Fig. 2. A fruiting stalk of white baneberry. The white fruit with a dark spot at the apex (a remnant of the stigma) is responsible for the common name "doll's eyes." Note the thick pink pedicels (flower stalks).

White Baneberry and Red Baneberry

Actaea pachypoda and Actaea rubra
Buttercup Family (Ranunculaceae)

Both white baneberry and red baneberry are poisonous plants native to the Northeast. They are most easily distinguished from one another when in fruit because the leaves and flowers of the two species are similar.

Habitat: Both species of baneberry are commonly found in deciduous forest but may also occur in mixed forest with conifers, particularly the red baneberry. Red baneberry may also inhabit swamps.

Range: White baneberry—parts of the Canadian Maritimes and the southern border of eastern Canada south along the East Coast to northern New Jersey, continuing inland along the southern Appalachians and then west to eastern Minnesota and northern Mississippi. Red baneberry—more extensive, reaching north well into Canada, west to Alaska, and south only to northern New Jersey and Pennsylvania in the East. Across the northern United States, its distribution extends irregularly south in the Midwest and the Mountain States and from the Pacific Northwest into California in the Far West.

It is difficult to tell the two species of baneberry apart when they are not in flower or fruit. Both are perennials inhabiting deciduous woodlands, and both are similar in overall appearance and in the shape of their compound leaves with sharply toothed leaflets (fig. 3). However, when in flower, there are small but detectable differences: first, the inflorescence of white baneberry is cylindrical with the flowers densely congested on the raceme (fig. 4), in contrast to the inflorescence of red baneberry, which is more pyramidal with its flowers less densely arranged (fig. 1); second, and probably more important for identification purposes, is that the stigma of the white baneberry flower is sessile and is as wide as or wider than the ovary, sometimes appearing even to extend down the sides of the ovary (fig. 5). The stigma of red baneberry is just slightly elevated and, while large, is narrower than the ovary and never extends down its sides (fig. 6). Looking carefully at the flowers will result in the additional observation that the 4–10 petals of the two species differ in shape. The tips of the petals of white baneberry appear either as though they had been bluntly cut off or that they are bilobed at the tip, almost as if anthers

Fig. 3. A plant of white baneberry showing the overall habit and leaf type, which is similar in both species of baneberry.

Fig. 4. A cylindrical inflorescence of white baneberry, with densely crowded flowers.

were affixed to the apex of the petals (some botanists consider the petals to be staminodes rather than petals; indeed some consider the petals in all Ranunculaceae to be derived from stamens) (fig. 7). In contrast, the petals of red baneberry have an apex that is either acute or obtuse, but never bilobed (fig. 6). Both species have petals that are more or less clawed (sharply narrowed) at the base.

When the inflorescence is just beginning to flower, it is not always easy to discern that the pedicels (flower stalks) of the flowers of white baneberry are thicker than those of red baneberry. However, as the inflorescence matures, and especially when in fruit, this feature becomes more pronounced. In fruit, the two species cannot be mistaken. In white baneberry, the raceme and individual fruit stalks will be nearly as thick as the main stalk of the inflorescence and deep pink to red in color (fig. 2). The inflorescence stalk of red baneberry is more delicate and is greenish-brown with filamentous pedicels (figs. 1, 6).

Berry color should not be used as the sole means of identifying the two species, since fruit color can be variable. White baneberry typically has white fruit, but very occasionally red-fruited forms do occur (called *A. pachypoda* forma *rubrocarpa*, or even *A. ludovicii*, if viewed as a distinct species). These red-fruited rarities are probably the result of hybridization with red baneberry and do not contain viable seeds. Red is the typical color of red baneberry fruits (fig. 8), but plants with white fruits are not uncommon (known as *A. rubra* forma *neglecta*) (fig. 9), particularly in certain geographic regions. Thus, it is important to always look at the form of the raceme and the width of the pedicels when making an identification. A noticeable black spot at the apex of each fruit, whether red or white, is the remnant of the stigma; it is markedly larger in white baneberry fruits, giving rise to another common name for the species—"doll's eyes" (fig. 2). *Actaea spicata*, a black-fruited European species, has a red-fruited variety, *A. spicata* var. *erythrocarpa*, which is considered by some taxonomists to be the same species as *A. rubra*. Further investigation is needed to make a valid assessment of the relationships between the various members of this circumboreal group of species.

The generic name, *Actaea*, is from the Greek *aktea*, an ancient name for elderberry (*Sambucus*), although there is little resemblance in the plants. The specific

Fig. 5. (Left) A close-up of a newly opened flower of white baneberry in which the stigma is receptive but the anthers have not yet dehisced to release their pollen. Note that there are already pollen grains from another flower on the stigma. **Fig. 6.** (Right) A close-up of flowers of red baneberry. Note the slender pedicels, stigmas that are not as wide as the ovaries, and petals that are acute at the apex.

Fig. 7. A close-up of a flower of white baneberry. Note the thick pedicel, the stigma that is wider than the ovary, and the petals with small, bilobed structures on their blunt tips.

epithet, *pachypoda*, from the Greek meaning "thick foot" (*pachy*, "thick"; *poda*, "foot"), refers to the thick stalk of the mature fruit in white baneberry. Red baneberry's epithet, *rubra*, of course, denotes the usual color of the fruit of that species, and the term "bane" refers to a source of harm or death, because these plants are known to be poisonous. *Actaea* is a genus originally described by Linnaeus in 1753. Linnaeus' genus *Actaea* included two species having a single carpel: one with dry, dehiscent fruits (the North American black cohosh), which Linnaeus called *Actaea racemosa*, and one with fleshy berries, a European species, which he called *Actaea spicata*. Linnaeus also included in *Actaea* another species with dry fruits comprising four carpels, a Siberian species that had been described previously in the genus *Cimicifuga* and was recognized as such by Linnaeus in his *Genera Plantarum* in 1752. By 1753 he had decided that carpel number alone was not a sufficient reason for separating the two genera and transferred the *Cimicifuga* species to *Actaea*. Linnaeus based his decision on the similarity in inflorescence type, flowers, and seeds of the two genera. However, he was to change his opinion once again in 1767, returning *A. cimicifuga* to the genus *Cimicifuga* as *C. foetida*, again distinguishing the genera based on the number of carpels.

Later taxonomists defined the two genera differently—by fruit *type*; species with berrylike fruits were placed in *Actaea*, whereas those with dry, dehiscent follicles were placed in *Cimicifuga*, including black cohosh (*C. racemosa*), the only single-carpelled member of that dry-fruited genus. That classification system was still in use when volume 3 of the *Flora of North America*, which includes the Ranunculaceae (buttercup family), was published in 1997. However, the following year, John Compton published his definitive work on the systematics of *Actaea* and *Cimicifuga*, showing the two genera to be so closely related that it was necessary to "lump" them into a single genus. Compton and his colleagues felt that separating two morphologically similar genera based on a single (but obvious) feature (fruit type) was not a justifiable reason for maintaining the two as separate genera. They cited examples of other genera that include species with both berrylike and dry, dehiscent fruits (e.g., *Aloe*, *Hypericum*, and *Lobelia*), and they demonstrated that a set of less obvious morphological features, along with DNA analysis of two different

Fig. 8. (Left) A red baneberry plant in fruit. Note the slender pedicels. **Fig. 9.** (Right) A white-fruited red baneberry plant. Note the slender pedicels and black stigma remnant at the tip of each fruit; the black spot is smaller in this species than in white baneberry.

genes, all indicated that members of the two genera should, in fact, be consolidated into a single genus—*Actaea*, the earliest name applied to this group. Compton's work is recognized by the APG. This long history of taxonomic changes offers some insight into the reasons behind the name changes that cause confusion for amateur and professional botanists alike.

The genus *Actaea*, as described in the *Flora of North America*, has eight species, two of which are found in North America. As previously noted, one, *A. pachypoda* (formerly known as *A. alba*), is confined to the eastern part of the continent, while the other, *A. rubra*, occupies a range that extends across the entire northern expanse of the continent, with fingers extending irregularly south in the Mountain States and the Far West. However, at the time of publication of this family treatment in *Flora of North America* (vol. 3, 1997), *Cimicifuga* was still considered to be a separate genus of about 12 species (6 in North America). Thus, if one combines the total number of species in the two former genera, there would now be about 20 species of *Actaea* worldwide.

Sweet aromas produced by the petals of both white and red baneberry flowers attract insect visitors. Analysis of the roselike fragrance of red baneberry petals indicates that the primary constituents responsible for producing the aroma are a mixture of monoterpenes and related compounds. The fragrance of white baneberry has not yet been analyzed, but it differs from that of red baneberry in that it is more citruslike. Rosy and citrusy scents are attractive to many types of insects, but they are also very similar to compounds that deter herbivory by insects. Olle Pellmyr and his colleagues hypothesize that the aromatic compounds originally produced as deterrents also served as cues for female insects to find flowers that provided copious, nutrient-rich pollen and ovules to feed on. This chemical signature also signaled to male insects that mating opportunities existed at the site (because of the profusion of visiting females). The insects then carried pollen to other plants of the same species, thereby enhancing the plant species' reproductive success to a point where it outweighed the detrimental effects of the pollen feeding. In baneberry, the natural selection that benefited the insects (and thus the plant species itself) led to an enhancement of the aroma used to attract the insects. Pellmyr proposes that in this way, compounds originally designed to deter insects subsequently underwent modifications that allowed flowering plants in general to evolve to their present state of insect attractiveness, with the result of enhancing successful pollination. Many species of ancient lineage, such as *Actaea*, have a strong fragrance that attracts insects, possibly indicating that floral aroma, rather than color, was the original insect attractant. In *Actaea*, aromatic compounds, including geraniol and nerol, have been shown to affect the behavior of insect visitors. Nerol, which has a sweet "rosy" odor, is found in many essential oils and is an important ingredient in perfumery.

The flowers of *Actaea* offer no nectar reward, only pollen. Strangely, the current principal pollinator of both species of baneberry in the Northeast is an introduced weevil, the European snout beetle (*Phyllobius oblongus*) that arrived in the United States sometime prior to 1923. The European snout beetle does not visit the flowers for pollen; rather, it favors

Fig. 10. Fruits and seeds of white baneberry. Note the thick, red pedicels, large black spot at the tip of each fruit, and wedge-shaped seeds.

the inflorescences of baneberry as mating sites. The ensuing activity results in the beetles being covered with pollen, which they then transport to the receptive stigmas of nearby plants. Baneberry stigmas are receptive to pollen immediately upon anthesis (the opening of the flower) and throughout the flower's life, but the anthers do not elongate and release pollen until four days after the flower opens, a partial barrier against self-fertilization (see pollen grains on the stigma of a flower in which the anthers have not yet dehisced, fig. 5). Reproductive success is high in both eastern species of baneberry, which have nearly 100% fruit set. Investigations of the gut contents of the introduced weevils revealed that they do not feed on the pollen; instead, they are known to feed on the leaves of deciduous trees, leaving telltale notches along the leaf margins in spring. Obviously, before the alien beetles arrived, pollination must have been carried out by other insects, and in the Michigan study by Pellmyr, it was shown that native beetles are responsible for pollination in *A. rubra* in that area. However, in the later-flowering *A. pachypoda*, pollination is carried out principally by solitary bees and syrphid flies, insects that emerge at the same time that the white baneberry blooms but later than the flowering peak of red baneberry. In areas where both species coexist, *A. rubra* always begins flowering earlier, with the flowering periods of the two species overlapping by just three to five days. There is, therefore, a small window of time during which pollen from one species might be deposited on the stigma of the other, with the rare result of a hybrid. The Michigan study provides a look at the original reproductive system of the two species of baneberry, which has become obscured by the introduction of an alien beetle in the Northeast.

Although highly toxic, baneberry fruits are consumed by a wide variety of birds (including robins and yellow-bellied sapsuckers) that generally digest the pulp and excrete the tan-to-brown, wedge-shaped seeds (fig. 10); ruffed grouse also eat the fruits, but the seeds are destroyed in the process. Small mammals, such as mice, squirrels, and voles, eat baneberry fruits, with most fruits disappearing at night. The rodents sometimes remove the pulp and eat just the seeds and thus do not serve as dispersal agents (unless they cache some seeds for future use and then forget to retrieve them). Larvae of geometrid moths attack a high percentage of the fruits of both species while they are still green, burrowing into the seeds and destroying them.

The berries are the most poisonous part of the plant, but all parts of the plant are toxic, and ingestion can cause respiratory paralysis and cardiac arrest. Despite this known toxicity, white-tailed deer are known to browse the plants. The browsing does not kill the plants, but it does prevent them from flowering, thereby curtailing their ability to reproduce. Baneberry plants have long been used for medicinal purposes. Peter Kalm (see the chapter on skunk cabbage) reported in 1770 that both species were used by Native Americans and colonists to treat rattlesnake bite. Native Americans also used red baneberry for the treatment of menstrual problems, as a purgative, to treat syphilis, to increase milk flow, and as a gargle. Yet the juice from the fruits was reportedly also used as an arrow poison!