var. Baby. The foliage takes on a purplish color in the winter. The margin of the leaves is crenate-serrulate. Both the tip and base of the leaves are bluntly rounded. The branchlets and upper surface of the leaves are minutely warty. The underside is smooth.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They had an average spread of 10" when planted in June, 1947. By October, 1949 they had an average spread of 10" Both specimens were severely damaged by rabbits during the fall of 1947. They held their foliage during the winters of 1947-1948 and 1948-1949. The foliage turns a purplish color during the early winter.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate VIII, Fig. 2.

Euonymus fortunei var. Glossy, Glossy Wintercreeper Euonymus. This spreading shrub is not altogether evergreen at Manhattan, Kansas. The leaves are from 14/16" to 1 13/16" long and 8/16" to 1 5/16" wide. They are elliptic to elliptic-ovate. The base of the leaves is cuneate or sometimes founded. The tip is usually acutish. The leaf margin is

crenate-serrate. The leaves are smooth above and below. The branchlets are minutely warty. The foliage is dark green and lustrous above and lighter green below.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' high at planting in November, 1947. By October, 1949 they averaged 8" high with an average spread of 1'. The foliage of the prostrate branchlets retained their leaves but the foliage of the upright branchlets showed winter injury or was dropped during the 1947-1948 and 1948-1949 winters.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate VIII, Fig. 4.

Euonymus fortunei var. Purpleleaf, Purpleleaf Wintercreeper Euonymus. This spreading shrub is usually evergreen at Manhattan, Kansas. The leaves are ovate to ovate-elliptic. They are from 12/16" to 2 6/16" long and 6/16" to 1 9/16" wide. The base is broad-cuneate and the tip is acute to almost obtuse. The leaf margin is crenate-serrate. The leaves are dark green above and lighter green below. They take on a distinct purplish color during the winter. They are smooth above and below. The branchlets are minutely warty.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College.

They had an average spread of 1' at planting in May, 1947. By October, 1949 the plants had an average spread of 3½'. Most of the foliage was lost during the 1947-1948 winter but was retained during the 1948-1949 winter.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate X.

Euonymus fortunei radicans, Common Wintercreeper Euonymus. Two specimens labeled Euonymus radicans were purchased from Kallay Bros. Co. of Painesville, Ohio, and two specimens labeled Euonymus radicans were purchased from Henry Kohankie and Son of Painesville. The two pair do not seem to be the same variety (see Plate IX, Figs. 1 and 2). One pair represented by the specimen in Fig. 2 has ovate to broad-ovate to almost orbicular leaves which are from 9/16" to 1 4/16" long and 7/16" to 1 1/16" wide, while the specimen representing the other pair in Fig. 1 has ovate to ovate-elliptic leaves which are from 7/16" to 1 13/16" long and 4/16" to 10/16" wide. Both are marked light green to white along the veins. Hottes (4) states that the leaves are lighter colored along the veins in this variety. Rehder (9) states that the veins are obsolete in this variety. Chadwick (2) states that this variety shows wide variation in leaf form. The branchlets of both pairs are minutely warty as are the leaves on the upper surface. The leaves are glabrous below on both pairs.

Rehder (9) and Chadwick (1) discuss a variety of E. fortunei which they call Euonymus f. reticulata. The only distinguishing characteristic they give is that the leaves are marked white along the veins. Some other varieties of Euonymus f. are marked light along the veins also. The literature is so confusing on these varieties that it is difficult to determine the difference at this point.

Both pair, which are labeled Euonymus f. radicans in the Broad-leaved Evergreen Collection, proved to be quite hardy and evergreen at Manhattan, Kansas.

According to Quinlan (8), this variety was planted at Kansas State College, Manhattan, Kansas in 1930 but no data were recorded on the plant and it no longer exists.

Euonymus fortunei var. Silveredge, Silveredge Wintercreeper Euonymus. This spreading shrub is not always evergreen at Manhattan, Kansas. The leaves are ovate to ovate-elliptic. They are from 7/16" to 1 4/16" long and 4/16" to 14/16" wide. The tip of the leaves is acute and the base is broad-cuneate to rounded. The leaves are variegated. The green part of the leaf is of a blue-green color. The white part is sometimes streaked with pink. The underside of the leaves take on a distinct purplish color in the winter. The margin of the leaf is crenate-serrulate. The branchlets and upper surface of the leaves are minutely warty. The underside of the leaves is smooth.

The specimens planted in the Broad-leaved Evergreen

Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 10" high at planting in June, 1947. Both specimens were severely damaged by rabbits in the fall of 1947. Both specimens froze to the ground during the 1947-1948 winter. Both came up from the crown in the spring of 1948 but one plant died by the fall of 1948. The specimen that lived measured about 6" high and had a spread of 1' 8" by October, 1949. It suffered no winter damage during the 1948-1949 winter.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate VII, Fig. 2.

Euonymus fortunei var. Upright. This shrub is evergreen at Manhattan, Kansas. The habit of growth is supposed to be upright, thus its name, but it has not been grown long enough in the Broad-leaved Evergreen Collection to determine this. The specimens were donated by J. H. Skinner and Co., Topeka, Kansas. They were labeled Euonymus fortunei Upright by the nursery. It is not listed by Rehder (9) or Kelsey (5). No description of a Euonymus by this name was available. The leaves are ovate or broad-ovate. They are dark green above and lighter green below. They are from 9/16" to 1 6/16" long and 6/16" to 15/16" wide. The tip of the leaf is acute and the base is rounded to very broad-cuneate. The midrib is slightly raised above but less outstanding below. The leaves are glabrous above and below. The leaf margin is crenate-serrate.

The specimens averaged 4" high when planted in the Broad-leaved Evergreen Collection in April, 1948. Both plants were cut to the ground by the mower shortly after planting but recovered nicely by the fall of 1948. By October, 1949 they averaged about 6½" high with a spread of about 7". They suffered no winter injury during the 1948-1949 winter.

According to Quinlan (8), this variety was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1946. It has done moderately well since it was planted and favors an upright habit of growth.

This variety is illustrated in Plate VIII, Fig. 3.

Euonymus fortunei vegetus, Bigleaf Wintercreeper Euonymus. This variety is usually evergreen at Manhattan. It has a spreading habit of growth but will climb if given support. The leaves are broad-elliptic to almost orbicular. They are from 12/16" to 1 12/16" long and 10/16" to 1 9/16" wide. The leaf margin is crenate-serrate. The leaf tip is broad-acute and the base is broad-cuneate to almost rounded. The leaves are dark green above and lighter green below. They are glabrous above and below. The branchlets are minutely warty.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 10" high at planting in November, 1947. Both plants were severely damaged by rabbits in the fall of 1947. By October, 1949 they averaged 8" high with a spread of 1' 9". The tips of the upright shoots were defoliated dur-

ing the winters of 1947-1948 and 1948-1949. The more prostrate shoots did not lose their foliage. The foliage that persisted did not change in color during the winter months.

There is no record of this plant having been tried before at Kansas State College, Manhattan, Kansas, but there are several excellent specimens growing on the north side of the library building on the campus of the College. They have been there for about 20 years and have climbed to a height of about 40'. These specimens are quite evergreen.

This variety is illustrated in Plate VII, Fig. 1.

Euonymus japonicus var. Boxleaf, Boxleaf Evergreen Euonymus. This variety is not altogether evergreen at Manhattan, Kansas. The leaves are oblong to lance-oblong. They are from 7/16" to 15/16" long and 2/16" to 6/16" wide. The tip of the leaf is rounded and the base is cuneate. The leaves are a dark glossy green above and lighter green below. The upper and lower surfaces of the leaves are glabrous. The leaf margin is crenate-serrate.

The specimens planted in the Broad-leaved Evergreen Collection were propagated from shrubs growing in Muskogee, Oklahoma in May, 1947. They were planted in the Broad-leaved Evergreen Collection in May, 1948. They averaged 4" high at planting. By October, 1949 they averaged 5½" high with a spread of about 4½". There was considerable winter injury on the tips of the branchlets during the 1948-1949 winter.

There is no record of this variety having been tried

before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate IX, Fig. 3.

Euonymus kiautschovicus, Spreading Euonymus. This species is not altogether evergreen at Manhattan, Kansas. It may reach a height of 10', Rehder (9). It usually has an upright habit of growth. The leaves are obovate to broad-elliptic. They are from 1 5/16" to 3 12/16" long and 12/16" to 1 13/16" wide. They are a dark glossy green above and lighter green below. They are smooth above and below. The leaf margin is crenate-serrulate. The tip of the leaf is acute or broad-acute and the base of the leaf is cuneate. The venation is inconspicuous below.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 1' high at planting in May, 1947. By October, 1949 they averaged 2½'. The foliage suffered quite severe winter injury during the 1947-1948 and 1948-1949 winters. The foliage near the base of the plants was injured less than that on the higher parts of the branchlets.

According to Quinlan (8), this species was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1942. It has proved to be very successful here. It often fruits freely.

This species is illustrated in Plate XI.

Hedera - Ivy

A. Leaves 1 4/16" to 4 6/16" long, broad-oval, lobes broad-acute . . . . . *H. helix*.

B. Leaves 1" to 2 10/16" long, broad-oval, lobes broad-acute or sometimes acute; hardier than the type . . . . . *H. h.* var. Baltic.

C. Leaves 13/16" to 2 2/16" long, broad-oval, middle lobe is longer than the others, lobes acute or broad-acute . . . . *H. h.* var. Caenwood.

Hedera helix, English Ivy. This creeping or climbing shrub is not altogether evergreen at Manhattan, Kansas. It sometimes climbs to a height of 100', Rehder (9). The foliage of the sterile branchlets are broad-oval and from 3 to 5 lobed. The lobes are broad-acute. The base of the leaf is hastate or broad-hastate. The leaves are from 1 4/16" to 4 6/16" long and 1 4/16" to 4 13/16" wide. The young growth is stellate-pubescent. The mature leaves are glabrous above and below while the branchlets and petioles are stellate-tomentose. The leaves are dark green above with whitish veins. They are lighter green below. According to Rehder (9) the flowering branchlets have entire leaves that are ovate to rhombic in outline.

The specimens planted in the Broad-leaved Evergreen Collection came from the campus nursery of the College. They had a spread of 6" when planted in May, 1947. One plant died by

the fall of 1947. The living specimen froze back to 3" in length during the winter of 1947-1948. The plant retained its foliage during the 1948-1949 winter. By October, 1949 the plant had a spread of about 3½'. The foliage takes on a bronze color during the winter.

There is no record of this species being grown before at Kansas State College, Manhattan, Kansas. However, there are several plantings on the campus of the College that closely resemble this species. They serve as ground covers here.

This species is illustrated in Plate XII.

Hedera helix var. Baltic, Baltic English Ivy. This creeping or climbing shrub is usually evergreen at Manhattan, Kansas. The leaves are broad-oval and from 3 to 5 lobed. The lobes are acute to broad-acute or sometimes obtuse. The base of the leaves is hastate to broad-hastate. The leaves are from 1" to 2 10/16" long and 1" to 2 7/16" wide. The matured leaves are glabrous but the petioles and branchlets are sparingly stellate-pubescent. The leaves are dark green above with whitish veins and lighter green below.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son, Painesville, Ohio. They had a spread of 8" at planting in June, 1947. By October, 1949 the plants had almost covered the 3' X 6' planting bed. This variety seems to be more hardy than the type. It did not freeze back during the 1947-1948 winter as did Hedera h. The foliage of Hedera h. var. Baltic

suffered slight winter injury during the 1948-1949 winter.

According to Quinlan (8), this variety was planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1942. The specimens no longer exist and the record does not relate what happened to them.

This variety is illustrated in Plate XIII.

Hedera helix var. Caenwood, Caenwood English Ivy. This creeping or climbing shrub is evergreen at Manhattan, Kansas. Free (3) states that this variety is often sold by nurseries as Hedera h. pedata and Hedera h. donerailensis, but this does not agree with Kelsey (5) who gives Hedera h. caenwoodiana as the only synonym. The specimen planted in the Broad-leaved Evergreen Collection closely resembles the description given by Rehder (9) for Hedera h. pedata. The leaves are broad-oval with 3 to 5 lobes. The middle lobe is longer than the others. The lobes are acute to broad-acute. The base of the leaf is broad-hastate. The leaves are from 13/16" to 2 2/16" long and 12/16" to 2 8/16" wide. The leaves are a dark green color above with whitish veins. The leaves are lighter green below. The young growth is stellate-pubescent. The more mature leaves are glabrous. The petioles and branchlets are stellate-pubescent.

One specimen was planted for this variety. It was purchased from the Bobbink and Atkins Nursery of East Rutherford, New Jersey. The specimen had a spread of about 9" when planted in May, 1948. By October, 1949 it had a spread

of about 2½'. The foliage did not suffer any winter injury during the 1948-1949 winter. The leaves take on a purplish color during the winter.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate XIV.

Hypericum - St. Johnswort

Hypericum calycinum, Aaronsbeard St. Johnswort. This species is usually not evergreen at Manhattan, Kansas. It is a low-growing shrub that may reach a height of 1½' here. The leaves are long-ovate to oblong. They are from 1 2/16" to 2 13/16" long and 8/16" to 1 4/16" wide. The tip of the leaf is obtuse and the base is blunt with a very short petiole. The leaves are dull dark green above and glabrous. The underside is glaucous. The stems are quadrangular in cross section.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They were 7" high at planting in May, 1947. The specimens covered the 3' X 6' planting bed by October, 1948. All above ground parts were killed during the 1947-1948 and 1948-1949 winters.

According to Quinlan (8), this species was planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in

1930. All specimens died in 1940. Another planting was made in 1940. These specimens died in 1941. Another planting was made in the deciduous Shrub Collection. These plants existed by October, 1949 and were in a fair condition of growth.

This species is illustrated in Plate XV.

Iberis - Candytuft

Iberis sempervirens, Evergreen Candytuft. This species is not altogether evergreen at Manhattan, Kansas. It is an herb or rarely a sub-shrub that may grow to a height of almost 2', Rehder (9). The leaves are linear. They are from 8/16" to 2 7/16" long and 2/16" to 4/16" wide. They are glabrous above and below. The tip of the leaf is obtuse and the base is cuneate. The leaf margin is entire. The white flowers are quite attractive. They are borne in raceme-like heads in April.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 3½" high at planting in May, 1947. By October, 1949 they had reached a height of about 6½" and a spread of about 11". Both specimens suffered winter injury during the 1947-1948 and 1948-1949 winters. Some of the foliage protected by snow stayed green until spring.

There is no record of this plant having been grown before at Kansas State College, Manhattan, Kansas. There are, however,

several good specimens growing in the perennial gardens on the campus of the College. They are used as a low edging plant and are fairly hardy. They flower freely here.

This species is illustrated in Plate XVI, Fig. 1.

Ilex - Holly

A. Leaves with coarse spiny teeth, quite stiff.
  B. Leaves almost rectangular, lustrous above, broad apex tipped with 3 stiff spines, 1 4/16" to 3 8/16" long; branchlets glabrous . . . . . I. cornuta.
  C. Leaves elliptic to broad elliptic, dull above, apex usually acute and tipped with a stiff spine, 1 3/16" to 2 10/16" long; young branchlets finely puberulous . . . . . I. opaca.
  D. Leaves rhombic or quadrangular-ovate, 9/16" to 1 3/16" long, 1 to 3 spines on each side; young branchlets minutely pubescent, Rehder (9) . . . . . I. pernyi.

AA. Leaves serrate, crenate or sometimes entire less stiff.
  B. Leaves elliptic to obovate, crenate-serrulate, 7/16" to 1 4/16" long . . . I. crenata.

C. Leaves broad-elliptic to obovate, convex above and concave below, crenate-serrulate, 5/16" to 14/16" long . . . I. c. var. Convexleaf.

D. Leaves elliptic to oblong, 5/16" to 9/16" long, Rehder (9) . I. c. var. Littleleaf.

E. Leaves obovate to oblong-obovate, crenate-serrate or sometimes entire, 13/16" to 2" long . . . . . I. glabra.

Ilex cornuta, Chinese Holly. This species is not altogether evergreen at Manhattan, Kansas. It is a dense-growing upright shrub and may reach a height of 10', Rehder (9). The leaves are almost rectangular in shape. They are from 1 4/16" to 3 8/16" long and 9/16" to 2 2/16" wide. They are dark lustrous green above and lighter green below. They are glabrous above and below. The foliage is very stiff. The tip of the leaf is broad and usually bears 3 stiff spines. The base is broad-cuneate. The young branchlets are reddish-brown turning gray when older. The branchlets are glabrous. According to Rehder (9), the fruit is bright red.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son, Painesville, Ohio. They averaged 1½' high at planting in June, 1947. The plants were in a poor condition when received. One specimen dropped all of its leaves shortly after planting. By October, 1949 they averaged 1' 8" high with an average spread of about 1' 10". Both plants lost most of their

foliage during the winter of 1947-1948. The tips of the branchlets suffered winter injury during this period also. Both specimens were pruned back to about 1' high in May, 1948. One plant held its foliage during the 1948-1949 winter but the other one suffered severe winter injury on some of the tips of the branchlets. The foliage turns a bronze color during the winter.

According to Quinlan (8), this species was planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1930. The specimens were dead by 1939.

This species is illustrated in Plate XVII.

Ilex crenata, Japanese Holly. This species is usually evergreen at Manhattan, Kansas. It is an upright shrub that may reach a height of 23', Rehder (9). The leaves are elliptic to obovate. They are from 7/16" to 1 4/16" long and 4/16" to 8/16" wide. The tip of the leaf is acute to broad-acute. The base is cuneate. The leaf margin is crenate-serrulate. The serration is usually more prominent from the middle of the leaf to the tip. The leaves are glabrous above and below. The young branchlets are finely puberulous. The foliage is dark glossy green above and lighter green below. According to Rehder (9), the fruit is black.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' high at planting in November, 1947. By October, 1949 they averaged 1' 7" high with a spread of 2½'.

Both specimens lost about 25 per cent of their leaves during the 1947-1948 winter. Both plants held all of their foliage during the 1948-1949 winter. The foliage did not discolor in any way during the winter. Both plants bloomed in June, 1949, but neither set any fruit.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XVIII, Fig. 3.

Ilex crenata var. Convexleaf, Convexleaf Japanese Holly. This species is not entirely evergreen at Manhattan, Kansas. It is a shrub of upright habit of growth. The leaves are broad-elliptic to obovate. They are quite convex above and concave below. They are from 5/16" to 14/16" long and 3/16" to 8/16" wide. The leaves are glabrous above and below. The young branchlets are finely puberulous. The leaf margin is crenate-serrulate. The serration is usually more prominent from the middle of the leaf to the tip. The tip of the leaf is broad-acute to rounded. The base of the leaf is usually cuneate. The foliage is lustrous dark green above and lighter green below. The fruit is black.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' 1" high at planting in November, 1947. By October, 1949 they averaged about 10½" high. One specimen suffered severe winter damage during the 1947-1948 winter. About 2/3 of the above ground parts of this plant were killed

during this period. The other specimen suffered very little winter injury. It bloomed and bore fruit during the summer of 1948. Both plants suffered severe winter injury during the 1948-1949 winter except near the ground where protected by snow.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

This variety is illustrated in Plate XVIII, Fig. 2.

Ilex crenata var. Littleleaf, Littleleaf Japanese Holly. It was difficult to buy specimens of this variety from commercial sources. About 25 cuttings were obtained from the Morris Arboretum of Philadelphia, Pennsylvania in July, 1948. These cuttings died and another supply of cuttings was obtained from the same arboretum in January, 1949. Two specimens of the plants grown from these last cuttings were planted in the Broad-leaved Evergreen Collection in May, 1949. They were in a good growing condition by October, 1949.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas.

Ilex glabra, Inkberry. This species is not always evergreen at Manhattan, Kansas. It is a shrub of upright growth habit and may reach a height of 8', Rehder (9). The leaves are obovate to oblong-obovate. They are from 13/16" to 2" long and 5/16" to 12/16" wide. The leaf margin is crenate-serrate or sometimes entire. The serration is usually from the middle of the leaf to the tip. The tip of the leaf is

acute or broad-acute. The base is usually cuneate. The leaves are glabrous above and below. The branchlets are also glabrous. The leaves are lustrous dark green above and lighter green below. According to Rehder (9), the fruit is black.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' 2" high at planting in November, 1947. By October, 1949 they averaged 1' 8" high. One specimen suffered severe winter injury during the 1947-1948 winter. The other specimen suffered much less winter injury during this time. Both plants indicated only slight winter injury of the foliage during the 1948-1949 winter. One plant bloomed during the summer of 1948 but it did not set any fruit.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XVIII, Fig. 1.

Ilex opaca, American Holly. This species is not evergreen at Manhattan, Kansas. It is a tree of pyramidal form that may grow to 50' high, Rehder (9). The leaves are elliptic to broad-elliptic. They measure from 1 3/16" to 2 10/16" long and 1 1/16" to 1 14/16" wide. The tip of the leaf is usually acute and ends in a stiff spine. The base is blunt to wide-cuneate. The leaf is quite stiff and the margin is usually lined with spiny teeth. The leaves are glabrous above and below. The young branchlets are fine-

puberulous. The leaves are dull green above and yellowish-green below.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' 10" high at planting in November, 1947. Both plants suffered severe winter injury during the 1947-1948 winter. One specimen died by the fall of 1948. It was replaced in April, 1949 by a plant from the campus nursery of the College. The one original specimen that lived lost all of its foliage during the 1948-1949 winter. It measured 1½' high with a spread of 1½' by October, 1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XIX.

Ilex pernyi, Perny Holly. It was difficult to buy specimens of this species from commercial sources. About 15 cuttings were obtained from the Morris Arboretum of Philadelphia, Pennsylvania in July, 1948. Two specimens of this species grown from these cuttings were planted in the Broad-leaved Evergreen Collection in May, 1949. They were in a good growing condition by October, 1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Jasminum - Jasmine

Jasminum nudiflorum, Winter Jasmine. This species was not planted in the Broad-leaved Evergreen Collection but it is growing in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas. According to Quinlan (8), the specimens were planted in 1942. It is not evergreen here. They froze to the ground during the 1946-1947 winter. Blooms were recorded in 1944, 1945, and 1946. Only one specimen existed by October, 1949. It was in a fair condition of growth.

Lonicera - Honeysuckle

A. Leaves ovate to elliptic-ovate, 14/16" to 3" long, pubescent above and below when young, midrib often ciliate below . . . . . L. japonica halliana.

B. Leaves ovate to elliptic-ovate, 3/16" to 6/16" long, glabrous above and below . . . . L. nitida.

C. Leaves elliptic-ovate to oblong-ovate, 7/16" to 14/16" long, glabrous above and below, midrib below sometimes slightly pubescent . . . . . L. pileata.

Lonicera japonica halliana, Halls Japanese Honeysuckle. This variety is usually not evergreen at Manhattan, Kansas. It has a creeping or twining habit of growth. The leaves are ovate to elliptic-ovate. They are from 14/16" to 3" long and

7/16" to 1 9/16" wide. The tip of the leaf is acute or broad-acute. The base is usually rounded. The leaves are pubescent above and below when young. Later they are glabrous but the midrib is often ciliate below. The branchlets are pubescent. The leaves are dark green above and lighter green below. The flowers are white when new but they turn yellow when older.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They had a spread of 10" at planting in May, 1947. By October, 1947 the plants had grown together and almost filled the 3' X 6' planting bed. The planting was in a vigorous state of growth by October 1949. The height of the entwined mass averaged 1½'. The specimens lost nearly all of their leaves during the 1947-1948 and 1948-1949 winters. The foliage turns a purplish color by early winter.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas. There are, however, many plantings on the campus of the College that are probably this variety. It is quite hardy here but usually not evergreen.

This variety is illustrated in Plate XX.

Lonicera nitida, Box Honeysuckle. This species is not altogether evergreen at Manhattan, Kansas. It is an upright shrub that may reach a height of 6½', Rehder (9). The leaves are ovate to elliptic-ovate. The leaves are from 3/16" to

6/16" long and 2/16" to 5/16" wide. The tip of the leaf is broad-acute to rounded. The base is blunt. The leaves are glabrous above and below. The branchlets are puberulous. The leaves are a semi-glossy dark green above and lighter green below. According to Hottes (4), the fruit is bluish-purple and transparent.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 10" high at planting in June, 1947. By October, 1949 they averaged 1' 10" high with a spread of about 2'. Both plants suffered severe winter injury during the 1947-1948 winter except where protected by snow. That foliage unprotected by snow suffered severe winter injury again during the 1948-1949 winter. The foliage takes on a purplish color by early winter.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XXI, Fig. 1.

Lonicera pileata, Privet Honeysuckle. This species is not altogether evergreen at Manhattan, Kansas. It is a low-spreading shrub. The branchlets often take root where they strike the ground. The leaves are elliptic-ovate to oblong-ovate. They are from 7/16" to 14/16" long and 3/16" to 6/16" wide. The tip of the leaf is usually obtuse. The base is cuneate. The leaves are glabrous above and below except for the midrib below which is sometimes slightly pubescent. The

branchlets are pubescent. The leaves are a dark glossy green above and lighter green below. The fruit is purple and transparent.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 5" high at planting in June, 1947. By October, 1949 they averaged about 11" high with a spread of about 2' 7". Both plants survived the 1947-1948 winter with very little winter injury but the foliage that was not protected by snow was severely injured during the 1948-1949 winter. Both plants bloomed in May, 1949 and set a sparse number of fruits.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XXI, Fig. 2.

Mahoberberis

Mahoberberis neuberti. It was difficult to purchase specimens of this species from commercial sources. About 12 cuttings were obtained from the Masonic Homes Arboretum of Elizabethtown, Pennsylvania in February, 1949. Two specimens of these cuttings were planted in the Broad-leaved Evergreen Collection in May, 1949. They were in a good growing condition by October, 1949.

There is no record of this species having been tried

before at Kansas State College, Manhattan, Kansas.

Mahonia - Mahonia

A. Leaflets ovate to elliptic-ovate, glossy green above, sinuate-serrate . . . . . M. aquifolium.

B. Leaflets broad-ovate to ovate, dull green above, spinulose-dentate; stoloniferous, Rehder (9) . . . . . M. repens.

C. Leaflets obliquely ovate to ovate-lanceolate, very stiff, lustrous above, sinuately spiny-dentate, Rehder (9) . . . . . M. nervosa.

Mahonia aquifolium, Oregongrape. This species is not always evergreen at Manhattan, Kansas. It is a shrub of an upright habit of growth and may reach a height of 3' or rarely 6', Rehder (9). The leaflets are ovate to elliptic-ovate. They are from 15/16" to 2 14/16" long and 9/16" to 1 10/16" wide. The tip of the leaflet is acute. The base is usually blunt or broad-cuneate. The margin of the leaflet is sinuate-serrate. The serrations are tipped with a sharp stiff spine. The leaflets are glabrous above and below. They are stiff and a lustrous dark green above. They are lighter green below. The flowers are bright yellow. The fruit is a dark blue color and bloomy. The foliage turns a purplish color by early winter.

The specimens planted in the Broad-leaved Evergreen Col-

lection were purchased from Kallay Bros. Co. of Painesville, Ohio. They averaged 1' 3" high at planting in November, 1947. Both plants froze to the ground during the 1947-1948 winter. They came up from the crown and averaged 4" high by October, 1948. They suffered severe winter injury during the 1948-1949 winter. One specimen was very severely injured and was replaced by a plant purchased from the Scott Nursery of Manhattan, Kansas. It measured 7" high at planting in April, 1949. This plant measured 1' 2" high by October, 1949. The one original plant measured 1' high by October, 1949.

According to Quinlan (8), this species was planted in the Trial Nursery of Kansas State College, Manhattan, Kansas in 1930. The specimens died by 1940. Two specimens were planted in the deciduous Shrub Collection of the College in 1942. They were in a fair condition of growth by October, 1949. The largest specimen measured 2½' high. This species is used in several plantings on the campus of the College and is hardy although not entirely evergreen. It blooms profusely here.

This species is illustrated in Plate XXII.

Mahonia nervosa, Cascades Mahonia. This species was purchased from the Sherwood Nursery Company of Portland, Oregon. It was planted in the Broad-leaved Evergreen Collection in April, 1949. Both specimens were in a fair growing condition by October, 1949.

There is no record of this species having been tried

before at Kansas State College, Manhattan, Kansas.

Mahonia repens, Creeping Mahonia. Nine rooted cuttings that averaged 6" in length were donated by the United States Department of Agriculture Southern Great Plains Field Station at Woodward, Oklahoma. They were planted in the Broad-leaved Evergreen Collection in May, 1948. All of them were dead by October, 1948.

According to Quinlan (8), this species was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1943. It has proved hardy here but not always evergreen. The specimens in the deciduous Shrub Collection averaged 6" high by October, 1949.

Nandina - Nandina

Nandina domestica, Nandina. This species was not planted in the Broad-leaved Evergreen Collection but it is growing in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas. According to Quinlan (8), the specimens were planted in 1942. It is not evergreen here and often freezes to the ground. It holds its foliage until about January of each year. The leaves take on a bronze color by early winter. The largest specimen in the deciduous Shrub Collection measured about 3' high by October, 1949.

Pachistima - Pachistima

Pachistima canbyi, Canby Pachistima. This species is usually evergreen at Manhattan, Kansas. It is a low-growing shrub that may reach a height of 10", Rehder (9). The leaves are oblanceolate to lanceolate or linear. They are from 5/16" to 1 2/16" long and 2/16" to 6/16" wide. The leaves are glabrous above and below. The leaf margin is serrulate with the serration usually from the middle to the tip. The leaf margin is usually revolute. The tip of the leaf is acute to blunt. The base is cuneate.

The specimens planted in the Broad-leaved Evergreen Collection were purchased from Henry Kohankie and Son of Painesville, Ohio. They were planted in June, 1947. They died during the summer. Two more specimens were donated by the Wayside Gardens Company of Mentor, Ohio. These averaged 5" high at planting in November, 1947. One specimen suffered severe winter injury during the 1947-1948 winter. Both specimens survived the 1948-1949 winter without injury. By October, 1949 they averaged 4½" high with a spread of 10". The foliage turns a purplish color in the early winter.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

This species is illustrated in Plate XVI, Fig. 3.

Pachysandra - Pachysandra

Pachysandra terminalis, Japanese Pachysandra. This species is evergreen at Manhattan, Kansas. It is a shrub that may grow to 8" high, Rehder (9). The leaves are obovate or wedge-shaped. They are from 1 6/16" to 2 12/16" long and 12/16" to 1 6/16" wide. The leaf margin is dentate near the tip. The tip of the leaf is usually acute and the base is cuneate. The leaves are glabrous above and below as are the branchlets. The leaves are dark lustrous green above and lighter green below.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from a planting in the perennial gardens on the campus of Kansas State College, Manhattan, Kansas. They averaged 2½" at planting in March, 1948. By October, 1949 they averaged 7½" high with a spread of 9". Both plants held their foliage during the 1948-1949 winter. The foliage takes on a slight bronze color by early winter.

According to Quinlan (8), this species was planted on the campus of the College in 1930. No growth records were taken on the plants. They were dead by 1940.

This species is illustrated in Plate XXIII.

Pyracantha - Firethorn

A. Leaves narrow-elliptic to lanceolate or oblanceolate, closely crenulate-serrulate; branchlets grayish pubescent when young; fruit bright red, Rehder (9) . . . . . P. coccinea.

B. Leaves less deeply crenate than with A; of more vigorous browth with slenderer and longer branches; fruit bright orange-red, Rehder (9) . . . P. c. lalandi.

C. Leaves elliptic or obovate to obovate-oblong; young branchlets rusty-pubescent; fruit coral-red, Rehder (9) . . . . . P. crenato-serrata.

Pyracantha coccinea, Scarlet Firethorn. The specimens planted in the Broad-leaved Evergreen Collection have not grown enough to make a very thorough check on their true identity. The plants were purchased from Henry Kohankie and Son of Painesville, Ohio. They averaged 8" high at planting in June, 1947. One specimen died during the 1947-1948 winter. It was replaced in May, 1949 by a plant propagated from the specimen that lived. The young plant was in a favorable condition of growth by October, 1949. The one specimen of the original planting that lived did not suffer any winter injury during the 1947-1948 winter but it suffered severe winter damage during the 1948-1949 winter. By October, 1949 it measured about 4½" high with a spread of 1'.

There is no record of this species having been tried Before at Kansas State College, Manhattan, Kansas.

Pyracantha coccinea lalandi, Laland Firethorn. The specimen planted has not grown enough to make a thorough check on its true identity. One plant was donated by the Kansas Landscape Nursery of Salina, Kansas. It was planted in the Broad-leaved Evergreen Collection in September, 1949.

There are several good specimens of this variety growing in Manhattan, Kansas. These plants are not always evergreen here but they usually fruit quite freely. Plate XVI, Fig. 2 illustrates this variety. The parts photographed are from a specimen at Manhattan, Kansas. The plant is about 5½' high with a spread of almost 5'. The foliage usually bronzes by early winter.

According to Quinlan (8), two specimens of this variety were planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1942. One specimen died by 1945. By October, 1949 the other specimen was dead.

Pyracantha crenato-serrata. The specimens planted in the Broad-leaved Evergreen Collection did not grow enough to permit a thorough check on their true identity. They were purchased from Henry Kohankie and Son of Painesville, Ohio. They were planted in June, 1947 and died by spring, 1948.

Stranvaesia - Stranvaesia

Stranvaesia davidiana, Chinese Stranvaesia. The specimens planted in the Broad-leaved Evergreen Collection did not grow enough to permit a thorough check on their true identity. They were purchased from Henry Kohankie and Son of Painesville,

Ohio. They were planted in June, 1947. One specimen died by fall, 1947. The other was dead by spring, 1948.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Teucrium - Germander

Teucrium chamaedrys, Chamaedrys Germander. This species is not evergreen at Manhattan, Kansas. It is a low shrub that may grow to 10" high, Rehder (9). The leaves are usually ovate. They are from 4/16" to 11/16" long and 3/16" to 7/16" wide. The tip of the leaf is acute. The base is cuneate to broad-cuneate. The leaf margin is serrate or crenate. The leaves are pubescent above and below. The branchlets are also pubescent. The leaves are dark green above and lighter green below. According to Rehder (9), the flowers are purple or rose.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 4" high at planting in May, 1947. About one-half of the length of the above ground parts were killed during the 1947-1948 winter. Nearly all of the foliage suffered winter injury during this period. Nearly all of the foliage suffered winter injury during the 1948-1949 winter except that very near the ground which was protected by snow. By October, 1949 the plants averaged 1' high with a spread of 1' 7". The foliage bronzes by early winter.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas but there are

specimens growing in the perennial gardens on the campus of the College. It is not evergreen but quite hardy. It is used for an edging plant.

This species is illustrated in Plate XVI, Fig. 4.

Vauquelinia - Vauquelinia

Vauquelinia californica, Torrey Vauquelinia. The specimens planted in the Broad-leaved Evergreen Collection did not grow enough to permit a thorough check on their true identity. They were donated by the United States Department of Agriculture Southern Great Plains Field Station at Woodward, Oklahoma. They were planted in May, 1948 and were dead by spring, 1949.

There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas.

Viburnum - Viburnum

A. Leaves ovate to long-ovate, 14/16" to 2 11/16" long, stellate-tomentose above and tomentose below when young, glabrous above and tomentose below when more mature . . . . . V. burkwoodi.

B. Leaves ovate-oblong to ovate-lanceolate, 2 1/16" to 7 12/16" long, glabrous above, tomentose below, leathery texture . . . . . V. rhytidophyllum.

Viburnum burkwoodi, Burkwood Viburnum. This species is not evergreen at Manhattan, Kansas. It has an upright habit of growth. The leaves are ovate to long-ovate. They measure from 14/16" to 2 11/16" long and 7/16" to 1 10/16" wide. The tip of the leaf is acute. The base is usually blunt or

rounded. The leaves are stellate-tomentose above and tomentose below when young. When more mature they are glabrous above and tomentose below. The branchlets are also tomentose.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 4" high at planting in May, 1947. By October, 1949 they averaged 20" high with a spread of 1'. The plants lost most of their foliage during the winters of 1947-1948 and 1948-1949. The foliage bronzes by early winter.

According to Quinlan (8), this species was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1945. About 75 per cent of the top growth suffered winter injury during the winter of 1946-1947. It has not proved evergreen here. The largest specimen in the deciduous Shrub Collection measured about 4' high by October, 1949.

This species is illustrated in Plate XXIV.

Viburnum rhytidophyllum, Leatherleaf Viburnum. This species is usually evergreen at Manhattan, Kansas. It is an upright shrub that may grow to a height of 10', Rehder (9). The leaves are ovate-oblong to ovate-lanceolate. They are from 2 1/16" to 7 12/16" long and 1" to 2 7/16" wide. The tip of the leaf is acute to obtuse. The base is blunt or slightly cordate. The leaves are glabrous above and tomentose below. The branchlets are tomentose. The upper surface of the leaf is wrinkled and of a leathery texture. They are dark green above and much lighter green below.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 5" high at planting in May, 1947. The foliage of both plants suffered slight winter injury during the winters of 1947-1948 and 1948-1949, but they did not drop their foliage. The foliage bronzes slightly by early winter.

According to Quinlan (8), this species was planted in the deciduous Shrub Collection of Kansas State College, Manhattan, Kansas in 1945. It has proved to be fairly hardy but not altogether evergreen. The largest specimen in the deciduous Shrub Collection measured about 3½' high by October, 1949.

This species is illustrated in Plate XXV.

Vinca - Periwinkle

A. Leaves elliptic or elliptic-ovate to oblong-ovate, glabrous above and below . . . . . V. minor.

B. Leaves more leathery and veins more prominent than with A; flowers larger and brighter blue than A, Chadwick (1) . . . . . V. m. var. Bowles.

Vinca minor, Common Periwinkle. This species is evergreen at Manhattan, Kansas. It is a low trailing shrub that may reach a height of 6", Rehder (9). The leaves are elliptic or elliptic-ovate to oblong-ovate. They are from 9/16" to 1 12/16" long and 5/16" to 14/16" wide. The tip of the leaf

is acute to broad-acute. The base is broad-cuneate. The leaves are glabrous above and below. The branchlets are also glabrous. The leaves are dark glossy green above and lighter green below. According to Rehder (9), the flowers are lilac-blue.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 7" high at planting in May, 1947. By October, 1947 they had covered about two-thirds of the 3' X 6' planting bed. The planting bed was completely covered by October, 1949. The plants did not suffer any winter injury during the winters of 1947-1948 or 1948-1949. There is no record of this species having been tried before at Kansas State College, Manhattan, Kansas, but it is used in several plantings on the campus of the College. It is evergreen and hardy here.

This species is illustrated in Plate XXVI, Fig. 2.

Vinca minor var. Bowles, Bowles Common Periwinkle. This variety is evergreen at Manhattan, Kansas. It is a low trailing shrub like the type. The leaves are elliptic or elliptic-ovate to oblong-ovate. They are from 10/16" to 1 12/16" long and 6/16" to 15/16" wide. They are glabrous above and below. The branchlets are also glabrous. The tip of the leaf is acute to broad-acute. The base is broad-cuneate. The leaves are of a more leathery texture and the venation is more obvious than with the type. Chadwick (2) states that the flowers of Vinca m. var. Bowles are larger and brighter blue

than the type.

The specimens planted in the Broad-leaved Evergreen Collection were obtained from the campus nursery of the College. They averaged 6" high at planting in May, 1947. By October, 1947 the plants had covered about two-thirds of the 3' X 6' planting bed. By October, 1948 they had covered the entire bed. The specimens suffered no winter injury during the winters of 1947-1948 and 1948-1949.

There is no record of this variety having been tried before at Kansas State College, Manhattan, Kansas, but it is used in several plantings on the campus of the College. It is evergreen and somewhat hardier than the type.

This variety is illustrated in Plate XXVI, Fig. 1.

Table 1. Evergreen characteristics of specimens in the Broad-leaved Evergreen Collection.*

Plant name	1947		1948		1949	
	May-Sept.	Oct.-Dec.	Jan.-May	Oct.-Dec.	Jan.-May	Oct.-Dec.
Abelia grandiflora		E	LN	E	LN	LE
Berberis julianae		D'	ND"			
B. sargentiana		D'	N	E	E	E
B. triacanthophora	D'	E	N	E	LD"	
B. verruculosa		E	LN	E	LN	E
Buxus microphylla		LE	LE	LE	LE	LE
B. m. koreana		LE	LE	LE	LE	LE
B. sempervirens var. Handsworth		E	N	E	E	E
B. s. var. Truedwarf		E	E	E	E	E
B. s. var. welleri		E	E	E	E	E
Cotoneaster apiculata		N	N	N	N	N
C. francheti		N	ND'D"			
C. horizontalis		N	ND'D"			
C. h. perpusilla		N	N	N	N	N
C. h. wilsoni	D'D"					
C. microphylla		E	ND'D"			
C. rotundifolia		N	ND'	N	N	N
C. salicifolia		N	ND'	N	N	N
Daphne cneorum		E	ND'D"			
D., Somerset		E	ND'D"			
Euonymus fortunei var. Baby		E	LE	E	LE	E
E. f. var. Glossy		E	N	E	E	E
E. f. var. Kew		E	LE	E	LE	LE
E. f. var. Purpleleaf		LE	N	LE	LE	LE
E. f. radicans		E	E	LE	LE	E
E. f. var. Silveredge		E	ND'	LE	LE	E
E. f. var. Upright				E	E	E
E. f. vegetus		E	E	E	N	E
E. japonicus var. Boxleaf				E	N	E
E. kiautschovicus		E	N	E	LN	E

Table 1. (concl.).

Plant name	1947		1948		1949	
	May-Sept.	Oct.-Dec.	Jan.-May	Oct.-Dec.	Jan.-May	Oct.-Dec.
Hedera helix	D'	E	LN	E	LE	E
H. h. var. Baltic		E	E	E	N	E
H. h. var. Caenwood				LE	E	E
Hypericum calycinum		E	N	E	N	E
Iberis sempervirens		E	N	E	N	E
Ilex cornuta		E	LN	E	LE	E
I. crenata		E	E	E	E	E
I. c. var. Convexleaf		E	N	E	N	E
I. glabra		E	N	E	E	E
I. opaca		E	N	D'E	N	E
Lonicera japonica halliana		E	LN	E	LN	E
L. nitida		E	N	E	LN	LE
L. pileata		E	N	E	N	E
Mahonia aquifolium		E	N	E	LN	E
M. repens				D'D"		
Pachistima canbyi		E	N	E	LE	E
Pachysandra terminalis				E	LE	E
Pyracantha coccinea		E	ND'	E	LN	E
P. crenato-serrata		E	ND'D"			
Stranvaesia davidiana	D'	E	D"			
Teucrium chamaedrys		E	LN	E	LN	E
Vauquelinia californica				E	D'D"	
Viburnum burkwoodi		E	LN	E	LN	N
V. rhytidophyllum		E	LE	E	LE	E
Vinca minor		E	E	E	E	E
V. m. var. Bowles		E	E	E	E	E

* E = Evergreen
N = Not evergreen
L = Change in leaf coloration
D' = One specimen dead
D" = Second specimen dead

Table 2. Climatological data at Manhattan, Kansas.

Date	Temperature, degrees F.		Precipitation in inches
	Minimum	Maximum	
1947			
Jan.	-31	64	0.99
Feb.	- 2	71	0.18
March	8	78	3.43
April	29	85	5.15
May	33	89	3.33
June	47	95	7.26
July	50	109	0.64
Aug.	65	108	3.91
Sept.	38	112	0.25
Oct.	32	98	1.73
Nov.	12	66	0.76
Dec.	8	66	2.67
1948			
Jan.	-13	56	0.59
Feb.	- 2	70	2.33
March	-12	78	2.59
April	24	89	3.65
May	35	87	3.64
June	50	96	11.68
July	52	96	5.97
Aug.	51	101	0.59
Sept.	39	99	3.63
Oct.	23	85	1.69
Nov.	19	74	1.06
Dec.	- 4	66	0.71
1949			
Jan.	- 4	59	4.48
Feb.	4	62	0.95
March	1	77	1.96
April	26	85	1.74
May	42	86	5.88
June	54	96	6.85
July	55	103	2.24
Aug.	50	100	2.62
Sept.	30	89	2.30
Oct.	17	90	1.24
Nov.	15	79	0.33
Dec.	1	60	1.35

Source: Official weather records kept by the Department of Physics, Kansas State College, Manhattan, Kansas.

EXPLANATION OF PLATE I

Fig. 1. *Abelia grandiflora*

Fig. 2. *Berberis julianae*

PLATE I

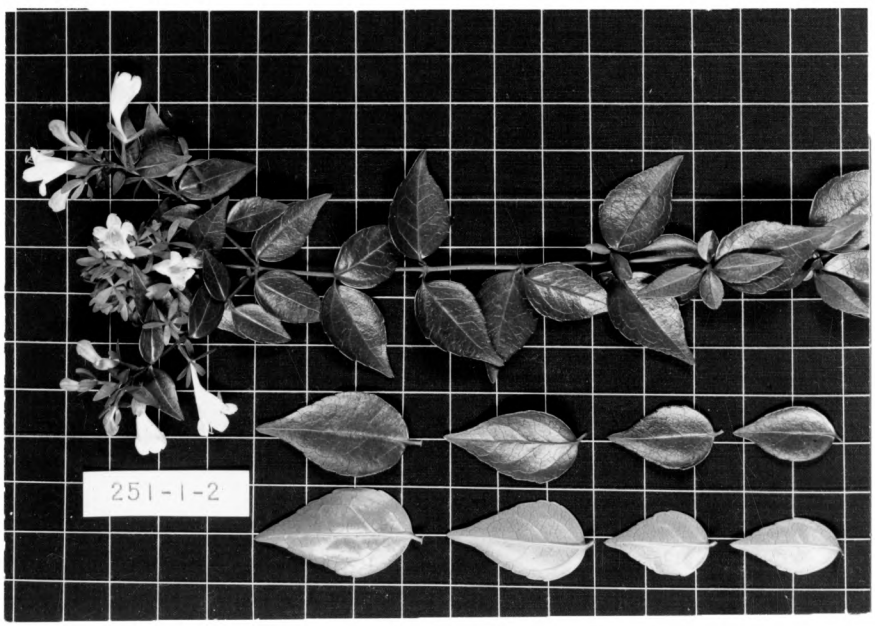


Fig. 1.

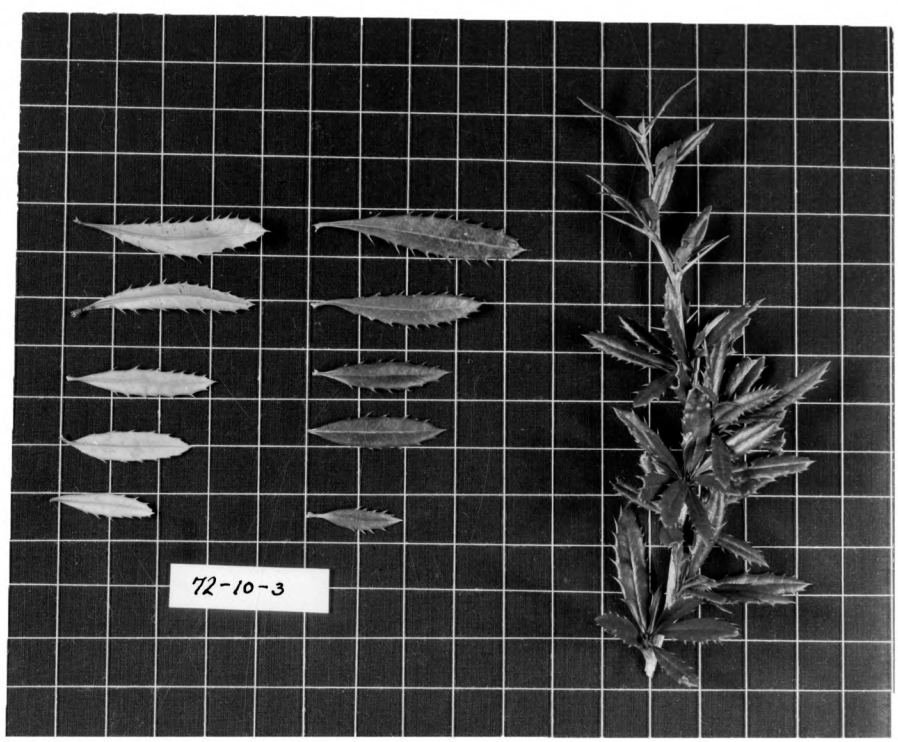


Fig. 2.

EXPLANATION OF PLATE II

Fig. 1. Berberis sargentiana

Fig. 2. Berberis verruculosa

PLATE II

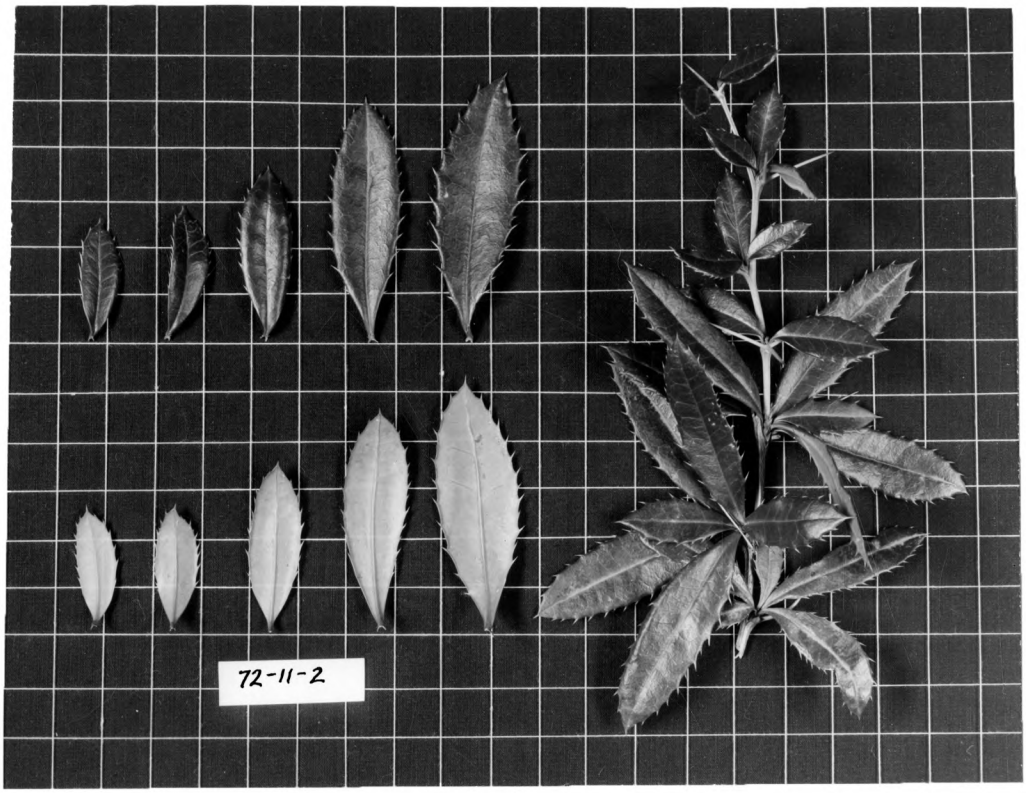


Fig. 1.

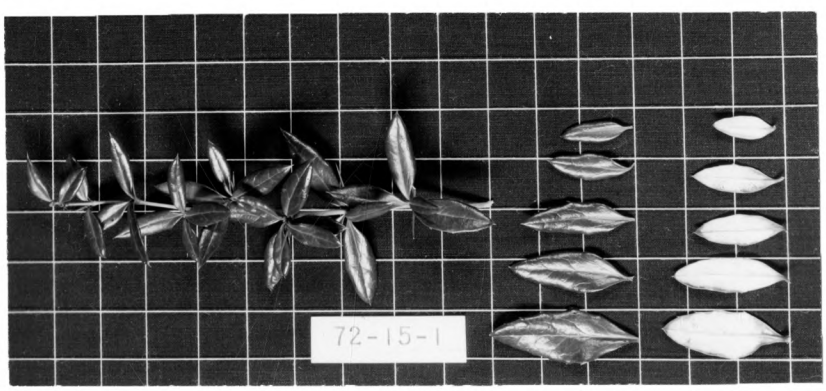


Fig. 2.

EXPLANATION OF PLATE III

Fig. 1. *Buxus microphylla*

Fig. 2. *Buxus microphylla koreana*

PLATE III

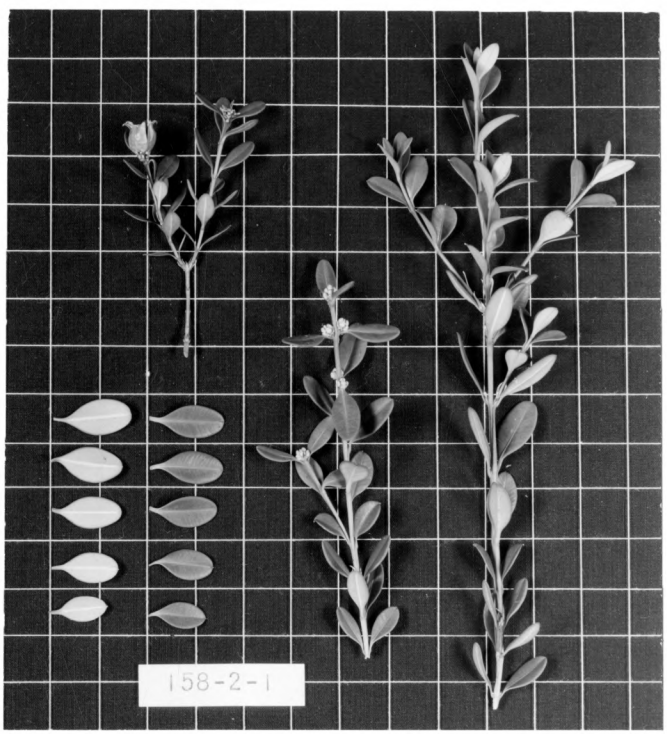


Fig. 1.

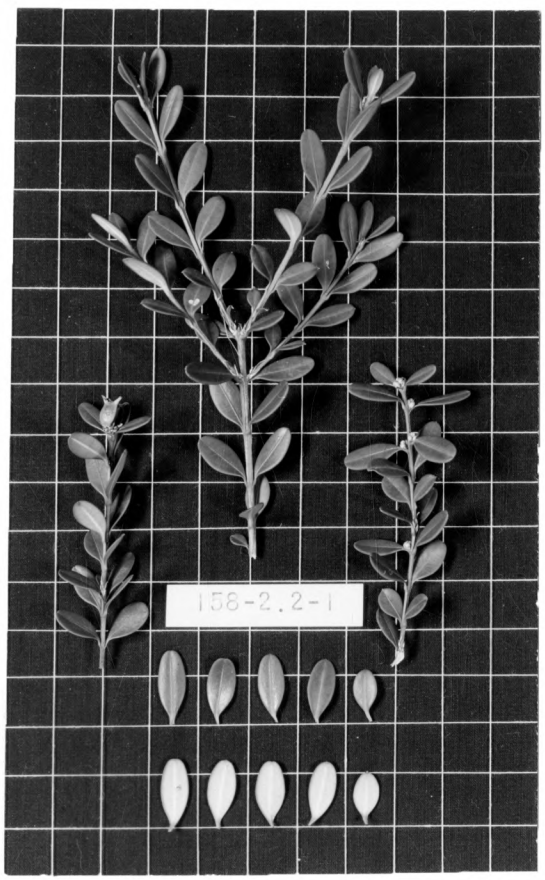


Fig. 2.

EXPLANATION OF PLATE IV

Fig. 1. Buxus sempervirens var. Truedwarf

Fig. 2. Buxus sempervirens var. Weller

Fig. 3. Buxus sempervirens var. Handsworth

PLATE IV

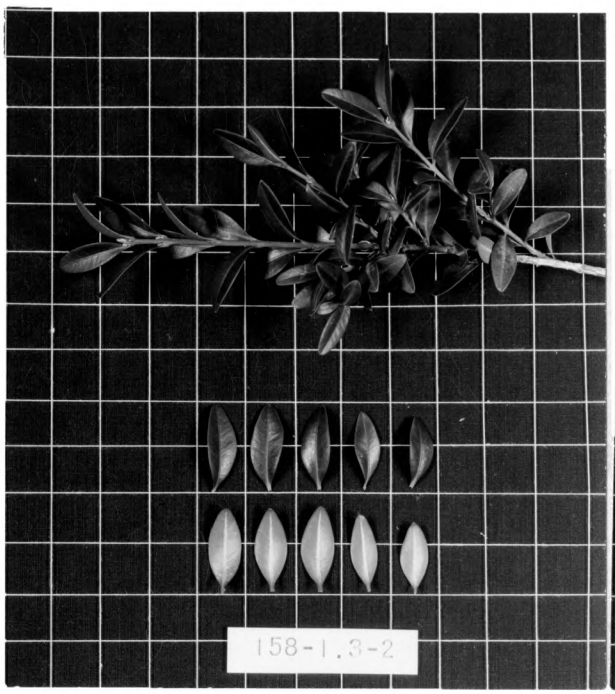


Fig. 1.

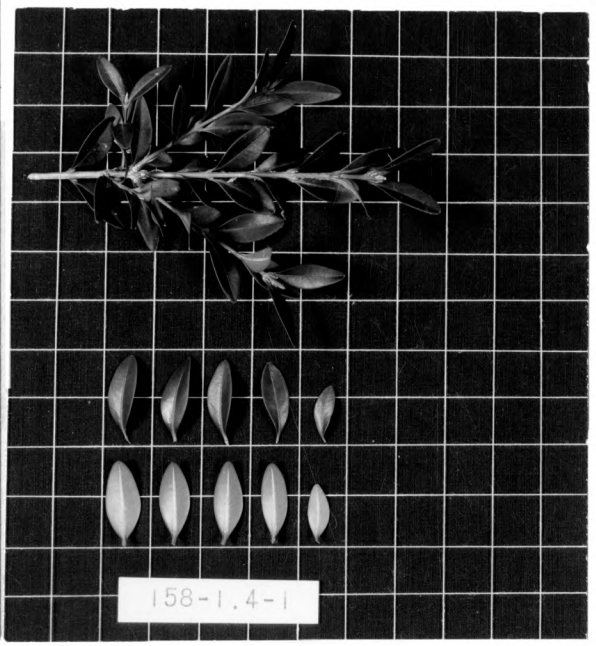


Fig. 2.

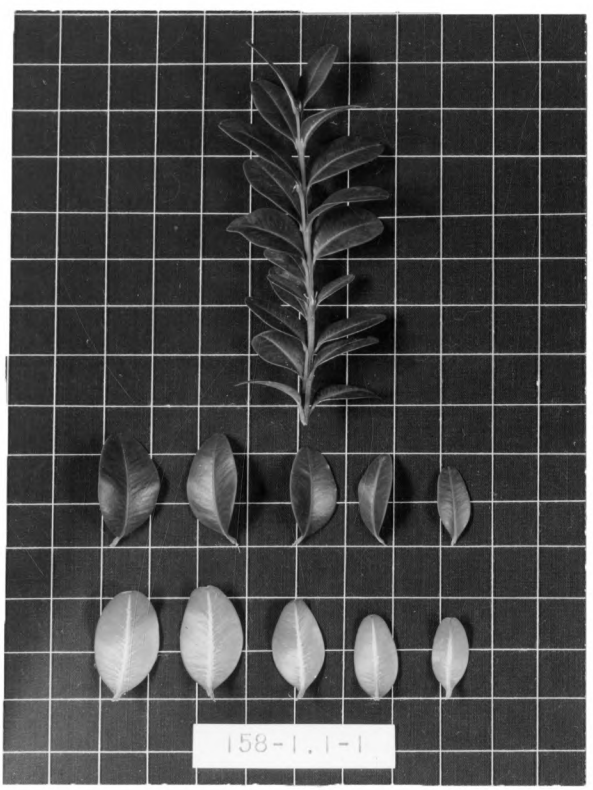


Fig. 3.

EXPLANATION OF PLATE V

Fig. 1. Cotoneaster apiculata

Fig. 2. Cotoneaster horizontalis perpusilla

PLATE V

Fig. 1.

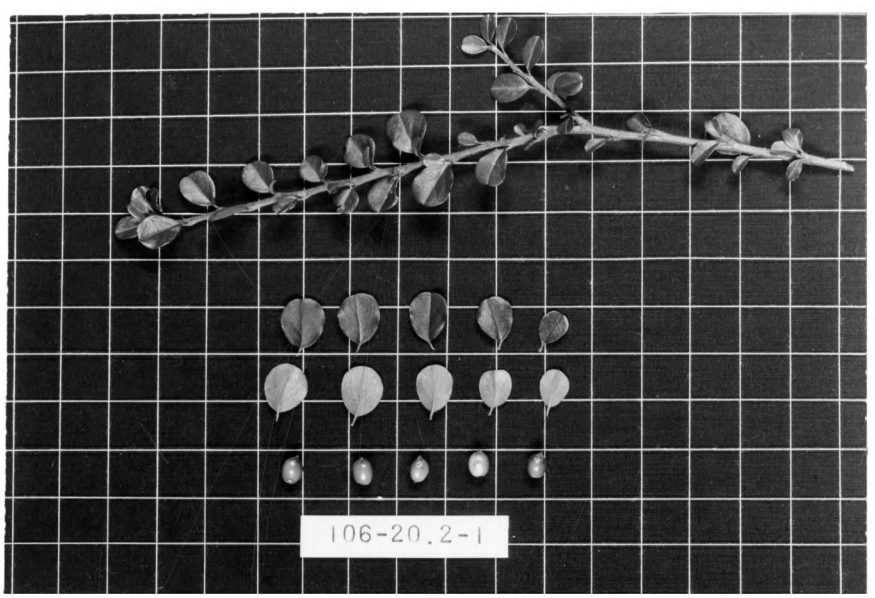


Fig. 2.

EXPLANATION OF PLATE VI

Fig. 1. Cotoneaster rotundifolia

Fig. 2. Cotoneaster salicifolia

PLATE VI

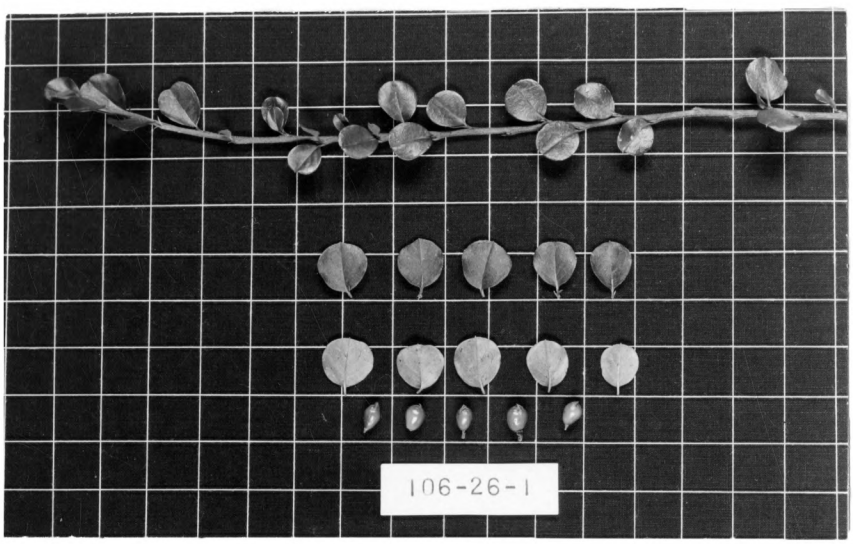


Fig. 1.

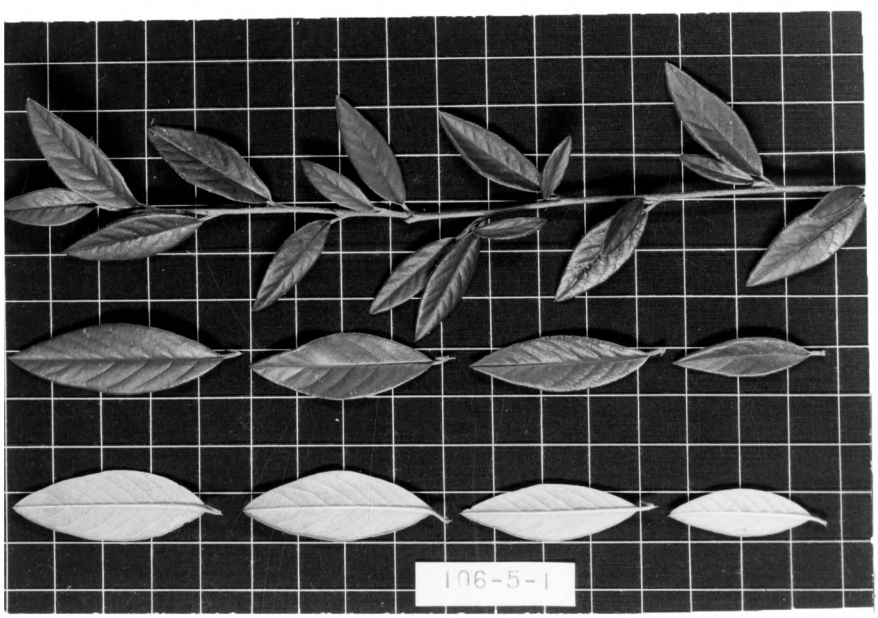


Fig. 2.

EXPLANATION OF PLATE VII

Fig. 1. Euonymus fortunei vegetus

Fig. 2. Euonymus fortunei var. Silveredge

PLATE VII

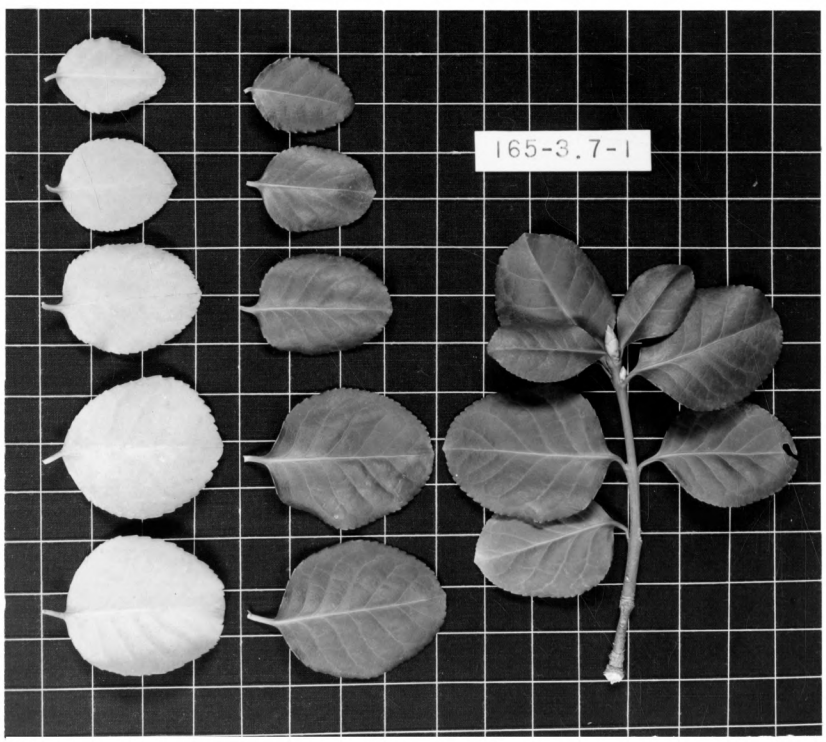


Fig. 1.

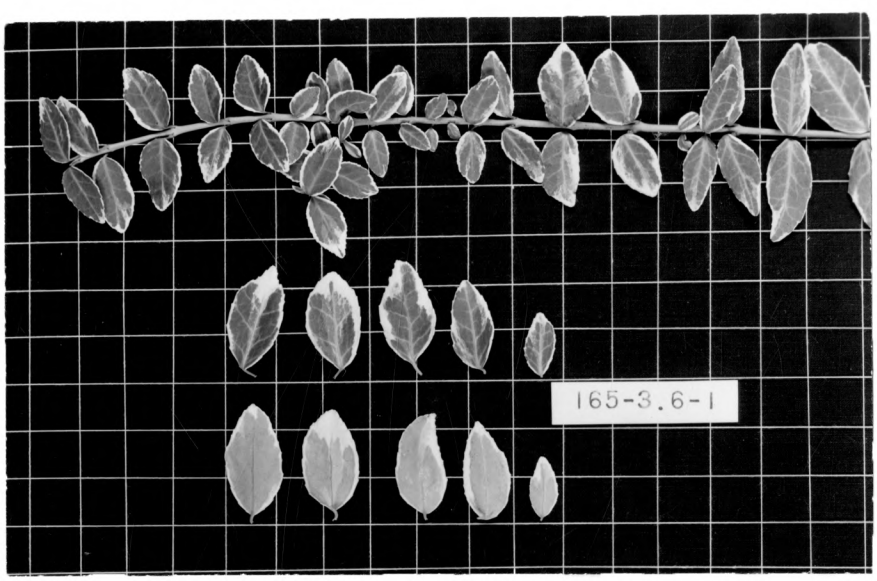


Fig. 2.

EXPLANATION OF PLATE VIII

Fig. 1. *Euonymus fortunei* var. Baby

Fig. 2. *Euonymus fortunei* var. Kew

Fig. 3. *Euonymus fortunei* var. Upright

Fig. 4. *Euonymus fortunei* var. Glossy

PLATE VIII

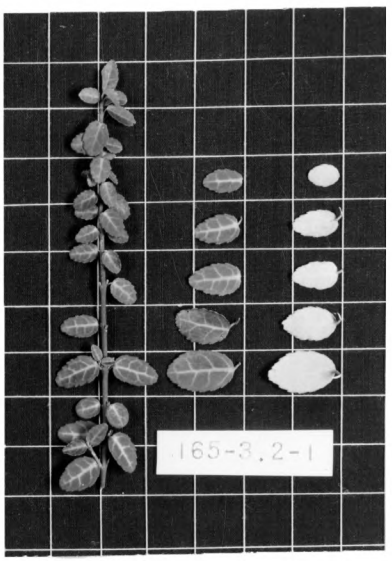


Fig. 1.

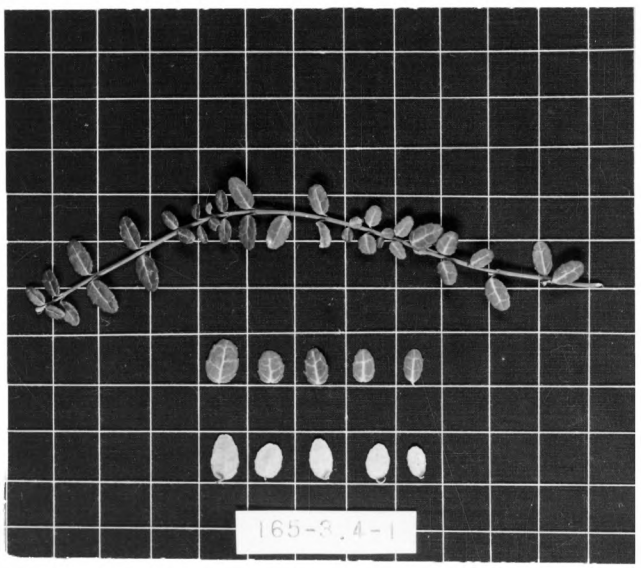


Fig. 2.

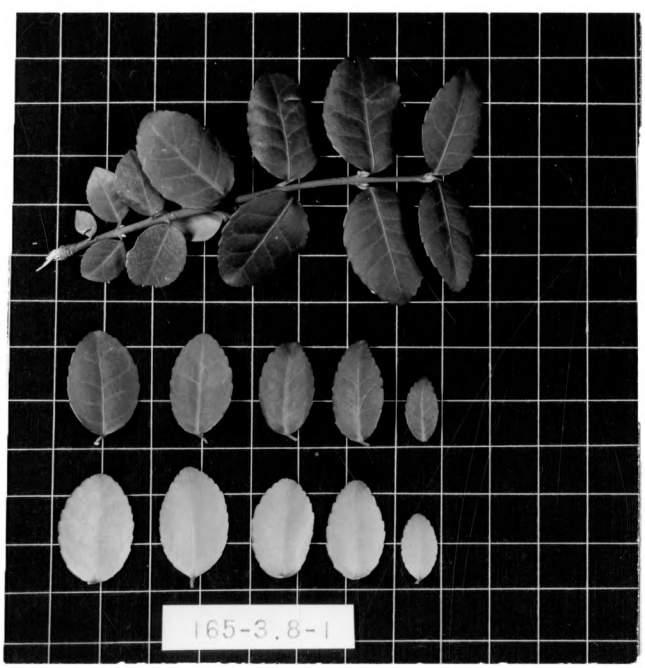


Fig. 3.

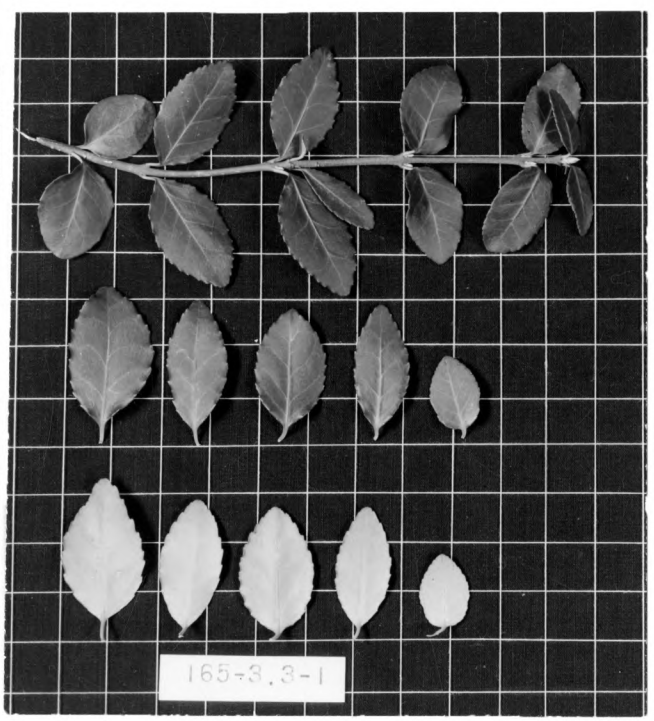


Fig. 4.

EXPLANATION OF PLATE IX

Fig. 1. *Euonymus fortunei radicans*

Fig. 2. *Euonymus fortunei radicans*

Fig. 3. *Euonymus japonicus* var. Boxleaf

PLATE IX

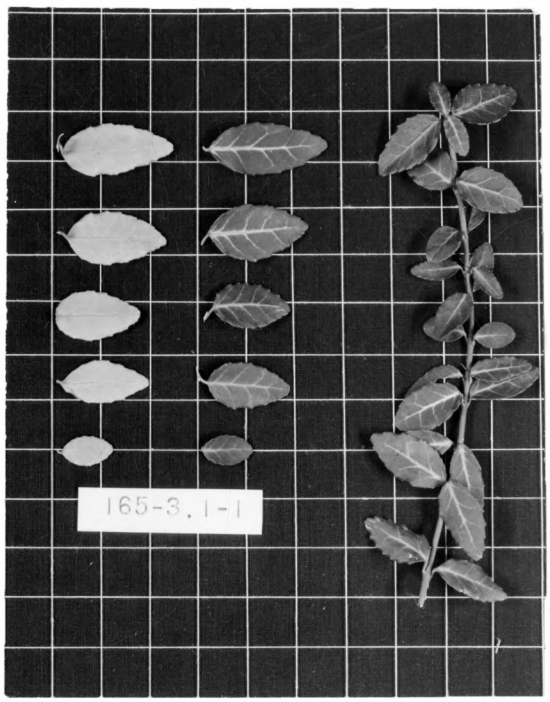


Fig. 1.

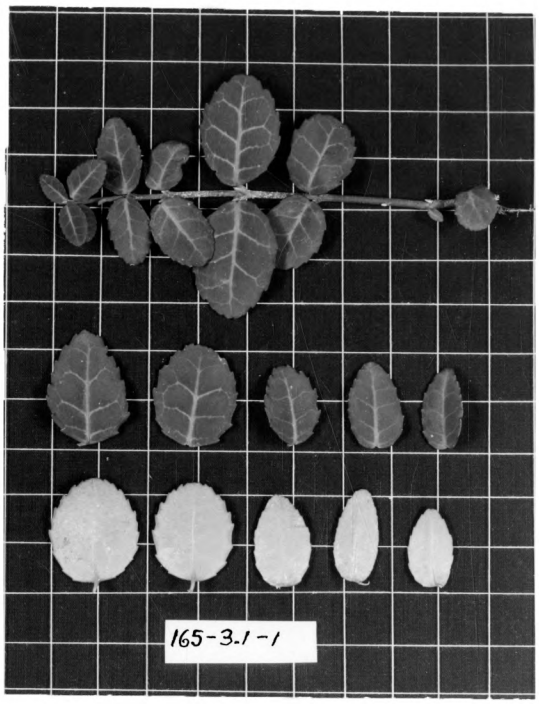


Fig. 2.

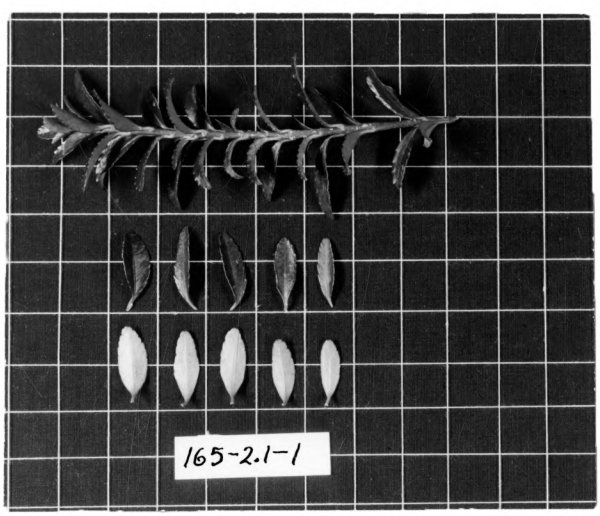
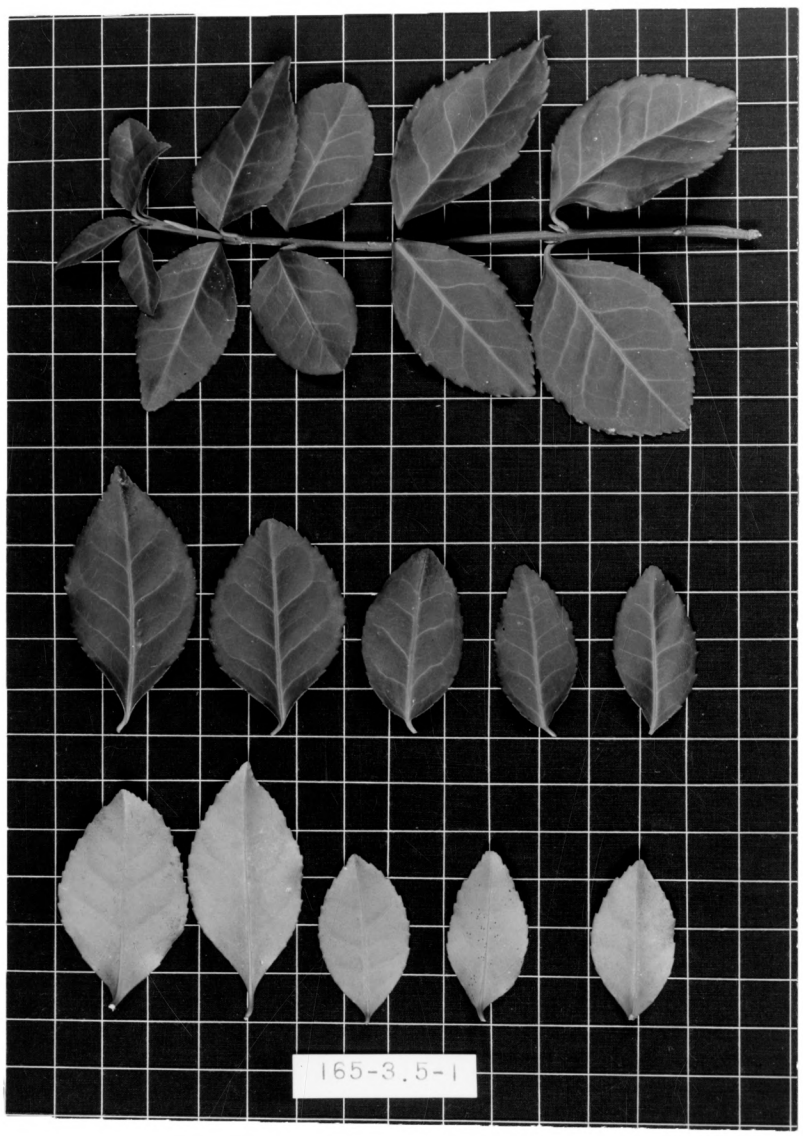


Fig. 3.

EXPLANATION OF PLATE X

Euonymus fortunei var. Purpleleaf

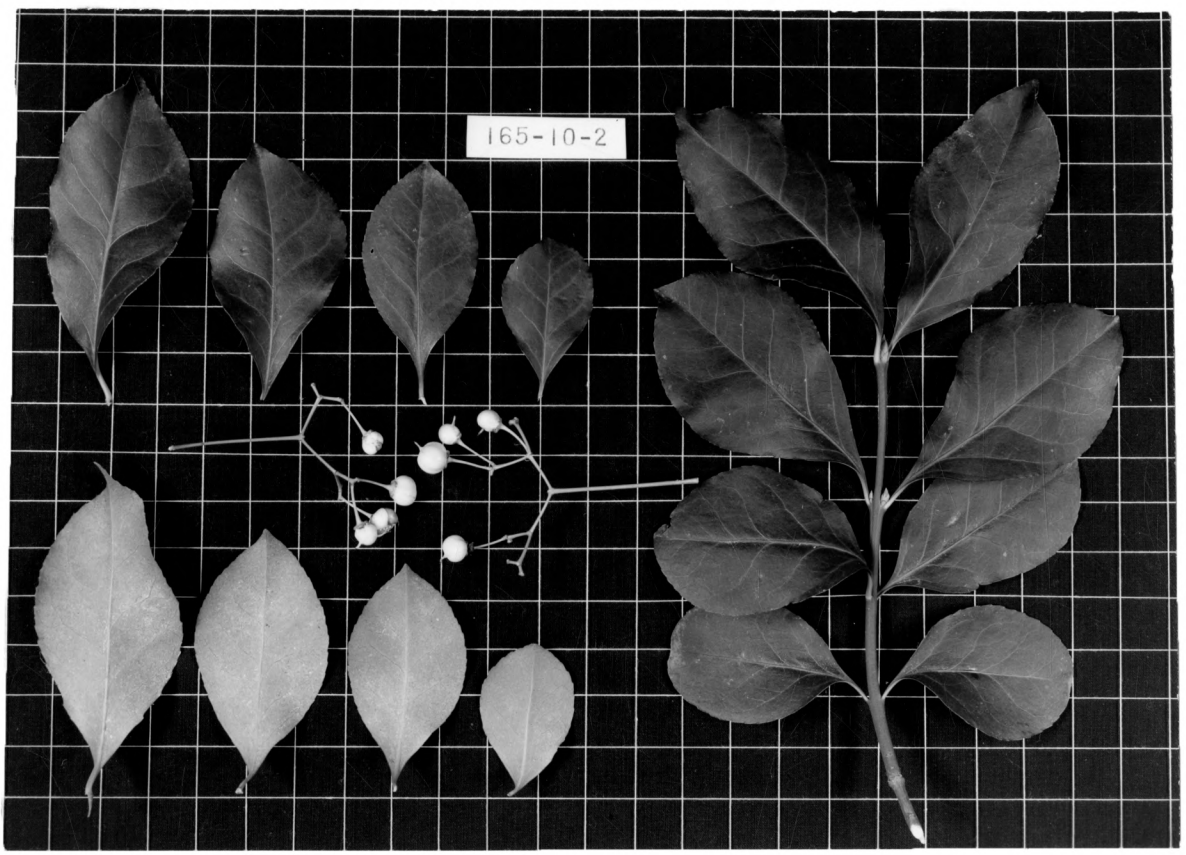
PLATE X



EXPLANATION OF PLATE XI

Euonymus kiautschovicus

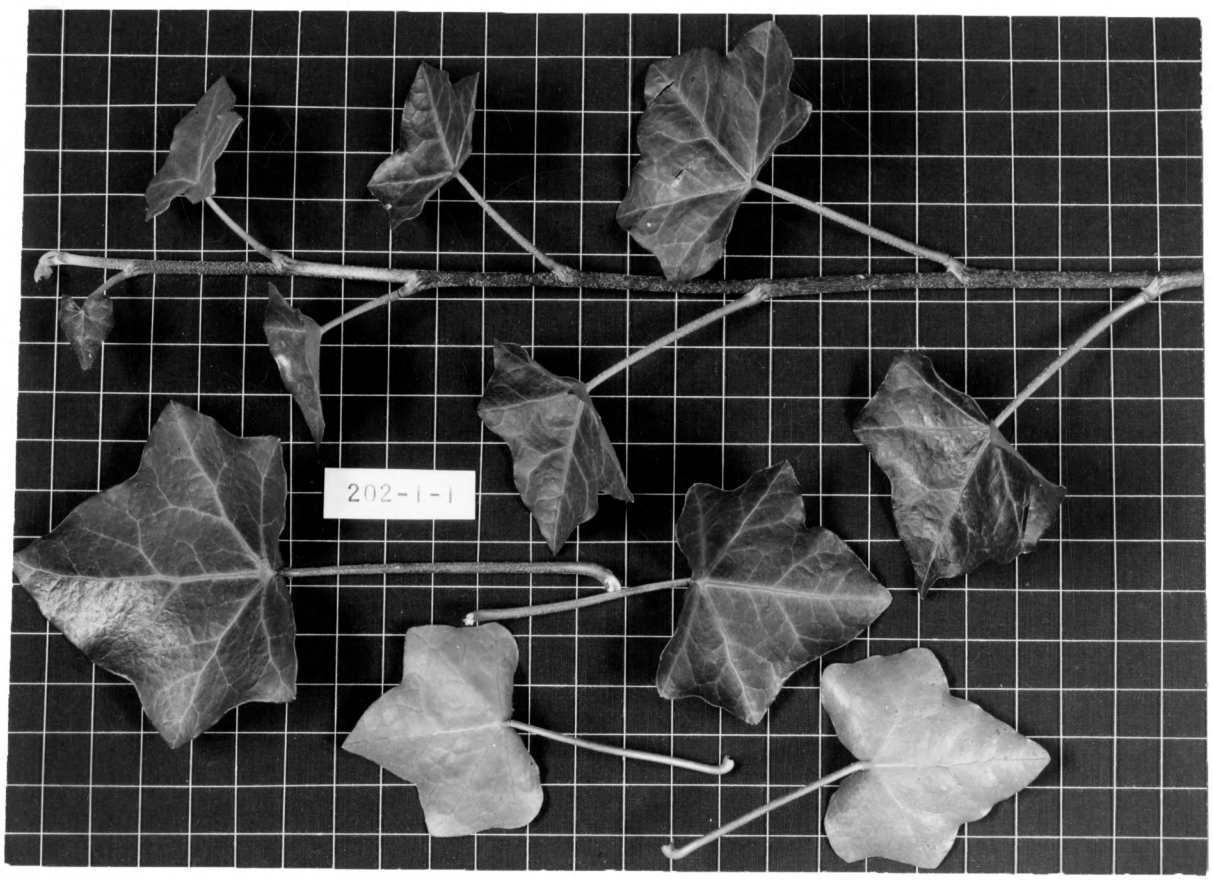
PLATE XI



EXPLANATION OF PLATE XII

Hedera helix

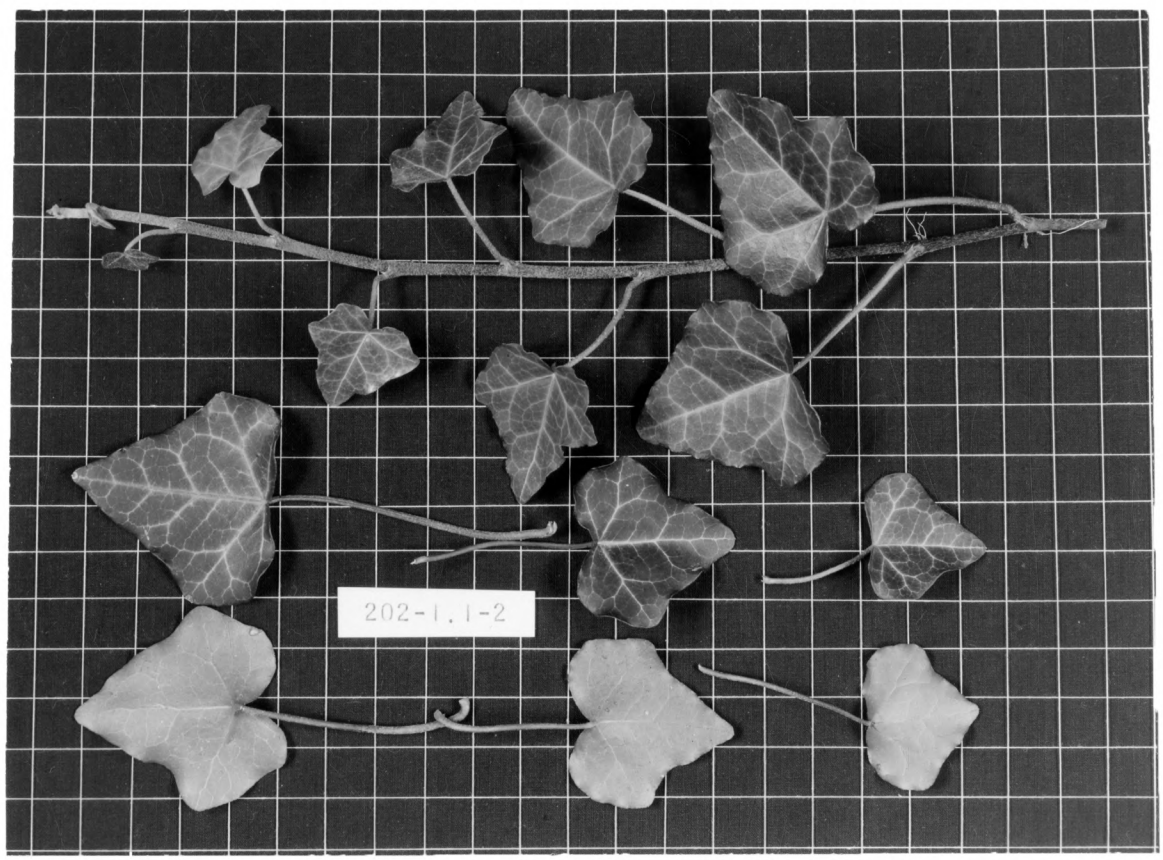
PLATE XII



EXPLANATION OF PLATE XIII

Hedera helix var. Baltic

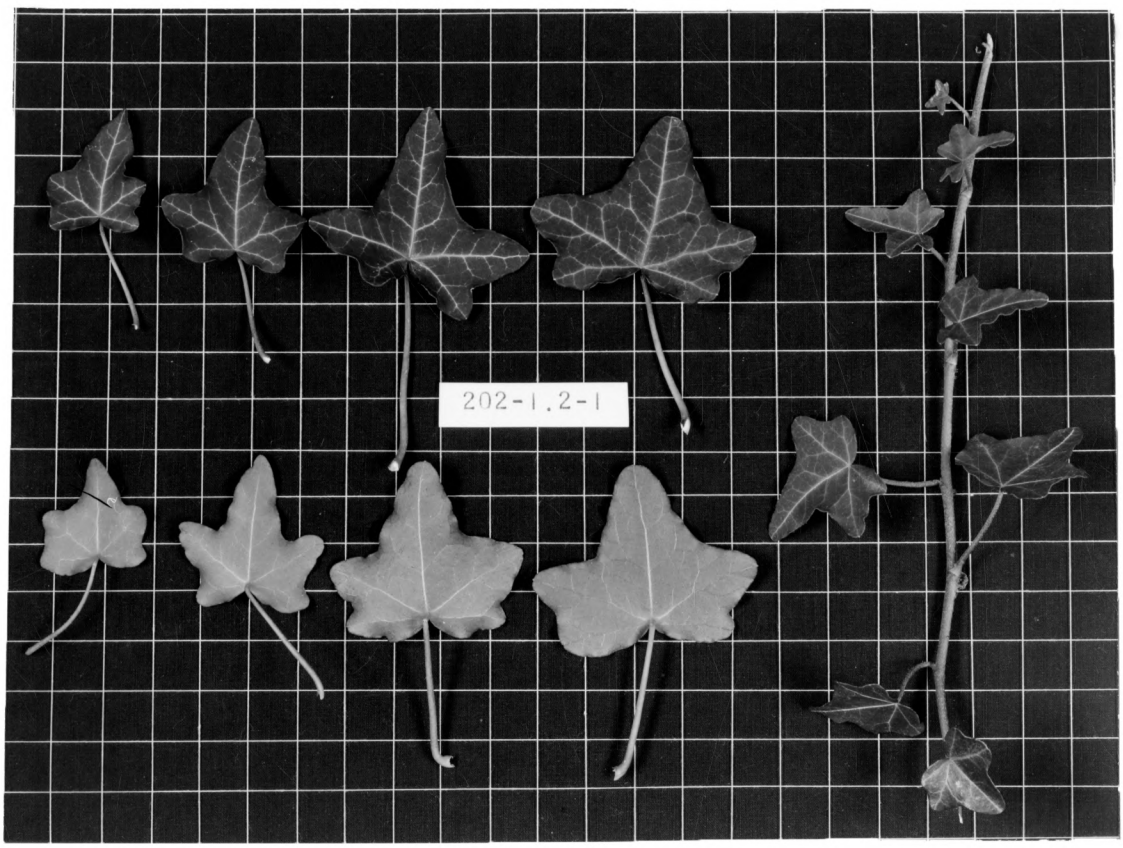
PLATE XIII



EXPLANATION OF PLATE XIV

Hedera helix var. Caenwood

PLATE XIV



EXPLANATION OF PLATE XV

Hypericum calycinum

PLATE XV

EXPLANATION OF PLATE XVI

Fig. 1. *Iberis sempervirens*

Fig. 2. *Pyracantha coccinea lalandi*

Fig. 3. *Pachistima canbyi*

Fig. 4. *Teucrium chamaedrys*

PLATE XVI

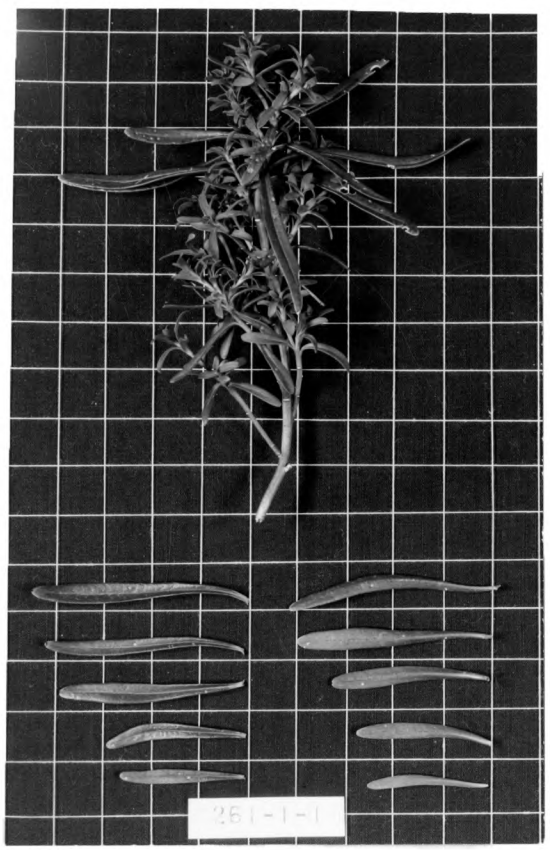


Fig. 1.

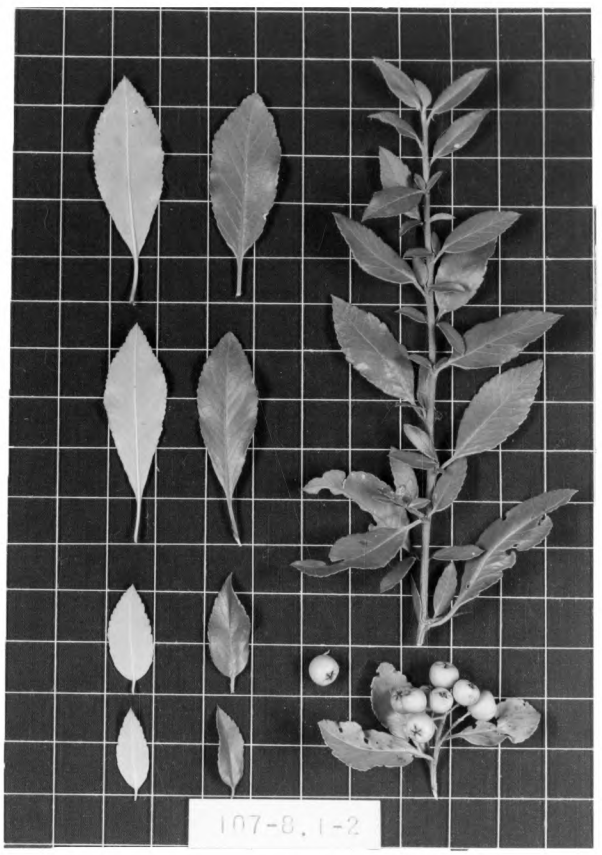


Fig. 2.

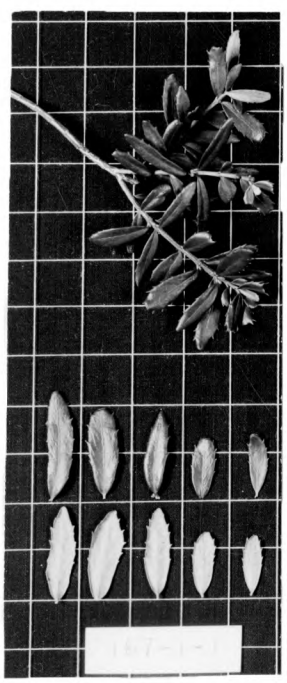


Fig. 3.

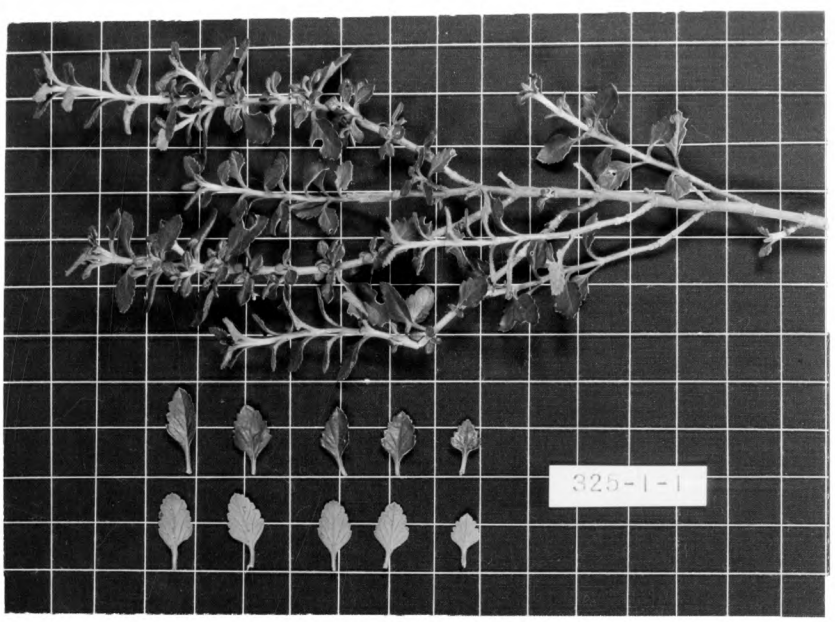
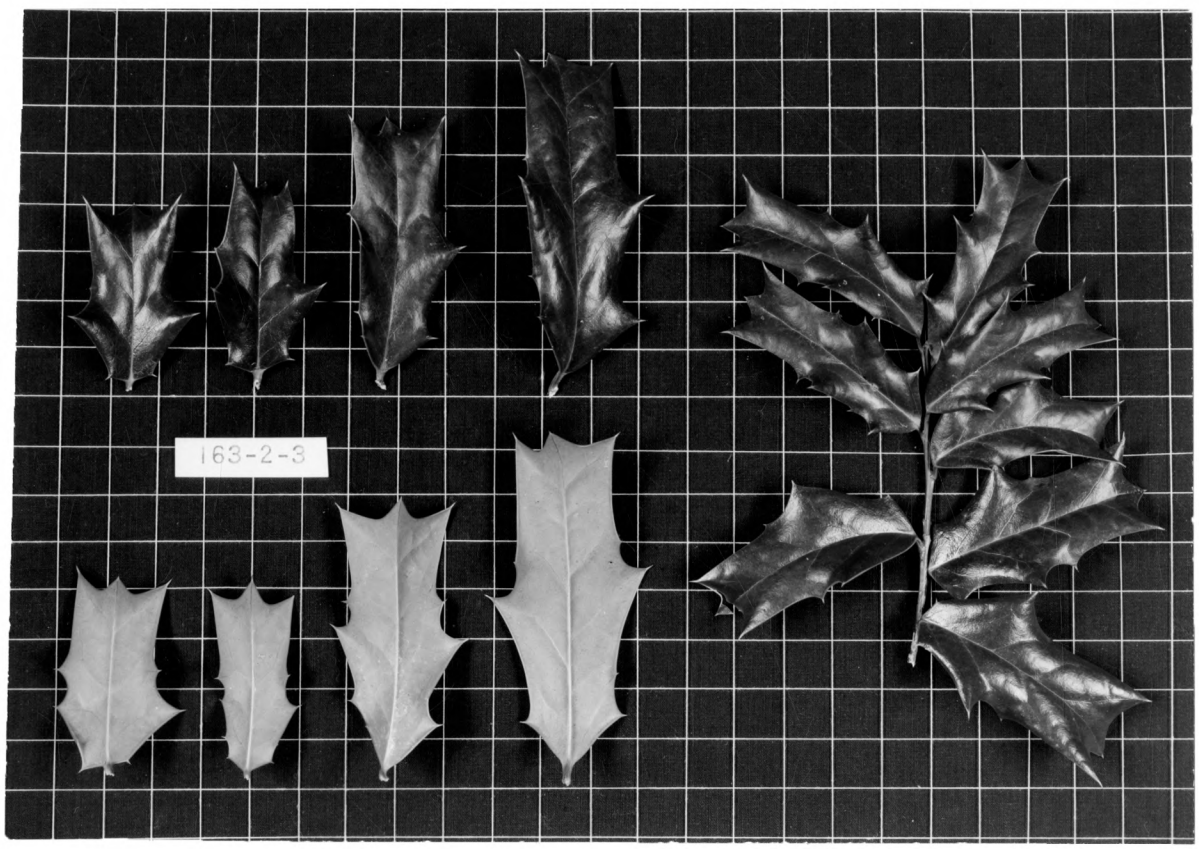


Fig. 4.

EXPLANATION OF PLATE XVII

Ilex cornuta

PLATE XVII



EXPLANATION OF PLATE XVIII

Fig. 1. *Ilex glabra*

Fig. 2. *Ilex crenata* var. Convexleaf

Fig. 3. *Ilex crenata*

PLATE XVIII

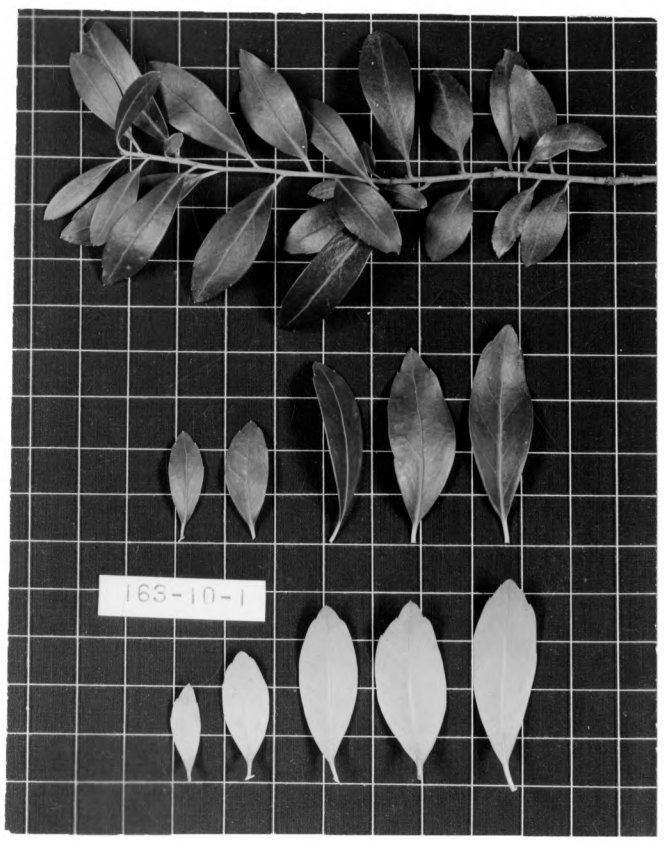


Fig. 1.

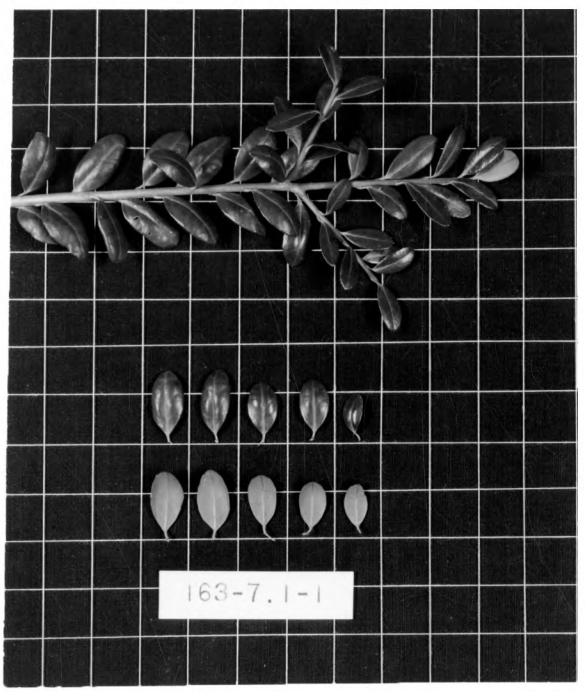


Fig. 2.

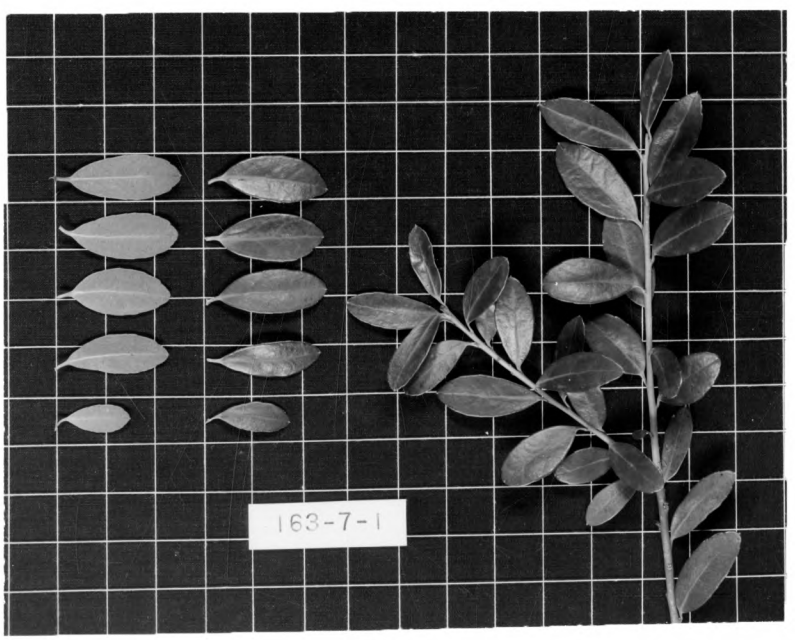
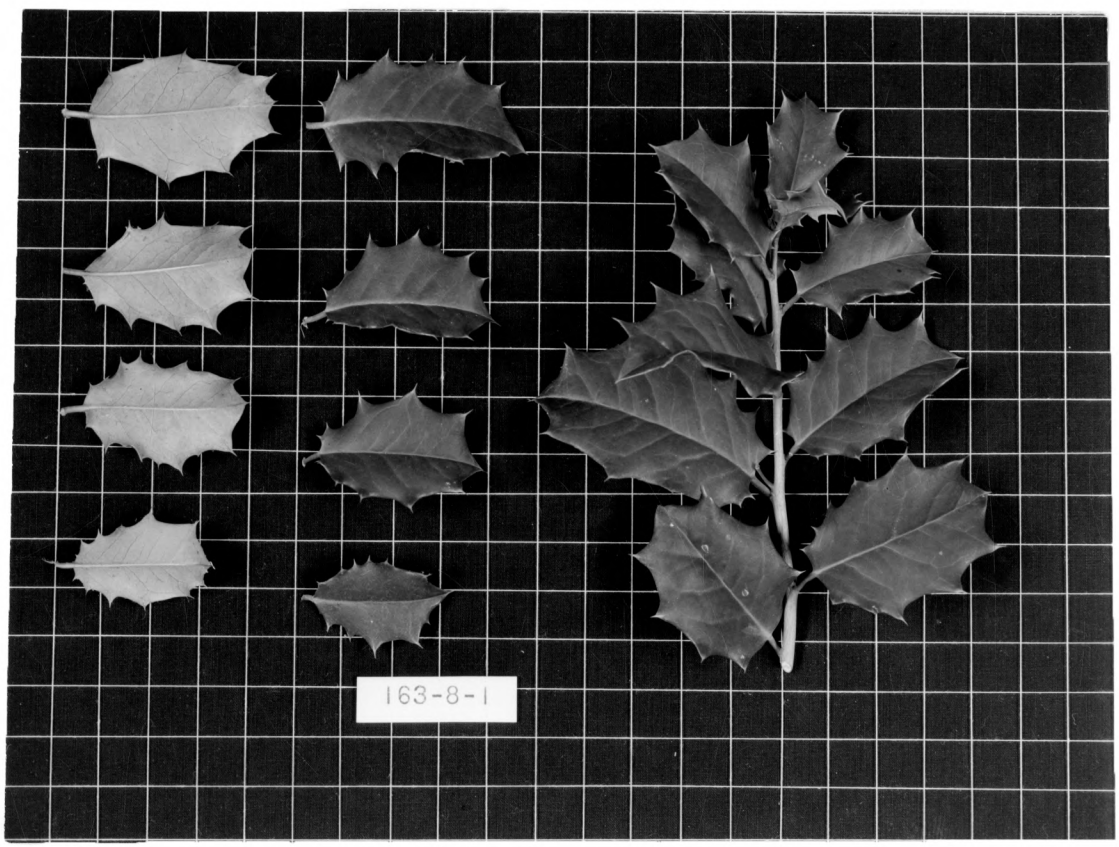


Fig. 3.

EXPLANATION OF PLATE XIX

Ilex opaca

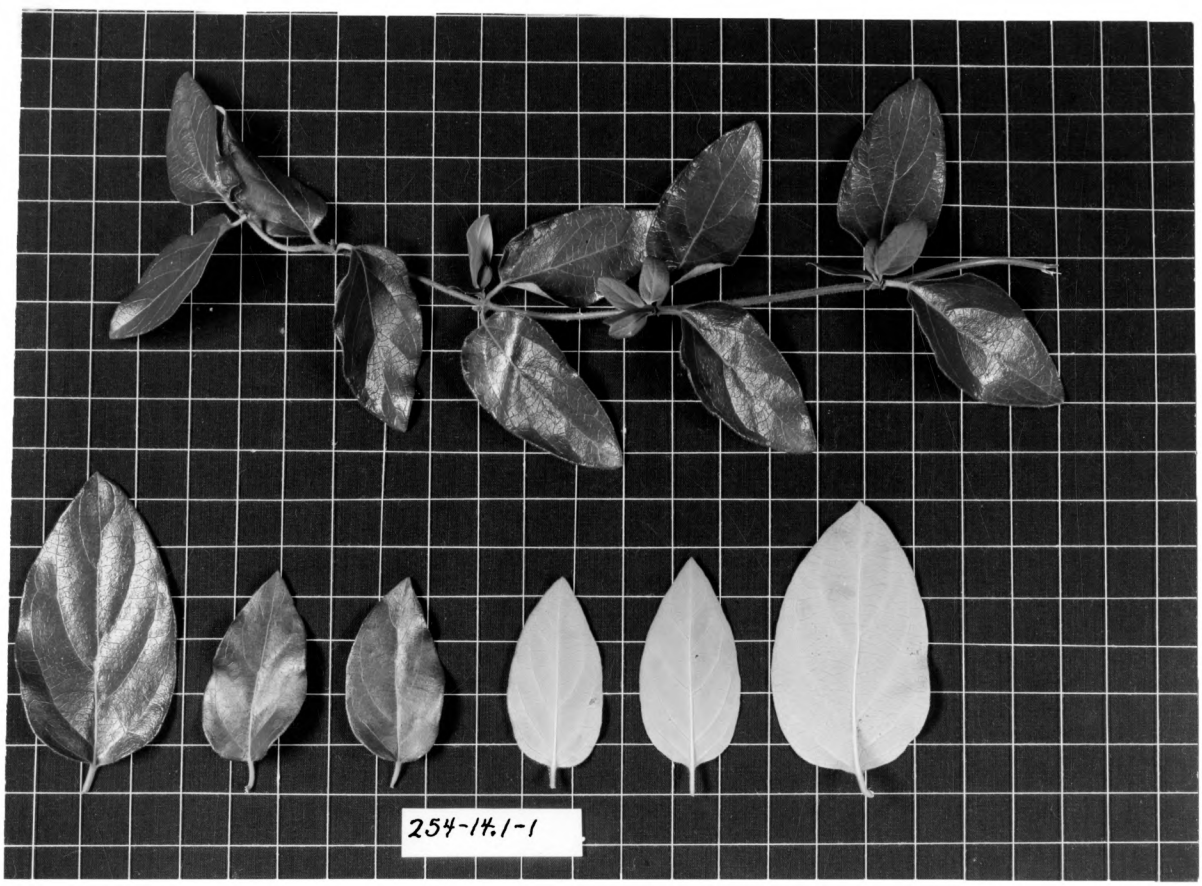
PLATE XIX



EXPLANATION OF PLATE XX

Lonicera japonica halliana

PLATE XX



EXPLANATION OF PLATE XXI

Fig. 1. Lonicera nitida

Fig. 2. Lonicera pileata

PLATE XXI

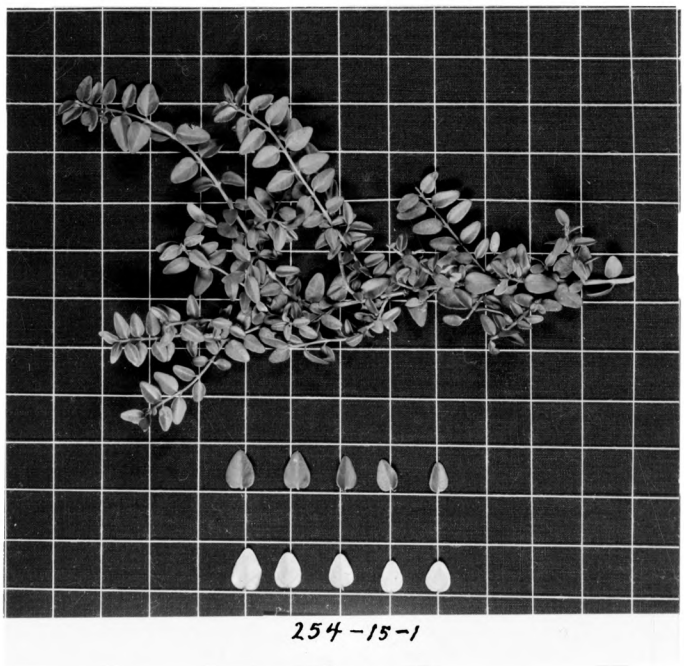


Fig. 1.

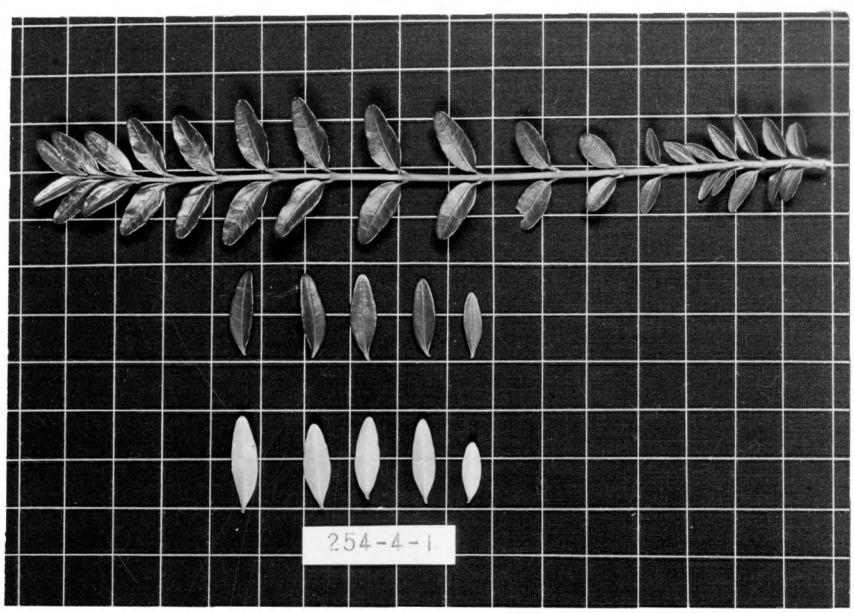


Fig. 2.

EXPLANATION OF PLATE XXII

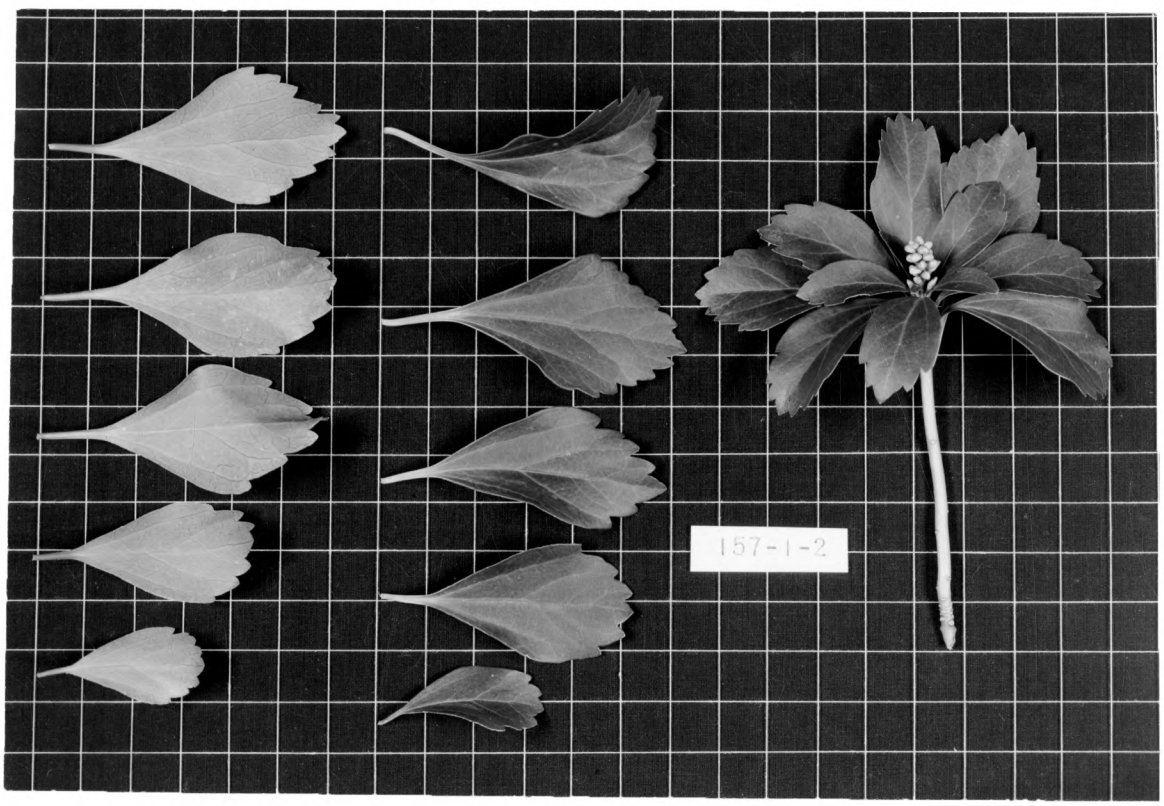
Mahonia aquifolium

PLATE XXII

EXPLANATION OF PLATE XXIII

Pachysandra terminalis

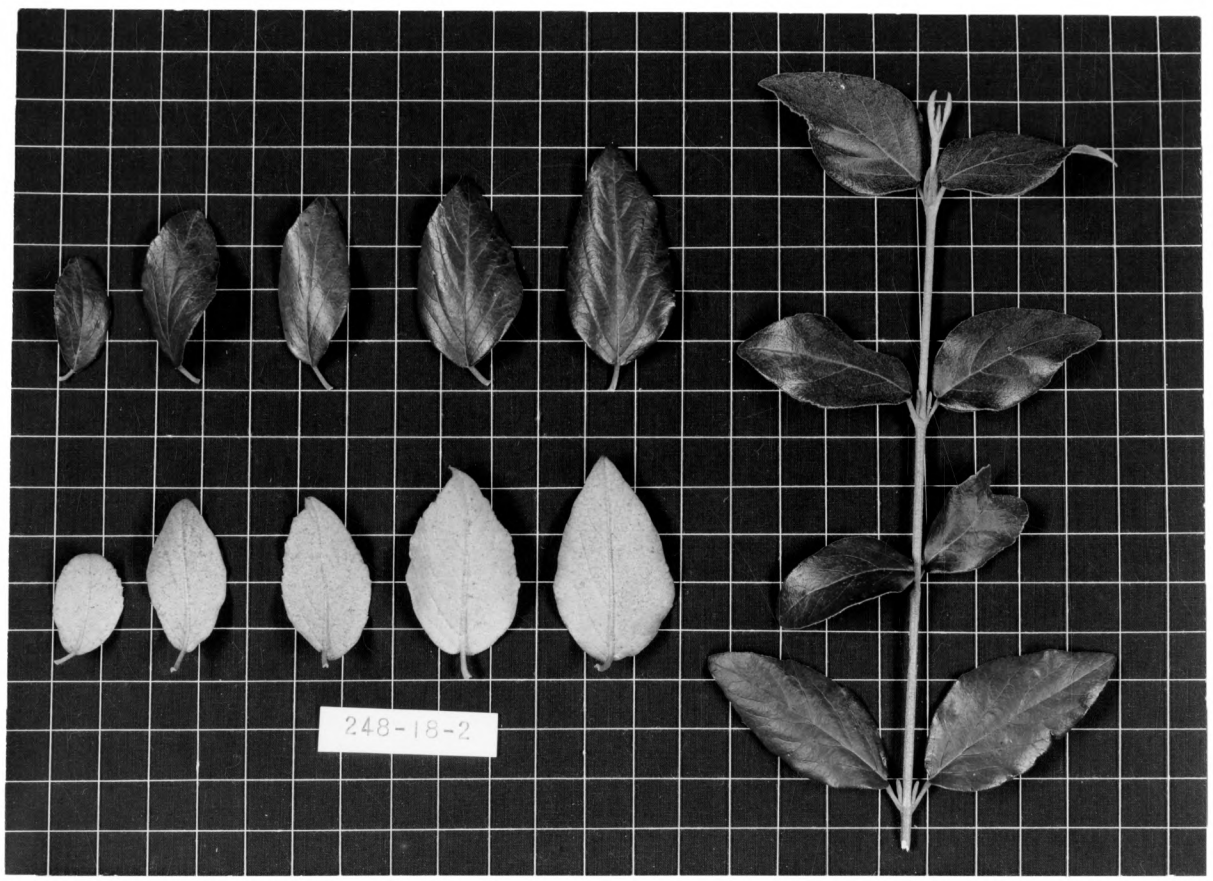
PLATE XXIII



EXPLANATION OF PLATE XXIV

Viburnum burkwoodi

PLATE XXIV



EXPLANATION OF PLATE XXV

Viburnum rhytidophyllum

PLATE XXV

EXPLANATION OF PLATE XXVI

Fig. 1. *Vinca minor* var. Bowles

Fig. 2. *Vinca minor*

PLATE XXVI

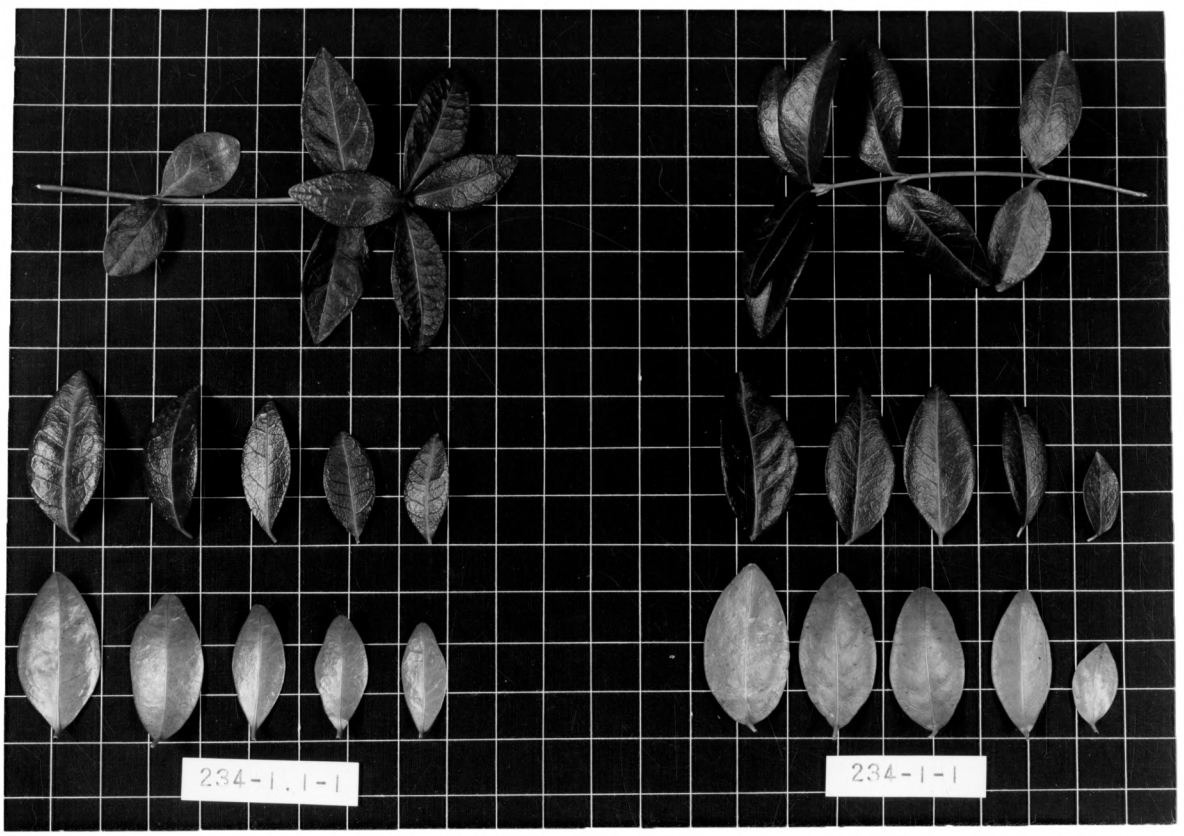


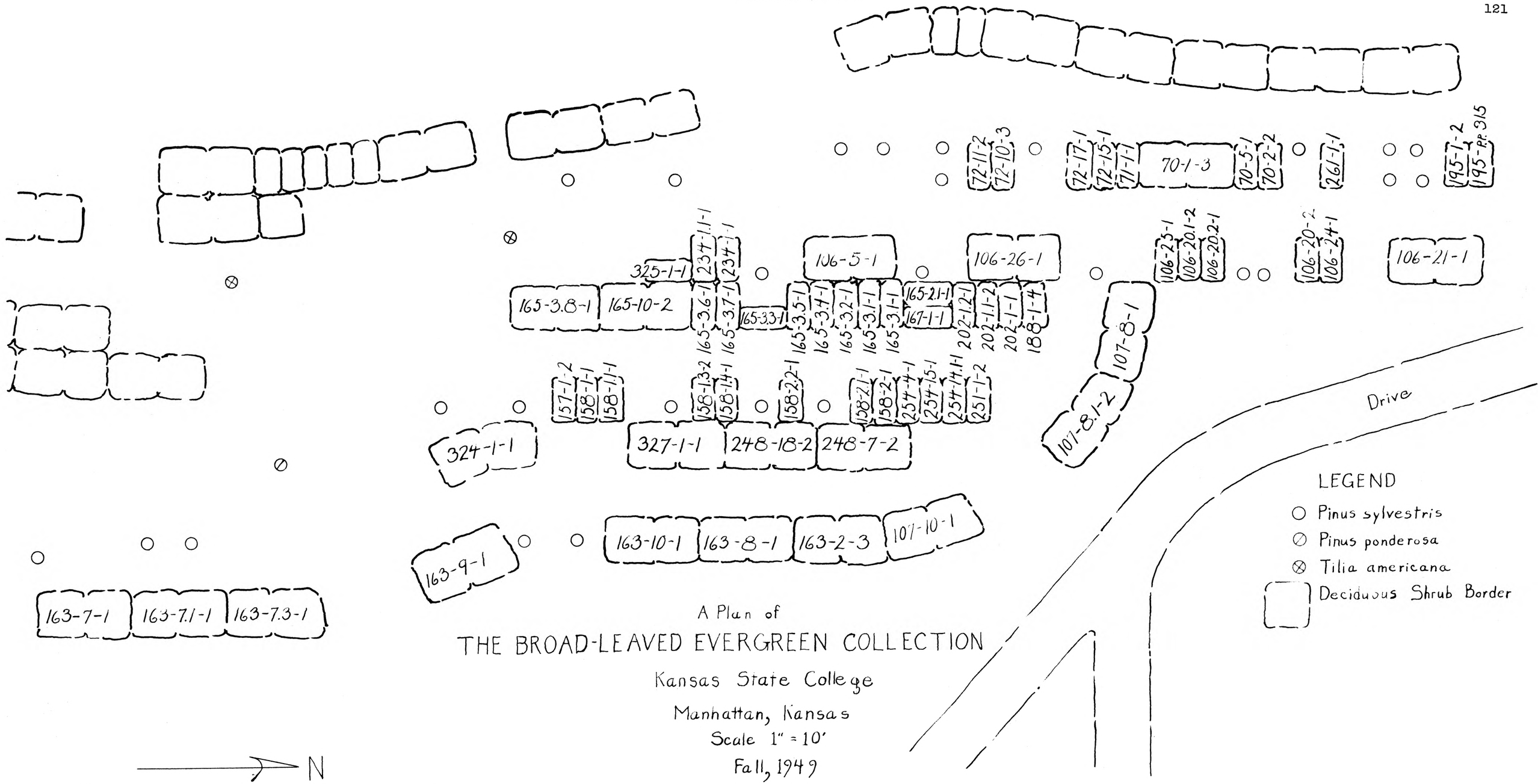
Fig. 1.

Fig. 2.

EXPLANATION OF PLATE XXVII

Hort. no.*	Plant name
251-1-2	Abelia grandiflora
72-10-3	Berberis julianae
72-11-2	Berberis sargentiana
72-17-1	Berberis triacanthophora
72-15-1	Berberis verruculosa
158-2-1	Buxus microphylla
158-2.1-1	Buxus microphylla japonica
158-2.2-1	Buxus microphylla koreana
158-1-1	Buxus sempervirens
158-1.1-1	Buxus sempervirens var. Handsworth
158-1.3-2	Buxus sempervirens var. Truedwarf
158-1.4-1	Buxus sempervirens var. Weller
106-21-1	Cotoneaster apiculata
106-24-1	Cotoneaster francheti
106-20-2	Cotoneaster horizontalis
106-20.2-1	Cotoneaster horizontalis perpusilla
106-20.1-2	Cotoneaster horizontalis wilsoni
106-25-1	Cotoneaster microphylla
106-26-1	Cotoneaster rotundifolia
106-5-1	Cotoneaster salicifolia
195-1-2	Daphne cneorum
195-pp315	Daphne Somerset
165-3.2-1	Euonymus fortunei var. Baby
165-3.3-1	Euonymus fortunei var. Glossy
165-3.4-1	Euonymus fortunei var. Kew
165-3.5-1	Euonymus fortunei var. Purpleleaf
165-3.1-1	Euonymus fortunei radicans
165-3.6-1	Euonymus fortunei var. Silveredge
165-3.8-1	Euonymus fortunei var. Upright
165-3.7-1	Euonymus fortunei vegetus
165-2.1-1	Euonymus japonicus var. Boxleaf
165-10-2	Euonymus kiautschovicus
202-1-1	Hedera helix
202-1.1-2	Hedera helix var. Baltic
202-1.2-1	Hedera helix var. Caenwood
188-1-4	Hypericum calycinum
261-1-1	Iberis sempervirens
163-2-3	Ilex cornuta
163-7-1	Ilex crenata
163-7.1-1	Ilex crenata var. Convexleaf
163-7.3-1	Ilex crenata var. Littleleaf
163-10-1	Ilex glabra
163-8-1	Ilex opaca
163-9-1	Ilex pernyi
254-14.1-1	Lonicera japonica halliana
254-15-1	Lonicera nitida
254-4-1	Lonicera pileata
71-1-1	Mahaberberis neuberti
70-1-3	Mahonia aquifolium
70-5-1	Mahonia nerrosa
70-2-2	Mahonia repens
167-1-1	Pachistima canbyi
157-1-2	Pachysandra terminalis
107-8-1	Pyracantha coccinea
107-8.1-2	Pyracantha coccinea lalandi
107-10-1	Pyracantha crenato-serrata
324-1-1	Stranvaesia davidiana
325-1-1	Teucrium chamaedrys
327-1-1	Vauquelinia californica
248-18-2	Viburnum burkwoodi
248-7-2	Viburnum rhytidophyllum
234-1-1	Vinca minor
234-1.1-1	Vinca minor var. Bowles

* Each plant in the deciduous Shrub Collection and Broad-leaved Evergreen Collection at Kansas State College, Manhattan, Kansas is given a horticultural number (Hort. no.) for convenience in labeling and record keeping.



A Plan of

THE BROAD-LEAVED EVERGREEN COLLECTION

Kansas State College

Manhattan, Kansas

Scale 1" = 10'

Fall, 1949

M.B.M.

ACKNOWLEDGMENT

The author is indebted to his major instructor, Professor L. R. Quinlan, for his helpful suggestions in outlining the problem, his constructive criticism and his help in obtaining much of the plant material used; to Professor R. A. Keen for his help in the propagation of some of the plants used and his suggestions in photographing the plants; to Dr. W. F. Pickett, Head of the Department of Horticulture, for general suggestions; to R. J. Barnett, Professor of Horticulture, emeritus, for editorial criticism.

LITERATURE CITED

(1) Chadwick, L. C.
Key to the hardier broadleaf evergreens (mimo.). Department of Horticulture, Ohio State University. February, 1943.

(2) Chadwick, L. C.
Selection of broad-leaved evergreens. Chicago. American Nurseryman. Reprint from American Nurseryman. December, 1941.

(3) Free, Montague.
All about house plants. New York. American Garden Guild. 329 p. 1946.

(4) Hottes, Alfred Carl.
The book of shrubs, ed. 4 rev. New York. A. T. De LaMare. 438 p. 1942.

(5) Kelsey, Harlan P., and William A. Dayton, ed.
Standardized plant names, ed. 2. Harrisburg. J. Horace McFarland. 675 p. 1942.

(6) Knerr, Margaret M.
A taxonomic study of shrubs in Kansas. Unpublished thesis. Kansas State College of Agriculture and Applied Science. Manhattan, Kansas. 136 p. 1934.

(7) Manning, J. Woodward.
Manning's plant buyers index, ed 4. Duxbury, Mass. J. Woodward Manning. 1939.

(8) Quinlan, L. R.
Shrub collection records. Unpublished material. Department of Horticulture, Kansas State College of Agriculture and Applied Science, Manhattan, Kansas.

(9) Rehder, Alfred.
Manual of cultivated trees and shrubs, ed. 4. New York. Macmillan. 996 p. 1947.

(10) Wyman, Donald.
The arboretums and botanical gardens of North America. Reprint from Chronica Botanica. 10: 395-495. 1947.