Suitability, Digestibility and Assimilation of Various Host Plants of the Gypsy Moth * **

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Summary. The development and survival of gypsy moth (Lymantria dispar) larvae is strongly influenced by the host plant upon which they feed. The most rapid development and largest pupae were produced from grey birch fed larvae. Beech and maple-fed larvae produced the smallest pupae while maple-fed larvae exhibited prolonged development. White and red oak-fed larvae exhibited development and pupal weights intermediate between the above two groups. The approximate digestibility (AD) and efficiencies of conversion of food (ECD and ECI) were generally highest among grey birch-fed individuals. The utilization of the relatively closely related oak species, as reflected in AD and ECD values, differed.

Leaves were examined for 14 elements. The content of each element varied among host plant species and over time. For example, nitrogen levels were highest in grey-birch and dropped over time in all host plants.

Introduction

Within environmental limits, patterns of host plant utilization by Lepidoptera reflect the sum total of behavioral, physiological and ecological interactions between host plant and herbivore. The degree and nature of the exploitation of various hosts are determined, in part, by the suitability of hosts (as manifested in consumer development rate, size, and fecundity), acceptability of hosts to larvae and/or adults and host plant assimilation (the metabolic processing of food).

Barbosa and Capinera (1977) and Capinera and Barbosa (1977) have demonstrated differences in suitability of several host species of the gypsy moth. The

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The present study evaluates the suitability of additional host plants, in terms of the efficiency of digestion and assimilation of the hosts. In addition, differences in the mineral content of host plants are examined for possible correlations with suitability or assimilation.

Material and Methods

Egg masses used for experiments were dehaired and the eggs surface disinfected with a 10% sodium hypochlorite solution. Larvae were reared on foliage from grey birch (*Betula populifolia* Marsh.), American beech (*Fagus grandifolia* Ehrh.), red maple (*Acer rubrum* L.), white oak (*Quercus alba* L.) and red oak (*Quercus rubra* L.) as well as artificial diet (Bio-Serv Gypsy Moth Diet). Leaves were disinfected with a 10% sodium hypochlorite solution. For each food type, 183 to 204 larvae were reared individually in 8 oz wax paper cups (1 oz = 28.413 cm³). Third instars were transferred to 8 oz unwaxed cups. Larvae were reared at 24.4 °C, 90% RH and a 14:10 L:D cycle. Molting was confirmed by checking all cups daily for exuviae and head capsules. Host suitability was determined by recording the dates of pupation, weights of three-day-old pupae, dates of ecolosion and the sex of adults. Also the number of eggs per mass of at least 10 egg masses produced by individuals fed on each of the six foods was recorded.

The nutritional indices calculated, included AD (approximate digestibility), ECD (Efficiency of conversion of digested food), and ECI (efficiency of conversion of ingested food) (Waldbauer 1968). These are calculated using the formulae:

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AD = \frac{\text{Food ingested} - \text{Frass}}{\text{Food ingested}} \times 100
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ECI = \frac{\text{wt. gain}}{\text{Food ingested}} \times 100
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ECD = \frac{\text{wt. gain}}{\text{Food ingested} - \text{Frass}} \times 100
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About 8 h after molting, 25 fifth instars were randomly selected from each treatment for the determination of nutritional indices. This was a mixture of penultimate and ultimate instars. The wet weight of these larvae was determined. Twenty additional fifth instars, within eight hours of molting, were weighed wet, dried in an oven at 50–55 °C for 24 h and reweighed. Using the relationship between wet weight and dry weight of these larvae, an initial dry weight value was calculated for the experimental larva.

To determine consumption, leaves were cut into two symmetrical halves; one half given to larvae, the other retained for dry weight determinations. Frass, remaining bits of leaves and the original leaf halves were dried in an oven at 50–55 °C for 24 h. Larvae were always fed more than they could consume in a 24 h period. When the larvae molted to 6th instars, or became pre-pupae, they were oven dried at 50–55 °C for 24 h and weighed. As leaves were collected to feed larvae, another series of samples were collected for analysis of N, P, K, Ca, Mg, Na, Al, Ba, Fe, Sr, B, Cu, Zn, and Mn content. Beech, birch and red maple leaves were sampled three times each over a 5–6 week period. Red oak and white oak leaves were sampled three times over a 7–8 week period. Foliar collections were initiated when the laboratory feeding experiments began and terminated when nearly all larvae had completed development. Collection dates differed for each species because of differences in the timing of budbreak.

Mineral content analyses were conducted by the Warf Institute, Inc. Nitrogen content analyses were conducted using procedures in AOAC (1975). Analyses of all other elements were performed using emission spectroscopy method (Christensen et al., 1968). Analyses of significant differences due to host plant were conducted using ANOVA and Scheffe tests.