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Handbook of Hollies

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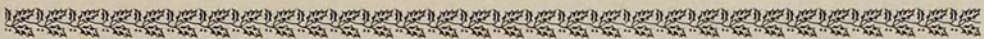
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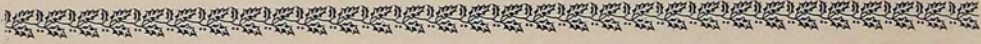
HANDBOOK OF HOLLIES

HARRY WILLIAM DENGLER

Guest Editor

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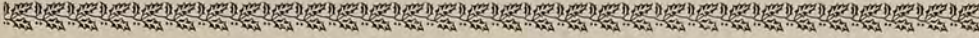
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The Editorial Staff
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AMERICAN HORTICULTURAL SOCIETY
wish to record
their appreciation
to the members of the
HOLLY SOCIETY OF AMERICA, INC.
for making it possible
to produce the
HANDBOOK OF HOLLIES



PREFACE



The newly organized and incorporated Holly Society of America published its first bulletin in 1947—it was Gustaf E. Malmberg's *Comments On The Holly Species*. This was a cooperative venture with the Wildflower Preservation Society and was issued as a reprint from that organization's *Wildflower Magazine*. To a young and struggling association, with little funds and less experience, this modest twelve-page booklet was a noteworthy and prideful achievement.

Prior to this time, there was extremely little interest in the hollies except that shown by the English holly orchardists in the Pacific Northwest, by small numbers of conservationists, foresters, and garden club members concerned with the destructive practices of gathering Christmas greenery from native trees in Eastern and Southern United States and by an even smaller group of nurserymen, ornamental horticulturists and directors of arboretums who early foresaw the commercial and ornamental possibilities inherent in the hollies.

Since then, the intervening years have seen a phenomenal, an almost unbelievable and an ever-increasing interest in these plants. Aside from their values as Christmas decoratives—whether from orchards, native trees or from ornamental plants—the rich and wide variety of hollies available and their uses for hedges, barriers, screens, specimen and accent plants, ground covers, foundation and background plantings, shade and boulevard trees, flower arrangements, wildlife and songbird food and cover plants, for topiary work and even bonsai—all these make the attention now given the hollies readily quite understandable.

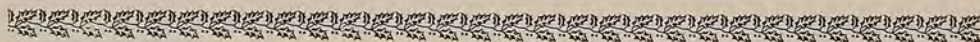
The large number of native and introduced hollies, and those of foreign countries yet to be admitted to the United States, with their correct names, varieties, hybrids, descriptions, culture, uses and potentialities, create a puzzling and a bewildering situation to those who wish to grow or to know more about them. This is especially irritating to home owners, landscape architects, horticulturists, students, nurserymen, and prospective orchardists where reference facilities are lacking or not readily available. Now, ten years after its first cooperative publication, the Holly Society of America, Incorporated, is happy and most grateful to avail itself of the facilities of the American Horticultural Society in preparing this *Handbook of Hollies* which may be useful to those interested in this fascinating group of plants and which in some small way may make another contribution to both organizations' interest in the advancement of horticulture.

The publication of this handbook would have been most difficult to complete without the splendid cooperation of a large number of helpful individuals. A listing of these would make impressive reading but limitations of space make this impossible. The appreciation of the guest editor is therefore expressed to all those who, in one way or another, assisted in the preparation of this work. Sincere apologies are, likewise, hereby expressed to all those who were inconvenienced by letters or by personal conversations in the search for facts and the constant need for checking on the correctness of details—no matter how trivial they might now appear in print. The enormity of this and the complexities involved in the preparation of this handbook are ones that shall neither soon nor easily be forgotten.

There are those, however, to whom special attention must be called. Firstly, to all the contributing writers, very sincere and most heartfelt thanks. With no thought of any possible remuneration they have freely given of their

time, their talents, their knowledge and their experience to make this handbook possible. May the satisfaction these writers receive from their contributions to horticulture be ample compensation for their labors. Deep appreciation is also extended to W. Dallimore, late keeper of the Museum, Royal Botanic Gardens, Kew, England, for the inspiration provided by his *Holly, Yew and Box* and personal correspondence over the past six years; to Henry Cork, dealer in second-hand books, London, England, for his help in locating needed references on the folklore and history of the hollies; to Dr. John C. Wister, Director, Arthur Hoyt Scott Horticultural Foundation, Swarthmore, Pennsylvania, and his committee of Professor Robert B. Clark and Dr. Charles H. Connors, Rutgers University, New Brunswick, New Jersey, for their *Preliminary Holly Check List*, Bulletin No. 6 of the Holly Society of America, Inc., which immeasurably helped in locating sources of descriptions of many of the English and American hollies and without which the preparation of this handbook would not have been undertaken; to Henry T. Skinner, Gabriel Edwin, contributors Francis de Vos, and Wm. F. Kosar, all of the United States National Arboretum, Washington, D. C., for their valued suggestions and facilities in providing the majority of the excellent photographs of holly specimens; to M. M. Fulton, trustee and former historian, Holly Society of America, Inc., Harrisburg, Pennsylvania, for the use of his reproductions of the article on the English hollies by Tom Moore which appeared originally in the *Gardeners' Chronicle*, London, England, 1874, 1875, and 1876; to contributor Shiu-ying Hu, Flora of China Project, Arnold Arboretum, Harvard University, Jamaica Plain, Massachusetts, for her line drawings of the American and Oriental hollies from herbarium and fresh specimens and of the English hollies from the pictures included in Tom Moore's articles mentioned above; to S. B. Detwiler, former chief, the old Hillculture Section, Soil Conservation Service, Washington, D. C., assistant chief G. B. Posey and their fellow co-workers F. L. O'Rourke, C. S. Britt, Wilmer W. Steiner, contributor Jackson M. Batchelor, and others, for their foresight in the late 1930's as to the commercial potentialities of the hollies, their compilation of a valued bibliography of holly references and for their complete collection of most useful field data and literary materials; to Mr. C. R. Wolf, Millville, New Jersey, President, Holly Society of America, Inc., the trustees and members of the Society, for their encouragement in the undertaking of this work and, likewise, that of Alfred Teufel, Portland, Oregon, President, Oregon Holly Growers Association; to the officers and directors of the American Horticultural Society, Washington, D. C., for their confidence in entrusting this work to the guest editor and the contributing writers and in making the publication of this handbook possible; to Mrs. Jayne Silva for her splendid and cheerful secretarial abilities; to Miss May M. Blaine, formerly secretary to David Fairchild, for her technical knowledge of botanical terms and for her painstaking correction of our errors in grammar, spelling and punctuation; to B. Y. Morrison, editor, *The National Horticultural Magazine*, for his completeness and accuracy in reading the handbook throughout its many stages and for his valued suggestions gleaned through his many years of experience in the field of horticulture; and, lastly and especially, my deepest appreciation to James R. Harlow, managing editor, *The National Horticultural Magazine*, whose contributions can best be summed up by saying that without his special and inclusive talents this *Handbook of Hollies* could not possibly have been completed.

HARRY WILLIAM DENGLER,
Holly Hollow, Hyattsville, Maryland



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HANDBOOK OF HOLLIES

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The National Horticultural Magazine

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Original papers increasing the historical, varietal, and cultural knowledges of plant materials of economic and aesthetic importance are most welcomed and will be published as promptly as possible. Material of lasting interest appearing in related journals will be reprinted as available. Publications received for the Library will be reviewed and made available to members after publication of the reviews. These books are designated "Library" following the prices in the book reviews. Reviews of private collections will also be accepted and published. These books, however, are not available for loan to members of the Society.

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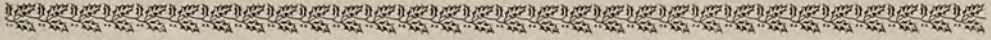
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Ilex cornuta 'Shiu-ying'—a selection of the Chinese holly.

AN INTRODUCTION TO THE HOLLIES



Folklore and Legends

HARRY WILLIAM DENGLER

There are few groups of trees and shrubs which possess such a fascinating and diverse background as do those plants which belong to the genus *Ilex*, or, as it is more commonly called, holly. Since the days of the Romans, the Greeks, the Druids, and the Indians of the Americas, holly has played an exciting part in medicine and magic, science and superstition, and legend and lore.

Much of our present-day folklore of medicines, superstitions, and Christmas customs comes from the practices and beliefs of the early Britons. These can be traced further to the Druids, an order of priests, teachers, philosophers and astronomers of ancient Britain and Gaul, who lived some two thousand years ago. They believed the sun never deserted the holly tree, and to them it was a sacred plant. It was their custom to decorate the interiors of their dwelling-places with evergreens in which the woodland spirits might take refuge from the rigors of winter.

Holly has long been symbolic of Christmas. The name is believed to be a corruption of the word "holy," although many historians differ on the point. William Turner, the earliest English writer on plants, in his herbal of 1568, calls the tree "Holy" and "Holy-tree." In parts of Italy, sprigs of holly were used in decorating the mangers in commemoration of the Infant Saviour. In Germany, holly is called Christdorn—the thorn woven into the crown of crucifixion. Legend has it that the berries of holly were once yellow, but, being stained from the wounds of Christ, have ever since remained red. Among the old Pennsylvania Dutch, the holly berries represented the blood of Christ issuing from His wounds, and the white flowers of the holly tree were symbolic of the purity in which He was conceived.

Stowe, in his *Survey of London*, published in 1598, wrote that in his time, every man's house, the parish churches, the corners of the streets and the market places were decorated with holly at Christmas. Henry Mayhew estimated that the amount of holly sold in London, in 1851, was 250,000 bunches.

All the peoples of the great nations of antiquity—the Assyrians, Egyptians, Persians, Greeks and Romans—were accustomed to decorating their altars, their homes, and themselves with flowers, and to combining leaves and blossoms into wreaths and garlands. The compositions of these floral decorations possessed deep significance and the plants involved had symbolical meaning, being

varied according to the social standing of the wearer and the seasons of the year. Wreaths of holly were sent the Roman newlyweds as tokens of good wishes and congratulations.

The symbolism or language of flowers is almost as aged as that of speech itself. The ancient Chinese, the Assyrian, and the Egyptian races seemed to possess a simple but complete way of transmitting ideas and sentiments by means of floral arrangements. Each blossom and plant had its meaning, and these were ingeniously selected and composed to convey the message at hand—a practice much favored, needless to add, by suitors in pressing their romances with their ladies fair. Floral symbolism reached its zenith with the classic Greeks. In the old floral vocabularies, mistletoe implied the ability to overcome difficulties while holly stood for foresight—a bouquet of the two carried this message: "By foresight you will surmount your difficulties."

Most peoples of antiquity were accustomed to celebrating an annual observance when the usual curbs on propriety and sobriety were considerably relaxed. During such occasions, the populace exhibited much merriment and indulged in passions that never would be tolerated at other periods of the year. These eruptions of human energy, often plunging into mad orgies of excesses, took place most commonly towards the end of the year, and were usually associated with the beginning or ending of one or another agricultural season of sowing or harvesting.

Of all such festivals, none is perhaps more widely known than that of the Saturnalia. This event took place in December, the last month of the Roman year, which occurred about the time of our present Christmas and commemorated the good King Saturn, the god of Sowing and Husbandry. It was during Saturn's reign that no war was rife, the fields and flocks produced abundantly, no men were bound in slavery, and the world was a most pleasurable place in which to live.

During the great festival of the Saturnalia, it was customary among the Romans to send holly boughs along with gifts to their friends as tokens of their good wishes and emblems of the esteem in which they held them. It is from this custom that historians consider

holly to be symbolical of good-will and the reason we decorate our homes and churches with this colorful greenery during the Christmas holidays.

The holly, like other thorny plants, was believed in early Europe to repel all evil spirits. In its name, the witches perceived the word "holy" and its spiny foliage and blood-red berries were suggestive of Christian associations. Pliny, the Elder, wrote that a holly tree planted about the house served as a countercharm and kept away all evil spirits or enchantments and defended the house from lightning. Branches of holly were hung about the homes and stables, and cattle were said to thrive if a piece of holly was hung where it could be seen on Christmas Day.

Canes of holly were formerly highly prized in early England. Fast-growing, young shoots of holly made excellent walking sticks and were carried by maidens and matrons alike as protection against mad dogs, vicious beasts and other perils of that day. A staff of holly was considered so effective that when thrown at any animal, even if it did not find its mark, would so affect the beast as to cause him to lie down beside it.

Henry Phillips, in 1823, however, deemed quite credulous the old customs of his forefathers, who trusted to branches of holly for their defense against witchcraft. "But this precaution," he wrote, "has become unnecessary, since old ladies have lost their charming powers, and the spells of the youthful fair are too agreeable to be driven from us by a rod of holly."

Many superstitions existed about bringing in the holly for Christmas. In Wales, if it was brought in before Christmas Eve, it was sure to cause family quarrels throughout the year. In parts of Germany and England, the prickly varieties were known as He-Hollies, while the smooth-leaved kinds were called She-Hollies. The type of holly brought into the household determined who was to dominate the home during the year. If the holly was smooth, the wife was in command; if the holly was prickly, the husband governed for the year. This latter custom was brought into America and was known until the turn of the century among the Ulster Scots of Pennsylvania. Here, the belief existed, too, that if the holly was brought into the house during good weather, the

wife would master the household for the ensuing year; if during rough weather, the husband would be the ruler.

Superstitions, too, existed regarding the removal of the holly following Christmas. In parts of England, it was decidedly unlucky to leave holly up after New Year's Eve, or Twelfth Night, lest the maidens of the household be visited by a ghost for each leaf in the decorations. Others said that a misfortune for each leaf would befall those unheeding this rule. The holly could not merely be thrown away but had to be burnt else the ill-luck would continue as though the holly had not been removed. Elsewhere in England, holly had to be taken down before Shrove Tuesday and burnt on the same fire on which the pancakes were to be baked; misfortune was certain to befall anyone so unwise as to not heed this belief.

In some parts of England, the holly could not be burnt, but had to be saved until the following year to protect the house from lightning. In cottages with leaded-pane windows, it was essential that one pane of each window include a sprig of variegated holly in the holiday decorations. If the Christmas decorations were thrown away, a death in the family would occur before next Christmas. However, a sprig of holly from church decorations was considered quite valuable and insured its owner a year of good luck.

Among the early Anglicans of America, holly was kept in their churches until Good Friday to prevent the Christmas festivals from being forgotten. Berries from the Christmas holly were kept for good luck during the year, in Louisiana.

Among the Chinese, the Oriental holly, *Ilex chinensis*, was much used for decorating temple-courts and large halls during their New Year festivals in February.

Legend has it in Brittany, that when Christ was bearing His cross a small bird attempted to relieve His sufferings by plucking thorns from His brow. The bird's breast became stained with blood and became known forever afterwards as Robin Redbreast. To this very day, in England and Germany, it is considered unlucky to step on a holly berry, a favorite food of the robin, in recognition of the bird's charitable act.

Of all old English traditions, however,

one of the most enchanting is that even the bees must be wished a Merry Christmas and a sprig of shiny green and bright red holly must adorn each hive.

Quite apart from the holly superstitions associated with Christmas are those related to divination—the pretended art of foreseeing future events by supernatural or magical means. Perhaps, to paraphrase Folkard, the most interested in this form of sorcery were those vain and silly maidens no longer able to endure the suspense of not knowing the names of their future husbands. Off to the house of the old witch they would go—there had to be three of them for the magic to work. The witch would show the three of them how to construct a witch's chain of holly, juniper and mistletoe berries with an acorn at the end of each link, and how to wind these beads around a slender wand of wood. This was to be placed on the fire with magical sayings and, as the last acorn was burnt, each would see her future husband walk across the room.

A less expensive but more painful method of foreseeing a future husband in early England was for the maiden to place three pails of water on her bedroom floor. Upon retiring, she pinned three leaves of holly on her nightdress, opposite her heart. During her sleep, she would be awakened by three loud yells, followed by three coarse laughs; after this, the form of her future husband would be seen. The intensity of his love for the maiden was determined by whether or not the pails were disturbed. Unfortunately, this charm was only potent if carried out on Halloween, Midsummer Eve, New Year's Eve and Christmas Eve.

Another traditional form of foreseeing the future in parts of England consisted of collecting nine smooth-leaved, or She-Holly leaves, and placing them in a three-cornered handkerchief that had to be tied with nine knots. The knotted handkerchief was placed under the pillow and, during sleep, pleasant dreams of the future were certain to ensue. The holly leaves had to be picked late on a Friday and the utmost care taken to maintain complete silence until the following morning for this spell to be fully effective.

A quaint fortune-telling superstition of England consisted of fixing little lighted candles on holly leaves and plac-

ing them in a pan of water. If the leafy vessels floated, it was a sure sign that the project the person had in mind at the time would prosper. If, however, they sank, the person would do well to abandon the idea as soon as possible.

The Indians of early Pennsylvania regarded the holly as their "Red Badge of Courage" and the token of success in battle. They had a method of preserving and hardening the berries without their shrinking or losing their brilliant colors. These were used as decorative buttons on vests, sleeves, trousers, and in their hair. Brisk trading in the berries occurred with tribes where holly did not grow naturally.

These Indians often painted or embroidered sprays of holly, like coats-of-arms, on their shields and jackets. Many legends were told about the holly's connection with happier days and great victories. The spines of the leaves symbolized the fierceness of the warriors and their refusal to take insults from anyone; the toughness of wood indicated that the Indians would never submit to their enemies. Since the leaves of holly do not readily fall off, the tree was an emblem of courage and everlasting life. When Indians went on the warpath, sprigs of holly were often pinned on their clothing with great ceremony to speed their triumphant return in safety.

In the floral vocabulary of the ancients, holly symbolized "Defense," and, strangely enough, eastern North American Indians planted holly about their cabins as "Protectors," feeling that the trees kept away the evil spirits.

Among the many old and curious beliefs associated with healing was the idea that diseases could be transferred to trees and plants, especially by passing the patient through an arch or hoop of the branches, or through a cleft in the trunk of a tree. In almost every country of the world, this superstition could be found. In England, ruptured children, or those with rickets, were passed through fissures of tree trunks, often of holly. To insure success, the tree had never to have been used before for such a purpose. The trunk was split from east to west; the youngster was passed through by a maiden and received by a boy on the other side. Sometimes this was repeated three times; sometimes, too, the child had to be thrust through head first for the charm to work; at

other times, the feet must be the foremost part of the body.

When the passing-through ceremony was completed, the split, which had been held open with wedges, was allowed to spring together, and the wound bound and plastered up with clay. As the gash gradually healed, so did the youngster's rupture in a like manner. It is recalled that the largest known American holly tree was similarly used to cure the rupture of a boy, some forty years ago in North Carolina. The Russians used holly trees in a somewhat similar manner for curing tuberculosis.

Culpeper, in his pithy herbal of 1653, relates that holly is governed by the planet Saturn, and, as such, influences the *Melancholy*, a sediment of the blood whose receptacle was the spleen. Thus the holly, like other Saturnine plants, is considered "cold and dry in quality, fortifying the retentive faculty, and memory; makes men sober, solid, and staid, fit for study; stays the unbridled boys of lustful blood, stays the wandering thoughts; and reduces them home to the centre."

Writing specifically about the virtues of the holly tree, Culpeper states that the berries expel wind and are, therefore, good for the colic. If a dozen ripe but undried berries are eaten in the morning, and then fasting, they purge the body of wastes. If the berries are dried, however, and beaten into a powder, they bind the body, stop bleeding and fluxes. The bark of the tree, and also the leaves, are excellently good, being used in fomentations for broken bones, and such members as are out of joint. Gerarde, in his herbal of 1597, some fifty years earlier had published Culpeper's remedies in language more picturesque than printable.

In more modern times, infusions, decoctions, and fomentations of holly were used for a wide assortment of human disorders. In England, a tea of holly bark was a cure for the cough. In France, a decoction of leaves and bark was considered equal to and sometimes better than quinine in the treatment of the intermittent fever. A tea of holly leaves was a cure for measles by tribes of North American Indians; while an elixir of the leaves, bark and wood was regarded by them as a specific against disease. A beverage of the berries pacified the squaws of the Cherokee Indians and

curbed their urge for wandering. The juice of holly leaves was recommended in the cure of jaundice. A tea of holly leaves was also good for pain in the side.

American Indians wore sprigs of holly during childbirth, believing them to ease the pain and to insure the delivery of healthy offspring.

John Evelyn, in 1662, related that a posset, made of milk and beer in which is boiled some of the most pointed of holly leaves, is certain to abate the torments of colic when all else has failed. Leaves of holly, he reported, dried to a fine powder and drunk in white wine is prevalent against the gall stone.

In England, an old cure for chilblains was to thrash them soundly with branches of holly; a rustic specific for whooping cough was to drink new milk out of a cup made from the wood of variegated holly. Followers of Zoroaster in Persia and India used an infusion of water and holly bark to sprinkle the faces of newly-born children.

An old and quaint English cure for toothache concerns the belief that the pain was caused by the gnawing of little worms inside the tooth. The remedy for this was to hold a smoldering holly coal in the mouth so that the smoke could enter the cavity of the afflicted part. This promptly dispatched the tiny offenders and caused them to drop out of the tooth.

While these remedies have all been attributed to our familiar American and English Christmas hollies, other members of this same family have likewise contributed to the well-being of the world. In the Far East, decoctions of the bark and leafy shoots of the familiar Chinese holly are commonly used as tonics, especially for the kidneys; the crushed seeds of the *Ilex chinensis* are frequently used in medicines. Among the natives of the Saint Helena Islands of South Carolina, a mixture of lard and mockingbird bush, the *I. cassine*, is used as an ointment for smallpox. Farther northward, the berries and bark of Winterberry, the deciduous holly, have often been substituted for Peruvian bark in cases of intermittent fevers. The bark and fruit are tonic; the latter also emetic. The bark has also been used as a wash for gangrene and eruptions of the skin. The Dahoon holly was used by the early settlers of North Carolina to purify the coastal swamp water

and render it fit to drink.

Despite these varied and valued healing properties of holly and its contributions to the medicinal lore of the world, it is of interest to note two old Welsh superstitions: to pluck a sprig of holly in flower was a sure cause of death in the family of the picker, and, holly must never be brought into a sick room for the patient was almost surely to suffer a relapse or die as a consequence.

Young branches of holly were cut by the Morbihan peasants in Europe and cured for hay. The stems were dried, bruised and fed to cattle three times a day. Milk and butter from these holly-fed cows was said to be both wholesome and good.

The young shoots of *Ilex chinensis* are sometimes blanched in China, and eaten in salads. Here, too, the limber twigs of the familiar Chinese holly, *I. cornuta*, are used as nose rings for cattle.

Palatable and stimulating is a tea-like beverage called maté, yerba maté, or Paraguay-tea, a favorite with millions of South Americans. Brewed from the leaves of one of several South American hollies, maté is an all-purpose drink used by more than thirty million South Americans daily.

An early South American Indian custom, still practiced today, is to serve each visitor to camp with a gourd of maté. The chief sips some of the tea through a *bombilla* and passes the receptacle to the visitor, who drinks from the same tube. Everyone in camp partakes of the beverage until it is consumed. It is an act of unpardonable rudeness to refuse to drink any of the maté.

Maté is recognized by the chemists as a stimulant for the nerves and muscles, as well as for the brain. The British, French, and German armies used it during the first World War, finding it a valuable stimulant in times of stress.

High in the mountains on the eastern side of the equatorial Andes in Ecuador, the Zapara and Jibaro Indians have used guayusa since pre-Columbian times. It is a tea brewed from another South American holly not unlike that in appearance to the old holly trees of England. While quite acceptable as a substitute for coffee or tea, the infusion, as brewed by these Indians, is so strong that it acts as an emetic. The guayusa pot is kept carefully covered up and the

brew simmered over a slow fire throughout the night. On arising in the morning, the Indians would drink enough to make them vomit, believing that the beverage conferred strength and swiftness to the hunter. Groves of this holly were planted about the villages of the Indians.

Since ancient times, southern tribes of the North American Indians held in greatest esteem the celebrated "black drink" or "cassena," brewed from the toasted leaves of *Ilex vomitoria*, the Yaupon of southeastern United States. To the Indians, this holly tea restored lost appetites, confirmed their health, and gave them courage and agility in war.

Accounts of the black drink ceremony among the American Indians were recorded as long ago as 1536. In the spring of the year, the Indians gathered in areas along the sea coast where the Yaupon grew in abundance, some traveling several hundred miles to attend the rituals. The leaves of the holly were parched in earthenware vessels over fires and then boiled for a considerable period. While brewing, the pot was kept carefully covered, but if, by chance, any woman came into the vicinity while the pot was uncovered, the Indians threw the drink away believing that some evil would be imparted to the beverage. No woman was allowed to move or walk about during the cooling and serving process and should, perchance, this occur, the Indians would throw the drink away, disgorge what they had already swallowed, and severely punish the transgressing female. At the same time, the Indians continually called out, "Who will drink? Who will drink?" Any squaw within hearing distance of the shouts was obliged to remain motionless, even if standing on tiptoes, until the men had consumed their fill.

On other occasions, the cassine was used in ceremonies concerned with the well-being of the tribe. Sitting at the head of a semi-circular bench, the chief, with his councilors and elders, accepted the blessings of those who were to partake of the drink. Having accepted salutations from each of the braves, one at a time, the eldest first, the chief ordered the women to brew up the drink.

Matters of importance to the tribe were discussed and debated by the priests, elders, and nobles among the

Indians. No decisions were made until a number of councils had carefully deliberated the opinions and recommendations of the speakers. During the discussions, the chief was served the hot drink in a capacious shell. The chief, in turn, directed the rest to drink from the same vessel.

So esteemed did the Indians hold this holly tea that no one was allowed to drink it during the council except those proved to be brave and courageous warriors. So strong was this beverage that it immediately threw the drinker into a deep sweat. Those whose stomachs rejected the beverage were not to be trusted to any difficult or warlike mission. The drink, the Indians believed, nourished and strengthened the body.

There are some sixty species of hollies yielding leaves for beverage purposes. It is more than a passing interest to note that the leaves of one holly frequently used for tea by the natives of the Chinese-Tibetan border is the same holly, *I. yunnanensis* var. *eciliata*, belongs to the same section of plants, and has been used in a similar way, as the hollies used by the Indians of both North and South America since ancient times.

In the old traditional English Shrove-tide dances—the last merrymaking period before the observance of Lent—there often appeared a holly-boy and an ivy-girl. The holly was supposed to be male and to personify the steadfast and the holy, while the ivy, because of its clinging and embracing nature, was symbolical of a maiden's love and friendship. In some areas of England, it was traditional, according to Dallimore, for the girls to make chains of holly to burn on Shrove Tuesday, the boys retaliating with ropes of ivy.

The observance of May Day, with its poles and dances, has long been a traditional custom of the spring festivals of the European peasants. This is a remnant of the ancient worship of the benevolent tree spirits and of the necessity each spring of paying homage to them to insure the fertility of the fields and flocks in the coming year. Often, the spirit was represented by a pole, a freshly-cut tree, a branch, flower, a vegetable, a person, or a combination, like a bough-bedecked mummer.

Jack-in-the-Green, so Sir James Frazer informs us, is the best known example of the latter. Encased in a wickerwork

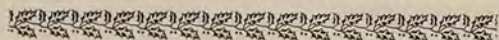
covered with holly, ivy, and surmounted by a crown of flowers and ribbons, he dances on May Day at the head of a troop of fellow chimney-sweeps, all collecting gifts of pennies. Here, it should be mentioned, the preference of the chimney-sweeps was for branches of holly in cleaning the chimneys of London and of the tradition that all flues must be cleaned by New Year's Eve to permit an easy exit for all household evils.

Of all the unusual customs concerning English hollies, perhaps none is more curious than the use of the bark in making birdlime. This mucilaginous substance was spread on branches and other places where birds were accustomed to roost. In the days before firearms, there was no easier way of trapping the ingredients for a tasty sparrow or starling pot pie. Birdlime was also used for keeping snails, insects and other vermin from climbing fruit trees and invading gardens. In some provinces of China, bark of the beautiful *Ilex latifolia* is used for the same purposes.

The bark of the holly was gathered in midsummer and boiled in spring water for twelve hours. On cooling, the inner green bark was separated from the rest and laid aside in a cool cellar for a fortnight, whence it became a perfect mucilage. It was then pounded fine in a mortar, washed in a stream of running water, and boiled with a third part of capon or goose grease. Oil of walnuts was substituted for the grease to prevent the birdlime from freezing in winter weather.

The folklore recorded here relates to but a very few of the five hundred hollies believed to occur in various parts of the world. As these new species gradually become introduced to America, and as their folklore successively becomes known, a most exciting story is surely to be unfolded. We await this with both interest and impatience.

Harry William Dengler, extension forester, Maryland Extension Service, University of Maryland, College Park, Maryland, is a trustee and one of the founders of the Holly Society of America, Inc. He is a honorary vice-president of the American Horticultural Society, and a 1957 recipient of the Holly Society's "Certificate of Honor."



Hollies of the World

The hollies are members of AQUIFOLIACEAE (Holly Family) which, in turn, belongs to the order Sapindales. Included in this same order, and somewhat closely related to the AQUIFOLIACEAE, are such groups as the Box, Cashew, Staff Tree, Buckeye and the Maple Families.

Three genera are included in the holly family. The genus *Phelline* is found on the island of Tasmania and in Australia. No records of its cultivation in the United States are known. The genus *Ilex* has the flower petals slightly united at the base and the sepals forming a small calyx, while the genus *Nemopanthis* has the petals free at the base and often no calyx present. Of the three, the genus *Ilex* is the most important and the one to which this handbook is devoted.

Plants in this group are deciduous or evergreen trees or shrubs and are widely scattered throughout the world, occurring in the temperate and tropical regions of both hemispheres. The exact number of *Ilex* species is in doubt. J. C. Loudon, an assiduous compiler of botanical information, in his *Arboretum et Fruticetum Britannicum*, 1838, described and mentioned some forty-five species, plus varieties known at that time. Ludwig Eduard Theodor Loesener of Germany, who has done most toward the botany of hollies, described two hundred and seventy-five species and a large number of forms in the early nineteen hun-

dreds. Modern estimates of the plants in this genus range from over three to five hundred, and perhaps more.

North America has between twenty and thirty species, but the validity of at least two is in question by some taxonomists.

More than a hundred and twenty-five hollies are native to Central and South America. They are rarely encountered in cultivation here.

Dr. Shiu-ying Hu, in her descriptions and key to the Oriental hollies in this Handbook, lists a hundred and twenty species as being native to Asia.

The East Indies has a number of interesting but poorly understood species. Some of these are said to be of great beauty.

Two opposite-leaved species have been reported from New Guinea, but their acceptance as "hollies" must await further study.

Three hollies are native to Europe, two to Africa, while Madagascar has about twelve species.

It surprises those unfamiliar with the hollies to learn that these plants are generally of two sexes: that is, a plant is either a male, or staminate; or a female, or pistillate. Both sexes have flowers but only the females produce berries. Male flowers are necessary for the pollen needed to fertilize the female flowers in order that berries with viable seeds will result. Male flowers are borne more abundantly and, while estimates vary, generally one male will be adequate for ten female growing in fairly close proximity. Some of the English hollies and the *Ilex cornuta* f. *burfordi* bear fruits in the absence of male plants but the seeds they may contain will be sterile. Insofar as is now known, there is no way to distinguish a male from a female until the plants are old enough to produce flowers.

If a holly does not bear berries, it is generally because of one or more of the following reasons:

1. It is a male plant and will never have berries.

2. It is a female too young to have berries.

3. It is a female with no nearby flowering male to ensure proper pollination.

4. It is a female but nearby males do not blossom at the same time to ensure pollination.

5. Flowers were injured by late spring frosts or cold weather.

6. Cold, rainy weather at blossoming time prevented effective pollination by insects.

Like human beings, the hollies differ widely in their physical appearances. And, just as the likenesses of sons and daughters exhibit differences among themselves and their human parents, so also do the seedlings of the hollies. These variations in hollies are even more understandable when it is realized that more than one male may have been responsible for fertilizing the berry-producing plant.

These variations have been recognized for many years, and this, plus the tendency of some hollies to produce sports or mutations, has given rise to a number of interesting and beautiful plants. Such deviations include the differences in size, shape, form, color, degree of glossiness, presence or absence of spines, texture and other related characteristics of the leaves and the size, shape, color, glossiness, showiness, abundance and firmness of the berries, plus the regularity and earliness of fruiting. Also, to be included are the growth habits, hardiness, and the ornamental or commercial values of the entire plants themselves.

For well over two hundred years these differences among the hollies were noted by observing plantsmen and individual plants or sporting branches were selected which were thought to be outstandingly beautiful or had some character which was unusual or merited the holly's perpetuation. These were often named for the discoverer or in honor of some particular individual, for the place where they were discovered, or were given common or Latinized names somewhat descriptive of the character for which they were selected. Sometimes, too, such hollies were named, or renamed, with a fanciful one to enhance their salability for landscape or for commercial orchard uses.

All these are propagated from the original selection by cuttings, grafts or by budding. Thus, these new plants, barring sports or mutations, would be of a similar appearance and sex, when growing in a comparable habitat, as the original plant or the branch from which they were taken. These, then, would not exhibit any of the variations that would be expected from seedlings of

the selection if this were a female plant.

These hollies, originating vegetatively from a single source, have been loosely called selections, clons or clones, varieties or named varieties. In recent years, the term *cultivar* (abbreviated as cv.) has been applied to a variant not known in the wild or not known to have an equivalent in the wild in sufficient numbers to justify botanical recognition, as distinct from a *variety*, which is a wild variant warranting botanical recognition. Because of the relative newness of this term, the word *cultivar* has not been used by some authors. For the purposes of this *Handbook of Hollies*, all of these names *might be used interchangeably* without any impairment of the intent of their meaning.

In the sections which follow, no mention is made of the Central or South American or other distinctly tropical hollies. The possibility of their successful cultivation here is so remote as to make their omission excusable.

The list of named varieties of American hollies following the chapter and key on the North American species is by no means complete. Admittedly, too, their descriptions are all too brief and inconclusive. The present status of our knowledge of these hollies makes this treatment necessary. The establishment of test gardens by the Holly Society of America, Incorporated, where these, other, and new selections may be grown under identical conditions, will make their compilation more positive in the future. Since the habitat of origin of these hollies is apparently indicative of its northern or southern hardiness, the State in which the selection was made, and the name of the originator or namer, where known, is included in parenthesis at the end of each description.

Most of the hollies of the Orient as described and keyed out by Dr. Shiu-ying Hu are not now in cultivation in America. Their inclusion here is for several reasons: many of them are beautiful and useful ornamental plants and will be welcome additions to our landscape scenes; the ever-increasing interest

in hollies has turned attention to new and hardier species and forms, both for use in their present form or for hybridizing purposes; recent plant explorations in Japan have resulted in importations eventually to be released to the American nursery trade and some advance descriptive material seems desirable; and, lastly, since considerable confusion exists in the present-day nomenclature of hollies, it is hoped that Dr. Hu's chapter will forestall any such confusion at the start and will keep these hollies in their orderly place when they eventually are introduced to America. Anyone who has conscientiously attempted to determine the correct names for some of these confused hollies will readily appreciate the wisdom of this action.

The "English hollies" is the term applied to the varieties, clones, cultivars and hybrids of *Ilex aquifolium* Linn. or of allied species of what has been called the aquifolium complex. The treatment given this group is different from that of the previous two and a special introduction is given them under this heading.

The keys on the North American and the Oriental hollies which follow are independent of one another. No key to the English group, which includes the English varieties selected in America, is known to this editor. At the present time, then, descriptions of these hollies must be largely relied upon in determining their proper names. Such a key, in combination with those of the previous two, would be most valuable.

Other keys which might be of some value to the reader are included in:

Trees and Shrubs in Eastern North America, Benjamin Blackburn, Oxford University Press, New York City, 1952.

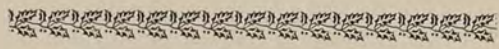
Hollies, H. Harold Hume, The Macmillan Company, New York City, 1953.

Key To Evergreen Ilex, L. C. Chadwick, *American Nurseryman Magazine*, pp. 59-60, No. 6, March 15, 1934.

All The Hollies Worth Growing, Wilhelm Miller, the *Garden Magazine*, 3 and 4, December, 1906.

Manual of Cultivated Plants, L. H. Bailey, The Macmillan Company, New York City, 1949.





North

American Hollies

FRED C. GALLE

The number of evergreen and deciduous holly species native to North America is between twenty and thirty. While the number is not as large as those found in other countries, it does contain some very important plants for the landscape.

All too often in the past, we have looked for new plants from foreign lands without sufficient regard for the values of our native plant materials. With the increased interest in hollies, more of our native species should be tested and evaluated, not to replace the introduced plants, but to combine with them in the landscape. The majority of the American hollies are native to the Southern States and some may not be satisfactory in northern areas. Only after sufficient testing under varied conditions will their true hardiness be known.

The true landscape value of a plant cannot always be judged only by observing the plant in its native habitat. Many people are familiar with *Ilex glabra* and other native plants in their native habitat but fail to recognize them when used in a landscape planting. Also, many of the other hollies are lowland plants, growing in marshes or bogs as their native habitat. This is often erroneously construed to mean that to transplant these plants to other situations would result in failure. Plant ecology is an intriguing science involving many factors affecting plant growth and distribution. Needless to say, most of the native hollies will do well planted in well-drained garden soil.

Illustration 2.

Hollies Native to North America

Evergreen-leaved hollies

1. *Ilex opaca*
2. *Ilex cassine*
3. *Ilex krugiana*
4. *Ilex myrtifolia*
5. *Ilex vomitoria*
6. *Ilex coriacea*
7. *Ilex glabra*

Deciduous-leaved hollies

8. *Ilex montana*
9. *Ilex ambigua*
10. *Ilex laevigata*
11. *Ilex decidua*
12. *Ilex longipes*
13. *Ilex amelanchier*
14. *Ilex verticillata*

VEGETATIVE KEY TO NORTH AMERICAN ILEX

- A. Leaves evergreen.
- B. Fruit red or occasionally yellow.
- C. Leaves usually spiny toothed.
- D. Spines pointing forward, fruit pulp apple scented 1. *Ilex cumulicola*
- DD. Spines pointing outward (some varieties spineless), fruit pulp not apple scented 2. *Ilex opaca*
- CC. Leaves serrate, crenate or sometimes entire, but not spiny toothed.
- D. Leaves entire or with a few oppressed teeth near apex.
- E. Leaves less than 2 in. long, linear or narrowly elliptic 3. *Ilex myrtifolia*
- EE. Leaves 2-5 in. long.
- F. Leaves oval or elliptic-obovate; length less than 4 times the width 2a. *Ilex opaca* f. *subintegra*
- FF. Leaves elliptic; length more than 4 times the width.
- G. Leaves with an acute or tapering apex, usually elliptic or lanceolate 4. *Ilex attenuata*
- GG. Leaves blunt or obtuse at apex, oblanceolate to oblong 5. *Ilex cassine*
- GGG. Leaves linear to linear oblong 5a. *Ilex cassine angustifolia*
- DD. Leaves with crenate or scalloped margin, elliptic or ovate-oblong, 3/8 to 1-1/4 in. long 6. *Ilex vomitoria*
- BB. Fruit black or dark purple.
- C. Leaves ovate, petioles relatively long and slender, twigs white with age 7. *Ilex krugiana*
- CC. Leaves obovate or spatulate, petioles short, twigs dark.
- D. Leaves entire or coarsely with 3-7 serrations near apex 8. *Ilex glabra*
- DD. Leaves spinescent toothed above the middle and spiny tipped, somewhat leathery 9. *Ilex coriacea*
- AA. Leaves deciduous, fruit red or occasionally yellow.
- B. Fruit with smooth nutlets.
- C. Leaves pubescent (occasionally glabrous) at least on the veins beneath, usually dull above; fruit 1-3 in cluster; calyx pubescent 10. *Ilex verticillata*
- CC. Leaves glabrous or nearly so beneath, usually lustrous above; fruit solitary; calyx glabrous or merely ciliate 11. *Ilex laevigata*
- BB. Fruit with nutlets ribbed or lined on the back.
- C. Leaves glabrous or only few hairs at veins.
- D. Leaves typically broadest above the middle.
- E. Leaves 3/8 to 3/4 in. long, obscurely crenate 12. *Ilex curtisii*
- EE. Leaves 1-1/4 to 3-1/2 in. long.
- F. Leaves pale beneath, marginal teeth, slender pointed tips crenulate 13. *Ilex longipes*
- FF. Leaves yellow green beneath, marginal teeth, finely serrate 14. *Ilex collina*
- DD. Leaves broadest at the middle or below.
- E. Leaves conspicuously serrate, 2-3/8 to 6-3/8 in. long 15. *Ilex montana*
- F. Leaves only 3/4 to 1-1/2 in. long, leathery 16. *Ilex buswellii*
- FF. Leaves 1-5/8 to 2-3/4 in. long, thin membranous, pubescent above 17. *Ilex ambigua*
- CC. Leaves pubescent beneath.
- D. Leaves typically broadest above the middle.
- E. Leaves crenate-serrate; fruit usually clustered 18. *Ilex decidua*
- EE. Leaves usually inconspicuously toothed, fruit solitary 19. *Ilex cuthbertii*
- DD. Leaves broadest at the middle or below.
- E. Leaves serrate, fruit one per stalk 20. *Ilex beadlei*
- EE. Leaves inconspicuously serrate, fruit usually 3 per stalk 21. *Ilex amelanchier*

DESCRIPTIONS OF NORTH AMERICAN SPECIES

1. *Ilex cumulicola* Small

The Dune holly. An evergreen, fastigate, compact tree, or large shrub, usually found up to 25 ft. Leaves somewhat similar to those of *Ilex opaca*, but more acuminate or narrowly-elliptical. The spines point forward. The leaves vary from 3/4 to nearly 2 in. long. Fruit is bright red and is noted to have an apple scent when crushed. The plant is native on the peninsula of Florida on dunes and it is not known to occur elsewhere. The plant is hardy as far north as Georgia, but, due to its close similarity to *Ilex opaca*, there is little reason to use it or to try to extend its range beyond the lower South.

2. *Ilex opaca* Ait.

American holly. The most common and best known plant of the native American hollies, growing up to a large shrub or tree up to 50 ft. or more in height, and typically found to be rather compact, pyramidal or round headed in outline. The evergreen leaves are variable in size, 2-4 in. long, and vary from flat leaves to those that are twisted along the margin. Their color varies from a dull green to a glossy green color. Margins are usually spiny toothed, but many variations of this characteristic exist; many trees in the South have leaves that are nearly to completely entire. The less spiny-leaved trees are often thought to be the result of natural intergraded hybrids between *Ilex opaca* and *Ilex cassine*, and are usually less hardy than spiny-leaved trees. A few trees with variegated foliage have been reported, but, as yet, nothing similar to the variegations found in English hollies. The fruit is usually borne singly, one berry to a pedicel and is typically rounded to elliptical and up to 3/8 in. or more in diameter. Variations from the typical bright red fruit have been observed ranging from orange to red. Yellow-fruited forms are also not uncommon.

Ilex opaca is native to a large part of the eastern United States, from Massachusetts, west to Pennsylvania and West Virginia, south to Florida, and west to Texas, Missouri, Tennessee and Indiana. Trees are normally found in rich, hardwood bottom land in association with oaks and, on Coastal Plain areas, among pines. Although capable of growing on poor soils of either sand or heavy clay, the best growth is seen in deep, rich, fertile, well-drained soils and it is common to find it along the banks of streams.

The ultimate size of *Ilex opaca* restricts its use for home foundation plantings, unless for two-story houses or for large buildings. It is best used as individual specimen plants on a lawn or as a screen or background planting along the shrubbery border.

2a. *Ilex opaca* f. *subintegra* Weatherby and vars.

Leaves entire or nearly so.

2b. *Ilex opaca xanthocarpa* Rehd.

Yellow-fruited varietal name of *Ilex opaca*. Several horticultural forms of this variety have been named.

3. *Ilex myrtifolia* Walt.

Myrtleleaf holly. This has been regarded for a long time as a variety of *Ilex cassine*, but now is generally correctly listed as a separate species. It is a large shrub or small tree with gray bark and crooked branches. The evergreen leaves are narrowly elliptical or linear, usually 1-2 in. long. Fruit is typically red, but there have been found yellow-fruited forms and others with colors varying from yellow to red. The yellow-fruited variety has been named forma *lowei* Blake. There has been little selection done on the other colored forms. The Myrtleleaf holly is found in swamps and bog areas of the Coastal Plain from Florida to Louisiana and north to North Carolina. While Myrtleleaf holly is not common in the trade, it is certainly an ideal plant to use in the South and one which should be more readily made available by nurserymen.

4. *Ilex attenuata* Ashe.

Topal holly. Considered a natural hybrid between *Ilex opaca* and *Ilex cassine*, is a large shrub or small tree, pyramidal in its growth habit. The leaves are elliptical to oblong-obovate, 1-1/2 to nearly 4 in. long, with one long spine at the apex and few spines along the margin. The fruit is red and usually borne in clusters. The plant is similar in many respects to various forms of *Ilex cassine*, but, due to its pyramidal and heavy fruiting habits, is somewhat better for use in the lower South. The parent plant occurred in Florida and there are other hybrid forms that can be found throughout the South.

5. *Ilex cassine* L.

Dahoon holly. An extremely variable shrub or small tree. The evergreen leaves are lanceolate to elliptical in outline and vary in size from 1-1/2 to 4 in. in length. Variations exist also in glossiness, size and amount of fruit. A narrow-leaved form of *Ilex cassine* is listed and available in the trade. There have also been named yellow-fruited forms, but they are extremely rare. The plant is usually found in acid soils along the Coastal Plain from Virginia to Florida to Louisiana and is not common normally above Zone 7.



Illustration 3.

American holly, *Ilex opaca*, growing near the Battle-Vance-Pettigrew Dormitory, University of North Carolina, Chapel Hill—one of the older holly trees on the campus.



Illustration 4.

A handsome fifty-foot tree of *Ilex opaca* in Bedford County, Virginia.



Illustration 5.

Fruiting specimen of *Ilex vomitoria*, the Yaupon holly, which is an attractive red-fruited evergreen holly native to the Southeastern United States.

Within *Ilex cassine*, there are plants called Foster Hybrids, numbering one through five. These are selections of seedling plants by Mr. E. E. Foster of Bessemer, Alabama, from seed of *Ilex cassine* hollies, the parent plants undoubtedly crossed with *Ilex opaca*. Plants are typically small-leaved, glossy green, with spiny margins with a more compact habit of growth. They are heavily fruited in clusters, like *Ilex cassine*. This group of plants has become very popular in the the South and is being used in foundation plantings, in hedges, and other landscape work.

5a. *Ilex cassine angustifolia* Ait.

A narrow-leaved form of *Ilex cassine*, listed and available in the trade.

6. *Ilex vomitoria* Ait.

Yaupon holly. The next most common red-fruited evergreen plant. It is a large shrub or small tree up to 25 ft. tall, with stiff, grayish branches. The evergreen leaves are oval to elliptical in outline and vary in size from 3/8 to nearly 2 in. in length. The leaves are glossy green with a crenate margin. Fruit is typically red, borne in clusters and varies in size from 1/8 to 1/4 inch in diameter. They are quite showy on specimen plants. There are a few yellow-fruited specimens of *Ilex vomitoria*, one of which is named 'Yawkeyi.'

There has been very little selection done with the numerous natural forms of Yaupon. In recent years, there has been selected a dwarf form of Yaupon. This particular plant is ideal in form. While the original selection is not too heavily fruited, there have been other selections of dwarf Yaupon in Texas that are reported to fruit regularly. Yaupons with weeping habits of growth have been noted along with other habit variations, again pointing out the need for additional selection of plants.

Yaupon holly is native in Florida to Texas, north into southern Virginia and northern Arkansas and is hardy in Tennessee and up to Washington, D. C. Thus, the Yaupon holly is more common in the South. Here, it is used in foundation work, hedges, screens, and various other landscape purposes. Also, it is well to note that this plant has the highest caffeine content (in leaves) of any of our native North American species and has been used in the past to make tea (black drink of the Indians) and other beverages.

7. *Ilex krugiana* Loes.

Krug's holly. An evergreen shrub or small tree to 30 ft. The twigs are grayish-white and glabrous, the dark green leaves elliptical or ovate (occasionally even subrotund) in shape, varying from 2 to nearly 3-1/2 in. long, usually with an entire margin or a few spines at the upper half of the leaf. Black fruit is borne solitary or in small clusters, usually 2-5 on a peduncle. The

plant is native in the West Indies and in the hammocks of the Everglade Keys in Dade County, Florida. It is not common in landscape work and there is a question as to whether it is really hardy beyond the lower South. It is a link between the distinct North American and Central American holly groups.

8. *Ilex glabra* (L.) Gray

Inkberry or Gallberry. Of the evergreen, black-fruited hollies, *Ilex glabra* is undoubtedly the most common plant within this group. It is a stoloniferous shrub, forming dense clumps with upright branches up to 6 or 10 ft. in height. Leaves are usually green, obovate to elliptical oblanceolate, or oval in outline. They vary in size from 3/4 to nearly 2 in. The leaf is usually found with a few obtuse teeth along its margin near the apex or is entire. There is a great deal of variation in the color and glossiness of Inkberry. Typically, it is light green, but there are dark green foliage specimens and some with glossy surfaces. The fruit is typically black, borne individually or in small clusters and varies in size up to 3/8 in. in diameter. The plant is native from Nova Scotia south to Florida, west to Missouri.

Extreme variations exist within the plants throughout the entire area. There has been found, both in Florida and in New Jersey, a white-fruited form of *Ilex glabra*, now called *luteo-carpa* F. W. Woods. There is also reported in Small's Manual a red-fruited form of *Ilex glabra*, but it is not known to be available.

There has been very little selection done on the various forms of Inkberry. The 'Compact Inkberry' selected by Princeton Nurseries, Princeton, New Jersey, is a slow grower, forming a compact shrub with dark, glossy, green leaves, and bears black fruit abundantly.

Inkberry, while extremely common in the South and in many areas along the Coastal Plain, should be used more often, for it can be shaped or pruned to low hedges and works very well for foundation work or mass plantings.

9. *Ilex coriacea* (Pursh) Chapm.

Large Gallberry. A plant very similar in characteristics to *Ilex glabra*, being stoloniferous in habit, forming large, open clumps, the individual plants growing 10-12 ft. high. Leaves are dark, glossy green, obovate to oblanceolate, margins entire or with a few sharp-pointed serrations toward the apex. Fruit is commonly glossy black, but there is extreme variation from this, even to reddish brown. The plant is native in the Coastal Plain from Virginia to Florida and west to Louisiana. It is not nearly as desirable a landscape plant as *Ilex glabra* and should only be used in the South as a mass planting



Illustration 6.

Berried branches of the red-fruited *Ilex verticillata*, the Black Alder or Winterberry.

in the shrubby border. Both *Ilex glabra* and *Ilex coriacea* appear different when the crown is destroyed and root shoots develop.

10. *Ilex verticillata* (L.) Gray

Black Alder or Winterberry. (In some areas also called Coonberry or Michigan holly.) A large deciduous shrub to small tree about 20 ft. in height or more. Winterberry forms a wide, spreading plant; individual specimens may be quite rounded in outline. The leaves are elliptical or obovate to oblanceolate, 1-1/2 to 3-1/2 in. in length, with acuminate or doubly serrate margins, and are usually very pubescent beneath, at least near the veins. Fruit is red and borne in clusters. *Ilex verticillata chrysocarpa* is a selected yellow-fruited variety. *Ilex verticillata* is native in swamps and low woodland areas from Nova Scotia to West Ontario and Wisconsin, south to Florida and west to Missouri. It is hardy in Zone 3 and is more commonly used than *Ilex decidua* but will not hold its fruit nearly so long in the landscape scene or under cut conditions. Another feature which may be to its disadvantage is that, after the first fall frost, the leaves turn black or brown, giving it the name "Black Alder."

There are several botanical varieties of Winterberry in addition to the yellow-fruited form. These plants differ from the species in leaf shape and minor details. The variety *polycarpa* has brownish twigs and red fruit larger than normal. *Ilex verticillata* is more common in wet areas but will do well in average home garden soils. It can be used in the shrubby border and is a good attraction for birds.

11. *Ilex laevigata* (Pursh) Gray

Smooth Winterberry. A deciduous shrub to about 10 ft. or more in height. Plants usually have upright branches. The leaves are somewhat glossy, elliptical, oval or sometimes lanceolate, 1 to 3-1/2 in. in length. The margins are finely serrulate, the fruit is borne singly and is commonly orange-red although there is one yellow-fruited variety called 'Hervey Robinson.' Smooth Winterberry is native in swamps and low woods from Maine to New Hampshire, south to north Georgia. The fruit is retained longer, the foliage color is yellow and, in many respects, is more favorable than *Ilex verticillata* for home landscape use. Unfortunately, it is not as common in the trade as the ordinary Winterberry.

12. *Ilex curtissi* (Fern.) Small

Possunhaw holly. A large shrub or small tree to 15 ft. high, with spreading branches. The leaves are thin, lanceolate to elliptic spatulate, varying from 3/4 to 1-1/2 in. in length. The red fruit is borne singly

or in small clusters and usually persists through the winter. Found in hammocks along the Suwannee River and other streams in Florida. It has also been called *Ilex decidua* var. *curtissi* Fernald.

13. *Ilex longipes* Chapm. ex Trel.

Georgia holly. A large shrub or small tree to 20 ft., with wide spreading branches. Leaves elliptic to elliptic-obovate, 1-3 in. long and remotely toothed. The red fruit is usually solitary on a stalk 1/2 to 3/4 in. long. A yellow-fruited variety, *vantrumpi* has been reported. The plant is normally found on rocky banks from North Carolina, Tennessee, Georgia, Alabama, Florida and Louisiana.

14. *Ilex collina* Alex.

This is the newest addition to the native deciduous hollies found at high altitudes in Virginia and West Virginia. It had been regarded by a botanist as being identical with *Ilex longipes*, but the leaves are yellowish green beneath and with serrate margin, showing close affinities with *Ilex verticillata*. It is included here but with reservation that it may indeed be the same as *Ilex longipes*.

The specific epithet "dubia" has been used in several places in the history of holly nomenclature which makes its use at any time in the present day both highly dubious and ambiguous.

15. *Ilex montana* Torr. and Gray

Mountain holly. (Sometimes called the Large-leaved or Mountain Winterberry.) A deciduous, large shrub or small tree to 35 ft. or more. Leaves are ovate or oblong-lanceolate, 2-1/2 to 6 in. long and sharply serrate. The fruit is bright red and very noticeable in the fall in contrast to the green foliage. The plant is native to wooded mountain slopes from New York to south Georgia and Alabama. Its botanical history is checkered, having been called *Ilex dubia*, and *Ilex monticola*, etc.

15a. *Ilex montana* var. *mollis* Britton or *I. mollis* Gray. This plant which may only be a variety is not keyed here as its status is in grave doubt, but it does exist in north Florida and Georgia and should be noted. In brief, it is a hairy-leaved plant much like a small *Ilex montana*, but the leaves are darker, shorter and less ovate.

16. *Ilex buswelli* Small

Buswell Possunhaw holly. The southernmost native deciduous holly, found in hammocks along the Caloosahatchee River in Florida. The plant is a heavily-branched shrub to 10 ft., with dark purple twigs. The leaves are elliptic to ovate, 3/4 to 1-1/4 in. long, serrate beyond the middle of the leaf. Fruit is red.



Illustration 7.

Ilex decidua, the Possumhaw holly, in fruit.

17. *Ilex ambigua* (Michx.) Chapm.

Ambiguous Winterberry. A shrub or small tree up to 20 ft. in height. The leaves are thin, hairy above, plainly veined beneath, and varying in length from 1-1/2 to 2-1/2 in. The fruit is red, maturing early, but not normally holding throughout the winter. *Ilex ambigua* is found in hammocks and sand hill areas with live oak, hawthorn and hickory in the Coastal Plain areas from North Carolina to Florida and west into Texas and Arkansas. A new form with small leaves, *Ilex ambigua* f. *chanellii* Edgin has recently been published.

18. *Ilex decidua* Walt.

Possumhaw holly. Thought to be the best of the native deciduous hollies. It forms a large shrub or small tree to about 25 ft. with gray twigs. Leaves are partly fascicled, obovate to obovate-oblong, 1-1/2 to 2-1/2 in. long. The leaves are dark green, occasionally with a little gloss. The fruit is borne singly or in small groups on short spurs and varies from bright orange to red. Young plants do not fruit as readily as mature plants or some of the other species. *Ilex decidua* is native from Virginia to Florida and west to Texas, and is usually found in low woodlands and river bottoms. The plant is hardy in Zone 5. The main feature of the Possumhaw over other deciduous hollies is that it retains its fruit well into the winter and usually until spring. Many of the other deciduous hollies, while equally colorful, lose their fruit, often before Christmas.

19. *Ilex cuthberti* Small

A large shrub or small tree, usually with densely pubescent twigs. Leaves are thick, obovate to elliptic and inconspicuously toothed and pubescent, mainly on the underside. The red fruit is borne singly or in pairs. The plants are found in wooded areas in the Coastal Plains of Florida and Georgia.

20. *Ilex beadlei* Ashe

Often referred to as a variety of *Ilex montana*, *Ilex montana* var. *beadlei*. The plant is very similar in its general characteristics and location, but its leaves are typically more pubescent. Even the twigs are pubescent as contrasted to those of *Ilex montana*. The plant is found native in rocky woods of North Carolina, Tennessee, Georgia, and Alabama.

21. *Ilex amelanchier* M. A. Curtis

A large shrub or a small tree with somewhat persistent, elliptical to elliptical-lanceolate leaves 1-1/2 to 3 in. long. The fruit is red and usually borne 3 to a peduncle. The plant is from the Coastal Plain areas, being found in South Carolina and Georgia, often in difficult habitats.

DESCRIPTIONS OF NAMED VARIETIES OF *ILEX OPACA*

1. 'Alloway Upright'

A female with medium to dark green leaves and berries of average quality and quantity, tending towards orange-red, then red. Exceptional with regard to forming pyramidal shape at an early age. (Dilatush.)

2. 'Amy'

A splendid female for landscape groups or single specimens. Drooping branches carry large brilliant berries on long stems well displayed against a background of large, spiny, glossy green leaves. Original tree a seedling from the New York Botanical Garden. (Wheeler, Massachusetts; New York Botanical Garden.)

3. 'Arden'

A female seedling selected in 1922, with foliage of good color; heavy, annual bearer with fruits turning yellow then scarlet. Easily rooted. An orchard variety; the bright fruits contrasting well with the bronzing foliage for Christmas decorations. (Near-ing, Delaware.)

4. 'Ashumet'

A highly ornamental, compact-growing male with large dark green leaves and branches that stand out from the main trunk. Selected chiefly for the abundance of flowers and pollen; "It is literally a large bouquet of bloom." (Wheeler, Massachusetts.)

5. 'Big Red'

A distinct female variety with intense red berries and leaves so very dark green they might be called "black-green." Reg. AAN No. 511. (Dilatush, New Jersey.)

6. 'Boyce Thompson Xanthocarpa'

A shapely, good-foliaged female, with clear yellow berries tipped with large black dots. "A novelty among hollies." (Boyce Thompson Institute.)

7. 'Bradshaw'

A large, well-spined, dark green-leaved female, with red fruits usually in clusters. (Hohman, Maryland.)

8. 'Brilliance'

A female with large, semi-glossy, slightly convex leaves. Abundant fruiter, even on small plants; berries extra large, bright red in color. (Hillenmeyer, Kentucky.)

9. 'Brooks'

A selection of a well-known female of large size, growing in Upshur County, West

- Virginia, at an elevation of 1700 feet. Leaves are leathery, usually without much sheen, tend to be blunt at the end, and are of fairly large size. Growth habit is typically upright and fairly coarse; not too easy to root. (O'Rourke, West Virginia.)
10. 'Brown'
A male plant considered one of the most compact and glossiest-leaved American hollies. Original tree at Locust, New Jersey. (Connors, New Jersey.)
11. 'Canary'
An abundantly-fruiting female producing yellow berries with no hint of orange. Leaves, good green, not discoloring with frost. Reg. AAN No. 512. (Dilatush, North Carolina.)
12. 'Cape Cod Improved'
A vigorous-growing female of bushy habit; medium average green leaves. Berries, red, large, "the size being the result of double-ovary berries which occur in the manner of double-yolked eggs." Fruit size is inconsistent; some years majority large, but always present are a scattering of normal and small berries. (Dilatush; Boyce Thompson Institute.)
13. 'Cardinal Improved'
A female with medium-sized, prickly green leaves, bright red berries. Does not grow as large as most varieties and may be kept indefinitely to a height of four feet or so by regular pruning. So named because of the attractiveness of its fruits to the Cardinal. (Dilatush; Boyce Thompson Institute.)
14. 'Charles'
A highly ornamental male with heavy branches and colorful dark foliage. Heavy and "middle-of-the-season" bloomer. (Wheeler, Massachusetts.)
15. 'Cheerful'
A heavy-fruiting, attractive female of upright habit, with dark green leaves and average-sized, deep red berries. (Hohman, Maryland.)
16. 'Christmas Carol'
A female with very flat leaves, medium green tending to pastel. Berries very red, profuse, often in clusters. Forms a compact pyramidal plant at an early age. (Bosley; Boyce Thompson Institute.)
17. 'Christmas Spray'
A rapid-growing female with large, medium to dark green leaves, good-sized red berries on longer than usual stems. Awkward and leggy when small, requiring severe pruning to develop proper framework. (Dilatush.)
18. 'Clark'
A small, compact female, with ascending branchlets and bright red berries. Recommended for hedges, screen plantings or as specimens. The shiny leaves are gracefully formed. (Miss White, New Jersey.)
19. 'Clarks Valley'
A female with fairly long and wide, flat, spiny leaves of good, dark color. Fruits are bright red, medium sized. (Fulton, Pennsylvania.)
20. 'Cobalt'
A male selection, with small, very dark green, fairly shiny leaves. (From seed collected in 1928, near Buckhannon, West Virginia. Of several thousand seedlings from this source, only a few hollies survived 32 degrees below zero in the winter of 1934, in Pennsylvania. This is one among ten of the better hollies of these survivors, selected for withstanding low and fluctuating temperatures.) (Pride, Pennsylvania.)
21. 'Croonenberg'
A female of compact, upright habit, with fair-sized scarlet berries. Leaves of deep green color, less spiny than average. (Thrasher, Virginia.)
22. 'Cumberland'
A prolific fruit producer of light red berries. Leaves, very dark green of unusually high gloss. Considered glossiest-leaved American holly of today. (Wolf, New Jersey.)
23. 'Dauber'
A female seedling selected from Ohio nursery stock. A popular plant with very spiny leaves, unusually dark green color, resembling *aquifolium*. A heavy producer of berries; spreading habit, with an erect pyramidal shape. (Dauber, Pennsylvania, Ohio.)
24. 'David'
Attractive male of dense habit, producing an abundance of blossoms. Leaves deep green, small, with a characteristically curved appearance. (Wolf, New Jersey.)
25. 'Delia Bradley'
An abundant-fruiting female of merit, with dark, glossy green leaves of medium size. A dependable bearer of dark, glossy red fruits, borne one, two or three on a peduncle. (Hohman, Maryland.)
26. 'DuPre'
A red-berried female of good fruiting habits; leaves distinctive in shape. Assumes a broadly rotund and spreading shape; may be used as a large dwarfish form. Original tree near Walhalla, South Carolina. Reg. AAN No. 24. (Frierson, South Carolina.)

27. 'East Palatka'
A distinctive, open-branched, small female of upright conical habit, with shiny pale green foliage. Leaves usually single-spined at the apex, occasionally three or four on upper leaf margins. A heavily abundant fruiter, with small crimson berries, often two or three on a stalk. Requires protection in the North from winter sunshine and winds. (Hume, Florida.)
28. 'Edith'
A female selection of broad, heavy growth, with medium-large leaves, dark green in winter. Berries are bright red, in good quantity. (See 'Cobalt.') (Pride, Pennsylvania.)
29. 'Edward Thomas'
A symmetrical, small male with excellent glossy foliage. This holly has also been called 'Makepeace.' (Miss White; Wheeler, Massachusetts.)
30. 'Eleanor'
A heavy-berried female, with medium-sized, very glossy, light red berries. Leaves small with depressed veins. (Wolf, New Jersey.)
31. 'Elizabeth'
A rapid-growing female of striking appearance resulting from well-displayed large, light scarlet berries distributed in loose clusters throughout the tree. Leaves long, deep green. Suitable for orchard or landscape use. (Wheeler, Massachusetts.)
32. 'Emily'
A female noted for large size of its "real holly red" berries, measuring up to 1/2 in. in diameter. Leaves, dark green, smaller than usual and inclined to curl at edges. Young plants grow rapidly and bear early. Berries are borne in large clusters. Original tree at West Barnstable, Massachusetts, destroyed. (Wheeler, Massachusetts.)
33. 'Everberry'
A female with medium-sized leaves of good color. Berries are bright red and persist until new crop turns red. (See 'Cobalt.') (Pride, Pennsylvania.)
34. 'Fallaw'
A compact, upright female of good vigor; leaves up to 4 in. long. Fruits of good size, borne in great profusion; clear, medium yellow color. Original tree near Batesburg, South Carolina. (Batchelor, South Carolina.)
35. 'Farage'
A strong-growing, broad-spreading symmetrical female, with excellent glossy foliage. Berries are shiny red. (Miss White; Windon, New Jersey.)
36. 'Ferry'
A seedling male collected near the Susquehanna River in York County. Excellent green foliage; has tendency to shed inside leaves each autumn. (Dauber, Pennsylvania.)
37. 'Fishing Creek'
Heavy berry-bearing female of compact growth, needing little trimming. Leaves, same length as the type, but much narrower. Originated near Dauphin, north of Harrisburg. (Dauber, Pennsylvania.)
38. 'Fink'
A female with leathery, dark green leaves; considered superior to the type. (Dauber, Pennsylvania.)
39. 'Freeman'
Large, rapid-growing female with attractive berries borne in long, loose clusters. Useful as specimen tree or where large effects are desired; also as an orchard tree because of its long branches. Original tree at Falmouth, Massachusetts. (Wheeler, Massachusetts.)
40. 'Golden Fleece'
A bronze-leaved female; exceedingly tender; leaves so susceptible to sunburn that it must be most carefully handled in partial shade, especially when young. (Brownell; Frierson, North Carolina.)
41. 'Goldie'
An abundant-fruitering female, with dull green leaves and yellow berries. (Miss White, Delaware.)
42. 'Grace'
A slow-growing female of very narrow pyramidal habit, with medium-large leaves of bright green winter color. Berries, orange-red, in large clusters. (See 'Cobalt.') (Pride, Pennsylvania.)
43. 'Griscom'
A small-leaved, abundant-fruitering female. Vigorous young shoots often produce three berries to a peduncle. (Miss White; Griscom, New Jersey.)
44. 'Halcyon'
An open-branched female, bearing bright scarlet, almost orange-colored berries, well displayed. (Miss White; Windon, New Jersey.)
45. 'Hedgeholly'
Very hardy, dense-growing, self-branching female of neat growth habit. Foliage, semi-glossy, slightly smaller than average, of



good dark green color. Considered excellent for most landscape purposes; stands shearing well and forms compact hedges. (Bosley, Ohio.)

46. 'Helvetia'

A female with unusually large leaves, 3-1/2 to 4 in. long. Open type holly, with large, bright, brilliant red berries, well displayed. Selected from the wild at an elevation of 1700 feet, twenty miles southeast of Buckhannon, West Virginia. Easily rooted; young plants tend to creep laterally for several years before starting upright habit. (Steiner, West Virginia.)

47. 'Henry Hicks'

A conspicuous female with dark green foliage, brilliant red berries. Original tree near Clayton, Georgia. (Frierson, Georgia.)

48. 'Howard'

A vigorous-growing female, densely branched, columnar in habit, tender in the North. An abundant fruiter, with bright shining red berries of medium size. Leaves are small to medium size, dark glossy green, with 1-5 spines, often spineless. (Hume, Florida.)

49. 'Hume No. 2'

A strong-growing, broad, cone-shaped, heavily-fruited female. Berries are small to medium in size, dark red and borne one, 2 or 3 on a peduncle. Leaves are a shiny green, usually with a single apical spine, or occasionally 1-4 short, small spines confined to the upper margins of the leaves. A southern variety, somewhat more hardy than 'Howard' and 'East Palatka.' (Hume, Florida.)

50. 'Isaiah'

A broadly-conical male, with bright green glossy foliage; abundant flowers produce copious supply of pollen. (Miss White, New Jersey.)

51. 'Jingle Bells'

A female with rich, semi-glossy, broad

V-shaped foliage "with some leaves having a washboard effect." Profuse fruiter, with extra large, brilliant red berries, slightly tinted with orange. Considered a very fine holly because of "its snappy and polished appearance." (Bosley, West Virginia.)

52. 'Johnson'

A female selected for hardiness following the severely cold 1933-1934 winter. A very normal *Ilex opaca*, except that in sun and exposed situations the leaves are quite convex in form. It berries well; easy to root. Reported hardy in the fringe areas beyond the range of American holly. (Gable, Pennsylvania.)

53. 'Judge Brown'

An excellent specimen type female of symmetrical habit; berries, scarlet, egg-shaped. Foliage, dark green above, lighter beneath. Original tree at Locust, New Jersey. Reg. AAN No. 419. (Conners, New Jersey.)

54. 'Katz'

A large, dark green-leaved, abundant-fruited female with somewhat pendent branches. Berries are large, bright red, occasionally borne 2 or 3 on a peduncle. (Hume, Louisiana.)

55. 'Kentucky'

A male with leaves of good green color, twice as large as normal; of massive pyramidal habit. Selected about 1930, from plants collected in Kentucky. (Dauber, Pennsylvania.)

56. 'Knight'

A very straight female of distinct upright habit; plants require no staking from cuttings on. Leaves dark green; excellent fruiting habits, with bright red berries. (Quaintance, Maryland.)

57. 'Lady Alice'

An easily propagated female, annually bearing good crops of medium red-colored fruits. Leaves, large and glossy. (Wolf, New Jersey.)

Illustration 8.

Named varieties of *Ilex opaca*

'Old Heavy Berry'

'Miss Helen'

'Norfolk'

'Perfection'



58. 'Lake City'
An openly-branched female of pyramidal habit, with light green leaves, each with 3-7 fine, sharp spines confined to the upper leaf margins. Fruits are medium to large, orange in color. (Hume, Florida.)
59. 'Lanny'
A compact male of medium-broad habit with average-sized leaves of a very fine green winter color. (See 'Cobalt.')
60. 'Lewis Swarts'
An abundant-flowering male of moderate growth rate, maintaining a compact, full-foliaged habit when older. Leaves are leathery, with irregularly reflexed margins and prominently spined. (Pennsylvania; New Jersey.)
61. 'Mae'
A slender, well-shaped, heavily-bearing female, with small to medium dark, glossy green leaves and red berries of average size. (Miss White; Windon, New Jersey.)
62. 'Mamie Eisenhower'
A female, with heavy-bearing fruits of excellent size and color. Leaves, very dark green, smaller than normal. (Wolf, New Jersey.)
63. 'Manig'
A heavy-fruited female, with rather large, dark, glossy green leaves and dark, shiny red berries, sometimes borne 3 on a peduncle. This holly has also been called 'Delia.' (Miss White; Windon, New Jersey.)
64. 'Margaret'
A female of rather broad, heavy growth, with medium-large leaves of an attractive apple-green winter color. Berries are orange-red, in fine clusters. (See 'Cobalt.')
65. 'Margaret Smith'
A female selection with very large lush leaves, deep green in color, even in unshaded situations. Berries medium to large, good color. Rooted cuttings easy to grow and to shape into comparatively compact plant; fair rooter. (Pease, West Virginia.)
66. 'Marion'
A rather openly-branched female of good foliage; medium-sized bright yellow berries. Original tree from Marion County, Florida. (Hume, Florida.)
67. 'Maryland Dwarf'
A somewhat shy-bearing female. Leaves good green. A low, spreading plant, about 4 times broader than high, offering new landscape uses not possible with generally upright habits of typical American hollies. (Dilatush, Maryland.)
68. 'Maurice River'
A vigorous-growing female; foliage glossy green. Easy to propagate. Young plants have upright habit and set berries readily. (Wolf, New Jersey.)
69. 'Maxwell Point'
A female with unusually large leaves and very pronounced spines. (Hohman, Maryland.)
70. 'Menantico'
A rapid-growing, easy-to-propagate female, setting numerous fruits when only two years old. Foliage, deep green with prominent spines. (Wolf, New Jersey.)
71. 'Merry Christmas Improved'
A female with good, green leaves, and a dependable berrying habit. (Dilatush; Boyce Thompson Institute.)
72. 'Millville'
A well-shaped female. Light red, oval berries, set in profusion. Easily propagated. (Wolf, New Jersey.)

Illustration 9.

Named varieties of *Ilex opaca*

'Emily'	'Amy'
'Knight'	'Canary'



73. 'Miss Helen'

A popular female of conical habit, with large, egg-shaped scarlet berries, abundantly produced, even on young plants. The foliage is dense and dark green. An attractive holly. Reg. AAN No. 144. (McLean, Maryland.)

74. 'Monty'

A fast-growing female of compact growth, requiring little or no pruning. Leaves considered of better color than average. Selected in Pennsylvania from lining-out stock purchased from Alabama, about 1937. (Dauber, Pennsylvania; Alabama.)

75. 'Mossy'

A male with large, spiny leaves of an unusual bright apple-green winter color. Grows into a compact plant with very little pruning. (See 'Cobalt.') (Pride, Pennsylvania.)

76. 'Mrs. Davis'

A female selected for the novelty of its clear yellow berries. (Pease, West Virginia.)

77. 'Mrs. S. D. Hunter'

A female of good foliage, bright red berries; considered an excellent selection in the South. Original tree at Westminster, South Carolina. (Frierson, South Carolina.)

78. 'Mrs. Santa'

A female selected about 1924, with berries moderately plentiful, crimson, of small size. A good hedge holly because it branches freely, the tips curving downwards and sideways, tending to fill openings down to ground level. (Nearing, Delaware.)

79. 'Natale'

A hardy, medium-sized, very bushy, compact female. Leaves, small, dark. Berries, borne in very close clusters with short stems, in great abundance. An attractive plant for use where space is limited. Original tree on the north and exposed side of Cape Cod, Massachusetts. (Wheeler, Massachusetts.)

80. 'Norb'

A male with large leaves of very good

winter color. Abundant flowers, unusually showy. (See 'Cobalt.') (Pride, Pennsylvania.)

81. 'Norfolk'

An orchard-type female of spreading habit, good foliage. Very heavy producer of berries. Original tree near Norfolk, Virginia. (Dauber, Virginia.)

82. 'October Glow'

An abundant-fruiting female, with dark red fruits; leaves dark green, with evenly spaced, large spines. (Hohman, Maryland.)

83. 'Old Faithful'

A slow-growing female. Leaves better than average dark green. Dependable bearer; showy fruits somewhat slower to color up than most hollies. (Dilatush, New Jersey.)

84. 'Old Heavy Berry' ('Hookstra')

A hardy female. Leaves, large, corrugated, dark green, shiny. Open framework of branches. Slow-growing informal type with round darkened red berries, somewhat clustered; dependable bearer, producing good cut holly. Original tree from Burlington, New Jersey. Reg. AAN No. 513. (Dilatush, New Jersey.)

85. 'Osa'

A fruitful female considered by Miss Elizabeth White to be as fine a variety as 'Manig.' (Miss White; Windon, New Jersey.)

86. 'Pearle LeClair'

A heavy- and regular-bearing female, with strongly but sparsely spined, large leaves; berries are red, large, average 1/2 in. in size in heavy clusters. Original tree bears berries with no apparent nearby males. Young plants set fruits indoors and in greenhouses when no other hollies are in bloom. (LeClair, North Carolina.)

87. 'Perfection'

A female with medium to dark green leaves; bright red berries, well distributed, average in quantity. Forms a somewhat broad, compact plant at an early age; strong growing and upright in habit. (Dilatush.)

Illustration 10.

Named varieties of *Ilex opaca*

'Cumberland'

'Menantico'

'Lady Alice'

'Maurice River'

88. 'Perpetual'

A tall, slender female, rather short branches and medium-sized, splendid "Christmas red" berries borne in large clusters. "A popular, annual-bearing variety which holds its berries the year around; the tree will appear as red on the Fourth of July as in winter, if the berries are not eaten by robins." Original tree at Sandwich, Massachusetts. (Wheeler, Massachusetts.)

89. 'Pride Berry'

A rather fast-growing female, with large leaves of dark green winter color; good for cut sprays. Berries, bright red, "form in good quantities even with no males nearby." (See 'Cobalt.') (Pride, Pennsylvania.)

90. 'Pride Hedge'

A small-leaved female of good dark green winter color, growing into a compact plant with little or no pruning. Berries are bright red, in good quantity. (See 'Cobalt.') (Pride, Pennsylvania.)

91. 'Red Velvet'

A female with well-displayed berries. Grows into an attractive pyramidal shape with minimum pruning; excellent for landscape uses. (Wolf, New Jersey.)

92. 'Repandens Spreading'

A low, spreading female form; leaves, attractive medium green; shy producer of red berries; circular habit. Useful under picture windows, or where low-spreading forms are desirable. Reg. AAN No. 510. (Dilatash, Delaware.)

93. 'Reynolds'

A female with bright red oval berries to 1/2 in. Considered a desirable variety in warmer areas. Of broad columnar habit; leaves large, broad, spiny, retaining dark green color throughout the year. Reg. AAN No. 62. (Reynolds, Tennessee.)

94. 'Richards'

A vigorous-growing female, with berries in large clusters; erect habit, pronounced even in cuttings. Leaves somewhat broad, more or less flat; considered good wreath type. Original tree in southern Maryland; recommended for warmer areas. (Steiner, Maryland.)

95. 'Ridgeway'

A small-leaved female of very upright habit; distinct tendency of throwing many lateral branches. Fair rooter; extremely delicate when young, needs staking. (Pease, West Virginia.)

96. 'Saint Ann'

A fine, large, rapid-growing female with long, spreading branches. A good landscape or orchard tree as large berries borne on long stems are very well displayed. Original tree from Saint Mary Island, Cape Cod, Massachusetts. (Wheeler, Massachusetts.)

97. 'Saint Mary'

A compact female, with closely-growing branches. Leaves very dark green. Berries bright, medium sized, appear early and in abundance. A fine pot plant for Christmas sales because of its youthful fruiting habits and name. Original tree from Saint Mary Island, Cape Cod, Massachusetts. (Wheeler, Massachusetts.)

98. 'Salem Compact'

A very slow-growing, dwarf-type female, with a narrow, pyramidal habit; short, thick, leathery leaves. Considered ideal for restricted planting areas. Discovered wild in southern New Jersey. (Dauber, New Jersey.)

99. 'Sallie'

A heavy-bearing female with dark green leaves and rather large, bright red fruits. (Miss White, New Jersey.)

100. 'Santa Claus'

A very hardy, fine male of compact growth. Leaves, good dark green, slightly smaller than average in size. Blooms so freely that blossoms are a feature of this selection. (Bosley, Ohio.)

101. 'Savannah'

A fruitful female of upright columnar habit, with well-displayed, deep red berries. Young twigs, leaf midribs and petioles purplish-brown in color. (Robertson, Georgia.)

102. 'Silica King'

A vigorous-growing male, with large, glossy leaves and abundant flowers. Easy to propagate. (Wolf, New Jersey.)

103. 'Slim Jane'

A narrow-leaved female, with irregular type of growth habit, making it suitable for informal plantings. Berries large, plentiful, very bright and scarlet in color. (Wolf, New Jersey.)

104. 'Slim Jim'

A male selection with narrow leaves, medium green in color. (Miss White; Windon, New Jersey.)

105. 'T. B. Symons'

A male of vigorous habit, with large, deep green leaves. Flowers unusually abundant, even present on short leafless shoots arising from knobs along trunk of original tree. Reg. AAN No. 255. (Dengler, D. C.)

106. 'Taber No. 3'

A heavily-fruiting female of distinct conical habit, with medium-sized, widely spaced, shining red berries. Leaves are dull green, usually with 5 or 6, sometimes more or less. (Hume, Florida.)

107. 'Tiny Tim'

A dense-growing male, with abnormally small leaves. (Wolf, New Jersey.)

108. 'Tom Brown'

A male of compact growth habit. Leaves, small, crinkly, medium green color. Reg. AAN No. 420. (Brown, New Jersey.)

109. 'Toner'

A female selection with slightly larger than normal, flatish, dull, deep green leaves, evenly spined; fruits borne abundantly and regularly in tight and loose clusters; individual berries dull red, stigma scars appear as conspicuous black dots. (O'Rourke, D. C.)

110. 'Trisco'

A female of open habit, with large clusters of bright red berries, well displayed. Leaves are medium sized, slightly curved, flat, dark green. (O'Rourke.)

111. 'Victory'

A female, originally found in New Jersey, with dark green leaves, distinctly keeled, curved, moderately glossy; spines slightly divaricate. Berries average in size, round, dark red, moderately glossy; fruits well while young. (Crooks, Pennsylvania.)

112. 'Waltemyer'

A slow-growing, hardy female of very compact growth habit. Needs little pruning; prolific fruiter; foliage good; a distinct type. (Dauber, Pennsylvania.)

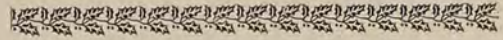
113. 'Westcroft'

A hardy female somewhat similar to 'Old Heavy Bearer.' (Westcroft Gardens, Michigan.)

114. 'Yule'

A hardy female; sturdy, extra stiff-branched type. "The feature of this tree is that the birds do not normally eat its larger-than-normal-sized berries, and they retain their red color into midsummer." Original plant believed a Boyce-Thompson Institute selection from Massachusetts. (Bosley, Ohio.)

Fred C. Galle, director of horticulture, Ida Cason Calloway Gardens, Chipley, Georgia, was formerly assistant professor of horticulture at the University of Tennessee and later held the same position at the Ohio State University. He is the author of numerous articles on ornamental plants for southern areas in the United States.



Oriental Hollies

SHIU-YING HU

Oriental hollies are here defined as hollies growing in China, Japan, and their adjacent islands. Japanese botanists usually include the species of the Bonin Islands in their flora. The writer has found that the hollies of this area are more closely related to the Micronesian elements than to the Chinese or Japanese species. Moreover, none of them have been introduced into cultivation. They are excluded from this treatment.

In a way this work is a summary, a digest and an amplification of all the writer's publications on hollies. It is a summary because it covers almost all the species described in *The Genus Ilex in China* and the *Ilex in Taiwan and the Liukiu Islands*. It is a digest because only the part of a species that would interest the growers is extracted from the taxonomic treatments in the above-mentioned articles. It is an amplification because the Japanese species as listed in Hara's *Enumeratio Spermatophytarum Japonicarum* (1954) and described in Ohwi's *Flora of Japan* (1953) are incorporated. Moreover, for the first time, most of the species are illustrated. In order to help growers to identify their material and to name their species correctly, in most cases, the drawings are portraits of the type specimen. The habit sketches of all the species are half the natural sizes and the detached fruits are enlarged to one and a half times the natural sizes.

A couple of obvious limitations should be mentioned here. First, on account of the limitation of space, the flower characters are omitted. Second, a few species known only from very insufficient material are omitted, for example, *Ilex brachyphylla* known only from a specimen of staminate flowers and *I. kusanoi* known from fragments with young fruits.

KEY TO THE ORIENTAL SPECIES

- A. Plants evergreen; lenticels obscure or absent on current year's growth; leaves leathery, rarely papery.
- L. Pistillate flowers and fruits in cymose or umbelliform clusters, each inserted singly behind a bud in the axil of a leaf; pyrenes unicanalicate or 3-striate and 2-sulcate -----
- I. *Section Lioprinus*
- BB. Pistillate flowers or fruits solitary in the axils of leaves or to scales at the basal portion of current year's growth (except in *Ilex triflora*); pyrenes smooth on the back -----
- II. *Section Paltoria*
- BBB. Pistillate flowers or fruits fasciculate and axillary to leaves on second year's growth.
- C. Flower and fruiting fascicles containing compound cymes or umbels -----
- III. *Section Lauroilex*
- CC. Flower and fruiting fascicles containing single flowers or simple cymes.
- D. Pyrenes 6-8, rarely 5, leathery, striate -----
- IV. *Section Pseudoaquifolium*
- DD. Pyrenes 4, rarely 3, 2 or 1, stony or woody, rugose -----
- V. *Section Aquifolium*
- AA. Plants deciduous; lenticels conspicuous on current year's growth; leaves membranaceous or papery.
- B. Pistillate flowers and fruits solitary and axillary to normal leaves or 3 to numerous in a simple or compound cyme on a single peduncle axillary to a normal leaf.
- C. Fruit 10 or more in a large cymose or subumbelliform cluster; staminate flower cymose -----
- VI. *Section Micrococca*
- CC. Fruit solitary or 2 or 3 in a simple cyme; staminate flowers fasciculate -----
- VII. *Section Euprinos*
- BB. Pistillate flowers fasciculate with leaves on a spur.
- C. Fruit small, 1/6 in. long; pyrenes 6-13, smooth, woody -----
- VIII. *Section Pseudoprinos*
 (1 sp. No. 3
 I. fragilis)
- CC. Fruit medium-sized or large, 1/4 to 1/2 in. long; pyrenes 4-9, rugose, striate-sulcate or canaliculate, stony -----
- IX. *Section Prinoides*
- I. *Section Lioprinus*
- A. Pyrenes unicanalicate on the back or smooth; fruiting clusters cymose or subcapitate; leaves entire, crenate or serrate.
- B. Leaves entire, thickly leathery.
- C. Fruit cluster with evident secondary axis; leaves 5 in. or more long, 2-3 in. wide.
- D. Leaves glabrous; pyrenes 4 -----
1. *I. maclurei*
- DD. Leaves pubescent; pyrenes 5 or 6 -----
2. *I. latifrons*
- CC. Fruit cluster without evident secondary axis; leaves less than 5 in. long.
- D. Fruit large, solitary, 1/2 in. in diameter; fruiting stalk 1/5 in. long -----
3. *I. lancilimba*
- DD. Fruit rather small, in simple loose cymes, less than 1/3 in. in diameter; fruiting stalks longer than the diameter of the fruit.
- E. Plant densely pubescent, petioles rather short, 1/8 to 1/3 in. long.
- F. Leaves 2-1/2 in. long -----
4. *I. dasyphylla*
- FF. Leaves 3 in. or more long -----
5. *I. lonicerifolia*
- EE. Plant glabrous; petioles 1/2 to 1 in. long.
- F. Leaves ovate; fruiting cluster loose, peduncles about 1 in. long, pedicels about 1/2 in. long -----
6. *I. sterrophylla*
- FF. Leaves elliptic; fruiting cluster more compact, peduncles 3/4 in. long, pedicels less than 1/2 in. long.
- G. Leaves thick-leathery; pyrenes shallowly canaliculate on the back, the cross-section

- V-shaped _____
- GG. Leaves thin-leathery; pyrenes deeply canaliculate on the back, the cross-section U-shaped _____
- DDD. Fruits medium-sized, subsessile, in subcapitate umbels; fruiting pedicels 1/16 to 1/8 in. long.
- E. Umbels 5-7-flowered; leaves glabrous _____
- EE. Umbels 3-flowered; midrib densely pubescent beneath _____
- BB. Leaves crenate or serrate, leathery or papery.
- C. Lamina ovate, the base rounded, 2 in. or less long _____
- CC. Lamina elliptic, base acute or obtuse, 3-6 in. long.
- D. Fruiting cluster subumbelliform, the peduncles 3/4 to 1-1/4 in. long, longer than the petioles; leaves thick leathery _____
- DD. Fruiting cluster cymose, the peduncles less than 1/2 in. long, usually shorter than the petioles.
- E. Branchlets and leaves glabrous; fruit ellipsoid; pyrenes narrowly canaliculate _____
- EE. Branchlets and leaves pubescent; fruits globose; pyrenes broadly canaliculate or ecanaliculate.
- F. Fruiting cluster loose, secondary axis usually developed; peduncles 1/4 to 1/2 in. long; cross-sections of pyrenes U-shaped _____
- FF. Fruiting cluster simple, secondary axis lacking; peduncles 1/8 in. long; cross-sections of pyrenes triangular _____
- AA. Pyrenes 3-striate, usually 2-sulcate on the back; fruiting clusters umbelliform; leaves entire.
- B. Pyrenes smooth, 3-striate, esulcate, leathery _____
- BB. Pyrenes 3-striate and 2-sulcate, woody.
- C. Fruit ellipsoid or globose; calyx erose, eciliate.
- D. Leaves 2-3 in. long, 3/4 to 1-1/2 in. wide; petioles rather long, one-fifth the length of the lamina _____
- DD. Leaves 1 in. long, about 1/2 in. wide; petioles short, about one-tenth the length of the lamina _____
- CC. Fruit depressed globose; calyx ciliate.
- D. Branchlets pubescent; fruit 1/8 in. in diameter; pyrenes 5 or 6 _____
- DD. Branchlets glabrous; fruit 1/4 in. in diameter; pyrenes 6-10 _____
7. *I. editicostata*
8. *I. matsudai*
9. *I. tugitakayamensis*
10. *I. manneiensis*
11. *I. ferruginea*
12. *I. suaveolens*
13. *I. chinensis*
14. *I. kwangtungensis*
15. *I. atrata*
16. *I. excelsa*
17. *I. rotunda*
18. *I. angulata*
19. *I. godajam*
20. *I. umbellulata*

II. Section *Paltoria*

- A. Fruits red; leaves not punctate.
- B. Leaves 2-3 in. long, subentire or the apical half serrate; fruiting pedicels 1-2 in. long _____
- BB. Leaves less than 1-1/2 in. long, serrate; fruiting pedicels less than 3/4 in. long.
- C. Fruiting pedicels 1/5 in. long; leaves obovate, rounded at the apex _____
- CC. Fruiting pedicels 1/3 to 1/2 in. long; leaves ovate, ovate-elliptic or lanceolate.
- D. Branchlets densely pubescent; leaves serrate throughout; pyrenes 4 _____
- DD. Branchlets almost glabrous; leaves serrate only at the apical half, the basal half entire; pyrenes 4-6 _____
- AA. Fruits black; leaves punctate.
- B. Fruits solitary, axillary to leaves or to scales at the base of current year's growth.
- C. Leaves elliptic or obovate-elliptic.
- D. Flowers 4-merous; calyx rounded and entire; stigma of fruit applanate.
- E. Pyrenes smooth, 5-striate, the striae impressed; petioles 1/4 as long as the lamina _____
- EE. Pyrenes subglobose, slightly ridged on the back; petioles 1/6 as long as the lamina _____
21. *I. pedunculosa*
22. *I. rockii*
23. *I. yunnanensis*
24. *I. sugeroki*
25. *I. maximowicziana*
26. *I. vividis*

- DD. Flowers 4-9-merous, calyx erose or dentate; stigma of fruit elevate; pyrenes smooth.
 E. Leaves small, 1/3 to 1-1/4 in. long, the apex rounded or acute; fruiting pedicels about 1/4 in. long; flowers 4-merous 27. *I. crenata*
 EE. Leaves rather large, 1-1/2 to 2-3/4 in. long, the apex shortly acuminate; fruiting pedicels about 1/2 in. long 28. *I. szechwanensis*
 CC. Leaves oblanceolate; base cuneate 29. *I. mutchagara*
 BB. Fruits usually fasciculate, axillary to leaves of the second year's growth 30. *I. triflora*

III. Section *Lauroilex*

- A. Leaves shortly acuminate; primary lateral nerves 6-8 pairs, obscure; fruiting fascicles containing umbels 31. *I. omeiensis*
 AA. Leaves caudate-acuminate; primary lateral nerves 15-22 pairs, prominent on both surfaces; fruiting fascicles containing compound cymes 32. *I. venulosa*

IV. Section *Pseudoaquifolium*

- A. Pyrenes 3-striate and 2-sulcate, woody; branchlets slender, ridged, cross-section appearing quadrangular.
 B. Pistillate fascicles containing both uniflorous and cymose flowers; fruiting fascicles loose, pedicels about 1/4 in. long 33. *I. stewardii*
 BB. Pistillate fascicles containing only uniflorous pedicels about 1/8 in. long.
 C. Leaves serrate or subentire, hirsute; branchlets hirsute 34. *I. pubescens*
 CC. Leaves entire, glabrous; branchlets puberulous 35. *I. hainanensis*
 AA. Pyrenes smooth, leathery; branchlets roundish.
 B. Fruits in fascicles or short racemes; fruiting pedicels 1/3- to 3/4 in. long, longer than the diameter of the fruit.
 C. Fruit medium-sized, 1/4 in. in diameter, style evident; stigma columnar or capitate.
 D. Leaves not punctate beneath.
 E. Branchlets pilose; leaves linear-lanceolate or oblanceolate, about 1/3 in. wide; pistillate fascicles containing uniflorous and cymose flowers 36. *I. metabaptista*
 EE. Branchlets glabrous or puberulous; leaves ovate, oblong or elliptic, 1 in. or more wide; pistillate fascicles containing uniflorous pedicels.
 F. Fruits with thick leathery skin; pyrenes unistriate on the back; branchlets glabrous 37. *I. elmerrilliana*
 FF. Fruits with membranaceous skins; branchlets puberulous.
 G. Pyrenes 4 or 5; leaves thick leathery; primary nerves 7-8 pairs, obscure 38. *I. memecylifolia*
 GG. Pyrenes 6 or 7; leaves leathery; primary lateral nerves 11-14 pairs, evident beneath 39. *I. sinica*
 DD. Leaves punctate beneath.
 E. Leaves obovate, thick-leathery, apex rounded, strongly emarginate, rarely obtuse 40. *I. tutcheri*
 EE. Leaves thin-leathery, linear, oblong or elliptic, apex acuminate, the tip retuse or obtuse, rarely acute.
 F. Fruiting pedicels 1-1/4 in. long; leaves very large, 7-10 in. long, 2-3 in. wide 41. *I. dolichopoda*
 FF. Fruiting pedicels less than 1/2 in. long; leaves less than 6 in. long.
 G. Leaves ovate-elliptic; apex abruptly acuminate, the tip retuse; fruiting pedicels about 1/4 in. long.

- H. Branchlets glabrous; flowers 5-8-merous ----- 42. *I. kobuskiana*
- HH. Branchlets puberulous; flowers 4-merous ----- 43. *I. retusifolia*
- GG. Leaves elliptic or oblong-elliptic; apex acuminate and obtuse; fruiting pedicels about 1/2 in. long.
- H. Leaves 5-6 in. long; fruiting pedicels 3/4 in. long ----- 44. *I. cochinchinensis*
- HH. Leaves 2-3 in. long; fruiting pedicels 1/3 in. long ----- 45. *I. ardisioides*
- CC. Fruit small, 1/8 in. in diameter; style wanting, the stigma discoid.
- D. Leaves entire; pyrenes 4, rarely 5.
- E. Lower surfaces of leaves punctate.
- F. Leaves 1-2 in. long, the apex obtuse and retuse; stigma navel-like in fruit ----- 46. *I. buxioides*
- FF. Leaves 1-1/2 to 4 in. long, the apex caudate or acuminate; stigma elevated in fruit.
- G. Fruiting fascicles containing 1-5-flowered cymes; apex of leaf acuminate ----- 47. *I. kengii*
- GG. Fruiting fascicles containing uniflorous pedicels; apex of leaf caudate ----- 48. *I. longicaudata*
- EE. Lower surface of leaves epunctate.
- F. Leaves oblong or obovate, the apex rounded or obtuse; flowers occurring at the basal portion of current year's growth ----- 49. *I. liangii*
- FF. Leaves broad-elliptic, ovate or elliptic, the apex acuminate, caudate or shortly produced and retuse; flowers fasciculate, axillary to leaves on second year's growth.
- G. Leaves roundish or broad-elliptic, the apex shortly produced and retuse; fruiting fascicles containing 1-3-flowered cymes ----- 50. *I. goshiensis*
- GG. Leaves ovate, ovate-oblong or ovate-elliptic, the apex acuminate or caudate; fruiting fascicles containing uniflorous pedicels.
- H. Branchlets pubescent; leaves elliptic to lanceolate, 1/3 to 3/4 in. wide; stigma of fruit capitate.
- I. Leaves elliptic, 1-2 in. long, the apex caudate, the margin entire ----- 51. *I. hayataiana*
- II. Leaves oblong-lanceolate, 1-1/4 to 2-3/4 in. long, the apex acuminate, the margin often with 1 or 2 bristly teeth ----- 52. *I. oligodonta*
- HH. Branchlets glabrous; leaves ovate or ovate-oblong, 3/4 to 1-1/3 in. wide; stigma of fruit discoid.
- I. Leaves ovate, thick leathery, shiny above; fruiting pedicels 1/6 in. long ----- 53. *I. wilsonii*
- II. Leaves ovate-oblong or ovate-lanceolate, opaque; fruiting pedicels 1/4 in. long ----- 54. *I. fukienensis*
- DD. Leaves serrate, crenate or subentire; pyrenes 6 or 7, minute.
- E. Leaves thin-leathery, oblong-lanceolate, 3-4 in. long, the basal half entire; primary lateral nerves 10-12 pairs ----- 55. *I. forrestii*
- EE. Leaves rigidly leathery, elliptic or obovate-elliptic, 1-1/2 to 2-1/4 in. long, sharply serrate throughout ----- 56. *I. wardii*

- BB. Fruits paired, axillary in leaves of second year's growth; fruiting pedicels very short, 1/10 in. long, always shorter than the diameter of the fruits.
- C. Leaves punctate beneath 57. *I. championii*
- CC. Leaves not punctate.
- D. Leaves dimorphic, those on juvenile branches strongly spinose, those on fruiting branches entire 58. *I. dimorphophylla*
- DD. Leaves not spinose.
- E. Midrib elevate; branchlets hirsute; leaf-apex rounded and retuse 59. *I. lohfauiensis*
- EE. Midrib plane or impressed; branchlets puberulent; leaf-apex obtuse or shortly acuminate, rarely retuse 60. *I. hanceana*

V. Section *Aquifolium*

- A. Leaves spinose, or entire with or without a spine at the apex.
- B. Pyrenes stony, irregularly wrinkled and pitted; fruit containing 4 pyrenes.
- C. Fruiting pedicels 1/10 in. long, always shorter than the diameter of the fruit; leaves coarsely serrate or spinosely dentate.
- D. Leaves 3 to 4-3/4 in. long, the margin coarsely serrate, sometimes the teeth ending with weak spine; fruit large, 1/2 in. in diameter 61. *I. hylonoma*
- DD. Leaves 2 to 3-3/4 in. long, the margin armed with 4-10 spines; fruit 1/4 to 1/3 in. long 62. *I. centrochinensis*
- CC. Fruiting pedicels about 1/4 to 1/2 in. long; leaves sinuate, armed with 1-3 rigid spines on each side, or entire with or without 1 strong apical spine.
- D. Leaves quadrangular-oblong, sinuate and armed with 1-3 rigid spines on each side or entire with a strong apical spine 63. *I. cornuta*
- DD. Leaves entire, unarmed.
- E. Leaves obovate-elliptic, petiole 1/3 as long as the lamina 64. *I. integra*
- EE. Leaves oblong or lanceolate-elliptic, petioles 1/6 to 1/8 as long as the lamina 65. *I. leucoclada*
- CCC. Fruiting pedicels very short, 1/10 in. long; leaves entire 66. *I. brachypoda*
- BB. Pyrenes woody, palmately striate; fruit generally containing 2 pyrenes.
- C. Leaves large, 2-3 in. long; petioles 1/4 in. long 67. *I. dipyrena*
- CC. Leaves 1/3 to 1-3/4 in. long; petioles 1/6 in. long.
- D. Pyrenes generally 4; leaves ovate.
- E. Leaves 1-1/4 to 1-3/4 in. long, margin sinuate, with 3-7 spines on each side; pyrenes suborbicular in outline, broadly grooved on the back 68. *I. wenchowensis*
- EE. Leaves 1/2 to 1 in. long, the margin armed with 1, 2, rarely 3 spines; pyrenes obovate or oblong, impressed at the broad end 69. *I. pernyi*
- DD. Pyrenes usually 2, rarely 1, 3 or 4; leaves lanceolate, elliptic, rhomboid, quadrangular or ovate.
- E. Leaves lanceolate with 4-7 spines on each side; fruits obovoid-ellipsoid, 1/4 in. long 70. *I. georgei*
- EE. Leaves elliptic, rhomboid, quadrangular or rarely ovate; fruit ellipsoid or subglobose, 1/3 in. long.
- F. Large shrubs or small trees 3-20 ft. high; leaves elliptic or ovate, truncate or rounded at the base, acuminate at the apex; pyrenes 2, occasionally 3 or 4, palmately striate and sulcate.
- G. Leaves elliptic or ovate, the margin armed with 4-6 weak spines on each side; fruiting pedicels pubescent 71. *I. ciliospinosa*

- GG. Leaves ovate or quadrangular, margin armed with 2 or 3 strong spines on each side; fruiting pedicels glabrous 72. *I. bioritsensis*
(= *I. pernyi* var. *veitchii*)
- FF. Small shrub about 1 ft. high, usually prostrating; leaves subrhomboid, rugose, base obtuse, apex broadly deltoid and acute; pyrenes 1, palmately striate and esulcate..... 73. *I. perryana*
- AA. Leaves serrate or crenate, rarely entire, those on the flowering branches never spinose.
- B. Pyrenes stony, irregularly wrinkled and pitted; fruits 1/3 in. in diameter (except *Ilex suzukii*); stigma navel-like, rarely discoid.
- C. Ovary and fruit pubescent.
- D. Fruiting pedicels 1/8 in. long; leaves elliptic or ovate-elliptic, less than 3 in. long; petioles less than 1/4 in. long 74. *I. pubilimba*
- DD. Fruiting pedicels 1/3 in. long; leaves oblong, 4-6 in. long; petioles 3/4 in. long 75. *I. kaushue*
- CC. Ovary and fruit glabrous.
- D. Branchlets, leaves and flower-clusters densely hirsute 76. *I. nanningensis*
- DD. Branchlets and flower-clusters glabrous or puberulous; leaves always glabrous.
- E. Leaves unusually thick and large, 4-7 in. long; flower-clusters paniculate 77. *I. latifolia*
- EE. Leaves medium-sized, less than 4 in. long; flower-clusters fasciculate or shortly racemose.
- F. Leaves entire; fruits 1/5 in. in diameter 78. *I. suzukii*
- FF. Leaves crenulate-serrulate, serrate or subentire; fruit 1/3 to 3/4 in. in diameter.
- G. Fruit about 1/3 in. in diameter; pyrenes 1/5 in. long.
- H. Leaves leathery, the apex obtuse or rarely short-acuminate; fruiting pedicels 1/3 in. long or less.
- I. Branchlets glabrous; leaves densely serrate; fruiting pedicels 1/3 in. long 79. *I. denticulata*
- II. Branchlets puberulous; leaves remotely serrate; fruiting pedicels 1/6 in. long 80. *I. graciliflora*
- HH. Leaves thin-leathery, apex acuminate; fruiting pedicels 1/2 in. long.
- I. Leaves acuminate 81. *I. tsangii*
- II. Leaves obtuse 82. *I. liukuensis*
- GG. Fruits 1/2 in. in diameter; pyrenes 1/4-1/3 in. long.
- H. Mature fruit solitary; fruiting pedicels very short, about 1/8 in. long 83. *I. chingiana*
- HH. Mature fruits fasciculate; fruiting pedicels 1/3 in. long.
- I. Leaves elliptic or obovate, reticulation of the veinlets prominent on both surfaces 84. *I. uraiensis*
- II. Leaves oblong, ovate-elliptic or oblanceolate; reticulation of veinlets obscure above.
- J. Apex of leaves caudate, base obtuse or rounded 85. *I. subficoidea*
- JJ. Apex of leaves acuminate, base cuneate 86. *I. nuculicava*
- BB. Pyrenes palmately striate and sulcate; fruits rather small, 1/5 to 1/4 in. in diameter; stigma discoid or capitate, rarerly navel-like.
- C. Leaves papery, rarely leathery, the veinlets impressed above; fruiting pedicels 1/5 to 1/4 in. long.

- D. Branchlets smooth, glabrous; leaves medium-sized, 3-6 in. long, acuminate at the apex.
- E. Calyx and bracts eciliate; fruiting pedicels longer than the diameter of the fruit; terminal buds unfolding at anthesis _____ 87. *I. hookeri*
- EE. Calyx ciliate; fruiting pedicels shorter than the diameter of the fruit; terminal buds unfolding after anthesis.
- F. Leaves elliptic or obovate-elliptic, the lateral nerves 10-15 pairs; stigma of fruit discoid.
- G. Fruiting pedicels glabrous _____ 88. *I. franchetiana*
- GG. Fruiting pedicels pubescent _____ 89. *I. melanotricha*
- FF. Leaves oblanceolate or linear, the lateral nerves 8-10 pairs; stigma of fruit capitate _____ 90. *I. fargesii*
- DD. Branchlets warty; leaves rather small, 1/3 to 2 in. long, rarely longer, the apex acute or obtuse.
- E. Leaves elliptic-lanceolate or linear, over 1 in. long; fruits fasciculate.
- F. A small tree or large erect shrub; fruiting pedicels equal to or shorter than the diameter of the fruits _____ 91. *I. delavayi*
- FF. A weak often prostrate shrub; fruiting pedicels longer than the diameter of the fruit _____ 92. *I. rugosa*
- EE. Leaves broadly elliptic or obovate-elliptic, less than 3/4 in. long; fruits usually solitary or paired.
- F. A small tree up to 20 ft. high; leaves papery, broadly elliptic, the apex cuspidate; petioles 1/4 in. long, one-half the length of the lamina _____ 93. *I. nothofagifolia*
- FF. A small shrub usually prostrate, up to 3 ft. high; leaves leathery, obovate, the apex obtuse or acute; petioles 1/10 in. long, 1/4 to 1/7 the length of the lamina _____ 94. *I. intricata*
- CC. Leaves thick-leathery or thin-leathery, the veinlets never impressed above; fruiting pedicels generally short, 1/8 to 1/3 in. long.
- D. Fruits pubescent _____ 95. *I. wangiana*
- DD. Fruits glabrous.
- E. Fruits 1/4 in. in diameter; pyrenes 1/5 in. long _____ 96. *I. glomerata*
- EE. Fruits 1/5 in. or less long; pyrenes 1/8 in. long.
- F. Leaves oblanceolate; petioles very short, 1/10 in. long; pyrenes hairy _____ 97. *I. cinerea*
- FF. Leaves elliptic or oblong; petioles moderately long; pyrenes not hairy.
- G. Branchlets densely pubescent.
- H. Fruiting pedicels 1/8 in. long.
- I. Leaves ovate-elliptic, 2-3 in. long; pyrenes 1/8 in. long _____ 98. *I. buergeri*
- II. Leaves oblong, 4-5 in. long; pyrenes 1/5 in. long _____ 99. *I. pingnanensis*
- HH. Fruiting pedicels 1/4 in. long _____ 100. *I. subrugosa*
- GG. Branchlets glabrous.
- H. Leaves linear-lanceolate, the lower surface punctate _____ 101. *I. peiradena*
- HH. Leaves ovate, oblong or elliptic, not punctate beneath.
- I. Fruiting pedicels 1/8 in. or less long, always shorter than the diameter of the fruit.
- J. Petioles less than 1/3 in. long.
- K. Leaves coriaceous; veinlets evident beneath.

- L. Fruiting cluster compact, the central axis not evident; stigma navel-like..... 102. *I. corallina*
- LL. Fruiting cluster rather loose, the central axis evident, up to 1/3 in. long..... 103. *I. formosana*
- KK. Leaves thickly leathery; veinlets obscure beneath 104. *I. confertiflora*
- JJ. Petioles 1/2 in. long 105. *I. ficoidea*
- II. Fruiting pedicels 1/4 to 1/3 in. long, usually equaling or longer than the diameter of the fruit.
 - J. Leaves thinly leathery; pyrenes palmately striate, rather smooth.
 - K. Apex of the leaf caudate; stigma discoid 106. *I. cyrtura*
 - KK. Apex of the leaf obtuse, acute or shortly acuminate; thickly discoid 107. *I. intermedia*
 - JJ. Leaves leathery; pyrenes palmately striate and sulcate 108. *I. chieniana*

VI. Section *Micrococca*

- A. Fruiting cluster a trichotomous compound cyme with well-developed secondary axis; leaves with 6-8 pairs of lateral nerves 109. *I. micrococca*
- AA. Fruiting cluster umbel-like, the secondary axis usually lacking; leaves with 10-20 pairs of lateral nerves 110. *I. polyneura*

VIII. Section *Euprinos*

- A. Fruiting pedicels shorter than the petioles of leaves.
 - B. Leaves elliptic, base acute, the width about 1/2 the length of the lamina 112. *I. serrata*
 - BB. Leaves oblanceolate, base cuneate; the width about 1/4 to 1/5 the length of the lamina 113. *I. nipponica*
(*I. nemotoi*)
- AA. Fruiting pedicels several times longer than the petioles; leaves ovate, base rounded 114. *I. geniculata*

IX. Section *Prinoides*

- A. Pyrenes 3-ridged and deeply 2-canaliculate on the back; fruit with capitate or columnar stigma; style evident.
 - B. Leaves rather small, generally 1-2 in. long; fruit 1/4 in. in diameter; fruiting pedicels slender and long, 5 or 6 times as long as the diameter of the fruit 115. *I. asprella*
 - BB. Leaves large, generally 3-4 in. long; fruits large, 1/2 in. in diameter; pedicels various, but never as much as 3 times the diameter of the fruit; stigma columnar.
 - C. Pyrenes 7-9, laterally compressed, the back 1/10 in. wide; style glabrous; fruiting pedicels equal or longer than the diameter of the fruit 116. *I. macrocarpa*
 - CC. Pyrenes 6 or 7, the back 1/6 in. wide; style puberulous; fruiting pedicels shorter than the diameter of the fruit 117. *I. chapaensis*
- AA. Pyrenes striate and sulcate, the striae of the back reticulate; stigma discoid or capitate; style lacking.
 - B. Leaves obovate, 1 to 1-1/2 in. long, cuneate at the base; pyrenes 4 118. *I. aculeolata*
 - BB. Leaves ovate or ovate-elliptic, 2-1/2 to 3 in. long, base rounded; pyrenes 5 or 6.
 - C. Fruit pedicels 1/4 in. long; pyrenes 5; reticulation obscure on the upper surfaces of the leaves 119. *I. macropoda*
 - CC. Fruiting pedicels 1/8 in. long; pyrenes 6; leaves with sharply defined areoles on both surfaces 120. *I. tsoii*



1. *Ilex maclurei* Merr.

An evergreen tree. Leaves thick-leathery, oblong-elliptic, 3-1/2 to 7-1/2 in. long, 1-1/2 to 3 in. wide. Fruits in compound cymes axillary to leaves on current year's growth, secondary axis well-developed, globose, 1/4 in. in diameter, pyrenes 4, U-shaped in cross-section. A native of tropical China and northern Indo-China; taxonomically a very interesting species for it illustrates all the primitive characters of the genus; ornamentally its value is doubtful.

2. *Ilex latifrons* Chun

A tree about 25 ft. high, branchlets and leaves thinly covered with golden hairs. Leaves thin-leathery, elliptic-oblong, 7 to 8 1/2 in. long, 2-3/4 to 3-1/2 in. wide, base obtuse, apex shortly acuminate, entire. Fruits ellipsoid, 1/3 in. long, pyrenes 4. A native of southern China, with limited distribution, probably not worthy of introduction.

Illustration 11.

Hollies of the Orient

1. *Ilex maclurei*
2. *Ilex lancilimba*
3. *Ilex crenata* f. *microphylla*
4. *Ilex dasyphylla*
5. *Ilex sterrophylla*
6. *Ilex editicostata*
7. *Ilex venulosa*
8. *Ilex omeiensis*
9. *Ilex tutcheri*
10. *Ilex chinensis*
11. *Ilex suaveolens*
12. *Ilex umbellulata*
13. *Ilex rotunda*
14. *Ilex angulata*
15. *Ilex sugeroki*
var. *brevipedunculata*
16. *Ilex sugeroki*
17. *Ilex rockii*
18. *Ilex yunnanensis*
19. *Ilex yunnanensis paucidentata*
20. *Ilex yunnanensis parvifolia*
21. *Ilex yunnanensis gentilis*
22. *Ilex crenata*
23. *Ilex crenata* f. *longifolia*
24. *Ilex crenata* f. *latifolia*
25. *Ilex mutchagara*

3. *Ilex lancilimba* Merr.

An evergreen tree, 30 ft. high, the young stems and flower clusters covered with short golden hairs. Leaves elliptic-lanceolate, 3 to 5-1/2 in. long, 3/4 to 1-1/2 in. wide, entire, glossy, both ends acute. Fruits large, globose, 1/2 in. in diameter, 3 in a very compact cyme, peduncle and pedicels both short, together 1/5 in. long; pyrenes U-shaped in cross-section. A native of south China and Hainan Island, fruiting abundantly and the large red fruits are conspicuous; worthy of introduction.

4. *Ilex dasyphylla* Merr.

A very hairy evergreen species of tree form, up to 30 ft. high, branchlets, leaves and inflorescences covered with long golden hairs. Leaves ovate-lanceolate, entire, 1-1/2 to 3-1/4 in. long, 1/2 to 1 in. wide. Fruits pea-sized, in loose cymes of 3 or rarely solitary, axillary. A very curious species, native to the mountainous region of warm temperate China, well worth introduction.

5. *Ilex lonicrifolia* Hayata

An evergreen tree, pubescent stems, leaves and flower clusters. Leaves entire, oblong, 3-4 in. long, 1 to 1-1/2 in. wide. Fruits in loose cymes, axillary to leaves on current year's growth, globose, 1/5 in. in diameter, stalk slender, peduncles and pedicels about equal in length, together about 2/3 in. long, pyrenes 5 or 6. A native of Formosa, worthy of introduction.

5a. *Ilex lonicrifolia* var. *hakuensis*
(Yamamoto) S. Y. Hu

A glabrous variety with longer fruiting stalks, the peduncle and pedicel together 1-1/4 in. long.

6. *Ilex sterrophylla* Merr. & Chun

An evergreen tree, 10-45 ft. high, entirely glabrous. Leaves ovate-elliptic, 2-3 in. long, 3/4 to 1-1/2 in. wide, base rounded, apex acuminate, petioles one-third as long as the lamina. Fruits ellipsoid, 3 in a loose cyme, axillary to leaves on current year's growth, peduncles 1/2 to 3/4 in. long, pedicels 1/4 in. long, pyrenes 4, the back shallowly concave. A native of southern China and northern Indo-China, a pretty species with the appearance of *Ilex pedunculosa* but with larger and more numerous fruits.

7. *Ilex editicostata* Hu & Tang

An evergreen shrub, 9 ft. high. Leaves thick-leathery, shiny, entire, elliptic, 3 to 4-3/4 in. long, 1-1/2 to 1-3/4 in. wide, attenuate at both ends. Fruits rather large, 1/3 in. in diameter, 3 in loose cymes, axillary to leaves. A native of warm-temperate China, occurring in edge of forests at altitudes of 4,000 ft.; an interesting species, worthy of introduction.



Illustration 12.

Ilex chinensis, an Oriental holly used for decorative purposes during the New Year festivals in China.

- 7a. *Ilex editicostata* var. *chowii* S. Y. Hu
A variety with glabrous branchlets and leaves.
- 7b. *Ilex editicostata* var. *litseaefolia* (Hu & Tang) S. Y. Hu
A botanical variety with smaller leaves and fruits.
8. *Ilex matsudai* Yamamoto
An evergreen tree, entirely glabrous. Leaves broad-elliptic, 1-1/2 to 3-1/2 in. long, 1 to 1-1/2 in. wide, entire. Fruits globose, 3 in loose cyme axillary to leaves on current year's growth, about 1/3 in. in diameter, peduncles and pedicels together 1/2 to 3/4 in. long, pyrenes 4 or 5, U-shaped in cross-section. A native of Formosa, may be used as a substitute for *Ilex chinensis*.
9. *Ilex tugitakayamensis* Sasaki
An evergreen tree with robust branchlets. Leaves leathery, elliptic, entire, 4 to 5-1/2 in. long, 1-1/4 to 2 in. wide, glabrous. Fruits subsessile, forming a subcapitate cluster at the flattened end of a peduncle 1/3 in. long, ellipsoid, 1/4 in. long, pyrenes 4-6, smooth. A native of Formosa, known only from the type collection, a very interesting species, may be of little ornamental value.
10. *Ilex manneiensis* S. Y. Hu
An evergreen tree, 30 ft. high. Leaves entire, elliptic, 3-6 in. long, 3/4 to 2 in. wide, glabrous, the midrib thickly covered with golden hairs. Fruits globose, 1/3 in. in diameter, peduncles 1/4 in. long, pedicels very short, 1/10 in. long. A native of southwestern China, a curious species but may be of little ornamental value.
11. *Ilex ferruginea* Hand.-Mazz.
An evergreen shrub or small tree, the branchlets, petioles and principal nerves pubescent. Leaves ovate, serrate, 3/4 to 2 in. long, 1/2 to 1-1/2 wide. Fruits pea-sized, 3 in loose cymes.
12. *Ilex suaveolens* (Lévl.) Loes.
A beautiful, entirely glabrous evergreen tree, 35 ft. high. Leaves thick-leathery, glossy, elliptic, attenuate at both ends. 2-4 in. long, 1 to 1-1/2 in. wide, serrate. Fruits globose, 1/4 in. in diameter, 3-5 in a simple loose cyme, axillary to leaves on current year's growth, peduncles 3/4 to 1 in. long, pedicels slightly shorter, pyrenes 4 or 5, smooth. A native of southeastern China, closely related to but a much superior species to *Ilex chinensis* for its more glossy leaves and more showy fruits; being a tree it stands harvest-cutting better, well worthy of introduction.
13. *Ilex chinensis* Sims
An evergreen tree up to 50 ft. high. Leaves oblong-elliptic, serrate, 1-1/2 to 4 in. long, 3/4 to 1-1/3 in. wide, shiny dark green above. Fruits in loose cymes of 3-7, ellipsoid, 1/3 in. long, 1/4 in. in diameter, scarlet. A very beautiful species, extensively cultivated in China, cuttings used in New Year festivals (in February). Specimens in the University of Florida collections do not seem to express the full beauty of the species. It is worth trying to raise it in the more temperate climate of the Carolinas and Tennessee.
14. *Ilex kwangtungensis* Merr.
A tree about 30 ft. high, branchlets and underside of leaves pubescent. Leaves ovate-elliptic, 3-6 in. long, 1-1/4 to 2-1/2 in. wide, serrate, base rounded, apex acuminate. Fruits in a loose cyme, solitary and axillary to the leaves on current year's growth, ellipsoid, 1/3 in. long; pyrenes 4, cross-section U-shaped. A native of southern China, fruiting very abundantly, well worth introduction.
15. *Ilex atrata* W. W. Smith
A large evergreen shrub or small tree. Leaves large, serrate, oblong-elliptic, 6 in. long, 1-1/2 to 2 in. wide, midrib densely covered with brown hairs beneath. Fruits solitary or 3 in a cyme, in the axil of leaves, pea-sized, scarlet. A native of southwestern Yunnan; not yet introduced into cultivation.
16. *Ilex excelsa* (Wall.) Hook. f.
An evergreen tree, 20-30 ft. high. Leaves broad-elliptic, 2-4 in. long, 1 to 1-1/2 in. wide, entire, acuminate. Fruits globose, 1/5 in. in diameter, 3-7 in a cyme or umbel. A native of the eastern Himalayan region, similar to *Ilex rotunda* in appearance, worthy of introduction.
17. *Ilex rotunda* Thunb.
An entirely glabrous tree up to 60 ft. high. Leaves ovate or broad-elliptic, 1-3/4 to 3-1/2 in. long, 3/4 to 1-1/2 in. wide, base acute or obtuse, apex acuminate, entire. Fruits 3-7 in a small umbel axillary to leaves on current year's growth, ellipsoid, 1/4 in. long, pyrenes 5-7, the back 3-striate and 2-sulcate. A native of eastern Asia from Korea and Japan southward to southeastern China, proved to be the most beautiful specimen of the living holly collection in the University of Florida.
- 17a. *Ilex rotunda* var. *sinensis* Masamune
(*Ilex rotunda* var. *microcarpa* Hu)
A variety with pubescent peduncles and pedicels, and smaller fruits, less sulcate pyrenes.
18. *Ilex angulata* Merr. & Chun
Evergreen, leaves small, entire, elliptic, 1 to 1-1/2 in. long, 1/3 to 1/2 in. wide. Flowers pink. Fruits oblong, 1/4 in. long, 1 or 3 in a cyme, in axil of leaves. A native of Hainan Island, growing at 1,700 ft. altitude, worthy of introduction to the Southern States.



Illustration 13.

Ilex pedunculosa, native to China and Japan and hardy as far north as Boston, Massachusetts, in the U.S.A.

18a. *Ilex angulata* var. *longipedunculata*
S. Y. Hu

A variety with longer fruit-stalks and larger fruits.

19. *Ilex godajam* (Colebr.) Wall.

An evergreen tree with entire leaves resembling those of *Ilex rotunda* but fruiting more abundantly and the branchlets and leaves are pubescent. A native of tropical southeastern Asia, may not grow well in the United States.

20. *Ilex umbellulata* (Wall.) Loes.

An evergreen tree about 55 ft. high. Leaves large, oblong, entire, 4 to 5-1/2 in. long, 2 to 2-1/2 in. wide, base obtuse or roundish, apex obtuse or shortly acuminate. Fruits globose or depressed-globose, 1/4 in. in diameter, 7 in an umbel axillary to basal scales or leaves of current year's growth, peduncles 2/3 in. long, pedicels 1/7 in. long, pyrenes 6-10, woody. A native of eastern Himalayan region, may prove to be as good as *Ilex rotunda* for ornamental purposes.

21. *Ilex pedunculosa* Miq.

An evergreen shrub or small tree, 15 ft. high. Leaves ovate or oblong-elliptic, 2-3 in. long, 3/4 to 1-1/4 in. wide, entire, base rounded, apex acuminate. Fruits pea-sized, 3 in a loose cyme or solitary, axillary to leaves on current year's growth, peduncle and pedicel together up to 2 in. long, pendulous, pyrenes 5, may be 4 or 6, smooth. A native of China and Japan, proved to be hardy as far north as Boston, a very attractive species.

21a. *Ilex pedunculosa* f. *aurantiaca*
(Koidz.) Ohwi.

A horticultural variety with yellow-variegated leaves.

21b. *Ilex pedunculosa* var. *senjoensis*
(Hayashi) Hara

A botanical variety with prostrate and ascending stems.

21c. *Ilex pedunculosa* var. *taiwanensis*
S. Y. Hu

A botanical variety with small leaves 1/2 to 1-1/4 in. long, 1/3 to 5/8 in. wide.

21d. *Ilex pedunculosa* f. *variegata* (Nakai)
Ohwi.

A horticultural variety with white-variegated leaves.

22. *Ilex rockii* S. Y. Hu

A compact, evergreen shrub 2-5 ft. high with puberulous branchlets. Leaves obovate, resembling those of *Ilex crenata*, but not punctate. Pistillate flowers red, solitary, axillary to basal scales or leaves on current year's growth. Fruits red, pea-sized, pedicels 1/4 in. long. A native of the high mountains in southwestern China, growing at altitudes of 12,500-13,000 ft. A unique

and most desirable species for ornamental purposes, with all the virtue of *Ilex crenata* and superior for its red fruits, better than *Ilex yunnanensis* because of its dwarf habit.

23. *Ilex yunnanensis* Franch.

An evergreen shrub, 5-12 ft. high, branchlets densely pubescent. Leaves ovate to ovate-lanceolate, 3/4 to 1-1/2 in. long, 1/3 to 3/4 in. wide, base rounded to subacute, apex acute, mucronate. Pistillate flowers white, solitary, axillary to leaves on current year's growth. Fruits red, globose, 1/4 in. in diameter, pedicels about 1/2 in. long, nodding, pyrenes 4, smooth. A native of western China, introduced by the Arnold Arboretum in 1911, E. H. Wilson Seed No. 4458, a very attractive species to have, hardy as far north as Boston.

23a. *Ilex yunnanensis* var. *brevipedunculata* S. Y. Hu

A variety with short fruiting peduncles 1/4 in. long.

23b. *Ilex yunnanensis* var. *eciliata* S. Y. Hu

A variety with eciliate calyx lobes.

23c. *Ilex yunnanensis* var. *gentilis*
(Franch.) Loes.

A variety with crenate ovate leaves, obtuse at the apex.

23d. *Ilex yunnanensis* var. *parvifolia*
(Hayata) S. Y. Hu

A variety with oblong-lanceolate leaves, sharply serrate, a native of Formosa.

23e. *Ilex yunnanensis* var. *paucidentata*
S. Y. Hu

A variety with subentire leaves with 1-3 aristate teeth.

24. *Ilex sugeroki* Maxim.

An evergreen shrub, 15 ft. high. Leaves ovate, apical half serrate, the rest entire, 3/4 to 1-1/2 in. long, 1/2 to 1 in. wide, base rounded, apex acute. Fruits solitary, axillary to leaves on current year's growth, globose, 1/4 in. in diameter, red, pedicels 1-1/3 in. long, pyrenes 4-6, smooth. A native of Japan, introduced to the United States twice by the Arnold Arboretum, first by E. H. Wilson in 1914, and in 1925 seeds were obtained from the Botanic Garden of Sapporo, Japan; rare in this country.

24a. *Ilex sugeroki* var. *brevipedunculata*
(Maxim.) S. Y. Hu

A variety with smaller, very glossy elliptic leaves and shorter fruiting pedicels about 1/2 in. long.

25. *Ilex maximowicziana* Loes.

An evergreen shrub, 10 ft. high. Leaves elliptic, 1 to 1-1/2 in. long, 1/3 to 3/4 in. wide, serrate, punctate beneath. Fruits globose, 1/3 in. diameter, solitary, pedicels 1/3 in. long, pyrenes 4, 5-striate. A native of Formosa, of no ornamental importance.



Illustration 15.

Ilex crenata varieties

- f. *convexa*
- 'Stokes'
- f. *helleri*



Illustration 14.

More hollies of the Orient

1. *Ilex centrochinensis*
2. *Ilex leucoclada*
3. *Ilex pernyi*
4. *Ilex pernyi* var. *veitchii*
5. *Ilex ciliospinosa*
6. *Ilex perryana*
7. *Ilex corallina*
8. *Ilex ardisioides*
9. *Ilex hylonoma*
10. *Ilex georgei*
11. *Ilex lohfauiensis*
12. *Ilex longicaudata*
13. *Ilex hayataiana*
14. *Ilex goshiensis*
15. *Ilex wilsonii*
16. *Ilex forrestii*
17. *Ilex hanceana*
18. *Ilex latifolia*
19. *Ilex cornuta*
20. *Ilex integra*
21. *Ilex brachypoda*
22. *Ilex dipyrena*
23. *Ilex wenchowensis*
24. *Ilex pubilimba*
25. *Ilex tsangii*
26. *Ilex liukiensis*

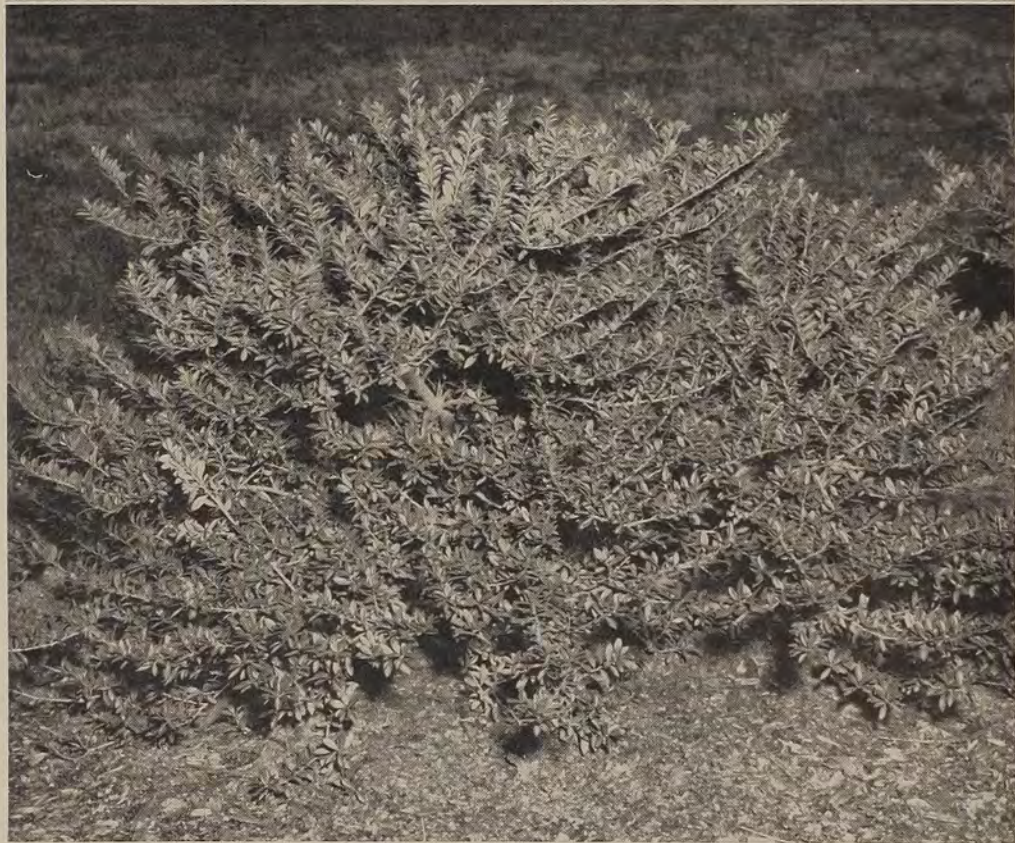


Illustration 16.
Ilex crenata f. *mariesii*
Ilex crenata f. *microphylla*

26. *Ilex viridis* Champ. ex Benth.

An evergreen shrub, 15 ft. high. Leaves shiny, yellowish green, punctate beneath, ovate-elliptic, 1 to 2-3/4 in. long, 1/2 to 1-1/4 in. wide, serrate, midrib impressed above. Fruits solitary, black. A native of southeastern China and Hong Kong, of little value as an ornamental plant.

27. *Ilex crenata* Thunb.

A compact evergreen shrub normally 2-5 ft. high, may grow up to 20 ft. high. Leaves shiny dark green, obovate, faintly crenate, 1/2 to 1 in. long, 1/4 to 1/2 in. wide, rounded or obtuse at the apex, punctate beneath. Fruits black, solitary or rarely 3 in a loose cyme, axillary. A native of Japan. Many forms in cultivation, a very useful species, good for landscape in general, for hedges, in a foundation planting and as a background for perennials.

27a. *Ilex crenata* f. *convexa* (Makino) Rehder (*Ilex crenata* f. *bullata* Rehder).

A form with leaves convex above, concave beneath, a very beautiful specimen in the Arnold Arboretum collection with mound-shaped growth of 15-ft. diameter.

27b. *Ilex crenata* f. *fastigiata* (Makino) Hara

A horticultural form with upright habit, probably not introduced yet.

27c. *Ilex crenata* f. *helleri* Rehder

A dwarf form with compact low habit, small elliptic leaves 1/3 to 1/2 in. long with 2-4 teeth on each side.

27d. *Ilex crenata* f. *latifolia* (Goldr.) Rehder (also known as f. *rotundifolia*, f. *fortunei*, f. *major*).

A horticultural variety with large leaves 3/4 to 1-1/2 in. long, obtuse at the apex, a form much cultivated in Europe and United States.

27e. *Ilex crenata* f. *longifolia* (Goldr.) Rehder

A horticultural variety with lanceolate or oblong-elliptic leaves up to 1-1/4 in. long, 1/5 to 1/2 in. wide, acute at both ends, a form commonly cultivated in Germany, Great Britain, and the United States.

27f. *Ilex crenata* f. *longipedunculata* S. Y. Hu

A variety with elongate peduncles, very likely not introduced to the United States.

27g. *Ilex crenata* f. *luteo-variegata* (Regel) Rehder

A horticultural form with elliptic or lanceolate leaves variegated with yellow.

27h. *Ilex crenata* f. *mariesii* Bean ex Dallimore. (also known as *Ilex crenata* var. *nummularia* (Franch.) Yatabe.)

A horticultural variety with suborbicular leaves crowded at the ends of the twigs, often used for dwarfing by Japanese artists.

27i. *Ilex crenata* f. *microphylla* Rehder

A dwarf form with small oblong to obovate leaves 1/3 to 3/4 in. long, about 1/4 in. wide. It is more abundant in Korea than in Japan.

27j. *Ilex crenata* var. *paludosa* (Nakai) Hara (also known as *Ilex crenata* var. *radicans* or *Ilex radicans*).

A variety growing in swampy places, with prostrate stems, broad-elliptic leaves with rounded apex and obtuse base, not introduced yet.

27k. *Ilex crenata* f. *pendula* (Koidz.) Hara

A variety with pendulous branchlets, native of Japan, not introduced yet.

27l. *Ilex crenata* f. *tricocca* (Makino) Hara

A form with fruits appearing in 3, a native of Japan, probably not introduced yet.

27m. *Ilex crenata* f. *watanabeana* Makino

A variety with papery oblong-elliptic leaves 1 to 1-1/2 in. long. A native of southern Japan & Okinawa, not introduced yet.

28. *Ilex szechwanensis* Loes.

An evergreen shrub 3-10 ft. high. Leaves yellowish green, obovate-elliptic, 1-1/2 to 2-3/4 in. long, 3/4 to 1-1/2 in. wide, serrate, punctate beneath. Fruits black, solitary, axillary to leaves on current year's growth, globose, 1/2 in. long, pyrenes 4, smooth. A native of western China, of no merit for ornamental purposes.

29. *Ilex mutchagara* Makino

An evergreen shrub, 9 ft. high, glabrous. Leaves oblanceolate, 1-1/2 to 2 in. long, 1/3 to 1/2 in. wide, glossy, coarsely crenate, punctate. Fruits solitary, in the axils of bracts at the base of current year's growth, globose, 1/3 in. in diameter, pyrenes 4, smooth. A native of Okinawa, closely related to *Ilex crenata*, may not be of much value for ornamental purposes.

30. *Ilex triflora* Blume

An evergreen shrub with punctate leaves and black fruits, resembling *Ilex viridis* but the fruits are usually fasciculate, a very wide-spread species extending from the warm region of China southward to Java, of little value for ornamental purposes.

30a. *Ilex triflora* var. *kanehirai* (Yamamoto) S. Y. Hu

A variety with leaves rounded at the apex, a native of Formosa.

31. *Ilex omeiensis* Hu & Tang

An evergreen tree, 35 ft. high. Leaves leathery, large, entire, oblong-elliptic, 4-8 in. long, 1-3/4 to 2-3/4 in. wide, base obtuse, apex short-acuminate. Fruits globose, small, 1/6 in. in diameter, 5-7 in an umbel, 5-10 umbels fasciculate in the axils of leaves on

second year's growth; pyrenes 6-7, 3-striate on the back. A native of Mt. Omei in western China, one of the most interesting species, well worth introducing.

32. *Ilex venulosa* Hook. f.

An evergreen shrub or small tree about 25 ft. high. Leaves large, entire, leathery, oblong-elliptic, 4-8 in. long, 1-1/3 to 2-1/4 in. wide, apex long caudate, primary lateral nerves 15-22 pairs. Fruits small, globose, 1/8 in. in diameter, 5-7 in a crowded cyme, several cymes fasciculate in the axil of leaves on second year's growth, central axis of fascicle evident, sometimes 1/4 in. long, pyrenes 5-7, 3-striate on the back. A native of the eastern Himalayan region, occurring in Yunnan, Burma and northern India, an interesting species, may well be worth introducing.

33. *Ilex stewardii* S. Y. Hu

A small evergreen tree, 25 ft. high. Leaves entire, thin-leathery or papery, 2-3 in. long, 1/2 to 1-1/4 in. wide, base acute, apex acuminate. Fruits small, subglobose, 1/8 in. in diameter, 3 in a loose cyme, the peduncle and pedicels about equal, together 1/3 to 1/2 in. long, 3-6 cymes fasciculate in the axils of leaves on second year's growth, pyrenes 6, 3-striate. A native of central and southern China, fruiting very abundantly, worthy of introduction.

34. *Ilex pubescens* Hook. & Arn.

An evergreen shrub about 10 ft. high, branchlets, leaves and flower clusters covered with grayish long hairs. Leaves elliptic or obovate-elliptic, 3/4 to 2 in. long, 1/3 to 1 in. wide, base obtuse, apex acute or shortly acuminate, subtire or the apical half faintly serrate. Fruits globose, red, 1/8 in. in diameter, fasciculate in leaf-axils of second year's growth, pedicels 1/5 in. long, pyrenes 6, sometimes 5 or 7, 3-striate on the back. A native of southern China, occurring also in Formosa, worthy of introduction.

34a. *Ilex pubescens* var. *kwangsiensis* Hand.-Mazz.

A variety with larger leaves, 3 in. long, 1-1/4 in. wide.

35. *Ilex hainanensis* Merr.

An evergreen tree, 15 ft. high. Leaves entire, oblong-elliptic, 1 to 2-1/2 in. long, 1/2 to 1 in. wide, acuminate. Fruits fasciculate, pea-sized, pedicels 1/4 in. long. A native of Hainan Island, the most abundantly fruiting specimen the writer ever examined; introduction advisable.

36. *Ilex metabaptista* Loes. ex Diels

A pubescent evergreen shrub, 3-5 ft. high, rarely higher. Leaves entire or subentire with 1 or 2 teeth near the apex, linear-lanceolate, 1-3 in. long, 1/4 to 1/2 in.

wide, both ends acute. Fruits globose, 1/5 in. in diameter, pedicels 1/3 in. long, fasciculate, the fascicles containing 3-flowered cymes or uniflorous pedicels, pyrenes 5-8, striate-esulcate on the back. A native of central China, fruiting most abundantly, worthy of introduction.

36a. *Ilex metabaptista* var. *myrsinoides* (Lévl.) Rehder

A variety with almost glabrous branchlets.

37. *Ilex elmerrilliana* S. Y. Hu

A shrub or small tree, 15-20 ft. high. Leaves leathery, shiny green, entire, acuminate, elliptic, 2-3 in. long, 3/4 to 1-1/4 in. wide. Fruits rather small, 1/5 in. in diameter with evident style, 4-6 in a fascicle, pedicels 1/3 to 1/2 in. long. Native of southeastern China, a very interesting species, worthy of introduction.

38. *Ilex memecylifolia* Champ. ex Benth.

An evergreen shrub, 6 ft. high, branchlets puberulent. Leaves thick-leathery, ovate-oblong or obovate, 1-1/2 to 3 in. long, 1/2 to 1-3/4 in. wide, base cuneate, apex abruptly short-acuminate. Fruits 4-5 fasciculate, globose, 1/8 to 1/4 in. in diameter, pedicels 1/4 to 1/3 in. long, pyrenes 4 or 5, rough, hairy. A native of Hong Kong, may be worthy of introduction.

39. *Ilex sinica* (Loes.) S. Y. Hu

An evergreen tree, 25 ft. high. Leaves entire, leathery, resembling those of *Ilex memecylifolia* but not so thick, and the lateral nerves evident beneath. Fruits fasciculate, axillary, on second year's growth, 1/5 in. in diameter, style prominent. A native of Yunnan in southwestern China, fruiting abundantly, may be worthy of introduction.

40. *Ilex tutcheri* Merr.

A compact evergreen shrub 12 ft. high. Leaves thick-leathery, glossy, obovate or obcordate, 1-2 in. long, 1/3 to 1 in. wide, entire, apex round, often emarginate. Fruits small, 1/5 in. in diameter, pedicels 1/3 in. long, pyrenes 5 or 6, striate. A native of southern China, fruiting abundantly, worthy of introduction.

41. *Ilex dolichopoda* Merr. & Chun

An evergreen tree, up to 25 ft. high. Leaves large, entire, oblong, 7-10 in. long, 2-1/3 to 2-3/4 in. wide, punctate beneath. Fruits pea-sized with prominent stigma, pedicels 1-1/2 in. long. A native of Hainan Island, a curious species, may not be worth introducing.

42. *Ilex kobuskiana* S. Y. Hu

A tree up to 60 ft. high. Leaves shiny, green, broad elliptic, 1-1/2 to 3-1/2 in. long, 2/3 to 1-1/2 in. wide, punctate beneath, base

roundish or obtuse, apex shortly acuminate, the tip retuse. Fruits small, 1/8 in. in diameter, fruiting pedicels 1/5 in. long, fasciculate. A native of southern China and northern Indo-China, may be worth introducing.

43. *Ilex retusifolia* S. Y. Hu

An evergreen shrub with large elliptic entire and punctate leaves. Pistillate flowers 4-5, fasciculate, pedicels 1/4 in. long. A native of southern China, discovered in 1936, poorly known still.

44. *Ilex cochinchinensis* (Lour.) Loes.

An evergreen tree up to 30 ft. high. Leaves large, glossy, elliptic, entire, 5-6 in. long, 1-1/3 to 2 in. wide, punctate beneath. Fruits pea-sized, fasciculate, pedicels 3/4 in. long. A native of Indo-China, occurring also in Hainan Island, not yet introduced.

45. *Ilex ardisioides* Loes.

A small evergreen tree. Leaves elliptic, entire, punctate beneath, 2-3 in. long, 1 to 1-1/4 in. wide, attenuate at both ends. Fruits pea-sized, fasciculate, pedicels 1/3 in. long. A native of Formosa, worthy of introduction.

46. *Ilex buxioides* S. Y. Hu

An evergreen tree up to 30 ft. high. Leaves small, compact, entire, elliptic, apex retuse, back punctate. Fruits small, 1/8 in. in diameter, solitary. A native of southern China, not introduced yet.

47. *Ilex kengii* S. Y. Hu

An evergreen tree 30-35 ft. high. Leaves elliptic, 1-1/2 to 5 in. long, 3/4 to 2 in. wide, apex acuminate, the tip obtuse and mucronate, base acute, punctate beneath. Fruits small, 1/8 in. in diameter, fasciculate, fascicles containing 3-flowered loose cymes or uniflorous pedicels. A native of southeastern China, fruiting abundantly, may be worth introducing.

48. *Ilex longicaudata* Comber

An evergreen tree about 30 ft. high. Leaves entire, punctate, elliptic, apex long caudate, 1-1/2 to 3-1/2 in. long, 1/2 to 1 in. wide. Fruits small, globose, 1/8 in. in diameter, fasciculate, pedicels 1/4 in. long, pyrenes 5. A native of southwestern China, fruiting very abundantly, a curious specimen to have.

48a. *Ilex longicaudata* var. *glabra* S. Y. Hu
A variety with glabrous branchlets.

49. *Ilex liangii* S. Y. Hu

A shrub 10 ft. high. Leaves thick-leathery, entire, oblong-elliptic, 1-2 in. long, 1/2 to 1 in. wide, base cuneate or obtuse, apex obtuse or rounded, sometimes retuse. Fruits small, 1/6 in. in diameter, pedicels 1/4 in. long. A native of Hainan Island, may not be worth introducing.

50. *Ilex goshiensis* Hayata

An evergreen tree, 20-35 ft. high. Leaves broad-elliptic or roundish, 1-2 in. long, 1/2 to 1 in. wide, entire, apex obtuse and emarginate. Fruits small, 1/6 in. in diameter, 3-5 fasciculate, pedicels 1/3 in. long. A native of Formosa and the Liukiu Islands, worthy of introduction.

51. *Ilex hayataiana* Loes.

An evergreen bushy tree 15-20 ft. high. Leaves elliptic, acuminate, entire, 3/4 to 2 in. long, 1/3 to 3/4 in. wide. Fruits fasciculate, small and dainty, 1/7 in. in diameter, pedicels 1/3 in. long. A very beautiful species growing on high altitudes of the mountains in Formosa, (8,500 ft.), fruiting very abundantly, one of the best unarmed evergreen hollies, well worth introducing.

52. *Ilex oligodonta* Merr. & Chun

An evergreen shrub, 6 ft. high. Leaves oblong-lanceolate, entire, or with 1 or 2 bristly teeth on each side, 1-1/2 to 3 in. long, 1/3 to 3/4 in. wide, acuminate. Fruiting material not collected yet, a native of southern China, ornamental value questionable.

53. *Ilex wilsonii* Loes.

A beautiful evergreen tree, 30 ft. high. Leaves glossy, entire, ovate or obovate-oblong, 1-3/4 to 2-1/2 in. long, 1/2 to 1-1/3 in. wide, apex acuminate. Fruits globose, 1/8 in. in diameter, pedicels about 1/4 in. long, pyrenes 4, 3-striate, esulcate. A native of the warm temperate region of China, fruiting abundantly, worthy of introduction.

54. *Ilex fukienensis* S. Y. Hu

An evergreen shrub, about 9 ft. high. Leaves ovate-oblong, 2-4 in. long, 3/4 to 1-1/3 in. wide, acuminate, entire. Fruits 6-8 in a fascicle. A native of Fukien in southeastern China, a rare species, introduction not advisable.

55. *Ilex forrestii* Comber

An evergreen shrub or small tree about 20 ft. high. Leaves oblong to oblanceolate, acuminate, subentire or serrate at the apical end, 2 to 3-1/2 in. long, about 1 in. wide. Fruits fasciculate, small, 1/5 in. in diameter, berry-like, with 5-7 small smooth seeds. A native of northwestern Yunnan, occurring in mixed forests at 7,000-7,500 ft. altitude; a curious species, fruiting abundantly, worthy of introduction.

55a. *Ilex forrestii* var. *glabra* S. Y. Hu

A variety with glabrous branchlets.

56. *Ilex wardii* Merr.

An evergreen shrub, 6 ft. high. Leaves leathery, serrate, elliptic, 1-1/2 to 2-1/2 in. long, 1/2 to 1 in. wide. Fruits globose, 1/6 in. in diameter, pedicels 1/4 in. long, pyrenes 6, smooth. A native of southwestern China

and northern Burma, very variable, fruiting abundantly, may be worth introducing.

57. *Ilex championii* Loes.

An evergreen shrub with compact low habit. Leaves obovate, entire, punctate beneath, 3/4 to 1 in. long, apex rounded, slightly retuse. Fruits in pairs or small fascicles, red, 1/6 in. in diameter. A native of Hong Kong, worthy of introduction because of its compact habit, evergreen small leaves and red berries.

58. *Ilex dimorphophylla* Koidz.

A compact evergreen shrub with obovate entire leaves 1 in. long, 1/2 in. wide, those on the juvenile branches lanceolate, spinose, 1 in. long, 1/3 in. wide with 4 or 5 spines of unequal size. Fruits pea-sized, fasciculate. A native of Amami Oshima, an island north of Okinawa, well worth introducing.

59. *Ilex lohfauiensis* Merr.

An evergreen shrub 4-8 ft. high, branchlets pubescent. Leaves oblong to obovate, 1/3 to 1 in. long, 1/4 to 1/3 in. wide, apex emarginate, entire. Fruits subsessile, paired, small, 1/8 in. in diameter, pyrenes 4. A native of southeastern China; for its compact habit, small leaves and red fruit it may prove to be a good substitute for *Ilex crenata*.

60. *Ilex hanceana* Maxim. (*Ilex buxifolia* Hance).

An evergreen box-like compact shrub with small obovate entire leaves, small paired red fruits. A native of Hong Kong, a very curious but poorly understood species, well worth introducing. In the warmer part of the country it may take the place of *Ilex crenata*. Its foliage is compact like that of *Ilex crenata*, but its red fruits give a better color contrast than the black fruits of *Ilex crenata*.

61. *Ilex hylonoma* Hu & Tang

An evergreen tree, 30 ft. high. Leaves elliptic, serrate, 2-1/2 to 5 in. long, 1 to 1-3/4 in. wide. Fruits large, oblong, 1/2 in. long, paired or in small fascicles, pedicels very short, 1/10 in. long. A native of West China, a curious species, may not be very ornamental.

61a. *Ilex hylonoma* var. *glabra* S. Y. Hu

A variety with glabrous branchlets and midribs.

62. *Ilex centrochinensis* S. Y. Hu (*Ilex aquifolium* var. *chinensis* Loes.)

An evergreen shrub up to 10 ft. high. Leaves shiny deep green, spinose, oblong-lanceolate, 1-1/2 to 2-1/2 cm. long, each side with 6-8 strong spines. Fruits pea-sized, pedicels very short, 2 mm. long. Pyrenes 4,

wrinkled and pitted, stony. A native of central China, occurring in the same region where *Metasequoia glyptostroboides* was recently discovered, apparently an element of a very old flora, worthy of introduction.

63. *Ilex cornuta* Lindl. & Paxton

A beautiful evergreen holly of tree form and compact growth. Leaves shiny green, oblong or quadrangular in outline, sinuate-spinose, normally 2-3 in. long, 1 to 1-1/4 in. wide, with 2 strong or sometimes 1 or 2 weak spines on each side and one at the apex. Fruits rather large, oblong, about 1/3 to 1/2 in. long, on elongate pedicels, 5-8 in an axillary fascicle. A native of eastern China, a very valuable holly, hardy as far north as Boston. There is a great variation in the manner of spines on the leaves.

63a. *Ilex cornuta* f. *burfordi* (De France) Rehder

A horticultural form with entire leaves and a terminal spine.

63b. *Ilex cornuta* f. *fortunei* (Lindl.) S. Y. Hu

A form with elongated fruit pedicels.

63c. *Ilex cornuta* f. *macrocarpa* S. Y. Hu

A form with large oblong-ellipsoid fruits 1/2 in. long, 1/3 in. in diameter.

63d. *Ilex cornuta* f. *microphylla* S. Y. Hu

A form with small leaves 1 to 1-1/2 in. long, 1/3 to 1/2 in. wide, globose fruits 1/3 in. in diameter.

64. *Ilex integra* Thunb.

A shrub or small tree 9-15 ft. high. Leaves obovate or broad-elliptic, 1-3 in. long, 1 to 1-1/4 in. wide, apex abruptly acuminate, oblong, or the very tip obtuse. Fruits fasciculate, subglobose, 1/2 in. long, fruiting pedicels 1/3 to 1/5 in. long; pyrenes 4, rugose, pitted, stony. A native of Japan, a very ornamental species because of its large fruits; introduced by the Arnold Arboretum in the form of seeds in 1881 and 1915. Both plants are dead now.

64a. *Ilex integra* f. *ellipsoidea* (Okamoto) Ohwi.

A horticultural form with ellipsoid fruits.

64b. *Ilex integra* 'Oblanceolata' S. Y. Hu

A horticultural form with narrower leaves which are oblanceolate, 1/2 to 3/4 in. wide.

64c. *Ilex integra* f. *xanthocarpa* (Matsum. & Nakai) Ohwi.

A horticultural form with yellow fruits.

65. *Ilex leucoclada* Makino

A shrub, the branchlets ash-colored. Leaves lanceolate, 3 to 4-1/2 in. long, 1 to 1-3/4 in. wide, attenuate at both ends. Fruits fasciculate, globose, 1/4 in. in diameter, pedicels 1/3 in. long. A native of Japan, worthy of introduction.

65a. *Ilex leucoclada* f. *angustifolia* (Miyabe & Tatw.) Hara

A form with narrow leaves about 3/4 in. wide.

66. *Ilex brachypoda* S. Y. Hu

An evergreen bush, 6-8 ft. high. Leaves entire, obovate, 2-3 in. long, 1 to 1-1/2 in. wide, cuneate at base. Fruit of unusually large size, oblong-ellipsoid, 1/2 in. long, 3 or 4 fasciculate, in axil of leaves. A native of the Liukiu Islands, morphologically closely related to *Ilex integra* Thunb. of Japan, distinguished by its very short peduncles about 1/10 in. long, not introduced yet.

67. *Ilex dipyrrena* Wall.

An evergreen shrub or small tree 10-40 ft. high. Leaves ovate-oblong, 1-1/2 to 3 in. long, 1 to 1-1/2 in. wide, entire or with 1-4 sharp spines on each side, apex acute or with a strong spine. Fruits globose, 1/3 in. in diameter, subsessile. A native of eastern Himalayan region, growing in mixed forests at altitudes of 7,000 ft.; a very variable species; intermediate between *Ilex aquifolium* of Europe and *Ilex pernyi* of eastern Asia; a very interesting species, worthy of introduction.

68. *Ilex wenchowensis* S. Y. Hu

An evergreen shrub, 6 ft. high. Leaves ovate, 1-2 in. long, 1/2 to 1 in. wide, subsessile, each side with 4 or 5 large spines, apex acuminate, spinose. Fruits fasciculate, subsessile, globose, 1/3 in. in diameter, pyrenes 4, palmately striate, esulcate, woody. A native of eastern China, only known by the type collection.

69. *Ilex pernyi* Franch.

A beautiful evergreen shrub or small tree, 25 ft. high, branchlets pubescent. Leaves subsessile, ovate, with 1 or 2 strong spines on each side, 1/2 to 1 in. long, 1/3 to 3/4 in. wide, apex spiny. Fruits paired, globose, about 1/3 in. in diameter, scarlet, subsessile, pedicels about 1/10 in. long, pyrenes 4. A native of central China, introduced into the United States three times by the Arnold Arboretum, first by E. H. Wilson in 1908 and 1917, and then in cooperation with a Chinese university in Nanking, proved hardy as far north as Boston, a very desirable specimen to have.

69a. *Ilex pernyi* var. *veitchii* Bean (*Ilex bioritsensis*)

A variety with larger leaves, generally 1-1/2 in. long and fruits usually with 2 pyrenes. Concerning the number of seeds of this taxon Dr. H. H. Hume wrote on November 24, 1953, "I found in 120 fruits taken at random, 29 fruits 2 seeds each; 80 fruits 3 seeds each, 11 fruits 4 seeds

each." This observation proves that the number of seeds is variable in this variety.

70. *Ilex georgei* Comber

An evergreen compact, spinose shrub up to 18 ft. Leaves shiny green, ovate-lanceolate, 3/4 to 1-1/2 in. long, 1/3 to 1/2 in. wide, apex with a spine 1/8 in. long, margin with 4-7 spines on each side. Fruits abundant, fasciculate, subsessile, ellipsoid, about 1/4 in. long. Native of Yunnan in southwestern China, a very beautiful species, fruiting more abundantly than *Ilex pernyi*, very worthy of introduction.

71. *Ilex ciliospinosa* Loes.

A shrub or small tree up to 20 ft. high. Leaves evergreen, spiny, ovate to elliptic, 1 to 1-1/2 in. long, 1/2 to 2/3 in. wide, with 5-7 weak spines on each side. Fruits fasciculate, often only in pairs, ellipsoid, bright red, 1/4 in. long, pedicels very short. A native of western China, introduced in 1908, compact habit, small evergreen leaves and bright red berries are its good qualities.

72. *Ilex bioritsensis* Hayata = *Ilex pernyi* var. *veitchii* Bean

73. *Ilex perryana* S. Y. Hu

A prostrate evergreen shrub, 1 ft. high. Leaves compact, occurring even on third year's growth, broad-elliptic with 2 or 3 strong spines on each side, 1/2 to 1 in. long, 1/3 to 5/8 in. wide, base obtuse, apex spinose. Fruits ellipsoid, 1/4 in. long, pedicels 1/8 in. long, pyrenes 4, woody, palmately striate, esulcate. A native of Yunnan and northern Burma, occurring at altitudes of 9,000-10,950 ft., a very desirable species to have.

74. *Ilex pubilimba* Merr. & Chun

A densely pubescent evergreen tree, 45 ft. high. Leaves leathery, elliptic, crenate-serrate, 1-1/4 to 3 in. long, 1/2 to 1 in. wide, acuminate. Fruits fasciculate, globose, 1/3 in. in diameter, pubescent, pedicels 1/8 in. long, pyrenes 4, woody, rugose. A native of Hainan Island, may be worthy of introduction.

75. *Ilex kaushue* S. Y. Hu

A species with large leaves and fasciculate fruits like those of *Ilex latifolia*; distinguished by its pubescent branchlets and hairy fruits; native of Hainan Island, unworthy of introduction except for the sake of curiosity.

76. *Ilex nanningensis* Hand.-Mazz.

A densely pubescent evergreen tree, 60 ft. high. Leaves leathery, elliptic, or lanceolate, 2-3 in. long, 1/2 to 1-1/4 in. wide, crenate-serrate. Fruits fasciculate, glo-

bose, 1/3 in. in diameter, hairy, pedicels slender, 1/3 in. long, pyrenes 4, rugose, woody. A native of southern China, an interesting species, may be worthy of introduction.

77. *Ilex latifolia* Thunb.

An evergreen tree up to 60 ft. high, branchlets stout. Leaves thick-leathery, glossy, serrate, oblong, 3 to 6-1/2 in. long, 1-1/2 to 3 in. wide. Fruits in axillary racemes or fascicles, central axis 3/4 in. long, crowded with globose red berries, 1/4 in. in diameter. A native of eastern China and Japan, proved to grow well in southeastern United States, an elegant specimen to have.

77a. *Ilex latifolia* f. *variegata* Makino

A horticultural form with yellow-variegate leaves.

78. *Ilex suzukii* S. Y. Hu

An evergreen shrub, branchlets glabrous. Leaves elliptic, entire, glossy, both ends acute or obtuse, 1 to 1-1/2 in. long, 1/2 to 3/4 in. wide. Fruits fasciculate, globose, 1/5 in. in diameter, pedicels 1/5 in. long, pyrenes 4, palmately striate, esutate, woody. A native of Formosa, a little known species, may be worthy of introduction.

79. *Ilex denticulata* Wall.

An evergreen tree up to 35 ft. high. Leaves oblong-elliptic, 2-1/2 to 4 in. long, 1 to 1-3/4 in. wide, serrate, acuminate. Fruits pea-sized, in large racemose axillary clusters. A native of the temperate region of the Himalayan Mountains, can grow well in the Carolinas and Tennessee, well worth introducing.

80. *Ilex graciliflora* Champ.

An evergreen tree 20-30 ft. high. Leaves shiny green, leathery, obovate-elliptic, 3/4 to 2-3/4 in. long, 1/2 to 1 in. wide, apex obtuse, margin faintly crenate. Fruits fasciculate, 1/4 in. in diameter, pedicel 1/3 in. long. A beautiful specimen, fruiting abundantly, native to Hong Kong, worthy of introduction.

81. *Ilex tsangii* S. Y. Hu

A small evergreen tree, 25 ft. high. Leaves ovate-elliptic, 2-3 in. long, 3/4 to 1 in. wide, acuminate, remotely crenulate or subentire. Fruits fasciculate, depressed globose, 1/5 in. in diameter, pedicels about 1/2 in. long, pyrenes 4, rugose. A native of southern China, known only from the type collection, ornamental merit medium.

82. *Ilex liukiensis* Loes.

A small tree. Leaves obovate or elliptic, 1-3/4 to 2-1/4 in. long, 3/4 to 1 in. wide, base cuneate, apex obtuse, crenulate. Fruits

apple-shaped, 1/3 in. in diameter, pedicels 1/2 in. long. A native of the Liukiu Islands. Well worth introducing.

83. *Ilex chingiana* Hu & Tang

A large evergreen tree up to 40 ft. high. Leaves leathery, almost entire, faintly crenate, oblong-elliptic 3-5 in. long, 1-1/4 to 1-3/4 in. wide. Fruits large, 1 in. in diameter, solitary, axillary. A native of Kwangsi in southern China, a curious species having the largest fruit among all holly species.

84. *Ilex uraiensis* Yamamoto

An evergreen tree, 30-75 ft. high. Leaves glossy, obovate-elliptic or elliptic, 2-3 in. long, 1/2 to 3/4 in. wide, remotely crenate or serrate, base cuneate, apex shortly acuminate, the tip obtuse. Fruits fasciculate, globose, 1/2 in. in diameter, pedicels 1/3 in. long, pyrenes 4, striate and wrinkled, stony. A native of Formosa, worthy of introduction.

84a. *Ilex uraiensis* var. *formosae* (Loes) S. Y. Hu

A variety with obovate leaves 1 to 1-3/4 in. long, obtuse or rounded at the apex.

84b. *Ilex uraiensis* var. *macrophylla* S. Y. Hu

A variety with larger leaves 3-4 in. long, 1-1/3 in. wide, and longer fruiting pedicels 1/3 in. long.

85. *Ilex subficoidea* S. Y. Hu

An evergreen tree, 45 ft. high. Leaves ovate to oblong-elliptic 3-4 in. long, 1-1/4 in. wide, thick-leathery, glossy, weakly crenate, apex acuminate. Fruits globose, rather large, about 1/2 in. in diameter, pedicel 3/8 in. long, pyrenes 4, stony, wrinkled and pitted. A native of southern China, ornamental merit medium.

86. *Ilex nuculicava* S. Y. Hu

An evergreen tree, 30 ft. high. Leaves leathery, oblong-elliptic, 3-5 in. long, 1 to 1-3/4 in. wide, subentire or faintly crenate. Fruits fasciculate, globose, 1/3 in. in diameter, pedicels 1/4 in. long, pyrenes 4 woody, palmately striate and sulcate on the back, pitted on the side. A native of Hainan Island, ornamental value for American gardens low.

86a. *Ilex nuculicava* var. *autumnalis* S. Y. Hu

A form that flowers in October.

86b. *Ilex nuculicava* var. *brevipedicellata* S. Y. Hu

A form with subsessile fruits.

86c. *Ilex nuculicava* var. *glabra* S. Y. Hu

A form with glabrous branchlets, buds and flower clusters.

87. *Ilex hookeri* King
An evergreen tree up to 50 ft. high. Leaves and fruits like those of *Ilex franchetiana*. A native of the Himalayan region, not very good for ornamental purposes.
88. *Ilex franchetiana* Loes.
An evergreen shrub or small tree, about 20 ft. high. Leaves oblanceolate, 2 to 4-1/2 in. long, 3/4 to 1-1/2 in. wide, acuminate, apical 2/3 serrate. Fruits globose, 1/4 in. in diameter, fasciculate, pedicels 1/4 in. long. A native of western China, fruiting very abundantly, worthy of introduction.
89. *Ilex melanotricha* Merr.
An evergreen tree, 30 ft. high. Leaves oblanceolate or oblong-elliptic, 3 to 5-1/2 in. long, 1 to 1-1/2 in. wide. Fruits pea-sized, pedicels 1/3 in. long, pubescent, pyrenes 4, palmately striate and sulcate on the back, woody. A native of southwestern China and adjacent Burma, closely related to *Ilex franchetiana*, ornamental merit rates low.
90. *Ilex fargesii* Franch.
A small evergreen tree, 20 ft. high. Leaves oblanceolate, 2-1/2 to 4-1/2 in. long, 1/2 to 3/4 in. wide, acuminate, apical 1/3 serrate, the rest entire. Fruits pea-sized, globose, fasciculate, pedicels 1/5 in. long. A native of central China, introduced by E. H. Wilson of the Arnold Arboretum in 1908, rare in American gardens.
91. *Ilex delavayi* Franch.
A shrub or small evergreen tree 10-25 ft. high, branchlets with warty ridges. Leaves elliptic-lanceolate, serrate, 1-1/2 to 2-3/4 in. long, 1/2 to 3/4 in. wide, apex acute. Fruits pea-sized, red, 3-5 fasciculate, peduncles 1/5 in. long. A native of the high mountains in western Yunnan, occurring in mixed forests at altitudes of 10,600 ft., a very interesting species, worthy of introduction.
- 91a. *Ilex delavayi* var. *comberiana* S. Y. Hu
A botanical variety with pubescent and warty branchlets.
- 91b. *Ilex delavayi* var. *exalta* Comber
A botanical variety with smooth branchlets and broad leaves, 1 in. wide.
- 91c. *Ilex delavayi* var. *linearifolia* S. Y. Hu
A botanical variety with elongate linear leaves, 3 in. long, 1/3 in. wide.
92. *Ilex rugosa* F. Schmidt
A small prostrate shrub, the branchlets angular, ridged, under a lens tuberculate. Leaves oblong or lanceolate, 1-2 in. long, 1/3 to 5/8 in. wide, the reticulation of nerves impressed, the surface appearing rugose. Fruits fasciculate, often only 1 or 2 growing into mature size, globose, 1/5 in. in diameter, pedicels 1/4 in. long; pyrenes 4, rarely 5, striate-sulcate, woody. A very variable species, native of Sachalin and northern Japan, introduced into the United States twice by the Arnold Arboretum, both times in the form of seeds. In 1895 seeds were received from the Forest Department of the University of Tokyo and in 1902 from the Botanic Garden of Tokyo.
- 92a. *Ilex rugosa* var. *stenophylla* (Koidz.) Sugimoto
A variety with very narrow leaves 1/8 to 1/5 in. in diameter.
- 92b. *Ilex rugosa* f. *vegeta* (Hara) Hara
A form with broader leaves about 1-1/2 in. long, 3/4 in. wide.
93. *Ilex nothofagifolia* F. K. Ward
An evergreen shrub 8-20 ft. high, branchlets very warty, densely covered with shiny, green leaves even on the third year's growth. Leaves small, oblong or roundish, 1/4 to 1/2 in. long, 1/4 to 1/3 in. wide, serrate, apex mucronate, pedicels half as long as the lamina. Fruits usually solitary, depressed globose, 1/8 in. in diameter, red, pedicels 1/8 in. long, pyrenes 4, smooth. A very interesting species occurring as an undergrowth of the conifer forests of the eastern Himalayan region, well worth introducing.
94. *Ilex intricata* Hook. f.
An evergreen, compact low shrub, often prostrate, branchlets warty. Leaves small, obovate, or roundish, crenate, shiny, up to 1/2 in. long, 1/4 in. wide. Fruits red, paired, rather large, subsessile, 1/5 in. in diameter. A native of the Himalayan region, in Yunnan it grows at altitudes of 9,000-11,000 ft. This is one of the most beautiful and interesting species. It should have a priority for introduction. Because of its habitat in the high altitudes it would be a hardy specimen.
95. *Ilex wangiana* S. Y. Hu
A species resembling *Ilex corallina* in every respect except the fruits which are pubescent. A native of China growing in forests at altitudes of 3,700-6,300 ft.
96. *Ilex glomerata* King
An evergreen unarmed tree growing in tropical forests of southern China, Burma and Indo-China, resembling *Ilex formosana* and *Ilex ficoidea*, but with much larger fruits, about 1/3 in. in diameter, worthy of introduction.
97. *Ilex cinerea* Champ.
An evergreen shrub or small tree 6-20 ft. high. Leaves oblong, 4 to 5-1/2 in. long, 1 to 1-1/2 in. wide, serrate, petioles very short, a little less than 1/4 in. long. Fruits pea-sized, in large axillary clusters. A native of Hong Kong, common on dry clay slopes, not yet introduced, worthy of introduction.



Illustration 17.

More hollies of the Orient

1. *Ilex micrococca*
2. *Ilex serrata*
3. *Ilex geniculata*
4. *Ilex macropoda*
5. *Ilex tsoii*
6. *Ilex asprella*
7. *Ilex macrocarpa*
8. *Ilex aculeolata*
9. *Ilex chingiana*
10. *Ilex wraiensis*
11. *Ilex buergeri*
12. *Ilex delavayi*
13. *Ilex pedunculosa*
14. *Ilex fargesii*
15. *Ilex nuculicava*
16. *Ilex delavayi*
var. *linearifolia*
17. *Ilex ficoidea*
18. *Ilex intricata*
19. *Ilex nothofagifolia*
20. *Ilex peiradena*
21. *Ilex subrugosa*
22. *Ilex buxioides*
23. *Ilex cinerea*
24. *Ilex rugosa*
25. *Ilex pubescens*

98. *Ilex buergeri* Miq.

A large evergreen tree up to 50 ft. high. Leaves ovate-elliptic or oblong, 2 to 2-1/2 in. long, 1 to 1-1/5 in. wide, crenate. Fruits pea-sized, 4-7 fasciculate in the axil of leaves. A native of Japan and eastern China, a beautiful specimen, worthy of introduction.

99. *Ilex pingnanensis* S. Y. Hu

A pubescent evergreen species with oblong-elliptic subintery leaves, fasciculate pea-sized fruits, a little known Chinese species, ornamental virtue comparable to that of *Ilex subrugosa*, or may be inferior.

100. *Ilex subrugosa* Loes.

An evergreen tree, 30 ft. high, branchlets hairy. Leaves leathery, lanceolate, coarsely serrate, 1-1/2 to 4 in. long, 1/4 to 1 in. wide. Fruits globose, fasciculate, 1/5 in. in diameter, pedicels 1/4 in. long, pyrenes 4, striate-sulcate, woody. A native of western China, a pretty specimen to have.

101. *Ilex peiradena* S. Y. Hu

An evergreen shrub, 6 ft. high. Leaves lanceolate, attenuate at both ends, entire, 1-1/2 to 3 in. long, 1/2 to 3/4 in. wide. Fruits fasciculate, globose, 1/8 in. in diameter, pedicels 1/4 in. long, pyrenes 4, stony, palmately striate and sulcate on the back, pitted on the sides. A native of southern China, ornamental virtue comparable to that of *Ilex fargesii*, but superior because of its low habit.

102. *Ilex corallina* Franch.

An evergreen tree up to 30 ft. high. Leaves ovate-lanceolate, acuminate, normally 4 in. long, 1-1/2 in. wide, sharply serrate, the teeth of juvenile growth often ended with weak spines. Fruits small, bright red, about 1/8 to 1/6 in. in diameter, 5-7 in close clusters in the axils of leaves. A native of western China, introduced but not well known in American gardens, well worth growing. *

102a. *Ilex corallina* var. *loeseneri* Lévl.

A variety with sharper spines.

102b. *Ilex corallina* var. *macrocarpa* S. Y. Hu

A variety with larger oblong fruits, which are 1/4 in. long.

102c. *Ilex corallina* var. *pubescens* S. Y. Hu

A variety with hairy branchlets and midribs.

103. *Ilex formosana* Maxim.

An evergreen tree up to 40 ft. high. Leaves oblong-elliptic, acuminate, crenulate, 2 to 3-1/2 in. long, 3/4 to 1-1/4 in. wide. Fruits rather small, 1/6 in. in diameter, fasciculate, pedicels very short. First described from Formosa, now known to have



Illustration 18.
Ilex serrata, in fruit.

wide range in southeastern China, fruiting very abundantly, worthy of introduction.

103a. *Ilex formosana* var. *macrophyrena* S. Y. Hu

A botanical variety with larger fruits and subtire leaves.

104. *Ilex confertiflora* Merr.

An evergreen shrub or small tree, 10-20 ft. high. Leaves large, oblong, faintly serrate, 2 to 3-1/2 in. long, 1 to 1-3/4 in. wide, base rounded, apex acuminate. Fruits pea-sized, 5-8 in a compact axillary fascicle. A native of southern China, worthy of introduction.

105. *Ilex ficoidea* Hemsl.

An evergreen tree about 25 ft. high. Leaves shiny green, oblong-elliptic, acuminate, faintly crenate, 2 to 3-1/2 in. long, 1/2 to 1-1/3 in. wide. Fruits rather large, 1/4 in. in diameter, fasciculate, pedicels 1/4 in. long. First known from Hong Kong, now known from warm temperate region of China; a very interesting species, worthy of introduction.

106. *Ilex cyrtura* Merr.

An evergreen tree up to 35 ft. high. Leaves oblong-elliptic, serrate, 2-1/2 to 4 in. long, 1 to 1-1/2 in. wide, apex caudate, acuminate 3/4 in. long. Fruits pea-sized, 3 or 4, fasciculate in the axils of leaves, pedicels short. A native of southern China and Burma, not known in cultivation, not very outstanding for ornamental purposes.

107. *Ilex intermedia* Loes.

A tree about 30 ft. high. Leaves oblong-elliptic, 2-1/2 to 4-1/2 in. long, 1-2 in. wide, both ends attenuate, crenulate or coarsely serrate. Fruits fasciculate or racemose, pea-sized, fruiting pedicels 3/8 to 1/2 in. long. A native of central China, fruiting abundantly, worthy of introduction.

107a. *Ilex intermedia* var. *fangii* (Rehder) S. Y. Hu

A variety with larger and more prominently serrate leaves.

108. *Ilex chieniana* S. Y. Hu

A large evergreen tree up to 30 ft. high. Leaves leathery, sharp-serrate, oblong-elliptic, 4-1/2 in. long, 1 to 1-1/2 in. wide. Fruits in elongate clusters, pea-sized, scarlet. A native of western China, a beautiful specimen, worthy of introduction.

109. *Ilex micrococca* Maxim.

A deciduous tree, 60 ft. high, lenticels conspicuous on current year's growth. Leaves ovate or ovate-elliptic, 3-5 in. long, 1-1/3 to 2 in. wide, aristate-serrate or subtire, base rounded, apex acuminate. Fruits small, round, red, 1/8 in. in diameter, a great number of them form a compact, spherical ball on a short peduncle in the axil of a leaf on current year's growth, pyrenes 6-8, smooth,

leathery. A native of southeastern China and Japan, a very interesting species worthy of introduction.

109a. *Ilex micrococca* f. *pilosa* S. Y. Hu

A form with pubescent branchlets, pedicels and calyx.

110. *Ilex polyneura* (Hand.-Mazz.) S. Y. Hu

A deciduous tree, 60 ft. high. Leaves papery, serrate, oblong-elliptic, 3-6 in. long, 1-1/2 to 2-1/2 in. wide, primary nerves 11-20 pairs. Fruits red, small, globose, 1/8 in. in diameter, 10-15 in a rather compact cyme, axillary to leaves on current year's growth, peduncles 1/2 in. long, pedicels 1/4 to 1/3 in. long, pyrenes 7, back narrowly unicanalulate, leathery, a native of China, an interesting species to have.

110a. *Ilex polyneura* var. *glabra* S. Y. Hu

A variety with glabrous leaves and flower clusters.

111. *Ilex fragilis* Hook. f.

A deciduous tree about 30 ft. high, branchlets with warty spurs of 1/2 in. long. Leaves ovate, papery, serrate, acuminate, 2-5 in. long, 1 to 2-1/4 in. wide. Fruits 1-6, in axils of leaves terminating a spur or at the basal portion of a normal branch, compressed globose, 1/8 in. long, 1/5 in. in diameter. Native of the eastern Himalayan region, a very curious species, unrelated to any other *Ilex*.

112. *Ilex serrata* Thunb.

A deciduous shrub 4-8 ft. high, branchlets with conspicuous lenticels. Leaves elliptic, 1 to 1-1/2 or 2 in. long, 1/2 to 3/4 in. wide, sharply serrate or double-serrate, attenuate at both ends, glabrous or along the midribs inconspicuously pilose beneath. Fruits globose, 1/8 in. in diameter, solitary or 3 in a simple cyme, behind a bud and axillary to leaves on current year's growth, pyrenes 6, smooth leathery.

112a. *Ilex serrata* f. *koshobai* Hara

A form with smaller leaves 5/8 in. long, 1/5 in. wide.

112b. *Ilex serrata* f. *leucocarpa* Beissner

A form with white fruits.

112c. *Ilex serrata* f. *xanthocarpa* (Rehder) Rehder

A form with yellow fruits.

112d. *Ilex serrata* var. *sieboldii* (Miq.) Loes.

A variety with pubescent branchlets and leaves.

113. *Ilex nipponica* Makino (*I. nemotoi* Makino)

A small tree with puberulent branchlets. Leaves oblanceolate, 1-1/4 to 2-1/2 in. long, 1/3 to 3/4 in. wide, mucronate-crenate, slightly scabro-puberulent along the midribs on both sides. Fruits red, solitary or 3 in a subsessile cyme, globose, 1/6 in. in diameter, pedicels short, 1/6 in. long, pyrenes 5, smooth.

114. *Ilex geniculata* Maxim.

A deciduous shrub. Leaves ovate-oblong, 1-1/2 to 5 in. long, 3/4 to 2 in. wide, sharply serrate, acuminate. Fruits solitary or rarely 3 in a loose cyme behind a bud in the axil of a leaf or terminating a short spur, when solitary the stalk knee-like, 1-2 in. long, nodding; a very pretty species, first introduced into this country by the Arnold Arboretum in 1894 when the first director, C. S. Sargent, collected seeds from Japan himself.

115. *Ilex asprella* (Hook. & Arn.) Champ.

A deciduous shrub up to 9 ft. high. Leaves ovate or elliptic, attenuate at both ends, serrate, 1-2 in. long, 1/2 to 1-1/4 wide. Fruits pea-sized, peduncles 1 in. long, six times longer than the petiole. A native of southeastern China, occurring also in Taiwan and the Philippines, not introduced yet, morphologically very close to *Ilex longipes* Champ., of southeastern United States, if introduced, may share the same range, i.e., from W. Virginia to Texas.

115a. *Ilex asprella* var. *tapuensis* S. Y. Hu

A variety with unusually large fruit 1/3 in. long, not introduced yet.

116. *Ilex macrocarpa* Oliver

A deciduous tree with greenish-gray smooth bark, up to 50 ft. high. Leaves ovate, 2-6 in. long, 1-1/4 to 2-3/4 in. wide, serrate, acuminate, base rounded or obtuse. Fruits black, large, solitary, axillary to leaves on current year's growth, often fasciculate with leaves at the ends of spurs, globose, about 2/3 in. in diameter, with pointed stigma and short style. A native of warm temperate China, curious for its large black fruit, but of no ornamental value.

116a. *Ilex macrocarpa* var. *longipedunculata* S. Y. Hu

A variety with elongated fruiting pedicels 1 to 1-1/4 in. long.

117. *Ilex chapaensis* Merr.

A deciduous tree up to 35 ft. high. Leaves ovate to oblong-elliptic, 2-4 in. long, 1-2 in. wide, serrate. Fruits solitary, black, short pedicellate, a little over 1/2 in. in diameter, with 6 or 7 bony large but narrow pyrenes. A native of tropical China and Indo-China, unworthy of introduction except for the sake of curiosity.

118. *Ilex aculeolata* Nakai

A deciduous shrub up to 6 ft. high. Leaves obovate, base cuneate, serrate, 1 to 2-1/2 in. long, 3/4 to 1 in. wide. Fruits fasciculate with leaves on spurs; peduncles shorter than petioles. A native of southeastern China, never introduced, morpho-

logically closely related to *Ilex decidua* Walt. of the United States, may share the same range if introduced.

118a. *Ilex aculeolata* var. *kiangsiensis* S. Y. Hu

A variety with unusually large fruits, over 1/2 in. long, never been introduced.

119. *Ilex macropoda* Miq.

A deciduous tree, 40 ft. high, branchlets provided with rough spurs up to 2 in. long. Leaves alternate on elongated branchlets, fasciculate with flowers or fruits at the end of spurs, ovate or ovate-elliptic, 1-1/2 to 3 in. long, 1-2 in. wide, sharply serrate, base rounded, apex acuminate. Fruits solitary, axillary to leaves, generally at the apex of spurs, rarely at the base of elongate branchlets, globose, 1/4 in. in diameter, red, pedicels 1/4 to 1/3 in. long, pyrenes 5, striate and sulcate. A native of China and Japan, closely related to and resembling the American species *Ilex montana* Torr. & Gray, very pretty in October, fruits too juicy to hold the brilliant red color after a frost.

120. *Ilex toii* Merr. & Chun

A deciduous shrub or small tree, 6-10 ft. high, branchlets with spurs, lenticels conspicuous. Leaves papery, ovate or ovate-elliptic, 2-4 in. long, 1-1/4 to 2 in. wide, acuminate, base rounded, sharply serrate. Fruits fasciculate with leaves at the end of a spur or solitary, axillary to scales or leaves at the base of current year's growth, globose, about 1/4 in. in diameter, pedicels 1/8 in. long, pyrenes 6, ridged and sulcate on the back, bony. A native of warm temperate China, resembling the North American *Ilex montana*, distinguished for its very short pedicels.

NATURAL HYBRIDS

1. *Ilex* × *kuisiana* Hatusima (= *Ilex buergeri* × *integra*)

A shrub 12 ft. high with oblong or oblong-obovate leaves 2-1/4 to 3-1/2 in. long, 1 to 1-1/4 in. wide, leathery, acuminate, tip obtuse, base cuneate, apical half remotely serrate. Pistillate flowers 5-6 fasciculate, pedicels 1/3 in. long. Recorded from Kiusiu, Japan, ornamental merit not known yet.

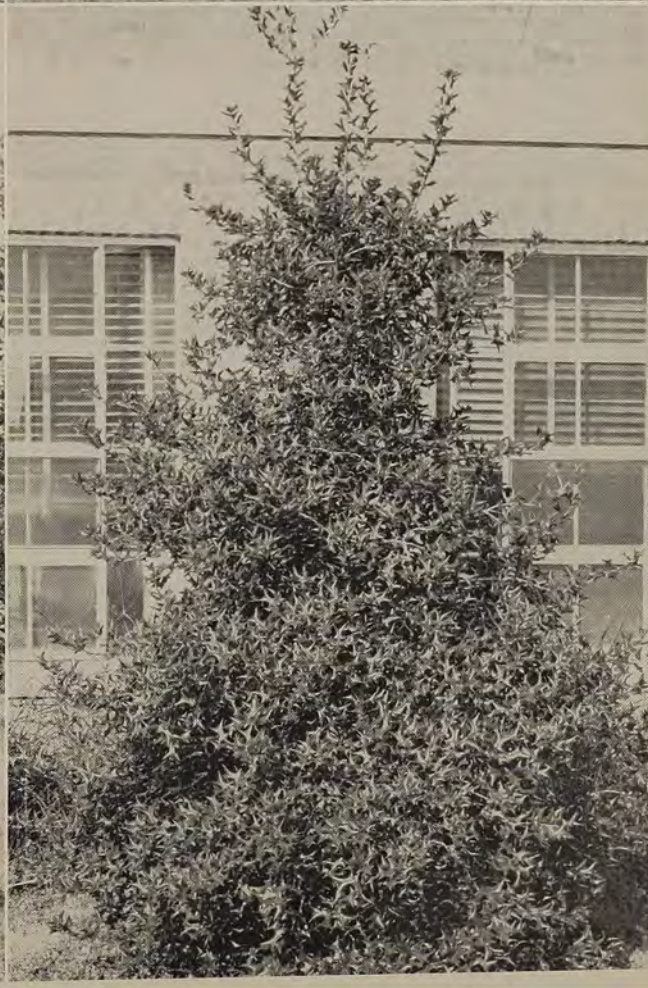
2. *Ilex* × *makinoi* Hara (= *Ilex leucoclada* × *rugosa*, also known as *Ilex fauriei*)

A nature hybrid, evergreen. Leaves ovate-oblong, 1-2 in. long, 1/2 to 3/4 in. wide, obtuse at both ends. Flowering shy, solitary. Fruit not seen. Unworthy of introduction unless for curiosity's sake.

Illustration 19.

Ilex pedunculosa
Ilex integra

Ilex latifolia
Ilex cornuta



CLONES AND HYBRIDS DEVELOPED
IN AMERICAN GARDENS

1. *Ilex aquipernyi* (*Ilex aquifolium* × *pernyi*)

A putative hybrid with spinose leaves similar in shape to those of *Ilex pernyi*, but twice as large; origin, J. B. Gable, Stewartstown, Pennsylvania.

2. *Ilex* 'Avery Island'

A staminate clone of *Ilex cornuta* with leaves varying from quadrangular and 7-spined to ovate and single-spined; origin, Jungle Gardens, Avery Island, Louisiana.

3. *Ilex* 'Brilliant'

A clone of *Ilex aquifolium* 'Golden Beauty' × *pernyi* with rather large and bright red fruits; origin, W. B. Clarke, San José, California.

4. *Ilex* 'Compacta'

A clone of *Ilex crenata*, with compactly packed dark-green shiny obovate leaves, 1/4 to 1 in. long, 1/5 to 1/3 in. wide, apex obtuse or rounded, base acute, margin with 5-6 minute teeth; a Bennett hybrid, available at Tingle Nursery, Pittsville, Maryland.

5. *Ilex* 'D'Or'

A pistillate clone of *Ilex cornuta* with both quadrangular multispinose and entire unispinose leaves and yellow fruits 1/4 to 3/8 in. in diameter; origin, Mrs. Carl Singletery, Columbus, Georgia, propagated and distributed by Ida Cason Callaway Gardens, Chipley, Georgia.

6. *Ilex* 'Glass'

A staminate clone of *Ilex crenata* f. *microphylla*, with compact upright habit, very small shiny dark-green leaves, 1/4 to 1/2 in. long, 1/8 to 1/5 in. wide, obtuse at both ends, 3 rarely up to 5 teeth on each side.

7. *Ilex* 'Golden Variegated'

A clone of *Ilex crenata* f. *luteo-variegata*, with low growth, thickly coriaceous shiny elliptic leaves, acute at both ends, some blotted and spotted yellow, some entirely green, 1/4 to 3/4 in. long, 1/8 to 1/4 in. wide, each side with 4 minute teeth at the apical end; available at Tingle Nursery.

8. *Ilex* 'Green Island'

A dwarf clone of *Ilex crenata*, with small elliptic leaves, 1/2 in. long, 1/4 in. wide.

9. *Ilex* 'Henryae' (*Ilex pernyi* var. *veitchii* × *fargesii*)

A new hybrid with spinose lanceolate

leaves, 2-1/4 to 3 in. long, 1/3 to 1/2 in. wide attenuate at both ends, 9-12 spines on each side; origin, Henry Foundation for Botanical Research, Gladwyne, Pennsylvania. This hybrid is named for Mrs. Mary A. Henry, President of the Foundation.

10. *Ilex* 'Hetzi'

A clone of *Ilex crenata* f. *convexa*, with rather large shiny dark green convex obovate or oblong-obovate leaves, 1/3 to 1 in. long, 1/4 to 1/2 in. wide, base obtuse, apex rounded or obtuse, 7-10 teeth on each side; a very desirable specimen.

11. *Ilex* 'Howard'

A Bennett hybrid with *Ilex crenata* f. *convexa* being a parent; leaves obovate-oblong, slightly convex, 3/8 to 1 in. long, 1/5 to 3/8 in. wide, both ends obtuse, 8-14 teeth on each side; a very pretty specimen, available at Tingle Nursery.

12. *Ilex* 'Hume'

A pistillate clone of *Ilex cornuta* with narrower leaves; origin, McLean Nurseries, Towson, Maryland.

13. *Ilex* 'Jungle Garden' (also known as *Ilex* 'Chinese yellow')

A pistillate clone of *Ilex cornuta*, with large clusters of light yellow fruits; origin, Avery Island, Louisiana.

14. *Ilex* 'Kingsville'

A dwarf clone of *Ilex crenata* f. *longifolia* with lanceolate leaves about 1 in. long, 1/4 in. wide.

15. *Ilex* 'Kingsville Green Cushion'

A very dwarf form of *Ilex crenata*, with low spreading habit; origin, Kingsville Nurseries, Kingsville, Maryland.

16. *Ilex* 'Longfellow'

A clone of *Ilex crenata* with small elliptic leaves, 1/2 to 1 in. long.

17. *Ilex* 'Lord'

A clone of *Ilex rotunda*, with entire, spineless leaves, and shining red fruits produced in great abundance; origin, University of Florida, Gainesville.

18. *Ilex* 'Major'

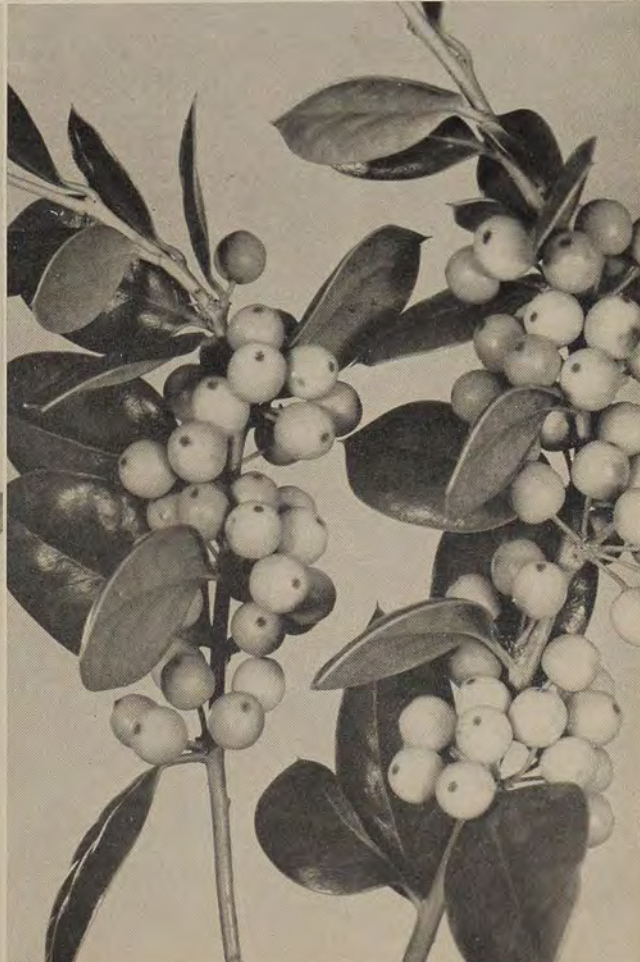
A clone of *Ilex crenata* with shiny dark-green obovate leaves, 3/8 to 7/8 in. long, 1/4 to 1/2 in. wide, base acute, apex rounded, rarely obtuse, 7-13 teeth on each side; a very pretty specimen, available at Tingle Nursery.

19. *Ilex* 'Maxwell'

A clone of *Ilex crenata* f. *convexa*, with

Illustration 20.

Ilex cornuta *Ilex cornuta* 'Hume'
Ilex cornuta f. *burfordi* in flower and fruit



oblong or oblong-obovate convex leaves, 1/3 to 1 in. long, 1/5 to 3/8 in. wide, apex obtuse or rounded, base acute or obtuse, 5-6 teeth on each side; a very desirable specimen, a Bennett hybrid.

20. *Ilex* 'Microphylla'

A clone of *Ilex crenata* var. *longifolia* f. *rehderiana*, with low and compact habit, small shiny elliptic leaves acute at both ends, 1/3 to 7/8 in. long, 1/5 to 3/8 in. wide, 4 minute teeth on each side.

21. *Ilex* 'Morris Dwarf'

A clone of *Ilex crenata* f. *microphylla*, with very dwarf habit, small dark-green elliptic-oblong leaves, 1/3 to 2/3 in. long, 1/6 to 1/3 in. wide; 4 or 5 minute teeth on each side, apex variable, generally acute, sometimes rounded or obtuse.

22. *Ilex* 'Oleafera'

A clone of *Ilex crenata*, with dark-green obovate or oblong-obovate leaves, 1/2 to 1 in. long, 1/4 to 1/2 in. wide, size and form very variable; a Bennett hybrid.

23. *Ilex* 'National'

A clone of *Ilex cornuta* with very abundant red fruits; origin, U.S. Botanical Garden, Washington, D. C.

24. *Ilex* 'Repandens'

A clone of *Ilex crenata*, with spreading habit, narrow obovate leaves.

25. *Ilex* 'Romal'

A staminate clone of *Ilex rotunda*; origin, Glen Saint Mary, Florida.

26. *Ilex* 'Rotunda'

A dwarf clone of *Ilex cornuta* with spinose leaves, flowers unknown; origin, Avery Island, Louisiana.

27. *Ilex* 'Rotundifolia'

A clone of *Ilex crenata* f. *latifolia*, with upright habit, shiny dark-green flat oblong or obovate-oblong leaves, 5/8 to 1-1/4 in. long, 3/8 to 5/8 in. wide, obtuse at both ends, 11-16 teeth on each side; having the largest leaves among all the forms of *Ilex crenata* in American gardens.

28. *Ilex* 'Shangri-La'

A pistillate clone of *Ilex cornuta* with erect tree-like habit, glossy dark-green quadrangular-oblong spinose leaves 1 to 2-1/2 in. long, deep vermilion short-pedicellate fruits 1/2 to 5/8 in. in diameter; a fast-growing form producing 5 ft. of terminal growth in one season, flowering in March or early April, fruits reaching mature sizes in June, turning red in early November and persisting on the plant until the following March.

29. *Ilex* 'Shiu-ying' McLean*

An attractive pistillate clone originating

as a seedling of *Ilex cornuta* f. *burfordi* at the nursery of, and named by, Stewart McLean, Towson, Maryland. A slow-growing, small and compact tree with quadrangular glossy dark green leaves, slightly narrowed in the middle, up to 2-1/2 in. long; leaf margins with 3, or very rarely 4, strong spines on each side. Fruits brilliant scarlet red, 1/3 to nearly 1/2 in. in diameter, borne in fascicles of 7-8, rarely less, on elongated pedicels.

Its name is associated with Dr. Shiu-ying Hu. *Shiu* in Chinese means *elegant* and *ying* means *plant* or *flower*.

30. *Ilex* 'Stokes'

A clone of *Ilex crenata* with compact sturdy habit; Plant Patent No. 887; origin, Warren E. Stokes, Butler, Pennsylvania.

31. *Ilex* 'Tennyson'

A clone of *Ilex crenata* f. *latifolia*, with elliptic leaves about 1 in. long, 1/2 in. wide.

32. *Ilex* 'Tingle One'

A low-growing, small-leaved form with oblong-elliptic leaves, 1/4 to 5/8 in. long, 1/8 to 1/4 in. wide, obtuse or acute at both ends, occasionally rounded at the apex, largely flat, some convex; probably a hybrid between *Ilex crenata* f. *microphylla* and *Ilex crenata* f. *convexa*; origin, Tingle Nursery.

33. *Ilex* 'Vaseyi'

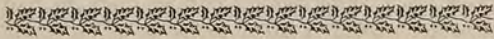
A clone of *Ilex crenata* f. *latifolia*, with rather loosely arranged oblong-obovate leaves, 1/2 to 1 in. long, 1/4 to 1/2 in. wide, more or less convex, apex rounded, base obtuse; a Bennett hybrid.

34. *Ilex* 'Willow leaf'

A clone of *Ilex crenata* f. *longifolia*, with spreading habit, shiny light-green oblanceolate leaves, 1/2 to 1-1/8 in. long, 1/4 to 3/8 in wide, some slightly convex; a Bennett hybrid, available at Tingle Nursery.

*It is a general practice among taxonomists that no author should name a plant in his own honor in an article written by him for publication. Consequently, it is the distinct pleasure of the Guest Editor to include Mr. McLean's description and naming of a heretofore unnamed new variety in recognition of Dr. Hu and her many contributions to the advancement of horticulture.

Shiu-ying Hu, botanist, *Arnold Arboretum, Harvard University, Jamaica Plain 30, Massachusetts*, was formerly professor of Botany, *West China Union University, Chengtu, China*. She is the author of the Genus *Ilex* in China and many botanical articles. Dr. Hu has traveled extensively in China and made several botanical expeditions there. She is an authority on the flora of China.



English Hollies

HARRY WILLIAM DENGLER

The hollies in this group more specifically relate to the varieties, selections, clones, cultivars, and hybrids of *Ilex aquifolium* L., the English or "Common holly" of Europe. This holly, however, is a member of a poorly understood complex comprising, in part at least, *Ilex perado* Aiton and *Ilex platyphylla* Webb and Berthelot, which itself may be but a variety of *perado*.

Ilex aquifolium is rather widely distributed throughout parts of southern and central Europe, occurs in Africa and China, and is a common plant in the British Isles, especially Scotland and England, while *platyphylla* is native to the Canary Islands. The relationships of these three hollies to one another and their possible hybrids and varieties have caused considerable confusion among holly authorities. These varieties and/or hybrids are indicated by the term "(Of doubtful ancestry)" in the descriptions which follow.

In its native habitat, *Ilex aquifolium* varies in form from a moderate-sized shrub to that of a tree anywhere from twenty to eighty feet in height. It is an evergreen species with leaves more or less oval in outline, 2-1/2 to 5 in. long, and 3/4 to 2 in. wide, coriaceous in texture, the margins wavy and spiny and the spines often completely absent on the leaves of older trees. The latter characteristic resulted in their being called "He," "She," or "Free" hollies, irrespective of their proper sex.

The English hollies are undoubtedly the oldest, best known, and, up to the present time at least, the most useful of all members of this genus. So far as is currently known, they are also one of the most variable of all hollies. One of the earliest references to varieties of this species is that of the "Hedgehog holly" said to have been introduced to England from France in the late sixteen hundreds. Many varieties of the English

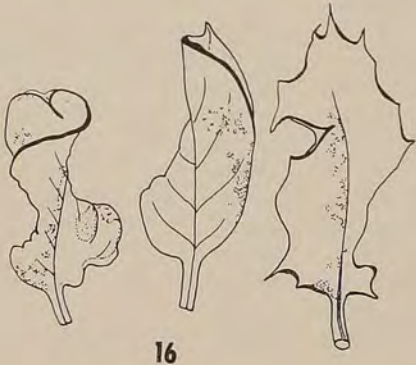
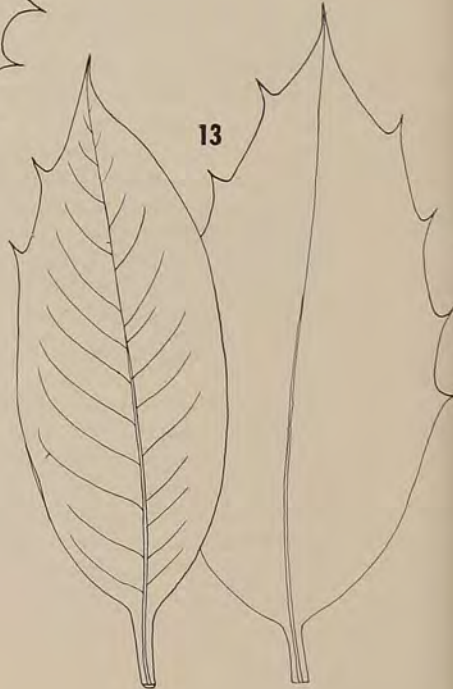
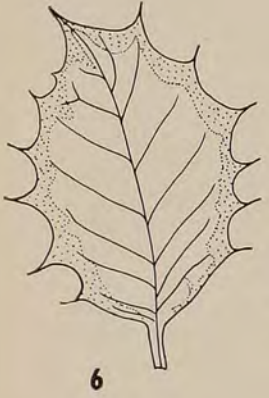
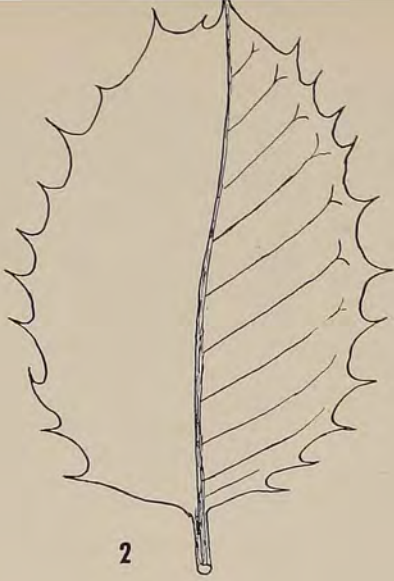
hollies are so old that their origins would be most difficult to determine.

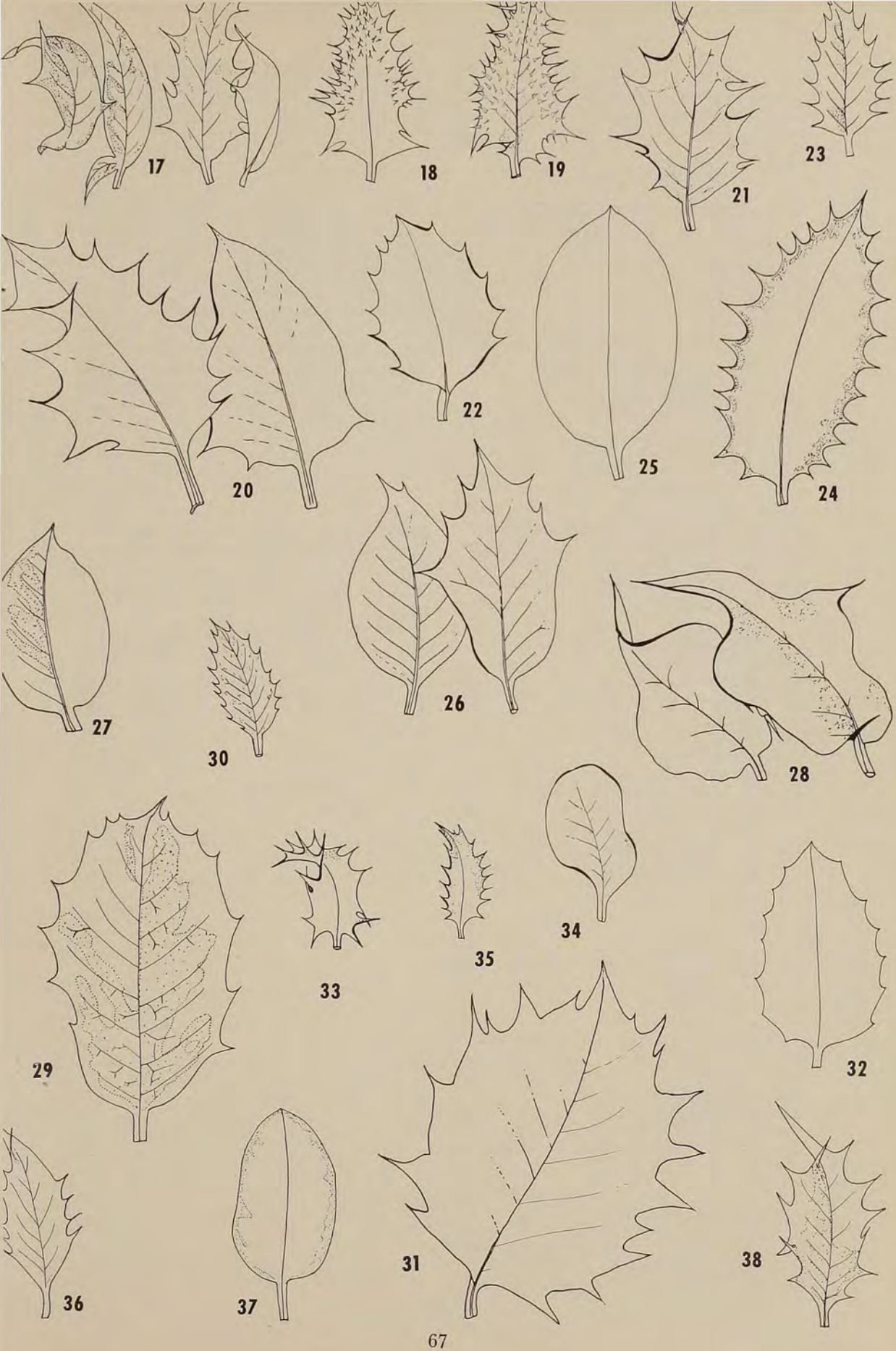
One of the most assiduous collectors of holly varieties of record was Wrench of Fulham, who lived during the latter part of the reign of Charles II, 1630-1685. In Hunters' edition of *Evelyn's Silva*, 1776, thirty-six varieties of variegated-leaved hollies are named. Loudon, 1838, noting the large number of variegated hollies available in London nurseries, grouped these as: *albo-marginatum*, white-edged-leaved; *aurea marginata* gold-edged-leaved; *albo-pictum*, white-spotted-leaved; *aureo-pictum*, gold-spotted-leaved. He also included the 'Silver-blotched' and the 'Gold-blotched Hedgehog' hollies.

In a series of fourteen articles appearing in the *Gardeners' Chronicle*, London, 1874, 1875 and 1876, Tom Moore described 153 varieties of the "Common holly." Of these, one was duplicated under another name, two had identical names, and one was the "type" from which the others varied. This is the most important work on the hollies to date and because of its completeness has become known as *Moore's Monograph*.

In 1908, W. Dallimore, Arboretum, Royal Gardens, Kew, in his book *Holly, Yew and Box*, treated the "Common holly" as fully as was possible and directed attention to other *Ilex* species, many of which were not then known. Dallimore brought up to date and clarified the descriptions and names of previous authors. Many of his descriptions of the English varieties were those of Mr. Moore, as were the leaf illustrations included in the *Monograph*. Dallimore, however, felt it advisable to place some of these hollies under *I. platyphylla*, while others he referred to as hybrids. Like Mr. Moore's, Dallimore's work was an important contribution; his limited edition book is an eagerly sought item among holly fanciers.

The descriptions of the hollies in this group that follow alphabetically, fall in two readily discernible classes. The first includes those which were selected and named from plants growing in the United States. These might have originated as seedlings, branch sports or mutations, from seedlings or imported varieties, accidental or planned hybridization, or an unwitting, yet invalid, renaming of a valid named variety. Where known, the name of the origi-





Illustrations 21. & 22.

Varieties of English holly

Ilex aquifolium

1. *alcicornis*
2. *altaclarensis*
3. *angustifolia*
4. *argentea marginata pendula*
5. *argentea medio-picta*
6. *argentea regina*
7. *aurea marginata ovata*
8. *aurea medio-picta*
9. *aurea medio-picta latifolia*
10. *aurea regina*
11. *aurifodina*
12. 'Belgica'
13. 'Camelliaefolia'
14. *ciliata*
15. *ciliata major*
16. *crispa*
17. 'Donnington'
18. *ferox argentea*
19. *ferox aurea*
20. 'Fisher'
21. *flavescens*
22. 'Fox'
23. 'Handsworth'
24. 'Handsworth New Silver'
25. 'Henderson'
26. *heterophylla*
27. *integrifolia*
28. *latispina*
29. 'Lawson'
30. *myrtifolia*
31. 'Nobilis'
32. *ovata*
33. *recurva*
34. 'Scotia'
35. *serratifolia*
36. 'Smith'
37. 'Waterer'
38. 'Whittington'

nator and the State of its origin follows the description in parenthesis. The second group includes those importations from Europe, largely the British Isles, known or believed to be currently growing in North America. These will be recognized by their more complete description, the absence of their originator and place of origin and, most often, a Latinized title somewhat descriptive of the variety. Names in parenthesis with this group indicate former names or names by which they might still be known. In all of the latter cases, the descriptions are very freely copied and condensed where necessary from those originally appearing in *Moore's Monograph* and Dallimore's *Holly, Yew and Box*.

Grateful appreciation is here expressed to both Mr. Dallimore and to Mr. Roy Hay, current Editor, *Gardeners' Chronicle*, for their kind permission in allowing this. Their courtesy should be most helpful to many confused nurserymen and collectors in determining whether their hollies may or may not be correctly labeled.

The remarks concerning the completeness of the list of American hollies applies equally to this group.

Readers are also advised to study the comments of A. N. Roberts and C. A. Boller on the English hollies under the article "Orcharding in the Pacific Northwest."

DESCRIPTIONS OF ENGLISH HOLLIES

1. *alcicornis*

A free-growing variety with greenish young bark, noted for its very spiny, bright green leaves, 3-1/2 in. long, 1-3/4 in wide, oblong-obovate, entire wedge-shaped base, the rest of the margin furnished with numerous narrow, stiff, sharply-pointed spines.

2. 'Alice'

A female selection of nursery-grown seedlings, originating in Pennsylvania about 1925. Berries large, very glossy and produced on young growth. This plant is "Number 1" of the Whitney hollies. Original tree at Woods Hole, Massachusetts. (Wheeler, Massachusetts; Pennsylvania.)

3. *altaclarensis*

A fine male holly with purplish bark, vigorous and dense habit, forming a noble specimen. Leaves deep green, roundish-ovate or oval, 3-4 in. long, 2-1/2 to 3 in. wide. On some leaves the spines are numerous and regularly developed; on others, few or lacking; where present, they are stronger and more divaricate than on *platyphylla*, suggesting a possible hybrid. Resembles 'Hodgins' in appearance and has been called the 'High Clere' holly. (Of doubtful ancestry.)

4. *angustifolia*

An elegant-growing variety, narrow pyramidal habit, green or purplish bark. Leaves shining green, lanceolate or lanceolate ovate, about 1-1/2 in. long, 1/2 in. wide, with a longish, entire point, five to seven narrow, weakish, regular spines on each side of leaf, lying in the same plane. Resembles *myrtifolia* but has narrower spines and the elongated entire apex well defined.

5. *argentea marginata (albo-marginatum)*

Commonest of silver variegated-leaved hollies, varying somewhat in appearance. Bark of young wood is green. Leaves are broadly ovate, 2 to 2-1/2 in. long; dark green color with slightly mottled disk, irregular, narrowish silvery margin. Spines usually somewhat numerous but irregular divaricate; sometimes fewer or almost lacking. A fruiting variety; names in the trade may include: 'Silver Beauty,' 'Silver Broadleaf,' 'Silver Princess,' 'Silver Queen,' 'Silvary,' and 'Teufel's Silver Variegated.'

6. *argentea marginata elegantissima*

A striking variety, bark of young shoots green. Leaves elliptic-oblong, 2 in.

long, 1 in. wide, dark green, mottled with gray and broad, rather even, creamy-white edging. Spines bold, regularly developed, becoming divaricate from the wavy surface of the leaf.

7. *argentea marginata erecta*

This female variety known in England as 'Upright Silver-striped,' has leaves about 2 in. long, flat, with a very regular marginal series of strongly-developed spines, somewhat resembling 'Handsworth New Silver.' Leaves have mottled green center with a broad creamy-white margin. Listed in the trade as 'Silver Charm.'

8. *argentea marginata pendula*

A fine, well-known variety of weeping habit, vigorous growth, belonging to the purple-barked group. Leaves 2-1/2 to 3 in. long, ovate or ovate-oblong, margins furnished with large conspicuous spines, somewhat less crowded and regular than in 'Handsworth New Silver,' surface green, freely blotched with grayish-green, margin irregularly but often boldly marked with creamy white. A fruiting variety, originally called 'Perry's Weeping' in England; in the American trade, 'Silver Weeping.'

9. *argentea medio-picta (albo-pictum)*

A well-known, handsome, green-barked, variegated holly (some green foliage may have to be pruned out). Leaves ovate or cuneately ovate, 1-1/2 to 2 in. long, about 1 in. wide, with very strong, much divaricated spines. Leaf color dark green at the edge with a large central blotch of creamy white, irregular in shape, size, position, frequently confined to basal half of the leaf. This is the 'Milkmaid' and 'Silver Milkmaid' of England; both male and female varieties available. 'Silver Milkboy' is a male form in the American trade.

10. *argentea regina*

A grand holly considered one of the best varieties having silver-edged leaves. Bark of young wood purplish or reddish brown. Leaves broadly ovate, 2-3/4 in. long, 1-3/4 in. wide, with strongly developed, much divaricated, fairly evenly spaced spines; disk dark green with patches of grayish-green, broad irregular but well-defined creamy-white edging, most strongly developed at apex. A male holly named the 'Silver Queen' in England, it has its counterpart in the American trade's 'Silver King.'

11. *aurea marginata*

In its widest sense this name includes a large proportion of the variegated-leaved female hollies with golden margins. A number of distinct forms and some showing slight variations have been selected and



named at various times, so considerable latitude has to be allowed this variety. Typically, bark is usually green, leaves large, about 2-1/2 to 3 in. long, 1-1/2 in. wide, with stout, divaricate, unequally distributed spines. Disk dark green with gray-green mottlings; golden edges moderately narrow, unequal but rather strongly developed about the tip, leaves sometimes entirely golden. Varieties in the American trade include 'Golden Queen' and 'Scotch Gold.'

12. *aurea marginata ovata*

A distinct variety with reddish brown young wood. Leaves ovate, strongly developed, fairly regular spines; mottled green and gray with broad pale yellow edges. A female form has been named 'Golden Gate' in the American trade.

13. *aurea medio-picta*

An attractive variety called 'Gold Milkmaid' in England, frequently occurring as a sport on the solid green-leaved English hollies. This, with the variations in leaf sizes, coloration, spines, has occasioned the adoption of several names. It is recognized by leaves irregularly marked by a large, deep golden blotch frequently occupying more than half the surface while the irregular margin is dark glossy green. There are both male and female forms. Names in the trade for this and/or *aurea medio-picta latifolia* may include: female—'Golden Milkmaid,' 'Golden Butterfly,' 'Harlequin,' 'Painted Lady'; male—'Golden Milkboy.'

14. *aurea medio-picta latifolia*

In England, this was considered the best type of 'Gold Milkmaid' and was distinguished from other forms by means of its large, flattened leaves. Spines variable in number, position, stout, well developed, divaricate, generally wanting at the rounded base of the leaf, sometimes confined to a few near the apex. Broad disk irregularly marked with a large, branching, deep yellow blotch, frequently covering more than half the leaf and with narrow irregular margin of green. (See also *aurea medio-picta* above.)

15. *aurea regina*

A beautiful holly, considered one of the best of the golden variegated forms. Bark of young wood green; leaves broadly ovate, 2-1/2 to 3-1/2 in. long, 1-1/2 to 2 in. wide, with very strong, spreading and variously directed spines. Disk usually much

mottled with dark green, pale green, gray, often in nearly equal proportions, with broad, well-defined, continuous margin of deep golden yellow. The tendency to variegation is so strongly marked that it is not uncommon to find leaves which, either on one side of the mid-rib, or both, are entirely gold colored. A free-growing male variety called 'Golden Queen' in England, and listed as 'Golden King' by at least one American nurseryman.

16. *aurifodina*

The 'Smudge' holly of England, upright or pyramidal habit, thickly covered with medium-sized or rather small foliage. Bark usually reddish, occasionally green. Leaves ovate-acuminate, about 1-3/4 in. long, spines continuous but distant, placed along the edge, or rarely few, scattered, moderately divaricate. Disk is dark green, flushed or marbled with dull yellow green, edge unequally marked with tawny orange-yellow, sometimes extending over fully half the leaf. A distinct variety on account of the handsome tawny hue which the variegation assumes during winter season.

17. *balearica*

Female form from the Balearic Islands; usually of pyramidal habit. Leaves ovate or ovate-oblong, 3 to 3-1/2 in. long, about 2 in. wide, thick in texture, bright green. Majority of leaves entire or bare but a few erratically placed spines, though occasionally short spines fairly well represented along the margins. (Of doubtful ancestry.)

18. 'Balkans'

A hardy strain growing at the Missouri Botanical Garden from seed collected in the Balkans in 1934. (Anderson, Yugoslavia.)

19. 'Barnes'

A male sport of *Ilex aquifolium angustifolia*. Leaves small, quadrangular-shaped, 5-7 sharp, divaricate spines. An excellent pollinator. Globular in shape. (Mattoon.)

20. 'Beacon'

A green-stem type, selected in 1945 as a heavy, consistent bearer, with distinctly bright, extra large, orange-red berries in large quantities. (Wieman, Oregon.)

21. 'Beautyspra'

A hardy female seedling, selected about 1927, with real red berries and pronounced spiny, crinkled leaves, somewhat smaller than

Illustration 23.

Variegated-leaved English hollies

Ilex aquifolium argentea marginata
Ilex aquifolium aurea regina

Ilex aquifolium argentea medio-picta
Ilex aquifolium 'Crinkle Variegated'



average. Early-bearing, early-ripening. Artistically attractive from the overall placement of berries on sprays. (Wieman, Oregon.)

22. 'Belgica'

A fine, vigorous-habited variety. Young bark, green; called Dutch holly in England. Leaves sap green, 3-1/2 in. long, ovate, or oblong-ovate, with a formidable array of strong, rather thickly-placed spines at the edges. (Of doubtful ancestry.)

23. 'Big Bull' (or 'Ferdinand')

A green-stem male, selected in 1935; of vigorous upright growth habit, very hardy, good pollenizer; leaves green and lustrous. (Teufel, Oregon.)

24. 'Butler'

An excellent foliated, hardy female with very large red berries. Original tree near the Maryland range of the Blue Ridge Mountains. (Adams, Maryland.)

25. 'Camelliaefolia'

A female variety with large, dark-colored fruits, considered one of the most ornamental of the English hollies. Vigorous habit, growing naturally into a handsome, shapely pyramid, retaining dense foliage at all seasons. Bark of young wood purple. Leaves oblong or elliptic, acuminate, dark, olive green, very glossy; 3-1/2 to 5 in. long, 1-1/2 to 2 in. wide. Leaf margins either smooth, spineless throughout, or with an erratic spine or two; or with lower part entire, upper with some 4 or 5 well-developed, undulating spines on each side; or rarely armed on both margins throughout entire length.

26. 'Christmas Eve'

A seedling selection from a tree in Tacoma, Washington. Tree very vigorous; producing comparatively large, coarse sprays. Sprays well balanced with very large, round, bright-red berries of good substance. Leaves large, waxy, leathery, with a tendency to be completely smooth, or only slightly spiny. Stems green to blue or intermediate in color. Berries early ripening. (DeMille, Washington.)

27. *ciliata* (*ciliata minor*, *pyramidalis*)

An attractive, purple-barked male variety; pyramidal habit, neat growth. Leaves ovate or lanceolate, shining green, 1-1/2 in. long, rarely 2 in., 1/2 to 3/4 in. broad; margined with long, weak, regularly

placed spines, which form a kind of fringe to the edge.

28. *ciliata major*

A free-growing, vigorous female variety. Bark of young shoots purple. Leaves ovate or ovate-oblong, flattish, ciliate margined with long, crowded, broad-based, plane spines; basal leaf portion usually entire, apex more or less prolonged; dark glossy green, sometimes olive tinged.

29. 'Coleman'

A hardy English holly. On November 10, 1955, after a very late, warm fall, the Washington area was hit with zero temperatures almost overnight. Many hollies were killed and all English hollies, with the exception of the 'Coleman' strain, were severely damaged. Of all the varieties growing in the State of Washington at the time, 'Coleman' was the only one that suffered no damage either to the leaves or to the berries. (Callison, Washington.)

30. 'Crinkle Variegated'

A female sport of *argentea mediopicta*, selected in 1945 because of the excessive crinkle of its small leaves and abundant fruiting habits. (Wieman, Oregon.)

31. *crispa* (*marginata*, *contorta*, *tortuosa*, *calamistrata*)

The Screw or Screw-leaved holly of England. Bark of the young shoots purple. Leaves blunt ended, spirally twisted, more variable than in other varieties, from one tree many different types may be gathered; margins entire or in some case rudimentary spines are produced, or one or more erratic spines may be abnormally developed. Chief characteristics of this male variety are the deep, glossy green leaves with thickened margins, spiral twisting, and the rugosity of the upper leaf surface.

32. *crispa aurea-picta*

This is the Gold-blotched Screw holly of England; a variety with purple young bark. Leaves twisted, coriaceous, with a thickened margin as in *crispa*. Glossy, puckered on the surface, almost shapeless from the twisting and irregular development of the spines, sometimes wholly wanting, the thickened edge being undulated, sometimes sparingly produced in an altogether erratic manner. Marginal portions deep green; disk marbled with yellow and pale green, yellow predominating near the base. Doubtless a sport of *ferox aurea*, subject to the production of green-leaved branches.

Illustration 24.

Ilex aquifolium 'Pinto'

Ilex aquifolium 'Teufel's Deluxe'

Ilex aquifolium ferox argentea

Ilex aquifolium 'Teufel's Hybrid'



33. 'Deluxe'

A rank-growing, hardy, green-stem female, with exceptionally large leaves and berries considerably larger than average. An early-ripening hybrid, selected in 1935, considered excellent for commercial orchards and landscape work. (Teufel, Oregon.)

34. 'Dickinson'

Leaves heavily spined; excellent pollinator, usually a single-stemmed male tree. (Mattoon, New Jersey.)

35. 'Donnington'

A male variety, free, pyramidal growth, bark a very dark purple color. Leaves variable in size and form, stout in texture, a dull purplish-green, causing the plant to contrast strongly with the bright green varieties. Leaves lanceolate in general outline, but not unfrequently turned to one side so as to become sickle-like; frequently have a small lateral and often falcate lobe at the base. Leaves have a purple streak along the mid-rib on the back; average about 2 in. long, 3/4 in. wide, sometimes slightly exceed these dimensions. Margins frequently entire or with 1-5 erratic spines, occasionally spines more numerous, sometimes margins furnished throughout with them; the spines, when present, strong, much divaricate. Spiny leaves resemble 'Whittington' in form but their thicker texture and purple hue serve to identify them.

36. 'Dr. Huckleberry'

A female selected in a mixed seedling planting on the Wilmarth place at Brighton, Oregon, in 1946, and tested at the Oregon Experiment Station as O.S.C. No. 25. An early-ripening form of the green-stemmed Blegg group. Exceptionally bright red, oval-shaped berries. Leaves on mature plants medium to large, wavy, spiny, shiny and hold their green color well under adverse conditions. Not subject to leaf drop. Rapid-growing, early-cropping tree. Greens not excessively coarse and well balanced in growth and leaf arrangement. One of the best. (Oregon.)

37. "Dutch Type"

A term applied to forms of the English hollies in the Pacific Northwest differing from the varieties so commonly associated with the Christmas season. In general, leaves quite flat, dark green, glossy, most

often spineless. Berries usually larger, firm to handle, more uniformly round in shape, produced abundantly and early-ripening.

38. 'Early Cluster'

A winter-hardy, early-bearing female, selected in 1932. Berries in extremely heavy clusters. An outstanding producer of good quality holly. (Wieman, Oregon.)

39. 'Echo'

A small, wavy-leaved fruiting form of *angustifolia*. (Brownell, Oregon.)

40. 'Eldredge'

A female form introduced on Long Island, New York, about 1900. Berries large, red, borne in profusion. Leaves, large, flat, ovate, resembling *altaclarensis* and *ovata*. (May also be known as 'James G. Esson,' or spelled 'Eldridge.')(Batchelor, New York.)

41. 'Escort'

A sturdy, free-growing, green-leaved male selected as a dependable and profuse producer of pollen for orchard pollinizing needs. (Brownell, Oregon.)

42. 'Favorite'

A green-stemmed female of Dutch descent, selected about 1935. Berries medium to large, bright red, extremely early-ripening, early-bearing. Leaves medium spiny, flat, with slight crinkles. Produces short, long, and branched sprays of unusual quality, excellent for arrangements. (Wieman, Oregon.)

43. *ferox*

A male variety commonly called 'Hedgehog' holly, or, in America, 'Green Porcupine' or 'Porcupine,' on account of the prickly leaf surface. Bark of young shoots purple. Leaves ovate-oblong, or narrowly ovate, 2 to 2-1/2 in. long, much acuminate, with strongly developed divaricate, marginal spines; surface more or less convex, being echinate, or furnished with stiff, erect spines.

44. *ferox argentea*

Originally named the 'Silver-striped Hedgehog' holly, also called 'Silver Variegated Hedgehog' and 'Silver Porcupine.' Leaves same size, shape, and spininess of *ferox* but majority of spines silver colored; broad and irregular margin of the same color, disk being deep green. A male, or non-fruiting holly.

Illustration 25.

Ilex aquifolium (a French-English type)

Ilex aquifolium 'Dr. Huckleberry'

Ilex aquifolium 'Pilkington'

Ilex aquifolium 'Oregon Select'



45. *ferox aurea*

This, the 'Gold-blotched Hedgehog,' is a well-marked and handsome male holly. Young bark is purple; leaves vary considerably in size and form, oblong or ovate-oblong, very strongly spined at margin and upper surface. Leaves also strongly waved, more or less recurved longitudinally. Surface a deep rich green, green spines which bristle from its surface have pale tips, while on the plain central portion near the base of the leaf blade is to be found a conspicuous blotch of golden yellow. Names in the trade include 'Gold Porcupine,' 'Golden Ferox,' and 'Golden Variegated Hedgehog.'

46. 'Firecracker'

A low-growing, bushy female with spiny leaves and crimson berries in clusters. An early and abundant fruiter. (Brownell, Oregon.)

47. 'Fisher'

A bold, free-growing, handsome male variety. Young bark unusually green, sometimes purple. Leaves, variable in character about 2-1/2 in. long, 1-1/4 in. wide, very dark green color, and coriaceous texture, ovate, with a somewhat acuminate apex. Leaf margins thickened, somewhat spiny throughout, with strong, much divaricated spines, more commonly with 1-2 to 5-6 spines along the edges, occasionally entire, and an entire acuminate point.

48. *flavescens (aurantiaca)*

Known variously as 'Copper-colored,' 'Bronze,' or 'Moonlight' holly, this golden variegated female variety has no distinctly defined variegation but has a flush of a yellowish color spread over more or less of the leaf surface, variable in extent and position. Dull bronzy-yellow hue sometimes covers the upper half of the leaf, sometimes an irregular portion near the center, other portions remaining green. Coloring is most strongly marked on the young and year-old shoots, the older, more persistent leaves becoming gradually greener. Leaves are oblong-ovate, sometimes as much as 3-1/2 in. long, thick in texture, strongly waved, with prominent marginal spines.

49. 'Fox'

A male variety with the bark of young shoots purple. Leaves bright, very glossy green, ovate, stoutish in texture, 2-1/2 in. long. Spines rather far apart, regular, plane,

fully-developed, appearing somewhat like *ovata* but as if longer spines had been added to its margin.

50. "French-English"

A type of holly rather than true clonal or horticultural variety, containing a certain amount of mixture, depending on the source of the propagating stock. Originally selected and propagated by Mr. P. H. Peyran of Hollycroft Gardens, Gig Harbor, Washington, from *aquifolium* stocks obtained in France and shipped by boat to the Pacific Northwest. The type has dark, blue or purplish wood with thick, leathery leaves that are durable. Trees fairly rapid growing but late in bearing. Berries round-oblate, very firm when red-ripe. Late-ripening characteristic of berries has made them unsuitable to commercial production in some areas. The type tends to produce a high percentage of parthenocarpic berries. Names in the trade for these include: "Peyran," "Falco," "Gigharbor," "Brotje," and "Bluestem."

51. *fructu-aurantiaco*

This, the orange-berried holly, is apparently a form of the yellow-berried holly with deep orange-colored fruits, sometimes flushed with scarlet. Evidently of seedling origin for several forms are known; one in the trade is called 'Orange Gem.'

52. *fructu-luteo*

The yellow-berried holly is one of the oldest known varieties in this group. Leaves are from 2-1/2 to 3 in. long, ovate in form, and bright green in color. Margins generally armed with a moderate number of spines, slightly divaricate. In general appearance it closely resembles the ordinary English hollies. Yellow-berried seedlings apparently are not uncommon. Names in the trade include: 'Yellow Beam' and 'Berigold.'

53. 'Golden Beauty'

A brighter, golden-variegated-leaved female of unusually vigorous growth. (Registered AAN No. 113.) (Clarke, California.)

54. 'Green Knight'

A dark-leaved, ornamental male of stately habit. (Brownell, Oregon.)

55. 'Green Maid'

A vigorous-growing, hardy, graceful, dense and large-leaved, green-stemmed female. Berries well disposed, large, early-ripening. (Brownell, Oregon.)

Illustration 26.

Ilex aquifolium 'Favorite'

Ilex aquifolium 'Beacon'

Ilex aquifolium 'Shortspra'

Ilex aquifolium 'Beautyspra'



56. 'Handsworth'

A variety with glossy green, ovate-lanceolate, acuminate leaves, 1-3/4 in. long, 3/4 in. wide. Numerous thickly-set marginal spines project forward towards the apex of leaf, are moderately divaricate. Some slight resemblance to *ciliata major*, but differs in spine divarication. Both purple- and green-barked forms appear identical otherwise.

57. 'Handsworth New Silver'

A handsome "silver holly" of the purple-barked varieties with free and vigorous growth habits. Leaves elliptic-oblong, 2-1/2 to 3-1/2 in. long, margined with very prominent spines which lie in the plane of the leaf with little tendency to divarication. Disk mottled with green and grayish-green, a distinct and tolerable even creamy-white margin, strong conspicuous marginal spines also white. In the American trade this has been called 'Silverboy' and 'Silver Plane.'

58. *hastata (latispina minor)*

A distinct male variety of dwarf habit with purple bark and dark green, peculiarly shaped small leaves, varying from 3/4 to 1-3/4 in. long, 1/2 in. wide, irrespective of the spines, which are large and very prominent for so small a leaf. Spines usually consist of 1 or 2 pairs on each side at the base, occasionally more, upper half of the leaf forming a large, entire, oblong, bluntish lobe, not infrequently emarginate. Thus the whole leaf, in the case of those which are few-spined below, and have the apex entire, has a strongly marked hastate figure.

59. 'Henderson'

A green-barked variety with opaque, dark green, oblong-elliptic leaves with sunken veins, the apices usually acute, the margins entire, or with a few scattered spines. Leaves 2-1/2 to 3-1/2 in. long, 1-3/4 to 2 in. wide. A female producing large fruits but not in abundance. (Of doubtful ancestry.)

60. *heterophylla*

Resembles *laurifolia* but has shorter and comparatively broader leaves. Bark usually purple. Leaves dark green, ovate or elliptic-ovate, averaging 2-1/2 in. long, 1 or 1-1/2 in. wide; somewhat twisted near the point; may be entirely smooth or spiny, both on the same branch, or, rarely, but occasionally, spiny throughout. Spines, when present, strongly developed and divaricate, generally spaced irregularly, far apart along the margins.

61. 'Hodgins'

A female variety of hardy, vigorous growth, with purplish young bark. Leaves dark green, roundish ovate, 2-3/4 to 3-3/4 in. long, about 2-1/2 in. wide. Marginal spines bold, somewhat far apart, fairly evenly placed, or occasionally a few scattered ones only. 'Hodgins' resembles *altacclarensis* and 'Shepherd'; leaves, however, darker in color than the latter. (Of doubtful ancestry.)

62. 'Hudson'

A heavy-blooming, thick, olive green-leaved male with few spines. (Mattoon, New Jersey.)

63. 'Ingram'

A very distinct, small-leaved male holly, with purple bark. Leaves elliptic ovate, 1-1/4 in. long, about 1/2 in. wide, evenly bordered with plane spines. Disk dark olive green, somewhat mottled and rugose. Teeth and margins grayish-white, markings being freckly with no distinct outline. 'Polkadot' is a name for 'Ingram' in the American trade.

64. *integrifolia (rotundifolia)*

A purple-barked variety. Leaves ovate, entire, thick in texture, somewhat thickened margin, dark green, 2 in. long, 1 in. wide. Leaf has a slight twist, point being sometimes acute, sometimes bluntly rounded. It has something of the character of 'Scotia' but leaves not so decidedly rounded or twisted. Both male and female forms known.

65. 'Jan van Tol'

One of the so-called "Dutch-types" of holly, with smooth, glossy leaves usually somewhat convex. An early-bearing holly, with early coloring, large, dark red shiny fruits. (van Tol, Holland.)

66. *latispina*

An effective, free-growing male of fine pyramidal habit. Bark of young shoots dark purple. Leaves vary from 2 to 2-1/2 in. long, acuminate spiny point generally decurved, about 2-3 broad, elongated spines, commonly deflexed, sometimes erect, occasionally hooked backwards with a rounded shoulder. A very deep glossy green color, texture leathery, margins thickened; entire leaf, in some instances, slightly twisted. Sometimes margin merely wavy without spines except for the long terminal one. It is thought to be a sport of *crispa*.

Illustration 27.

Ilex aquifolium angustifolia

Ilex aquifolium angustifolia
(Note bud clusters of male flowers)

Ilex aquifolium 'Jan van Tol'

Ilex aquifolium 'Christmas Eve'

67. *latispina major*

A variety with leaves larger than *latispina*.

68. *laurifolia*

A well-known male variety, called the 'Smooth-leaved' holly, erect, tall habit, somewhat open, irregular growth. Bark dark purple. Leaves dark green hue, very glossy; vary from 2-3 in. long, in form from ovate to oblong-lanceolate or elliptic. Leaves usually quite entire, rarely with from 1-6 marginal spines, occasionally, very rarely, spiny throughout, surface being either flat or slightly undulated.

69. 'Lawson'

A variegated form of 'Henderson.' Young bark reddish-brown. Leaves ovate or bluntly elliptical, 2-1/2 to 3-1/2 in. long; margins distantly but rather evenly spined, nearly or quite plane; opaque green color, central portions marked with broad bands or blotches of yellow, very variable in shape, often occupying greater part of the surface on one side of mid-rib, marginal portions of two shades of green. Occasionally as many as ten spines on each side of the leaf, much less when either the basal part or a portion of the margin is spineless. A female form considered in England as one of the handsomest of the golden hollies. (Of doubtful ancestry.)

70. 'Lewis'

A female of upright habit, with attractive, divaricately spined, deep green foliage. Berries are large, deep red in color, borne abundantly along the twigs. "What you would expect an English holly to look like." (McLean, Maryland.)

71. 'Lichtenthal'

A variety with oblong leaves, 4 in. long, 1-1/2 in. wide, bright green, regularly spaced, moderately strong divaricate spines. A characteristic is narrowness of leaves in relation to length, distinct pale color of principal vein, spines, margins, under surfaces, and formation of two tiny spines, one on each side near the base of the leaf.

72. 'Lilygold'

An unusually bright-colored, golden variegated variety, selected in 1940. A mutation of, and having other characteristics similar to, the "French-English" kinds. (Teufel, Oregon.)

73. 'Little Bull'

A mutation of *angustifolia* with spiny leaves about three times as large as normal. Leaves glossy; a good pollenizer. Very ornamental; useful for landscape work where a male tree is necessary and hardiness is desired. (Teufel, Oregon.)

74. *maderensis*

A male variety not reliably cold hardy. Leaves usually 3 in. or more in length, 1-3/4 to 2 in. wide, bright green, furnished throughout the margin with rather regular spines lying in the plane of the leaf, directed towards the apex, rather stronger than those of *platyphylla*. Apex acute, terminated with a spine. (Of doubtful ancestry.)

75. *maderensis atrovirens*

A form considered to have darker leaves than *maderensis* but with no really well-marked difference. (Of doubtful ancestry.)

76. *maderensis variegata*

A conspicuous variety with reddish-purple bark. Leaves ovate or obovate, smaller than *maderensis*, 2-1/2 to 3 in. long, 1-1/2 to 2-1/4 in. wide. Spines evenly placed, usually arranged in the same plane, although occasionally a slight waviness is noticeable. Margin dark green with a feathered golden blotch mixed with pale green in the center. Colors are bright and effective. (Of doubtful ancestry.)

77. 'Marnocki'

A fruiting variety, green bark on the undersides of branches and purplish above. Foliage almost as large as 'Camelliaefolia' but less dense and ornamental. Leaves from 4 to 4-1/2 in. long, 2 in. wide, oval, acute with a peculiar twist about the middle. Margins usually thick, spineless; occasionally a few erratically placed spines are borne, more rarely the margins well and regularly armed with strong, divaricate spines.

78. 'Misty Green'

A female form with leaves two tones of green; centers are dark green edged with a broad marginal band of a paler shade. (Brownell, Oregon.)

79. 'Mundy'

A green-barked male variety, with leaves dull in appearance, regular in shape, broadly ovate and evenly spined along the whole of the margin, sometimes slightly undulated on one side; usually 3-4 in. long, 1-1/2 to 2 in. wide, prominently and evenly veined as to give the upper side a somewhat ribbed appearance. (Of doubtful ancestry.)

80. *muricata (bicolor)*

A green-barked variety, with ovate or oblong-ovate, acuminate leaves which vary from 1-3/4 to 2-1/2 in. in length, and 3/4 to 1 in. wide. Leaves are moderately flat and spiny, spines being short and fairly evenly spaced along the margins, majority pointing in one direction. Disk dark green, heavily streaked or blotched with gray or greenish-

yellow, marginal band being of irregular width, generally widening about the apex, and yellow tinged with green.

81. 'Myers'

A selection of seedling origin, said to be over fifty years old; hardy, heavy producer of berries. Original tree at York, Pennsylvania. (Dauber, Pennsylvania.)

82. *myrtifolia*

A small-leaved, neat-growing form of the English holly, with both green and purplish bark. Leaves usually from 1-1/4 to 1-1/2 in. long, 1/2 to 5/8 in. wide, ovate-lanceolate, margin either entire or with one or two erratic spines, or more commonly in the largest leaves moderately spiny throughout, spines being usually sub-divaricate, sometimes nearly flat, especially in the few-spined examples, bright green color. This variety appears to come closest to *angustifolia* and resembles *serratifolia*.

83. *nigrescens*

A distinct male variety with ovate-oblong leaves, 3 to 3-1/2 in. long, and 2-1/4 to 2-1/2 in. wide. Apex is acute, margin often entire, occasionally a few erratic spines are borne; other times 4 or 5 pairs, in all instances they are small. This is a very vigorous holly of ornamental value. (Of doubtful ancestry.)

84. 'Nobilis' 'Urquhartii'

A purplish, young bark variety, with dark green leaves, roundish ovate, 2-3/4 to 3-3/4 in. long, having bold marginal spines somewhat distant, fairly evenly spaced. Closely resembles both *altaclarensis* and 'Hodgins.' (Of doubtful ancestry.)

85. 'Noss'

A hardy female of pyramidal habit; probably of seedling origin. A heavy producer of berries. (Dauber, Pennsylvania.)

86. 'Oregon Select'

A chance seedling selected and named in 1947. Trees mature and bear fruit early; not as vigorous a grower as some varieties. A green-stemmed holly with shiny leaves and well-balanced sprays; a favorite for commercial cutting. Leaves generally spiny, but some smooth leaves develop in older trees. Oval-shaped, early-ripening berries bright red. (Sawyer, Oregon.)

87. *ovata*

A slow-growing, unusual male form having purple young shoots. Leaves deep opaque green, moderate and fairly even size, 2-1/2 in. long, ovate, very thick in texture, with regular, angular, scarcely spiny teeth, sinuses between them unusually even, regular and pronounced.

88. *pendula*

A fruiting variety with pendent branches, leaves deep green, divaricately spiny, ordinarily from 2-3 in. long. Bark deep purple, purplish in some cases, green in others. Spines somewhat broader and, in some cases, fewer than in the average English holly. Forms a handsome specimen many yards in circumference, with an evenly balanced head. Since no leading shoot is formed, it is necessary to keep a shoot tied upright to get height.

89. *perado*

This is the *Ilex perado* Ait. of Azores and Canary Islands. A moderate-sized tree. Leaves oval, often blunt at the apex; vary considerably in size, sometimes attaining a length of 6 in., and a width of 3-4 in. or may be little more than half that size. Leaves dark green, often entire, sometimes margins armed with short, spiny teeth. Fruits large, deep red, sometimes almost black, borne in dense axillary clusters.

90. 'Pilkington'

A seedling selection of *aquifolium*, made about 1900. Planted widely as one of the best of green-stemmed "Bleeg types." Very similar in most respects to 'Dr. Huckleberry.' Early-ripening berries large, bright Chinese red, oval-shaped. Leaves medium in size, thick, black green, wavy, spiny, shiny, with some smooth in older trees. Rapid-growing, early-cropping trees, not excessively coarse or woody. A commercial cutting holly. Tree is compact and conical; terminal growth averages about 12 in. long, making it ideal for Christmas gift boxing. (Bleeg, Oregon.)

91. 'Pinto'

A golden variegated female sport of the green-stem type, selected around 1935. Red-berried, winter-hardy, heavy, consistent bearer; leaves green splashed with gold. (Wieman, Oregon.)

92. *platyphylla*

This is the *Ilex platyphylla* Webb and Berthelot of the Canary Islands. A handsome evergreen tree of small stature. Leaves large, dark green, broadly oval, often 4-5 in. long, 2-1/4 to 3 in. wide, occasionally, on wild plants, 8 in. long, 4-1/2 in. wide, with tiny, brown or black, triangular stipules. Margins usually unequally, irregularly armed with short spines. Occasionally spines wholly suppressed, more frequently lower halves bear a few to many spines, again margins sometimes evenly armed with spines. Apex usually acute, terminated with a spine, but not always the case.

93. *recurva* (*serratifolia compacta*)

A male form with a tendency to a



Illustration 28.

Ilex aquifolium 'Camelliaefolia'—a variety considered in Great Britain to be one of the most ornamental of English hollies.

dwarfish, dense habit of growth; usually having purplish bark, occasionally green. Leaves dull dark green, 1-1/4 in. long, 1/2 in. wide, spiny throughout the margin, apex usually terminating in an elongated spine. Strongly spined like *serratifolia*, but spines more divaricate, or appear to be more so, in consequence of much stronger convex curvature of the leaf in the direction of the mid-rib, combined with which there is a kind of lateral twist, also a twisted disposition of leaves on the stalk. The convexity of the leaf surface gives it a channelled appearance from the lifting up of the edges.

94. 'Rederly'

A single tree selection of a Sickler seedling, with heavy clusters of bright berries reddening in early November. A tall, handsome female of erect growth. Stems slender, light in weight, brown in color. Leaves dark, glossy green. (Brownell, Oregon.)

95. 'Robinson'

A very distinct, lesser known variety with very fierce spines. Leaves deep green, glossy, 3 in. long, barely 1 in. wide. Margins undulated, divided up into numerous divaricate spines often 1/2 in. long, sometimes standing out straight from margins, at others, bent downwards at right angles with the leaf, at other times turned upwards at the same angle.

96. 'Royal Red'

One of the "Dutch-type" hollies, with large clusters of near cherry-size berries. Leaves bold, rounded, heavy texture, deep dark green, generally tipped with a single often blunted spine. (Brownell, Oregon.)

97. 'Scotia'

A distinct and well-marked female variety of free, erect habit, densely clothed with very dark green glossy leaves. Bark of young growth dark purple. Leaves oblong-obovate, bluntish, rounded at the apex, 1-1/2 to 2 in. long, 3/4 to 1 in. wide, leathery, margins entire, thickened, wavy, apex usually blunt, occasionally with a short spine, or with a cup-like thickening, and margin moreover bears an occasional, but very rare erratic spine.

98. *serratifolia*

One of the smaller, neat-leaved hollies, resembling *myrtifolia*, but differing in its more decidedly divaricate spines, and in its tendency to become recurved at the point. Pyramidal habit, well adapted for training into formal specimens; bark green or purplish. Leaves lance-shaped in outline less than 1-1/2 in. long, 1/2 in. wide, dark glossy green, stiff, mid-rib convexly curved so that the leaf edges are brought up and form a sort of channel of the upper surface, with the numerous regular and rather stout spines moderately divaricate. Variety sometimes seen under the name *angustifolia*.

99. 'Shepherd'

In England considered one of the finest and hardiest of the large-leaved hollies. A vigorous male sort with green bark. Leaves stout in texture, 2-3 in. or more long, broadly ovate with a short acumen, rarely quite spineless, occasionally few-spined, more frequently spiny throughout, flat or plane, rather strongly developed spines which, in rare instances, are somewhat wavy or divaricate, indicating it may possibly be of hybrid origin. Leaf color bright green, which helps to distinguish it from 'Hodgins,' which is of a much darker hue. (Of doubtful ancestry.)

100. 'Shortspra'

A green-stem female, selected around 1932. An extremely hardy type of perhaps Dutch heritage, with orange-red berries. A more compact variety suitable for landscape purposes, as well as for cut holly. (Wieman, Oregon.)

101. 'Smith'

A distinct male variety, with narrow leaves, forming the green counterpart of 'Donnington.' Bark green or sometimes tinged with reddish-purple. Leaves lanceolate, 2 to 2-1/2 in. long, 3/4 to 1 in. wide, bright, glossy green color; distant, irregular, weakish spines, moderately divaricate. Leaves are comparatively thin in texture.

102. 'Special'

A fast-growing, thrifty female with large, deep green, well spined leaves. Berries large, profuse, an opalescent shade of red. (Brownell, Oregon.)

103. 'Teufel's French English'

A female selection of the "French-English" type made about 1890. A vigorous grower with dark green spiny leaves considered a good commercial type. (Teufel, Oregon.)

104. 'Teufel's Green Stem,' 'Curly,' or 'Neahkahnie'

An excellent green-stemmed female, with firm, very bright red, early-maturing fruits. Leaves glossy, spiny, slightly lighter green in color than 'Teufel's Hybrid.' Selected about 1890; considered "well suited for coastal plantings as the berries ripen early and the leaves would not tend to grow into smooth spineless forms as other varieties do on the immediate coast." (Teufel, Oregon.)

105. 'Teufel's Hybrid'

An exceptionally glossy, green-leaved female with bright red berries. A green-stemmed variety, hardy, sets fruit consistently at an early age. A very fine commercial holly. (Teufel, Oregon.)



106. 'Vera Kent'

An English female, with very large crimson berries. Leaves are spineless, 1-1/4 in. wide, 3 in. long. (Mattoon, Pennsylvania.)

107. 'W. J. Bean'

A tall, compact, attractive holly of slow growth. Leaves are spined and large, resembling 'Hodgins' though smaller. Twigs are purple; berries are large and bright red. Considered excellent at Kew. (Kew, England.)

108. 'Waterer'

Called 'Waterer's Gold' or 'Waterer's Gold-striped' holly in England. Considered one of the most distinct, easily recognized of the numerous gold variegated kinds. A male form with the bark of the young shoots green, striped with a greenish-yellow. Leaves vary in shape and size, may be either oblong, ovate, obovate, or often oblique, measuring 1-1/2 to 2-1/2 in. long, 1 to 1-1/3 in. wide. Spines usually few in number, produced at irregular intervals, never strongly developed. Occasionally spines absent except for small terminal one, while more frequently represented by 2-6 on the upper half of the leaf. Disk dark green, mottled often in sectional streaks with yellowish-green and grayish-green; broad, but irregular marginal band of deep golden-yellow, which is not continuous. Not infrequently leaves wholly or half golden. It is a close, neat, slow-growing variety, naturally compact without the need for clipping; rarely are vigorous leading shoots formed.

109. 'Whitney'

Female plants number 1 through 5 selected on the Mrs. G. G. Whitney property, Woods Hole, Massachusetts, from 100 seedlings purchased from a Pennsylvania nursery about 1925. These plants show typical seedling variation and have survived winter temperatures of 20 degrees below zero. (Wheeler, Massachusetts; Pennsylvania.)

110. 'Whittington'

A small-leaved and elegant male variety, with purple bark. Leaves lanceolate, or elliptic-ovate, thinnish, 2-1/2 in. long, 5/8 in. wide, sometimes 3 in. long, and 1 in.

wide; these have numerous stiff, divaricate spines, being often unequally spaced. Leaves dark shining green, sometimes rather recurved. Quite distinct in character, but sometimes mixed up with 'Donnington,' which is altogether a much darker-hued plant.

111. 'Wilson'

A vigorous-growing, green-barked female, considered as one of the most ornamental of all the green-leaved varieties. On healthy specimens the leaves grow to a large size, sometimes being upwards of 5 in. long, 2-1/2 in. wide, oval, armed with numerous, evenly developed spines 1/4 in. or so long, which usually lie in the same plane and point in an upward direction. In the shade, leaves are dark, very distinct by reason of the well-defined veins. Berries are intermediate in size and color between those of *platyphylla* and the average English holly. (Of doubtful ancestry.)

112. 'Yellow Beam'

A hardy, consistent-bearing female with clean, clear yellow fruits. Selected in 1937. Foliage tends towards a spineless leaf. (Wieman, Oregon.)

113. 'Yocum'

Leaves, smooth, thick, dark green, recurved, with 1-3 divaricate spines. Large, bright red berries. (Mattoon, Pennsylvania.)

114. 'Yuleglow'

A female of rapid growth. Leaves dark green, shiny, prickly. Berries, borne profusely, turning bright red early in November. Considered especially adapted to coastal climate. "The tree is self-pollinating." (Sander, Oregon.)

115. 'Zero,' or 'Teufel's Weeping'

A "French-English" female, with dark green leaves slightly smaller than average. Berries bright red, early-ripening; remain firm long after Christmas. Of upright habit, the branches grow long, thin, and graceful, tending to a weeping effect. Selected in 1930, considered a hybrid. A vigorous grower withstanding cold temperatures without damage, hence the name 'Zero.' (Teufel, Oregon.)

Illustration 29.

Ilex aquifolium 'Early Cluster'

Ilex aquifolium 'Butler'

Ilex aquifolium 'Yellow Beam'
Ilex aquifolium 'Big Bull' (or 'Ferdinand')
(Note bud clusters of male flowers)

CULTURE OF THE HOLLIES



Planting Hollies

STEWART H. MCLEAN

Hollies have a much undeserved reputation for being one group of plants that is difficult to move successfully. The main reason for this apparently stems from inexperienced individuals attempting to move native American hollies from their natural environment to a setting completely opposite to that in which they had spent the early years of their lives. Often the trees were bodily yanked from the ground, were much too large for one person to handle, were exposed to drying winds in transit, or were moved at the wrong time of the year. Naturally, such trees, formerly shaded from the hot summer sun, protected from the cold wintry winds, and moved without adequate roots, simply were unable to adjust to or support themselves in their new location. Hence, they did poorly, grew slowly, or just simply died.

Actually, there is nothing either magical or mysterious about planting hollies. In fact, few plants are as easy to grow, or are as tolerant of as wide a variety of soils as are the hollies. We find them growing successfully on mountain tops, at nearly sea level in almost pure sand, on hammocks in swamp lands, and under most types of soil conditions in between.

If hollies do have any preferences towards soils, they lean towards those neutral to slightly acid, well drained,

fairly light, loamy to sandy in texture. Heavier soils should be lightened with leaf mold, decomposed pine needles, rotted cow manure, or a liberal amount of sand. The last is preferable since it is more permanent in its action as a soil conditioner. It is necessary to use only just enough organic material or sand to make the soil friable and easy to work. This helps the newly-planted holly on its way to becoming nicely established.

An over-abundance of organic material has a tendency to take away any incentive the roots might have to grow deeper and farther out into the soil in search of food and moisture. Actually, too, as the organic material is either decomposed or used up by the plant, cracks and air-pockets may form which allow the soil and roots to dry out.

In planting hollies, first, one should be reasonably certain that the plant he has in mind would be hardy in his area and suitable for the purpose he has in mind. He should attempt to determine the finest variety of this species. Preferably, he would do well to buy his plant locally from a reputable nurseryman. Naturally, the plant should be healthy, vigorous, and as freshly dug as possible.

In purchasing dug plants, the size of the burlapped root ball in relation to the size of the tree is important. Generally, the ball should be a foot in diameter for each inch of trunk diameter, measured about a foot from the base of the plant. For example, a tree with a trunk caliper of two inches should have a root ball two feet across. The ball should be firm, solid to the touch, and tightly laced to prevent breakage in handling.

The best time for planting dug hollies

is early spring, after the frost is out of the ground, up until the new growth starts to appear. Hollies are successfully moved also in the fall when the plants become dormant, but before the ground freezes.

Careful consideration should be given to the location of hollies before they are actually planted. They should, of course, be so placed that they will harmonize with their surroundings and fit into the landscape plan. Large-growing hollies should be allowed ample space to develop to their proper size, particularly if they are to keep their lower branches sweeping the ground. All too often both these factors are overlooked.

The hole for the plant should be roughly about twice as large and twice as deep as is the size of the root ball. Most of the sod is skimmed off. Before removing any soil, the top layer of soil and sod roots is carefully and completely chopped up and thoroughly mixed into the topsoil in the hole. The topsoil is removed and placed in a pile beside the hole. The poorer soil below is dug out and replaced with good topsoil, if possible. If the soil is placed on pieces of burlap, this will facilitate the work of cleaning up.

Enough topsoil should now be shoveled back into the hole and firmed well, in order that when the plant is placed into the hole the top of the root ball will be just slightly below the level of the ground. Bear in mind here that, if the soil is heavy, sand, leaf mold, rotted cow manure or decomposed pine needles should be added to lighten it.

After placing the tree in the hole, it should be checked from two sides to test for plumbness. Without removing the burlap, more soil should be added, filling the hole nearly two-thirds full and tamping the earth tightly about the ball. Here, the burlap may be loosened from the top of the ball, cut away, or merely opened out and covered over with soil.

If the soil is very dry, a good watering is then advisable. When all this moisture has soaked in, enough earth should be added to slightly, but completely, cover the ball. This, too, must be firmly tamped to prevent any air-pockets which would allow the roots to dry out. The surface of the ground should slope slightly from the sides of the hole to the base of the plant; this forms a catch

basin to facilitate watering. A good watering is then advisable, spraying the top as well as the ground. This should be repeated as often as seems needed until the plant has become well established.

Small plants in pots or cans are best planted in the spring. These can, however, be planted at other times of the year, when the ground is not frozen, provided a reasonable amount of protection from the summer's hot sun and winds is given them. The hollies should be removed from their containers and care taken not to break the core of earth. Container-grown plants require slightly more after-care. The plants are not so deeply rooted, and more attention must be given their moisture needs.

Hollies are generally shallow-rooted plants and appreciate a light mulch to keep their roots cool and moist. Well-rotted cow manure, peat moss, pine needles, woods' dirt, leaf mold, or buckwheat hulls are satisfactory for this purpose. The mulch should be kept a foot away from the trunk to reduce mice and decay injuries. It should extend out beyond the tips of the branches.

By nature, hollies are heavy feeders and are quick to respond to a generous application of fertilizer. This, applied around mid-March, quite often brings out the gorgeous fruit and foliage characters inherent in the plants, the true beauty of which would never otherwise be enjoyed by their owners. Summer and fall feedings of hollies are not recommended.

The kind of fertilizer and the amounts to use are debatable. Unquestionably, these would vary with the sizes of the plants and the types of soils in which the hollies are growing. This is a good reason for buying hollies from a local nurseryman; he knows the local conditions and the needs of the hollies in his area.

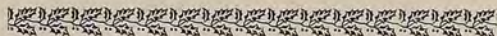
In the Baltimore area, mineralized 10-10-10, or its equivalent has been used with exceptional success. For a six-foot tree, use about three pounds; for a three-foot tree about one to one and one-half pounds. This is applied on the top of the ground, scattered evenly in a band inside and about a foot and one-half outside the drip line of the tree. Stay as far away as possible from the trunk of the holly. Every three years a liberal coating of chicken manure is applied

to the same area sometime during the winter. This helps to maintain the organic matter in the soil. The following spring, use 0-10-10 fertilizer in place of the 10-10-10.

In localities where these mineralized fertilizers and chicken manure are not easily obtainable, "Holly-tone" or other commercial fertilizers specially prepared for broad-leaved evergreens are recommended.

While all this may seem unduly complicated, such is actually not the case. All that is involved in planting hollies is common sense; no magical green thumb is necessary. A good holly, suitably selected, properly planted and given moderate care, will reward its owners with many pleasures each day of the year.

Stewart H. McLean, a trustee of the Holly Society of America, Inc., is a holly nurseryman and orchardist at 9010 Satyr Hill Road, Baltimore 34, Maryland.



Pruning Hollies

L. J. ENRIGHT

Both the shrub and tree types of hollies frequently require periodic pruning. Nature, unattended, often produces forms and shapes which are not the most desirable for ornamental plant specimens.

There is no substitute for good pruning and shearing. Judiciously done, the pruning and shearing of hedge hollies results in healthier and stronger plants,

more vigorous growth, denser or more open forms, a greater abundance of fruits, and control of the size and shape of the plant.

As we do with other ornamental plants, we prune hollies to adjust them to the unnatural conditions in which they often have to grow. Hollies adapt themselves quite readily to various environments and usually need little pruning other than to train a true leader or to remove dead, diseased, or damaged branches.

It is always better to allow the plant to grow in as natural a manner as possible although there will be occasions where stiff, formal shearing will be required. In most cases, to cut for grotesque shapes and forms destroys the overall beauty and dignity of hollies. Good pruning consists simply of removing portions of the plant growing out from the typical form, reducing parts which are out of proportion to the rest of the plant, keeping the leaders clear, and the removal of dead wood and branches growing into the ground.

Vigorous-growing hollies, like some of the Japanese varieties, will often send forth long, leggy shoots of new growth. If these detract from the beauty of the plant, are growing too close to a building, or protrude over a garden path or walk, they are easily shortened back to the proper length. This is quickly done with a sharp hedge shears, or more slowly with a hand clipper. A denser, more compact plant results from this treatment.

Young hollies grown from cuttings, like the American varieties, are often of a sprawling nature, with no recognizable leading shoot apparent. Here, the most flexible and promising-appearing branch can be tied to a stake in an upright fashion. The stake should be well-sharpened, and firmly driven. One or more ties are made as may be necessary, with narrow strips of cloth rather than string.

Invariably, however, such sprawling hollies will, as the nurserymen say, "break" and one or more erect-growing shoots will arise from either the trunk or a side-growing branch. A light cutting back of the tips of some of the side branches may possibly cause this to happen sooner than would occur if the branches had not been pruned. If two or more upright shoots break, it prob-

ably would be best to allow them to grow for one full season, and then cut those that seem less likely of making a good leader. The one selected should preferably be as close as possible to the main axis of the tree. No concern need be given a noticeable crook that will result where the leader joins the trunk of the tree. This will lessen with age, and the lower branches will eventually hide this deformity.

These leading shoots often grow very rapidly and spoil the symmetry of the hollies. Such leggy branches are pruned back to the desired length. This forces side shoots to break and allows the plant to fill out nicely.

There is, of course, no objection to tree types of hollies with two or more trunks. In fact, multiple-stemmed hollies are preferred by some. This is purely a question of personal taste or, where the lower branches are completely trimmed from the tree, the landscape effect desired. If single-stemmed hollies are desired, it is a simple matter to cut out the least promising of double- or multiple-leaders, whenever they appear. This can be safely done at any time of the year.

Sometimes, the leading shoots of hollies are injured by frost, wind, insects, diseases or heavy snow. These are trimmed back to live wood, just above a bud or leaf, and the surrounding side branches pruned back in proportion.

If the leader is completely killed, it should be cut back to the nearest whorl of branches. In this case, a side branch may be bent into an upright position and fastened in place with a splint or brace for several seasons, until it naturally assumes its new duties. If this is difficult or awkward to do, all of the uppermost whorl of branches but one are pruned back to the trunk, or shortened about half their length. The branch selected to be the new leader should be one that appears most capable of growing upright in the shortest time. For several seasons, it will probably be necessary to trim the side branches near the top of the tree so that they will conform to the overall shape of the tree.

Some varieties of American hollies often send up vertical shoots on the side branches of the tree. These may originate close to the trunk near the base, or may appear further upward and outward on the branches. These should be

clipped out when small, otherwise their upright growth might injure the branches above.

Older plants of the Chinese varieties will also frequently send up vigorous growing shoots. These may grow four to five feet in length in one season. These, too, should be removed unless one may be needed to fill out a scraggly-appearing plant.

An occasional lateral tip may need to be shortened and, within the framework of the hollies themselves, some twigs may need to be thinned or pruned out when they start growing into nearby branches. This can be done anytime during the dormant season; a good time, of course, is just before the Christmas holly season when the pruner will be rewarded with a supply of holiday greens. Always, it should be remembered, in pruning American hollies, that if a branch is cut completely back to the trunk, or a twig back to a branch, that no new growth will arise from this spot. Therefore, if this is not wanted, all cutting should be done back to a leaf or a bud.

It is good to remember, too, that the buds on hollies are arranged in a definite pattern as they appear on the leaders and branches of the plants. The direction in which these buds point indicates the direction in which the new shoots arising from them will grow. By pruning back to the proper bud, we can then control the direction of any branch we desire. With proper pruning, we can thus force new twigs to fill in openings or unsightly gaps in hollies where these may appear. Theoretically, at least, it is possible to fashion weeping forms of hollies by pruning with this purpose in mind.

The filling in of an unsightly opening in larger hollies can be speeded up by pulling down an over-hanging branch into the gap. This is held in position by a weight or stake driven into the ground.

Where it is necessary to remove large limbs, they should be trimmed so that all final cuts are flush with and parallel to the parent branch or the main leader. The first cut eliminates the hazard of a fallen limb tearing the bark from the portion of the tree below the working area. The second cut is to completely remove the heavy limb and allow freedom of movement for the worker. The third and final cut can then be made

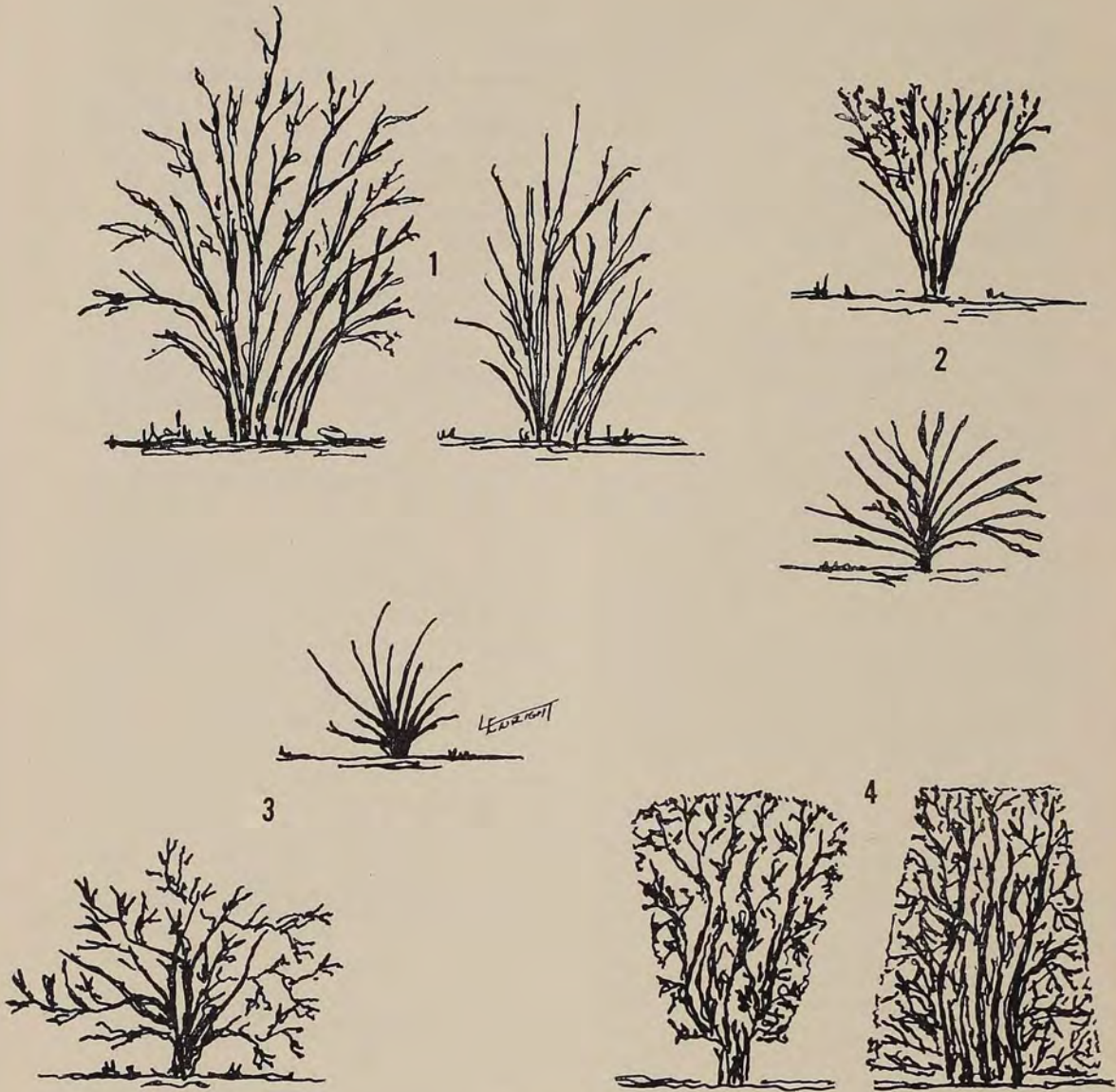


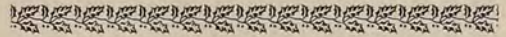
Illustration 30.

1. Thinning or pruning shrubby types of holly produces plants of more desirable forms and attractive appearances. Left, before pruning; right, after.
2. Cutting all shoots at the same height results in a flat-topped, unattractive shrub; upper sketch. Too severe pruning at any one time causes plant to appear dehorned—lower sketch.
3. Renewal pruning improves the appearance of older shrub type hollies and helps to maintain more vigorous growth in mature plants. Lower sketch—before renewal pruning, upper—after.
4. The lower branches of holly hedges need adequate sunlight. Do not cut the bases of hedges narrower than the top. Left, incorrect; right, correct.

carefully at the base of the stub to be removed. Pruning wounds of less than two inches diameter are rarely treated with a wound compound, but the larger wounds should be covered with an asphalt base-wound dressing. Those which contain turpentine or coal tar will injure the growing tissues. House paints will injure the tissue and also slow the healing process.

The rate of growth and the desired height for the planting will determine the amount of shearing and pruning necessary for hollies used as hedges. Shearing at frequent intervals throughout the growing season will make it possible to maintain a soft foliage outline from the ground up. If large twigs and branches are cut off well within the outlines of the hedge, no unsightly stubs will be visible to draw from the attractiveness of the planting. Once a holly hedge has become established, it should not be necessary to indulge in a great deal of actual pruning to maintain its form.

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Holly Pests in the East

CLYDE C. HAMILTON

This discussion of insects and spider mites attacking hollies will be divided into two parts: first, those attacking the native American hollies, mainly *Ilex opaca*, with some introduced hollies as the Japanese and the Chinese hollies, and, second, pests of the English varieties of hollies growing principally in the northeastern part of the United States. The number of different species of pests attacking the hollies is not great, less than thirty having been recorded for the entire United States. Most of these occur in the Eastern holly-growing areas. Only about one-third of these are serious pests, and, since good control methods are available, they should not be a serious detriment to the growing of holly.

The following pests have been found attacking hollies in the East:

Spider mites:

Oligonychus ilicis (McG) *—southern red mite

Scale insects:

Aspidiotus sp.—an unidentified scale insect

Aspidiotus pseudospinosus Woglum—rhododendron scale

Aspidiotus hederæ (Vallot)—oleander scale

Aspidiotus juglans-regiæ Comst.—walnut scale

Asterolecanium puteanum Russell—holly pitmaking scale

Coccus hesperidum L.—soft scale

Lecanium corni Bouché—European fruit lecanium

Aphids:

Macrosiphum rosæ (L.)—rose aphid

Mealybugs:

Pseudococcus comstocki (Kuw.)—Comstock mealybug

*This is the method of indicating authors of scientific names of insects as used in insect taxonomy. Only the original describer of a species is cited by name, the parenthesis indicate that the species has been transferred to a different genus.

Whitefly:

Tetrалеurodes mori (Quaint.)—mulberry whitefly

Leaf or berry miners:

Phytomyza ilicis (Curtis)—holly leaf miner

Phytomyza iliciocola Loew—native holly leaf miner

Phytomyza weidhausii Crafts, reared from *Ilex glabra*

Rhopobota naevana ilicifoliana Kearf. holly bud moth

Asphondylia ilicicola Foot—holly midge

Leaf eaters:

Popillia japonica Newm.—Japanese beetle

Epicauta pennsylvanica (DeG.)—black blister beetle

Porthetria dispar (L.)—gypsy moth

Pseudocneorhinus bifasciatus Roelofs—Japanese weevil

Grasshoppers, several species

Root feeders:

Brachyrhinus sulcatus (F.)—black vine weevil

Borers:

Xylosandrus germanus (Bldfd.)—ambrosia beetle

Southern Red Mite

The southern red mite, *Oligonychus ilicis* (McG.), is one of the more serious holly pests. The mites suck out the plant juices, causing a loss of the green coloring on the upper surface of the leaves. These grayish-green spots are quite small and, when numerous, give the leaves a grayish-green and sometimes brownish-green color. The foliage lacks the bright green color; severely infested trees can be recognized at a distance. The leaves are smaller than normal and the twig growth may be considerably reduced. (*Illus. 31.1*)

The mature female mites are about one-fiftieth of an inch long, rounded to oval, dark red, with some prominent hairs, or setae, on the body. The young mites are a brighter red than are the mature ones. The eggs are round, slightly flattened, red, with the overwintering eggs slightly striated and with a slender stalk arising from the top of the egg.

In New Jersey, the winter is passed in the egg stage principally on the lower surface of the leaves, although some eggs may occur on the upper surface. Several hundred overwintering eggs may be found on a single leaf. Hatching of

these overwintering eggs begins in the spring about the time new growth begins to develop and continues for several weeks. These mites develop rather slowly; migration to the new growth does not occur until late May or early June. During the summer and fall, development is rapid, and there may be five or six generations during the year.

Infestations of the southern red mite may be determined by examining the leaves with a good hand lens; by drawing the leaf between the thumb and fingers, thus crushing the mites which appear as small red streaks; or by jarring twigs on white paper.

Some varieties of holly are more susceptible to red-mite injury than others. Those varieties of *Ilex opaca* that have a basal yellow color under the green chlorophyll show more injury than do those varieties with a good green color. Some of the Japanese hollies, particularly the convex-leaf holly, *I. crenata* f. *convexa*, are very subject to red-mite infestation and injury.

Many materials have been tested by the writer for control of the red mite. Phosphate-containing insecticides, such as parathion, TEPP (tetra-ethyl pyrophosphate), malathion and others, give good kill of the active stages of the mites but are not too effective against the egg stage. Moreover, they are very destructive to predators which might feed on the mites. Therefore, their continued use, while giving temporary control, has usually resulted in the necessity for more frequent treatments.

Some of the special insecticides, such as "Aramite," "Ovex," "Chlorobenzilate," and "Dimite," have given good control of the southern red mite. These sprays are specific for spider mites and do not kill beneficial insects. Sometimes three or four treatments during a year may be required.

During a four-year period, the best control of the southern red mite in commercial holly orchards was obtained by spraying in late March or early April just before the new growth began to develop with a superior type dormant oil spray. Two and five per cent oil concentrations; approximately a pint or a quart to five gallons of water, have been used on *Ilex opaca* and *I. cernata* f. *convexa* with essentially a hundred per cent kill and no plant injury. One commercial holly orchard of more than twenty-

five hundred trees, twelve to fifteen feet tall, had been sprayed during March or early April of 1953, 1954, 1955, and 1956, with a two per cent oil spray. This spray was applied with a mist blower at an average rate of five quarts of diluted spray per tree with excellent control and no plant injury. The oil-sprayed trees did not require any further treatments until late August or early September, while trees not sprayed with the dormant oil had an average of three sprays up to the end of August. The oil sprays have helped to control scale insects, have not killed beneficial parasites or predators, and the trees are in much better condition than before the oil sprays were started.

A five per cent superior type oil spray has given almost complete eradication of the southern red mite eggs on *Ilex crenata* f. *convexa*. Three acres of these plants containing an average of approximately 5,800 plants per acre, twelve to fifteen inches across and the same height, were sprayed with an average of sixty gallons of spray per acre applied with the mist blower. Extensive examination, under a binocular microscope, of leaves containing up to fifty or more eggs per leaf showed only an occasional live egg or mite. Careful spraying with a high-pressure hydraulic sprayer using considerably more material and time did not give nearly as good a control.

Scale Insects

Several species of scale insects may infest hollies. Of these, one of the most injurious in the writer's experience has been an unidentified species of the genus *Aspidiotus*. Dr. Harold Morrison of the Division of Insect Identification and Parasite Introduction, Agricultural Research Service, United States Department of Agriculture, has placed it as a "non-characteristic species of *Aspidiotus ansylus* (Putn.)." This species is characterized by a round, grayish to black scale covering with a reddish-orange exuvia located centrally or slightly to one side. Found on hollies as single individuals, it is almost black. In heavy infestations the scales are usually covered over with a grayish or greenish alga-like growth which makes them difficult to distinguish (*Illus. 31.2*). Feeding causes the cambium layer of the bark to turn black, and the leaves on heavily infested limbs turn brown and die within a few weeks. Little

is known about the life history of this scale. The winter is apparently passed as mature and partly mature female scales. The young are produced in May and early June and there may be several generations a year.

A two per cent superior type dormant oil spray, one pint to five gallons of water, applied in late March and early April, has given almost one hundred per cent kill on small twigs where the scales were not abundant. On encrusted infestations covered with the alga-like growth, about sixty per cent kill was obtained. Although the twigs were thoroughly wet with the spray material, apparently there was not enough oil in the spray to penetrate the encrusted masses of scales. Therefore, it is suggested that a five per cent oil be used for scale insects.

Several other species of scale insects belonging to the genus *Aspidiotus* found on hollies are the walnut scale, *Aspidiotus juglans-regiae* Comst.; the oleander scale, *Aspidiotus hederæ* (Vallot); and the Rhododendron scale, *Aspidiotus pseudospinosus* Woglum (*Illus. 31*). These three species have not been too injurious in the East. They may be controlled with delayed dormant applications of two to five per cent dormant oil spray.

The holly pitmaking scale, *Asterolecanium puteanum* Russell, has been found fairly abundantly several times in New Jersey and Delaware and is reported from several of the Eastern States south of this area. Its injury is indicated by the presence of shallow to deep pits in the bark (*Illus. 32.1*), containing the greenish-yellow, slightly convex scales, from one to two millimeters in greatest diameter. Its injury has been found on twigs from one-eighth inch to more than one-half inch in diameter.

This scale insect has been controlled with dormant applications of liquid lime diluted one to nine and with applications of two per cent and five per cent delayed dormant oil sprays, one pint or one quart to five gallons of water.

Another scale insect found infesting the American hollies is the European fruit lecanium, *Lecanium corni* Bouché. It has not been too common, but where it has occurred, its heavy feeding, abundant secretion of honeydew and the subsequent development of a black sooty fungus have caused considerable damage

to the growth and appearance of the foliage (*Illus. 32.2*). The mature female scales vary from amber to a dark reddish brown. They are very convex, are longer than wide, being about one-eighth inch long. The young are light yellow, turning reddish brown as they grow older. The females become mature in late spring and eggs are present in late May or June. The young crawlers settle at first on the leaves and later move to the twigs where they pass the winter as half to two-thirds grown females. There is only one brood a year.

The European fruit lecanium scale may be controlled by delayed dormant oil sprays. If dormant oil sprays have not been applied, a considerable degree of control may be obtained by using summer oil sprays or malathion sprays applied during the crawling stage or about two weeks after the eggs begin to hatch. In the New Jersey area, this is about the last week in June. If uncertain as to the exact time of spraying, two applications of the malathion spray may be made, the second about two weeks after the first one.

Other Sucking Insects

Other sucking insects attacking American hollies are several species of plant lice, such as the rose aphid, *Macrosiphum rosae* (L.); Comstock's mealybug, *Pseudococcus comstocki* (Kuw.); and the mulberry whitefly, *Tetraleurodes mori* (Quaint.) (*Illus. 32.2*). The aphids and mealybugs are found mostly on young propagating plants and may be controlled with any of the summer type of contact sprays. Malathion is a very good spray for these pests. The whitefly infestations have been found mostly on plants growing under wild or uncultivated conditions. Delayed dormant oil sprays will clean up the whitefly infestation.

Insects Attacking the Leaves and Mining the Berries

There are two and possibly three species of fly larvae mining the leaves of hollies. These leaf miners are among the worst pests of hollies and frequently do considerable damage to the plants. Heavily-infested leaves sometimes drop off in the fall and the twigs may be almost bare of leaves by the time new growth develops in the spring. Infested

plants do not make a pleasing appearance and growth may be considerably retarded.

The most common species is the holly leaf miner, *Phytomyza ilicis* (Curtis). The second distinctive species is the native holly leaf miner, *Phytomyza ilicicola* Loew, and a third species reared by the writer from the native inkberry and gallberry plant, *Ilex glabra*, has only recently been described by E. C. Crafts of the University of Massachusetts as *Phytomyza weidhausii*. Mr. Crafts is studying the identity of leaf miners on holly.

The adults of all three miners are small, black, two-winged flies from one-eighth to three-sixteenths of an inch in length. They have lapping or sponge-like mouth parts and the female flies have an ovipositor which is used to lay eggs in the leaf tissues. The ovipositor is also used to puncture the tender surface of new growing leaves. The flies feed by lapping up the plant juices exuding from these punctures. This feeding injury, when abundant, may distort the new growth (*Illus. 33*).

The life history, habits and kind of injury of the three species of leaf miners are as follows: the holly leaf miner, *Phytomyza ilicis*, in New Jersey emerges from the leaves of American hollies about the middle of May or when the first new twig growth is three to four inches long and has three to five leaves. Emergence may continue over a period of several weeks. The flies do not begin to lay eggs until ten days or two weeks after they have emerged. Meanwhile, they make their feeding punctures and their presence can usually be determined by this injury to the new developing leaves. The eggs do not begin to hatch until July or early August, or six to eight weeks after oviposition. The injury first appears as slender, narrow mines usually not more than one-half inch long. It then begins to spread out in broad blotch-like mines (*Illus. 33.3a*). The winter is passed as young larvae. Growth continues in the spring and the blotch-like mines may become one-half inch or more in diameter (*Illus. 33.3b*). The full-grown larvae, which are greenish to white, pupate in April or early May and adults emerge several weeks later. The mines have a surface color of a light grayish green. They are mostly on the upper surface of the leaves. The larva pupates with two sharp spines on the

front end of the pupa projecting out through the leaf surface. The adult flies emerge from the upper surface of the leaves. There is only one generation a year.

The larval mines of the native holly leaf miner, *Phytomyza ilicicola*, are usually less than one-eighth inch in diameter, long, slender and may traverse the length of the leaf two or three times (*Illus. 33.2*). They have a yellowish-orange color, are near the upper surface of the leaf, and the mine is packed with the frass or borings of the larvae. The adults emerge through the lower surface of the leaf. The mines are fully developed by fall and adults have been noticed to have emerged in late September, October and early November. Some adults may not emerge until the following spring. Eggs are laid in the new leaf growth in the spring, presumably at about the same time that the eggs of the holly leaf miner are laid.

The mines of another possible species of leaf miner are longer than those of the holly leaf miner; wider than those of the native holly leaf miner, are grayish green in color and in general resemble those of the holly leaf miner more than the native holly leaf miner (*Illus. 33.4*). The mine is not packed with frass and the adults emerge from the upper surface. However, the larval mines develop by fall and adults have been noticed to have emerged in September and October. Some larvae and pupae may winter over in the leaves and emerge in the spring. Eggs are laid on the new growth in the spring.

The holly leaf miner infesting the native inkberry or gallberry, *Ilex glabra*, has a mine somewhat similar to that of the holly leaf miner. However, the life history is different in that the eggs laid on the new growth in the spring hatch in July or early August, the mines may be fully developed, larvae pupated and adults emerged by late September or October. Some larvae and some pupae may pass the winter in the leaves and the adults emerge in late April. Eggs are laid in the new growth of *I. glabra* in late May. On May 25, 1956, a heavy frost killed all the new growth on *I. glabra* in New Jersey. The new growth developing after this freeze was heavily infested with larvae in late July and August.

Control of the holly leaf miners may

be obtained at two stages in its life history, when adults emerge and when eggs hatch. One may spray with DDT or similar insecticide from the time the adults begin to emerge from the leaves until they begin to lay their eggs. This time is usually about the middle of May in the New Jersey area or when the first new twigs are three to four inches long and have three to five new leaves. An examination of the blotch mines in the old leaves will also disclose whether the flies have emerged. Sometimes the small black flies may be observed on the sunny side of the trees. The spray should be applied as near the beginning of emergence as possible so as to kill the flies as they emerge and before they injure the young foliage by their feeding punctures.

One of the best insecticides is DDT, used at the rate of two pounds of a fifty per cent wettable powder or two quarts of a twenty-five per cent emulsion to one hundred gallons of water, one ounce of powder or two fluid ounces of emulsion to one gallon of water where only a few plants need to be sprayed. A one per cent DDT emulsion, applied with a mist blower, has been used extensively in commercial holly orchards with good results and considerable saving in time and materials. Some growers have used sprays containing lindane in place of the DDT sprays. A twenty-five per cent lindane wettable powder or a twenty per cent lindane emulsion should be used at a minimum of two pounds or two pints to one hundred gallons of water. For small amounts use one ounce to each gallon of water. Two sprays are suggested, the first shortly after the adults begin to emerge and the second ten days to two weeks after the first.

The second stage in the life history of the holly leaf miners when they can be controlled is at the time the eggs begin to hatch and the larval mines are still quite small. Delaying the control measures until the eggs begin to hatch is not recommended as the best procedure, since it will not prevent injury to new growth by the feeding punctures of the adults and it is somewhat more difficult to determine the best time to apply the sprays. There are several insecticides which give promise of giving good control of the young larvae in the leaves. These insecticides are called by the general name of "systemics." They are materials which, when applied to the soil,

the bark, or the foliage, are absorbed and translocated to other parts of the plant. When the insects feed upon treated plants, they are killed. Much work still needs to be done before systemic insecticides can be recommended for general use.

Some tests made by the writer in the summer of 1956 gave very good results. Briefly, the results are as follows: July 10, 1956, the following materials were applied to groups of fifty to seventy-five plants each of *Ilex glabra*.

1. Thimet, 90% active, diluted 1 pint to 100 gallons of water.
2. Systox, 23% active, diluted 1½ pints to 100 gallons of water.
3. Systox, 23% active, diluted 3 pints to 100 gallons of water.
4. Sytam, 42% active, diluted 2 pints to 100 gallons of water.
5. Isotox 200, 20% lindane, diluted 2 pints to 100 gallons of water.

The first three spray insecticides contain phosphates. The Isotox 200 contains lindane.

The plants were two to three feet tall, and they were infested with larvae of a holly leaf miner, probably *Phytomyza ilicis*. Most of the eggs had hatched and the larval mines were not more than one-quarter to three-eighths of an inch long.

Ten days after spraying, or July 20, examinations of infested leaves showed one hundred per cent kill of the young larvae with all spray materials except those sprayed with Isotox 200. There was eighty-three per cent kill with this spray material. The live larval mines were quite small and the larvae had apparently hatched after the spraying but from eggs present at the time of the spraying.

Tests were also made against the holly leaf miner infesting *Ilex opaca*. Seven trees, moderately infested with leaf miners, were sprayed August 23, using Thimet emulsion, forty-five per cent active, diluted 2 pints to 100 gallons of water. The larval mines were quite small, being not more than one-quarter inch long at the time of spraying. An examination made September 11, showed eighty-three per cent of the larvae had been killed. A second examination made October 10 also showed eighty-three per cent dead larvae.

According to studies made by Dr. Ernest N. Cory and Mr. Henry High-

land, while with the Department of Entomology, University of Maryland, excellent control of the holly leaf miner was obtained by applying undiluted "Systox" in a four- to six-inch band around the trunk of the tree, just below the lowest branches. Their experimental work indicated that treatments during the last two weeks in June were almost completely effective.

Since the "Systox" is applied in a concentrated form, rubber gloves must be worn, or, if applied as a spray, rubber gloves and the proper gas mask should be used. Read the label carefully and follow all precautions regarding the handling of this material as it is extremely poisonous.

The Holly Midge

For several years it has been noted that in some areas the berries of *Ilex opaca* do not turn red in the fall as is the normal expectancy. Investigations have shown that this condition is associated with the presence in the berry of a small yellow larva or maggot, *Asphondylia ilicicola* Foote. The life history and habits of this pest were investigated by Henry Highland, formerly of the University of Maryland.

The egg is deposited in the open flower ovule and the maggot hatching therefrom remains in the berry until the following spring when it changes to a small cecidomyid fly about the size of a large mosquito. The berries remain green the year round. Some of the berries may have a red blush on one side and some may be slightly deformed. After the emergence of the adults in the spring, the berries usually dry up, turn brownish gray, and drop off the tree.

The holly midge is found in Maryland, Virginia, and some of the other southern states. It is not known to occur in New Jersey or northward. No control has been attempted but it is possible that a good residual spray, such as DDT, applied when the adults are emerging, would prove effective.

Leaf-Eating Insects

Several leaf-eating insects, such as the Japanese beetle, *Popillia japonica* Newm., the black blister beetle, *Epicauta pennsylvanica* (DeG.), the gypsy moth, *Porthetria dispar* (L.), several species of grasshoppers, and a Japanese weevil

Pseudocneorhinus bifasciatus Roelofs, have been found feeding upon holly leaves. The damage is usually not too great. Control may be obtained by spraying with DDT at the first indication of injury. The injury caused by grasshopper feeding and by the Japanese weevil is shown in *Illus. 34*. The feeding of this weevil is very striking since it eats entire portions of the leaves except for a narrow strip around the margin of the leaf.

Mr. Harry B. Weiss reports as follows on the Japanese weevil in the *Entomological News*, February, 1953:

"This weevil which is the *P. setosus* of American authors, according to the Blackwelder's *Fifth Supplement to the Leng Catalogue of Coleoptera of America, North of Mexico* (1948), is extending its range in New Jersey. It is listed in the Leng & Mutchler *Catalogue of the Coleoptera of America, North of Mexico* (1927), from Connecticut and Japan. Introduced from Japan, it was reported from Connecticut in 1923. It was first noted in New Jersey at South Orange during September, 1947, the adults having been taken while feeding on the leaves of privet, mimosa, Japanese barberry, rhododendron and a few other ornamental plants. Shortly afterward it was collected at West Orange, Maplewood, Orange and Newark, all in New Jersey. It has also been reported from New York City, and the College Park area of Maryland.

"During September, 1952, Mr. Robert J. Sim collected the species at Morristown, New Jersey, where it was doing considerable damage to the foliage of azaleas and other shrubs. In spite of its injury to foliage, it does not appear at present to be an insect of prime economic importance. During the thirty years since it was reported from Connecticut, the species has no doubt invaded a larger area of New Jersey than is indicated by the localities mentioned."

While the damage caused by this non-flying insect is generally localized, it can become quite severe in small areas.

A satisfactory control of the Japanese weevil has not been worked out. Floyd F. Smith, Entomologist of the Entomology Research Branch, United States Department of Agriculture, reported in 1955:

"In tests at Beltsville, Maryland, for the control of this weevil, twelve insecticides in dusts with pyrophyllite as di-

luent were compared on caged azaleas and two on infested garden plantings. DDT, endrin, lindane, methoxychlor, and toxaphene were nontoxic at the concentrations tested. The minimum concentrations that killed all weevils appeared to be 2.5 per cent of aldrin, chlordane, heptachlor, isodrin, malathion, and parathion, and one per cent dieldrin. High but incomplete kills were also obtained with one per cent of aldrin and chlordane.

"Although these dusts had killed all the weevils at the end of eight to twelve days, they varied considerably in their speed in causing paralysis and death. Aldrin, dieldrin, and heptachlor usually caused them to become paralyzed and drop to the ground within six hours, and death followed with almost no feeding on the foliage. Chlordane, isodrin, malathion, and parathion caused slower paralysis, over a period of four to six days, and there was slight to moderate feeding injury before the weevils succumbed.

"Dusts containing five per cent of heptachlor or 2.5 per cent of aldrin killed adult weevils infesting plants on two properties. Because weevils appeared in 1954 on one property tested in August 1953, it was evident that treatment earlier in the season is required to prevent oviposition."

On holly plants with their smooth foliage, better results might be obtained by sprays to which stickers have been added. It is evident that further work is needed on the control of this pest.

Larvae of the black vine weevil, *Brachyrhinus sulcatus* (F.), have been reported as feeding upon the roots of young holly plants, particularly in nursery plantings which may be close to other plants infested by this insect. Where infestations occur, they may be controlled by applying to the soil the equivalent of five pounds of actual dieldrin or of actual heptachlor to an acre. This is the equivalent of one hundred pounds of a five per cent material per acre or two and one-half pounds per thousand square feet.

Boring Insects

A rather unusual insect, but one which has been found several times in nursery plantings of hollies in New Jersey, is one known as an ambrosia beetle, *Xylo-*

sandrus germanus (Blfd.). The beetles are less than one-eighth of an inch long, black to dark brown, and bore into the host plant making tunnels about three-thirty-seconds of an inch in diameter, *Illus. 34.3*. These tunnels do not follow the bark area but extend into the woody tissues. The beetles inoculate the tunnel walls with a fungus and the beetles and the larvae feed upon this fungus growth. Eggs, larvae, pupae, and adults may frequently be found during the summer in the burrows at the same time. The fungus stains the walls of the tunnels a dark blue and the cambium frequently becomes streaked with black and dies rapidly. The overwintering beetles become active in early spring, boring into twigs and limbs from one-eighth to three-fourth inch in diameter. In some twigs they may be fairly abundant, with ten or more in a six-inch length.

In one nursery, presence of the infestation was indicated by dead branches with dead, brown foliage. The twigs and foliage had died rather suddenly. Small plants eighteen to thirty-six inches tall in tar-paper pots, nursery plants four to five feet tall, and mature trees up to fifteen or twenty feet tall were infested. Small nursery plants infested near the ground broke off quite easily.

Under field conditions, all stages of the ambrosia beetle are present in New Jersey from June to September. The complete life cycle takes four to five weeks and there are apparently two broods a year. Adults of the first brood are abundant during the first two weeks of July and adults of the second brood, the first two weeks of August. Adults of the second brood overwinter, many of them in the burrows in which they developed from pupae.

Limited tests with insecticides have not produced any satisfactory control materials. A considerable degree of control has been obtained by carefully cutting out the infested portions and burning them. When disturbed, the beetles do not readily leave the tunnels in the infested plants and by carefully cutting out and handling, few beetles will be lost.

Non-Insect Injuries

Before finishing this discussion of insect pests of hollies, it would seem desirable to mention a type of injury which

may sometimes be mistaken for insect punctures. This injury is caused by the sharp spines on mature leaves puncturing some of the foliage during strong winds and is especially noticeable following hurricanes. Protected trees may not be injured severely but the side of the tree from which the winds come is likely to be injured the most. Spine punctures in the leaves may occur on both surfaces of the leaves. The surface of the leaf is pricked in, giving a conical puncture. This puncture may or may not be entirely through the leaf, usually not. There is no healing of the punctured area, since injury usually occurs after growth has stopped. However, a small purplish discolored area usually develops around the spine puncture, *Illus. 34.4*. This injury should not be confused with a purple blotch which has the same general appearance but which lacks the definite spine punctures. The spine punctures also should not be confused with the feeding punctures of the holly leaf miner in the spring or early summer. These feeding punctures occur on growing leaves, extend entirely through the leaf, show effects of healing as the margins are usually rounded. The feeding punctures sometimes occur close together, are more numerous, and frequently are found near the margins of leaves.

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Illustration 31.

- 1: The Southern red mite; (left) twig severely injured; (right) uninjured.
- 2: Holly scale, *Aspidiotus* sp.
- 3: Rhododendron scale, *Aspidiotus pseudospinosus*.
- 4: Walnut scale, *Aspidiotus juglans-regiae*, on a holly branch.

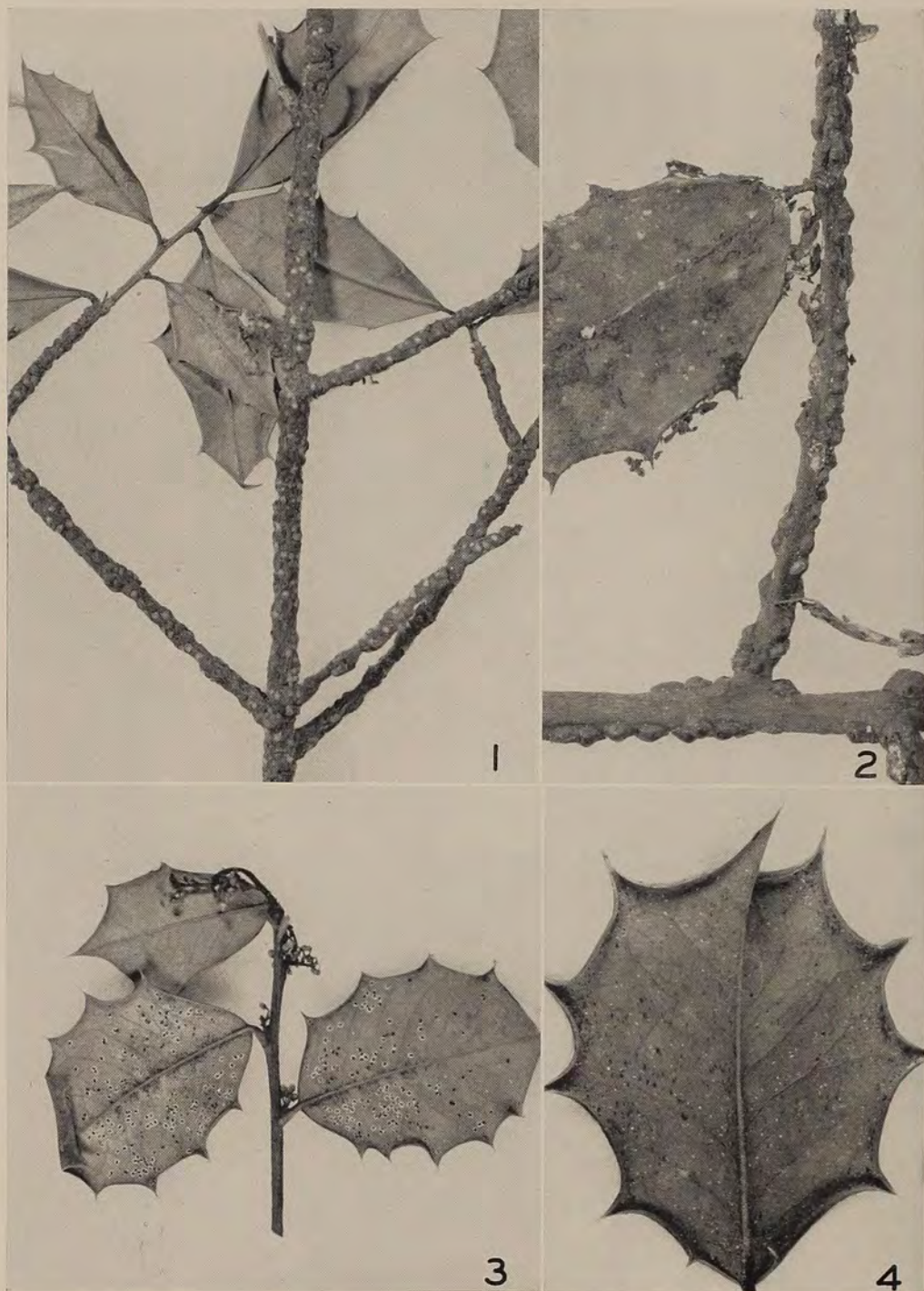


Illustration 32.

- 1: The pitmaking holly scale, *Asterolecanium puteanum*.
- 2: European fruit lecanium, *Lecanium corni*.
- 3: Mulberry whitefly, *Tetraleurodes mori*, on holly.
- 4: Southern red mite on under surface of holly. White specks are cast skins of mites; black specks are red mites and eggs.



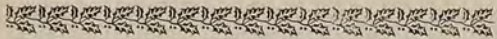
Illustration 33.

- 1: Tip of new holly twig showing distorted growth caused by feeding punctures of holly leaf miner and narrow black mines of the young larvae.
- 2: About two-thirds mature mines of the holly leaf miner.
- 3: a: Young mines of the native holly leaf miner; b: Fully developed mines of the native holly leaf miner as they appear in late fall and spring. Both mines in English holly.
- 4: Mines of the possible new species of holly leaf miner.



Illustration 34.

- 1: Holly foliage injured by the feeding of grasshoppers.
- 2: Injury caused by feeding of Japanese weevil.
- 3: Brood tunnels of ambrosia beetle in holly twigs.
- 4: Holly leaves showing injury after being punctured by sharp spines during heavy wind storms—note discolored areas around points where punctures were made.



English Holly Insects in the Pacific Northwest

K. G. SWENSON

The group of insect pests of the English hollies differs considerably from that of the American hollies. The holly bud moth, holly leaf miner, and scale insects are the principal insect pests of the English hollies. In holly orchards, the bud moth and leaf miner are more serious than scale insects. Once they become established in an area, control measures are likely to be necessary in all orchards. Although scale insects can bring about severe losses where they occur, they are principally a problem of individual orchards.

Holly Bud Moth

The holly bud moth, *Rhopobota naevana ilicifoliana* Kearfott, has been present in the Pacific Northwest for at least thirty years (3)*, although it has only recently become established in the principal holly-growing areas of Oregon (8). Injury results from the webbing of caterpillars in the new growth. These caterpillars hatch from the eggs just after the new growth appears in the spring. After completion of the larval stage, most of the caterpillars drop to the ground where they pupate. Moths emerge from these pupae and lay eggs during July and August. The eggs are not easy to discover since they are laid singly on the leaves and twigs and not in clusters as are the eggs of some moths. Winter is passed in the egg stage, there being but one generation a year. Hollies are the only known host.

For many years, control consisted of an oil-nicotine spray to kill the eggs.

*Numbers in parenthesis refer to references at end of this article.

This spray was applied in the spring just before the buds opened. The increasing importance of the bud moth as a pest led to the evaluation of newer insecticides. The organic phosphate insecticides—Chlorthion, Diazinon, malathion and parathion—gave a very high degree of control. Chlorthion, Diazinon, and malathion should be applied at the rate of four pounds of twenty-five per cent wettable powder to one hundred gallons of water, or two ounces to three gallons of water. Parathion should be used at the rate of one pound of twenty-five per cent wettable powder to one hundred gallons of water, or one-half ounce to three gallons. These insecticides should be applied when the new growth is about one-fourth inch long.

Oblique-Banded Leaf Roller

This insect, *Archips rosaceana* (Harris), has been reported as attacking hollies (6, 7), although it is not a consistent problem. There are two generations a year. The winter is spent in the larval stage and it is these overwintering larvae which cause most of the injury to hollies when they begin feeding again in April and May. Unlike the holly bud moth, the oblique-banded leaf roller infests a great many plants other than hollies. The application of organic phosphate insecticides for holly bud moth appears to control the oblique-banded leaf roller also.

Holly Leaf Miner

The holly leaf miner, *Phytomyza ilicis* (Curtis), a native of Europe, has been established in the Pacific Northwest for many years (2) but was not found in Oregon until 1954. Breakey has described the life cycle of the holly leaf miner in Washington and recommended control measures (1).

The leaf miner is the maggot or larval stage of a small fly. In the State of Washington, the flies appear in May and June and begin to lay eggs. The maggots hatching from these eggs feed between the upper and lower layers of the leaves. Evidence of their injury is first apparent in August as small red spots on the leaves. By mid-winter, the feeding of the maggots is extensive enough so that light-colored blotches are visible. The maggots pupate within the mines in the leaves in February and March, and flies



Illustration 35.

Stage of holly growth just after bud moth eggs hatch—mutilated leaves are result of previous season's injury by holly bud moth (left) and the soft brown scale on an English holly leaf (right).

emerge from these pupae in May.

Control measures consist of the use of DDT sprays. DDT is applied at the rate of two pounds of fifty per cent wettable powder to one hundred gallons or one ounce to three gallons of water in May when the new leaves are about one-half inch long.

According to Hartzell (4), the native holly leaf miner, *Phytomyza ilicicola* Loew, occasionally attacks *Ilex aquifolium* and *I. cornuta*. Melander (5) reported this insect from Oregon, but there is no indication of its occurrence in Oregon at the present time.

Soft Scale

The soft scale, *Coccus hesperidum* L., is the most important scale insect on hollies in Oregon. Serious losses are likely to result when infestations in holly orchards are not controlled. The principal injury results from the sooty mold which develops in the honeydew or excrement of the scales. This mold becomes a problem long before the scales are abundant enough to injure the trees

by their actual feeding. The soft scale infests a great many plants besides hollies.

The young are born alive, rather than hatching from eggs as do most insects. Under Oregon conditions, the first of these crawlers can be found under the adult scales about the first of July. These first new scales of the season do not mature in time to produce offspring the same year. Thus, there is only one generation a year, although there is a great deal of variation in size of the scales present at any one time.

This scale can be controlled with malathion applied at the rate of six pounds of twenty-five per cent wettable powder to one hundred gallons of water or three ounces to three gallons.

Lecanium Scale

Lecanium scales are sometimes found on hollies in Oregon. The exact species is not known. When these scales occur on hollies, heavy infestations will develop unless they are controlled. The type of injury is the same as that caused

by the soft scale. The adult scales lay eggs in late spring. The eggs are deposited in a mass under the adult scale which subsequently dies but remains in place on the twig, covering the eggs. These eggs hatch in late July and the newly-hatched crawlers migrate from the twigs to the leaves. Late in the fall, these scales move back to the twigs where they complete their development the following spring. Lecanium scales on English hollies are readily controlled with Chlorthion or malathion applied during August at the same rate of six pounds of twenty-five per cent wettable powder to one hundred gallons of water or three ounces to three gallons.

Cottony Camellia Scale

Pulvinaria floccifera Westwood is primarily a pest of camellias but is occasionally found on hollies in small numbers. It can be identified readily by the presence of elongate cottony masses on the underside of the leaves of the previous season's growth. These are the egg masses. The cotton-like material remains on the leaves for some time after the eggs hatch in July. A high degree of control can be obtained by following the same procedures used for the control of Lecanium on hollies.

Holly Scale

This scale, *Aspidiotus britannicus* Newstead, is very common on older ornamental trees. Although it occurs in holly orchards, large populations can develop without much loss because the scales tend to remain on the old leaves and do not move to the new growth as do the soft scale and Lecanium scale. Boxwood is also frequently infested. The female scales are round, about three-thirty-seconds of an inch in diameter, comparatively flat, and brown in color with a small yellow spot in the center of the scale. Control consists of the application of a three per cent light-medium summer oil in the spring before the buds open.

Orange Tortrix

Larvae of this moth, *Argyrotaenia citrana* (Fernald), have been found feeding on holly berries in late summer and early fall in Oregon. There are no indications, however, that it is a problem of any consequence.



Illustration 36.

Cottony camellia scale, *Pulvinaria floccifera*, on a camellia leaf showing their cottony elongated appearance.

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Foliage of *Ilex opaca* 'Howard' infected with the tar spot disease.



Berries of *Ilex opaca* 'Howard' infected with the tar spot disease.

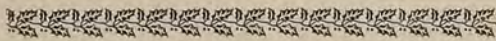
Illustration 37.

Chinese holly scab, black spot type.



Chinese holly scab, leaf-deforming lesion type on leaves; spots on shoot.





Diseases of Holly

in the East

G. FLIPPO GRAVATT

A new disease of the Chinese hollies, a spot anthracnose, caused by a species of *Sphaceloma* has been reported by Dr. A. G. Plakidas at one location in Louisiana. This disease has reoccurred year after year on some seedling trees of this holly, seriously damaging the appearance of the leaves and also causing spots on the twigs and berries. The leaves are frequently misshapen by the blackened areas and in addition there are frequently scattered black spots. Some seedling trees have remained free of any infection over a period of years, indicating the great variability in resistance.

In the Northwest there is one serious disease, *Phytophthora* leaf and twig blight, of the English hollies, while in the East there is at present no widespread serious disease of the various holly species. This is very fortunate but every possible precaution should be taken to prevent the introduction and spread of new diseases. Hollies are widely distributed in the world with many different species and only a small proportion of the diseases are now present in this country. Introductions into holly plantings should be watched and suspected unhealthy parts sent to a state plant pathologist or burned.

Many reports of damage from disease are received but in nearly all cases investigated the primary cause has been environmental. In the spring normal yellowing and leaf fall cause apprehension to many new holly owners. The damages caused by improper transplanting, drouth, overwatering, winter injury, fall and spring freezes are confusing to many people, partly because their after effects may not appear immediately or

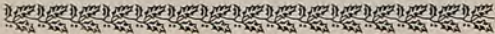
may continue for some time. The hardiness of the hollies has not been accurately determined, and outside of their proved ranges some hollies may appear unhealthy.

There are some root and twig diseases of holly in the East which cause occasional trouble, but the total damage from any one is not important. A fusarium die-back of the American hollies causes some damage in New Jersey. Cutting out and burning affected parts is advisable. This same sanitary practice is recommended for similar twig diseases.

More than seventy different fungi have been reported on the American hollies, but fortunately only a very few of these are serious. Many of these fungi occur on the leaves, frequently as weak parasites following other injuries. Leaf discolorations caused by unfavorable environmental conditions are sometimes confused with infections by parasites.

During years of excessive rainfall the tar, or black, spot of the American hollies produced by a fungus, *Phacidium curtisii*, is responsible for considerable damage to the leaves and berries of commercial hollies, especially in some parts of the South. The blackened areas on foliage or berries (*Illus. 37*) materially reduce the value of the crop, at times making a large part of the holly unsalable. Mr. John R. Cole (1951. *Control of Tar Spot of Holly (Ilex) by Spraying in South Georgia*. *Plt. Dis. Repr.* 35: 408-410) worked out control measures for tar spot in a one hundred-fifty-acre orchard of *Ilex opaca* 'Howard' near Albany, Georgia. Spraying (*Illus. 59*) the trees with 4-1-100 Bordeaux, April 15, May 1, and June 28, gave good control. It would be better to substitute 1-100 Phygon XL for the last two applications because of the objectionable residue left by late sprays of Bordeaux. The sanitary measures of eliminating some of the crowded trees, removing lower limbs to a height of about three feet, and harrowing the orchard turning under the old leaves assisted in control as reported by Mr. Cole.

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Diseases of English Hollies in the Pacific Northwest

ROY A. YOUNG AND
IVAN W. BUDDENHAGEN

The culture of English hollies in the Northwest has developed into a substantial speciality crop industry. This area is the principal source of cut English holly sold throughout the United States for Christmas greenery and of holly nursery stock sold for landscape plantings. In Oregon alone more than one thousand acres have been planted to holly orchards.

English hollies are affected by relatively few serious plant diseases. The most serious disease is the leaf and twig blight caused by *Phytophthora ilicis* (Described by Buddenhagen and Young in *Phytopathology* 47:95-100, February 1957.) Other abnormal conditions on English hollies are *Phomopsis* canker, green algae, sooty molds, heat canker, cold injury and mechanical damage such as rodent injury and wind whipping of leaves.

Phytophthora Leaf and Twig Blight

The leaf and twig blight disease of hollies occurs in several plantings to a limited extent but has caused severe losses in only a few plantings. This disease develops during cool, rainy weather and subsides during warm, dry summer months. The disease consists of the development of dark leaf spots (*Illus.* 38.), subsequent defoliation, and the development of black stem cankers. In cool, rainy fall weather spotting develops first on the lower leaves and progresses upward during the late fall and winter months. Infections may result in die-back of young twigs. Young plants in

nursery beds are also affected and may be defoliated and completely killed by the disease. Stem cankers are at first black but become brown with age. The causal fungus is spread from infected to healthy plant parts by means of sporangia that are produced on infected leaves and then spread short distances by wind or in splashing water. Oospores, thick-walled spores that resist unfavorable conditions, develop in leaf and twig tissues and are believed to be the form in which the pathogen survives during warm summer months.

The disease has been most severe in certain orchards in the coastal region where air movement is restricted due to topography or surrounding vegetation. In such orchards, defoliation and twig blighting may be very severe, appearing by late October and continuing to develop through the winter months. The disease has not been severe in orchards planted on moderately open sites where air movement is not greatly restricted, and it is not anticipated that the disease will become a limiting factor in holly production in the Northwest.

Failure of the disease to become destructive in young or less dense orchards indicates that it may be prevented by (1) selection of moderately open and well drained planting sites, (2) proper spacing of trees, and (3) pruning to permit air movement. In infested plantings, spread may be retarded by the application of protectant fungicides at the beginning of cool, rainy fall weather.

Boydia Canker

The so-called *Boydia* canker disease of the hollies is actually caused by *Phytophthora ilicis* rather than by *Boydia insculpta* as was believed for many years. *Boydia insculpta* quickly invades tissues killed by *Phytophthora ilicis* and fruits abundantly in the diseased tissue. *Boydia insculpta* actually appears to be saprophytic and in controlled inoculation trials has not infected healthy holly leaves and twigs.

Phomopsis Stem Canker

Phomopsis crustosa has been reported also to cause a brown stem canker disease of hollies in the Northwest, but this pathogen was not found during a recent two-year study in Oregon.

Green Algae

The development of green algae on the surface of holly leaves, although not particularly damaging to the leaves, is a serious problem for many commercial growers since the presence of the dull green coating on the upper surface of leaves renders the foliage unsalable as cut holly. A species of *Protococcus* may develop rapidly and extensively on the bark and foliage of holly trees that are in dense plantings where air movement is restricted. The alga usually develops first on bark on the north side of trees and spreads from there to outer leaves and twigs. Selection of a moderately open planting site and the proper spacing and pruning of trees to permit air movement are usually sufficient to avoid development of algae on holly trees. If cultural methods do not suffice, it is possible to check the development of the algae by spraying trees in the spring with a fixed copper fungicide such as tri-basic copper sulfate used at the rate of two pounds per one hundred gallons of water.

Sooty Molds

The growth of sooty mold fungi renders foliage unsightly and unsalable and reduces the amount of photosynthesis that occurs. These fungi do not actually parasitize the leaves but grow on honeydew from scale insects and form a dark green to black layer on the upper surface of holly leaves. Growth of sooty molds may be prevented by keeping holly trees free of insects.

Leaf Spots

Several different types of leaf spots occur: Transparent swellings often occur on the lower leaf surface. These swellings are circular and very small. Cause is unknown.

Reddish swellings sometimes occur on the lower leaf surface. These swellings are large and give a blotchy appearance to the leaf. Cause is unknown.

Purple-red spots may occur on the upper leaf surface. These spots are large and may be associated with insect or spine punctures or with frost damage.

Chlorosis of several types may occur due to nutritional disturbances or deficiencies. Chlorosis is common in late

summer on heavily laden berry sprays, especially on the inner leaves. Chlorosis and dropping of old leaves are also common in spring when new growth is initiated.

Heat Cankers

Brown cankers frequently develop near the ground level on the main stem of young holly plants shortly after they are removed from lath houses or cutting beds and planted in an open space. Usually these cankers result from heat injury to the bark on the south side of the exposed stem. Such injury offers a point for entry of mildly parasitic fungi which may continue to grow and girdle the entire stem. To prevent development of heat cankers, care should be taken to avoid exposing tender young plants to the full heat of the sun.

Cold Injury

Holly trees may be damaged severely by cold temperatures in the range of ten to fifteen degrees Fahrenheit and lower. If trees have been conditioned by a cool fall and have hardened properly, they are not so susceptible to cold injury. In years, however, when temperatures remain mild through most of the fall and early winter, a sudden drop to ten or fifteen degrees Fahrenheit may result in general browning of the leaves and injury to the wood. Young trees may be killed to the ground line. In such cases it is usually possible to cut off the dead tops and develop a new tree from sprouts that grow from the uninjured roots. Freezing injury may also result in injury to bark at the ground line.

Mechanical Injury

Young holly trees may be girdled and destroyed by mice or other rodents. When trees are planted where they are exposed to the full force of the wind, leaves may be seriously marred as a result of scratching or puncturing by spines on other leaves. Such injury may result in the development of corky, roughened areas on the lower surface of leaves and an accumulation of red pigmented material that causes a red leaf-spotting appearance on the upper surface of such leaves.



Illustration 38.

38. *Phytophthora* disease of English holly.
 Black marginal spots on leaves (*top, left*).
 Partially defoliated orchard trees (*top, right*).
 Active black canker on two-year-old stems (*center, left*)
 and on one and a half-inch limb (*center, right*).
 Oospore in stem cortex (*bottom, left*).
 Stem canker beneath infected berry cluster (*bottom, right*).

Control of Holly Diseases

To avoid or control the various diseases that affect hollies, the following steps should be carried out:

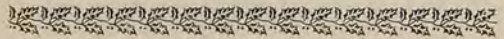
1. Select a planting site that is suffi-

ciently open to allow moderate movement of air through a planting but not located where it will receive the full force of strong winds. If air movement is too restricted, humidity may remain high and favor disease

- infection and surface growth of algae and fungi.
2. Space trees sufficiently far apart to allow air movement through the orchard and to permit movement of spray equipment.
 3. Prune trees sufficiently to allow air movement through the trees.
 4. Prune out and destroy all cankered and diseased twigs to remove a potential source of infection.
 5. Carry out a chemical program for control of green algae and *Phytophthora* leaf and twig blight if necessary.
 - a. To control green algae spray with a fixed copper fungicide such as tri-basic copper sulfate used at a rate of two pounds in one hundred gallons of water. This spray may be applied safely in the spring, summer or fall.
 - b. To control *Phytophthora* leaf and twig blight, spray with a fixed copper such as tri-basic copper sulfate at the rate of two pounds per one hundred gallons of water or with nabam two quarts per one hundred gallons, plus zinc sulfate one pound per one hundred gallons of water. The first application should be made when cool, rainy weather begins in the fall, usually by the middle of October, and additional applications can be made during the winter as deemed necessary. The use of tri-basic copper sulfate or nabam plus zinc sulfate in October has not left an undesirable residue on hollies cut in November for Christmas sales.

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Propagating Hollies

General Methods

Hollies are most often propagated by cuttings in order that the true varieties and desired sexes may be increased and maintained. Under some circumstances and for special purposes, hollies are propagated by grafting, budding, layering, root cuttings, and by plant divisions. All these methods are discussed in the pages that follow.

Because of the variation in sex, characteristics, and hardiness of hollies raised from seed, this method is not usually selected except for experimental purposes, for raising hybrids, or where large numbers of plants are needed for grafting or budding purposes.

Seeds of most species contain immature embryos even though the fruit is ripe and may require from one to several years to germinate. After collection, the ripened berries may be mixed with three or four times their own bulk of moist sand and placed in a suitable container with adequate bottom drainage. This may be placed outdoors exposed to the weather, buried outside in some convenient location and protected from rodents, or stored in a cool cellar or garage, keeping the sand somewhat moist at all times. In the spring, the seed and sand may be sown together in flats or outside in nursery beds or rows.

Or, the ripened berries may be crushed of their pulp, placed in a container of warm water and allowed to stand for three or four days. Several vigorous stirrings will help to separate the pulp from the seeds. The seeds can more easily be separated from the pulp by mashing them through a sixteen-mesh screen. These can then be placed in another container of water and the light and infertile seeds floated or skimmed off and discarded.

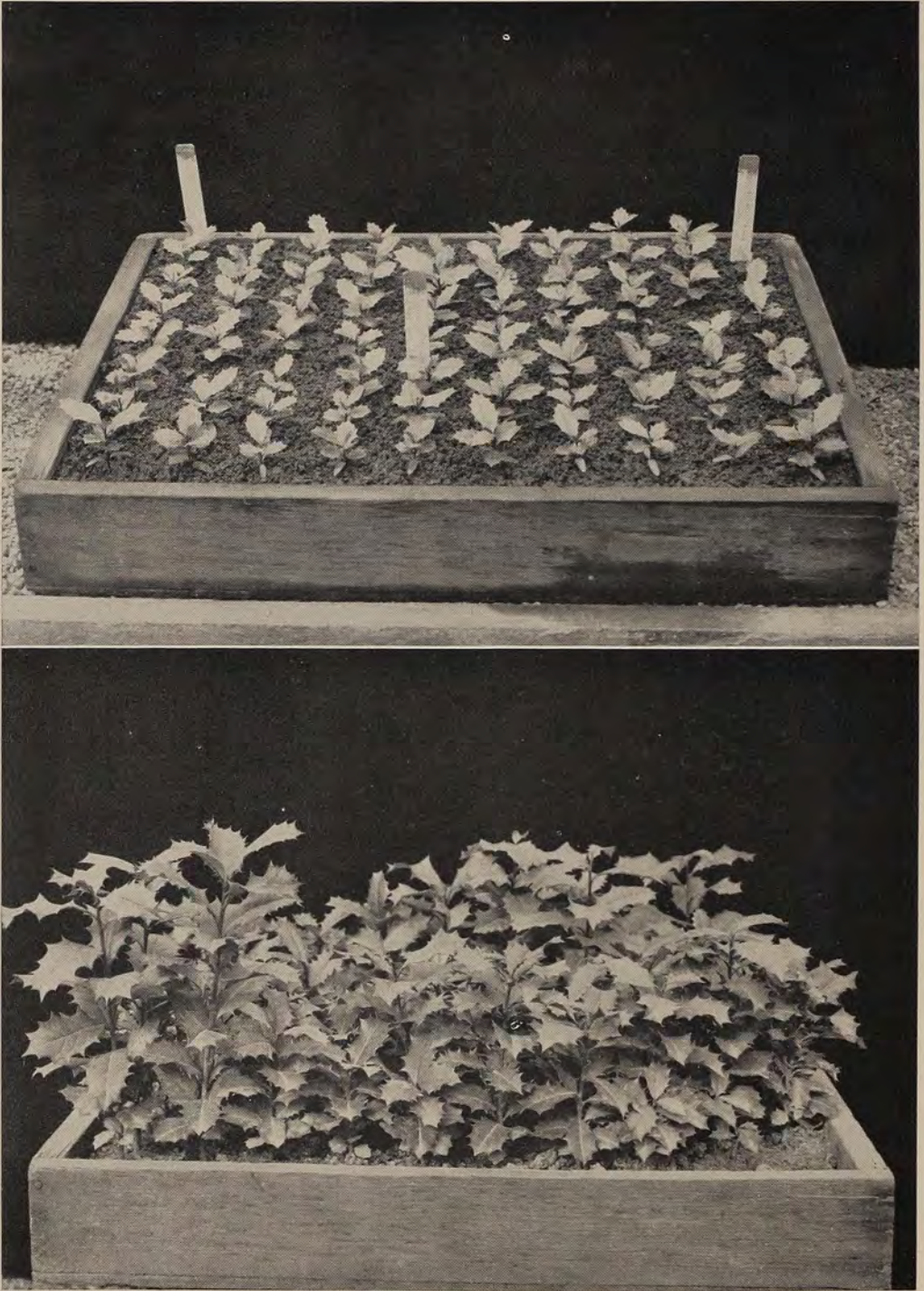
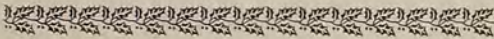


Illustration 39.

Newly transplanted holly seedlings.
Same seedlings, six months later.

The clean seed may then be handled in the same manner as the berries or can be sown immediately in flats or outside beds consisting of a mixture of equal parts of good soil, peat moss, and sand. The seeds should be sown thinly and about one-quarter of an inch deep. Seeds of rare species and those resulting from crosses should, of course, be handled with more care.

When individual seedlings are large enough to handle, they can be pricked out and potted, placed in a cold frame, or a specially prepared shaded area until they are large enough to withstand transplanting out into the open.



Stem Cuttings

ROGER W. PEASE

During the past two decades rooting hollies from cuttings, or "slips," has become standard practice among many nurserymen and of increasing interest to hobbyists. The techniques used, however, seem to differ almost as much as the people employing them. An attempt to describe all of the techniques and modifications of these techniques would be pointless; to claim superiority for any one would be merely an expression of opinion.

Fog nozzles, polyethylene film, bottom-heated cold frames, the "Electronic Leaf," thermoswitches, time clocks, and sashes are tools by which desirable environmental conditions may or may not

be obtained, depending on how they are used. Holly cuttings can be rooted under a glass jar, in a window box, in a cold frame without bottom heat (*Illus. #0.*), or in an elaborately controlled environment in a specially constructed greenhouse. Here, a discussion of some basic principles and their application to rooting hollies may be more useful than a detailed description of overall techniques or of the many devices they utilize.

Any successful technique is an accumulation of devices and practices, supplying environmental conditions favorable to rooting cuttings and sometimes capitalizing on inherent and physiological variations of hollies themselves. For purposes of brevity, these favorable conditions and variations will be called factors. The factors themselves, however, merely are means through which basic principles are followed.

Basic Principles

As soon as a holly cutting has been severed, it should be considered as the beginning of a young plant. Its life processes now must continue without a root system. It must live on what food already has been stored within its tissues. If the life processes in the leaves are active enough to cause shoot growth or if water is lost more rapidly than it can be taken up by the stem, the stored food soon will be consumed or the young tree will dry out. In either case, it will die. Therefore, practices should be followed to reduce metabolism above the growth medium in which the cutting is stuck and to maintain turgidity in the leaves. Other practices should be followed to increase metabolism in the portion of the stem which is buried in the growth medium and to stimulate root formation. After roots have formed, a normal balance should be established between the young roots and the foliage. Growth should then be encouraged. All devices and environmental factors which are utilized should serve as means to regulate metabolism and water loss, and to stimulate root formation. As water loss is minimized, metabolism above ground may be increased; if water loss is appreciable, metabolism above ground should be decreased. Yet, the life processes always must continue.

The discussion of factors which follows will center around the American

hollies because a technique suitable for rooting this species usually will be satisfactory for all species. The converse is not necessarily valid.

Inherent and Physiological Factors

There are at least two inherent or physiological factors which can be utilized. American holly trees apparently differ in their inherent "rootability." Other conditions being equal, results sometimes vary from complete success with cuttings from a tree selected for its high "rootability" to failure with cuttings from a tree selected for the consistently poor response of its cutting wood. Year after year, a similar difference in success may occur between cuttings from the two trees, apparently irrespective of the age of the trees and the vigor or condition of both cuttings and trees. Certain varieties, such as *Ilex opaca* 'Helvetia,' a West Virginia selection, are consistently good rooters. Seldom is a named variety extremely stubborn, but an untested parent tree may prove to possess poor rootability.

The physiological condition of the wood from which cuttings are taken is an important factor. Current season's growth usually will root more readily than older growth. In the Middle Atlantic area cuttings taken about August 15 are preferable; long spindly growth is undesirable. Shoot growth from the trunk or limbs makes poor cutting wood. Care should be taken to select sturdy, well-developed annual growth without soft tips and tender new leaves (*Illus. 40*). Often several cuttings can be prepared from one desirable shoot. Basal, tip, and intermediate sections respond equally well, although, after rooting, tip cuttings tend to show the most symmetrical new growth, at least for the first year.

Another aspect of the physiological condition of cutting wood was reported by F. E. Gardner in 1930. (F. E. Gardner, *The relationship between tree age and the rooting of cuttings*. Proc. Amer. Hort. Sci. 26: 101-104. 1930.) He obtained one hundred per cent success with *Ilex opaca* cuttings taken from one-year-old seedlings, sixty-four per cent from two-year-olds, forty-seven per cent from three-year-olds, and complete failure from trees older than three years. New shoots from the roots of old trees sometimes possess the juvenile characteristics

noted by Gardener and root well. Rooting techniques have been improved since 1930, however, and cuttings from very old trees often root as well as cuttings from young seedlings. Modern techniques have "masked" or counteracted juvenility until it is relatively unimportant. However, it may become the deciding factor for success, provided an ineffectual technique is used.

Environmental Factors

There are at least eight environmental factors which should be utilized in rooting American hollies. Sometimes they are counteracting. In such a case the counteracting effect of two factors often can be annulled by altering a third factor, by using a specialized piece of equipment or by some change in management. The degree of harmonious interplay achieved in utilizing these eight factors determines the efficiency of any rooting technique.

Ventilation and Humidity

Two of the eight factors, ventilation and humidity, are critical in that neither can be masked. American holly cuttings require some ventilation and almost constant high humidity in the surrounding air. If an attempt is made to root the cuttings in a small, airtight compartment impervious to the passage of gases, the cuttings will defoliate, usually in about ten days. Even a few holly cuttings in a tight chamber containing as much as one hundred and fifty cubic feet of air tend to defoliate within two or three weeks; yet, in the same chamber cuttings will thrive if as much as five minutes' thorough airing is furnished every day. This defoliation may or may not be caused by the presence of ethylene gas. Hollies sometimes defoliate in an airtight compartment where young tomato seedlings remain upright and vigorous; and tomato seedlings are especially sensitive to ethylene.

If the air surrounding American holly cuttings is not high in water content, the loss of moisture through the leaves is more rapid than the intake of water through the stem, even if the latter is "stuck" in a wet growth medium. Death usually follows. The more succulent the cutting the more sensitive it is to this unbalanced condition. Even a well-matured cutting, none of whose leaves are tender,



Illustration 40.

A desirable stem cutting, large enough for two cuttings (*top, right*); removing the unwanted leaves (*top, left*); making a clean-cut tip (*top, center*); the resulting two cuttings: the terminal cutting (*center, left*) and the basal cutting (*bottom, left*); treating the cutting with a root-inducing substance (*center illustration of center row*); placing the cutting in the rooting medium (*center, right*); the cuttings in a polyethylene sealed window box (*bottom, center*); and the rooted cutting one month after placing (*bottom, right*).

seldom withstands more than a day of drying out even though actual death may be delayed. The more turgid the leaves are kept, other conditions being equal, the greater will be the rooting success. Hence, an effort should be made to maintain one hundred per cent humidity, especially during daylight hours. This can be accomplished by the use of fog nozzles running intermittently or even steadily.

Very high humidity can be maintained without fog nozzles, provided the rooting compartment is kept airtight; but ventilation is then inadequate and defoliation follows. As ventilation increases, humidity decreases unless fog nozzles are used. Without their use the operator must maintain a careful balance between ventilation and humidity. If about five minutes' full ventilation is given morning and evening, and if the morning ventilation is accompanied by a thorough but gentle watering of the growth medium, an excellent balance can be maintained, provided the rooting compartment is kept tight between waterings. As the period between ventilations and waterings is lengthened, the danger of defoliation is increased. Sometimes ventilation and watering can be delayed for a week without resultant loss of leaves, but again a few days' neglect will be fatal.

A rooting compartment sealed with polyethylene film is an excellent device for maintaining adequate ventilation and sufficiently high humidity. Polyethylene resists the passage of water vapors but allows an interchange of gases. Thus it supplies some ventilation but retains moisture. Its action, however, is not absolute in that there is some resistance to the passage of gases, and apparently there is a very slight loss of water vapor. In rooting American hollies under polyethylene, infrequent ventilation and watering act as insurance against failure. Excellent rooting results can be obtained in a polyethylene-sealed window box.

A balance between ventilation and humidity can be maintained in an open bed under a continuous mist from fog nozzles. Such a bed either should be sheltered completely from the wind or have the area covered by mist extend well beyond the area for cuttings. If the mist is blown away from the cuttings, and if they are left exposed to the

bright sun for as little as an hour, drying out and resultant death may occur. Tender cuttings taken early in the season, in May or June, often will die after a few minutes' exposure to the sun unless protected by mist.

An adequate balance between ventilation and humidity should be maintained from the time the shoots are removed from the parent tree until the cuttings are "stuck" in the growth medium. Shoots dropped into a pail of water as they are taken will be damaged if left in the water overnight or, sometimes, for an hour. The leaves become saturated, no water loss occurs, and physiological breakdown sets in. On the other hand, newly-taken shoots left an hour in the open air often dry out sufficiently to cause eventual death. By placing newly-severed shoots in a polyethylene bag or a wet burlap sack, a desirable balance is established which will prevent damage for a day or more. The burlap must be kept moist and the polyethylene bag closed.

The fewer the leaves left on a cutting, the less humidity it requires. When cuttings are to be rooted in a chamber which is neither equipped with fog nozzles nor sealed with polyethylene, only about two or three square inches of leaf surface should be left on each cutting. Under fog nozzles, at least double the leaf surface is satisfactory. Perhaps rooting is speeded by the larger leaf area under fog nozzles, but data for proof are difficult to obtain, since early rooting may be caused by many other factors, known or unknown.

There seems to be no advantage in preparing American holly cuttings more than three inches long, nor in sticking the stems more than an inch in the growth medium. There are indications that long cuttings tend to root less readily and that stems, buried much more than an inch, tend to rot beneath the surface. Sometimes the bottom inch will rot and a poor root system develop above the dead portion.

Stimulation of Root Formation

Stimulation of root formation by the application of chemicals is an almost critical factor. Although American hollies can be rooted without treatment by an "auxin" or "hormone," success is more exceptional than is failure. To

form root tissue, the stem of a cutting must alter its normal formation of new cells, or embryonic cells must alter their predestined development. Without stimulation from an auxin, the stem tends to develop callous-tissue around its severed portion. Often, more and more such tissue is formed until the young plant's stored food has been consumed. Death results. After proper stimulation by an auxin, a comparatively slight callous is formed, followed by root tissue.

Two chemicals commonly used to stimulate root formation are indoleacetic and indolebutyric acids. The latter gives satisfactory results in rooting holly. At least two methods of preparing a suitable substance containing indolebutyric acid are employed: a mixture in talc and an aqueous solution. It is more difficult to prepare the aqueous solution than the talc mixture and also more time-consuming to use it for treating the cuttings. The talc mixture usually is preferred and may be purchased under several trade names and in various strengths. One part acid crystals to one hundred and fifty parts talc, by weight, is effective. Usually the strongest commercial mixture approximates this concentration.

Whether or not the mixture deteriorates under storage at room temperature, or even under refrigeration, is debatable. The danger of deterioration is lessened, however, by mixing a supply a few days before cuttings are to be stuck. One gram of indole-3-butyric acid crystals is sufficient to treat thousands of cuttings. A quantity of the mixture sufficient to treat several hundred cuttings may be prepared by dissolving one-tenth gram of the crystals in fifteen cc. of ninety-five per cent ethyl alcohol and stirring fifteen cc. of unscented talc into the solution. More alcohol can be added if the paste does not stir freely. The mixture should be allowed to dry until the alcohol has evaporated; it then should be ground until it forms a fine powder, placed in a sealed glass container, and kept cool until used. A Mason jar cap is a handy container for the powder when it is to be used.

The application of the root-inducing mixture should follow immediately after the final preparation of cuttings; each cutting should be stuck in the wet growth medium immediately after it has been treated. The foliage should be

kept turgid while the cuttings are prepared, treated, and stuck. These operations should be performed in the shade and out of the wind.

One method to prepare and set the cuttings is to drop about fifty shoots into a pail of water, remove the cuttings one at a time, and with a very sharp knife trim each three to four inches in length. The cut may be finished by removing the tip of the bevel. There should be no crushing or loosening of the bark and the bark should not be torn while the leaves are being removed. Each prepared cutting should be dropped immediately, stem down, into a second pail of water. The prepared cuttings should be removed one at a time from the pail of water, and each cutting should be treated and stuck before another is removed. Half an inch of the base of a cutting should be dipped into the powder, and the cutting inserted into a pencil-size hole in the growth medium, about one inch deep. The growth medium should be firmed around the cuttings. They should be far enough apart to prevent overlapping of the leaves.

Aeration and Drainage

Aeration and drainage are mutually interacting factors less critical than ventilation, humidity, or root stimulation. If a cutting is stuck in a soggy, dense growth medium, saturated with stagnant water, there is a tendency for air to be sealed out. Life processes in the stems may be retarded and rotting and death may result. There are some indications that a dense, soggy medium is satisfactory, however, if water can be kept seeping through it, even very slowly.

As the growth medium becomes more porous, both aeration and drainage increase, but water should be added more frequently to prevent drying out. Coarse, white, washed building sand is an excellent medium under fog nozzles but a poor medium when water is added every few days, or even daily. Under fog nozzles, water seeps continuously through the sand, there is excellent aeration, and a constant water supply prevents drying.

A mixture of two-thirds German peat moss and one-third white, washed, build-

ing sand, by volume, is an excellent medium when daily watering is practiced, or under polyethylene.

If free bottom drainage is supplied under a few inches of pure German peat of coarsely-shredded sphagnum moss, aeration and drainage are adequate unless water is applied constantly or even daily. Both media are satisfactory when the overall rooting technique calls for infrequent watering. Percentages of rooting tend to be lower in pure peat or sphagnum, however, than in pure sand or in the peat-sand mixture, even when overall conditions are kept well balanced. Michigan peat and fine vermiculite tend to pack and thus interfere with drainage, but very coarse vermiculite often is satisfactory.

Free sub-drainage is desirable under the growth medium, especially if fog nozzles are used. A six-inch layer of crushed rock over a line of drain tile is suitable in a cold frame. In rooting benches, window boxes, frames, and flats, reinforced bottoms of one-quarter-inch mesh hardware cloth with free air underneath assure adequate aeration and drainage. One-half inch of unshredded sphagnum spread over the hardware cloth will keep the growth medium from washing through.

Temperature of the Air and of the Growth Medium

Air temperature and the temperature of the growth medium are factors which also are less critical than humidity, ventilation, and root stimulation. The temperature of the air can range from just above freezing to at least ninety degrees Fahrenheit without fatal injury to the cuttings. The more constant the temperature, however, the more effective is the overall rooting technique. By maintaining the temperature at sixty to sixty-five degrees, life processes in the above-ground portions of the cuttings seem to be retarded. Therefore, if the overall technique is relatively ineffective, air temperature should be kept low. If the overall technique is highly effective, the temperature may be maintained as high as eighty to ninety degrees. The use of fog nozzles tends to maintain air temperature within the rooting chamber at a point about ten to fifteen degrees lower than the surrounding air.

As the temperature of the growth medium falls below seventy degrees, the

speed of root formation apparently is retarded; as it rises above seventy degrees, the tendency toward stem decay is increased. Therefore, an effort should be made to maintain in the growth medium a steady temperature of about seventy to seventy-five degrees.

An electrically-heated soil cable, controlled by an adjustable thermostitch, is an effective device for controlling the temperature of the growth medium in a cold frame. Indirectly, it also tends to maintain a steady air temperature. Satisfactory results can be obtained without the use of a soil cable, provided the cold frame is constructed with the growth medium at least two feet lower than the ground level; but in such a frame an early period of cold weather will retard rooting or even cause mortality among the cuttings.

Cuttings stuck in mid-August usually have formed good root systems by mid-November. After this they can be treated as normal young plants. Water need be added only occasionally. If the growth medium freezes, the plants may be heaved, the roots torn, and mortality caused. Hence, winter protection should be provided.

Light Intensity

Light intensity is a factor which can be controlled to retard or stimulate life processes in the foliage of the cuttings. About three-quarters full light should be shut out if the overall technique is inefficient. If fog nozzles are used intermittently or only during daylight hours, about half light should be admitted. Under continuous operation of fog nozzles, no shade is necessary, but probably about one-quarter light admittance is preferable. A technique which permits at least half light usually causes an early development of effective root systems.

The spacing of cuttings in the growth medium has not been considered as a separate factor because highly successful operators habitually use different spacings. A beginner, however, would be wise to arrange cuttings in such a manner that leaves do not overlap or even touch. Later, he may find that he is equally successful by "shingling" cuttings, with leaves overlapping and almost covering each other; but when cuttings are set very close, there is increased dan-

ger of defoliation caused by molds or by an accumulation of gases.

Many successful plant propagators are able to neglect one or more of the eight factors discussed. The importance of light intensity can be minimized by the use of constant mist; drainage can be slighted if aeration otherwise is achieved; high air temperature can be maintained if very high humidity and heavy shade are supplied. However, no factor should be neglected until a successful overall technique has been developed.

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Minor Methods

JOHN L. CREECH

Since cuttings are used so commonly in holly propagation, all other vegetative methods are of secondary importance. Although this fact is true in the United States, it is of interest to note that one better English propagation text says of hollies, "but propagation by cuttings is hopeless for commercial purposes." In most European nurseries, layering is the most important means of propagating hollies. The minor methods about which we speak are grafting, layering, root cuttings, and division. Although they are less important with respect to large-scale practices, there are many instances where such methods are essential to success, such as when there is a limited amount of propagating material or when new introductions have been shipped under adverse conditions.

None of the methods discussed are particularly difficult nor do they result in low returns. It is merely that they have been superseded by a technique which has been highly developed as a result of propagation research—the rooting of stem cuttings.

Grafting. Grafting is highly successful for holly propagation and has considerable value when cutting material is weak such as on variegated varieties or when the material has been shipped by poor methods. This may be exemplified by a recent shipment of cuttings from abroad of *Ilex crenata* that was inadvertently shipped by boat and arrived in poor condition. Actually, the fact that the material survived at all was due to the use of polythene film as a wrapping. A part of the shipment was stuck in a sand bed as cuttings and several of the shoots were grafted onto Japanese holly stocks. None of the cuttings lived but two grafts survived and have become a source of ample cutting material. Thus, while the grafting implemented the initial success, cutting propagation was promptly resorted to under normal conditions. This introduction, incidently, is the yellow-fruited form of *I. crenata*, P.I. 231948, which was being introduced for the first time.

Grafting can be done at any time of the year when greenhouse facilities are available, otherwise it must be carried on in the summer with active material. There are no marked indications of incompatibility in young grafts, and several interspecific combinations have been accomplished at the Glenn Dale Plant Introduction Garden. *Ilex cornuta*, *opaca*, and *crenata* have been used as understock for such species as *I. pedunculosa*, *chinensis*, and *centrochinensis*. In Europe, *Ilex aquifolium* is generally used as understock but *I. verticillata* and *I. glabra* have also been used.

Any of several methods of joining the scion and stock may be employed but a simple side graft, using ripened wood of the current season or wood of the previous year, will seldom fail. As with any graft, it is essential that the cambiums be in contact and prevented from drying out. This may be done by tying either with strips of polythene film or with rubber bands followed by waxing. The grafts should be placed in a humid, warm atmosphere such as a typical propagating house, with the pots preferably

plunged in the sand. Under these conditions, the callus will form rapidly and the grafts will be united within four weeks. The top of the stock can then be cut back to the union and the grafted plants moved to the open greenhouse or cold frame, weather permitting.

Budding. Hollies may also be budded, using the conventional "T" bud method, or cleft-grafted in the field. Budding is done between June and August, wrapping the bud union with polythene strips or rubber bands. The period for grafting can be extended into late fall and the cleft wound waxed for protection.

Layering. Natural layering may be observed among some hollies in nature, particularly *Ilex aquifolium*, *crenata*, *glabra*, and *rugosa*. This information is of value when it becomes necessary to obtain wild collections and layered branches can easily be removed without destroying the entire plant. Although such propagations are poor in appearance, they survive readily and make excellent stock plants for future cuttings. Collected layers should be plunged in a peaty medium in a cold greenhouse or coldframe until they are established.

In the nursery, layering is a reliable but slow method of propagating hollies. It requires that the stock plant be cut back to the base, forcing the development of numerous sucker shoots. This preparation of the stock plant is accomplished in the autumn and the new shoots will develop during the next year. In September, the sucker shoots can be bent over and pegged to the ground. A wound on the underside will permit the propagator to bend the stems into an upright position without breaking them completely. Moist peat is then mounded over the stems and kept moist at all times. The layers will require the next year to root after which they can be severed from the stock plant and transplanted. No more than half of the stems should be removed at any one time.

The amateur will prefer to use air layering with plastic wraps. All species can be propagated by this method without difficulty. The air layers should be applied in March or late August, wounding the stem and applying a rooting compound at the time of preparation. Some layers applied in the spring will root the same year, for example, *Ilex crenata*. Other layers, and this applies

to the majority of the species, will not be rooted until the following summer. Therefore it is essential that the plastic wrap be durable and watertight. Rooted layers can be cut from the parent and plunged in peat, either in an unheated greenhouse or a protected coldframe. In the greenhouse the layers will continue to develop roots during a part of the winter and be well established for planting out in the spring. Branches up to finger size can be expected to root and establish themselves without difficulty.

Root Cuttings. A limited number of species can be propagated by planting small root pieces in a suitable medium during October and November. This is true of such slow-growing types as *Ilex* 'Rotunda' and *I. crenata* f. *helleri*. *I. opaca* has not succeeded from root cuttings in any past attempts.

The root pieces should be no less than a quarter of an inch in diameter and three to four inches in length. The pieces from the portion of the root closest to the base of the plant will give better results than those out near the end of the root. Small root pieces can be scattered over a flat of sphagnum moss and covered with an additional amount. If the roots can be conveniently handled individually, they may be inserted upright with the upper (proximal) end of the root protruding through the medium. Flats of root cuttings succeed best if placed in a warm propagating house but they can be placed in a basement or in a protected coldframe. The new shoots appear in the following spring and the rooted pieces will have to be left undisturbed until the end of summer. Then they can be transplanted to beds or potted.

Division. Division is infrequently resorted to except in the case of colony-forming species, of which *Ilex glabra* is the most common. Plants should be divided in the autumn and divisions placed in a coldframe or protected bed. Usually they will be rather ungainly if from the wild and require considerable pruning to produce an adequate plant. Occasionally *I. cornuta* will produce rooted shoots where the main roots are close to the surface and these can be removed as plants to grow on successfully. Division appears to be neither profitable nor adequate and is the least suitable of methods of holly propagation.

While the fundamental factors of these

methods of propagation with respect to success have been fairly well determined, there remain those even more important studies to be accomplished which deal with problems of stock/variety relationships as they relate to vigor, adaptation, fruiting, and related characteristics. In the field of root cuttings, it is worth examining the effect of root cuttings on reproduction of variegation or leaf characters of certain varieties. Separate sexes also have to be considered in hollies and there is a definite tendency in some species for the male plant to be much more vigorous (particularly *I. centrochinensis*) and this point might be considered with respect to grafting. Thus while our initial statement implied a secondary position for these methods, their scientific potentialities are equal if not more substantial than those of stem cuttings.

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Hybridizing Hollies

WM. F. KOSAR

The current interest in holly culture, from both a commercial and a hobby viewpoint, has focused attention on the possibilities of developing newer and better types from the major holly species and varieties. In the past either a chance seedling or a mutation was selected and named by some observing individual and introduced into the trade as a named cultivar. The cultivars of the future, however, will undoubtedly arise as the result of planned breeding programs.

Objectives

The objectives in holly breeding are many and vary according to the ultimate uses intended. Generally, the primary purpose is to produce a desired effect in landscape design. This effect is dependent upon such characters as size of mature plant, habit of growth, texture and tone of foliage, color and size of fruit, adaptability to various environments, and hardiness. The secondary use of hollies is for Christmas decorations. Commercial holly orchardists provide berried greens in bulk, package, or wreaths for the Christmas trade. In this specialized use of hollies such characters as annual bearing, size, shape, color and lustre of leaf; size, color, placement and retention of berries; and shipping qualities of the severed twigs are important considerations. In either case the holly breeder's ultimate goal is to produce a new individual or cultivar that is a pleasing combination of desired characters.

Holly breeding objectives vary with the species, the region, and the intended use of the improved cultivars. Major objectives which apply to most of the important species are: (1) extension of the hardiness range, (2) annual yield of quality berries, and (3) hardy hollies of good form with perfect flowers, thereby eliminating the need of male plants for pollination purposes.

Some of the specific improvements that may be expected through crossing within species of *Ilex* are:

1. *I. opaca*. Glossy leaves with no winter discoloration. Acceptable landscape forms with dense habits. Adaptable to a wider range of soil types. Acceptable shipping quality of severed twigs.
2. *I. aquifolium*. Good foliage effects in combination with heavy fruit set. Acceptable shipping quality of severed twigs.
3. *I. cornuta*. Good foliage effects in combination with heavy fruit set.
4. *I. crenata*. Dwarf landscape forms with varying habit and texture.
5. *I. pedunculosa*. Acceptable landscape forms with dense habit.
6. *I. pernyi*. Adaptable to a wider range of soil types. Acceptable landscape forms with increased vigor.
7. *I. latifolia*. Adaptable to a wider range of soil types.
8. *I. chinensis*. Acceptable landscape forms.

9. *I. centrochinensis*. Glossy leaves with no winter discoloration.

10. *I. integra*. Glossy leaves.

11. *I. vomitoria*. Acceptable landscape forms with dwarf habit.

12. *I. cassine*. Acceptable landscape forms with dwarf habit. Adaptable to a wider range of soil types.

13. *I. myrtifolia*. Acceptable landscape forms with dwarf habit. Adaptable to a wider range of soil types.

14. *I. glabra*. Acceptable landscape forms with dense and dwarf habit.

15. *I. rotunda*. Acceptable landscape forms with dense habit.

16. *I. decidua*. Acceptable landscape forms with dwarf habit.

17. *I. serrata*. Larger berries.

18. *I. verticillata*. Acceptable landscape forms with dwarf habit.

Cytology and Genetics

Cytogenetics has an important role in a holly breeding program in that it contributes information on chromosome numbers of the various species, the existence of polyploidy (cultivars or species having three or more basic chromosome sets), the occurrence of parthenocarpy (production of normally formed fruit with no seed or with empty seed), the occurrence of apomixis (seed formation that does not involve the typical union of egg and pollen nuclei), and the determination of dominance and recessiveness of various plant characters and their interaction with environment. A knowledge of chromosome numbers can be applied in deciding which interspecific crosses may be successful. The induction of polyploidy might be necessary in obtaining fertile progeny from an interspecific cross. The negative results obtained in controlled crosses between some species, even though there is a definite fruit set, may be explained by the occurrence of either parthenocarpy or apomixis, and may be corrected in some cases by using as the female parent, species that do not exhibit these tendencies. The segregation of various characters in breeding is very important for from this information one determines the size of the hybrid population to be grown and the chances of recovering the desired combinations of plant characters. The numbers of a progeny of various crosses which should be grown must be carefully calculated in a long-term program where one must wait

many years before certain characters are expressed and then tested under different environments.

The dioecious nature of hollies and the lack of pedigree records determine the breeding method to be followed. With standard breeding procedure of self-fertile species from which homozygous parents can be obtained, the individuals of an F_1 generation (progeny of an initial mating) are usually similar in appearance and genetic make-up. By sib-mating (brother-sister mating) within the F_1 generation, a segregating F_2 generation is obtained. It is in this F_2 generation that individuals with various combinations of desired characters are selected. As a rule, emphasis is placed on growing a large F_2 population so that the desired combination of characters can be recovered.

This practice is not possible in holly breeding, because variability occurs among the sibs in the F_1 generation due to the genetic heterozygosity of both parents. For selection of outstanding sibs to use as parents for the F_2 generation, a large F_1 population is necessary. The chances of obtaining superior selections are good if this F_1 population is followed by a still larger F_2 population. The secret of success in this method of breeding lies in producing large populations in direct proportion to the number of characters that differ in the combining parents, so that the chances of recovery are increased in the selection process. Under normal conditions, good results could be expected from this practice.

Cytological information about the species of *Ilex* is still very meager. The *Chromosome Atlas* by Darlington and Wylie lists the following information:

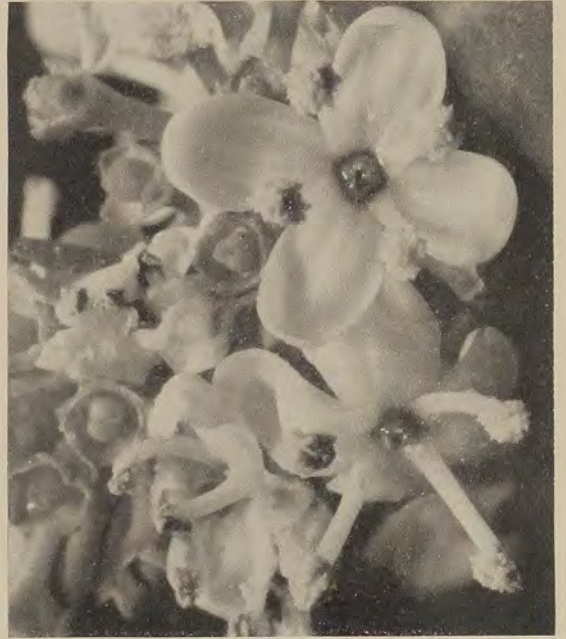
Somatic Chromosome Number

<i>I. opaca</i>	36
<i>I. verticillata</i>	36
<i>I. aquifolium</i>	40
<i>I. dumosa</i>	40
<i>I. paraguariensis</i>	40
<i>I. theezans</i>	40
<i>I. vomitoria</i>	40
<i>I. decidua</i>	40
<i>I. monticola (montana)</i>	40

Primary basic chromosome number of *Ilex* $x = 9, 10$.



Female flower showing the non-functioning or rudimentary anthers and the pistil which, when fertilized, develops into a berry.



Male flowers showing the pollen-laden anthers and the rudimentary or non-functioning pistils in the centers of the flowers.

Illustration 41.

Enlarged flowers of the English holly.

Cluster of female flowers.



Cluster of male flowers.



Flower Characteristics

Flowers of holly species are produced either on the basal parts of new growth or in axillary clusters or fascicles on growth of the previous season. To the first group belong *Ilex cassine*, *chinensis*, *crenata*, *decidua*, *glabra*, *myrtifolia*, *opaca*, *pedunculosa*, *rotunda*, *serrata* and *verticillata*. To the second group belong *I. aquifolium*, *centrochinensis*, *cornuta*, *integra*, *latifolia*, *pernyi*, and *vomitaria*.

Except for a few reported instances of polygamous individuals, all holly species are dioecious, having male and female flowers borne on different plants. At first glance, the male and female flowers look similar. The small flowers usually have four yellowish-white petals and the same number of stamens. In the center of the flower is the small, greenish, bulbous pistil. Around the pistil and at the base of the petals is secreted a nectar which attracts insects. Upon closer examination, differences are observed between the male and the female flowers. Male flowers are produced in larger numbers. The female flower has a larger pistil than the male. The female has withered whitish anthers, while the male has plump yellow anthers. The anthers are the pollen-bearing organs and are functional in the male. The ovary, or swollen part of the pistil, is functional in the female and it develops into the berry-like drupe, or fruit, of the hollies. The major distinction then is that in the male the *pistil* is aborted and in the female the *anthers* are aborted. The male is recognized by the abundance of flowers produced, the plump yellow anthers and the aborted pistil. The female is recognized by fewer flowers, the withered whitish anthers and the plump pistil which has a viscid stigmatic surface when it is receptive.

Hybridizing Technique

Once the objectives of a breeding program are determined, the holly breeder should familiarize himself with the material available and develop a hybridizing technique. Much time and effort will be saved if considerable attention is given to the selection of the parent material. This is especially true of crosses within species.

The mechanics of controlled breeding are relatively simple. All flowers intended for use in hybridization must be pro-

tected against possible contamination. This applies to male as well as female flowers. This protection is usually accomplished by bagging individual branches before the flower buds open or by working with potted specimens in a screened greenhouse. Do not use an airtight covering such as polyethylene as this has a tendency to increase the temperature and humidity about the flowers. Muslin or cheesecloth is a satisfactory covering which allows air movement. Precautions must be observed even under screened greenhouse conditions for greenhouse pests, such as snails or ants, that may be present and contaminate a cross.

In preparation for cross-pollination, all excess flowers and flower buds not used in the cross are removed from a branch of the female parent. Also, any twigs or leaves which interfere with ease of pollination are pruned. A record tag is then attached to the branch just below the last flower to be used. As soon as the female flower is fully open, it is in the receptive stage. The viscid stigmatic surface of the pistil glistens at this time. When the receptive stage is past, the stigmatic surface becomes dry and brown. The pollen from the male is applied to the viscid stigmatic surface of the female flowers. If fresh pollen is available, an individual male flower is held with the aid of forceps and the anthers are brushed against the stigmatic surface. Several female flowers may be pollinated by each male flower. If the parents flower at a different time, stored pollen is used. This is collected on wax paper when the anthers dehisce, placed in a labeled vial, and stored with a desiccant at a low temperature (thirty-five to forty degrees) until ready for use. Either silica gel or calcium chloride may be used as a desiccant to lower the relative humidity of the air surrounding the stored pollen. The pollen is stored in loosely stoppered vials, which in turn are placed in a sealed bottle containing the desiccant. The pollen is applied to the stigmatic surface with a camel's hair brush. A separate brush should be used with each lot of pollen, or the brush should be dipped in alcohol before changing to a new lot in order to prevent pollen mixture. It is best to work with fresh pollen, as there is insufficient information on the quality or longevity of stored holly pollen. After the pollen

is applied to the female flowers, they should be protected by bags for a few days until the period of receptiveness is past. When the berries begin to change color, it is wise to cover them again as a protection against birds and rodents. The fruit is harvested when fully colored and each hybrid lot is accompanied by its original record tag.

Hybridization of holly falls into two categories—crosses within species and interspecific crosses. In either case, preliminary testing of foreign and domestic varieties and species under a particular environment should be initiated. The data from these tests and the recorded results of tests from other localities will largely determine the material to be used as parents. Progeny evaluation is also simplified by this procedure. When testing species, it is wise to include several strains from different localities as the species may be variable for characters such as hardiness within its range.

Crosses within species are usually simple to produce, since the chromosome numbers of the parents are the same. Sterility of one of the parents, parthenocarpy (fruit without viable seeds), apomixis (seed without fertilization), or polyploidy (chromosome multiplication) might be limiting factors in exceptional cases. The possibility of obtaining superior progeny from crosses within species is dependent upon the range of variation in the species. If all the varieties of a species are uniform for a certain character, it is likely that the character is fixed for the species, and crossing within the species will not produce an improvement. If the range of variation is extensive, however, selections that surpass either parent in a particular character might be produced. Thus by crossing two strains originating from different localities at the northern limits of their range, a variety hardier than any existing might be produced.

A method which might be worth trying in holly breeding is backcrossing. Backcrossing seems to be a logical procedure when it is advantageous to add one or two characters to an otherwise desirable variety. The plan of operation may be outlined as follows:

1. Selection of parents for crossing.
Cultivar A, female with a majority of desirable characters, but lacking one or two characters.
Cultivar B, male with these one or

two characters lacking in A.

2. Selection of male (resulting from the cross between $A \times B$) and backcrossing to cultivar A.

3. Selection within the progeny of step 2 for individuals that have a majority of the desirable characters of cultivar A plus the one or two characters of cultivar B if they are dominant.

4. Sib mating of male and female selections from progeny of cross derived from step 2 if the characters desired from cultivar B are recessive.

The principal cultivated species of hollies are endowed with a wealth of variation; therefore, in crossing within species the plant breeder need only assemble and combine superior characters. The majority of the objectives of a holly-breeding program may be attained by initiating a well-planned program, selecting rigidly from large populations and ending by extensive testing before introduction as a new cultivar.

Interspecific crosses are usually difficult to produce. The difficulty may be due to various factors, such as different periods of flowering, different chromosome numbers, or irregular pairing of chromosomes. Various techniques may have to be developed to overcome these obstacles. Nevertheless, interspecific hybridization may be helpful in introducing special characters into a species that may be lacking in its range of variation or it may produce a synthetic species different from all others.

One may expect some trouble in producing interspecific hybrids between species of different chromosome numbers. An example would be an interspecific cross between *Ilex opaca* and *I. aquifolium*. The possibility of such a cross is usually greater if the species with the larger chromosome number is used as the paternal parent.

In some cases, difficult interspecific combinations may be achieved by using a "bridge." This is simply the introduction of a third species into the breeding procedure. The plan of operation may be outlined as follows:

1. Finding a third species C that is compatible with each incompatible species A and B.
2. Cross species A and species C.
3. Cross species B and species C.
4. Cross F_1 interspecific hybrid ($A \times C$) and F_1 interspecific hybrid ($B \times C$).



Illustration 42.

(Top) *Ilex myrtifolia* (left) crossed with *Ilex opaca* (right) and the resulting first generation (F_1) hybrid (center).

(Bottom) *Ilex pernyi* (left) crossed with *Ilex aquifolium* (right) and the resulting named clone *Ilex aequipernyi* (center).



Illustration 43.

(Top) *Ilex cornuta* (left) crossed with *Ilex pernyi* (right) and the resulting first generation (F_1) hybrid (center).

(Bottom) *Ilex cornuta* f. *burfordi* (left) crossed with *Ilex pernyi* (right) and an example of the resulting first generation.

(In a recorded cross, *Ilex cornuta* f. *burfordi* did not contribute any influence other than traits of its species *Ilex cornuta*.)

5. Selection within progeny of step 4 for individuals having desirable combination of characters of species A and species B if these characters are dominant.

6. Sib mating of male and female selections from progeny of trispecific cross derived from step 4 if the desired characters are recessive.

Some of the improvements one may expect through interspecific crossing are:

1. Introduction of glossy leaf character into *Ilex opaca* species.

2. Introduction of red berry character into *Ilex crenata* and *I. glabra* species.

3. Introduction of hardiness character into any tender species.

4. Introduction of spiny leaf character into any spineless leaf species.

5. Introduction of vigor into any weak-growing species.

6. Production of a synthetic, or amphidiploid, species that is different from all other species and that breeds true.

Some of the suspected and known hybrids and crosses made up to this time and their originators are as follows:

1. Suspected interspecific hybrids in the trade:

Ilex altaclarensis (*I. aquifolium* × *perado*)

Ilex aquipernyi (*I. aquifolium* × *pernyi*)

Ilex attenuata (*I. cassine* × *opaca*)

Ilex beani (*I. aquifolium* × *dipyrena*)

Ilex 'Foster' (*I. cassine* × *opaca*)

Ilex koehneana (*I. aquifolium* × *latifolia*)

2. Known interspecific hybrids in the trade:

Ilex (aquifolium 'Golden Beauty' × pernyi) 'Brilliant,' Clarke, San Jose, California.

Ilex (aquifolium var. pyramidalis × pernyi) 'AQUIPERN,' Gable, Stewartstown, Pennsylvania.

Ilex (aquifolium 'Wilson' × sikkimensis) 'San Jose,' Clarke.

Ilex cornuta × pernyi var. veitchii (?), Furness, Media, Pennsylvania.

Ilex (crenata × glabra) 'Hatfield,' Hatfield, Wellesley, Massachusetts.

3. Known interspecific crosses not in the trade:

Ilex (aquifolium × latifolia), Hohman, Kingsville, Maryland.

Ilex (aquifolium × rugosa), Meserve, Saint James, New York.

Ilex (aquifolium × yunnanensis), Meserve.

Ilex (aquipernyi × rugosa), Meserve.

Ilex (cornuta × pernyi), Skinner, Washington, D. C.

Ilex (cornuta f. burfordi × pernyi), Skinner.

Ilex (glabra × pedunculosa), deVos, Washington, D.C.

Ilex (glabra × serrata), deVos.

Ilex (myrtifolia × opaca), Skinner.

A suspected interspecific hybrid has been reported from the United States Plant Introduction Garden, Savannah, Georgia. An isolated female of *Ilex chinensis* produced several seedlings, one of which is a male with lavender flowers similar to those of *I. chinensis* and with foliage intermediate between *I. chinensis* and *I. glabra*. The parentage is, therefore, suspected as *I. chinensis* × *glabra*. Other suspected hybrids might be cited.

Breeding Aids

Mutations (sudden variations that are inherited) also play an important role in the plant breeder's program. Recent research with fruits, vegetables, and ornamentals has produced a method whereby the mutation rate of a plant may be increased. Irradiation of plants or plant parts by thermal neutrons, which is a type of atomic radiation, was successful in producing a high rate of beneficial mutations or variants. Dark red color sports of apple were induced by this method and in another case the size and shape of muskmelon fruit were altered. Thermal neutrons might be used by the professional breeder to alter the color or size of holly berries without affecting the other characters of a desirable holly cultivar.

Another tool for the plant breeder is colchicine. This chemical when applied to a growing point in the correct concentration and at the proper time will effect chromosome doubling. It has been used to produce new tetraploid

cereal, flower, fruit and vegetable cultivars from diploid material. The vegetative parts, flowers and fruits of tetraploids are usually larger than those of the corresponding diploids. Colchicine has also been used to double the chromosomes of a sterile interspecific hybrid to produce a fertile amphidiploid. The value of colchicine to the holly breeder can only be determined by future research.

Progeny Selection

Regardless of the breeding method used, superior individuals may appear sporadically during the breeding program. It is wise to perpetuate these superior individuals vegetatively so that they may be compared with later selections at the same stage of development. A successful breeder is critical in the selection phase and it is not unusual for him to discard all but one per cent of an F_2 population of a cross within species. It is a mistake to name and introduce countless selections that have only slight variation and are no better than established varieties.

Once hybrid populations are produced they should be grown under uniform cultural conditions so that no bias in selection occurs. Selection within populations is a continuing process and its duration is dependent on the type of characters one is dealing with. Most leaf characters might be decided upon after two years, while habit of growth or some fruiting characters may require a longer period of observation. The best procedure is to eliminate individuals with undesirable characters as quickly as they are discernible so that the comparison of superior characters remains among fewer individuals. When a population is reduced to a few outstanding individuals, they should be vegetatively propagated and tested under different environments in comparison with standard cultivars. Data from these tests should determine the suitability of any selections as new cultivars.

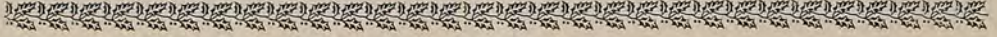
Concluding Remarks

The rate of progress in holly breeding depends on several factors. The breeder must be able to draw upon his imagination and experience to create a new hybrid. He must be observant during the whole course of his program, be able to spot superior individuals, and be strong-willed enough to discard all inferior ones as soon as possible. Much time and energy can be saved through a mutual exchange among holly breeders of plant material and information as the program progresses. Cooperative agreements providing for the testing of new material and the protection of the originator would benefit the program. Radical procedures, such as interspecific hybridization and thermal neutron irradiation, should be thoroughly investigated. The rate of progress in holly improvement will depend upon the ingenuity of the holly breeder who can in turn be materially assisted by the cooperation of the amateur, commercial, and professional groups interested in holly culture.

Research on hybridization of holly has been initiated at the United States National Arboretum, Washington, D. C., and more complete information on the behavior of various crosses is expected. This long-term breeding program is suitably located at a federal institution where pertinent information may be compiled, and where necessary facilities for the maintenance of living collections and herbarium specimens are available.

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USES OF THE HOLLIES



Hollies and Landscape Architecture

ROBERT E. MARVIN

The things man has done before greatly influence what is done today. So, before discussing hollies in the landscape for present day living, a careful analysis of what has been done with hollies and with gardens in the past should be made.

First, there was a formal type landscape architecture in America. The formality and the exactness here demanded that the hollies be placed in relationship to the pattern of the garden. They were generally balanced with the walks, walls, gates, borders, and other items included in the garden.

Next, there was a great movement toward naturalizing plants in the landscape. This tended to scatter the hollies in no particular pattern throughout large flower beds.

During the Victorian Era, the next period of landscaping in America, a scientific development of new varieties—not only of hollies but of many other plants—was so great that landscaping consisted of choosing beautiful plants and scattering them throughout the lawn area where each individual plant could be seen at its best.

Today, in many yards, one will see hollies used in two or more of the above methods.

Understanding the good and bad practices of these designs will help one to use hollies in an acceptable location in the landscape fashionable today. The

formal period was probably the best so far as art was concerned since its rigid design demanded that the hollies become part of the composition. This forced unity through the elements and principles of design.

In the other two periods, the hollies were often a part of nothing, but were in themselves individuals scattered here and there as the owner increased his collection. Of course, design and unity are lacking when plants are scattered here and there with little relationship to other objects in the yard. Although the holly berries, leaves and entire plant are pretty, this is not enough; they do not create a beautiful work of art unless they become a pleasing part of the overall landscape.

There are two distinct factors to consider in landscaping a yard. Everything must be arranged in that yard for the convenience of its users—walks, walls, services, drives, hollies, other plants, and everything else. All these elements must be combined into one pleasing design which should be a work of art employing all the necessary elements and principles of all Fine Arts. From these considerations one may conclude that hollies in the landscape must be located in relationship to everything else in the landscape; that before the hollies can be placed, a plan must be prepared for their proper location and also everything that is to go into the landscape; and that planting a yard is a skillful art. This art is called landscape architecture.

As a general rule, the yard should be divided into three parts; the front, or public area, which should be simple and dignified; the service area, which should be designed for usefulness and as a work area; and the family area. The family area would contain not only the hollies but, in addition, all the hobbies and outdoor living facilities. This area should

be screened from the public by fences, walls, screens or hedges. In it would be included the terrace for outdoor living, the barbecue pit for outdoor entertaining, the play yard for the children, the rose garden for the mother, and the holly collection for the father. It should be designed around the needs and hobbies of the family. It should appear to be a continuation of the home, so that the living area, instead of being confined to a small enclosure within the walls of the home, would be extended to the lot lines of the property.

Hollies have several characteristics which make them one of the more popular plants in America today. Many predict they will become even more popular in the future. They fit into the above plans very well. They give color through their red, yellow, orange, black, and even white berries. They have beautiful foliage varying from very fine to very coarse textures and modifying from very beautiful dark greens to grays and into other variegated forms. Many varieties also have the distinction of having spines and beautifully shaped leaves, some smooth, some crinkly, some cupped, and many other interesting shapes.

The hollies can also be found in almost any shape and size. There are spreading ones, columnar ones, vase shapes, and almost every shape that one might want or need in the landscape. From a cultural standpoint again we find that the hollies have many advantages; they will grow in a wide variety of soils and in a range of climates which extends nearly all over America.

One can see from these characteristics that the hollies have unlimited possibilities and that the people who predict the hollies will become even more important in landscape planting are undoubtedly correct.

Hollies, due to their tremendous variance, can be used in many different ways. Some of the most obvious and important ways will be discussed in detail in the following paragraphs.

Some varieties of hollies make excellent trees which may be used as specimen trees where the foliage can commence at the ground and follow to the top. The branch texture and berries can make these the talk of the whole city. The tree forms of hollies will vary from this to smaller trees ten or fifteen feet in height where the lower limbs have been re-

moved to expose the trunk or to show an interesting trunk formation. This last type will increase in demand in the future and will be used in foundation planting to replace the pyramidal cedars off the corners of buildings.

They can be used as the motif of the garden where their beautiful foliage, their contrast in texture, their form, and their wonderful berries will completely dominate the scene. In this instance, the garden should be designed so that these hollies become an integral part of the overall design and lend themselves to an overall picture.

Hollies can also be used with other plants in flower beds. In this case, extreme care must be given to foliage, texture, shape, and size, as related to other plants used, as well as to all man-made objects in the flower beds or bordering areas.

Hollies lend themselves especially well to foundation plantings because they are found in almost any size, texture and form, being compatible to various building materials and architectural styles.

Hollies can also be used in tubs and moved from place to place in the yard. During their fruiting seasons, they can be moved to the patio, thus giving red berries just outside the picture window.

Hollies are one of the best plants known for hedges, screens and barriers where a variety can be found to meet almost every need. They will form almost any size or shape hedge desired. Most varieties can be sheared to form an almost flat, green wall; they can be pruned to form a looser though still dense wall; or they may be left free standing where the different varieties will give an unlimited field from which to choose.

Another use of hollies would be espaliers used against a brick wall or fence. They are being used very successfully for this purpose, and the writer believes that this is one of the uses that will be expanded greatly as experiments increase in the future.

Hollies can be used as individual specimens scattered throughout the yard. This is generally not desirable, however, since it tends to disunity, as well as increased work in maintenance. Instead, these plants should be spotted and placed as a definite part of the landscape plan.

Many types of hollies can be found to work as edgings for beds, and there is a

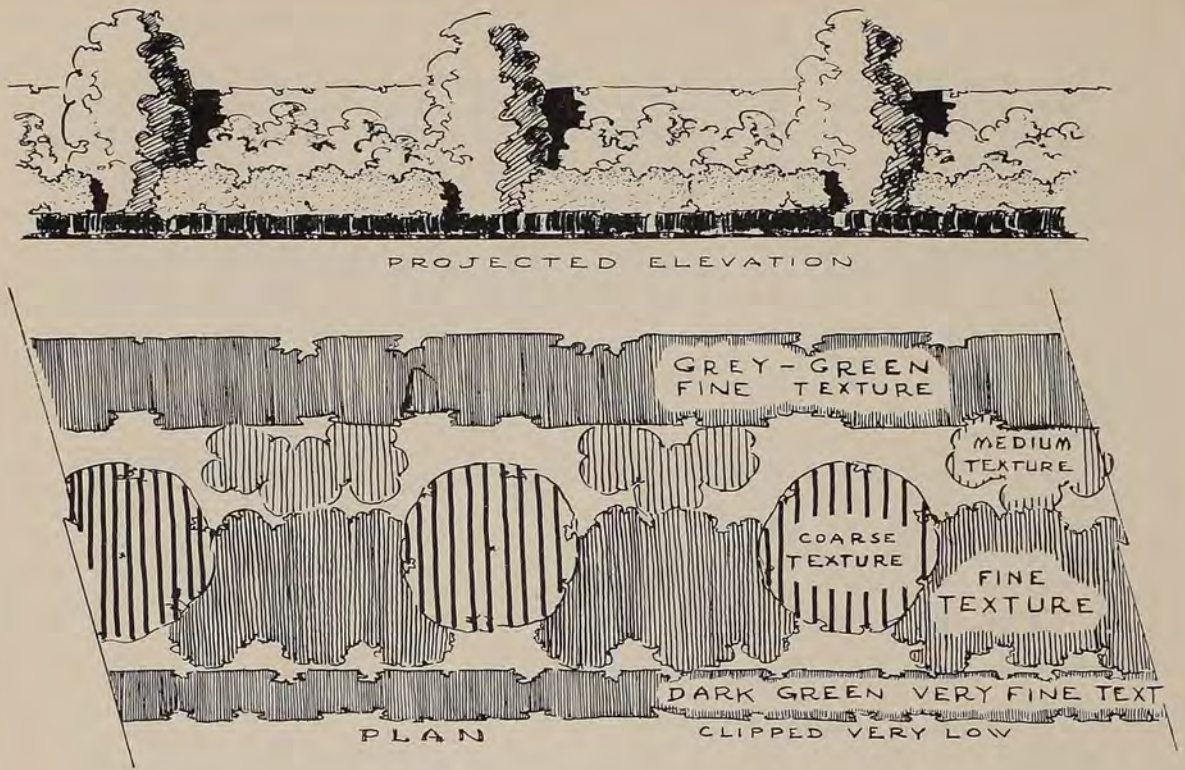


Illustration 44.
Landscape Sketch No. 1

possibility that some will be used as ground covers in the future.

A knowledge and understanding of the above discussion is not enough to create a beautiful, artistic garden. In addition, one must have an understanding of the elements and principles of art and then must take all the above characteristics and possibilities and combine them into a creative design. It would be impossible here to completely discuss art as it applies to landscape architecture. The following suggestions, however, are some that may help in combining hollies with other plants and the architecture which is used on the reader's property.

The exact uses of specific hollies for individual purposes have been purposely avoided in this article. The wide selection of kinds available, their versatility for landscape uses, their hardiness in the locality in which they are to be planted,

and the amount of money on hand for their purchase make such general recommendations difficult. The services of a landscape architect are always advisable, yet the home-owner wishing a holly garden can design his own. A leisurely and purposeful visit to an arboretum or holly nurseryman will help the planner in determining the plants needed for the effects he wishes to achieve. His labors here will be amply rewarded.

Sketch No. 1

This is a plant border which could be any length over forty-five feet. It could be used to hide clotheslines, to screen the neighbor's dog-yard or to give privacy for outdoor living. The way to use this sketch would be to choose plants and, for the sake of this article, hollies would be chosen to fit each requirement which would meet the textures, forms

and colors required and prescribed above.

Choose a hedge for the background which will grow six feet or higher and will have a dull gray color for contrast for the more striking textures and colors of the foreground planting. This hedge should be a fine texture, or a fence could be substituted in its place. The bed should be a minimum of eight feet wide and have a low clipped border in front, six to eight inches tall, dark green with a fine texture.

The specimens should be the tallest plants in the bed spaced fifteen to twenty feet apart, depending on the ultimate size, and should be of the coarsest textures. The taller plants in the background against the back hedge should be lower in height than the specimens. They would be massed for an airy effect using three to five plants in a group. Their textures should be medium and a definite step-down from the specimen plants. In front of this, choose a much lower plant with medium fine texture which will be another definite step-down in size and texture from the plants just discussed. Probably some twelve to fifteen plants would be used in this group. It may be understood from this that the ideal way to properly plant a border is to design it first. This will determine the size, shape, texture and color of foliage needed. Finally, choose specific plants which meet these requirements.

Sketch No. 2

Sketch No. 2 uses the same principles as described for the border above except that for this problem it is assumed that there is a six-foot stockade fence around a corner of the yard and that the fence and the home seem too close together. In this case, locate the specimen plants, which will be the heaviest textures and the tallest plants, in strategic spots as shown in the above sketch. Then gradu-

ate down to medium textures and then finally to fine textures in the far corner just as was done in the border above. This will create unity and harmony but, in addition, because of this arrangement, will gain depth since one will be looking past the heavy texture toward the small textures which will create a definite illusion in size and depth for this corner.

Sketch No. 3

Next is an illustration showing a proposed garden and the home. Notice that the foundation planting is not thought of as just a strip of plants around the house. The plants chosen for the foundation of the house must be chosen not only with the thought of the house but with all other plant borders and architecture in the garden. Notice also that the corner planting suggestions are small trees replacing the pyramidal arbor-vitae and other evergreens so commonly used. These could be hollies with the lower limbs removed showing their branch structure, thus forming a pretty, small evergreen tree which would never grow out of scale. Notice, also, that a few dwarf specimen plants are used and connected with a low mass planting or ground cover.

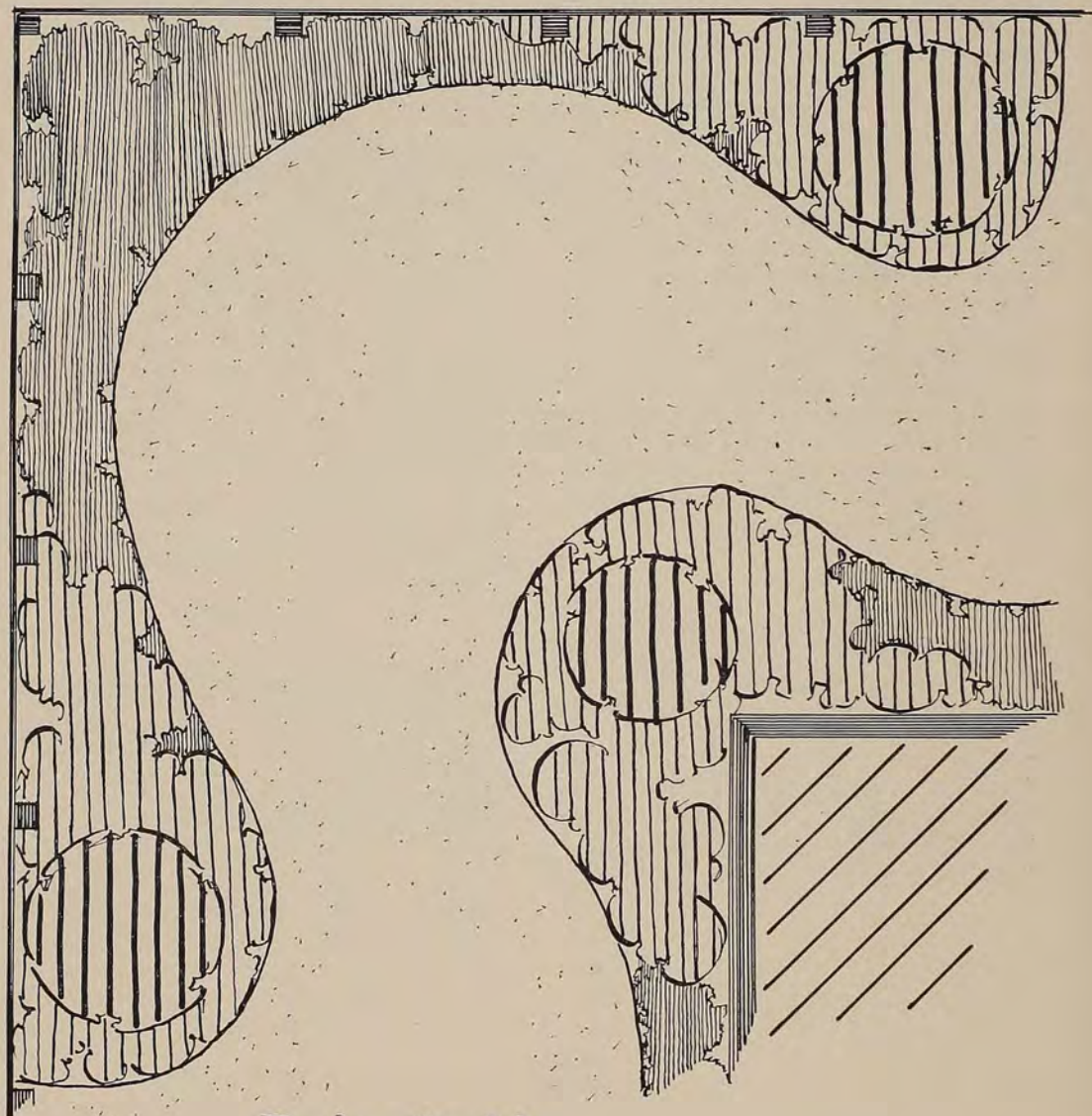
In summary, it should be emphasized that plants alone cannot spell the success of one's landscaping. Instead, success is realized through the artistic design which molds these plants, architecture and ground forms into a useful and beautiful garden.

Robert E. Marvin, landscape architect, Wildwood Designers and Contractors, Wildwood Garden Shop, Walterboro, South Carolina, editor of Wildwood Garden News, a popular lecturer and writer, has long had the dream and aim of bringing professional landscape design to the average home owner in South Carolina.

Texture symbols in Sketches 2 and 3 on the following pages are the same as those penned in Sketch No. 1

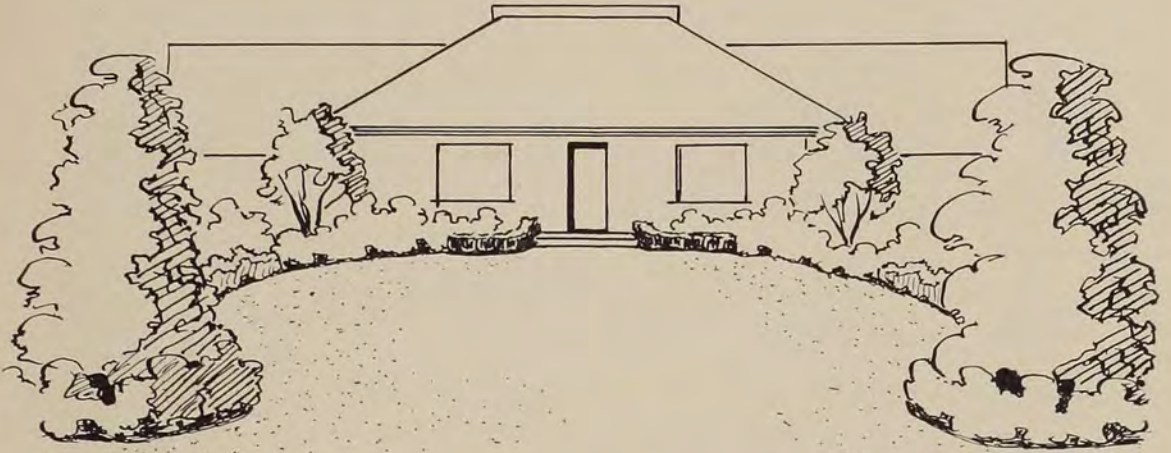


P E R S P E C T I V E

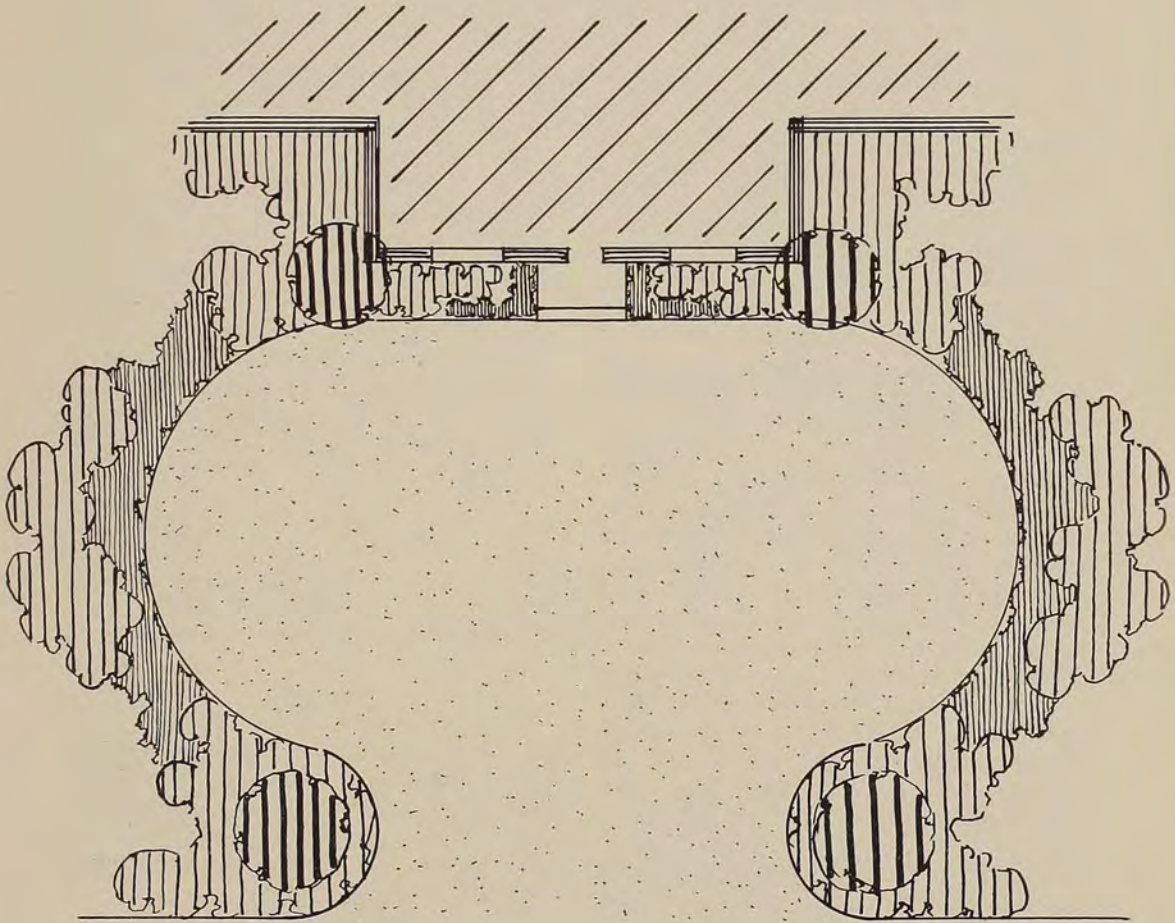


P L A N

Illustration 45.
Landscape Sketch No. 2

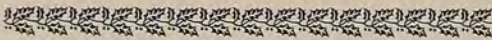


P E R S P E C T I V E



P L A N

Illustration 46.
Landscape Sketch No. 3



Evergreen Hollies

for the United States

H. GLEASON MATTOON

At least one of the many species of *red-berried evergreen hollies* will grow in most states. Not all will do well in any one state. Below an attempt is made, with information gleaned from correspondence and observations, to recommend certain hollies for specific areas. It should be remembered, however, that because a holly is listed as growing in a certain state, it does not mean that it will do well in all parts of that state. For instance, while *Ilex opaca* is listed as thriving in California, it would be foolish to attempt to grow it in the alkaline areas or the hot, arid sections. Even with pampering, it will not survive.

It should be remembered, also, that named strains, varieties, selections or cultivars, that originated in the warmer parts of the country have very much less chance to survive when planted in states bordering Canada than those that were selected from trees originally growing near the northern border of their natural ranges. In like manner, all named varieties of *Ilex aquifolium* will not do equally well in a given location in this country. That is understandable when one realizes that *I. aquifolium* is indigenous to southern Norway, the Black Forest of Germany, parts of Poland and Czechoslovakia, in the Alps at four thousand feet elevation, in the Caucasus Mountains of Russia and in west China, as well as in the British Isles, southern Europe, on the Canary Islands and on several in the Mediterranean, also in North Africa.

Because of its wide distribution, it would seem obvious that there must be great variation in its hardiness as well as in form. If one knew the origin of the

named varieties that have come from England, Holland, and France, he might be more intelligent in making selections for hardiness. A holly that originated in Poland would seem suitable for Michigan, New York, or New England while one that grew on the island of Corsica probably would find Louisiana, Alabama, and Florida more to its liking.

Superficial knowledge of English varieties and careless choice of American types have led to many planting mistakes. Failures in the broad area from Massachusetts to Iowa and south to Texas, where they have occurred, have been due to the selection of the wrong holly or its variety as often as to poor planting and care.

The fact that but few varieties of the English hollies and a small number of American and Oriental species and their varieties are mentioned under a state heading should not be construed as condemning all other kinds in that state. It means only that we have that much knowledge of success with hollies in that state at this time.

Alabama

Ilex aquifolium (protected from the afternoon sun—use heat-tolerant kinds, such as *alcicornis*, 'Fox,' *fructu-luteo*, and 'Lichtenthal'), *cassine* (native), *chinensis*, *ciliospinosa*, *cornuta* and varieties, *cumulicola*, *integra*, *latifolia*, *myrtifolia*, *opaca* (native) (southern varieties are recommended), *pedunculosa*, *perado*, *pernyi* and vars., *rotunda*, and *vomitorea* (native).

Arizona

Ilex aquifolium (under controlled conditions), *ciliospinosa*, *cornuta* and vars., *opaca* (in parts, when pampered), *pedunculosa*, and *pernyi* and vars.

Arkansas

Ilex aquifolium (especially *argentea marginata*, *aurea regina*, *ciliata major*, 'Fox,' 'Shepherd,' 'Smith,' and 'W. J. Bean'), *cassine*, *ciliospinosa*, *cornuta* and vars., *opaca* (native) (many varieties will thrive), *pedunculosa*, *pernyi*, and *vomitorea* (native).

California

Ilex aquifolium (many varieties, such as *alcicornis*, 'Camelliaefolia,' 'Chambers,' *ciliata major*, and 'W. J. Bean'), *chinensis*, *ciliospinosa*, *cornuta* and vars..

fargesii, *integra*, *latifolia*, *opaca* (in the north half and with pampering in other limited areas), *pedunculosa*, *pernyi* and vars., *rotunda*, *rugosa*, and *vomitorea*.

Colorado

In the dry eastern half only with irrigation. *Ilex ciliospinosa*, *opaca*, *pedunculosa* and *pernyi*.

Connecticut

Ilex aquifolium (along the rivers and the Sound, especially *altaclarensis*, 'Belgica,' 'Jan van Tol,' 'Scotica,' 'Shepherd,' and 'W. J. Bean'), *ciliospinosa*, *opaca* (native) (use northern selections), *pedunculosa*, and *pernyi*.

Delaware

Ilex chinensis, *ciliospinosa*, *cornuta* and vars., *opaca* (native), *pedunculosa*, *pernyi*, *rotunda*, and *rugosa*.

Florida

Ilex aquifolium (varieties *alcicornis*, 'Fox,' *fructu-luteo*, 'Lichtenthal' (with shade), and 'Marnocki,' *cassine* (native), *chinensis*, *cornuta*, *cumulicola* (native), *latifolia*, *opaca* (native), *pedunculosa*, *pernyi*, and *vomitorea* (native)).

Georgia

Ilex aquifolium (on a north slope and under high shade), *cassine* (native), *chinensis*, *ciliospinosa*, *cornuta* and vars. *integra*, *latifolia*, *opaca* (native) (use Southern varieties), *pedunculosa*, *pernyi* and vars., *rotunda*, and *vomitorea* (native).

Idaho

Ilex opaca (doubtfully suitable in the valleys).

Illinois

Ilex aquifolium (suggest trying *altaclarensis*, 'Belgica,' *ciliata major*, *integrifolia*, 'Jan van Tol,' and 'Shepherd'), *ciliospinosa*, *cornuta* f. *burfordi* (in south), *opaca* vars., *pedunculosa*, and *pernyi*.

Indiana

Ilex aquifolium (varieties *altaclarensis*, 'Belgica,' *integrifolia*, 'Jan van Tol,' 'Shepherd,' and 'W. J. Bean'), *ciliospinosa*, *cornuta* (in south), *opaca* (native in extreme south) (any of northern varieties), *pedunculosa*, and *pernyi*.

Iowa

Ilex aquifolium (varieties *altaclarensis*, *integrifolia*, and 'Jan van Tol'), *ciliospinosa*, *opaca* (northern varieties), *pedunculosa*, and *pernyi*.

Kansas

Ilex aquifolium (suggest trying *altaclarensis* and 'Jan van Tol'), *ciliospinosa*, *opaca* vars., *pedunculosa*, and *pernyi*.

Kentucky

Ilex aquifolium (varied climate should suit many varieties such as *altaclarensis*, *aurea regina*, 'Belgica,' *ciliata*, *ciliata major*, 'Fox,' *integrifolia*, 'Jan van Tol,' 'Shepherd,' and others), *ciliospinosa*, *cornuta* and var., *fargesii*, *integra*, *opaca* (native) (many varieties will thrive), *pedunculosa*, *pernyi* and vars., *rotunda*, *rugosa*, and *yunnanensis*.

Louisiana

Ilex aquifolium (varieties *alcicornis* *angustifolia*, 'Chambers,' *fructu-luteo*, 'Lichtenthal,' many of the variegated, 'Smith,' and others), *cassine* (native), *chinensis*, *ciliospinosa*, *cornuta* and vars., *cumulicola*, *integra*, *myrtifolia*, *opaca* (native), *perado*, *pernyi* and vars., *rotunda* and *vomitorea* (native).

Maine

Ilex opaca (may be tried in southwest; northern selections are obviously suggested).

Maryland

Ilex aquifolium (varieties *altaclarensis*, *argentea marginata*, *aurea regina*, 'Belgica,' *ciliata major*, 'Hodgins,' 'Jan van Tol,' 'Shepherd,' and others), *ciliospinosa*, *cornuta* and vars., *opaca* (native) (most of the varieties will grow), *pedunculosa*, *pernyi* and vars., *rotunda*, *rugosa*, *vomitorea*, *yunnanensis*, and others.

Massachusetts

Ilex aquifolium (varieties *altaclarensis*, 'Belgica,' *ciliata*, *ciliata major*, *integrifolia*, 'Jan van Tol' and 'Whitney'), *opaca* (native along coast) (use northern varieties), *pedunculosa*, *pernyi* and *yunnanensis*.

Michigan

Ilex aquifolium ('W. J. Bean' is growing in Detroit), *opaca* (northern varieties), and *pedunculosa*.

Minnesota

Ilex opaca and *pedunculosa* (worth trying in protected places in the southern cities).

Mississippi

Ilex cassine (native), *chinensis*, *cornuta* and vars., *cumulicola*, *integra*, *latifolia*, *myrtifolia*, *opaca* (native) (all southern varieties will grow), *perado*, *pernyi* and vars., *rotunda*, *rugosa*, *vomitorea* (native), and others.

Missouri

Ilex aquifolium (varieties *altaclarensis*, *ciliata*, *ciliata major*, *integrifolia*, 'Jan von Tol,' 'Robinson,' and others), *ciliospinosa*, *cornuta* and vars., *opaca* (native in part) (many varieties will do well), *pedunculosa*, *pernyi* and vars., and *rugosa*.

Montana

It is questionable if any varieties will grow.

Nebraska

Ilex opaca (in protected places) and *pedunculosa* should be tried.

Nevada

It is questionable if any varieties will grow.

New Hampshire

Ilex opaca (supposed to have grown near Portsmouth; try northern varieties) and *pedunculosa*.

New Jersey

Ilex aquifolium (many varieties), *ciliospinosa*, *cornuta* and vars., *opaca* (native) (most varieties will do well), *pernyi* and vars., *rugosa*, and *yunnanensis*.

New Mexico

Not considered favorable for hollies, although *Ilex ciliospinosa*, *opaca*, *pedunculosa* and *pernyi* might be tried.

New York

Ilex aquifolium (many varieties on Long Island, the hardier in Buffalo, Rochester, Syracuse, and Westchester County) (*altaclarensis*, 'Belgica,' *ciliata*, *ciliata major*, and 'Jan van Tol'). *I. ciliospinosa*, *pedunculosa*, and *pernyi* should be tried in many places. *I. cornuta* and *rugosa* should be on Long Island. Northern varieties of *I. opaca*

(native on Long Island) should do well in all parts of the State except in the Adirondacks.

North Carolina

Ilex cassine (native in the east), *chinensis*, *ciliospinosa*, *cornuta* and vars., *fargesii*, *myrtifolia*, *opaca* (native) (use all varieties according to locations), *pedunculosa*, *pernyi* and vars., *rotunda*, *rugosa*, *vomitorea* (native in east), and *yunnanensis*.

North Dakota

Not favorable for evergreen hollies.

Ohio

Ilex aquifolium (the hardier varieties, such as *altaclarensis*, 'Belgica,' *ciliata*, *ciliata major*, *integrifolia*, 'Jan van Tol' 'Shepherd' and 'W. J. Bean'), *ciliospinosa*, *opaca* (the northern varieties), *pedunculosa*, and *pernyi*.

Oklahoma

Ilex aquifolium (many varieties will do well), *cassine*, *chinensis*, *ciliospinosa*, *cornuta* and vars., *opaca* (native) (use any but Florida varieties), *pernyi* and vars., *rotunda*, and *rugosa*.

Oregon

Ilex aquifolium (many varieties), *cornuta*, *fargesii*, *opaca*, *pernyi*, and *rotunda*. Best to follow recommendations of the Oregon State College at Corvallis.

Pennsylvania

Ilex aquifolium (many varieties will grow in southern half, especially *altaclarensis*, *aurea regina*, 'Belgica,' *ciliata*, *ciliata major*, *integrifolia*, 'Jan van Tol,' and 'Shepherd'), *ciliospinosa*, *cornuta* and vars., (in the southeast), *opaca* (native in southeast) (all northern varieties should prove satisfactory), *pedunculosa*, *pernyi* and vars., and *rugosa*.

Rhode Island

Ilex aquifolium (varieties *altaclarensis*, 'Belgica,' *integrifolia*, 'Jan van Tol,' and 'Shepherd'), *ciliospinosa*, *opaca* (native) (northern varieties are recommended), *pedunculosa*, and *pernyi*.

South Carolina

Ilex aquifolium (all varieties can be grown on a northern slope with high shade), *cassine* (native), *chinensis*, *cilio-*

spinosa, *cornuta* and vars., *cumulicola* (near the coast), *fargesii*, *integra*, *latifolia*, *myrtifolia*, *opaca* (native) (the southern varieties do best), *pedunculosa*, *pernyi* and vars., *rotunda*, and *vomitorea* (native).

South Dakota

Ilex opaca, and *pedunculosa* (can be tried in protected places).

Tennessee

Ilex aquifolium (all varieties recommended under high shade), *cassine*, *chinensis*, *ciliospinosa*, *cornuta* and vars., *fargesii*, *integra*, *latifolia*, *opaca* (native) (most varieties will thrive), *pernyi* and vars., *rotunda*, and *vomitorea*.

Texas

Ilex aquifolium (especially *alcicornis*, 'Fox,' *fructu-luteo* and 'Lichtenthal,' are worth trying), *cassine*, *chinensis*, *cornuta* and vars., *integra*, *opaca* (native in places), *pernyi* and vars., *vomitorea* (native in places).

Utah

It is questionable if any varieties will thrive.

Vermont

Ilex opaca, and *pedunculosa* (in protected places in the southern end).

Virginia

Ilex aquifolium (most of the varieties, if given partial shade), *cassine*, *chinensis*, *ciliospinosa*, *cornuta* and vars., *myrtifolia*, *opaca* (native) (use northern varieties in western half), *pernyi* and vars., *rotunda*, and *vomitorea*.

Washington

Ilex aquifolium (is in its prime, except in the mountains), *cassine*, *ciliospinosa*, *cornuta*, *fargesii*, *latifolia*, *opaca* (in most places), *pernyi*, and *rotunda*.

West Virginia

Ilex aquifolium (does well, especially *altaclarensis*, 'Belgica,' *ciliata*, *ciliata major*, 'Fisher,' 'Jan van Tol,' *integri-folia*, and 'Shepherd') *ciliospinosa*, *cornuta* and vars., *opaca* (native) (some of the choicest selections have been made in the State; any varieties but those from Florida will thrive in all parts), *pedun-*

culosa, *pernyi* and vars., and *yunnanensis*.

Wisconsin

Ilex opaca (northern varieties, in protected places) and *pedunculosa* (worth trying).

Wyoming

It is questionable if any varieties will grow.

As the usefulness of the native and introduced hollies becomes more appreciated by those in areas where they are not now so well known, trial plantings will be made by venturesome gardeners, horticulturists, and nurserymen. In this way, the hardiness ranges of the hollies will be greatly extended. This list could not possibly have been compiled except from the results of the past efforts of these enterprising individuals. These unknown "hollyists" merit our sincere commendation.

H. Gleason Mattoon, consulting horticulturist, Narbeth, Pennsylvania, formerly president of the Pennsylvania Forestry Association and editor of *Forest Leaves*, formerly president of the Pennsylvania Nut Growers Association, is the editor and publisher of *Horticultural Newsletter*. He is the author of *Growing Evergreen Hollies* and numerous articles on horticulture and forestry subjects. At present, he is editor of the Sixth Edition of the *Plant Buyer's Guide*.

Hollies for Hedges, Screens, and Barriers

DONALD WYMAN

Some of the evergreen hollies make excellent hedge plants because of their dense, twiggy growth and the ease with which they recover from shearing. The deciduous species are not often used for this purpose, however, since there are many better and more vigorous deciduous hedge-making plants available. Evergreen holly hedges and screens are certainly nothing new in North American gardens, since they were used in the days of Colonial Williamsburg and in the garden of George Washington at Mount Vernon. Today, with many more species

of plants available for ornamental planting, they are still popular, for, with some of the more recently introduced Oriental species, the evergreen hollies are dense in habit and some have prickly leaves, so that they are ideal for hedges, screens, and barriers in areas where they prove thoroughly hardy.

The planting of a hedge requires some special consideration. In the first place, it should be decided exactly where the hedge is to be placed, what it is supposed to accomplish, and how tall it will be allowed to grow eventually. Some of the older holly hedges, planted fifty years and more ago, are maintained at about six feet in height. Others, planted specifically for screening purposes, are allowed to grow much taller. It is essential that this plan for the future be considered at the start so that sufficient lateral space can be allowed for the proper growth of the plants.

For instance, if a hedge is to be planted to border a permanent walk, it would be placed four feet from the walk if it were to be maintained at about five feet in height, but considerably farther back if it were to be allowed to grow to ten, fourteen, or more feet in height. Too many hedges are ruined because foresight is not used at the start in allowing for the definite line where the plants are to be placed. If too near the walk, the plants would be sheared to prevent them from crowding the walk before they reached the desired height. The base of the plants would then become open, lacking branches, and the entire hedge would be unsightly and possibly even useless.

In allowing for space on the ground for the width of the hedge, it should be remembered that all hedges should be wider at the base than at the top, especially hollies, if they are to be covered with branches directly to the ground. Admittedly, there are some faster-growing plants like privets and barberies that are sheared with their sides perpendicular, but there are many other plants that cannot withstand this type of pruning. Hollies are definitely in this latter category. More lateral space is needed at the base to allow for sufficient light, air, and even moisture to the lower branches. So often one sees an older hedge, sheared perpendicularly, with the lower branches all dead or dying and hence plenty of room for animals to run

through it. Such hedges are not satisfactory chiefly because lower branches of the plants are not allowed to grow out naturally and reach for sunshine. So it is best, if one wants a dense hedge covered with branches to the ground, to trim them so that they are wider at the base than at the top.

Another important item to consider is never to plant a hedge exactly on the property line, no matter how congenial one's present neighbors may be. Properties can change hands unexpectedly. That part of a hedge hanging over the property line on the abutting property belongs to that property owner, and he can do with it as he sees fit. In other words, when planting along a property line, be certain to place the hedge so that at its desired height it can be maintained all on one's own property. In this way, one retains full control of the planting, manner of clipping, and removal of the plants if and when desired.

The size of the plants used can be an economic question. Small plants cost less, are more easily handled and are less expensive to replace. On the other hand, it takes longer, sometimes, for small plants to serve effectively as a hedge than larger plants. However, in hedge planting, it is frequently more desirable to use smaller plants since then they can be spaced closer together at planting time. Three or four feet apart is about right to space three-foot plants. If this proves too costly and one is willing to wait for growth, they can be spaced farther apart and not be expected to serve as a barrier for several years. On the other hand, if the hedge is desired to look and act as a hedge immediately, one should select large plants, space them so that their branches touch, with the resulting increased initial cost.

When small plants, three to four feet high, are to be used, it is best, if possible, not to dig individual holes for each plant; rather a long ditch is preferable, excavated deeper than necessary especially if the soil is poor, and filled in the bottom with well-rotted manure and, on top of that, good loam. Hedges planted with this care get off to good growth at the start. Also, during dry periods, it is much easier to keep the hedge watered. A slight depression can be left along the ditch which will be much more conducive to easy watering than if each plant had to be watered separately.

Hollies planted as screens are usually of the larger sizes, planted as individual trees, seldom sheared except to improve the density of their branching when desired. It is often best to restrain the tops of such screens by judicious pruning until the side branches are sufficiently numerous and well-grown to provide the needed screen. Sometimes an overall shearing, or even a pruning of the tips of the branches here and there, is sufficient to bring about vigorous growth. Once one has planted hollies and noted their growth habits, it is not long before he can acquire the desired skill in bringing about more dense growth. Some species like *Ilex crenata*, the Japanese holly, are more dense in their growth habits than, say *I. opaca*, the American holly, and so require less attention in this respect.

Trimming requires a knowledge of the growth habits of the different species used. For instance, *Ilex crenata*, *glabra*, *cas sine*, and *vomitaria*, are all vigorous-growing shrubs or small trees which tend to grow vigorously from the base of the plant, although they sometimes do grow with a single trunk. Because of this base-growing tendency, these can be cut to within six to twelve inches from the base if desired early in the spring, and be expected to form many buds and new shoots at this point during the current year. We have done just this with a planting of *I. glabra*, Inkberry, in the Arnold Arboretum at Jamaica Plain, Massachusetts, because it was very weak and spindly at the base. Eight-foot plants were cut down to six to twelve inches in height in April. At the end of that growing season, they were excellent, dense, bushy plants about twelve to eighteen inches high.

The English and American hollies are normally trees, usually with a single trunk, and one should be extremely careful in treating them this roughly. In fact, it might be better not to cut them in this fashion unless one has had experience with doing this in one's particular locality. Some of the American hollies in their native habitat are frequently handled this way, but in other areas, where climate may not be too congenial, they would suffer materially. Hence, these species might best be treated with more care and be cut back this much only after careful investigation has proved that it can be done.

When the small plants are first planted, they might well be pruned back heavily on a majority of their shoots, for in this way dense growth is encouraged. It is much better to restrain the plants in height at this period in order to encourage basal branches, since young plants produce these more quickly than older plants.

Actual shearing of most kinds of holly hedges need be done but once a year and that is at just about the time in the very late spring when they have completed their current growth. Shearing in the late summer may cause new growth to form that will not have sufficient time to mature before winter, and so it may be killed by winter cold. Heavy shearing in the winter is to be discouraged, for it may let in more sunlight and wind to branches normally accustomed to shade and protection, and these in turn may be burned by winter sun or winter cold.

Making an early barrier of a young hedge is not always possible just with small, young plants. However, if, after the plants are properly planted, chicken wire is worked into the line of living foliage, this will do the job, and probably will rust out of usefulness by the time the plants have grown sufficiently themselves to serve the purpose.

Evergreen hollies in larger sizes have been used as sound deadeners along noisy thoroughfares in some ornamental plantings and serve well in this category. As protection from winter winds, they seldom are satisfactory, for high, dry winds at this time tend to burn the foliage and make the plants unsightly. But, as hedges, screens, and barrier plants, the following hollies serve well in many an area:

Ilex aquifolium. English holly. The lustrous, prickly, evergreen leaves of this species make its use as a hedge and screen especially desirable. Normally, it grows as a tree, but, with the right kind of pruning when it is very young, it can be forced to grow with several leaders from the base—an asset for any hedge plant. A careful study of the many varieties of this species will undoubtedly show several that, because of smaller foliage and more dense branching, regardless of fruit production, make such plants better for hedges. Being tall, it is one of the better screens. Zone 6.

Ilex cassine. Dahoon holly. A vigorous-growing, southern evergreen, considerably used in making hedges. Zone 7.

Ilex cornuta. Chinese holly. Especially mentioned here for its forma *burfordii* which is the Oriental holly most resistant to the dry climate in many parts of the South. One landscape architect in Dallas, Texas, told me that if he could have only one evergreen for planting in that hot, often dry area, it would be the 'Burford' holly. Zone 7.

Ilex crenata. Japanese holly. There are over thirty named varieties of the species, some very hardy as *I. cernata* f. *convexa*, convexleaf, and *I. cernata* f. *microphylla* littleleaf Japanese holly, which are hardy in Zone 5; others low and excellent for bordering walks as 'Helleri' and 'Kingsville.' All are extremely dense and very amenable to shearing and, because of their small leaves and dark green color, are widely used as hedges. *I. cernata* f. *convexa* has been termed the "hardest substitute for boxwood in New England" and justly so. It is a vase-shaped plant which needs little shearing as a hedge and can be easily restrained at almost any height from one to eight feet. Other useful varieties of the Japanese hollies include: 'Stokes' 'Hetzi' 'Glass,' 'Green Island,' and 'Kingsville Green Cushion.' All of the Japanese hollies are among the most desirable as evergreen hedge-making materials, especially suited for formal planting. They constitute the few hollies which can be kept in fairly good condition by shearing the sides vertically. Old plants of the taller-growing types make excellent screens. Zone 6.

Ilex glabra. Inkberry. Another good, hardy evergreen holly, with comparatively small box-like leaves doing best in moist or wet soils. Because of this, it may not do as well under city conditions as *I. crenata* and its varieties. Nevertheless, the Inkberry is an excellent evergreen, not nearly as stiff in habit, hence not as good a barrier as *I. crenata* varieties. However, its lustrous, dark green leaves, and its ability to recover quickly from heavy spring pruning, make it one of the hollies to be considered for hedge purposes. Zone 3.

Ilex opaca. American holly. The maze of American hollies at Williamsburg, Virginia, and another at Mount Vernon, are ample proof that the hedge-making qualities of this native plant were well known to the early American settlers. Many varieties have been named, some better than others for hedge-making because of better foliage or more dense growth. In any event, because this holly varies so much when grown from seed, it is highly advisable, if one wants a uniform-appearing hedge, to buy plants all of one named variety (produced by vegetative means) rather than grown from seed or from plants collected in the wild. A hedge of seed-grown plants will have a variation in sex, habits, leaf color, and size that will be most noticeable and spoil the effect of an otherwise congruous hedge. This species, like the English holly, is a tree with spiny leaves, but pruning it properly while young can force it to produce several leaders from the base. Because this species is a tree, it also makes a good screen.

Ilex vomitoria. Yaupon holly. Another southern evergreen that is being used considerably in the South for hedge and screening purposes. Informal, unpruned hedges of well-colored, heavily-berried plants of the Yaupon holly are breath-taking sights and a joy to behold. Zone 7.

As more of the now rarer hollies become more generally available, as their hardiness ranges become more thoroughly known, and as their values become more readily appreciated, more and more of these versatile plants will be used for hedges, screens and barriers.

Donald Wyman, horticulturist, Arnold Arboretum, Harvard University, Jamaica Plain 30, Massachusetts, a past director of the American Horticultural Society, is currently serving as secretary, American Horticultural Council, Inc., and as a trustee, Massachusetts Horticultural Society. A popular writer on horticultural subjects, he is the author of *Shrubs and Vines for American Gardens*; *Trees for American Gardens*; *The Arnold Arboretum Garden Book*, and *Ground Cover Plants*.

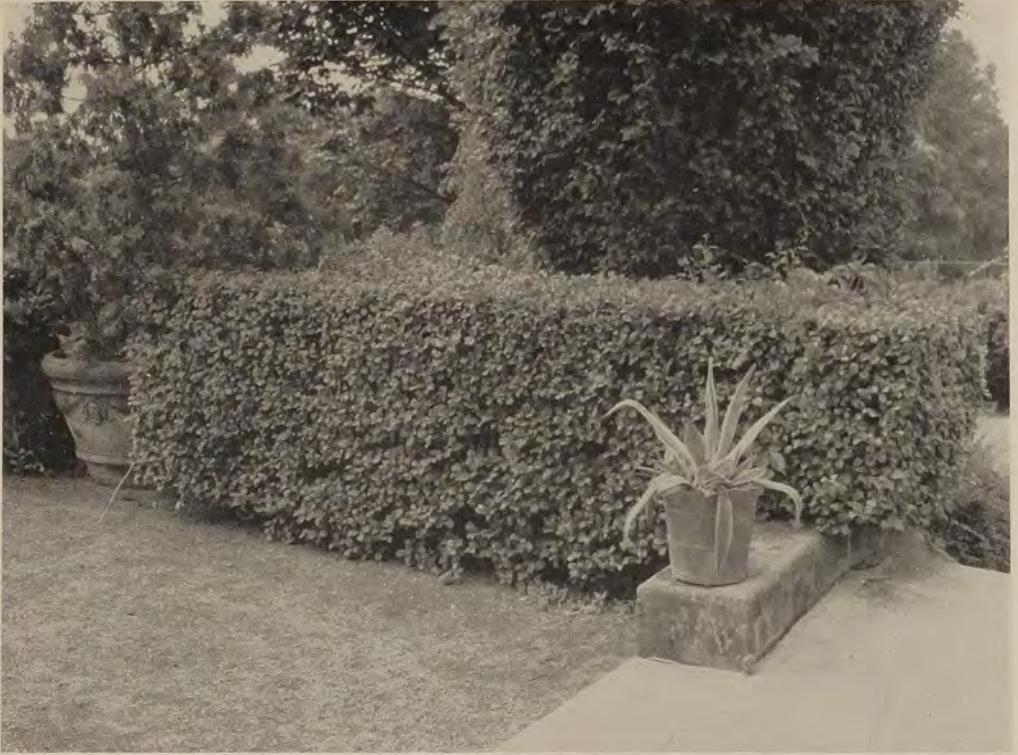


Illustration 47.

A formal hedge of *Ilex opaca* growing at Biltmore, Asheville, North Carolina (*top*) and an informal hedge of the tall-growing form of *Ilex crenata* growing in the Brooklyn Botanic Garden, Brooklyn, New York (*bottom*).



Illustration 48.

A well-kept hedge of *Ilex aquifolium* in the Edinburgh Botanical Garden, Scotland (*top*) and an interesting hedge and topiary in various forms of Yaupon hollies in the Blair Herb Garden, Williamsburg, Virginia (*bottom*).

Illustration 49.

A handsome plant of Yau-
pon, *Ilex vomitoria*, plant-
ed to screen a fire escape
at the University of North
Carolina.



Hollies
on the campus of the
University of
North Carolina
at Chapel Hill
have been used
liberally in
foundation plantings,
as individual specimens,
and in barriers,
screens, and hedges.

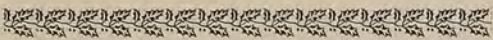
Here,
landscape architect
Francis J. Le Clair,
has developed a
unique seven-mile
"Holly Trail"
where many holly species
and their varieties
may be observed
and studied.



Illustration 50.

(Top) *Ilex crenata* f. *rotundifolia* planted as a hedge and barrier along walk leading to the Morehead Art Gallery, University of North Carolina.

(Bottom) *Ilex cornuta* f. *burfordi* planted as a hedge but serving as an excellent screen of the parking lot, also at the University of North Carolina.



Hollies for Topiary

ALDEN HOPKINS

Topiarius—"an ornamental gardener, one skilled in fanciful landscape-gardening"—refers, of course, to the art of training and clipping trees or other plant material into fanciful, artificial shapes. It is a project requiring time and patience, the "art of a leisurely age." The landscape architect whose diploma from a professional graduate school may relate that he is a *magistri in arte topiaria* indicates the historical background of the modern practitioner and his reliance in part on the formality of Rome and the later great seventeenth and eighteenth century gardens, when formality in training plants was at its height. Today we are all trainers of plant material, yet with a far broader meaning than that of the *topiarius*.

The *opus topiarum*, popular ornamentation for the Roman garden, returned to fashion again in early Tudor times to remain a highly-prized feature of gardens, large and small, for over two hundred years. The Dutch appeared to be particularly fond of this ornament and developed a fine sense in its use in their flat canal-encompassed gardens. With the arrival of William and Mary in the seventeenth century, English gardens soon reflected the court interest in topiary work, one of the fancies of a King intensely interested in gardening. Hampton Court received his particular attention and with the revisions undertaken by the two famous gardeners, George London and Henry Wise, the former Superintendent of the Royal Gardens, much of the old design was removed and the yews in fashionable clipped shapes set out in the fountain garden. Many of these now long unclipped trees exist today as mere accents in that garden.

In the first years of the eighteenth century (1703), a gardening book, *The Theory and Practice of Gardening*, by D'Argenville (Alexander Le Blond), translated from the French by John

James of Greenwich, had considerable influence on the English garden design. In one chapter, he writes of topiary work and its fashion—"Heretofore they gave them a thousand extravagant forms, which are yet much in use in the gardens of Italy and Spain: some shaped out men on horse-back, boars, stags, dogs; in short an entire Hunting-piece. Others cut them into Pyramids, Obelisks, Balls and Scrolls—This practice still continues in Holland and Flanders, where these whimsical Designs are more in vogue than in any other country."

Soon after 1700, there arose a voluble reaction to these collections over which the gardeners with their shears had reigned so long. Topiary work had been carried to such extremes that little was free from the cutting and snipping. People were tiring of it all. This reaction was instigated, no doubt, in great part by the columnists of that day who recognized that the time was ripe for a complete reversal of fashion in gardening. The artists of picturesque and romantic landscapes were also in the fore with their persuasive back-to-nature paintings illustrating the peace and simplicity of rustic surroundings unhindered by scythe and the shears.

This re-discovery of the beauty of natural plant shapes in the garden, the freedom from "the work of the scissors upon every plant and bush," was heartily encouraged by Joseph Addison in his *Spectator* articles. He wrote (*Spectator* 414, June 25, 1712) that the British gardener, instead of humoring nature, loved to deviate from it as much as possible. " * * * I would rather look upon a tree in all its Luxuriance and Diffusion of Boughs and Branches, than when it is then cut and trimmed into a mathematical figure; and cannot best fancy that an orchard in flower looks infinitely more delightful than all the little labyrinths of the most finished Parterre."

These early years of the eighteenth century saw the beginning of the revolution in the use of topiary pieces. In 1713, at the same time Addison was criticizing, Alexander Pope broke out in poetry and derisive descriptions of the art and especially the abundance of work now cluttering many fashionable gardens. In the *Guardian*, he wittily quotes from a listed sale of nursery stock—"Adam and Eve in yew, Adam a little shattered by

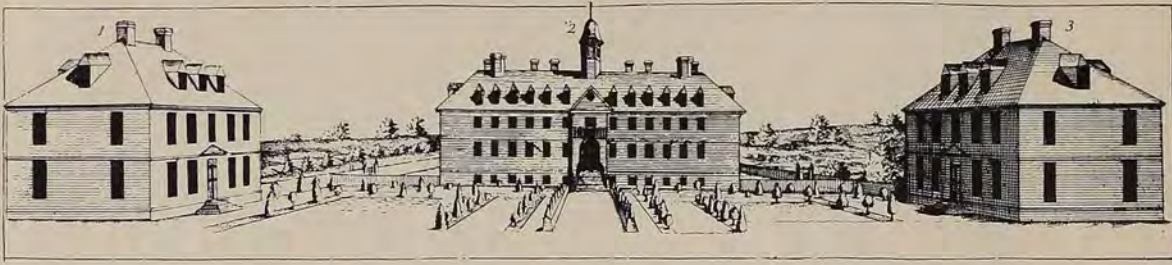


Illustration 51.

A portion of the Bodleian Plate showing the College of William and Mary frontage with topiary pieces. While this may be the earliest preserved record of trimmed plants in the United States, it is not known if the plants portrayed are hollies, yews, boxes, or other greens.

the fall of the tree of knowledge in the great storm; Eve and the serpent very flourishing. St. George in box, his arm scarce long enough, but will be in condition to stick the dragon by next April; a green dragon of the same, with tail of ground ivy for the present. (NB—These two not sold separately) Divers eminent poets in bay, somewhat blighted, to be disposed of a penny worth. A quickset bay, shot up into a porcupine, by its being forgot a week in rainy weather." In all, this trend to extremes of topiary art, soon to cause its complete downfall, can be summed up in a further quote from Pope—"We seem to make it our study to recede from nature, not only in the various tonsure of greens into the most regular and formal shapes—and are yet better pleased to have our trees in the most awkward figures of men and animals than in the most regular of their own."

Thus the topiary fad, fashionable for over two hundred years, slowly passed away. Many gardens were completely torn apart to follow the new natural style so well publicized at Stowe. There were a few places, however, which escaped and, today, display antique specimens of yew topiary scattered and arranged throughout the plain parterres. Levens Hall and Packwood House still show their great clipped "Greens."

In the Colonies, this art, so prized under William and Mary, held on for a considerable period beyond its termina-

tion in England. Here, too, its popularity was considerable and we have numerous records of topiary "greens" from New England to Virginia. The early years of the seventeenth century provided few references, but the eighteenth, with more prosperity, brought many. In Boston, yews were ordered from England in 1736 by Thomas Hancock—" * * * 100 small yew trees in the rough which I'd frame up here to my own fancy." It appears from this quotation that yew topiary in considerable quantity, perhaps for bordering a parterre, was planned for this new garden.

The most authentic evidence of the popularity and use of clipped evergreens in Virginia is the Bodleian Plate, believed made between 1733 and 1747. This copper plate engraving, discovered at Oxford's Bodleian Library, shows the several important public buildings of Williamsburg, the Capital of the Colony. Among them the main building of the College of William and Mary is clearly illustrated. Here is discovered a wonderful display of topiary lining the three parallel entrance walks in an exact planned manner. Although these examples have long since disappeared, there is additional evidence of their having existed and that the impression created by the plate of this use of topiary is correct. A quotation from E. Hazard, who traveled in Virginia in 1777, gives one eye-witness proof of the use of topiary as ornament at the College—"At this Front of the



Illustration 52.

Ilex aquifolium sheared in various forms, illustrating how well the English holly takes shearing. The planting is in Kew, England.

College is a large court yard, ornamented with gravel walks, trees cut into different forms, and grass." There is no indication of the kind of plant material, whether holly, box, yew or other green.

An even earlier reference to these topiary pieces at the College was made in 1732 by Reverend William Dawson, Professor of Divinity, in addressing the Bishop of London describing the various buildings and "*** the East front of the College, before which is a garden planted with evergreens kept in very good order."

With the College as a nearby example, there is little reason to doubt but that domestic yards and gardens held fashioned greens still in style there. We do know of one place, owned by Colonel John Custis, an early student of botany and correspondent of many eminent European men of similar interests. In a letter to Peter Collinson in 1738, he

writes, "* * * I have had silver and gold hollies, yews, philereus, etc. come flourishing to me three feet high, the balls or standards having heads as big as a peck and the pyramids in full shape and are at this time flourishing in my garden; but these every individual tree was put into a basket with earth and the basket and tree buried together the basket soon rotted so that the tree was never stunted in the least—." Of these evergreens so carefully planted and enjoyed so fully by Colonel Custis, one yew still survives in this garden, now part of the Eastern State Hospital grounds. Of great size and age, and green rather than silver or gold, it has long since lost any of its former topiary appearance.

Through the keen interest and support of Mr. John D. Rockefeller, Jr., the restoration of Williamsburg has been made possible. Research into the life, activity, and appearance of the city at

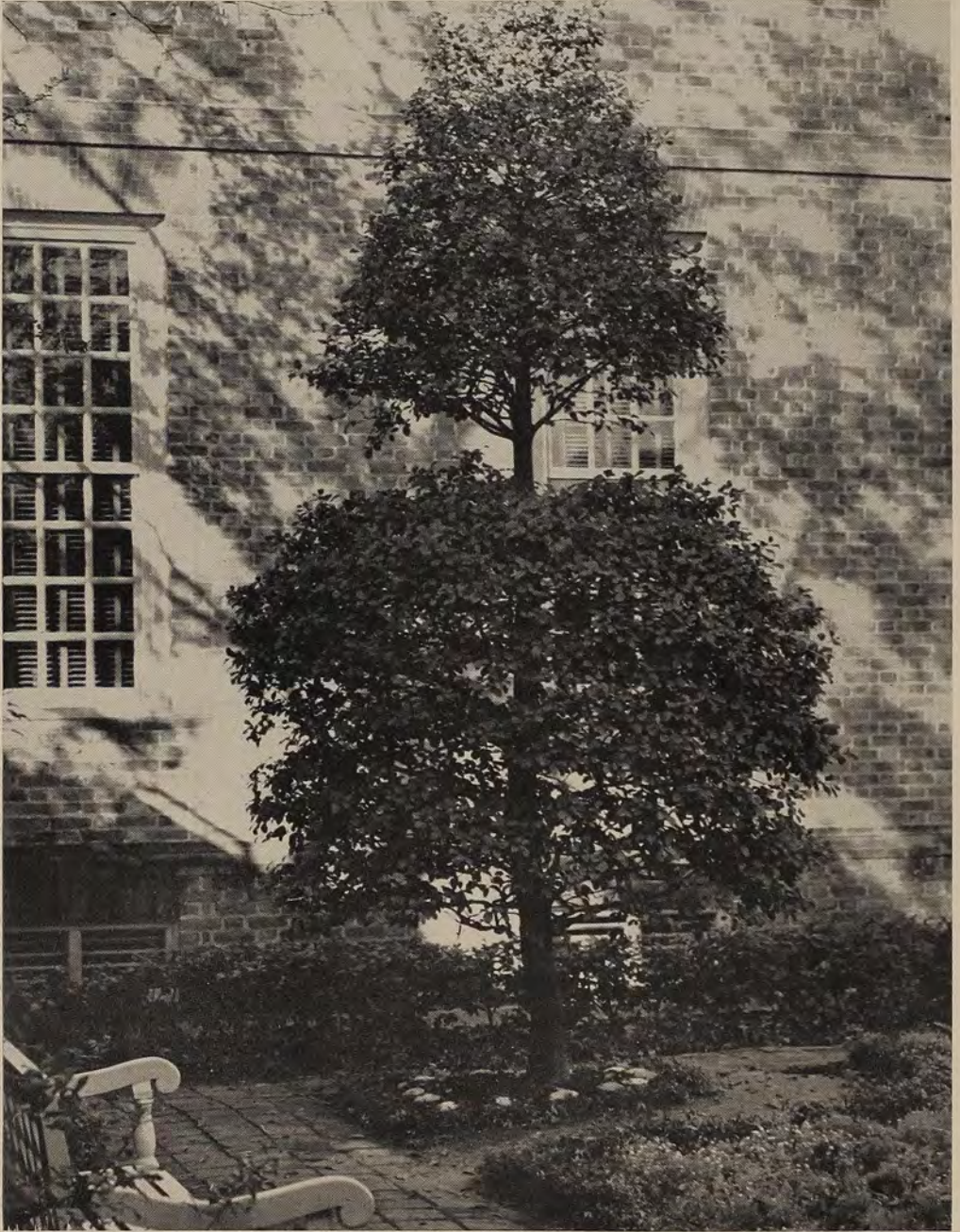


Illustration 53.

Large topiary in American holly located as corner accent in small square garden at the Governor's Palace, Williamsburg, Virginia.

the period of its greatest glory in the eighteenth century was one of the first requirements. Among these many lines of study, the first were concerned with architecture and landscape architecture, including the garden locations, pattern, ornamentation and plant materials. In this new land, the first gardeners soon recognized the great abundance of native plants, collecting and sending them in a continuous stream to collectors and botanists in the mother country. The native evergreen hollies were among these—American holly (*Ilex opaca*), Yaupon holly (*I. vomitoria*), and Dahoon holly (*I. cassine*).

The formation of "greens" in geometric and fanciful shapes is somewhat of an art in itself as anyone knows who has attempted, with shears in hand, to cut his way into a piece of boxwood or holly. In the formation of an animal form, the selection of the basic plant or grouping of plants is the most important step. Many times, a particular oddly-shaped plant may suggest an animal in general outline or it may form a portion of a figure, which, with the addition of another, may result in the beginning of an amusing realistic form. By trimming here and drastically cutting there in another part of the plant, a ragged form may eventually appear. To undertake this, a study of the branching habit is necessary, for the more the plant is developed through natural pruning rather than by the use of wire and forms, the easier the general maintenance will ultimately be. We know the use of artificial support was not neglected in the early years of topiary construction. From D'Argenville we learn that many times " * * * Verdures, which are the fewer in number on account of the continual charge they require, as well as Wood and Wire for the constant Repair of their frames, as in their clipping four times a year." D'Argenville was quite correct, too, on the need for constant care in the clipping and the forming. At several recent restoration plantings in Virginia, there have been developed a peacock, a frog, a setting hen and geometric forms—all started from a plant or grouping of plants which gave some semblance of these objects to commence with.

The formation of a geometric form in holly or other material is a much more simple project. For a tall interrupted cone, select a plant with a central trunk

and side branches so arranged that a severe cutting back will still leave a sufficient number of branches to furnish with new growth the remaining basic form. It will require a number of years' growth before the piece is well filled in and takes shape. For other forms, pyramids, corkscrews, globes and cylinders, the same careful selection and severe pruning is required. No forms and very few wires are necessary if the plant to be formed is selected with care.

Other geometric forms may be made by the combination of several plants grouped around a center accent, or a series of repeating accents to form a screen or backdrop. A simple hedge, the lowest form of topiary work, can gradually be developed with the addition of knobs, points, waving variations and swoops in profile into a most imaginative and interesting sight.

In Williamsburg, our selection of holly species for topiary work has been limited to those known before the year 1800. In this section of the country, we are most fortunate to have at hand three native evergreen hollies of great beauty and ease of culture. The American holly fills the woods and from the earliest days was transferred into gardens for use as shade, natural accents, hedges and topiary. The other two, Yaupon and Dahoon, are among the most beautiful evergreens. This is especially true of the Yaupon holly. Its ease of clipping into any form, its great beauty in its native growth, in foliage, and in glistening red berries make it outstanding among evergreen shrubs. Its native habitat covers the South from Virginia to Florida and west to Arkansas and Texas.

The accompanying illustrations show but a few of the holly topiary shapes developed in the restored gardens at Colonial Williamsburg. They all serve as decorative garden features, as conversation pieces and for the creation of atmosphere reminiscent of the eighteenth century.

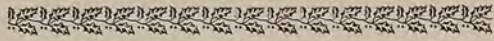
Alden Hopkins, resident landscape architect, Colonial Williamsburg, Virginia, is a Garden Club of America Fellow and recipient of its Fife Award. He is a landscape consultant and lecturer at the University of Virginia, has served as the landscape architect for many Colonial mansions including "Hampton," "Claremont Manor," "Dickinson Mansion," "West St. Mary's Manor," "Gunston Hall," and "Woodlawn."

Illustration 54.

Yaupon topiary in various shapes reminiscent of the College plantings shown in the Bodleian Plate. Chiswell-Bucktrout Garden, Williamsburg, Virginia.

Yaupon holly developed as decorative cylinders with circular top-knots. Sixteen of these are located at outer corners of the Purdie's Dwelling Garden, Williamsburg, Virginia.

Glorified hedge in Yaupon is used to emphasize the garden entrance of the Blair Brick House Garden, Williamsburg, Virginia. Note natural Yaupon growth in the background.



Bonsai Hollies

GEORGE S. AVERY, JR.

A love of small things, coupled with a deep feeling for Nature, led the Japanese centuries ago, to catch in miniature the spirit of ancient trees growing in the forests and on the high mountains. These container-grown copies of Nature's venerable specimens are called *bonsai* (singular or plural), for this is the Japanese word that means a dwarfed potted tree (or trees).

Such trees are kept small by rather simple cultural techniques, and may reach an age of several hundred years. They are frequently handed down from father to son, and are affairs of the spirit as well as tangible little (but old) trees. While grown and kept out-of-doors by the Japanese, they are brought into the almost unheated home on special occasions for exhibit and appreciation. Peaceful is the soul of the Japanese bonsai fancier who has fashioned in miniature a diminutive likeness of a spruce forest—or perhaps a single venerable mountain pine or oak.

In brief, the principal objective in shaping the life of a good bonsai specimen is to give it a natural look of great age, perhaps as if it had been exposed to the elements for a century or two. A large and often gnarled trunk, with sometimes twisted or drooping side branches help create this effect. Some specimens are trained to give a distorted appearance, as if they had grown in a remote mountain cranny.

Whether hollies will lend themselves to this type of training is for enterprising bonsai enthusiasts to discover, but whatever the form one works to achieve, the tree must be growing in a small and generally shallow container— not necessarily during the early training period, but certainly after it begins to attain the desired character.

The secret of growing hollies or other forest-sized species as bonsai is to root prune, pinch back or otherwise prune branches, and occasionally apply copper wire to young branches to train their growth for a year or two—to achieve the desired form. Large-leaved specimens of holly are not as desirable as those with smaller leaves, and if a berried specimen is chosen, remember that the berries as well as the leaves will be the same size as if the tree had been allowed to grow to its normal large size, thus producing another problem in artistic training.

One short-cut is to transplant small nursery-grown holly plants to clay pots for the first two or three years of training. They may then be moved to the small, authentic Japanese-style containers, after gradually pruning the root system to a shallow habit. Some Americans think a clay pot painted in gay colors and with many different gadgets in it, as well as the tree, lends an air of authenticity. Nothing could be in poorer taste! It would be heresy to the Japanese whose art it is.

A bit of information worth remembering is that bonsai are dwarfed, but not by starving. It is important to apply fertilizer once or twice each year. It is also important to water properly, just as one would any well-grown potted plant.

Special Tips for Holly Bonsai

1. Any small-leaved species of evergreen holly can be trained as bonsai, including small-leaved selections of American or English hollies. Among the best is Japanese holly (*I. crenata*) and its forma *helleri*.
2. If berried plants are desired, insure pollination by placing female bonsai in the proximity of male trees when specimens are in flower.
3. In general, keep holly bonsai out-of-doors, in partial shade. Where winter temperatures are low, place in deep coldframe or cold greenhouse. Bring indoors for occasional exhibit.

Those feeling the urge to grow holly bonsai (or any other species) should take a short course of instruction, if possible. People have come from far and near to take such a course here at the Brooklyn Botanic Garden. Those not within commuting distance of the Garden may find the listed publications of help:



Ilex 'Brilliant' (left)—a four-year-old specimen, six months after starting training as a bonsai. A seven-year-old plant of *Ilex crenata*, the Japanese holly (right). Authentic containers for medium-sized and miniature bonsai (below).

Illustration 55.

George S. Avery, Jr., director of the Brooklyn Botanic Garden, Brooklyn, New York, is a trustee and vice-president of the Holly Society of America, Inc., president of the Botanical Society of America and editor-in-chief of the Survey of Biological Progress. He is the author of more than fifty articles and reports of research, chiefly in the field of plant hormones.



The art of growing miniature trees, plants, and landscapes. Tatsuo Ishimoto. Crown Publishers, Inc., New York, New York. 1956. \$2.95.

Bonsai miniature trees. Claude Chidamian. D. Van Nostrand Company, Princeton, New Jersey. 1955. \$3.95.

Japanese dwarfed trees. (Plants and Gardens Handbook). Brooklyn Botanic

Garden, Brooklyn, New York. 1957. \$1.00. Third printing, revised.

Bonsai, photos of now famous miniature trees. Kenji Murata, Editor. Kofu-En Bonsai Nursery, Tokyo, Japan. 1956. About \$2.50.

Bonsai—miniature potted trees. Norio Kobayashi. Japan Travel Bureau, Tokyo, Japan. 1950? About \$2.00.

Orcharding in the Pacific Northwest

A. N. ROBERTS
and C. A. BOLLER

The culture and marketing of Christmas holly has become a major item in the horticultural speciality crops' industry of Oregon and the Pacific Northwest. Commercial holly growers in Oregon annually ship an average of more than seventy-five carloads of holly greens from the Portland area alone, besides numerous smaller shipments from other points. The return from this crop is estimated at \$250,000.00 annually. This holly is produced on approximately twelve hundred acres, less than half of which is now of productive age. This does not include the many trees and hedges cut each year in home plantings.

The planting phase of the industry is still under way, and in time this acreage will be materially increased. It is true that a part of the present acreage is or will be unsuitable for future commercial shipment as the trade is continuing to demand a higher quality product.

The rapid development of holly production in the Pacific Northwest during the past twenty-five years has brought about an interest in this ornamental plant from the orchard production standpoint, as well as for its use in landscape planting. The problems involved in growing English hollies in large orchard tracts are different from those of the landscape planting, where the question of variety, maturity, and yield are not so important. The handling, shipment, and sale of cut holly further complicates the problem.

The Oregon Agricultural Experiment Station has been conducting research on holly production problems for the past twenty years. The results of these studies and the experiences of growers have done much thus far toward solving some of these problems. As these studies progress, more detailed information on some phases of holly production will be forthcoming.

Species of Hollies

There are several ornamental species of hollies adapted to the Pacific Northwest, but the one used for the production of Christmas sprays and wreaths is the English holly, *Ilex aquifolium*. *I. opaca*, the American holly, native to the South Atlantic States, is used for Christmas greenery in the East, but most varieties of it do not favorably compare in quality to the English varieties as grown here, and it is seldom planted in the Pacific Northwest.

Horticultural Types and Varieties of English Hollies

There are many varieties of *Ilex aquifolium*, which early British horticulturists carefully described. The Kew Gardens in England, as well as several commercial nurseries, have many of these varieties. Early issues of the *Gardeners' Chronicle* carried detailed descriptions and illustrations of over one hundred and fifty varieties found in England and France. A number of these varieties have found their way into Northwest collections.

In the early days, propagation of these imported varieties from seed resulted in numerous variations of the original varieties. The number of hybrids or new

varieties is limited only by the number of seedling variations that developed. Holly seedlings, like seedlings of our common fruit plants, tend to resemble their parents in many respects, but each one must be considered as a new horticultural variety if selected for propagation. Some refer to them as hybrids since they are a result of cross-pollination.

As interest in commercial holly production developed, selections of desirable plants were made from seedling plantings. These selections have been kept fairly true to type by vegetative propagation. In some cases, however, these original selections were made from several desirable trees and do not represent a true clone or horticultural variety but a mixture of varieties with similar appearance. The trend at present is to vegetatively propagate a true variety from one tree and thereby produce a uniform product.

Common English Types. The common English varieties vary considerably in wood, foliage, and berry character. They have in common a solid green leaf of more or less spiny character and berries which are either red or reddish orange. The principal wood difference is that of color, which may be either blue or green or a blending of the two. This characteristic of stem color has been used to roughly classify varieties into two groups, blue- or green-stem types. One of the principal types in commercial production today is a collection of blue-stem varieties commonly referred to as French-English. The same is true of the more or less green-stem types of which the Bleeg selections are typical. A third group that contains several intermediate stem color types is found in the Sickler selections. These groups do not represent true clones or varieties, however, since they are mixtures to a greater or lesser extent of seedling types which have in common only stem color in many cases.

The original plantings of the so-called French-English holly were apparently of a mixed nature, since considerable variation is found in orchards supposedly of this origin. While some of this variation is no doubt due to location and growing conditions, there are several distinct types found as mixtures. Varieties of French-English have been known variously in the trade as "Peyran," "Gig-

harbor," "Falco," "Brotje," and "Blue-stem." Until the variations that exist from one planting to another and within the same orchard can be explained, they cannot be considered as true clonal varieties.

As a group, the French-English hollies produce trees of relatively heavy blue-stemmed wood with good foliage. The principal objection to this group is the late-ripening habit of its berries. This is variable, however, and may not be the case with all varieties classed in this group. This late-ripening factor is known to vary with location and the degree of pollination. This group produces large numbers of parthenocarpic berries, which are later ripening than those with completely developed seeds as a result of adequate pollination. Pollination requirements of the French-English hollies, in some cases, have been overlooked because these types were considered "bi-sexual." The French-English berries are firm and handle well compared with some of the earlier ripening types. The best of these French-English types are being selected, named and kept free from mixture by vegetative propagation from the original tree. Only those trees that produce berries that ripen well before Christmas are being selected.

Both the Bleeg and Sickler (Bailey) groups contain seedlings that have good foliage and wood character. Since they also have early-maturing berries in most cases, they are being used further in the selection of desirable commercial types. A desirable single tree selection made from the Sickler collection was named 'Rederly' because of its early berry ripening and other desirable characteristics. Further selection and naming of varieties has occurred in this group as well as in other groups during the past ten years.

Dutch Holly Types. The so-called Dutch types of English hollies differ from the commoner varieties in leaf and berry character. They are smooth leaved without the spiny margins so commonly associated with Christmas holly. The berries are generally larger and of more uniform round shape. The berries ripen quite early and are sufficiently firm to withstand handling. These desirable berry qualities have placed the Dutch hollies in demand for wreath berries. Seedlings have been found that resemble

in some ways both the Dutch and common types. It is probable that hybrids between the two distinct types exist.

Variegated Types. The variegated forms of English hollies are assuming increasing importance as cut holly. The silver variegated types with their white or silver-penciled margins are in favor for both spray and wreath holly, so much so that to date it commands a higher price per pound. There are distinct varieties in the silver variegated group and these are being named and propagated as clones. The variegated trees are ordinarily shy berry producers. Some propagators believe it possible to select and propagate varieties with higher berry production. Since the leaf margin may vary from pure white or silver to less pleasing shades, only the best types should be grown.

The 'Golden Variegated,' 'Yellow-berried,' 'Splash,' or 'Pinto' hollies and other novelty varieties are finding special uses as time goes on. These are being propagated true to type and are being given horticultural varietal names.

Horticultural Varieties

The importance of obtaining the right variety cannot be over-emphasized. The prospective grower should not plant his orchard until he is sure he has the very best possible varieties of hollies available. It may be desirable to grow two or three of the best varieties in order to supply the varied uses to which the greens are put.

Until a holly is propagated vegetatively from one-tree foundation stock, it cannot be considered a variety. A collection and study of commercial holly varieties grown in the Northwest have been made at the Experiment Station near Corvallis and at the Astor Branch Experiment Station at Astoria in an effort to assist the holly industry in selecting the best varieties for naming and propagation as true clones. This is most important to the future development of a standardized product.

The variety collection at the Oregon Agricultural Experiment Station contains over seventy-five selections and more are being added continually. A list of the best of the commercial varieties now available in the trade is given as propagator groups, since all are selections from seedlings or sports of English holly, *Ilex aquifolium*.

It is hoped that these varietal studies will make possible the accurate description and evaluation of the various holly varieties while growing under similar conditions. Such studies are of a long-time nature, however, and observations over a period of years are necessary before any conclusions can be made as to the relative merits of these varieties. Until this can be accomplished, it behooves the prospective grower of hollies to investigate carefully the varieties of hollies being grown and make his selection with an "eye to the future."

Leading commercial varieties of English holly, *Ilex aquifolium*, now being propagated by nurserymen and holly growers in the Pacific Northwest include: (Female or pistillate, berry bearing varieties unless noted as male (M) or staminate, non-berry bearing).

Brownell group. 'Brownell Special,' 'Escort' (M), 'Firecracker,' 'Green Knight' (M), 'Green Maid,' 'Rederly,' and 'Silverary.'

Wieman group. 'Astoria,' 'Beacon,' 'Beautyspra,' 'Early Cluster,' 'Longspra,' 'Oregon Favorite,' and 'Shortspra.'

Teufel group. 'Teufel's Hybrid,' 'Teufel's Hybrid' (M), 'Teufel's Deluxe,' 'Teufel's Neahkahnne,' and 'Teufel's Silver Variegated.'

Leach group. 'Bailey's Pride,' 'Coronation,' 'Early Commercial,' and 'Silver Trim.'

Oregon State group (promising seedlings under test). 'Dr. Huckleberry,' 'Irvine Seedling,' 'Duruz Selection,' 'Besse Selection,' and 'Riverton' (M).

Miscellaneous group (one variety per propagator). 'Bodley's Seedling,' 'Callison,' 'Oregon Select,' 'Pilkington,' 'Yule-glow,' and French-English ('Peyran,' 'Falco,' 'Gigharbor,' 'Brotje,' and 'Blue-stem').

Requirements of Commercial Hollies

The growers, shippers and buyers of Christmas hollies are not entirely agreed on all the points desired in commercial hollies, but there are certain requirements generally accepted. These requirements will vary somewhat depending on the forms in which the hollies are to be marketed.

The ideal spray holly should have stems that have a well-balanced branch

development, are not excessively coarse or woody, have leaves uniformly distributed along their entire length, are resistant to withering and dropping of leaves in shipment, and may be either green or blue in color. The leaves of the ideal holly spray should lie flat and at right angles to the stem, be deep green in color and glossy even when carrying a heavy crop of berries, not drop or lose their color when heavy crops of berries are set, or when grown under adverse conditions, seldom if ever be smooth in character, but be flat at the midrib and ruffled and spiny on the margins, and should not be coarse, but of good size and substance. The berries should be of uniform size and shape with bright red color well before Christmas, be distributed throughout the spray and not clumped in a few heavy clusters, be firm and resistant to bruising and darkening when red-ripe, and should not shatter when ripe.

Hollies for wreath making have essentially the same requirements as those outlined for sprays, with the exception of berry types. The berries used in wreaths are "made up" from extra large berries borne in clusters by some varieties especially adapted to this use. They must be of bright red color and sufficiently firm to stand considerable handling without bruising or shattering. Some of the so-called Dutch hollies have the berry size and quality to meet these requirements. Well-developed terminal shoots are ordinarily used in supplying the green for the wreath.

Certain types of English hollies are grown in pots to a height of one to two feet as little Christmas trees. Some of the variegated foliage types are quite decorative without berries. The selection of a variety or method of growing which will set berries while the tree is small and not more than three years old is being accomplished.

Still other varieties need to be selected for landscape use. Some have a columnar habit of growth. There are weeping forms and small bush types. Others are especially suited for hedge work. Color of leaf and berry would no doubt be a factor in their ornamental use.

A variety of holly that will reach maturity for cutting at an early age has a decided advantage. The foregoing requirement, however, should not be forfeited in order to gain two or three years

in getting the trees in production. Some varieties will produce sufficient growth and berries in six or eight years so that cutting may be started, while other varieties may require a period of time of nine to ten years before the first crop can be harvested.

Berry Ripening is Important

In selecting the variety to grow, the question of berry ripening should not be overlooked. With the trend toward earlier cutting to lengthen the harvest period, the necessity for growing varieties that ripen their berries well before Christmas becomes important. Berry ripening will vary from year to year with seasonal climatic conditions, age of the trees, and the varied growing conditions in different locations. Studies have shown that pollination also has its effect on berry maturity. Some varieties, however, are by nature so late in ripening their berries as to be useless for commercial purposes.

Winter Hardiness

The popular opinion that English hollies lack winter hardiness is true to a certain degree, but the subject should not be simplified to this extent. In the first place, varieties of the species vary greatly in their resistance to winter injury. Two or three varieties in the Oregon Experiment Station's variety test planting withstood temperatures of fourteen degrees below zero in January of 1950, while most other varieties in the same planting were killed back to the snow line. This shows that considerable winter hardiness is to be found among the varieties of English hollies if they are selected for this characteristic.

In considering hardiness, in hollies, as with other plant materials, one must consider the condition of the plants when they are subjected to low temperatures. In November of 1955, an unseasonable freeze in Oregon subjected the above-mentioned planting to temperatures of approximately fourteen degrees above zero. The same varieties that survived fourteen degrees below zero temperatures in 1950, as well as the normally very hardy *Ilex opaca*, were severely injured by these fourteen degrees above zero temperatures in November, and the supposedly less hardy varieties were not injured in the least.

In this early freeze, those varieties maturing their berry crop early were less damaged than the late berry-ripening sorts. In the latter case, the berries were blackened and some leaf and twig damage resulted. It was also noted that the variegated forms were more subject to leaf scorching from the low temperatures than were the green-leaved sorts.

The above results call attention to the fact that "absolute" hardiness in hollies follows certain chilling requirements and maturity of the berry crop. A variety maturing its berries early and having a fairly low chilling requirement to attain maximum hardiness will be less subject to lower temperature damage in November and December than will a variety maturing its berries late and having a higher chilling requirement to obtain its maximum hardiness, even though the latter may have a much better chance of surviving a very severe freeze in January or February. This can account for the confusion that now exists in hardiness ratings on holly varieties across the continent at the present time. These ratings are only applicable where the variety has been subjected to the same low temperature conditions when in the same physiological condition.

The influence of soil management, drainage, irrigation, etc., on plant development and maturity has the same bearing on winter hardiness in hollies as with other crops.

Location, Sites, and Soils

The Pacific Northwest with its mild, moist winters and relatively cool summers is especially well adapted to growing English hollies. It has been demonstrated that hollies can be grown successfully both in the valleys and along the coast in western Oregon or Washington. This area does not extend farther south than Douglas County in the interior valleys of Oregon because of the relatively hot, dry summers unsuited to the best growth of hollies. The southern range of holly adaptation along the coast is yet to be determined, although individual specimen trees of good growth are found throughout the coastal area, and at least one or two commercial orchards are to be found in the San Francisco Bay area.

Coastal versus Interior Valleys. There

are advantages to be found in both the coastal and interior locations. The cool, moisture-laden air of the coast, even in summer, is conducive to the development of the finest type of holly foliage. These same conditions, however, have been thought to delay maturity of the trees and subsequent berry production. The full influence of these climatic factors on berry ripening has not yet been determined. It is likely that varieties can be selected which are especially adapted to growing under the specific climatic conditions in this area. The advantage in soils and nearness to shipping centers in favor of the valley areas cannot be overlooked. The advantages of one locality over the other, however, are more apparent than real and, in all probability, the acreage will continue to increase in both sectors.

Selecting the Site. The ideal site for the holly orchard has not been determined. The question of slope does not seem to be critical. There are good orchards growing on level sites on the valley floor and on slopes with all possible exposures. There seems to be some advantage in north and east slopes for shade. For the best growth of hollies and berry production, the site should be protected from strong, drying winds in order to prevent excessive desiccation or drying out.

The importance of good soil drainage should not be overlooked. Holly trees, like most other tree crops, are not adapted to wet, poorly drained locations. The orchard should not be exposed to seasonal river floods. If flooding does not actually interfere with harvesting operations, it will leave deposits of silt and debris that make the crop unfit for cutting. The orchard should be readily accessible at all times of the year.

Sites subject to late spring frosts should be avoided. Holly orchards located on such sites in Oregon and Washington have been injured to greater or lesser extent in some seasons. This injury may be confined to destruction of the flowers or may be accompanied by killing back of the new terminal growth.

Soil Requirements. A deep, fertile, well-drained orchard soil is a decided advantage in growing good hollies. Although hollies will grow on a wide range of soil types of high and low fertility, the plant-

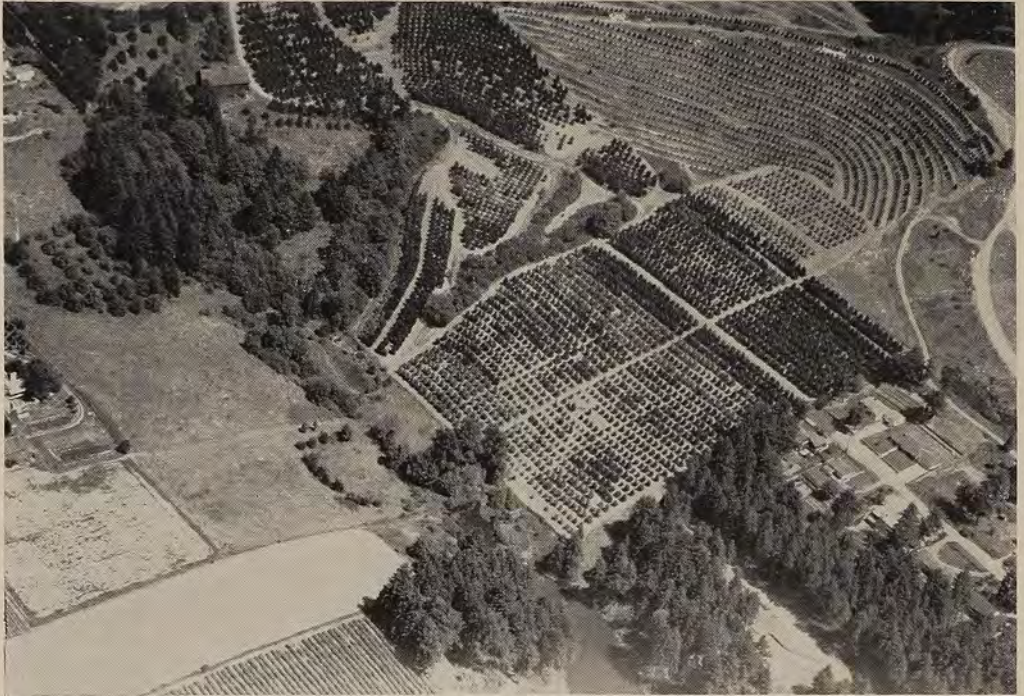


Illustration 56.

(Top) Aerial view of one of the orchards of the George Teufel's Holly Farm, showing planting in terraces on steep hillside. This planting is approximately fifty acres of trees from five to twenty-five years old. Growth has been exceptional on these terraces.

(Bottom) Another orchard of English hollies in Oregon.

ing should not be made on marginal tree land. The problem of maintaining foliage quality along with heavy sets of berries will not be solved unless the soil is naturally quite fertile. The soil should be retentive of moisture throughout the summer months. Soils three to four feet in depth and liberally supplied with organic matter should grow good hollies. Like many of the other broadleaf evergreens, hollies respond to soils high in organic matter. It is a generally accepted fact that slightly acid soils are best. It has not been determined, however, how critical a factor this may be; at present hollies are found growing on soils of varying acidity. It is quite probable that holly orchards on exceedingly acid soils may be benefitted by liming, if for no other reason than to promote cover-crop growth. Whether an excess or lack of soil acidity can be associated with some present orchard ills is yet to be demonstrated.

Pollination Requirements

Male and Female Trees. English holly is a dioecious plant, that is, one in which the male and female flowers are borne on separate trees. The female (pistillate) or berry-bearing trees produce flowers without viable pollen and are dependent for pollination upon the male (staminate) trees, which produce no berries.

The fact that certain strains of hollies set more berries than others in the absence of male trees (pollinizers) is due to the fact that some varieties produce considerable numbers of parthenocarpic fruits (berries which develop with sterile seeds). Of the leading commercial types studied, however, none produce sufficient numbers of these berries for commercial purposes. It seems probable that the popular concept of a "bi-sexual" condition (both male and female flowers on the same tree) in hollies has been brought about by the fact that some varieties were observed to produce berries in this manner.

Pollinizers Necessary. Studies made by the Oregon Experiment Station during the past several years have shown conclusively the necessity of having sufficient numbers of male trees in the holly orchard to provide adequate pollination and berry set. The number of pollinizers (male trees) required, however, is small when compared with other tree

crops. Limited observations indicate that one male tree for every fifty female or berry-bearing trees will be sufficient to supply the necessary pollen in normal years. Increasing the proportion of male to female trees beyond this point may result in too heavy a set of berries in some years with a resultant loss in foliage color. Male trees should be selected that have desirable foliage for wreath making and, in addition, a capacity for producing large amounts of viable pollen at the time the berry-bearing trees are in bloom.

A comparison of the fertilized berries and the sterile (parthenocarpic) fruits produced by a given variety of holly shows that the fertilized berries are considerably larger, heavier, earlier ripening, and are more likely to remain on the tree until harvest. Parthenocarpic berries are inclined to drop when growing conditions are unfavorable. Fertile berries developing as a result of pollination do not wither and shrink to the extent of those produced without pollination.

Experimental evidence indicates there is a correlation between adequate pollination and early maturation or ripening of the berries. Varieties of hollies that have a tendency to mature their berries late and have poor color at cutting time may be helped materially by providing adequate pollination. This is but one of the factors involved, however, and some varieties are by nature so late in ripening their berries that they are worthless for commercial purposes. Orchards of mixed seedlings will almost always show a few specimens of this late-maturing type.

Introducing Pollinizers. The introduction of pollinizer limbs by grafting or budding scions from male trees into the orchard is one method of providing pollen. The addition of male trees to the orchard will probably be the more economical method to use in orchards since so few trees are required. In any case, they should be so placed as to be equally distributed among the berry-bearing trees. The use of bouquets of male blossoms in the orchard during the blossoming season will help until male trees can be introduced. Since hollies are insect pollinated, the presence of a few hives of bees in or near the planting will make the pollen that is present go farther.

Establishing the Planting

Before planting the trees, the soil should be well prepared by the addition of large amounts of organic matter in the form of barnyard manure and cover crops. This treatment will help materially the problem of soil management during the early growth of the young trees. Serious weed pests should be brought under control at this time.

The question of planting distance for all orchard trees is always open to argument and no single recommendation can be made to cover all varieties, situations and plans for management. Holly varieties that come into bearing early and are more or less slow growing by nature can be planted rather close together (eight to twelve feet) in rows spaced twenty to twenty-five feet apart, if they are cut annually and kept in bounds. Even more rapidly growing varieties can be grown in this manner if properly managed as to pruning, cutting, etc. However, there is a limit as to how much growth control should be obtained by pruning practice. Some varieties tend to become overly vegetative and cease to bear if pruned excessively.

In either row planting or conventional orchard style planting, sufficient space must be left for carrying out orchard operations, such as spraying, cutting, hauling, etc. Such spacing will depend in great measure on the growth rate of the variety, how early it comes into bearing, how much annual cutting is to be done, and the type of equipment to be used. In most cases, sixteen to twenty feet between trees is sufficient in most orchards. If row planted, an additional tree can be planted between each tree in the row in one direction. The use of filler trees to be later removed does not seem feasible with the hollies, since the trees reach crowding size by the time there is sufficient production to offset the added cost of their establishment and later removal.

Intercropping May Be Practiced

Intercropping may be used to provide cash returns before the orchard comes into bearing. Low-growing crops, such as vegetables, strawberries, and bulb crops can be used. Growers have combined poultry with the hollies, using the orchard as runs to an advantage. Intercropping greatly increases the demands on soil moisture and fertility so should

be practiced only on good soils which are properly managed. This system, under good management, can aid in lowering the cost of getting the hollies into production.

The young holly trees should be kept in the nursery row until they are two to three years old and two to three feet in height. At this age they can be transplanted without undue shock. Well-balled trees can be moved to best advantage in late fall or early spring. Frequent rains during this time of the year help them to become established before the growing season commences. A mulch of manure, leaves, or sawdust around the young trees will aid in conserving moisture during this period of establishment.

Soil Management

Although more needs to be known about the soil requirements of the hollies, practices successful with other orchard crops in a given locality will not be far wrong in the holly orchard. The practice of clean cultivation during the growing season followed by a cover crop during the fall and winter months is generally accepted by holly growers. If turned under at the proper time in the spring, the cover crop will tend to maintain the fertility of the soil, as well as having reduced soil erosion during the winter months. This is also one of the best and most economical means of maintaining the soil's organic matter, so important in moisture conservation. A cover crop greatly facilitates orchard traffic during harvesting operations at Christmas.

Avoid Excessive Cultivation. Summer cultivation should be confined to killing weeds. Excessive cultivation, besides cutting off many feeder roots, tends to dry out the soil and to destroy humus. Where irrigation is feasible, the possibility of permanent legume or grass sods in the orchard should be explored. Hollies, like the other broadleaf evergreens, respond to cool, undisturbed soils of uniform moisture throughout the growing season. A permanent mulch of sawdust, straw, leaves, or barnyard manure will create such conditions if these materials are available in quantity. A ring mulch about the tree with the remaining area cultivated, cover-cropped, or placed in sod, would be ideal. The addition of commercial fer-

tilizers through the mulch and to the cover crop area as needed would take care of the soil management problem.

Use of Commercial Fertilizers. As the trees get older and are cut heavily, it may be necessary to resort to commercial fertilizers to maintain the annual growth. The choice of a fertilizer to use depends on what the soil is deficient in, as well as what mixture or proportion of plant food elements the holly trees may require. The proportion desirable for hollies is yet to be determined. The best commercial fertilizer and how and when to apply it will need to be determined for each location or orchard. This can be determined by the grower through the application of standard complete fertilizers in varying amounts to a few experimental trees and a study of their responses. At present, early spring applications seem desirable since there is some indication that nitrogen fertilization, if late, may result in delaying the ripening of both wood and berries. Fall and winter applications will lose much of their value through leaching. Studies are being made of the nutritional requirements of hollies and more specific information will be forthcoming.

Insects and Diseases

To produce top quality hollies, like other farm and orchard crops, requires constant attention to insect and disease prevention and control. These are described and their controls given elsewhere in this Handbook. Holly growers should thoroughly familiarize themselves with the identification and damage of these pests and be ever alert to keep them in check; an ounce of prevention is worth a pound of cure.

Harvesting and Pruning

Holly varieties will vary in the age at which the first sprays can be cut. Some varieties will produce trees of sufficient size and berry set to make cuttings possible in from six to eight years. Most varieties, however, should not be cut much before ten years. This, of course, depends a great deal on growing conditions and no set rule can be made.

Cutting should be light during the first few years of harvest in order to allow the tree to further develop its

productive area. This early cutting of sprays can be combined with pruning, using this opportunity to space the branches properly to overcome crowding in the more dense parts of the tree. Multi-stemmed trees do not seem to be of any particular disadvantage, since the problem in framing the tree is to get the maximum cutting surface. It quite often becomes necessary to top-back single leader trees as they get older and force out growth below. There is some danger of crowding with resultant development of poor quality sprays if all leaders are allowed to compete. They should be spaced and trained in a manner that will allow ample room for proper development.

As the tree becomes older, the old and devitalized wood should be removed whether marketable or not. This treatment will tend to promote the development of vigorous sprays of good quality on new wood. If the trees are properly fertilized and ample moisture is available, there should be a minimum of unusable material.

Amount of Cutting Varies. Harvest can begin at any time after the berries are red ripe provided the sprays can be preserved in good condition till they reach the consumer. Holly berries do not develop further red color after being removed from the tree. The question of the amount of wood or sprays to remove in a single harvest is a controversial one. The holly tree will tolerate severe cutting in any one year but such cutting will tend to put the tree out of production for at least two and possibly three years, depending on the vigor of the tree. In addition, unduly heavy cutting has a dwarfing effect on the tree. However, pruning tests showed that heavy annual cutting produced the greatest amount of marketable holly over a five-year period. Yet, it would seem advisable to remove only a portion of the marketable sprays each year and thus maintain a sustained yield from a closer balance between roots and top. If the trees are not trimmed too heavily, they will increase their size and amount of foliage more rapidly and return larger yields later. The failure of some varieties to produce good crops of berries in some years, however, might make it desirable to cut more heavily in years of heavy berry set.

In cutting the sprays, care should be taken to avoid cutting back the central leader of the tree and its several scaffold or main lateral branches. Heading back may become necessary when the tree gets excessively tall or widespread, but on the young tree this will tend to delay the tree in expanding its bearing surface. Some growers prefer to remove the limbs around the base of the tree to facilitate cultivation and to eliminate inferior sprays. This may not always be desirable, however, as those lower limbs, when left, shade the ground sufficiently to keep down weed growth in many cases and will prevent too close cultivation near the trunk.

The cutting should be distributed over the whole tree surface, removing a certain amount from each branch system. The smaller laterals to be used for sprays may be cut in one of two ways. Ordinarily, it is necessary to leave a stub a few inches long at the base of the lateral in order that a new spray can develop from its latent buds. If the growth is too dense so that the lateral should be removed permanently, however, the cut is made flush at its point of origin on the main branch. This will not leave buds to replace the branch with new growth and thus will eliminate it.

In combining the harvesting and pruning operations, the cutters should be instructed to discard all unmarketable hollies in the field since the extra labor and cost of hauling this material into the packing shed for grading are not justified. Some growers prefer to cut only marketable hollies and let the pruning go until the rush period is over. This, of course, means another operation and will too often be avoided altogether.

The tips of the past season's terminal growth are used in "making up" wreaths. Heavy cutting of these tips from trees to be used for spray production cannot be recommended. The return from these tips may not be sufficient to offset the loss in well-balanced sprays later on. The return from sprays is somewhat more per pound and cutting is much more rapid if the sprays are well balanced both in branch and berries.

The whole question of handling hollies from tree to consumer is in a developmental state and no one method can be said to be superior at present. It will pay the beginner to observe the methods being employed by large growers and handlers of hollies who have pioneered in developing satisfactory means of preserving the fine appearance of the product.

Hollies are a Perishable Product. One reason that hollies are used for Christmas greenery is that their foliage retains its shape and color even when partially withered. Nevertheless, hollies must be considered a perishable product. Their bright, fresh appearance may be seriously depreciated by exposure to dry air. They are also subject to defoliation and browning of the leaves.

With the present tendency toward early cutting, the problems of storing cut hollies are becoming increasingly important. Early cutting reduced the facilities and personnel required to handle large quantities of hollies. The earliest date for cutting depends on the date of berry maturity and the storage life of cut hollies. Some growers begin cutting two or three weeks ahead of the latest shipping date, which in recent years has been around the tenth of December for express shipments from Portland to New York. Thus, a storage period of two to five weeks is required if the product is to reach the ultimate consumer in first-class condition. Wreath makers will begin cutting the first of November or even earlier if they can be assured of successful storage.

Holly varieties differ greatly in the length of time which they can be stored. One variety may have twice the storage life of another under the same storage conditions. Observations made by the Oregon Experiment Station and by holly growers, however, indicate that handling methods which give good results with one variety are likely to give good results with other varieties.

Handling Cut Hollies in the Field. After the grower has decided on the day to begin harvesting, the next problem is to plan the field operations for the main-

tenance of quality. Quality may be lost by withering, mechanical injury, defoliation and browning of the leaves.

Withering is prevented by avoiding exposure to direct sunlight and drying winds and storage in heated rooms. If hollies are cut in warm, dry weather, they should be moved to a cool, moist place within the hour.

Cut hollies are often thrown from the tops of the trees into the crates or onto a canvas and dumped into the crates. Most varieties seem to tolerate this treatment, but excessively rough handling may cause cracks and scratches on the leaves. These injuries are inconspicuous at first but form discolored areas during storage. Severe damage may result if hollies are handled when frozen. Cutting should be postponed if the temperature is much below thirty-two degrees.

Defoliation and Its Prevention. Hollies which are kept moist from the time they are cut will begin to drop their leaves in a week or ten days, the time depending on the varieties and storage temperatures. There are three means of controlling defoliation in cut hollies: (1) partial drying, (2) hormone treatment, and (3) cold storage.

Allowing hollies to dry out slightly before packing or using a porous package to permit slow drying during transit may be used as a means of preventing defoliation. A serious objection to this method is that the drying may proceed too far before the hollies reach the consumer, resulting in an inferior product.

Hormone treatment is now being used successfully to prevent defoliation for about two weeks, if the hollies are held at common storage temperatures. In trials at the Oregon Experiment Station, the most effective treatments prevented defoliation of French-English hollies for four weeks at fifty degrees. This was as long as these hollies could be stored at this temperature without discoloration. Thus, in long storage, the major problem is not to keep the leaves on but to prevent the tissues from drying and turning brown. It should be remembered that cut hollies are alive and that they must be kept alive if they are to retain their best appearance.

The life of detached plant parts can be prolonged by reducing the rate of respiration. This is accomplished by

cold storage. For storing hollies longer than two weeks, a combination of hormone treatment and cold storage is recommended.

Preparation and Use of Hormone Dip. The hormone used is alpha-naphthaleneacetic acid. A concentration of thirty parts per million is recommended as a minimum. Higher concentrations give a more lasting effect and may be needed where defoliating conditions are severe. Concentrations as high as one hundred parts per million have caused no injury to cut hollies.

Alpha-naphthaleneacetic acid may be purchased as such from chemical supply companies, or it may be obtained in the commercial preparations used for delaying apple drop. If the pure compound is used, it should be dissolved in alcohol (just enough to dissolve it) before being added to the water. One ounce of the acid to two hundred gallons of water gives a solution of thirty-seven ppm. The addition of a spreader, such as used in sprays for pest control, may give better wetting.

Most growers find the commercial preparations easier to use. A concentration of thirty ppm. is obtained by using three times the strength recommended for spraying apples. There are three forms of these materials on the market: (1) powders containing a large portion of filler, using a wetting agent, (2) solutions containing oil and an emulsifying agent, and (3) solutions not containing oil. Among some of the powders are "App-L-Set," "Niagara-Stick," "S.N.A.," "Stafast," and "Vitatone." Any of these brands are satisfactory for treating hollies when used at three times the strength recommended for apples. If used in higher concentrations, some of them may leave a noticeable deposit on the foliage after drying.

Among the solutions containing miscible oil are "Kling-Tite" and "Parmone in Oil." Oils appear to increase the effectiveness of the naphthaleneacetic acid. They must be used with caution. Hollies which are cut and stored without ventilation seem to be more susceptible to oil injury than hollies on the tree. Only light summer oils of high quality should be used. The emulsion in the dipping vat should not contain over one per cent of oil and should not have a film of oil on the surface.

Other materials have been tried in combination with hormones. Whenever hollies can be given their maximum storage life with hormones alone, there would seem to be little reason to add other materials which, under some conditions, might produce injury.

Dipping Hollies. Treatment is usually applied by dipping. If the dipping vat is large enough, the crate containing the hollies may be immersed. A typical vat is made of galvanized sheet iron reinforced with angle irons, holds three or four hundred gallons, and is equipped with a drain at the bottom. Cleaning is simplified by having the bottom taper toward the drain. The drain and valve should be of sufficient capacity to remove the loose berries and other debris that accumulate in the tank.

The cut hollies are not allowed to soak in the solution but are merely dipped and allowed to drain. Some mechanical device should be used for lowering and raising the crates. The operation may be speeded up by the use of a sloping drainboard beside the tank. In order to keep the solution as clean as possible, the crates must be kept clean. Dirt in the solution necessitates frequent renewing of the solution.

If the hollies are dry before treatment, the volume of the solution will be gradually reduced. Tests show that one ton of dipped hollies will retain thirty to forty gallons of water after they have drained. To compensate for this loss, fresh solution can be added as needed until it becomes necessary to drain and refill the tank.

If the hollies are wet before they are dipped, as is often the case, the dipping solution will be diluted. If the liquid level in the tank is not lowered at all, it may be assumed that every ton of hollies adds thirty to forty gallons of water and removes an equal amount of solution. Thus, five tons of wet hollies dipped in four hundred gallons will reduce the concentration from thirty ppm. to about twenty ppm. The solution could be brought up to its original strength at this point by adding hormone, one-third the amount originally used. These calculations are approximations at best and apply only where the hollies that are being treated are so wet that the liquid level in the tank remains constant. When the hollies

coming in from the field are wet but not saturated, calculations based on changes of level in the tank might be made. The operator may prefer to start with a solution of double strength (provided the material used is known to be safe at this concentration) and to refill the tank after five or ten tons of hollies have passed through.

Dirt, depletion, and dilution have been mentioned as reasons for renewing the solution. Another reason for renewing is deterioration of the ingredients. The rate of deterioration depends on temperature, aeration, and other factors. Until more information is available, it is not advisable to use the solution for more than three or four days.

Packing and Storing Hollies. Hollies are packed after they are dipped and before they dry off. They should be drained sufficiently to prevent the package from dripping. Usually they are culled, trimmed, and packed by hand from a bench or conveyor. One grower dumps them into the package from a chute. This reduces labor in the packing shed but necessitates more careful cutting and handling in the field.

Hollies are usually packed soon after they are cut and are then stored in the package. The storage period includes the time they are in transit and in the hands of the distributor, as well as the time they remain in the packing house. During this period their quality may be affected by the following environmental factors: (1) humidity, (2) temperature, and (3) presence of ethylene in the atmosphere.

Humidity is maintained by proper packaging. Cartons holding three, five, ten and twenty-five pounds are commonly used. Smaller packages may be used for the mail-order trade. The cartons are lined with heavy moisture-proof paper, such as locker paper, and are sealed with gummed tape. This type of package is not completely moisture proof but should retain some moisture on the surface of the foliage for at least two weeks under reasonably good storage conditions.

The ideal storage temperature for hollies has not been determined. In tests conducted at the Oregon Experiment Station, hollies remained in good condition fifty per cent longer at thirty-

two degrees than at forty-five degrees. It is not a safe practice to store hollies longer than two weeks without the use of cold storage. Most hollies shipped from Portland to New York travel by refrigerated express. Hollies should not be exposed to temperatures much below freezing. If they should become frozen, injury will be minimized by allowing them to thaw out slowly without handling or shaking the package.

Minute quantities of ethylene in the atmosphere will accelerate defoliation. Ethylene gas is produced by ripening apples, pears, and bananas; therefore hollies should not be stored with these fruits. Another source of ethylene contamination is leaky gas pipes and incomplete combustion of gas and oil.

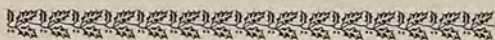
Hollies for wreaths or corsages may be stored in bulk. The same principles apply in bulk storage as in storing within the package. In order to check discoloration from bruising, berries for wreaths or corsages sometimes are allowed to dry slightly before they are used.

In recent years, there has been considerable interest in the use of transparent wrapping materials for small packages of hollies. Large-scale use of these materials, however, has been retarded by reports of severe defoliation and discoloration resulting from this type of pack. Storage tests at the Oregon Experiment Station have shown that both defoliation and discoloration are more rapid at a relative humidity of ninety-eight per cent than at eighty-five per cent. Most holly packages are not moisture proof and therefore not likely to maintain a relative humidity near one hundred per cent, especially when subjected to high temperature and long storage periods. On the other hand, certain transparent wrapping materials can maintain a saturated atmosphere within the package. It seems probable that the severe deterioration of the hollies that sometimes occurs in these packages, however, is owing to this factor in combination with high temperature and long storage periods. If hollies must be exposed to high temperatures, it may be advisable to use a package that will allow them to dry out slowly, since dry hollies are less objectionable than brown hollies. The many types of transparent wrapping materials now avail-

able have widely different permeabilities to water vapor. Some are excessively permeable for this purpose.

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Orcharding In the Middle Atlantic Area

DANIEL G. FENTON

Hollies are found growing in the wild along the eastern seaboard. Due to vandalism, the female hollies are fast becoming very scarce in some localities and very little of good quality is available for the market at Christmas. The poor appearance of this wild holly in comparison with that of cultivated varieties makes it undesirable for holiday greenery.

There is a definite need for holly orchards in the Middle Atlantic Area. The nearness to the country's largest markets hastens delivery and keeps shipping cost at a minimum.

The first problem to be considered when establishing an orchard is the site. Care must be taken to select a site with good air drainage to lessen the possibilities of spring frosts. Frost will reduce the amount of berries by injuring the new growth, thus killing the flower buds. Avoid frost pockets as it is easier to prevent this problem of poor location than it is to overcome it after a planting is made.

The selection of the proper soil type is also of utmost importance. A well-drained, fertile, sandy loam soil will

grow hollies quite well. The water drainage should be good because hollies do not want "wet feet." The soil should be well drained and well aerated to insure the best results.

Much care should be exercised in selecting the varieties to be planted. Some hollies that have been selected for landscaping and ornamental use may not be satisfactory for orchard use. The varieties which grow well in the South may not be satisfactory in the climate of the Middle Atlantic Area. Also, the market demand should be considered in selecting varieties. The American holly varieties *Ilex opaca* 'Howard' and 'East Palatka' grow well in the orchard at Millville, New Jersey, but they are spineless types not in demand in our market. A good variety for orchard use should have sprigs twelve to eighteen inches in length. It should produce enough growth to insure being pruned each year.

It is not possible to name all the varieties suitable for orchard planting in this paper, but a few of the American holly varieties are listed which experience has shown as satisfactory. The variety 'Cumberland,' with its very glossy dark green leaves, is outstanding but the supply of the basic stock is limited. Other acceptable varieties are 'Lady Alice,' 'Eleanor,' 'Mamie Eisenhower,' 'Old Heavy Berry,' 'Arden,' 'Maurice River,' 'Menantico,' 'Cardinal Improved,' 'Farage,' 'Taber No. 3,' and 'Natale.' The male varieties should be good pollinizers such as "David," 'Silica King,' and 'Edward Thomas.'

The hardiness of the English hollies (*Ilex aquifolium*) is considered somewhat questionable and much more work needs to be done before definitely recommending suitable orchard varieties for this area.

Male hollies must be planted in this area at a ratio of one male to fifteen females to insure a plentiful set of berries. The fact that hollies have separate sexes and only the female bears berries, of course, makes this necessary. It is good practice to have several hives of bees located near or in the orchard during the season when the trees are in blossom. This will insure the fertilization of the female flower which is necessary before the berry will develop. The male flowers contain the pollen which fertilizes the pistils located on the female tree.

It is better to plant trees too far apart than too close to one another. Trees should be planted approximately twenty-five feet apart or about seventy trees to the acre. This distance may appear far apart when the trees are small but when they are ten to fifteen years old this space will be needed for cultivating, spraying and harvesting. It must be remembered that hollies will spread to a distance nearly equal to their height.

A holly orchard is long lived and, once planted, will remain productive many years longer than a normal fruit orchard. Holly orchards may be kept in sod or cultivated cleanly. If sod is preferred, it should be kept clipped and the weeds and sod must be cleaned away from the tree in order for it to get the benefit of water and fertilizer. Field mice prefer to live in sod and may damage trees during cold weather when other food is not readily available.

Clean cultivation is the preferred method used by the few orchards already established. This is true of fruit orchards in the Middle Atlantic States also. It is well to sow it in a cover crop for the winter season to build up soil fertility and prevent soil erosion. A new orchard should be kept in a cover crop to build up the soil. A leguminous one is advisable to increase the fertility of the soil. This should be clipped and the clippings left on the soil.

Hollies require a good supply of water just as many other orchard crops. Young trees which are newly planted must be watered at least once a week unless there is sufficient rainfall. Their small and shallow root system makes this necessary. Established orchards need not be watered quite as often.

It takes at least three years for young hollies to become well established and nine years to produce enough fruit to harvest in any quantity.

Fertilizing is essential in a commercial planting where a high quality of sprigs is necessary. Poultry manure applied during the winter months and supplemented by a 5-10-10 chemical fertilizer in April or early May give excellent results. It is well to remember that the holly tree roots extend as far or farther under the soil as the branches extend above it. Too much fertilizer is not good for hollies. It may produce branches too long for the number of berries and may also cause them to keep growing so

Illustration 57.

Five-year-old
plants of
Ilex opaca
'Maurice River'
planted twenty-
two feet apart.



View of holly
orchard seventeen
years after
planting with
two-foot trees.



Holly is
harvested in
crates and
hauled directly
to a packing
shed.



(All 3 scenes in the
holly orchards of
the New Jersey
Silica Sand Company,
Millville, New Jersey.
The writer,
Daniel G. Fenton, is
in the lower right
foreground of the
bottom illustration.)

tate that their tender shoots shrivel under the impact of winter weather. It is well to consult the local county agricultural agent in your area to determine the amount of fertilizer to use on the particular type of soil in your area. A light sandy soil will require more than a heavy loamy soil.

Holly trees need some of the trace elements—copper, magnesium, boron, manganese, sulphur and other minor elements, to grow properly. The proper dosage is one-quarter to one-half pound for a six-foot tree.

The pH of the soil should be kept around 6.0 to 6.2. Hollies will grow on a more acid soil but they do not prefer it.

Small hollies should be mulched with peat moss, straw, pebbles, or other suitable materials to prevent freezing of the roots. A mulch keeps the soil temperature more uniform as well as prevents drying out of the roots beneath. One caution should be noted in the use of mulch. A mulch may harbor field mice which will gnaw the bark and eventually kill the tree. It is well to pull the mulch at least twelve inches from the trunk in winter months.

A rigid spray schedule should be maintained to insure a good quality of foliage. The insects which must be sprayed to prevent infestation are leaf miner, red spider mite, and scale. There are no known serious diseases attacking American hollies in this area.

Holly harvest in the Middle Atlantic Area can begin later than in other sections of the country because of the nearness of the markets. Sprigs are harvested beginning about the second week of December. They are pruned and placed in crates in the orchard. The crates are about four feet in length, three feet across, and two feet deep, constructed of open wood slats to permit circulation of air and water, and hold approximately seventy-five pounds. They are taken in trucks to the packing sheds, where, upon arrival, they may be dipped in alpha-naphthalene-acetic acid which prevents defoliation of the hollies. The concentration recommended is one ounce dissolved in a small quantity of alcohol and then mixed in two hundred gallons of water. The sprigs should be dipped while still in the crate to prevent excessive handling. The vat should be large enough to hold the entire crate.

The crate should be allowed to drain and then the hollies packed directly into the paper cartons lined with waxed paper. The cartons should be of sufficient size to hold ten to fifteen pounds of hollies which the wholesale market prefers, or smaller if for the retail trade. After the cartons are filled and weighed, they are sealed with gummed tape. They may be shipped immediately or put in storage at a temperature of forty degrees until shipped.

Daniel G. Fenton, holly orchard manager, New Jersey Silica Sand Company, Millville, New Jersey, is a trustee of the Holly Society of America, Inc., formerly president of the Millville, New Jersey, Horticultural Society, and a popular speaker on topics relating to the hollies.



Orcharding

In the South

JACKSON M. BATCHELOR

Holly orcharding is a long-term horticultural crop which requires patience, a love of plants, plus a knowledge of their requirements and, above all, optimism of the future despite pestilence, hurricanes, floods and freezes. There are many, many moments of discouragement and loss of faith but as the box tops are sealed on the beauty of the hollies' red berries and glossy green foliage, one knows that the fruits of his efforts will bring enjoyment to many during the Christmas seasons. He is grateful then for his faith in and love of hollies.

The Southern States are particularly blessed with a long growing season and excellent growing conditions both with respect to soils and a moderate climate for commercial holly growing. Land prices are reasonable and not as pro-

hibitively high as in many sections of the North. Likewise, harvesting labor is readily obtainable throughout most sections of the agricultural South at lower costs than for the average of the United States. Truck and rail facilities provide quick delivery of greens to the northern markets. The demand for holly greens and other decorative materials is present and will grow with an increase in population.

The writer's interest in hollies goes back to the period of 1937 to 1942 when he was associated with the Hillculture Division, Soil Conservation Service, United States Department of Agriculture. One of the objectives then of the Division was to bring to light and usage those tree and shrub crops which, when grown under suitable ecological and cultural conditions, would provide soil stabilization, supplement the farm income, and retire land from soil-depleting crops, such as corn, cotton, and tobacco. Hollies, particularly the English, *Ilex aquifolium* varieties, were being grown commercially in the Pacific Northwest, whereas the American holly, *I. opaca*, was being ruthlessly destroyed in the wild in New Jersey, Maryland, and elsewhere in the East.

The American hollies, with their wide range of soils and climatic adaptability from Massachusetts to Florida, appeared to offer great commercial orcharding promise for the eastern and southern United States. Extensive selection and evaluation work were undertaken in collaboration with such holly selectors as Mr. Wilfrid Wheeler of Massachusetts, Mr. Earle Dilatush and the late Miss Elizabeth White of New Jersey, and many other holly enthusiasts.

It was, therefore, inevitable that this interest in hollies and holly orcharding was continued when the writer moved to a new home in North Carolina in the spring of 1946. Our home is now located at Penderlea Farms, Willard, North Carolina, eighteen miles from the shore of the Atlantic Ocean, and thirty miles north of Wilmington. The soil consists of Lynchburg and Coxville fine sandy loam, phases of the greater Portsmouth series, having a pH range of from 4.7 to 5.2 and excellent moisture and nutrient-retaining capacities. The soil types and climatic conditions here are proving suitable in every respect for a commercial holly planting.

Test Planting

The first consideration was to determine those holly species and varieties most adaptable to commercial growing under the existing climatic and soil conditions. The secondary and monetary consideration concerned the desirability of having a profitable income during the period required to establish a holly orchard. In 1947, a test planting was made of eighteen varieties of *Ilex opaca*, numerous selections of *I. aquifolium*, *I. cornuta*, and several other apparently promising commercial species. One acre of strawberries was set in September in three-foot rows and later in the fall the holly plants were set on twelve-foot centers in the strawberry rows. Approximately one-half bushel of poultry compost was mixed with the soil at each plant hole. The following April \$600 worth of strawberries was sold, and the hollies were cultivated with only negligible additional expense. Strawberries were included in this integrated planting for five growing seasons, which provided an early cash income from \$600 to \$1200 a year until the area was converted totally to hollies. Taloosa geese, included the second season to keep the area grass free, reduced labor costs of hand hoeing by seventy-five per cent. Other early cash-income crops might well be integrated with long-term woody crops, such as hollies, to provide both complete utilization of the land and an economical method of bringing into production the tree crop involved. At the end of the fifth season, the first cutting of hollies was made.

Test Planting Results

American Hollies. Ten years later, it is concluded that northern selections of the American hollies have not done as well as many of the southern forms. *Ilex opaca* 'Alto' and 'St. Anne' are slow growing and almost dwarfed in habit. Eighty-four per cent of 'Brooks' dies within four seasons, while five-year-old replants of 'Howard' are well filled out to fifteen feet in height as compared with the remaining 'Brooks' which are eight to ten feet high and only lightly berried. 'Mt. Vernon' is a very slow grower, excellent berry producer with poor foliage color; 'Richards' has an excellent and attractive upright habit of a good lawn specimen, but the berries are hidden be-

neath the flat, wreath-type leaves and it is not considered a showy, commercial selection.

Of the southern forms tested, including 'Taber No. 3,' 'Howard,' 'East Palatka' and 'Lake City,' 'Howard' is much superior to the others. 'Taber No. 3' does not produce the weight of sprays per tree, the foliage is not as profuse or the color as good as 'Howard,' and the trees have been very susceptible to hurricane damage. This variety has been most severely injured by spring freezes. 'East Palatka' fruits profusely, but its light green foliage and its characteristic production of long sprays of new growth beyond the berried wood considerably detract from its usage as a cut Christmas green. 'Lake City' is a profuse bearer of bright, attractive fruits but does not have the fine foliage texture and color of 'Howard' nor the yields of cut sprays of the latter. 'Howard' is superior with respect to growth response, profusion of berries, foliage color, and general attractiveness within the florist trade, to other American hollies tested. The ten-year-old trees are from twenty to twenty-four feet high, ten to fourteen feet across, heavily berried, and each crop is in good demand by the trade. Following Hurricane Hazel, 1954, the ground beneath the 'Howard' trees was red with windfall berries, but a sufficiently full crop of berries remained on the tree to cut approximately one thousand dollars' worth of greens from one thousand feet of rows.

English Hollies. A holly known as *Ilex ataclarensis* 'Eldredge' from the Roswell Eldredge Estate, Great Neck, Long Island, is reportedly a hybrid of *I. perado* x *aquifolium*, made in Scotland. This plant has not as yet proved adaptable to the coastal regions of the South. The growth rate is slow, it flowers erratically throughout the summer and fall months and has produced only one crop of berries over a three-year period. The berries are large and light, orange red in color which detracts from its usability as a commercial holly species. Over one-half of the original plants here of *I. ataclarensis* were killed by the flooding conditions following the three hurricanes of 1955; American and Chinese hollies growing near by were undamaged.

Of the several varieties of English holly, *Ilex aquifolium*, tested, none has proved satisfactory. Eighty per cent have

died from spring freezes, excessive moisture, and general unsuitability to our climatic and growing conditions. The few remaining plants look sadly unhealthy. The same age plants of English holly are today only six to eight feet high as compared to the American variety 'Howard' in adjacent rows which are twenty feet or more. No further planting of the varieties of *I. aquifolium* for commercial purposes is deemed advisable.

Chinese Hollies. Several seedling selections of the Chinese hollies have been tested with *Ilex cornuta* 'Shangri-La,' offering the finest promise for commercial production. This variety resulted from a cross made by the author in 1939 of large-berried female selection having typically large leaves and a handsome male with small leaves. 'Shangri-La' was selected and named in 1947 because of its excellent growth rate, treelike and upright, symmetrical habit of growth, the dark green and high gloss to its small, finely-textured leaves, and its heavy production of large, attractive red berries.

It is not uncommon for three- and four-year-old orchard-grown plants of 'Shangri-La' to produce three to six feet of terminal growth in one season or for bed-grown liners to grow three to four feet in one summer. Lateral shoots are produced the following growing season to fill out and maintain the good form of the plants. Ten-year-old trees have been topped to a height of twenty feet to provide easier cropping with pole pruners.

The leaves of 'Shangri-La' are rich dark green with an attractive high gloss and from one inch and a quarter to one and three-fourth inches long. The fine color and waxy glossiness of the leaves and the small leaf texture of this variety make it particularly attractive for flower arrangements and decorations. Juvenile leaves of the younger plants are often two to three inches long, but reduced soil fertility and maturity of the tree will insure the small leaf characters. The leaf tissue is also much thicker than that of the American and English hollies tested. This factor greatly enhances the keeping qualities of the cut sprays.

It has been observed for several Christmas seasons that cut, berried sprays, kept at room temperatures, without water, have produced deterioration of foliage and berry color at the following rate:



Adaptability tests using same age planting stock—after nine years' growth. English holly (*right*) is 6 to 8 feet high; *Ilex opaca* 'Howard' (*left*) is 20 feet or more.

Illustration 58.

Three-year-old plants of *Ilex cornuta* 'Shangri-La' with hay mulch, which retains soil moisture, improves general growing conditions and retards weed growth. The writer, Jackson M. Batchelor, is shown with Talossa geese, his holly hoe-hands, in the background.

Ilex opaca 'Howard,' three to four days; *I. aquifolium* varieties six to seven days; *I. cornuta* 'Shangri-La,' ten to fourteen days. The berries of 'Shangri-La' persist without shattering even when the sprays are dry. This is not true of most American hollies.

The 'Shangri-La' fruits are large, to over one-half inch in diameter, attractive deep red and borne in great profusion throughout the plant. Consequently, this variety has yielded three times more poundage of cut hollies than the same age American holly plants and, because of its attractive beauty, has brought twice as much per pound.

Ilex cornuta 'Shangri-La' flowers some three to four weeks before the American hollies. Berry production has been reduced by spring freezes only once in four years. Steps are being taken to find a spray material to delay the flowering period and thereby reduce frost damage. It is expected that wind-machine towers and other protective devices against spring frosts will have to be considered here in the future. Normally, the berries of the 'Shangri-La' holly are fully formed by late May, turning red in late October; mid-summer droughts have neither reduced the fruit size nor crop.

The late March, 1955, freeze, coming after several weeks of warm weather, seriously injured two- three- and four-year-old plants of 'Shangri-La' with its temperature drop to twenty-one degrees. This freeze also damaged two- and three-year wood of 'Taber No. 3' and two-year wood of 'Howard' and other varieties of American hollies. At the same time, it totally destroyed all fruit and nut crops in the South and killed some thirty per cent of the two- and three-year-old plants of other hardy ornamental plants in nursery rows. 'Shangri-La' and 'Howard' have made excellent recovery; 'Taber No. 3' has not responded so well.

'Shangri-La' is remarkably free from insect and disease pests and has been noticeably free from the leaf and stem scale which attacks *Ilex cornuta* f. *burfordi*.

Holly Orcharding

Propagation. Here, hollies are propagated in a greenhouse with raised beds. Equally good rooting results are obtained by many growers using cold frames with raised ground beds. The holly cuttings are made four to six inches

long with the basal cut made just below a leaf node. On all American hollies, a vertical incision, three-fourths of an inch above basal cut, helps materially in providing a better root system. Cuttings of American hollies are taken in mid-summer and root-growth stimulants are used to insure better rooting. The cuttings are set one inch to one inch and a half deep in the beds and one inch apart in two and one-half inch rows. Mist-spray propagation of American hollies in clean, coarse sand has produced better rooting than without mist spray in sand and peat moss.

Chinese hollies are propagated in late February; in June, following the first growth period; and in August, following the second growth period. Excellent rooting is obtained without mist in peat and sand.

After a good root system has developed, the rooted cuttings are potted and plunged in frames until fall at which time they are set about ten inches apart in lining-out beds which have been thoroughly conditioned with a liberal application of poultry compost, old pine sawdust and 5-10-10 commercial fertilizer. Occasionally, with the late rooting of American hollies, it is necessary to delay bed planting until spring. Fall-set Chinese hollies will produce a high percentage of planting stock two to four feet high in one season; spring-set plants will remain generally too small for field planting the first season and yet they are often too large if held over until the second season.

Care is exercised throughout the growing period to irrigate the beds. Fertilizing is done once a month from May through August using a complete water-soluble fertilizer. Each week all lateral shoots are removed to develop terminal dominance and a tree-like habit. All plants, as may be necessary, are staked with two-foot bamboo stakes and 'Twistems.' Planting stock so handled will produce a larger orchard tree in two years' less time than stock grown in the conventional nursery rows; the plants are much easier looked after in a smaller area.

Field Planting. Fields are deeply plowed in one hundred and fifty foot plots. Lime is added to maintain a pH of 6.0 and superphosphate to take care of any field deficiency. The ground is then thoroughly disked and leveled; water



Illustration 59.

Spraying to control tar black spot on hollies in an orchard of *Ilex opaca* 'Howard' near Albany, Georgia.

furrows are cut to provide good drainage before planting. All planting is done here before January 1, as the warm winter days stimulate the newly-set plants to develop two or more inches of root growth before summer droughts. This results in increased growth over spring-planted stock.

Trees are planted in eighteen-foot check rows. The field is staked, holes four feet in diameter are dug, a half bushel of well-rotted poultry manure and commercial fertilizer (fifty pounds of 5-10-10 mixed with each cubic yard of manure) is thoroughly mixed into the planting soil. Wire rabbit guards are set around all plants under two feet high as a protection against rabbits sharpening their teeth on the hard-earned terminal shoots of the planting stock. The guards consist of a piece of screen wire nailed to a treated stake. Guards are used only one season at which time the terminal shoots are larger than a lead pencil and no longer tender and savory to the rabbit population. There is generally no rabbit damage to larger trees after two years of field growth. Spangles made of six-inch strips of heavy gauge aluminum foil are then loosely wired to widely scattered plants. The noise created by the rustling of the foil and its glittering appear to deter rabbits from doing further damage.

No male trees are necessary in the planting of 'Shangri-La' since fruits are set without the need of pollen. Two males are used per acre for the field planting of American hollies since it has been found that this ratio of males to female is entirely adequate to give us excellent pollination. Hives of bees should be added to further insure adequate pollination.

Planting stock is set at the same level as grown in the nursery rows. After firming in place, guards are driven down about the plants and a twelve- to sixteen-inch layer of hay is placed as mulch two feet around the plant. Within a few months the hay will decompose to a depth of about a half a foot, and will serve effectively in reducing weed competition and hoeing costs, will improve the general soil-growing conditions of the plants and retain soil moisture during critical periods of drought.

Soil-Building Ground Cover. A leguminous ground cover of Kobe lespedeza is

seeded at the rate of twenty-five pounds per acre in February or early March. This soil-building crop is important in enriching the soil and providing better soil drainage and aeration; it also is a valuable source of hay mulch material for our orchard.

Orchard Maintenance

The orchard areas are mowed several times during the early summer. The lespedeza is then permitted to grow to a height of one foot or so. This is cut with a sickle-bar mower in mid-August or sufficiently early to produce new growth and a seed crop for the next year. The hay is applied about the trees to a depth of two feet, and the mulch area extended one foot beyond the outermost branches as the trees develop.

Sixty Taloosa geese are used here to consume the grass which may persist around the mulched trees. The orchard plants are hoed twice during the summer months to remove any competing weed growth. It has been found that the hollies here are making excellent growth under the above-described mulch-soil-building-ground-cover program and that this program is much preferred to the clean-cultivation system.

Two sprays of malathion are usually applied during the summer months to prevent or destroy insects and particularly scale pests which may invade the plantings.

During the first five growing seasons, three applications of 5-10-10 fertilizer are applied at the rate of one-half pound per one-inch caliper per plant. The first application is made in March, the second in May, the final in July or early August. Old mulch material is raked back and the fertilizer applied in the outer root-zone area extending one foot beyond the outermost branches of the individual plant. The mulch is then replaced. Following the fifth growing season, two applications of fertilizer are made at the above rate in March and May. Further reduction of fertilizer may be necessary on occasional plants of 'Howard' American hollies and the Chinese varieties to prevent the trees from producing too much growth, which will detract from the beauty of the berried sprays.

The rate of applying fertilizer must also be reduced as the trees approach cutting age in order to maintain good leaf color and fruiting balance. If in-

sufficient fertilizer is applied to many hollies, an overproduction of berries may result in chlorosis of the foliage and severe damage to the plant. Such overcropping of *burfordi* Chinese holly has occasionally resulted in the death of plants of this variety in nursery rows here. Likewise, the application of too much nitrogen may well result in vegetative growth and subsequent light flower and berry crops.

The author recently visited the holly orchards of the New Jersey Silica Sand Company near Millville, New Jersey. The rich, deep color of each and every plant combined with a fine crop of berries made this orchard an impressive sight to behold. The manager of this orchard, Daniel G. Fenton, attributed much of his success with good foliage color to the incorporation of minor trace elements in their commercial fertilizer. Today, this orchard does not have "fall leaf scorch" or leaf spot which formerly was considered to be an attacking fungus organism. It is, therefore, recommended that these minor elements be included in the commercial fertilizers used in holly orcharding. The added cost is low in comparison with the magnificent results obtained.

Holly Cropping

A hormone foliage spray of one part alpha-naphthalene-acetic acid per million parts water and spreader is applied to all trees to be cropped two to three weeks before cutting. This spray deters foliage and berry drop and enhances the keeping qualities of the greens after cutting. A field spray prior to cutting is considered better than a solution dip after cuttings are made as there is better assimilation by the living tree to all petiole tissue. Further, the branches can be cut dry and packed dry. If a dip is used, the greens must be artificially dried before packing to prevent heating and damage en route. Any artificial drying process will not only remove surface moisture but will also remove some of the internal moisture and shorten the keeping qualities of the sprays.

At present, the hollies here are cut


within twenty-four hours of the shipping dates. As the holly planting approaches peak production, it will be necessary to cut a week or more in advance of shipment and place the orders in humidified and refrigerated storage until shipment. Berried sprays are cut sixteen inches to two feet long with hand shears and pole pruners and removed from the orchard in field boxes. Many of the finest sprays of 'Shangri-La' are the heavy-fruited cross branches within the plant itself. Care is exercised not to cut material which will in any way damage the form of the tree. In the packing shed, the greens are packed dry in ten, twenty, forty and hundred pound cardboard cartons for shipment. A cleaning and spray preservative machine has been designed and it is hoped that this equipment will be in operation next season.

Yields

The test plot's average yield of cuttings from each 'Shangri-La' plant is thirty pounds for five-year-old plants and forty pounds for seven-year-old plants. 'Howard' averaged ten and eighteen pounds for the respective plants.

The orchard planting here is approaching production, and it is conservatively estimated that a thousand pounds per acre yield will be obtained within the next two or three seasons, this yield to increase to two thousand pounds per acre annually as plant maturity is reached. Several years ago the author visited a five-acre planting composed of selected holly varieties then twelve years old and situated in northern Florida. The recorded yields were over three thousand pounds per acre with a valuation of one thousand dollars. The income derived from a holly orchard may well approximate that of blueberries, strawberries, and other high-yielding truck crops.

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Hollies in Cut Arrangement

HENRY P. ORR

Hollies are a wonderful source material for flower arrangements: for use in the thought-provoking linear arrangements of the Orient, the massive, picturesque compositions of the golden periods of Europe, or the more pleasing, informal combinations of line and mass for a truly American arrangement. From a few plants of hollies in the yard, one can provide a series of arrangements suitable for the home needs throughout the year. Often, it will be desirable to use hollies alone; at other times, in combination with flowers. As a result of careful pruning of branches and sprigs of hollies desired for arrangements, one will find that plants become more desirable as landscape specimens. The more hollies are used in arrangements through the year, the more desirable it will be to add new species to the planting each year. A more linear form, or one furnishing more massive form for arrangements, or a form with a more distinctive leaf pattern might be required.

In the past, one has thought of hollies for Christmas use only. Often, great branches of heavily-berried American hollies were placed in vases, or used to enframe pictures, or to make traditional garlands. Without being placed in water, these decorations may have lasted through the holiday period but were more often a fire hazard. This excessive use of hollies resulted in many natural stands being disfigured or destroyed. Had only the smaller branches needed for arrangements been cut, many of our native stands would still be attractive along our highways.

What could be more traditional than a candelabra arrangement of hollies? (*Illus. 60, top*). Here, the plant material used would constitute a very light prun-

ing of one or more species of hollies. The construction of the arrangement is simple. A block of florist's "Oasis" approximately four inches square and two inches thick is thoroughly soaked in water two hours. Then it is formed into a doughnut shape by rounding the edges and carving out a center hole. Chicken wire is fitted around the doughnut to strengthen it. The completed doughnut is placed in a glass epergnette in the center holder of the three-branched silver candelabra with a candle fitted into the center of the "Oasis" doughnut. The vertical, lateral, and forward lines of the arrangement are developed from linear branches of Chinese hollies. Slanting cuts should be made on the basal ends of these branches after soaking them overnight in deep containers of water. The slanting cuts are easily inserted into the "Oasis," being careful not to penetrate entirely through the soaked material. To insure easy burning of the candles, the branches, especially the vertical one, should slant away from the candle. Once the outline of the arrangement is established, the lightening lines of the variegated English hollies can be placed. Then the focal area of short, heavily-fruited branches of 'Foster's Hybrid No. 2,' the 'Howard' variety of American hollies, and Dahoon hollies can be developed.

A plastic coating sprayed onto the fruit after chilling the arrangement for a few hours gives a delightful frosted appearance. Such arrangements last for three weeks in rooms with temperatures of around seventy degrees.

If a higher arrangement is desired, the double-tiered effect of the two-, three-branched candelabra can be used. (*Illus. 60, top*). The removable shank of the front candelabra is added to the one in the rear to give increased height. Where a wider effect is desired, the basal arrangement can be broadened by increasing the length of the laterals.

Each year as we approach the Christmas holiday season our thoughts naturally return to the traditional use of hollies. Here hollies might enhance the beauty of the festive table for punch or egg-nog or form the base for a lovely candle arrangement for a table, buffet or end table (*Illus. 60 & 61*). Wherever used, the beauty of hollies will be more lasting if they are properly conditioned. Preferably, they should be cut

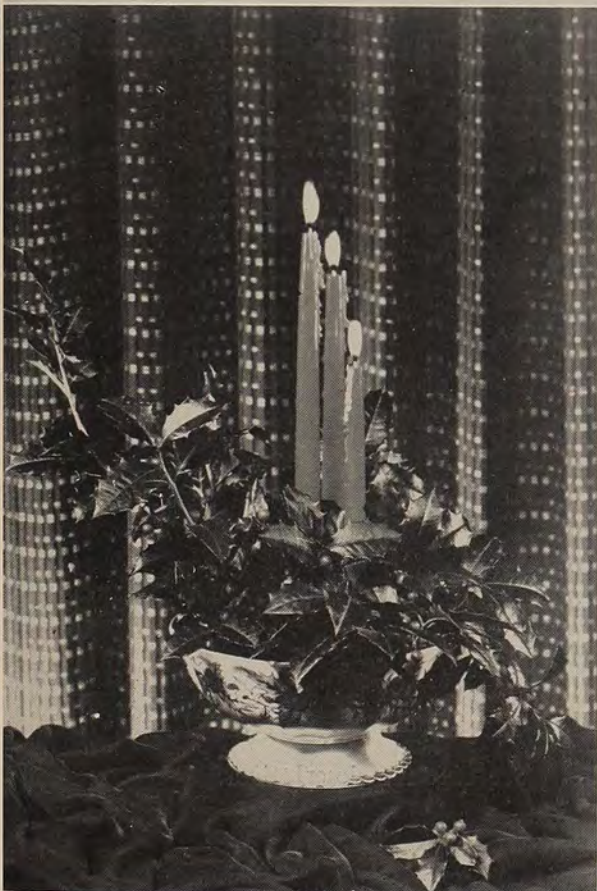


Illustration 60. Cut branches of hollies may be used indoors throughout the year in fashioning many arrangements of pleasing design. See text for details of the four illustrated here.



Illustration 61.

More unusual uses for cut hollies. See text for descriptions.

with a sharp knife late in the afternoon and the stem ends immediately placed deep in water in a cool, non-drafty location. The next morning the arrangements can be made using these water-filled branches. Suitable containers should be selected to hold water, or plans should include the use of water-filled plastic as "Oasis." Pinholders or chicken wire should be securely mounted in the containers or chicken wire should be wrapped around the "Oasis" to hold the stems firmly in position. Once the arrangement is completed, a spray of clear plastic can be applied to give a sheen to the leaves and fruit and to reduce transpiration and result in longer life.

Throughout the summer you can enjoy the hollies as living arrangements indoors in planters or outside in containers for your patio or terrace. *Burfordi* Chinese holly and Yaupon, especially the dwarf form, develop well in planters. Topiary or espalier forms can be rather easily developed and are usually interesting to the entire family and visitors. *Ilex* 'Rotunda' and the various *I. crenata* forms seem to withstand easily the rigors of culture in restrictive containers if they are not overwatered.

As we go into the autumn of the year, the holly, cattail, "rainrose" arrangement in the duck decoy might delight the heart of the huntsman of the family. (*Illus. 60, bottom, right*). "Oasis" has been used to hold the necessary water to keep the arrangement fresh. Cattails form the height accompanied by "Foster's Hybrid No. 2." and Inkberry or Gallberry. 'Wilson' English holly and a green form of English hollies form the base and width of the arrangement. Sitting on a woven mat, the decoy seems to be floating among a group of waterlilies which are actually "rainroses" produced by grouping the fruiting structures of Chinese parasol tree (*Firmiana simplex*) and centering the grouping with a common China fir cone (*Cunninghamia lanceolata*).

The American Indians lived close to nature. In *Illus. 61, top, left*, the rattlesnake design was used on a replica of one of the emblems of the Creek Indians of Moundville, Alabama. This emblem on a plaque has been used as the background for an arrangement of Yaupon hollies and Winterberry or deciduous hollies in an Indian bowl. The "frog-

pattern" bowl or cup has been used at one side for an accessory. Hollies with unripened fruits can be used with these containers as symbolic of the autumn season. These hollies were well known to the Indians for their medicinal properties and were probably admired by them for their berried beauty.

For the traditional wedding in June, what could be more beautiful than the gorgeous fan centered with an arrangement of three *Cattleya* orchids, lilies-of-the-valley, and leaves of variegated English hollies? (*Illus. 61, top, right*). The wedding dress will be protected by the backing of the fan. In the bridesmaid's bouquet of orchids, tuberose, variegated English hollies and Chinese hollies, the dress will be protected by the backing of maline. After carefully wiring and "florataping" each leaf or sprig of holly, plastic can be sprayed on to preserve the natural beauty and to prolong the nosegay's life.

To symbolize the gaiety often associated with the New Year, the accompanying arrangement was prepared (*Illus. 61, bottom, right*), depicting the antics of three celebrating tipplers. A cup-type pinholder was attached with florist's clay at the larger end of a free-form ceramic container. Chinese hollies with a very interesting leaf pattern were used to develop a vertical line, and American hollies were used to complete the lateral spread of the arrangement. 'Wilson' English holly was chosen to strengthen the focal area of this arrangement because of its heavy, glossy, dark green leaves and whorled leaf and branch effect. Sprayed with plastic and quickly sprinkled with glitter, it gives an icy, glittering interest to the arrangement. The linear, focal arrangement of the gardenias extends around the carousing revelers to simulate their having thrown their boutonnieres to the icy carpet of holly as they grabbed for their respective lamp posts. Variegated English hollies add life and sparkle to the dark background and make a pleasant textural transition from the coarseness of the 'Wilson' English holly to the smoothness of the gardenias.

A traditional use of hollies for the New Year might have featured a candelabra or vase arrangement of hollies complete with berries, but centered with bells in peeling position. Another novelty arrangement might have fea-

tured a small statue of Father Time limping out with a gay, plump New Year Baby bursting from the focal point.

In the period of January to June, the foliated stems of hollies are effective as compliments to our daily use of flowers. Hollies can be combined with leaves or branches for use with the traditional flowers on special holidays. Red satin hearts, backed with a frill of holly leaves and centered with a white carnation pierced with a holly leaf arrow, would be conversation pieces as the central feature of a valentine table or as individual place markers. Four Chinese holly leaves can be centered with a vivid green rosette to simulate abstract shamrock leaves for Saint Patrick's Day. Easter lilies rising majestically from a wreath of *Ilex ferox*, or similar coarsely-prickled hollies, are very symbolic of Easter. Spring arrangements of rugged driftwood, accented with native hollies to emphasize the bursting linear branches of forsythia and the focal grouping of daffodils, are the very essence of the thought of transition from winter to spring.

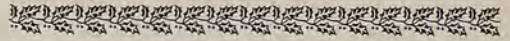
For many occasions especially throughout the winter, holly sprigs can be combined gracefully with corsage flowers to produce a truly distinctive corsage for milady. Cattleya orchids may be backed, for example, with glossy, dark green leaves of one of the English hollies. The linear pattern of the spray orchids may be accented by the tiny leaves of the tips of variegated English hollies. If the corsage is to be worn on a fine-textured fabric, or next to the skin of the wearer, then silhouettes of velvet or puffs of maline can be used to soften the prickle effect. The question may be asked concerning the coarseness of hollies as contrasted with orchids. Such a contrast naturally exists between the orchid flower and its own foliage. The true beauty of the orchid flower is accented by this natural contrast.

Other corsages can be fashioned for delightful effects from the use of hollies and flowers, or hollies and fruits or cones. The tiny Garnet Rose is a pleasant companion with the leaves of the *perryi* holly or that of *angustifolia*. The leaves of 'Foster's Hybrid No. 2' can be pleasing if used to give a twisted line effect with clusters of berries and cones for use on a tweed suit. Other combinations will become quickly apparent as

you visualize the possibilities of those hollies available to you.

Hollies are being used more and more in the landscape to give a desirable year-round effect. With a little thought they can also be used throughout the year to beautify our interiors. Hollies have been traditional for use during the winter season; let's make them a tradition for daily use in our homes! Enjoy arranging foliage and flowers; enjoy having them around you daily!

Henry P. Orr is an associate professor of horticulture and head, Ornamental Horticulture Division, Alabama Polytechnic Institute, Auburn, Alabama, and has flower arranging both as a hobby and as a profession. He is accredited with the National Council of Garden Clubs as an instructor in horticulture and flower show practices and has taught judging courses in Alabama, Georgia, and Ohio.



Care of

Cut Hollies

VICTORIA R. KASPERSKI

Necessary and helpful pruning can be done when gathering hollies for arranging and interior decoration. The pruning of evergreen hollies can be delayed until just before Christmas when foliage and berries are needed to enhance holiday decorations. The least desirable time to cut (arrangement-wise) would be when foliage is dropping or when new growth is extremely tender and underdeveloped.

After cutting, split woody stems several times at base for two or three inches. Condition with stems in water overnight or longer. In winter it helps to submerge cut branches of evergreen hollies in cold water for eight hours or longer

(overnight) to rid foliage of dust and grime and to give a fresher appearance. This is especially true if the period before cutting has been dry and windy. After the submerging period, lift branches and keep with stems in water until used. Handle carefully to avoid loosening berries which drop off when branches are crowded together or handled roughly.

Containers for conditioning should be wood, agate, earthenware or porcelain. Metal containers are least desirable and should be avoided.

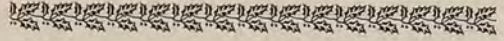
After conditioning and when foliage is dry it may be sprayed with clear plastic or coated with clear shellac. This helps check evaporation of moisture and delays curling and dropping of leaves. It does, however, create a polished and artificial look.

Berries of fruiting hollies may be cut as soon as they reach their full maturity and most brilliant colors. To save berries where birds feed heavily upon your trees, cut berried branches and keep in a cool, dark place with stems split and plunged into cold water. Some shriveling and dropping of berries is prevented by spraying branches with clear plastic, coating with clear shellac, or coating very thinly with melted paraffin. In any case, some of the natural beauty is destroyed.

When keeping hollies over a long period be sure to change water frequently and clean containers thoroughly. A few chunks of charcoal added to the water helps keep it clean by absorbing impurities.

Hollies used for decorations without use of water-filled containers, as on mantles, doorway decorations or similarly, should have stems cut slantwise or pointed and stuck into wet sphagnum moss which has been prepared especially for the decoration. Or, stems may be stuck into water-filled orchid tubes or small balloons (secured at top with a rubber band) before being used in the decoration.

Victoria R. Kasperski was formerly an assistant to the horticulturist at Mount Vernon, Virginia, and was responsible for the many artistic flower arrangements used throughout George Washington's historic mansion. As a result of her experience with cut flowers, she has authored a very successful book on How to Make Cut Flowers Last.



Holly Collections

FRANCIS DE VOS

Holly collections, whether in arboretums, parks, or private gardens, can advance our knowledge of the hollies and they can increase the popularity of the hollies as garden plants. The value of a collection is greater if it is properly labeled and carefully documented.

The educational and research values of a well-labeled and documented collection are reasons enough for its existence. To be of maximum educational value, however, it should be open to the public. There is no better way to interest the public in hollies than through attractively displayed and correctly labeled plants. The first spark of interest is often kindled when a person associates a name with a particular plant for the first time. To the beginning student of botany or horticulture, the labeled collection is an invaluable aid to learning; to the landscape architect and nurseryman, it is a standard on which he may base his selections to build his landscape picture; to the researcher and breeder, it is the very foundation upon which his work must commence; to the home owner and garden club member, the arboretum also provides authentic

List of Arboretums and Other Public or Semi-public Gardens Designated as Official Test Gardens of the Holly Society of America, Inc.	<i>Ilex aquifolium</i> and variants	<i>Ilex opaca</i> and variants	<i>Ilex crenata</i> and variants	Other (species varieties, cultivars, & hybrids)
Ambrose Brownell, Milwaukie, Ore.	*	*	*	*
Arnold Arboretum, Jamaica Plain, Mass.	3	55	18	32
Barnes Foundation, Arboretum of, Merion, Penna.	4	11	8	30
Boyce Thompson Institute, Yonkers, N. Y.	*	*	*	*
Brookgreen Gardens, Georgetown, S. C.	0	11	0	1
Brooklyn Botanic Garden, Brooklyn, N. Y.	28	29	6	33
Clarendon Gardens, Pinehurst, N. C.	92	87	24	51
Desmond Arboretum, Newburgh, N. Y.	*	*	*	*
Huntington Botanical Garden, San Marino, Calif.	*	*	*	*
Ida Cason Gardens, Chipley, Ga.	81	111	39	64
Long Island Agricultural & Technical Institute, Farmingdale, N. Y.	13	2	6	11
Longwood Gardens, Kennett Square, Penna.	18	3	6	21
Missouri Botanical Garden, St. Louis, Mo.	1	2	5	7
Morris Arboretum, Chestnut Hill, Philadelphia, Penna.	30	80	12	42
Morton Arboretum, Lisle, Ill.	0	16	4	8
New York Botanical Garden, Bronx Park, New York, N. Y.	9	25	14	28
Oregon State College, Corvallis, Ore.	85	6	6	30
Rutgers University, N. J. Agr. Exp. Sta., New Brunswick, N. J.	32	250	16	49
Scott Horticultural Foundation, Swarthmore, Penna.	9	58	7	22
U.S. National Arboreum, Washington, D. C.	92	101	40	75
University of Florida, Gainesville, Fla.	*	*	*	*
University of Washington Arboretum, Seattle, Wash.	31	18	8	38
Wolf, C. R., New Jersey Silica Sand Co., Millville, N. J.	26	29	5	16

*Enumeration of total species not available.

information regarding the suitability and hardiness of shrubs and trees for their personal landscape uses.

Collections, particularly those at arboretums, can serve as an important source for herbarium specimens of various species, varieties, and cultivars of hollies. The herbarium specimen is an important permanent plant record against which the authenticity of other specimens may be checked. Next to the living plant, the herbarium specimen is our most important plant record, and its degree of permanency is even greater.

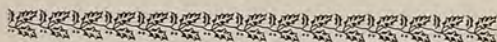
Perhaps the most consistently useful bit of information that has come out of

collections is a determination of adaptability and landscape value of existing species, varieties, and cultivars in various climatic situations. Cold-hardiness, heat-tolerance, and drought-resistance of a particular holly are of primary concern to anyone purchasing it. As holly collections are developed in the various climatic areas throughout the country so will our knowledge of their adaptability be increased. The range of landscape usefulness of a variety is often somewhat less than the range over which it will grow. It may survive in a wide range of climatic situations but retain its landscape merits in only a few.

The cultural problems confronting those that have large holly collections are but an enlargement of the problems of the homeowner who is growing only a few. In spraying for insect and disease control, planting, pruning or fertilizing, the collector is acquiring valuable information concerning species and varietal responses to his cultural methods. When these cultural procedures are carefully carried out and recorded so that others may benefit, our knowledge of hollies has been increased.

The following list of arboretums and other public or semi-public gardens and the extent of their holly collections was prepared in response to a questionnaire sent to those institutions designated as official test gardens for the Holly Society of America and others, in February 1957. Since they asked only to indicate the number of kinds in the major horticultural groupings, persons interested in locating specific clones, varieties, species or hybrids are referred to the *Holly Check List*. Large collections are also maintained in many of the nurseries specializing in holly.

Francis de Vos is assistant to the director of the United States National Arboretum, Washington 25, D. C., and is a past secretary of the American Horticultural Society.



Adventuring With Hollies

RAY R. HIRT

A holly sprig with its beautiful crisp prickly leaves and sparkling red berries commonly stirs memories of Christmas holidays and family gatherings. Perhaps largely for this reason, hollies appeal to the gardener and present a challenge in plant culture that is difficult to resist.

Until recent years, hollies have been thought of as mild-climate plants, and only the most adventurous gardener experimented with them in the vigorously cold inland climate of the New England States and central New York. As southern holly growers cultured and named their more winter-hardy selections, interest in growing hollies gradually spread northward. Attempting to grow hollies in Zones 4 and 5 is still a venture with some selections. In those zones, it is advisable to recognize in advance that the pleasure derived from watching hollies grow may be terminated during any winter season by the loss of the plants due to freezing. Every gardener has such experiences with choice annuals and biennials, and it is not an uncommon experience for rose growers. Hence, holly hobbyists should not be discouraged by similar experiences.

Well established plants of selected hardy varieties of American hollies can endure surprisingly low winter temperatures without serious injury, either to the foliage or wood, if proper precautions are taken. My own trees have survived seven central New York winters with temperatures as low as twenty below zero for several consecutive days. In cold climates, it is essential to mulch beneath the branches in order to keep the frost from penetrating below the root system. Frost in the upper soil layers will do no harm. Alternate layers of sawdust and oak leaves, or wood mold from oak or chestnut stumps make an excellent mulch. The soil should be wet within the root area as the plants go into winter dormancy. Rotted cow manure and cottonseed meal added to the mulch in the spring is desirable. If these precautions are taken, site will not be too important. The trees should endure the average winter winds and sunshine without serious injury.

Because evergreen hollies retain foliage all winter, they are very subject to breakage from heavy wet snows, much more so than evergreens with needlelike foliage. Therefore, the wet snow of spring and early winter storms should be carefully removed from hollies before the branches sag enough to break.

Hollies less than two years old are a real risk when planted in the North, due largely to their restricted root system. Field grown, balled and burlapped

plants will probably have a better chance of survival than those grown in bands or small impervious containers. The plants should be set out in the spring, back-filled with a sandy loam, and heavily mulched. Additional mulch and thorough watering are desirable in the late fall. For the first winter or two the young plants may need protection for the aerial parts. A circle of wire surrounding each plant and filled with loose excelsior or covered with burlap will reduce water evaporation from the foliage to a minimum. This is essential for recently transplanted evergreens with a restricted root system. It is a wise precaution to place poison mouse bait within the enclosures in order to eliminate injury by rodents.

Seedling hollies do not survive out of doors in the North, at least in my experience. Seeds will germinate and the minute seedlings appear above ground, but die during the following winter. If grown in a flat or pot, they can be brought into a cool basement room for the winter and placed outside again in the spring. During the winter the plants will require a little light daily although direct sunlight is not necessary. There is sufficient variation among seedlings to make their culture very interesting. The growth of seedlings can be hastened by exposing them to heat and fluorescent light during the winter season.

Hollies are either staminate or pistillate and plants of both sexes must be present if berries are to be produced by natural processes. One staminate tree will provide pollen for a relatively large number of pistillate trees, even when the latter are quite distant, provided bees or other insects are active when the plants are in bloom. It is surprising how bees will discover small isolated pistillate trees and carry pollen to them. Since staminate trees have no berries, their beauty must lie in the foliage and form of the tree. In selecting a male tree it is well to give attention to its appearance as well as its ability to produce abundant bloom when the female trees are receptive.

In central New York, American hollies have been quite free of insect and fungus pests. Apparently winter temperatures are too severe for good survival of the holly leaf miners accidentally brought in on new plants. If the miners do survive

a mild winter, a suitable insecticide properly applied will destroy them. Once eliminated, there is no natural source for further contamination. Neither spider mite nor scale has yet been a problem, and no fungus injury has appeared. Chlorosis or yellowing may occur but probably will not if the soil is properly prepared and kept slightly acid.

A gardener who succeeds in growing a few nice hollies may want to supply a few friends with some rooted cuttings. To root cuttings is a relatively simple procedure. Various publications tell how it is done. Slips of the season's growth about five inches long taken during September or October are suitable. Dip the fresh-cut ends in a hormone powder and set upright in a rooting medium such as vermiculite, or a mixture of equal parts (volume) of sharp sand and peat moss. Apply water until the rooting medium is quite thoroughly wet. If the container is a plant pot, the pot and cuttings can be enclosed in one of the transparent plastic wraps; or a glass jar can be inverted over the cuttings. The container should be placed in subdued light in a warm room and kept moist. In two to three months, some of the cuttings will have rooted. They can then be transplanted and passed on to a gardener friend.

Some American hollies will flower within a year or two after being started from cuttings. A small tree with a cluster of berries, placed in a silvered pot and tied with a red ribbon and dainty bow, makes a wonderful Christmas gift. Pot culture of early-fruiting hollies requires only a little work and a bit of ingenuity, some outdoor space during summer months, and a lighted area in a cool basement during the winter.

Many of the exotic hollies are fascinating plants for the gardener who wishes to venture into new fields of plant culture. Such gardeners may discover new information about the culture of these plants which can be passed on to other holly enthusiasts. It is the exchange of these ideas that makes meetings of garden clubs and related organizations as the Holly Society of America, Incorporated, informative and interesting. In Syracuse, New York, plants of English hollies have been grown for about twelve years. They were started from seed in a cold frame and later

transplanted to the lawn border. The plants rarely bloom because, unlike American hollies, flower buds are set by autumn and survive only the mildest winters. The leaf buds and foliage survive, however, and the plants add beauty and interest to the border plantings. *Ilex cornuta* f. *burfordi* makes an excellent pot plant. It is not winter hardy in Zones 4 and 5, apparently, and must be brought indoors for the winter. Common garden soil suffices; cramped roots do not seem to hinder survival; and dull light is ample for photosynthesis. Young plants form blossoms and fruit is set without pollination. My plants have remained in the same six-inch pots and soil for seven years. Each spring they produce their fragrant flowers while in the basement playroom, and have young berries of fair size by the time they are set in the garden for the summer. *I. pernyi* is an interesting Chinese holly that grows well when potted and is also surprisingly winter-hardy.

The evergreen, black-fruited garden varieties of *Ilex crenata* have proved hardy in my garden in central New York during the past several years. They are interesting plants that can be kept small by judicious pruning and are extremely easy to reproduce by cuttings.

Whereas my own experience with hollies has been restricted to the North where only a limited number of holly species are known or thought to be winter hardy, other sections of the country should be favorable for the growing of many different holly species and selections.

Pioneering in any field of endeavor is a challenge. Whereas many failures are almost inevitable, there is always the possibility of successful accomplishment that will give satisfaction to the adventurer, and may contribute to the pleasure of others. There is much to learn about growing American hollies outside their natural range. Only a few choice selections have been experimented with seriously in northern climates.

Ray R. Hirt, formerly head, now senior professor, Department of Forest Botany and Pathology, College of Forestry, State University of New York, Syracuse, New York, has served as president, National Shade Tree Conference and is one of the founders and a director of the National Arborist's Association. He is a member of the Holly Society of America, Inc., and is personally testing the hardiness of many American holly selections as well as English and Oriental hollies at Syracuse.

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