Managing and preserving a museum collection can be complex and challenging—especially when it is composed of a vast diversity of living organisms from around the world, each adapted to a unique set of conditions. Our collections of trees, shrubs, and vines at the Arnold Arboretum face continuous and ever-changing biotic and abiotic influences, from both native and introduced pests and diseases to environmental variabilities in precipitation and temperature. Even human influences, from the maintenance decisions we make as staff to issues with theft and vandalism, impact the success of cultivation. Managing this array of factors requires juggling between preserving valuable lineages, providing access to the collections and landscape, and reducing the environmental and human impacts of our preservation decisions—with a goal to maintain the valuable germplasm represented by our collections in perpetuity.

At the Arnold Arboretum, these multiple and sometimes competing objectives are coordinated by a talented team of horticultural professionals who steward the Arboretum’s Plant Health Care (PHC) program. Our PHC program starts with providing the right growing conditions to keep plants vigorous and thriving. Considerations include proper site selection and establishment, aesthetic and corrective pruning measures, reducing competition from weeds, and soil health management. While all of these actions serve to reduce the occurrence of compromising issues, our daily PHC operation requires the continuous evaluation, prioritization, and mitigation of the various plant stressors that impact the health of our collections. New knowledge and perspectives gained from our team’s observations and research, as well as partnerships developed with outside experts, have proven essential to the success of our efforts. This adaptive management approach—where problems are routinely assessed, care options are explored and implemented, and outcomes measured to provide prescriptive adjustments to our care strategies—lies at the root of the Arboretum’s PHC program.

Our response to winter moth (Operophthera brumata) offers a good illustration of this adaptive approach in dealing with significant issues affecting the health of our collections. Originally introduced from its native Europe to Nova Scotia in the 1930s, winter moth now inhabits parts of New England and the Pacific Northwest. Feeding on a wide range of plant genera including oak (Quercus spp.), ash (Fraxinus spp.), maple (Acer spp.), blueberry (Vaccinium spp.), apple (Malus spp.), and even rose (Rosa spp.), winter moth represents the single most destructive insect pest impacting our collections today. As its name suggests, adult moths emerge from the soil in late fall and early winter. Females lay their...
eggs in bark furrows of host trees, where they overwinter and emerge in early spring before most plant species break bud. The tiny, newly hatched caterpillars make their way to branch tips and begin feeding on foliage and flowers by working their way between bud-scales. As buds continue to swell and leaf-out, extensive damage has already occurred, apparent by the numerous irregular holes in leaves and destroyed flowers.

Staff have monitored the expansion of the winter moth population since it was first observed in the Arboretum in the mid-2000s. Early on, population levels required annual spring treatments based on detected “hot-spots” in the collections. The winter moth population grew quickly, however, and over the last ten years has required intensive efforts to keep the pest in check. Progress toward keeping winter moth populations below damaging thresholds without extensive treatment may be right around the corner, thanks in part to a small fly and the work of Joseph Elkinton, Professor of Environmental Conservation at the University of Massachusetts, Amherst. *Cyzenis albicans*, a parasitic fly, also a European native—has proven to be an effective biological control of winter moth in other areas of its introduced range here in North America. Dr. Elkinton and his team are now working to establish the fly in New England with encouraging results.

In 2015, the Arboretum assisted the Elkinton Lab with monitoring the fly’s establishment and spread from some of their original release sites in Wellesley, MA, and collaborated on a release in the Peters Hill section of the Arboretum to introduce the fly in Boston. Because spraying would reduce the fly’s rate of establishment and spread, the Arboretum has committed to a minimal spray approach for managing winter moth on Peters Hill. While this treatment reduction has increased defoliation, and in some cases led to the decline of some Peters Hill accessions, the long-term benefits of establishing *C. albicans* on Peters Hill exceed the risk.

Just one year later, our lab partners have successfully recovered *C. albicans* from winter moth pupae collected from Peters Hill. According to Dr. Elkinton, the rate of parasitism in the pupae sampled was around two percent, an establishment figure that typically takes several years to be detected. Of the eight 2015 release sites across the region, the Arboretum release is the only one where establishment has been documented. Although the use of *C. albicans* as a biological agent will never eradicate winter moth entirely from our landscape, we hope that its establishment will offer us a more effective and sustainable approach to control the pest over the long term. Once established, it should greatly reduce, and possibly eliminate, the need for chemical treatments for this highly destructive pest. As we continue to monitor and manage winter moth populations and the spread of *C. albicans* across our landscape, newly emerging information will continue to guide our management decisions.

Across our 281-acre landscape, the Arnold Arboretum seeks to better understand the conditions that affect the health of our plants, which are fundamental to our mission of science, horticulture, and education. As we face both new and ongoing plant health challenges, a top priority will be to identify effective and environmentally-sustainable solutions. Winter moth management is just one among many examples from the Arboretum’s PHC Program that applies the principles of adaptive management. In this dynamic landscape, our approaches to steward the living collections will only be successful through the continuous integration of new information, often through enterprising partnerships.