

Snow White and the Winter Wake-Up Call



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Several popular folk tales feature characters that sleep for extended periods of time. Rip Van Winkle fell asleep on a mountaintop for 20 years and awoke to find the Revolutionary War had ended and that his crabby wife had died. In Christian mythology, seven young men fell asleep in a cave near Ephesus (now Selcuk, Turkey). As a punishment for their refusal to renounce Christianity and embrace pagan ideals the Roman emperor Decius ordered the cave sealed. When the cave was unsealed decades later the Seven Sleepers of Ephesus awoke to find that Christianity had been widely adopted. And we can't forget little Snow White who fell into a deep sleep after being tricked by her evil stepmother into eating a poison apple. In the Disney-version of this Grimm Brothers tale she was awakened by a kiss from a princely suitor.

Like Snow White and Rip Van Winkle, the seeds of virtually all plants take a long nap, or in other words, are dormant after they are produced. Dormancy, which is a period of suspended growth, was an important evolutionary development for plants for two major reasons: (1) Dormancy provides time for the seed to be dispersed; and (2) Dormant structures such as seeds and buds are resistant to severe environmental conditions including the harsh cold of winter or the parching drought and heat of summer.

A dormant seed must remain "asleep" until conditions are favorable for the survival of its seedling; germinate too early or too late and the seedling may die. Thus, seeds wait for a wake-up call just like Snow White dreamily waited for the Prince's kiss. For most woodland herbs (and other plants) in the St. John's Arboretum, several weeks of exposure to temperatures about 5 C is their wake-up call. The cold treatment, termed

stratification, acts like an alarm clock to break dormancy even though the seed may not actually get out of bed – or germinate – until warmer weather. As a result the seeds of most of our plants "sleep" through the cold winter months and then germinate in the spring. Some woodland herbs that require cold stratification and germinate the following spring include jewelweed (*Impatiens capensis*), black snakeroot (*Sanicula canadensis*), wood-sorrel (*Oxalis acetosella*), and honewort (*Cryptotaenia canadensis*). In addition to the cold treatment, some plants like sweet cicely (*Osmorhiza claytonii*, *O. longistylis*) and yellow trout-lily (*Erythronium americanum*) also require a warm treatment during the summer before the winter cold treatment is effective.

In contrast, liverleaf (*Hepatica acutiloba*), wild ginger (*Asarum canadense*), wild leek (*Allium tricoccum*), baneberry (*Actaea pachypoda*), bloodroot (*Sanguinaria canadensis*), and many other woodland herbs wake up, or break dormancy, slowly. The seeds of these species are analogous to a sleepy college student who after hearing the alarm throws his/her legs out of bed but it takes several cycles of the sleep button to get the rest of their body moving. These species are interesting because they germinate in two stages that require warm and cold stratification periods, respectively. In the first stage the root grows and in the second the shoot develops. The seeds of these species are shed in the early summer but germinate in the autumn. Germination commences and the roots emerge from the seed only if it receives a warm treatment during the summer. During warm spells in the fall the roots of the germinating seedling continue to grow until winter arrives. Then, like our sleepy student who falls back asleep, the roots take a "nap." The shoot doesn't

emerge until the following spring, but only after the seedling receives a winter cold treatment. Presumably, the advantage of this pattern is that the root system that is established in the fall increases the survival of the seedling once the shoot appears.

Still other herbs, like Jack-in-the-pulpit (*Arisaema triphyllum*), large-flowered trillium (*Trillium grandiflorum*), Solomon's-seal (*Polygonatum biflorum*), false Solomon's-seal (*Smilacina racemosa*), bellwort (*Uvularia grandiflora*, *U. perfoliata*), and blue cohosh (*Caulophyllum thalictroides*), need to be kissed twice before they will awake. In other words, the seeds of these species sleep through two winters before they fully germinate! The seeds are typically released in the summer and germinate the following spring after winter cold stratification. The root system grows during the spring and remainder of the summer. However, the shoot doesn't develop until it receives another cold stratification period the following winter. This "double dormancy" insures that the root system is adequate to support subsequent shoot growth.

Not all seeds rely on a cold "kiss" to break dormancy. In a few species the alarm clock is set to wake their seeds in the autumn. For example, the seeds of false rue-anemone (*Isopyrum biternatum*) are shed in early summer when the embryo is still undeveloped and incapable of germination. The immature embryo can't elongate and reach maturity until it is heat-stratified during the summer. After this "sizzling kiss" the embryo elongates, becomes mature and germination begins. The resulting seedling then takes a "winter nap" and continues its growth in the spring.

We often think of winter as a time of the year when little happens in nature. As we've seen, this certainly isn't true. Most seeds require a cold treatment during the winter to break dormancy and synchronize their germination and growth with the season. So the next time you curse the bone-chilling cold of winter, imagine that you're a woodland herb and consider the frosty conditions a simple kiss. This thought may not warm you up too much, but hopefully it should provide some comfort knowing that the cold will spark our seeds from their slumber, just like Snow White and her prince.

