



Extension FactSheet

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Duckweed and Watermeal: Prevention and Control

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Duckweed and watermeal are two free-floating plants whose populations can attain nuisance levels in Ohio ponds. Their explosive reproductive capacity can quickly cause a pond to be completely covered in the green plants in just a few weeks. This not only causes aesthetic problems, but summer fish kills are common in ponds covered with either duckweeds or watermeal. The complete shading of the water sometimes caused by these plants severely limits photosynthesis by submerged plants and algae, depriving the pond of a major source of oxygen. Oxygen consuming respiration by aquatic plants and animals and decay processes continues unabated, with the end result being lethal low-oxygen levels after several weeks. For many ponds, prevention of duckweed and watermeal problems can be achieved, but chemical control options do exist once a problem develops.

Biology

Duckweeds (*Lemna spp.*, *Spirodela spp.*) and watermeal (*Wolffia spp.*) are members of the duckweed family (Lemnaceae). All three genera are found in Ohio, but most pond problems can be attributed to *Lemna* and *Wolffia*. Both genera are frequently found together (Figure 1), although one genus often is more abundant than the other depending on pond conditions.

Duckweed and watermeal plants are very small, with watermeal being the smallest flowering plant known to exist (Figure 2). While the individual plants look like leaves, they are not true leaves and are often called fronds. Duckweeds are typically less than 1/4 inch in width, with some species not even exceeding 1/8 inch in size. Typically, a single root hangs from under each frond from which the plant obtains its nutrients (Figure 2). Watermeal is considerably smaller, being about 1/32 of an inch in width or

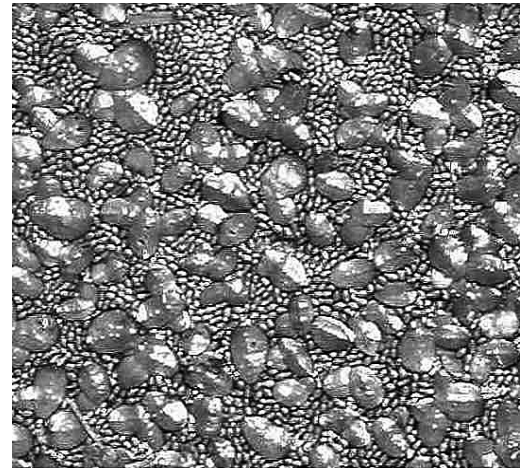
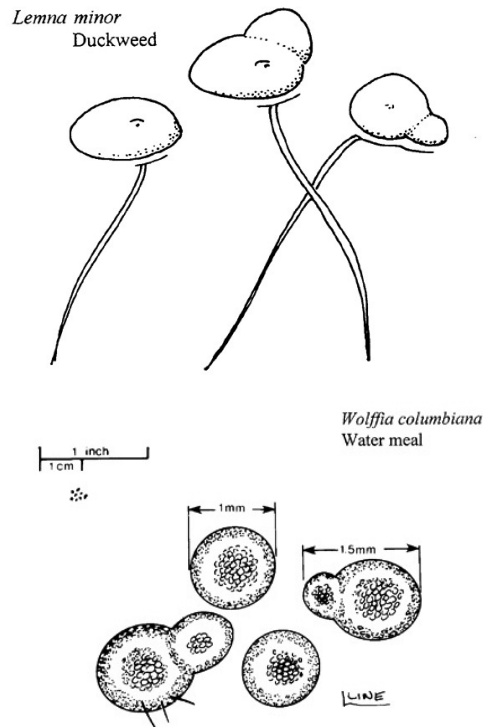


Figure 1. Photograph of a dense colony of co-occurring duckweed and watermeal. Note the relative size of these small plants to each other.

about the size of a pinhead. It has no root (Figure 2) and obtains nutrients thru the underside of the floating frond. Duckweeds, including watermeal, generally reproduce by a process called budding in which a new daughter bud is produced every day or so. In two weeks under ideal summer growth conditions, a single parent plant and its subsequent “daughters” can result in the production of up to 17,500 plants. It is this very rapid budding process that allows duckweeds to quickly cover a pond in just a few weeks.

Habitat

Both duckweeds and watermeal are typically found in quiet, nutrient rich wetlands and ponds. These plants require high levels of nutrients to “bud” profusely and



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Figure 2. Illustration of common duckweed (*Lemna minor*) and watermeal (*Wolffia* spp.). These drawings are the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with Permission.

thus, are indicators of ponds receiving excessive nutrients. Quite often, problem populations are located in or near woodlots, which not only provide the quietness preferred by this plant but also provide a rich, organic source in the form of tree leaves. Bottom sediments of infested ponds are best described as having a smelly, black ooze bottom, which can provide a valuable nutrient source for the plants. Older ponds tend to experience nuisance infestations more frequently because of the build-up of bottom organic matter.

Not all nutrient-rich ponds experience duckweed problems. Duckweeds and watermeal do not tolerate moving water. Thus, “unprotected” ponds that are windswept or ponds with considerable water flow-through do not typically experience nuisance populations of either genus. Apparently, these plants are fragile and require almost stagnant waters to flourish.

Prevention

Prevention is the key to eliminating the need for costly, annual control measures to eliminate a nuisance duckweed and/or watermeal problem. Two prevention strategies involve nutrient reduction and aeration.

Nutrient reduction - Most Ohio ponds receive unwanted nutrient inputs that, in the case of duckweeds, can lead to explosive, nuisance growth. Major sources of unwanted nutrients include Canada geese, lawn fertilizer, agricultural field run-off, inefficient septic systems, and drainage from domesticated animal feedlots. Additionally, inputs of a large amount of leaves during fall can lead to problems in successive years. Nearly all these sources of unwanted nutrients can be reduced, some more cheaply than others. Limiting nutrient inputs can eliminate or reduce the duckweed problem the following year in many ponds. However, it may take several years for total prevention to occur in some ponds, particularly older ponds with a thick accumulation of black bottom sediments.

Bubble Aeration - A major reason black bottom sediments are produced in ponds is stratification and the accompanying lack of oxygen in the deeper waters. Anaerobic bacteria decompose organic material in the absence of oxygen, but the process is inefficient. This causes a build-up of partially decomposed organic material that is black in color and smells like rotten eggs. For a better understanding of pond stratification, obtain Ohio State University Fact Sheet A-7-01, *Understanding Pond Stratification*.

Bubble aeration uses a compressor on shore that blows air through a plastic tube to a diffuser located near the bottom in the deepest area of the pond. The bubbles leaving the diffuser hydrologically lift bottom waters to the surface. This sets up a circulation pattern that prevents pond stratification and inhibits formation of black, bottom sediments. A reduction of decomposed organic matter along the bottom results in less duckweed and watermeal. Additionally, pond circulation improves rapid uptake of nutrients by the planktonic food chain, leaving less nutrients for duckweeds. Combining bubble aeration with nutrient reduction can alleviate a duckweed or watermeal problem.

Not all aeration systems are created equal. Fountains and surface agitators do not typically prevent stratification and as such, do little to prevent build-up of organic debris or efficient use of nutrients in the pond’s food chain for fish. It is not uncommon to see duckweed problems in ponds with these types of surface aerators.

Manual Control

Manual control involves physically removing the duckweeds or watermeal from the pond. Because of the explosive growth pattern of these small plants, few pond owners succeed in having manual removal solve their problem entirely. Best results are obtained if the owner

regularly removes the duckweeds as they begin to become apparent. If attempted, it should be done on a day when wind has pushed the duckweeds to one side of the pond. Keep in mind that duckweeds thrive in protected ponds, so an owner may have to wait for a very windy day to try this. Once the duckweeds are pushed to one side, take a fine mesh dip net and start removing. Long-handled swimming pool nets work well. Remove as much as possible, and repeat the process as needed.

Biological Control

Grass Carp & Koi – Both of these fish species eat duckweeds & watermeal. Grass carp (white amur), however, will generally consume other aquatic plants first. The fast reproductive potential of duckweeds allows nuisance levels to build while the grass carp are eating other plants. Also, large grass carp struggle to eat such small plants, which is likely why they prefer more substantial plants to eat. Thus, grass carp are not a recommended control for duckweed or watermeal. If used, only sterile, triploid grass carp are legal for stocking in Ohio.

Koi are a smaller cousin to the grass carp, rarely exceeding 12 inches in length. They are quite willing to eat duckweeds and watermeal and their small size allows koi to more efficiently consume them. They can prevent or reduce a duckweed problem if stocked early in spring prior to duckweed appearing. They cannot eradicate an existing problem as consumption by koi cannot keep pace with duckweed “budding.” No stocking rates are known, but prevention has been attained at 50 koi per acre. Pond owners should buy koi possessing little color value to the koi industry because many koi producers will sell these “low value” koi at cost. One drawback is that koi are vulnerable to predation by herons and large bass and maintaining them in sufficient numbers may be difficult.

Domesticated Waterfowl - White ducks or domesticated mallards eat duckweed and watermeal and can prevent nuisance populations of either. However, their defecation can lead to serious nutrient problems and cause a filamentous or planktonic algae bloom.

Chemical Control

Duckweed and watermeal can be controlled with herbicides although watermeal is much tougher to control than other duckweeds. In Ohio, watermeal and duckweeds typically occur together and the pond owner usually must plan his control based on watermeal recommendations. Chemical control is most effective if herbicides are applied early in the infestation, not once the pond has been covered with duckweeds. Regular walks around the pond can alert the owner to the first signs of duckweeds and watermeal. As always, be sure to read product labels for specific information on rates, application techniques, and safety.

Fluridone - Fluridone, which is sold as Sonar® or Avast!®, is a systemic herbicide that causes a slow degradation of photosynthetic activity in plants. It can take up to 30-90 days for a complete kill. Noticeable yellowing (chlorosis) of treated plants can occur within 14-21 days. It is by far the best herbicide available for eliminating watermeal. Two advantages of fluridone products are that (1) control often lasts for several growing seasons and the (2) slow killing of duckweeds and/or watermeal greatly reduces the chance of a fish kill caused by excessive decaying vegetation. General recommended application rate is 1.5 quarts per surface acre if average depth exceeds 5 feet. Best control is attained by treating with half the recommended rate initially, followed by the other half 10-14 days later. Fluridone is not appropriate for spot treatments of duckweeds and watermeal and can only be used in ponds where water outflow will be zero or very minimal for 30 days.

Diquat - Diquat is a contact herbicide that immediately causes exposed plant tissues to turn brown and die. Results are noticeable within several days. Commonly available diquat products are Reward and Weedtrine-D. Diquat is effective in eliminating duckweeds but is far less effective in killing watermeal. General recommended application rate is one gallon per surface acre. It should be mixed with water at a 50:1 ratio and finely sprayed on top of the floating duckweeds. Effectiveness is greatly enhanced by adding nonionic surfactant to the mixture prior to application. Diquat allows for spot treatments of duckweeds, which can be an advantage both in cost and in prevention of fish kills. It is also recommended that application be done when duckweeds have collected along one side of the pond. Finally, multiple applications about two weeks apart are typically needed to fully eliminate duckweeds. Survivors of the initial treatment can quickly reproduce and become a problem once more.

Chelated Copper – Copper compounds by themselves do not eliminate duckweeds and watermeal. However, combining chelated copper with diquat increases the effectiveness of diquat as a control measure. The copper slightly weakens the plant, allowing the diquat to be more lethal inside the plant. The general recommendation is to mix one part chelated copper to two parts of a diquat product. Common chelated copper algacides include Cutrine Plus, AlgaePro, and Clearigate.

Summary

Duckweed and watermeal can quickly reach nuisance levels in ponds, but is dependent on excessive nutrients to do so. This allows prevention to be very successful in preventing such problems. Eliminating unwanted nutrients from entering the pond and bubble aeration can reduce nutrient levels and increase nutrient uptake by planktonic

algae. In the case of an existing nuisance problem with either duckweed or watermeal, a two-step approach is often the best strategy. First, use an approved aquatic herbicide labeled for duckweed and watermeal to eliminate the current problem. Then, identify and eliminate potential unwanted sources of nutrients to prevent future problems. Lastly, consider installing a bubble aeration system to allow for enhanced decomposition of bottom materials and further reduce the likelihood of a future problem. Fluridone and diquat-based herbicides are the recommended products for duckweed control. Only fluridone products are recommended for watermeal control. As always, read product labels for instructions, water use restrictions, and safety information.

Additional Pond Management Information

Placing Artificial Fish Attractors in Ponds and Reservoirs; Ohio State University Extension Fact Sheet A1

Pond Measurements; Ohio State University Extension Fact Sheet A2

Controlling Filamentous Algae in Ponds; Ohio State University Extension Fact Sheet A3

Chemical Control of Aquatic Weeds; Ohio State University Extension Fact Sheet A4

Muddy Water in Ponds; Ohio State University Extension

Fact Sheet A6.

Understanding Pond Stratification; Ohio State University Extension Fact Sheet A7.

Winter and Summer Fish Kills in Ponds; Ohio State University Extension Fact Sheet A8.

Planktonic Algae in Ponds; Ohio State University Extension Fact Sheet A9.

Fish Species Selection for Pond Stocking; Ohio State University Extension Fact Sheet A10.

Cattail Management; Ohio State University Extension Fact Sheet A11.

Ponds and Legal Liability in Ohio; Ohio State University Extension Fact Sheet ALS-1006.

Farm Pond Safety; Ohio State University Extension Fact Sheet AEX-390.

Ohio Pond Management; Ohio State University Extension Bulletin 374

Controlling Weeds in Ohio Ponds. 41 minute videotape. VT50.

Visit your county office of Ohio State University Extension for copies of these resources.

Disclaimer

This publication contains recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read all current label directions for the specific pesticide being used. Because of constantly changing labels and product registration, some of the recommendations given in this publication may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The authors and Ohio State University Extension assume no liability resulting from the use of these recommendations.

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