Significance of These Pests in Ornamental Ponds

The increasing popularity of aquatic gardens has created a strong demand for high-quality aquatic plant material. Unfortunately, insect pests can damage these aquatic plants. Maryland nursery and landscape managers report that two major insect pests commonly damage waterlilies: the China mark moth, *Nymphuliella daeckealis* (Haimbach), Family Crambidae, Nymphulinae, and a waterlily leafcutter, *Synclita obliteralis* (Walker), another Crambidae. Aquatic nurseries and landscape companies have limited options for controlling these insect pests in aquatic pools.

Feeding injury from *N. daeckealis* and waterlily leafcutter larvae causes aquatic plant producers major economic losses. In aquatic landscapes, damage from larval feeding makes plants unattractive, and excessive populations may reduce plant vigor or cause plant death. (See Figure 1, “Defoliation from high larval populations.”)

Little information has been published about the life cycles of these two aquatic plant pests. To address this problem, the University of Maryland Cooperative Extension faculty at the Central Maryland Research and Education Center and at College Park conducted studies, detailed below, to establish basic life-cycle information about *N. daeckealis*. A brief explanation of the waterlily leafcutter’s life cycle appears on page 3.

Life Cycle of *N. daeckealis* in Maryland

**Egg and Larval Stages**

Adult females lay eggs close to the edge of the waterlily leaf or on the leaf’s underside. (See Figure 2, “Female laying eggs on leaf surface.”) After the eggs hatch, the larvae begin cutting small shot holes, which vary in diameter from 0.25 inch (63 cm) to 0.75 inch (1.8 cm), on the edge of the foliage. The larvae use the cutout leaf pieces as a body covering that serves as protection and enables the larvae to float.

*N. daeckealis* larvae have four instars, based on head capsule measurements. (See Figure 3, “Four larval instars.”) The moths overwinter as late instar larvae attached to the underwater stems of aquatic plants. In the spring, the water begins to warm and new waterlily foliage moves toward the surface. The larva, enclosed between two pieces of leaf held together with silk, begins to migrate to the water surface to feed on foliage. (See Figure 4, “Overwintering stage larva between two leaf pieces.”) The larva attaches to the underside or edge of the leaf or moves to the leaf blade where feeding results in leaf skeletonization. Throughout development, the larva uses two cutout leaf pieces to construct an enclosed, boatlike, floating structure, and places itself between these pieces, forming a case. The larva then spins a silken layer inside the case. This case provides protection and transport-
tion, allowing larvae to float from plant to plant. As the larva progresses through the instars, it consumes leaf tissue while concealed within the cut piece of foliage. As the larva matures, it harvests new, larger leaf pieces. The late instar leaf casing will be 0.5 inch to 0.75 inch (1.27 cm to 1.9 cm) long. When the larva in its case comes in contact with a waterlily leaf, the larva attaches itself and begins to feed.

Whereas early instar larvae are skeletonizers, late instar larvae are defoliators, consuming the entire leaf tissue. The larva does not leave the leaf case. If you carefully extract larvae from their leaf cases and place them in the aquatic pool, they sink and die. (See Figure 5, “Larva extracted from two leaf pieces.”) The leaf casing, therefore, appears to be essential to larva survival.

During hot weather, larvae were observed in higher numbers than during cool, rainy weather. During the later instars, larvae were found migrating over the leaf surface covered by a cut leaf piece and then boring down into the waterlily leaf petiole from the top of the leaf. (See Figure 6, “Larva in petiole.”) Larvae often join whole waterlily leaves together and feed between the leaves. Cocoons can be found on the underside of leaves and attached to the stem.

The insect’s development continues until cooler temperatures arrive and the waterlily foliage becomes scarce. At this time, remaining late instar larvae migrate down the waterlily leaf stem and overwinter inside their leaf boat.

Pupal Stage

Pupation occurs in a silken cocoon on the underside of leaves or on the stems.

Adult Stage

The adult *N. daeckealis* is small and orange-brown, with a 1-inch (2.5 cm) wing spread. The wings have orange-brown patterns with white markings. (See Figure 7, “Adult China mark moth.”) Adult males and females emerge in spring and mate, and the female lays eggs on the surface of the waterlily foliage. Large numbers of adults may be present from mid-July to late September.

Three overlapping generations occur each season in Maryland. Field research conducted in 1999 and 2000 at University of Maryland’s Central Maryland Research and Education Center found large numbers of early instar larva in mid-July, mid-August, and late September.

Host Plant Preference Trials

In 1999 and 2000, we evaluated *N. daeckealis’* preference for three waterlily varieties. Of the three, the green-leafed floating waterlily, *Nymphoides peltata* ‘Floating Heart’, had suffered the most extensive feeding damage and defoliation. (See Figure 8, “Damage to ‘Floating Heart’.”) The other two waterlily varieties evaluated, *Nymphoides cristatum* ‘White Snowflake’ and the Hardy Waterlily, *Nymphaea* ‘Mrs. C.W. Thomas’, were rarely damaged excessively, although they did suffer some feeding injury. (See Figure 9, “‘White Snowflake’,” and Figure 10, “Comparison of damage to ‘Floating Heart’ on left to ‘Mrs. C.W. Thomas’ on right.”) The foliage of both *Nymphoides peltata* ‘Floating Heart’ and *Nymphoides cristatum* ‘White Snowflake’ is much smaller and thinner than the *Nymphaea* Hardy Waterlily. Because we found the thin-leaved waterlily varieties often completely defoliated, the larvae of *N. daeckealis* appear to prefer them to the thicker-leaved plants. Larvae also appear to prefer the green-leaved, yellow flowering *Nymphoides peltata* ‘Floating Heart’ variety instead of the variegated, white flowering *Nymphoides cristatum* ‘White Snowflake’ variety. The larva may not favor variegated foliage. Tim Jennings, a senior gardener specializing in aquatic plants at Longwood Gardens in Kennett Square, Pennsylvania, notes that *N. daeckealis* larvae are primarily a pest of floating leaves in both tropical and hardy varieties of *Nymphaea* and secondarily a pest of *Nymphoides*. Damage initially appears in mid to late August and continues into early fall. At Longwood Gardens *N. daeckealis* has also been a problem for their greenhouse stock plants during the winter.
Monitoring

Examine ponds in early spring for leaf sections attached to stems. Tiny shot holes in the foliage are the first evidence of larval feeding. As larvae increase in size they cut larger leaf pieces from the edges, which they use as their boats. The early instar larvae skeletonize the foliage, causing extensive damage. Larva will unite several leaves together. Larva tunneling into the leaf petiole may kill whole leaves. They will also cut tissue from leaves of landscape trees that have fallen into the pond.

Management

Non-Chemical Control

Observe waterlily foliage closely in spring to detect the presence of *N. daeckealis* larvae. Remove and destroy leaves and stems with larvae attached. Also remove any floating larval boats. Mechanical removal alone may reduce larval numbers to acceptable levels in some aquatic displays. However, using waterlily varieties not preferred by *N. daeckealis*, such as *Nymphoides cristatum* ‘White Snowflake’ and *Nymphaea* ‘Mrs. C.W. Thomas,’ may be the most appropriate method of dealing with this pest.

Chemical Control

The Environmental Protection Agency (EPA) has labeled few pesticides for use in aquatic settings because of concern that pesticides could move into waterways. During University of Maryland pesticide evaluation trials, we found that the microbial insecticide, *Bacillus thuringiensis* ‘Kurstaki’ strain, and the spinosad insecticide, *Saccharopolyspora spinosa* (Conserve), effectively control *N. daeckealis* larvae.

Life Cycle of the *Synclita obliteralis* Waterlily Leafcutter

The waterlily leafcutter is another insect pest of ponds that feeds on waterlilies. Minimal research has been performed to document the life cycle of this pest. In spring the adult female moth lays eggs near the edges of submersed aquatic foliage. Damage appears as...
Picture 3. Four larval instars.

Picture 4. Overwintering stage larva between two leaf pieces.
Picture 5. Larva extracted from 2 leaf pieces.


Picture 7. Adult China mark moth.

Picture 10. Comparison of damage to ‘Floating Heart’ on left to ‘Mrs. C.W. Thomas’ on right.
Picture 8. Damage to ‘Floating Heart’.

Picture 9. ‘White Snowflake’.
oval to semicircular pieces of cutout leaf tissue. The larvae reside between two roundish leaf pieces forming a case. As they mature, larvae abandon smaller cases. During the spring and summer, larvae feed on water lettuce, floating lotus leaves, waterlilies, and creeping plants with leaves that touch the water. Larvae will feed on foliage for a short time and then migrate to the underside of the waterlily leaf and pupate. Before they pupate, larvae attach their cases to leaves either above or below the water surface. They then spin cocoons in which to pupate. After pupation, the larva works its way to the leaf surface to begin this life stage as a moth.

Reference
Controlling Two Aquatic Plant Pests: 
*Nymphuliella daeckealis* (Haimbach) and the 
Waterlily Leafcutter, *Synclita oblateralis* (Walker) 

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