The Dispersal of Mayapple by Whitetail Deer and Raccoon

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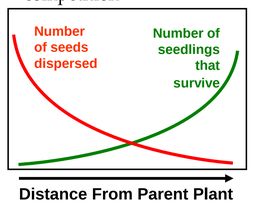
Introduction

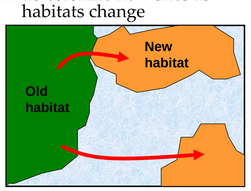
A knowledge of plant dispersal helps us protect biodiversity and understand patterns in the natural environment.

Plants need to disperse seeds to maintain their population for two main reasons:

1. To escape parent and sibling competition



2. To colonize new sites as habitats change



Plant dispersal is necessary to maintain biodiversity in a changing environment because habitats always change.

Mayapple (*Podophyllum peltatum*) is a common forest herb.

Mature mayapple. (A) Non-reproductive leaf. (B) Reproductive shoot. (C) Flower. (D) Ripe Fruit

Deer (*Odocoileus virginianus*) and raccoon (*Procyon lotor*) are newly documented consumers of mayapple fruit (Philhower and Matlack, in preparation).

Courtesy of Jen Philhower

Question

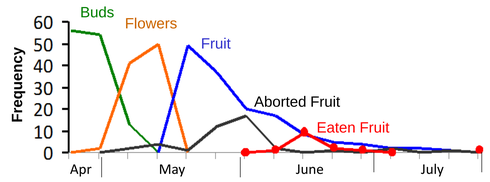
What effect does ingestion by deer or raccoon have on mayapple seeds?

Methods

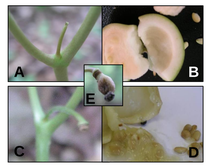
1. Recorded timing of fruit production, ripening and removal to determine the extent of premature fruit removal.
   Made weekly counts of mayapple shoots and fruits in 7 scattered 3x3 m^2 plots.
2. Fed captive deer and raccoon ripe mayapple fruit and recovered seeds from dung.
   Fed 1 deer 10 fruits, 12 raccoon 2- 3 fruits each for a total of 28 fruits.
   Collected dung for 4 days for deer or 2 days for the raccoon and sieved out seeds.
3. Planted animal ingested seeds, hand-harvested seeds (from both ripe and almost-ripe fruit) and dried seeds (purchased) to compare germination rates of each group.
   Seeds were sown in flats with potting soil, checked weekly and watered as needed.
   Seeds were sown in the fall and the flats were kept outdoors over winter.
   Recorded predation, decay and spring germination rates.

Results

Timing of Fruit Production and Removal



Timing of fruit development of 56 mayapple flower buds. 42 aborted, 13 were eaten unripe and 1 was eaten ripe.



(A) Unripe fruit removed
(B) Unripe fruit
(C) Ripe fruit removed
(D) Ripe fruit
(E) Aborted fruit

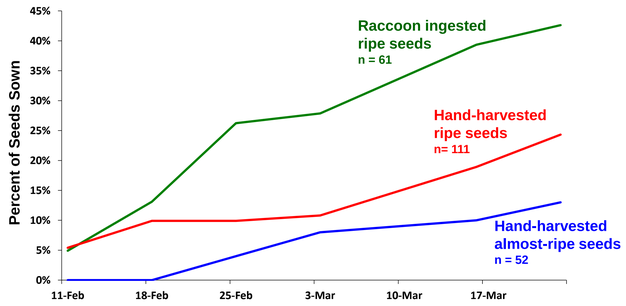
Fruit begin to ripen in late July. Evidence suggests that the very unripe fruit are eaten solely by deer. The ripe fruit are eaten primarily by raccoon (Philhower & Matlack in prep).

Seed Recovery Following Animal Ingestion

Species (number of animals)	Number of ripe fruit ingested	Approximate number of seeds eaten*	Number of seeds recovered	Approximate percent of seeds recovered
Raccoon (12)	28	420	136	32.4%
Deer (1)	10	150	2	1.3%

* Conservative estimate based on a mean number of 20 seeds per fruit (n = 28, SD = 10.16).

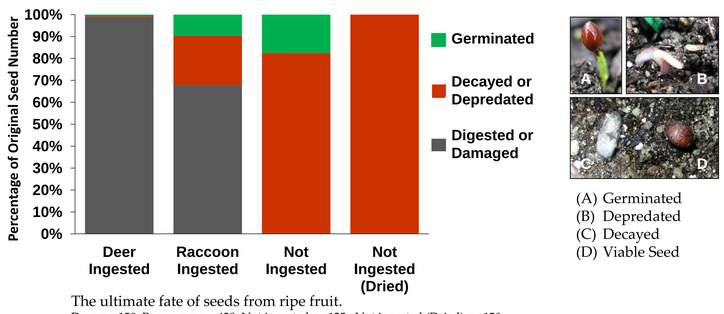
Cumulative Percent Germination



Cumulative percent germination of raccoon ingested (final = 43%) and hand-harvested ripe (final = 24%) and unripe seeds (final = 13%). Unripe fruit were harvested one week early. Excludes seeds eaten by insects. All dried seeds (purchased) molded within two weeks of sowing. One out of two deer ingested seeds germinated.

A chi-square equality of proportion test indicates the final germination percentage of raccoon ingested seeds is significantly higher than hand-harvested seeds. $X^2 = 6.183$, df = 1, p = 0.013. The germination percentages of the unripe and ripe seeds were not significantly different. $X^2 = 2.531$, df = 1, p = 0.113

Ultimate Seed Fate After Each Treatment



The ultimate fate of seeds from ripe fruit.
Deer n = 150, Raccoon n = ~ 420, Not ingested n =125, Not ingested (Dried) n =150

(A) Germinated
(B) Depredated
(C) Decayed
(D) Viable Seed

Conclusions to Date

Deer destroy ~ 99% of seeds eaten. The surviving seeds (from ripe fruit) are viable. Deer primarily eat unripe fruit.

Raccoons destroy ~ 70% of seeds eaten, but those that survive have higher germination rates than non-ingested seeds.

Mayapple seeds need to remain moist through fall and winter to remain viable. Dried and rehydrated seeds decay quickly.

Current and Future Research Questions

Where in the environment do deer and raccoon place mayapple seeds?

Where in the environment is most favorable for mayapple growth and reproduction?

Do dung deposition sites correspond to sites suitable for mayapple growth and reproduction?

What is the role of secondary dispersal (movement of seeds away from deposition site by water or small animals)?

Acknowledgments

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