



Diamondback Moth

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Introduction

Diamondback moth (DBM), *Plutella xylostella* (Lepidoptera: Plutellidae), is the most important pest of brassica crops worldwide. Its common name is derived from the white diamond shapes formed when the wings are closed by the adult moth (Fig. 1). In Virginia, it is active from May to November undergoing multiple generations. The larvae feed on the leaves of brassica weeds and crops such as broccoli, collards, cabbage, and kale (Fig. 2). Large populations can cause significant damage that affects both crop yield and marketability. DBM is a significant problem mostly due to insecticide resistance. Populations of DBM have developed resistance to most insecticides used against it, making it one of the most challenging pests to control.



Figure 1: DBM adult moth. Photo credit: Tom Kuhar



Figure 2: 5th instar larvae feeding on green cabbage leaf. Photo credit: Taylorre Sydnor

Identification

DBM life cycle from egg to adult requires ~283 degree days (usually less than 30 days), with 50°F as base temperature. It can have multiple generations per season. Eggs are oval-shaped, cream colored and approximately 0.4 mm long. They are deposited on leaves in a cluster of 2-8 eggs (Fig. 3). Eggs hatch in a few days. There are 4 instars of DBM larvae. Early instars are pale in color while later instars are green and can reach up to 11 mm in size (Fig. 4). When touched, DBM larvae will twitch frequently as a defense mechanism to deter predator feeding. Larvae also may drop on a thread of silk to escape. Adult moths are 6-12 mm in length and are brown with a light-colored diamond pattern along the back of their wings. Adults have a short lifespan of ~12-16 days.



Figure 3: DBM eggs. Photo Credit: Philips et. al



Figure 4: DBM neonate larva under microscope. Photo credit: Taylore Sydnor

Natural Control

Biological control of DBM plays a role in keeping pest densities in check. In Virginia, the hymenopteran parasitoids *Diadegma insulare* and *Oomyzus sokolowskii* are the primary natural enemies of DBM. They attack larvae. Among the two species, *D. insulare* is found more commonly in Virginia (Fig. 5). *D. insulare* larvae crawl out from inside the DBM pupa and use its casing for protection when pupating (Fig. 6). The *D. insulare* pupa is cylindrical and brown in color, while the DBM pupa is green and misshapen. High rates of parasitism of DBM (>75%) were found in multiple locations around Virginia in 2022 indicating the impact of this parasitoid.



Figure 5: *Diadegma insulare*, parasitoid wasp of DBM larvae. Photo credit: Taylore Sydnor



Figure 6: *D. insulare* pupa and DBM pupa. Photo credit: Philips et. al

Monitoring

Sampling for DBM can include visual observations for larvae and feeding injury (Fig. 7) as well as adult moth trap captures. Thresholds for monitoring may vary by state and crop type but often all lepidopteran larvae are counted and grouped together for action thresholds. Sampling is recommended once a week with a minimum sample size of 50 plants. Treatment for cabbage in Virginia is recommended if at least > 20% of plants contain 1 or more lepidopteran larvae before the heading stage, or > 5% of plants if 1 or more larvae is found between heading and harvest.

DBM moth activity can be monitored in fields using sticky panel type traps, such as Delta or wing traps, baited with a commercially-available DBM sex pheromone lure. Traps should be checked weekly and stick liners replaced as needed. There is not a set threshold currently for trap captures of DBM.



Figure 7: Visual observations and trap capture in green cabbage in Virginia. Photo Credit: Taylore Sydnor

Chemical Control

A wide range of insecticides are registered for control of DBM. However, resistance levels in local populations often impact the efficacy of various products. Since the mid 2000s, the best control has been achieved with *Bacillus thuringiensis* products, various diamide insecticides, spinosyns, various insect growth regulators, emamectin benzoate, and tolfenpyrad. To reduce resistance development, it is strongly recommended to rotate sprays of insecticide groups by their mode of action throughout the growing season, or to seek other pest management strategies such as mating disruption or rotating away from brassica crops for a period, to break the life cycle of DBM.

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